RECORDS OF THE WESTERN AUSTRALIAN MUSEUM
SUPPLEMENT 86 247–510 (2022) DOI: 10.18195/issn.0313-122x.86.2022.247-510

A Guide to the Ants of Western Australia. Part II: Distribution and Biology

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ABSTRACT – This paper, the second of two parts comprising this volume, outlines the distribution and biology of the Western Australian ant fauna addressed in part one.

KEYWORDS: Western Australia, ants, Formicidae, ecology, distribution maps

INTRODUCTION

On any interpretation, the sheer biodiversity of the Western Australian ant fauna is impressive, especially if considered at the higher taxonomic levels. One glance at the fauna in comparison with the major biogeographic regions of the world will reveal its richness. Thus:

Africa: 11 extant subfamilies, 135 extant genera.

North America: 12 extant subfamilies, 83 extant genera.

South America: 13 extant subfamilies, 127 extant genera.

Asia: 12 extant subfamilies, 174 extant genera.

Europe: 8 extant subfamilies, 67 extant genera.

Western Australia: 11 extant subfamilies, 76 currently recognised genera.

Much of this richness is compressed into two biodiversity hotspots, namely the south-west of WA, i.e. that part which constitutes the South-West Province (SWP) (= phytogeographic region in the Interim Biogeographic Regionalisation for Australia [IBRA] model) and the far north (the Northern Province (NP), in particular, the northern Kimberley region). In between is the vast Eremaean Province (EP) which has a reduced ant fauna. In the latter province, diversity at the genus level is much lower than in the wetter parts of WA, but the fauna nonetheless includes many thermophilic species that are adapted to the harsh, dry conditions that prevail in this part of Australia. Unlike taxa found in the more mesic zones, which often occupy restricted habitats or have a specialised lifeway and are highly localised in their occurrence as a consequence, ant species occurring in the deserts tend on the whole to have broad distributions that overlap at least several biogeographic subregions (Figures 1–2).

At a species level, the SWP currently has the greatest number of recorded species (529) (Table 1), but to some extent this is an artefact of the extensive collecting effort that has gone on in this province, which also contains most of the large urban centres in Western Australia including the state capital, Perth. Slightly fewer species (510) have been recorded from the EP, but many of its subregions are in remote areas of WA and are not serviced with roads, hence there has been little collecting done in those parts. In general, the western subregions of this province have seen a heavy focus on mining and ant species lists from these subregions approach those of the well-collected south-west in magnitude, but in the eastern and north-eastern deserts the figures drop away. The Tanami subregion in the far north-east, for example, has only 8 taxa records. The NP has the smallest number of species records (248), but this is undoubtedly due to its remoteness, as TERC publications and a few other ecological studies of the area reveal a very rich ant fauna. It is this province that will likely provide most of the novelty at the species level into the future as well as including possibly even new genus records.

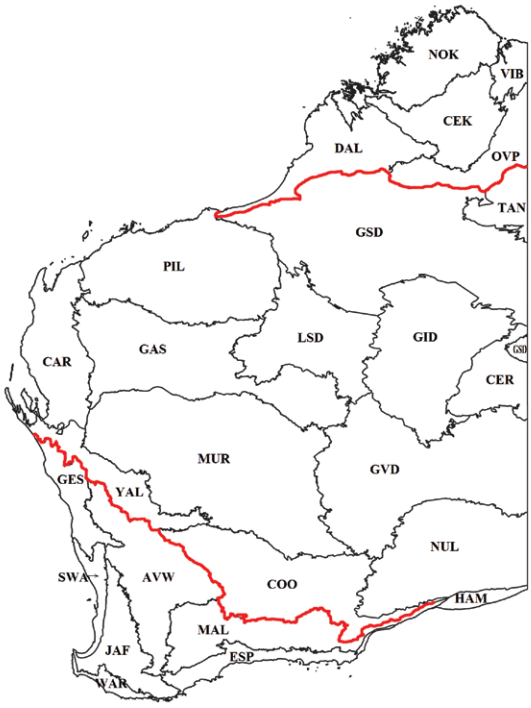

FIGURE 1 Western Australia's biogeographical regions and subregions (IBRA). The boundaries of the three provinces are indicated in red.

Northern Province: CEK, Central Kimberley; DAL, Dampierland; NOK, North Kimberley; OVP, Ord Victoria Plain; VIB, Victoria Bonaparte. Eremaean Province: CAR, Carnarvon; CER, Central Ranges; COO, Coolgardie; GAS, Gascoyne; GID, Gibson Desert; GSD, Great Sandy Desert; GVD, Great Victoria Desert; HAM, Hampton; LSD, Little Sandy Desert; MUR, Murchison; NUL, Nullarbor; PIL, Pilbara; TAN, Tanami; YAL, Yalgoo. South-West Province: AVW, Avon Wheatbelt; ESP, Esperance Plains; GES, Geraldton Sandplains; JAF, Jarrah Forest; MAL, Mallee; SWA, Swan Coastal Plain; WAR, Warren.

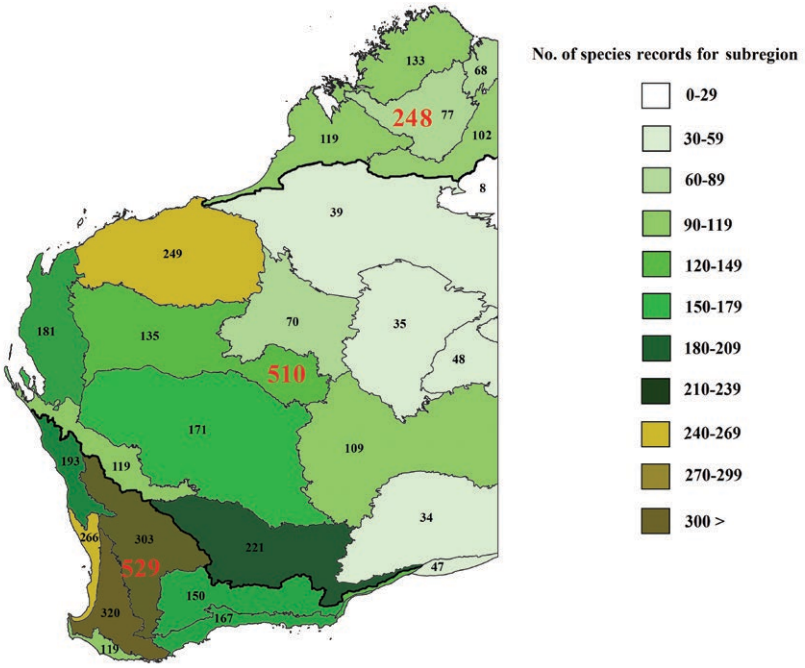

FIGURE 2 Colour-coded Province and subregion richness of the ant fauna, based on Western Australian Museum holdings, AntWeb records and less comprehensive records from other sources (e.g., TERC). Total ant species numbers for a given province are marked in red, totals for a subregion are marked in black.

TABLE 1 Distribution of individual ant species in Western Australia at the province and subregion level, illustrated by presence (•) or absence (blank).

Northern Province: CEK, Central Kimberley; DAL, Dampierland; NOK, North Kimberley; OVP, Ord Victoria Plain; VIB, Victoria Bonaparte.
Eremaean Province: CAR, Carnarvon; CER, Central Ranges; COO, Coolgardie; GAS, Gascoyne; GID, Gibson Desert; GSD, Great Sandy Desert; GVD, Great Victoria Desert; HAM, Hampton; LSD, Little Sandy Desert; MUR, Murchison; NUL, Nullarbor; PIL, Pilbara; TAN, Tanami; YAL, Yalgoo.
South-West Province: AVW, Avon Wheatbelt; ESP, Esperance Plains; GES, Geraldton Sandplains; JAF, Jarrah Forest; MAL, Mallee; SWA, Swan Coastal Plain; WAR, Warren.

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
AMBYLOPONINAE																													
Amblyopone aberrans Wheeler, 1927																									•		•		•
Amblyopone australis Erichson, 1842		•				•										•					•	•	•		•		•	•	•
Amblyopone clarki Wheeler, 1927																									•		•		•
Amblyopone longidens Forel, 1910																						•			•				•
Amblyopone michaelseni Forel, 1907																									•				•
Fulakora punctulata (Clark, 1934)																									•		•		•
Fulakora sp. JDM 1020										•					•						•								
Onychomyrmex glauerti (Clark, 1928)																						•		•		•	•		•
Onychomyrmex AU4 (ANIC)			•			•																							
DOLICHODERINAE																													
Anonychomyrma fornicata (Emery, 1914)																								•	•		•		•
Anonychomyrma itinerans perthensis (Forel, 1902)																								•	•		•	•	•
Anonychomyrma nitidiceps (André, 1896)									•								•				•		•	•	•		•	•	•
Arnoldius flavus (Crawley, 1922)									•												•		•	•	•		•		•
Arnoldius sp. JDM 433 (= *Arnoldius scissor* [Crawley]?)							•														•		•		•	•	•	•	•
Doleromyrma darwiniana fida (Forel, 1907)					•	•			•												•		•		•		•	•	•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Doleromyrma rottnestensis (Wheeler, 1934)							•		•												•		•				•	•	•
Doleromyrma sp. JDM 1154																		•			•								
Dolichoderus albamaculus Shattuck & Marsden, 2013							•		•							•	•			•	•		•			•	•		•
Dolichoderus angusticornis Clark, 1930																						•	•		•	•			•
Dolichoderus clusor Forel, 1907																											•		•
Dolichoderus formosus Clark, 1930																									•				•
Dolichoderus goudiei Clark, 1930																						•			•	•			•
Dolichoderus niger Crawley, 1922																							•			•	•		•
Dolichoderus nigricornis Clark, 1930									•												•	•							•
Dolichoderus omicron Shattuck & Marsden, 2013									•												•	•	•	•	•	•			•
Dolichoderus parvus Clark, 1930									•												•	•	•	•	•		•		•
Dolichoderus reflexus Clark, 1930							•											•			•	•		•		•			•
Dolichoderus rufotibialis Clark, 1930																							•		•			•	•
Dolichoderus semiorbis Shattuck & Marsden, 2013																								•					•
Dolichoderus ypsilon Forel, 1902									•												•		•	•	•		•	•	•
Froggattella kirbii (Lowne, 1865)			•			•			•								•				•	•	•		•	•			•
Froggattella latispina Wheeler, 1936																							•						•
Iridomyrmex agilis Forel, 1907										•	•	•	•		•	•	•	•			•	•	•	•	•	•	•		•
Iridomyrmex anceps (Roger, 1863)	•	•	•	•	•	•	•	•		•		•						•			•								
Iridomyrmex angusticeps Forel, 1901			•			•																							
Iridomyrmex anteroinclinus Shattuck, 1993			•			•																							
Iridomyrmex azureus Viehmeyer, 1914								•			•	•	•								•								

	Northern Province						Eremaean Province											South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Iridomyrmex bicknelli Emery, 1898							•	•	•		•			•		•	•	•		•	•	•	•	•	•	•	•	•	•
Iridomyrmex bigi Shattuck, 1993																•					•								
Iridomyrmex brennani Heterick & Shattuck, 2011									•							•					•								
Iridomyrmex brunneus Forel, 1902	•	•	•	•	•	•	•	•	•	•			•	•	•	•		•		•	•	•	•	•		•	•	•	•
Iridomyrmex calvus Emery, 1914																							•	•	•		•	•	
Iridomyrmex cappoinclinus Shattuck, 1993										•					•						•								
Iridomyrmex cephaloinclinus Shattuck, 1993		•				•	•											•			•								
Iridomyrmex chasei Forel, 1902					•	•	•	•	•	•			•	•	•	•	•	•		•	•		•	•		•	•		•
Iridomyrmex coeruleus Heterick & Shattuck, 2011			•	•		•	•						•					•			•								
Iridomyrmex conifer Forel, 1902																				•	•	•	•	•	•	•	•	•	•
Iridomyrmex continentis Forel, 1907										•	•					•		•		•	•	•							
Iridomyrmex cuneiceps Heterick & Shattuck, 2011								•	•	•					•	•		•			•								
Iridomyrmex cyaneus Wheeler, 1915								•							•						•								
Iridomyrmex difficilis Heterick & Shattuck, 2011		•	•	•	•	•		•	•				•	•		•				•	•	•	•	•	•	•	•	•	•
Iridomyrmex discors Forel, 1902							•	•	•				•	•		•		•			•	•	•	•	•	•	•	•	•
Iridomyrmex dromus Clark, 1938		•				•	•		•	•			•			•				•	•	•	•	•		•	•	•	•
Iridomyrmex elongatus Heterick & Shattuck, 2011										•			•		•						•								
Iridomyrmex exsanguis Forel, 1907	•	•	•	•	•	•	•	•	•			•	•		•	•		•		•	•								
Iridomyrmex gibbus Heterick & Shattuck, 2011							•	•										•			•								
Iridomyrmex hartmeyeri Forel, 1907	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•		•	•	•	•	•		•			•

	Northern Province					Eremaean Province											South-West Province						
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Iridomyrmex hertogi Heterick & Shattuck, 2011		•				•																							
Iridomyrmex hesperus Shattuck, 1993																										•		•	•
Iridomyrmex innocens Forel, 1907																						•	•		•			•	•
Iridomyrmex lividus Shattuck, 1993									•				•	•			•				•		•						•
Iridomyrmex longisoma Heterick & Shattuck, 2011																							•	•			•		•
Iridomyrmex luteoclypeatus Heterick & Shattuck, 2011							•						•							•	•	•							•
Iridomyrmex macrops Heterick & Shattuck, 2011									•												•	•		•	•	•			•
Iridomyrmex meridianus Heterick & Shattuck, 2011																					•		•		•			•	•
Iridomyrmex minor Forel, 1915	•	•	•	•	•	•	•			•		•			•	•		•			•								•
Iridomyrmex mirabilis Heterick & Shattuck, 2011																					•		•	•	•				•
Iridomyrmex mjobergi Forel, 1915	•	•		•	•	•	•	•		•	•		•	•		•		•		•	•	•	•		•	•		•	•
Iridomyrmex nudipes Heterick & Shattuck, 2011									•				•			•					•								
Iridomyrmex omalonotus Heterick & Shattuck, 2011									•					•							•	•	•	•	•	•	•		•
Iridomyrmex pallidus Forel, 1901	•	•	•	•	•	•																								
Iridomyrmex prismatis Shattuck, 1993																						•	•						•
Iridomyrmex purpureus (F. Smith, 1858)					•	•			•	•			•				•				•		•	•	•	•	•		•
Iridomyrmex reburrus Shattuck, 1993	•	•	•	•		•																				•			•

	Northern Province					Eremaean Province												South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Iridomyrmex roseatus Heterick & Shattuck, 2011		•		•		•	•	•		•	•	•	•		•	•		•	•		•								•
Iridomyrmex rufoinclinus Shattuck, 1993	•		•	•	•	•																							
Iridomyrmex rufoniger (Lowne, 1865)		•				•		•	•	•		•		•		•	•	•	•	•	•	•							•
Iridomyrmex sanguineus Forel, 1910	•	•	•	•	•	•	•			•	•	•				•		•	•		•								•
Iridomyrmex setoconus Shattuck & McMillan, 1998																					•		•						•
Iridomyrmex splendens Forel, 1907									•								•			•	•	•	•	•	•	•	•	•	•
Iridomyrmex spurcus Wheeler, 1915									•	•				•		•		•			•	•							•
Iridomyrmex suchieri Forel, 1907			•		•	•	•		•	•	•		•					•		•	•	•		•	•		•		•
Iridomyrmex suchieroides Heterick & Shattuck, 2011							•	•	•			•						•			•	•		•	•		•		•
Iridomyrmex tenuiceps Heterick & Shattuck, 2011	•	•	•	•	•	•						•						•			•								
Iridomyrmex trigonoceps Heterick & Shattuck, 2011								•		•		•						•			•								•
Iridomyrmex turbineus Shattuck & McMillan, 1998									•												•		•						•
Iridomyrmex viridiaeneus Viehmeyer, 1914							•	•	•	•	•		•			•		•			•	•				•			•
Iridomyrmex xanthocoxa Heterick & Shattuck, 2011							•	•										•			•								
Linepithema humile (Mayr, 1868)																					•	•			•	•	•		•
Nebothriomyrmex majeri Dobovikoff, 2004									•												•		•					•	
Ochetellus flavipes (Kirby, 1896)		•				•						•						•			•								
Ochetellus glaber (Mayr, 1862)																						•	•	•	•	•	•		•

	Northern Province						Eremaean Province														South-West Province							
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Ochetellus punctatissimus (Emery, 1887)									•												•		•	•	•		•	•	•
Ochetellus sp. JDM 527							•											•			•								
Ochetellus sp. JDM 851																						•	•	•		•			•
Papyrius nitidus (Mayr, 1862)		•	•			•																•	•		•	•	•	•	•
Papyrius sp. JDM 666																						•			•		•		•
Tapinoma melanocephalum (Fabricius, 1793)		•			•	•	•											•			•						•		•
Tapinoma minutum broomense Forel, 1915		•				•	•		•							•		•			•	•	•		•		•		•
Tapinoma sp. JDM 981								•	•	•		•		•		•		•		•	•	•			•				•
Technomyrmex jocosus Forel, 1910																								•	•		•	•	•
DORYLINAE																													
Aenictus acerbus Shattuck, 2008			•			•																							
Aenictus turneri Forel, 1900							•						•		•			•			•								
'*Lioponera*' sp. JDM 574									•							•					•	•							•
[*Lioponera angustata* (Clark, 1924)] — probable ergatoid																									•		•		•
Lioponera bicolor (Clark, 1924)																									•		•		•
Lioponera brevicollis (Clark, 1924)																									•		•		•
Lioponera brevis (Clark, 1924)		•			•	•	•			•								•			•		•		•		•		•
Lioponera clara (Clark, 1930)																						•		•	•		•		•
Lioponera clarki (Crawley, 1922)							•		•			•	•			•	•	•		•	•			•		•	•		•
[*Lioponera constricta* (Clark, 1924)] — ergatoid, probably of *L. greavesi*																									•		•		•
Lioponera elegans (Wheeler, 1918)																						•			•		•		•
Lioponera fervida (Wheeler, 1918)					•	•	•		•	•								•			•		•	•	•		•		•
Lioponera flammea (Clark, 1930)																									•				•

	Northern Province						Eremaean Province												South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Lioponera gilesi (Clark, 1924)							•						•			•					•				•				•
Lioponera greavesi (Clark, 1934)							•		•									•			•								•
Lioponera inconspicua (Clark, 1924)															•						•	•							•
Lioponera iovis (Forel, 1915)			•			•	•											•		•	•				•				•
Lioponera longitarsus Mayr, 1879																		•			•	•			•		•	•	•
Lioponera mjobergi (Forel, 1915)		•				•	•														•								
Lioponera nigriventris (Clark, 1924)									•				•			•					•				•		•	•	•
Lioponera picipes (Clark, 1924)																					•	•							•
Lioponera punctatissima (Clark, 1924)									•							•		•			•				•				•
Lioponera reticulata (Clark, 1926)																					•	•		•	•				•
Lioponera ruficornis (Clark, 1924)							•		•												•				•		•	•	•
Lioponera simmonsae (Clark, 1924)																				•	•	•			•		•	•	•
Lioponera sjostedti (Forel, 1915)							•								•					•	•			•		•			
Lioponera varians (Clark, 1924)									•						•	•					•				•				
Lioponera sp. JDM 741										•					•						•								
Lioponera sp. JDM 745									•							•					•	•							•
Lioponera sp. JDM 746																						•	•						•
Lioponera sp. JDM 941											•					•					•				•				•
Lioponera sp. JDM 942							•								•			•			•								•
Lioponera sp. JDM 1087													•								•								
Ooceraea australis (Forel, 1900)			•			•															•	•			•				•
Zasphinctus duchaussoyi (André, 1905)		•				•	•														•								•
Zasphinctus emeryi (Forel, 1893)			•			•															•								
Zasphinctus imbecilis (Forel, 1907)																					•								•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Zasphinctus occidentalis (Clark, 1924)																							•		•		•		•
Zasphinctus sp. JDM 1262	•					•																							
Zasphinctus sp. JDM 1263															•			•			•								
ECTATOMMINAE																													
Heteroponera imbellis (Emery, 1895)									•												•				•		•		•
Heteroponera majeri Taylor, 2011																									•		•		•
Heteroponera sp. JDM 732																									•		•		•
Rhytidoponera aciculata group sp. JDM 1022										•					•						•								
Rhytidoponera anceps Emery, 1898																									•			•	•
Rhytidoponera anceps group sp. 44 ANIC																							•			•			•
Rhytidoponera aurata (Roger, 1861)			•	•	•	•																							
Rhytidoponera borealis Crawley, 1918	•		•	•	•	•																							
Rhytidoponera castanea Crawley, 1925	•	•		•	•	•																							
Rhytidoponera cerastes Crawley, 1925		•	•		•	•																							
Rhytidoponera convexa group sp. JDM 1129			•	•		•	•											•			•			•			•		•
Rhytidoponera convexa group sp. JDM 1366																		•			•								
Rhytidoponera convexa group sp. JDM 1370																•					•								
Rhytidoponera 'crassinoda' (Forel, 1907)		•		•		•	•	•		•	•		•		•	•		•		•	•	•							•
Rhytidoponera dubia group sp. JDM 904										•					•			•			•	•							•
Rhytidoponera flavicornis Clark, 1936	•					•	•			•						•		•		•	•								
Rhytidoponera foveolata Crawley, 1925									•												•	•			•		•		•
Rhytidoponera inornata Crawley, 1922														•							•		•		•		•	•	•
Rhytidoponera levior Crawley, 1925																								•	•		•		•

	Northern Province						Eremaean Province												South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Rhytidoponera mayri (Emery, 1883)							•		•				•			•				•	•	•			•			•	•
Rhytidoponera metallica (F. Smith, 1858)								•	•				•	•		•	•			•	•	•	•		•	•	•		•
Rhytidoponera metallica group sp. JDM 1023 (*flavipes*?)							•		•				•		•		•			•	•								•
Rhytidoponera metallica group sp. JDM 1098							•													•	•								
Rhytidoponera micans Clark, 1936																•				•	•	•		•					•
Rhytidoponera micans complex sp. JDM 986															•						•								
Rhytidoponera mirabilis Clark, 1936								•													•								•
Rhytidoponera punctata (F. Smith, 1858)									•				•	•		•				•	•	•			•	•	•		•
Rhytidoponera punctata complex sp. JDM 253													•								•								
Rhytidoponera punctigera Crawley, 1925																					•	•			•			•	•
Rhytidoponera quadriceps Clark, 1936								•					•								•								
Rhytidoponera reflexa complex sp. JDM 576									•	•						•				•	•			•					•
Rhytidoponera reticulata (Forel, 1893)			•		•	•																							
Rhytidoponera reticulata group sp. JDM 1056	•				•	•				•																			
Rhytidoponera taurus (Forel, 1910)	•	•			•	•	•	•		•	•	•						•	•		•								•
Rhytidoponera tenuis (Forel, 1900)	•		•	•		•				•					•						•								
Rhytidoponera tyloxys Brown, 1958		•		•	•	•	•	•		•	•		•			•		•		•	•				•				•
Rhytidoponera violacea (Forel, 1907)							•	•						•		•		•		•	•			•	•	•	•		•
Rhytidoponera sp. JDM 736 (sp. 26 ANIC)							•														•								
Rhytidoponera sp. JDM 985								•		•			•		•						•								
Rhytidoponera sp. JDM 1372	•					•																							

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
FORMICINAE																													
Acropyga myops Forel, 1910	•	•				•																•	•		•	•			•
Acropyga pallida (Donisthorpe, 1938)																													
Calomyrmex glauerti Clark, 1930											•							•		•	•	•		•					•
Calomyrmex purpureus smaragdinus Emery, 1898							•		•	•			•			•		•		•	•	•		•	•	•	•		•
Calomyrmex splendidus viridiventris Forel, 1915		•				•																							
Calomyrmex sp. JDM 751							•											•			•								
Camponotus aeneopilosus group sp. JDM 430																						•			•				•
Camponotus aeneopilosus group sp. JDM 1031																						•			•				•
Camponotus aeneopilosus group sp. JDM 1108																				•	•								
Camponotus aeneopilosus group sp. JDM 1374																						•		•	•		•		•
Camponotus andrewsi Donisthorpe, 1936			•			•																							
Camponotus andyyoungi McArthur, 2008																							•		•		•		•
Camponotus arcuatus aesopus Forel, 1907									•	•						•				•	•								
Camponotus arcuatus group sp. JDM 996									•												•								
Camponotus arenatus Shattuck & McArthur, 2002									•	•			•			•					•								
Camponotus armstrongi McAreavey, 1949									•				•	•				•			•					•			•
Camponotus aurocinctus (F. Smith, 1858)		•				•		•	•	•	•	•	•		•	•					•								
Camponotus bigenus Santschi, 1919									•									•		•	•	•		•	•				•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Camponotus cf. *cameratus* Viehmeyer, 1925																						•							•
Camponotus capito Mayr, 1876							•			•								•			•								
Camponotus capito ebeninithorax Forel, 1915									•				•			•				•	•	•			•	•			•
Camponotus ceriseipes Clark, 1938																							•		•			•	•
Camponotus ceriseipes complex sp. JDM 105																									•		•	•	•
Camponotus ceriseipes complex sp. JDM 774									•												•		•	•	•		•		•
Camponotus chalceus Crawley, 1915																				•	•	•	•	•	•		•	•	•
Camponotus cinereus amperei Forel, 1915							•		•				•				•	•		•	•	•		•	•	•	•		•
Camponotus cinereus notterae Forel, 1907									•							•				•	•	•	•	•	•	•	•	•	•
Camponotus clarior Forel, 1902									•				•			•	•			•	•								
Camponotus claripes Mayr, 1876									•											•	•								
Camponotus claripes complex sp. JDM 63									•				•								•				•		•		•
Camponotus claripes complex sp. JDM 288																						•			•		•		•
Camponotus claripes complex sp. JDM 767																						•			•				•
Camponotus claripes complex sp. JDM 779									•												•	•			•				•
Camponotus claripes complex sp. JDM 939							•								•			•			•	•			•				•
Camponotus claripes complex sp. JDM 1345														•							•	•			•				•
Camponotus claripes complex A sp. JDM 448												•						•			•								
Camponotus claripes complex A sp. JDM 1243												•						•			•								
Camponotus consectator (F. Smith, 1858)		•				•				•								•			•	•			•	•	•		•
Camponotus crozieri McArthur & Leys, 2006	•	•	•			•	•			•								•			•								

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Camponotus darlingtoni Wheeler, 1934																							•	•	•		•	•	•
Camponotus discors Forel, 1902							•		•	•			•		•	•				•	•	•							•
Camponotus discors complex sp. JDM 599										•								•			•								
Camponotus discors complex sp. JDM 772																								•			•		•
Camponotus discors complex sp. JDM 1104							•			•								•		•	•	•							•
Camponotus donnellani Shattuck & McArthur, 2002							•		•				•					•			•					•			•
Camponotus dromas Santschi, 1919			•			•												•			•								
Camponotus dryandrae McArthur & Adams, 1996																•		•			•	•	•	•	•	•	•		•
Camponotus elegans Forel, 1902																									•				•
Camponotus ephippium (F. Smith, 1858)							•			•						•					•	•	•						•
Camponotus ephippium narses Forel, 1915		•		•		•																							
Camponotus ephippium group sp. JDM 775																•				•	•	•			•	•			•
Camponotus ephippium group sp. JDM 777									•							•		•			•	•	•			•			•
Camponotus ephippium group sp. JDM 1280																							•						•
Camponotus evae zeuxis Forel, 1915	•	•				•	•											•			•	•			•				•
Camponotus extensus Mayr, 1876																		•			•								
Camponotus fieldeae Forel, 1902	•	•	•	•		•	•			•						•		•			•								
Camponotus fieldellus Forel, 1910			•			•				•								•			•								
Camponotus gibbinotus Forel, 1902				•		•	•	•	•	•	•	•	•		•	•	•	•		•	•	•				•	•		•	•
Camponotus gouldianus Forel, 1922									•					•			•				•		•			•			•

	Northern Province					Eremaean Province														South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Camponotus hartogi Forel, 1902			•	•		•												•			•		•					•	•
Camponotus humilior Forel, 1902																													
Camponotus inflatus Lubbock, 1880										•					•			•			•								
Camponotus insipidus Forel, 1893									•												•	•	•	•	•		•	•	•
Camponotus insipidus group sp. JDM 1256																						•		•	•	•			
Camponotus inverallensis Forel, 1910									•	•			•					•			•	•	•		•		•	•	•
Camponotus johnclarki Taylor, 1992																							•	•	•	•	•		
Camponotus leae Wheeler, 1915									•	•	•				•	•				•	•			•					
Camponotus leae group sp. JDM 764										•								•			•								
Camponotus longideclivis McArthur & Adams, 1996									•								•				•	•	•		•	•	•		•
Camponotus longifacies McArthur, 2003										•						•		•			•	•	•				•		•
Camponotus lownei Forel, 1895							•		•	•			•	•							•	•	•	•			•		•
Camponotus macareaweyi Taylor, 1992		•				•																							
Camponotus marcens Forel, 1907																						•	•		•				•
Camponotus michaelseni Forel, 1907																						•	•		•				•
Camponotus michaelseni group sp. JDM 229																							•				•		
Camponotus michaelseni group sp. JDM 1080				•		•												•			•								
Camponotus molossus Forel, 1907																								•	•		•		•
Camponotus nigriceps (F. Smith, 1858)									•	•						•	•				•	•	•	•	•		•		•
Camponotus novaehollandiae Mayr, 1870	•	•	•	•		•	•											•			•								
Camponotus oetkeri Forel, 1910		•				•		•	•	•			•	•		•		•			•	•							•

	Northern Province					Eremaean Province												South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Camponotus pauseyi McArthur, 2003										•						•		•			•	•							•
Camponotus pellax Santschi, 1910		•				•																							
Camponotus perjurus Shattuck & McArthur, 2002													•								•	•	•			•			•
Camponotus peseshus Bolton, 1995																									•		•	•	•
Camponotus pitjantjatarae McArthur, 2003																•	•			•	•	•		•		•			•
Camponotus postcornutus Clark, 1930									•											•	•	•		•	•	•			•
Camponotus prosseri Shattuck & McArthur, 2002														•							•								
Camponotus prostans Forel, 1910																						•	•		•	•	•	•	•
Camponotus rubiginosus Mayr, 1876	•	•	•			•															•								
Camponotus rubiginosus group sp. JDM 296							•								•	•					•	•		•	•		•		•
Camponotus rubiginosus group sp. JDM 695																•		•			•	•		•					•
Camponotus rubiginosus group sp. JDM 771									•												•								
Camponotus rubiginosus group sp. JDM 1038									•												•								
Camponotus rubiginosus group sp. JDM 1158				•		•	•											•			•								
Camponotus rubiginosus group sp. JDM 1219																		•			•								
Camponotus rubiginosus group sp. JDM 1224																						•			•				•
Camponotus rudis McArthur, 2003																							•		•				•
Camponotus rufus Crawley, 1925																						•		•	•		•		•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Camponotus scotti McArthur, 2003																									•		•		•
Camponotus scratius Forel, 1907									•												•			•	•		•	•	•
Camponotus setosus Shattuck & McArthur, 2002	•		•			•																							
Camponotus simpsoni McArthur, 2003	•		•			•										•		•			•				•	•	•		•
Camponotus sponsorum Forel, 1910									•			•	•			•		•		•	•	•		•	•	•			•
Camponotusa subnitidus Mayr, 1876	•	•				•																							
Camponotus terebrans (Lowne, 1865)																•				•	•	•	•	•	•	•	•	•	•
Camponotus 'terebrans' (light-coloured morph)									•											•	•	•				•			•
Camponotus tricaloratus Clark, 1941								•	•	•	•				•			•		•	•	•		•		•			•
Camponotus tristis Clark, 1930									•												•	•	•	•	•				•
Camponotus tumidus Crawley, 1922b																									•				•
Camponotus versicolor Clark, 1930									•												•	•	•			•			•
Camponotus whitei Wheeler, 1915									•							•					•	•	•	•	•	•			•
Camponotus wiederkehri Forel, 1894	•	•	•	•	•	•	•	•	•	•	•		•			•	•	•	•		•	•							•
Camponotus wiederkehri group sp. JDM 924							•														•			•					•
Camponotus wiederkehri group sp. JDM 925																								•					•
Camponotus woodroffeensis McArthur, 2008																		•			•								
Camponotus group A sp. JDM 26									•				•			•					•	•	•	•	•	•	•	•	•
Camponotus unassigned sp. JDM 693										•								•			•								
Colobopsis gasseri Forel, 1894									•												•	•	•	•	•	•	•		•
Colobopsis sp. JDM 927																								•			•		•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Lepisiota frauenfeldi (Mayr, 1855)																											•		•
Melophorus aeneovirens (Lowne, 1865)		•				•							•			•				•	•		•	•	•	•	•	•	•
Melophorus andersenioides Heterick, Castalanelli & Shattuck, 2017																				•	•			•					•
Melophorus ankylochaetes Heterick, Castalanelli & Shattuck, 2017				•			•		•									•		•	•	•		•					•
Melophorus argus Heterick, Castalanelli & Shattuck, 2017			•			•																							
Melophorus attenuipes Heterick, Castalanelli & Shattuck, 2017							•											•			•			•					•
Melophorus bagoti Lubbock, 1883	•	•			•	•	•			•		•				•		•			•								
Melophorus barbellulatus Heterick, Castalanelli & Shattuck, 2017																						•			•				•
Melophorus biroi Forel, 1907																						•							•
Melophorus bruneus McAreavey, 1949									•			•	•							•	•								
Melophorus caeruleoviolaceus Heterick, Castalanelli & Shattuck, 2017								•					•		•						•								
Melophorus canus Heterick, Castalanelli & Shattuck, 2017	•			•		•				•					•	•					•		•	•		•			•
Melophorus castaneus Heterick, Castalanelli & Shattuck, 2017				•		•							•					•	•		•								
Melophorus chauliodon Heterick, Castalanelli & Shattuck, 2017							•	•			•	•	•			•					•	•		•			•		•
Melophorus chrysus Heterick, Castalanelli & Shattuck, 2017																		•			•				•				•
Melophorus clypeatus Heterick, Castalanelli & Shattuck, 2017												•						•			•								
Melophorus cuneatus Heterick, Castalanelli & Shattuck, 2017																											•		•

	Northern Province					Eremaean Province														South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Melophorus curtus Forel, 1902				•		•							•			•		•			•								
Melophorus dicyrtos Heterick, Castalanelli & Shattuck, 2017		•		•		•				•								•		•	•			•					•
Melophorus eumorphus Heterick, Castalanelli & Shattuck, 2017									•												•	•				•			•
Melophorus fieldi Forel, 1910									•	•						•		•			•	•		•			•		•
Melophorus fulvidus Heterick, Castalanelli & Shattuck, 2017		•		•		•												•			•								•
Melophorus gibbosus Heterick, Castalanelli & Shattuck, 2017													•			•					•								•
Melophorus graciliceps Heterick, Castalanelli & Shattuck, 2017																				•	•				•				•
Melophorus gracilipes Heterick, Castalanelli & Shattuck, 2017							•	•	•	•	•		•		•			•		•	•	•		•					•
Melophorus gracilis Heterick, Castalanelli & Shattuck, 2017		•				•				•								•			•								•
Melophorus griseus Heterick, Castalanelli & Shattuck, 2017				•	•	•																							
Melophorus hirsutipes Heterick, Castalanelli & Shattuck, 2017	•		•			•	•		•												•				•				•
Melophorus incisus Heterick, Castalanelli & Shattuck, 2017		•		•		•						•									•								•
Melophorus inconspicuus Heterick, Castalanelli & Shattuck, 2017	•		•	•		•				•			•		•						•		•				•		•
Melophorus isaiah Heterick, Castalanelli & Shattuck, 2017									•																				
Melophorus kuklos Heterick, Castalanelli & Shattuck, 2017			•			•																							

	Northern Province					Eremaean Province													South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Melophorus lanuginosus Heterick, Castalanelli & Shattuck, 2017	•			•	•	•			•	•			•			•		•			•	•		•					•
Melophorus laticeps Wheeler, 1915										•						•		•			•								
Melophorus latinotus Heterick, Castalanelli & Shattuck, 2017																								•			•		•
Melophorus lissotriches Heterick, Castalanelli & Shattuck, 2017																•					•								
Melophorus longipes Heterick, Castalanelli & Shattuck, 2017							•		•	•					•	•		•		•	•	•		•					•
Melophorus ludius Forel, 1902					•	•	•		•							•		•			•	•						•	•
Melophorus macroschismus Heterick, Castalanelli & Shattuck, 2017									•											•	•	•							•
Melophorus majeri Agosti, 1998																							•	•					
Melophorus major Forel, 1915			•			•												•			•								
Melophorus marius Forel, 1910		•		•		•			•	•			•			•		•			•	•		•		•	•		•
Melophorus marmar Heterick, Castalanelli & Shattuck, 2017									•							•					•								
Melophorus microreticulatus Heterick, Castalanelli & Shattuck, 2017									•							•					•	•		•					•
Melophorus microtriches Heterick, Castalanelli & Shattuck, 2017	•			•		•		•	•	•			•					•		•	•						•		•
Melophorus minimus Heterick, Castalanelli & Shattuck, 2017													•								•								
Melophorus mjobergi Forel, 1915		•		•		•												•			•								
Melophorus mullewaensis Heterick, Castalanelli & Shattuck, 2017																								•					•
Melophorus nemophilus Heterick, Castalanelli & Shattuck, 2017									•												•					•			•

	Northern Province						Eremaean Province												South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Melophorus oblongiceps Heterick, Castalanelli & Shattuck, 2016									•												•								
Melophorus orthonotus Heterick, Castalanelli & Shattuck, 2017												•						•			•								
Melophorus paramorphomenus Heterick, Castalanelli & Shattuck, 2017							•									•				•	•	•							•
Melophorus parvimolaris Heterick, Castalanelli & Shattuck, 2017										•						•		•			•								•
Melophorus pelecygnathus Heterick, Castalanelli & Shattuck, 2017										•					•						•	•							•
Melophorus pelorocephalus Heterick, Castalanelli & Shattuck, 2017										•			•		•						•								•
Melophorus perthensis Wheeler, 1934							•		•	•	•				•	•	•	•		•	•	•	•	•	•	•	•	•	•
Melophorus platyceps Heterick, Castalanelli & Shattuck, 2017																					•	•							
Melophorus postlei Heterick, Castalanelli & Shattuck, 2017	•					•				•						•					•								
Melophorus potteri McAreavey, 1947									•				•					•			•								
Melophorus praesens Heterick, Castalanelli & Shattuck, 2017		•	•			•			•	•			•		•			•			•				•				•
Melophorus prominens Heterick, Castalanelli & Shattuck, 2017																		•		•	•								
Melophorus propebiroi Heterick, Castalanelli & Shattuck, 2017																											•		•
Melophorus purpureus Heterick, Castalanelli & Shattuck, 2017									•											•	•						•	•	•
Melophorus pusillus Heterick, Castalanelli & Shattuck, 2017									•	•			•		•	•					•								

	Northern Province						Eremaean Province													Province	South-West Province							Province
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL		AVW	ESP	GES	JAF	MAL	SWA	WAR	
Melophorus rufoniger Heterick, Castalanelli & Shattuck, 2017			•	•	•	•	•		•							•		•			•	•							•
Melophorus sericothrix Heterick, Castalanelli & Shattuck, 2017																						•		•	•	•	•		•
Melophorus setosus Heterick, Castalanelli & Shattuck, 2017		•				•												•			•								
Melophorus solitudinis Heterick, Castalanelli & Shattuck, 2017													•								•								
Melophorus subulipalpus Heterick, Castalanelli & Shattuck, 2017							•		•				•					•			•								
Melophorus sulconotus Heterick, Castalanelli & Shattuck, 2017					•	•																							
Melophorus sulla Forel, 1910		•		•		•	•	•	•	•	•	•			•	•		•			•	•			•	•	•		•
Melophorus tenuis Heterick, Castalanelli & Shattuck, 2017			•			•																							
Melophorus teretinotus Heterick, Castalanelli & Shattuck, 2017	•	•		•	•	•	•											•			•								
Melophorus translucens Heterick, Castalanelli & Shattuck, 2017																						•			•		•		•
Melophorus turneri Forel, 1910							•		•	•		•				•		•			•	•	•		•		•		•
Melophorus vitreus Heterick, Castalanelli & Shattuck, 2017							•		•	•						•					•	•		•					•
Melophorus wheeleri Forel, 1910	•	•		•		•	•	•	•	•	•		•		•	•		•			•	•							•
Melophorus xouthos Heterick, Castalanelli & Shattuck, 2017										•					•						•								
Melophorus 'group K'				•		•																							
Myrmecorhynchus emeryi André 1896																									•	•		•	•
Notoncus capitatus Forel, 1915									•												•		•		•		•		•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Notoncus enormis Szabó, 1910									•									•			•	•	•						•
Notoncus gilberti Forel, 1895																						•	•	•	•	•	•		•
Notoncus hickmani Clark, 1930									•											•	•	•	•	•	•		•	•	•
Notoncus sp. JDM 487																											•		•
Nylanderia glabrior (Forel, 1902)		•	•			•	•					•						•			•						•		•
Nylanderia cf. *obscura* (Mayr, 1862)																											•		•
Nylanderia rosae (Forel, 1902)		•		•		•	•							•				•			•								
Nylanderia sp. JDM 1123			•			•												•			•								
Nylanderia sp. JDM 1163		•	•			•																							
Oecophylla smaragdina (Fabricius, 1775)	•	•	•		•	•																							
Opisthopsis diademata Wheeler, 1918										•								•			•								
Opisthopsis haddoni Emery, 1893	•	•	•	•	•	•	•	•			•								•		•								
Opisthopsis haddoni rufonigra Forel, 1910	•		•			•	•			•		•						•			•								
Opisthopsis rufithorax Emery, 1895									•							•				•	•	•		•	•	•	•		•
Opisthopsis sp. JDM 1162							•											•			•								
Paraparatrechina minutula (Forel, 1901)				•		•	•														•						•		•
Paraparatrechina minutula group sp. JDM 916							•									•		•			•						•		•
Paraparatrechina minutula group sp. JDM 1250		•				•																							
Paratrechina longicornis (Latreille, 1802)	•	•	•		•	•	•														•						•		•
Plagiolepis clarki Wheeler, 1934																						•		•	•		•	•	•
Plagiolepis lucidula Wheeler, 1934																											•	•	•
Plagiolepis squamulosa Wheeler, 1934									•												•	•		•	•	•	•		•
Plagiolepis sp. JDM 189																				•	•	•	•		•		•		•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Plagiolepis sp. JDM 489																									•		•		•
Polyrhachis ammonoeides Roger, 1863							•											•		•	•			•	•		•		•
Polyrhachis anderseni Kohout, 2013			•	•	•	•																							
Polyrhachis bohemia Kohout, 2013			•	•		•	•			•								•			•								
Polyrhachis capillata Kohout, 2013									•												•								
Polyrhachis clarki Kohout, 2013																		•			•			•					•
Polyrhachis consimilis F. Smith, 1858			•			•																							
Polyrhachis cracenta Kohout, 2013			•			•																							
Polyrhachis crawleyi Forel, 1916	•		•			•																							
Polyrhachis curtospinosa Kohout, 2013																•					•								
Polyrhachis cyrus Forel, 1901			•			•																							
Polyrhachis femorata F. Smith, 1858																									•		•		•
Polyrhachis gab Forel, 1879		•	•		•	•																							
Polyrhachis gravis Clark, 1930							•		•				•		•						•			•					•
Polyrhachis hespera Kohout, 2013																								•					•
Polyrhachis hirsuta Mayr, 1876																									•				•
Polyrhachis inconspicua Emery, 1887		•	•	•	•	•	•											•			•								
Polyrhachis io Forel, 1915		•				•																							
Polyrhachis lata Emery, 1895	•	•			•	•	•											•			•								
Polyrhachis macropa Wheeler, 1916							•			•						•		•		•	•								
Polyrhachis melanura Kohout, 2013		•	•	•		•	•														•								
Polyrhachis opacita Kohout, 2013							•														•								
Polyrhachis ops Forel, 1907																							•		•			•	•
Polyrhachis palmerae Kohout, 2013			•			•																							

	Northern Province						Eremaean Province													South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Polyrhachis phryne Forel, 1907														•							•		•				•	•	•
Polyrhachis pilbara Kohout, 2013										•								•			•								•
Polyrhachis prometheus Santschi, 1920					•	•												•			•								•
Polyrhachis pseudothrinax Hung, 1967		•	•		•	•																							
Polyrhachis pyrrhus Forel, 1910									•							•				•	•	•							•
Polyrhachis schenkii Forel, 1886			•			•																							
Polyrhachis schwiedlandi Forel, 1902							•		•	•								•		•	•								
Polyrhachis seducta Kohout, 2013							•		•												•								
Polyrhachis senilis Forel, 1902	•						•			•								•			•								
Polyrhachis sidnica Mayr, 1866																						•	•	•	•	•	•	•	•
Polyrhachis sokolova Forel, 1902			•			•	•														•								
Polyrhachis tanami Kohout, 2013																•		•			•								
Polyrhachis terpsichore Forel, 1893			•			•																							
Polyrhachis unicornis Kohout, 2013		•				•																							
Polyrhachis weiri Kohout, 2013				•		•																							
Polyrhachis zimmerae Clark, 1941									•							•				•	•	•							•
Polyrhachis (*'Camponyrma'*) sp. JDM 118																				•	•	•					•		
Polyrhachis (*'Camponyrma'*) sp. JDM 390																					•	•							
Polyrhachis (*'Camponyrma'*) sp. JDM 670										•					•	•					•	•							
Polyrhachis (*'Camponyrma'*) sp. JDM 703										•			•					•			•	•		•	•	•	•		
Polyrhachis (*'Camponyrma'*) sp. JDM 802																									•				
Polyrhachis (*'Camponyrma'*) sp. JDM 804																						•			•		•		
Polyrhachis (*'Camponyrma'*) sp. JDM 805									•						•			•			•								
Polyrhachis (*'Camponyrma'*) sp. JDM 1009									•	•								•			•								

	Northern Province						Eremaean Province												South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Polyrhachis (*Campomyrma*) sp. JDM 1010							•		•			•	•					•		•	•			•					•
Polyrhachis (*Campomyrma*) sp. JDM 1011			•			•												•			•								
Polyrhachis (*Campomyrma*) sp. JDM 1012										•					•			•			•								
Polyrhachis (*Campomyrma*) sp. JDM 1086													•			•					•								
Polyrhachis (*Campomyrma*) sp. JDM 1189																		•			•								
Polyrhachis (*Campomyrma*) sp. JDM 1200										•								•			•								
Polyrhachis (*Campomyrma*) sp. JDM 1201			•			•																							
Polyrhachis (*Campomyrma*) sp. JDM 1384																											•		•
Polyrhachis (*Chariomyrma*) sp. JDM 807							•			•								•			•				•		•		•
Polyrhachis (*Chariomyrma*) sp. JDM 808							•											•			•				•		•		•
Polyrhachis (*Chariomyrma*) sp. JDM 1204			•			•																						•	•
Polyrhachis (*Chariomyrma*) sp. JDM 1273								•	•				•			•		•		•	•	•		•	•		•		•
Polyrhachis (*Chariomyrma*) sp. JDM 1274		•				•																						•	•
Polyrhachis (*Hagiomyrma*) sp. JDM 1275							•														•		•						
Polyrhachis (*Hagiomyrma*) sp. JDM 1344			•			•																							
Prolasius antennatus McAreavey, 1947																		•			•				•		•	•	•
Prolasius flavicornis Clark, 1934		•				•																			•		•		•
Prolasius hemiflavus Clark, 1934																												•	•
Prolasius wheeleri McAreavey, 1947																						•		•	•		•		•
Prolasius sp. JDM 109																						•			•			•	•
Prolasius sp. JDM 551																							•		•			•	•
Prolasius sp. JDM 1120																									•			•	•
Stigmacros aemula (Forel, 1907)									•												•		•		•	•	•		•
Stigmacros anthracina McAreavey, 1957																													•

	Northern Province						Eremaean Province													South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Stigmacros barretti Santschi, 1928																								•					•
Stigmacros brachytera McAreavey, 1957																									•			•	•
Stigmacros clivispina (Forel, 1902)									•									•			•	•			•			•	•
Stigmacros elegans McAreavey, 1949																		•			•	•			•		•		•
Stigmacros epinotalis McAreavey, 1957									•												•				•		•	•	•
Stigmacros flava McAreavey, 1957																					•				•				•
Stigmacros froggatti Forel, 1902																					•				•		•		•
Stigmacros hirsuta McAreavey, 1957				•		•									•						•								•
Stigmacros inermis McAreavey, 1957									•								•	•		•	•				•				•
Stigmacros occidentalis (Crawley, 1922)																		•			•				•		•		•
Stigmacros pilosella (Viehmeyer, 1925)				•		•	•		•				•								•								
Stigmacros punctatissima McAreavey, 1957									•												•								
Stigmacros pusilla McAreavey, 1957									•												•								
Stigmacros rectangularis McAreavey, 1957																		•			•						•		
Stigmacros reticulata Clark, 1930																								•			•		
Stigmacros spinosa McAreavey, 1957									•												•	•							
Stigmacros termitoxena Wheeler, 1936									•							•		•			•	•		•	•	•			•
Stigmacros sp. JDM 115																									•		•	•	•
Stigmacros sp. JDM 341										•								•			•						•		•
Stigmacros sp. JDM 396																						•			•				•
Stigmacros sp. JDM 622																						•			•				•
Stigmacros sp. JDM 827																				•	•	•			•				•
Stigmacros sp. JDM 831																											•		•
Stigmacros sp. JDM 832																									•				•

	Northern Province						Eremaean Province													South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Stigmacros sp. JDM 833									•							•					•								
Stigmacros sp. JDM 1001														•							•								
Stigmacros sp. JDM 1045													•								•	•							•
Stigmacros sp. JDM 1046									•												•	•				•			•
Stigmacros sp. JDM 1067																											•		•
Stigmacros sp. JDM 1091													•			•					•								
Stigmacros sp. JDM 1135																						•							•
Stigmacros sp. JDM 1237																											•		•
Stigmacros sp. JDM 1367							•											•			•	•							•
LEPTANILLINAE																													
Leptanilla swani Wheeler, 1932																									•				•
MYRMECIINAE																													
Myrmecia acuta Ogata & Taylor, 1991																							•						•
Myrmecia analis Mayr 1862																						•	•		•	•	•	•	•
Myrmecia arnoldi Clark, 1951									•												•	•	•			•			•
Myrmecia callima (Clark, 1943)								•	•		•		•		•						•	•							•
Myrmecia cephalotes (Clark, 1943)									•							•					•								
Myrmecia chasei Forel, 1894																						•	•	•	•	•	•	•	•
Myrmecia clarki Crawley, 1922																		•		•	•		•		•		•	•	•
Myrmecia desertorum Wheeler, 1915				•		•	•	•	•	•		•	•		•	•		•			•	•	•	•	•	•	•		•
Myrmecia dispar (Clark, 1951)									•												•		•						•
Myrmecia elegans (Clark, 1943)														•		•					•	•	•	•	•	•			•
Myrmecia erecta Ogata & Taylor, 1991									•												•				•				•

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Myrmecia exigua (Clark, 1943)							•		•				•								•	•	•	•	•		•	•	•
Myrmecia forceps Roger, 1861									•												•	•	•		•	•		•	•
Myrmecia fucosa Clark, 1934													•			•					•								•
Myrmecia fulgida Clark, 1951									•												•	•	•	•	•	•			•
Myrmecia fuscipes Clark, 1951									•				•	•			•				•	•	•	•	•	•	•		•
Myrmecia gratiosa Clark, 1951																						•	•	•	•	•	•		•
Myrmecia hilli (Clark, 1943)										•					•	•					•								•
Myrmecia imaii Taylor, 2015																							•		•		•	•	•
Myrmecia infima Forel, 1900									•					•							•		•		•	•	•	•	•
Myrmecia inquilina Douglas & Brown, 1959																									•				•
Myrmecia ludlowi Crawley, 1922																												•	•
Myrmecia mandibularis F. Smith, 1858														•							•	•	•		•	•	•	•	•
Myrmecia michaelseni Forel, 1907									•												•	•	•		•	•		•	•
Myrmecia nigriceps Mayr, 1862																						•	•		•	•	•	•	•
Myrmecia nigriscapa Roger, 1861																									•		•	•	•
Myrmecia occidentalis (Clark, 1943)									•							•	•			•	•				•	•			•
Myrmecia pavida Clark, 1951																						•	•		•	•			•
Myrmecia picta F. Smith, 1858									•								•				•	•	•	•	•	•			•
Myrmecia picticeps Clark, 1951																									•		•		•
Myrmecia regularis Crawley, 1925																									•			•	•
Myrmecia rubripes Clark, 1951																							•			•			•
Myrmecia rufinodis F. Smith, 1858									•												•		•			•			•
Myrmecia rugosa Wheeler, 1933																												•	•

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	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Myrmecia swalei Crawley, 1922									•												•		•	•	•	•	•	•	•
Myrmecia tepperi Emery, 1898														•							•	•	•		•			•	•
Myrmecia testaceipes (Clark, 1943)																							•		•	•	•	•	•
Myrmecia urens Lowne, 1865																						•	•	•	•	•	•		•
Myrmecia urens group sp. JDM 71																							•				•	•	•
Myrmecia varians Mayr, 1876			•			•							•	•		•				•	•	•	•	•		•			•
Myrmecia vindex F. Smith, 1858									•							•					•	•	•	•	•	•	•	•	•
Nothomyrmecia macrops Clark, 1934									•												•								
MYRMICINAE																													
Adlerzia froggatti (Forel, 1902)																								•	•		•	•	•
Aphaenogaster barbigula Wheeler, 1916									•												•	•		•	•		•		•
Aphaenogaster kimberleyensis Shattuck, 2008			•			•																							
Aphaenogaster mediterrae Shattuck, 2008									•					•		•	•				•	•	•			•			•
Aphaenogaster poultoni Crawley 1922							•		•											•	•	•	•	•	•	•	•		•
Austromorium flavigaster (Clark, 1938)																						•		•	•	•	•	•	•
Austromorium hetericki Shattuck, 2009																								•			•		•
Cardiocondyla atalanta Forel, 1915	•	•	•			•																			•		•		•
Cardiocondyla nuda (Mayr, 1866)		•				•	•			•										•	•	•	•		•		•		•
Cardiocondyla paranuda Seifert, 2003	•	•				•	•									•				•					•		•		•
Cardiocondyla wroughtonii (Forel, 1890)			•			•																							
Carebara affinis (Jerdon, 1851)			•			•																							
Carebara cornigera (Forel, 1902)																											•		•
Carebara sp. JDM 440																									•				•

	Northern Province						Eremaean Province												South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Carebara sp. JDM 1131							•														•								
Chelaner anthracinus (Heterick, 2001)							•									•					•	•			•	•			•
Chelaner bicornis (Forel, 1907)									•												•	•				•			•
Cheaner bifidus (Heterick, 2001)				•	•	•																							
Chelaner bihamatus (Heterick, 2001)									•								•				•	•							•
Chelaner brachythrix (Heterick, 2001)																					•	•		•			•		•
Chelaner capito (Heterick, 2001)													•								•								
Chelaner centralis (Forel, 1910)										•						•					•	•			•	•			•
Chelaner crinitus (Heterick, 2001)																		•							•				
Chelaner decuria (Heterick, 2001)																					•	•		•	•		•		•
Chelaner durokoppinensis (Heterick, 2001)																					•	•							
Chelaner elegantulus (Heterick, 2001)									•				•			•					•	•							
Chelaner euryodon (Heterick, 2001)									•							•					•	•				•			
Chelaner flavoniger (Heterick, 2001)																					•	•		•					
Chelaner insolescens (Wheeler, 1934)		•	•	•	•	•	•														•								
Chelaner insolescens group sp. JDM 1174			•		•	•					•							•			•								
Chelaner insolescens group sp. JDM 1381			•			•																							
Chelaner insolescens group sp. JDM 1382	•	•	•			•																							
Chelaner lacunosus (Heterick, 2001)									•								•				•	•			•	•	•		•
Chelaner leae (Forel, 1913)							•		•	•						•		•		•	•	•		•	•	•	•		•
Chelaner legulus (Heterick, 2001)									•											•	•	•		•	•	•			•
Chelaner longiceps (Wheeler, 1934)																•					•	•			•	•	•	•	•
Chelaner longinodis (Heterick, 2001)									•												•	•			•	•	•		•
Chelaner majeri (Heterick, 2001)																•					•			•					

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	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Chelaner pubescens (Heterick, 2001)									•												•			•			•		•
Chelaner punctulatus (Heterick, 2003)							•								•						•								
Chelaner rubriceps group sp. JDM 1175							•											•			•								
Chelaner rufoniger (Heterick, 2001)							•									•					•	•		•	•		•		•
Chelaner striatifrons (Heterick, 2001)							•		•							•				•	•	•							•
Chelaner sublamellatus (Heterick, 2003)																							•		•				•
Chelaner whitei (Wheeler, 1915)							•		•					•		•		•			•								
Chelaner whitei group sp. JDM 1178																								•					•
Chelaner xantheklemma (Heterick, 2001)																				•	•	•							•
Colobostruma australis Brown, 1959																							•						•
Colobostruma cerornata Brown, 1959													•			•					•	•	•	•					•
Colobostruma elliotti (Clark, 1928)																							•	•	•		•		•
Colobostruma froggatti (Forel, 1913)																								•				•	•
Colobostruma mellea Shattuck, 2000																						•			•				•
Colobostruma nancyae Brown, 1965																						•	•		•		•		•
Colobostuma papulata Brown, 1965																							•						•
Crematogaster australis Mayr, 1876							•									•				•	•	•							•
Crematogaster bipartita Emery, 1922		•				•																							
Crematogaster clarior Forel, 1902			•			•																							
Crematogaster eurydice (♀) Forel, 1915 (*not included in the Part I key)		•		•		•																							
Crematogaster frivola Forel, 1902							•		•				•			•				•	•	•	•	•	•	•	•		•
Crematogaster laeviceps F. Smith, 1858		•		•		•	•											•			•	•	•	•	•	•	•		•
Crematogaster longicephala curticeps Wheeler, 1915							•		•									•			•	•		•	•		•		•

	Northern Province						Eremaean Province												South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Crematogaster mjobergi Forel, 1915			•		•	•																							•
Crematogaster queenslandica Forel, 1902		•	•	•		•	•											•			•								•
Crematogaster queenslandica froggatti Forel, 1902																							•		•	•			•
Crematogaster queenslandica gilberti Emery, 1922				•		•												•		•	•	•				•			•
Crematogaster queenslandica rogans Forel, 1902									•												•	•	•	•	•		•		•
Crematogaster rufotestacea Mayr, 1876																					•	•	•		•		•	•	•
Crematogaster whitei Wheeler, 1915									•							•		•			•	•		•		•			•
Crematogaster xerophila Wheeler, 1915							•		•									•		•	•	•							•
Crematogaster (*Crematogaster*) sp. JDM 1368																					•			•			•		•
Epopostruma frosti (Brown, 1948)									•					•				•			•	•			•				•
Epopostruma inornata Shattuck, 2007																									•				
Epopostruma kangarooensis Shattuck, 2000																									•				
Epopostruma lattini Shattuck, 2000																•					•	•				•			•
Epopostruma mercurii Shattuck, 2000																								•					
Epopostruma monstrosa Viehmeyer, 1925																									•				
Epopostruma natalae Shattuck, 2000																							•						
Epopostruma quadrispinosa (Forel, 1895)																						•			•				
Epopostruma sowestensis Shattuck, 2000									•				•	•				•			•								
Mayriella occidua Shattuck, 2007																												•	
Meranoplus ajax Forel, 1915		•	•		•	•		•				•						•	•		•								•
Meranoplus arcuatus Schödl, 2007										•					•						•								
Meranoplus aureolus Crawley, 1921					•	•				•				•		•		•			•	•		•			•	•	•

	Northern Province						Eremaean Province													South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Meranoplus berrimah Schödl, 2007			•			•																							
Meranoplus crassispina Schödl, 2007	•					•																							
Meranoplus curvispina Forel, 1910			•			•	•	•	•	•				•		•		•		•	•	•		•	•	•	•		•
Meranoplus deserticola Schödl, 2007								•		•	•				•	•					•								
Meranoplus dimidiatus F. Smith, 1867							•			•								•			•			•					•
Meranoplus dimidiatus complex sp. JDM 423														•						•	•	•		•		•	•		•
Meranoplus dimidiatus complex sp. JDM 491																									•		•		•
Meranoplus dimidiatus complex sp. JDM 627									•							•		•			•	•				•			•
Meranoplus dimidiatus complex sp. JDM 1144																		•		•	•								
Meranoplus dimidiatus complex sp. 1 (TERC)		•		•	•	•									•						•								
Meranoplus dimidiatus complex sp. 2 (TERC)	•			•		•																							
Meranoplus diversus F. Smith, 1867		•				•		•								•		•			•	•		•					•
Meranoplus duyfkeni Forel, 1915	•	•			•	•												•			•								
Meranoplus fenestratus F. Smith, 1867							•		•												•	•		•	•				•
Meranoplus fenestratus group sp. JDM 267																							•		•	•	•	•	•
Meranoplus fenestratus group sp. JDM 424																•					•	•		•					•
Meranoplus fenestratus group sp. JDM 866																						•		•	•				•
Meranoplus fenestratus group sp. JDM 1268			•			•																							
Meranoplus ferrugineus Crawley, 1922																						•			•		•		•
Meranoplus froggatti complex sp. JDM 677									•	•						•		•			•	•							•

	Northern Province						Eremaean Province													South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Meranoplus froggatti complex sp. JDM 922																								•					•
Meranoplus froggatti complex sp. JDM 1101							•													•	•								
Meranoplus linae Santschi, 1928			•	•	•	•												•			•								
Meranoplus macarthuri Schödl, 2007																						•							•
Meranoplus minimus Crawley, 1922				•	•	•																							
Meranoplus mjobergi Forel, 1915	•	•	•	•		•	•					•						•			•								
Meranoplus occidentalis Schödl, 2007							•			•								•			•								
Meranoplus oceanicus F. Smith, 1862							•		•												•			•	•				
Meranoplus oxleyi Forel, 1915	•			•		•				•					•			•			•								
Meranoplus pubescens (F. Smith, 1863)	•			•		•																							
Meranoplus puryi complex sp. JDM 673									•	•			•			•		•		•	•				•				•
Meranoplus puryi complex sp. JDM 674										•						•		•			•								
Meranoplus puryi complex sp. JDM 865				•		•	•														•								
Meranoplus puryi complex sp. JDM 889		•				•												•			•								
Meranoplus puryi complex sp. JDM 931		•	•			•																							
Meranoplus puryi complex sp. JDM 967															•						•		•						•
Meranoplus puryi complex sp. JDM 988										•			•		•						•								
Meranoplus puryi complex sp. JDM 1025															•						•								
Meranoplus puryi complex sp. JDM 1071							•											•		•	•	•			•				•
Meranoplus puryi complex sp. JDM 1107																•		•			•	•							•
Meranoplus puryi complex sp. JDM 1133							•					•						•			•								
Meranoplus puryi complex sp. JDM 1145									•												•	•							•
Meranoplus puryi complex sp. JDM 1146																		•			•								
Meranoplus puryi complex sp. JDM 1276	•	•		•	•	•																							

	Northern Province					Eremaean Province													South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Meranoplus puryi complex sp. JDM 1377																									•			•	•
Meranoplus puryi complex sp. JDM 1378																•					•								
Meranoplus puryi complex sp. 3 (TERC)	•			•		•																							
Meranoplus dimidiatus group complex A sp. JDM 867			•	•		•					•	•						•			•				•				•
Meranoplus dimidiatus group complex B sp. JDM 955		•		•		•																							
Meranoplus dimidiatus group complex C sp. JDM 1255	•	•	•			•																							
Meranoplus rugosus Crawley, 1922																						•	•		•		•		•
Meranoplus similis Viehmeyer, 1922																						•			•				
Meranoplus snellingi Schödl, 2007 (?)										•					•						•								
Meranoplus taurus Schödl, 2007							•											•			•								
Meranoplus testudineus McAreavey, 1956			•			•																							
Meranoplus unicolor Forel, 1902	•	•			•	•												•			•								
Meranoplus sp. 4 (TERC)			•			•																							
Mesostruma eccentrica Taylor, 1973																						•	•	•	•		•	•	•
Mesostruma inornata Shattuck, 2000									•					•		•					•		•						•
Mesostruma laevigata Brown, 1952																	•				•	•	•		•				•
Mesostruma loweryi Taylor, 1973																					•	•			•				•
Mesostruma spinosa Shattuck, 2007 [on loan to ANIC]																											•	•	•
Monomorium aithoderum Heterick, 2001																					•	•	•		•	•	•		•
Monomorium anderseni Heterick, 2001	•	•	•	•	•	•																							
Monomorium antipodum Forel, 1901		•		•		•	•							•		•		•			•	•							•

	Northern Province						Eremaean Province												South-West Province									
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Monomorium antipodum complex sp. JDM 103																											•		•
Monomorium antipodum complex sp. JDM 717							•													•	•								
Monomorium antipodum complex sp. JDM 1369							•		•									•			•								
Monomorium arenarium Heterick, 2001							•														•	•	•	•	•		•	•	•
Monomorium carinatum Heterick, 2001		•		•		•				•								•			•				•				•
Monomorium disetigerum Heterick, 2001		•	•	•		•	•			•						•		•			•								•
Monomorium eremophilum Heterick, 2001							•									•				•	•								•
Monomorium fieldi Forel, 1910	•		•	•	•	•	•			•								•			•				•				•
Monomorium floricola (Jerdon, 1851)			•			•															•								
Monomorium laeve Mayr, 1876	•		•	•		•	•									•		•			•				•				•
Monomorium megalops Heterick, 2001														•							•	•							•
Monomorium micula Heterick, 2001																•					•	•			•				•
Monomorium nanum Heterick, 2001									•		•		•							•	•	•							•
Monomorium orientale Mayr, 1879				•		•																							
Monomorium pharaonis (Linnaeus, 1758)									•									•			•				•				•
Monomorium rothsteini Forel, 1902	•	•	•	•	•	•	•	•	•	•			•			•		•			•	•		•	•				•
Monomorium silaceum Heterick, 2001		•		•		•		•			•					•	•				•	•							•
Monomorium stictonotum Heterick, 2001							•		•		•										•	•			•				•
Monomorium sordidum Forel, 1902	•	•	•		•	•	•	•	•	•			•	•	•			•		•	•	•	•	•	•	•	•	•	•
Monomorium sydneyense Forel, 1902		•		•	•	•			•							•	•				•	•		•	•		•		•
Monomorium sydneyense complex sp. JDM 101				•		•	•							•				•		•	•		•			•			•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Orectognathus clarki Brown, 1953																							•		•				•
Pheidole ampla Forel, 1893									•	•						•				•	•	•		•	•	•	•	•	•
Pheidole antipodum (F. Smith, 1858)									•												•	•			•		•	•	•
Pheidole bos Forel, 1893							•		•	•				•	•		•				•	•	•	•	•	•	•	•	•
Pheidole bos complex sp. JDM 871																		•			•	•							•
Pheidole deserticola foveifrons Viehmeyer, 1924										•								•		•	•	•	•			•			•
Pheidole dispar (Forel, 1895)			•			•																							
Pheidole hartmeyeri Forel, 1907							•		•				•							•	•	•		•	•	•	•		•
Pheidole hospes F. Smith 1865			•			•																							
Pheidole incurvata complex sp. JDM 164									•					•		•		•			•	•		•	•		•		•
Pheidole incurvata complex sp. JDM 306	•	•	•	•	•	•																							
Pheidole incurvata complex sp. JDM 429									•							•		•			•	•			•		•		•
Pheidole indica Mayr, 1879																									•		•		•
Pheidole longiceps doddi Forel, 1910			•	•		•																							
Pheidole megacephala (Fabricius, 1793)							•		•				•			•					•	•		•	•		•		•
Pheidole mjobergi Forel, 1915	•	•		•	•	•	•			•								•			•								
Pheidole mjobergi complex sp. JDM 1176																		•			•								
Pheidole proxima Mayr, 1876	•		•		•	•																•							•
Pheidole rugosula Forel, 1902									•												•	•	•		•	•	•		•
Pheidole rugosula complex sp. JDM 337									•							•					•	•							•
Pheidole turneri Forel, 1902	•	•	•	•		•	•											•			•								
Pheidole variabilis Mayr, 1876		•	•	•		•	•					•						•			•								
Pheidole vigilans (F. Smith, 1858)				•		•																					•		•

	Northern Province					Eremaean Province												South-West Province								
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Pheidole sp. JDM 280	•	•	•			•																							
Pheidole sp. JDM 684							•									•		•			•								
Pheidole sp. JDM 933			•			•																							
Pheidole sp. JDM 934		•	•	•		•																							
Pheidole sp. JDM 1332			•			•																							
Podomyrma adelaidae (F. Smith, 1858)									•	•	•		•				•	•		•	•	•	•	•	•	•	•	•	•
Podomyrma basalis F. Smith, 1859			•			•																							
Podomyrma chasei Forel, 1901																									•	•	•		•
Podomyrma christae (Forel, 1907)																		•		•	•	•	•	•	•	•	•		•
Podomyrma clarki (Crawley, 1925)																					•			•			•		
Podomyrma elongata Forel, 1895																					•	•			•	•	•	•	•
Podomyrma ferruginea (Clark, 1934)																						•			•	•	•		•
Podomyrma gastralis Emery 1897						•																							
Podomyrma libra (Forel, 1907)									•											•	•			•					•
Podomyrma macrophthalma Viehmeyer, 1925																													
Podomyrma nitida (Clark)																									•			•	•
Podomyrma sp. JDM 512																		•			•								
Podomyrma sp. JDM 1395																									•				•
Solenopsis belisarius Forel, 1907							•														•	•		•					•
Solenopsis clarki Crawley, 1922				•		•	•									•					•	•			•		•		•
Stereomyrmex anderseni (Taylor, 1991)		•	•			•															•								
Strumigenys emmae (Emery, 1890)			•			•																							
Strumigenys perplexa (F. Smith, 1876)																													•

	Northern Province					Eremaean Province													South-West Province						
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Strumigenys quinquedentata Crawley, 1923																													•
Strumigenys radix Bolton, 2000			•			•	•														•								•
Syllophopsis sp. JDM 438																									•			•	•
Tetramorium bicarinatum (Nylander, 1846)																						•		•	•		•		•
Tetramorium caldarium (Roger, 1857)																											•		•
Tetramorium impressum (Viehmeyer, 1925)									•	•				•		•		•			•	•		•	•		•		•
Tetramorium lanuginosum Mayr, 1870		•	•			•																							
Tetramorium laticephalum complex sp. JDM 1117									•												•								
Tetramorium megalops Bolton, 1977									•	•					•						•								
Tetramorium sjostedti Forel, 1915	•		•			•	•			•								•			•								
Tetramorium spininode Bolton, 1977	•	•		•	•	•	•											•			•			•					
Tetramorium striolatum (*sensu lato*)	•	•				•	•		•				•					•			•	•		•		•	•		•
Tetrmaorium simillimum (F. Smith, 1851)			•			•																							
Tetramorium viehmeyeri Forel, 1907																•					•								
Tetramorium sp. JDM 141					•	•							•					•			•								
Tetramorium sp. JDM 347																						•			•		•		•
Tetramorium sp. JDM 515							•													•	•			•					•
Tetramorium sp. JDM 522																								•			•		•
Tetramorium sp. JDM 884																								•			•		•
Tetramorium species group A sp. JDM 707																		•			•								
Tetramorium species group A sp. JDM 886			•			•																							
Tetramorium species group A sp. JDM 1007																				•	•			•					•
Tetramorium species group A sp. JDM 1177		•				•							•					•			•								•
Trichomyrmex destructor (Jerdon, 1851)	•				•	•	•											•			•						•		•

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
PONERINAE																													
Anochetus avius Shattuck & Slipinska, 2012			•			•																							
Anochetus graeffei Mayr, 1870			•			•																							
Anochetus rectangularis Mayr, 1876							•			•								•			•								
Anochetus renatae Shattuck & Slipinska, 2012				•		•			•				•			•		•		•	•	•			•		•		•
Anochetus veronicae Shattuck & Slipinska, 2012			•			•												•			•								
Austroponera rufonigra (Clark, 1934)																									•		•	•	•
Brachyponera lutea (Mayr, 1862)							•		•									•			•	•		•	•	•	•	•	•
Hypoponera congrua (Wheeler, 1934)		•				•	•														•		•		•		•	•	•
Hypoponera eduardi (Forel, 1894)																											•	•	•
Hypoponera sp. JDM 1376			•			•																							
Leptogenys centralis Wheeler, 1915																		•			•								
Leptogenys clarki Wheeler, 1933							•											•			•			•					•
Leptogenys darlingtoni Wheeler, 1933										•						•		•		•	•	•		•					•
Leptogenys exigua Crawley, 1921				•		•																							
Leptogenys fallax (Mayr, 1876)																		•			•								
Leptogenys neutralis Forel, 1907																									•		•	•	•
Leptogenys tricosa Taylor, 1969		•				•				•					•						•								
Leptogenys sp. JDM 1128							•														•								
Myopias tasmaniensis Wheeler, 1923																									•			•	•
Odontomachus ruficeps F. Smith, 1858	•	•	•	•		•	•	•	•	•			•		•	•		•		•	•	•		•	•	•	•		•
Odontomachus turneri Forel, 1900	•		•	•		•																							

	Northern Province						Eremaean Province														South-West Province							
	CEK	DAL	NOK	OVP	VIB	Province	CAR	CER	COO	GAS	GID	GSD	GVD	HAM	LSD	MUR	NUL	PIL	TAN	YAL	Province	AVW	ESP	GES	JAF	MAL	SWA	WAR	Province
Platythyrea brunnipes (Clark, 1938)									•												•				•		•		•
Platythyrea dentinodis (Clark, 1930)																						•					•		•
Platythyrea micans (Clark, 1930)																							•		•		•		•
Platythyrea parallela (F. Smith, 1859)																		•			•	•			•		•		•
Platythyrea parallela group sp. JDM 1171										•								•			•								
Platythyrea turneri Forel, 1895																									•		•	•	•
Ponera leae Forel, 1913			•			•																							
Ponera sp. JDM 1122																									•			•	•
Pseudoneoponera denticulata (Kirby, 1896)							•									•		•		•	•			•					•
Pseudoneoponera piliventris regularis (Forel, 1907)							•		•	•	•		•	•	•	•		•		•	•	•		•					•
Pseudoneoponera porcata (Emery, 1897)			•			•																							
Pseudoneoponera sublaevis (Emery, 1887)	•	•		•	•	•																							
Pseudoneoponera sp. JDM 984										•	•	•	•		•	•					•								
PROCERATIINAE																													
Discothyrea bidens Clark, 1928																												•	•
Discothryea clavicornis Emery, 1897			•			•	•											•			•								
Discothryea crassicornis Clark, 1926																									•	•		•	•
Discothryea turtoni Clark, 1934																									•			•	•
Probolomyrmex latalongus (♀) Shattuck, Gunawardene & Heterick, 2012							•														•								
PSEUDOMYRMECINAE																													
Tetraponera nitida (F. Smith, 1860)			•			•																							
Tetraponera punctulata F. Smith, 1877	•	•	•		•	•			•									•		•	•	•		•	•		•		•
Totals for provinces and subregions	77	119	133	102	68	**248**	181	48	221	135	35	39	109	47	70	171	34	249	8	119	**510**	303	167	193	320	150	266	119	**529**

CHARACTER OF THE WESTERN AUSTRALIAN FAUNA

All but five of Western Australia's 76 ant genera have representatives in the SWP, and of the subfamilies only the Aenictinae occur outside this province. Some nine small genera have thus far been recorded only within its borders or in a neighbouring subregion of the EP (in the case of the endemic *Nebothriomyrmex*), while others, including the formicine genus *Prolasius*, have only a couple to a few species in the EP and NP. The ants more-or-less confined to the SWP tend to have cryptic habits and require a cool, moist environment. Additionally, workers of *Leptanilla swani* have only been collected in the SWP, but males have been recovered in more northerly localities, including Barrow Island. In WA, *Oecophylla* is the sole genus found only in the NP, but no genera appear to be restricted to the EP. In this monograph, a queen of *Probolomyrmex latalongus* from Barrow Island in the EP is the only specimen mapped, but a male of the genus that is ascribed to this species (Shattuck et al. 2012) is held in the California Academy of Sciences, and that specimen was collected at Langi Crossing near Willare Bridge in the Kimberley.

The WA ant fauna consists predominantly of ground-nesting species, and this is unsurprising given that so much of the state is flat and sparsely vegetated. *Colobopsis*, *Oecophylla*, *Podomyrma* and *Tetraponera* are probably the only genera that in WA consist solely of arboreal nesting species, but most West Australian *Anonychomyrma* and *Crematogaster* species nest in living or dead timber. There are no Western Australian ants that are specialised twig-nesting species except, perhaps, *Tetraponera nitida* (see Ward 2001). Nonetheless, trees are an important direct or indirect source of food for WA ants and, in rural areas, it is not uncommon to see half-a-dozen or more ant species trailing up trees in search of nectar, honeydew or prey.

Army ants are fairly well represented in WA, with *Leptanilla swani* and several species of *Aenictus* and *Onychomyrmex* to be found in this state. Other ants which may exhibit army ant-like behaviour include *Carebara affinis* and *Ooceraea australis* (the latter included based on an observation by the author). Some members of the ponerine genus *Leptogenys* also have an army-ant lifeway, but this has not been recorded for any WA *Leptogenys* as far as is known. None of these ants is conspicuous, unlike their doryline counterparts in the Americas and Africa, and most would not be seen by the public because of their small size, predominantly fossorial habits, and remote habitats.

Tramp ant species are also common in settled areas of Western Australia, unfortunately, and some noxious species are capable of penetrating areas of woodland or forest adjoining settlement (Heterick 2009). At least 15 species of ant not native to Australia now call this state their home, though, fortunately, this number does not include the two species of fire ant (*Solenopsis geminata* [Fabricius] and *Solenopsis invicta* [Buren]) now bedeviling the north and east coasts of Australia — while this paper was in preparation, the red imported fire ant *S. invicta* was also detected in Fremantle port, and eradication activities are continuing. Most of these ants were probably brought into the country by ship many years ago and have dispersed from their original port of entry to the various Australian states via cargoes on state ships and railways and, more recently, by road transport. Air freight and sea containers from east and south-east Asian sources are, however, the likely greatest threat as far as more unwelcome introductions are concerned. As well as anthropogenic means, the arrival of a few species may have been facilitated by natural processes, such as inseminated queens arriving in hollow twigs, etc. This may have been the way *Lioponera longitarsus* arrived in Australia (Brown 1975). In addition to exotic species, several eastern Australian taxa have been introduced to the Perth region. *Carebara cornigera* has been collected twice in pitfall traps set in Perth suburbs not far from the CBD. One specimen was found in the vicinity of termite-infested wood (Heterick et al. 2013). *Pheidole vigilans*, a widespread eastern states species, is a relatively common ant in well-watered parks and some gardens, while a third species, *Nylanderia* cf. *obscura*, poses a minor nuisance by digging up copious amounts of sand between pavers on patios and paths and on ovals in the Perth area. While definitive records are from Australia's east, south-east and north coasts, this species may occur naturally in the east Kimberley (see Figure 74 — if correctly identified; there is a degree of doubt as *Nylanderia* species are extremely difficult to identify). *Technomyrmex jocosus*, which occasionally poses a nuisance by invading houses in huge numbers, may also be non-native to WA, although its provenance is clouded in time. However, it is likely this was the species that was named as a house-infesting nuisance (in mistake for *Technomyrmex albipes* [F. Smith]) in Melbourne, Vic, as early as 1941 (Clark 1941).

BIOLOGY OF INDIVIDUAL GROUPS AND TAXA

AMBLYOPONINAE

Members of this subfamily have a characteristic thick petiole, which is broadly attached to abdominal segment III. The clypeus has a row of small, dentiform setae. Three genera can be found in Western Australia, of which *Amblyopone* is the predominant genus.

Amblyopone (Figure 3)

The broadly separated antennal lobes, pectinate tibial spurs and relatively short apical mandibular tooth (no more than twice as long as the penultimate tooth), taken together, distinguish *Amblyopone* from two other genera in this subfamily found in WA. Only *Amblyopone australis* can be found away from the south-west corner of the state. However, most records of this species are from the Darling Range and areas west and south of this range of mountains. This species has a spine near the mandibular insertions brought about by the extension of the genae. Outside of WA, this species occurs in all Australian states. Nests are typically found under rocks and logs. The ant is purely entomophagous. This species paralyses or kills its prey, which consists of myriapods and other arthropods, by stinging it and dragging it underground to the brood chamber (Haskins and Haskins 1951). Beetle larvae and termites are particularly sought after as prey (Wheeler 1933). Nests can be situated a considerable depth underground: in a Curtin University student project involving a specially constructed trap consisting of a hollow plastic tube with baited sections at different soil levels that was designed to sample hypogaeic ants, a number of workers of this species were found congregated around proteinaceous baits. *Amblyopone michaelseni*, which has a similar appearance to *A. australis*, but lacks the genal spine, has been found in Vic and WA, but has not been seen in this state for many years, although the holotype was taken from Jarrahdale. This species may have been affected by habitat destruction.

The remaining species form a small complex of matt, orange ants. Two species are widespread in southern Australia, but *Amblyopone aberrans* is known only from the type locality. Within WA, *Amblyopone clarki* is an ant of the Swan Coastal Plain, found particularly in sandy soils dominated by *Banksia* and *Eucalyptus gomphocephala* (tuart) woodlands. In this ant, the upper sector of the frons is weakly shining with regular fine striae and punctation and the masticatory margin of mandible is straight or weakly convex, the mandible having weak dentition with the teeth varying little in size, and terminates in a prominent apical tooth. This ant also occurs in the ACT, NSW, SA, and Vic. The nest hole is often extended in a conspicuous sand turret by several centimetres. A single sentry(?) worker is often to be found inside this turret. The very similar *Amblyopone aberrans* (so called because of the almost abrupt termination of the mandible) has not been seen since it was described by William Morton Wheeler (1927) from material collected at Mundaring. This species has not been found elsewhere in Australia. *Amblyopone longidens* is a third member of this small complex, and is mainly eastern Australian, where it occurs in the ACT,

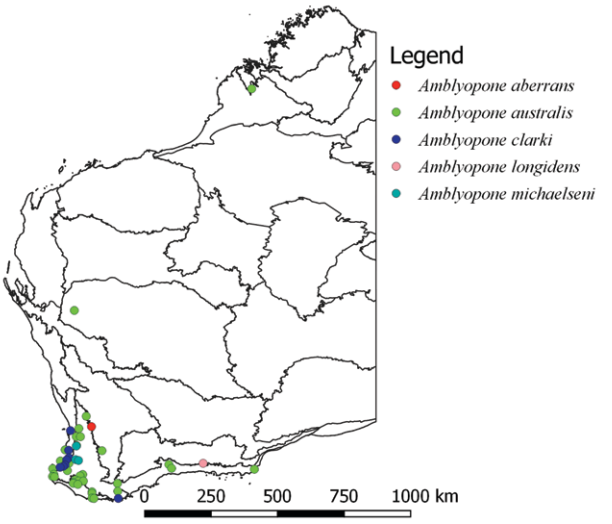

FIGURE 3 Distribution of *Amblyopone aberrans*, *A. australis*, *A. clarki*, *A. longidens* and *A. michaelseni*.

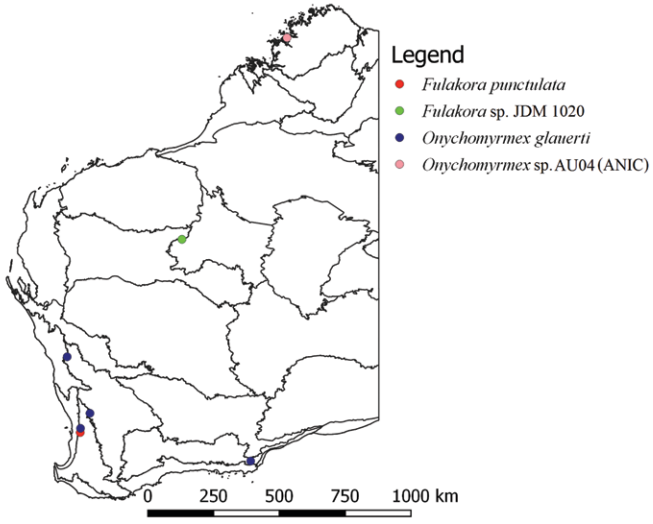

FIGURE 4 Distribution of *Fulakora punctulata*, *Fulakora* sp. JDM 1020, *Onychomyrmex glauerti* and *Onychomyrmex* sp. AU04 (ANIC).

NSW, southern QLD, and south-east SA, but there is one record from near WA's south coast. This species has a distinctive, large tooth midway along the inner margin of the mandible. Specimens have been collected in sandstone scrub and mallee, most often under a rock or foraging on tree trunks. The species has most commonly been associated with basalt, granite and sandstone.

Fulakora (Figure 4)

Fulakora comprises two rare species in WA. In this genus, the frontal carinae are contiguous or fused, the anterior subpetiolar process has a fenestra, and the apical mandibular tooth is not elongate. The specialised appearance of the mandibular teeth and the anterior margin of the clypeus suggest some sort of predatory behaviour, but the literature is silent as regards actual observations. A species of *Fulakora*, believed to be *punctulata* (Clark), is known only from the queen in WA. A specimen has been recorded from pitfall trapping in Jarrah forest not far south of Perth. Otherwise this species is known from Tas, its stronghold. *Fulakora* sp. JDM 1020 is known only from a pin of two specimens collected south of Newman. This species has the pronotum, mesopleuron and propodeum finely striolate throughout, unlike *F. punctulata*, where these sclerites are shining and smooth.

Onychomyrmex (Figure 4)

The other amblyoponine genus present in WA, *Onychomyrmex*, is equally obscure. This genus is similar to *Fulakora*, but the apical tooth is elongate. The species for which the biology is known have an army ant lifestyle and prey on centipedes. *Onychomyrmex glauerti*, confined to WA and initially given its own genus, *Lithomyrmex*, has been found occasionally at several sites in the SWP including the south-east coast, but there are no recent records. This species has well-developed eyes. The type series was found under a stone. *Onychomyrmex* sp. AU04 (ANIC) is known from one almost eyeless worker collected in rainforest at Mt Trafalgar in the northern Kimberley.

DOLICHODERINAE

Dolichoderine ants have a single waist segment (the petiole) that is constricted both in front and behind and has visible anterior and posterior faces and may also have a dorsal face, frontal lobes that partially or fully obscure the antennal sockets, and a pygidium that is neither flattened nor bears teeth but terminates in a transverse slit that is never surrounded by short setae. The Dolichoderinae are particularly well-represented on the Australian continent (12 genera, one of them introduced), especially by the large genus *Iridomyrmex*, which dominates the arid and semi-arid regions and is only absent from thick rainforest. Most of the species are generalised scavengers and predators. Recent phylogenetic work using an extensive molecular data set now reveals that a number of Australia's most common dolichoderines that are wholly or largely restricted to the Australian continent — namely, *Doleromyrma*, *Anonychomyrma*, *Nebothriomyrmex*, *Papyrius*, *Philidris* (absent from WA), *Turneria* (absent from WA), *Ochetellus*, *Froggattella* and *Iridomyrmex* — arose from neotropical ancestors. The descendants of these neotropical ancestors diversified in Australia around 30 million years ago. The ten Australia genera mentioned form an important component of tribe Leptomyrmecini. The introduced genus *Linepithema* is also part of this tribe. Other significant dolichoderines found in Australia, e.g. *Dolichoderus*, *Tapinoma* and *Technomyrmex*, have a different evolutionary origin (Ward et al., 2010).

Anonychomyrma (Figure 5)

Members of this genus are perhaps most easily confused with members of the genus *Iridomyrmex*; however, the mandibles are broadly triangular rather than linear-triangular, the eyes are placed on the lower half of the head (the eyes are placed at about the midpoint in *Iridomyrmex*), and in Australian species the anterior margin of the clypeus is broadly concave to broadly convex without the central spur or dimple most often seen in *Iridomyrmex*. Two of the WA species are strongly associated with trees, and nest in and forage on them. They are likely ecological generalists, and some species are associated with butterflies (Shattuck 1999). When disturbed, these ants emit a characteristic pungent odour, which can be smelled from several metres away. Of the two widespread tree-dwelling species, *Anonychomyrma nitidiceps* has a smooth, square head that lacks erect setae on its sides, and bright orange mandibles. The vertex in this species is distinctly concave. As well as WA, *Anonychomyrma nitidiceps* can be found in Tas and Vic. *Anonychomyrma fornicata*, which has also been recorded from NSW, is very similar but is shaggier in appearance with many erect setae on the sides of the head capsule, which tends to be more rectangular with a weakly concave vertex, and the ant has dark brown to black mandibles. The WA endemic *Anonychomyrma itinerans perthensis* is a soil dweller that is largely confined to the coastal sandplains of southern Western Australia, where its turret nests are a familiar sight in undisturbed bush areas. This species is not found in disturbed habitat within towns and cities. *Anonychomyrma itinerans perthensis* is browner in appearance than its two relatives and has a weakly convex vertex.

Arnoldius (Figure 6)

This genus was long confused with *Bothriomyrmex* until separated by Dubovikoff (2005). The palp formula of 2,2 readily separates workers of *Arnoldius* from all other Western Australian Dolichoderinae. AntWiki still mentions that *Arnoldius* is a temporary social parasite of *Tapinoma* and *Iridomyrmex* (https://www.antwiki.org/wiki/Arnoldius [accessed 21 July 2021]); however, this information relates to species retained in *Bothriomyrmex*, and it is not known if *Arnoldius* species share this feature. There is limited evidence by association for temporary parasitism in at least one species: based on the morphology of the mandible in the *Arnoldius scissor* queen, and the fact that the two syntype queens were taken from a nest of *Iridomyrmex innocens*, Crawley (1922) opined the species was parasitic. Little is recorded of the biology of this genus in Australia.

Two species are definitely known from WA, but the worker of *Arnoldius scissor*, being described from the queen only, is somewhat problematic. *Arnoldius flavus*, which is recognisable by its smaller eye and pale appearance, seems to be mostly confined to the SWP, where it is seen occasionally in small nests in soil, in old termite nests or in decayed wood in dry sclerophyll woodland. There is one record from the Kambalda region and also one Victorian record. *Arnoldius* sp. JDM 433 (*Arnoldius scissor*?) has a larger eye and is darker in colour. This species tends to be found in drier areas than its congener, nesting mainly under tree litter or in rotten wood (pers. obs.), and has been taken as far north as Barrow Island. Heterick (2009) also mentions that this species has been recorded from the Pilbara.

Doleromyrma (Figure 6)

Members of this genus possess a *habitus* that is remarkably similar to that of *Tapinoma*. Two species (one undescribed) can be identified as *Doleromyrma* by a small petiolar node, absent in *Tapinoma*, but *Doleromyrma rottnestensis* also lacks a recognisable node. The truncate posterior margin of the clypeus in the latter is a better character that helps to determine its generic identity, as all *Tapinoma* have a broadly convex posterior clypeal margin.

Doleromyrma are small, inconspicuous, generalist ants that in their natural environment are usually found under rocks, logs and in compacted leaf litter at the base of trees. The nests can be quite large. The ants are relatively tolerant of human activity, and in urban areas they can establish nests directly into soil in large yards that are not overrun by exotic ants. *Doleromyrma darwiniana fida* is ostensibly the most widespread of the three WA species. *Doleromyrma darwiniana* has been recorded in the ACT, NSW, QLD, and Vic and certainly also occurs in the NT but, since the genus has not been monographed, it is unclear whether the existing subspecies are distinct or should be synonymised under *D. darwiniana*. In NSW, *Doleromyrma darwiniana* has been recorded as an occasional house pest (Nitikin 1979) but has not come under adverse notice in WA (Heterick 2009). Most collections of *Doleromyrma darwiniana fida* and *Doleromyrma rottnestensis* have been made in the south-west of the state, but records of *Doleromyrma* have come from far-flung parts of WA, and *Doleromyrma rottnestensis* has been recorded from Barrow Island and also the Kambalda region, so the two species should probably be regarded as having a very broad occurrence in this state. By way

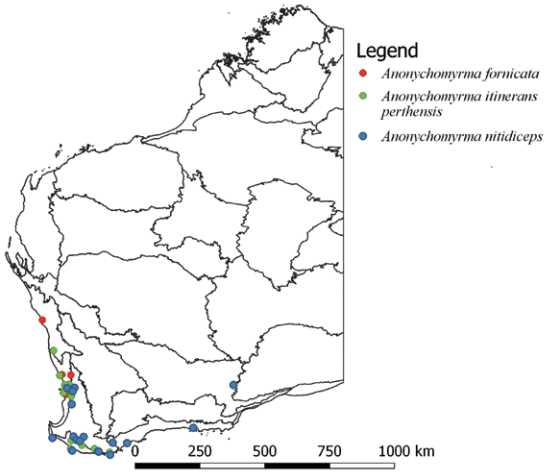

FIGURE 5 Distribution of *Anonychomyrma fornicata*, *A. itinerans perthensis* and *A. nitidiceps*.

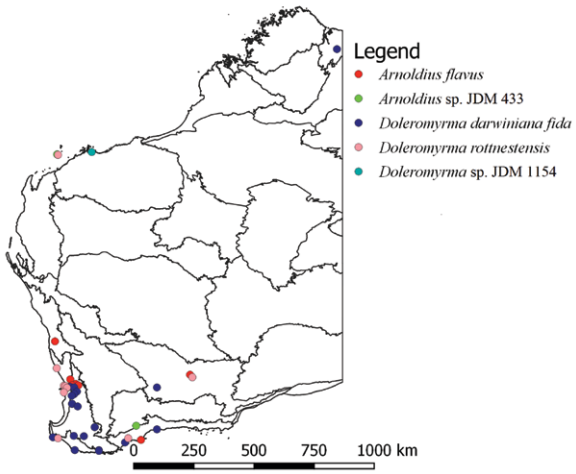

FIGURE 6 Distribution of *Arnoldius flavus*, *Arnoldius* sp. JDM 433, *Doleromyrma darwiniana fida*, *D. rottnestensis* and *Doleromyrma* sp. JDM 1154.

of contrast, *Doleromyrma* sp. JDM 1154 appears to be restricted to drier northern areas. This species was recorded from a number of sites in the Pilbara by Conservation and Land Management Surveys conducted between May 2003 and September 2006, but there are no other records in the JDM or WAM Collections. This species is easily recognisable through its large eye and pale yellow cuticle. Nothing is known of its biology.

Dolichoderus (Figures 7–8)

The Australian members of the genus *Dolichoderus* were revised by Shattuck and Marsden in 2013. Of the 28 species recognised by these researchers, 13 are currently known from WA. A hypostomal flange (i.e. a tongue of cuticle) on the venter of the head capsule is the formal way to identify members of this genus, but, as a rule of thumb, a strongly sclerotised cuticle (unusual in Dolichoderinae) is usually sufficient for the lay person to recognise an ant as belonging to *Dolichoderus*. Four species also carry strong propodeal spines, otherwise only seen in *Froggattella* among WA Dolichoderinae, but while in the latter genus the spines are blunt and extend directly posteriad, in the armed *Dolichoderus* the spines are acuminate and directed vertically.

WA *Dolichoderus* include some uncommon, apparently localised species and nearly all taxa are restricted to natural areas, with few persisting in the face of urbanisation. All species nest into soil, usually under rocks or wood, and are general scavengers as well as obtaining honeydew from aphids and other Hemiptera (Shattuck & Marsden 2013). They are frequently seen trailing on vegetation. Three of the four armed *Dolichoderus* belonging to the *D. scabridus* species-group, namely *D. angusticornis*, *D. rufotibialis,* and *D. ypsilon* are fairly difficult to separate, slight differences in leg colour (*D. rufotibialis* and *D. ypsilon*) and the orientation of the propodeal spines (*D. angusticornis*) being all that distinguishes each taxon from the others. *Dolichoderus niger* is easier to recognise because of its jet black cuticle. Apart from a solitary South Australian record, *Dolichoderus rufotibialis* is restricted to the south coast east to about Bremer Bay and the other three purely West Australian species are mainly confined to coastal areas of the SWP with just a few scattered reports from the most southerly subregions of the EP.

Among the unarmed *Dolichoderus*, *D. parvus* and *D. goudiei* in the *D. australis* species-group can be identified by their rounded propodeal dorsum, the remaining seven WA species, which belong to the *D. scrobiculatus* species-group, having a strongly concave posterior propodeal face. The gaster is pubescent in the dark-coloured *D. goudiei* but pubescence is absent from the gaster of the lighter-coloured *D. parvus*. *Dolichoderus parvus* is found along the southern Australian mainland and is quite common in *Banksia* woodlands in the Perth region, but *Dolichoderus goudiei* is mainly found in eastern Australia (ACT, NSW, SA and Vic) and the only known WA collections have been by researchers Raphael Didham and Peter Yeeles at Dudinin and Woodanilling in the Avon subregion. Specimens were collected on 'vane traps' (designed to collect pollinating insects) affixed 1.8 m above the ground on tree trunks. The habitat was isolated *Eucalyptus wandoo* remnants.

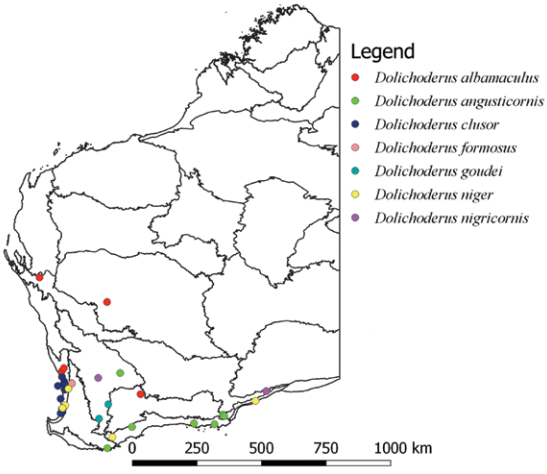

FIGURE 7 Distribution of *Dolichoderus albamaculus*, *D. angusticornis*, *D. clusor*, *D. formosus*, *D. goudei*, *D. niger* and *D. nigricornis*.

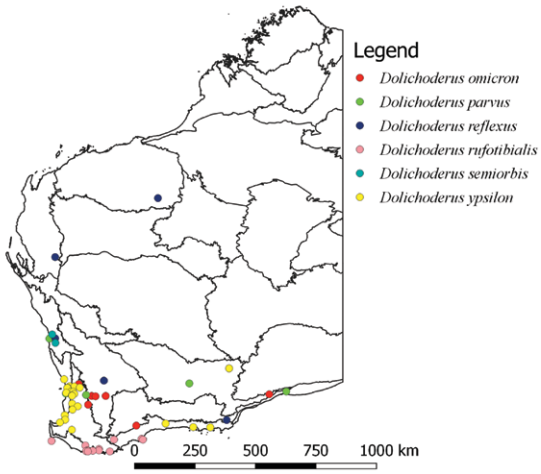

FIGURE 8 Distribution of *Dolichoderus omicron*, *D. parvis*, *D. reflexus*, *D. rufotibialis*, *D. semiorbis* and *D. ypsilon*.

Dolichoderus semiorbis is a distinctive, pale species, and the only WA *Dolichoderus* that lacks erect setae on the tibia. This rare species appears to be confined to sandplains in the Eneabba region. Another distinctive and rather attractive species is *Dolichoderus albamaculus*, which has a characteristic, elongate propodeal shelf and pale markings near the lower margin of the eye. This species has a broad but scattered distribution in open woodland, particularly that dominated by *Acacia*, and its range extends into the NT and SA. The highly arched propodeum is a distinctive feature of *Dolichoderus reflexus*, which also has a broad but sparse distribution throughout Australia, being absent only from the ACT and Tas. This is a mallee species, whose nests in open soil have a crater (Shattuck & Marsden 2013). A species commonly seen trailing on trees in *Banksia* woodlands south of Fremantle is *Dolichoderus clusor*. This form has an essentially smooth pronotum, and pubescent gaster, unlike the remaining three taxa. The entire range of the ant is, oddly enough, restricted to disjunct populations in the Perth and Adelaide areas. Around Perth, however, it is quite common, and this species is one of the few local *Dolichoderus* that can be attracted to cultivated 'bush gardens' and tiny relictual patches of bushland in urban parks.

The remaining three taxa are very difficult to tease apart morphologically. Colour is the only determining factor. *Dolichoderus omicron* mostly has a yellowish-red gaster that is lighter in colour than the mesosoma, the gaster being dark in the remaining two species, but the shade can vary. The former species is scattered throughout arid woodland in southern Australia. The author has found it most frequently in areas with dwarfed mallee, such as the Nullarbor. The ant forages on the ground in columns during the day and nests in soil under rocks (Shattuck & Marsden 2013). The author qualifies the taxonomic key in Shattuck & Marsden (2013) and agrees with Clark's (1930b) original key with regard to the distinction between *D. nigricornis* and *D. omicron*. Figure 17 in Shattuck & Marsden, supposedly of *D. nigricornis*, appears to be of *D. omicron* (compare with the image of a syntype of *D. nigricornis* in AntWeb at https://www.antweb.org/specimenImages.do?name=antweb1008170, which also has more angular humeri). The antennal scape is conspicuously darker than the reddish-coloured head in *D. nigricornis*, but the same colour as the head in dark-headed *D. formosus* and reddish-headed *D. omicron*. *Dolichoderus nigricornis* is quite a rare species, with just a handful of WA records, and may be confined to the state. The author found the ant next to settlement at Caiguna, on the Nullarbor, on the ground among low shrubs. The ant was originally described from material collected at Tammin in the wheatbelt. *Dolichoderus formosus* is found in WA and around the gulfs in SA. In WA, *Dolichoderus formosus* is mainly located in the Darling Range, where the author discovered a nest under a rock in the Julimar State Forest near Chittering. In the deep south of the state an all-black form with strongly angulate humeri occurs. This form was previously regarded as a distinct species ('*Dolichoderus occidentalis*, Clark'), but was synonymised under *D. formosus* by Shattuck and Marsden in 2013.

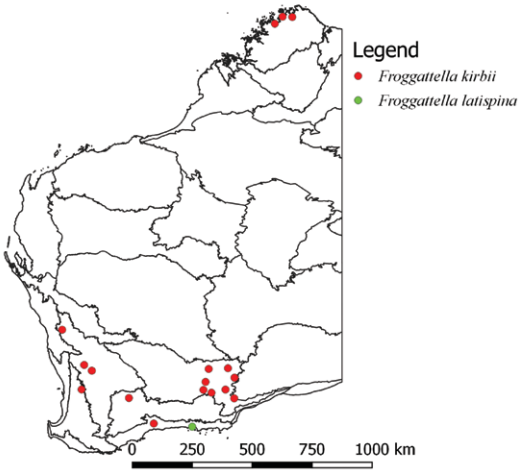

FIGURE 9 Distribution of *Froggattella kirbii* and *F. latispina*.

Froggattella (Figure 9)

This genus is unmistakable among WA Dolichoderinae because of the paired, flattened propodeal spines. Both of the known species of *Froggattella* occur in Western Australia. Elsewhere in Australia, *F. kirbii* has a known distribution in all mainland Australian states except the ACT, but *F. latispina* is restricted to a couple of localities in SA and one known locality in WA. There is little information on the habits of *Froggattella* ants, but their appearance suggests they are generalised scavengers and W. M. Wheeler (1936) mentions their likely tending of plant-sucking bugs. *Froggattella kirbii* is found principally in dry sclerophyll woodlands, including mallee (Shattuck 1996b). This species is larger, less sculptured and has thinner propodeal spines than has *F. latispina*. Much of its western habitat in WA is in the region that has been transformed for the purposes of sheep and wheat growing. Here it is confined to relictual patches of natural woodland. The author has seen individual workers foraging on mallee trees under defoliating bark, but he has also noticed them trailing on the ground. Nests can be found in the soil or in timber, especially in stumps or dead branches on

a living tree (Shattuck 1999). *Froggattella latispina* is a much smaller ant, with broader propodeal spines. It is also much rarer, and in WA it has only been recorded from the Lake Warden area near Esperance. Specimens were collected from blue mallee by chemical knockdown, indicating arboreal foraging, but otherwise there is no information on the habits of this species.

Iridomyrmex (Figures 10–21)

The genus *Iridomyrmex* is identifiable by the median position of the eyes on the head capsule, the shape of the mandible, the shape of the posterior margin of the clypeus and the presence in most species of an anteromedial clypeal prominence or dimple. Western Australia has a very rich *Iridomyrmex* fauna with 56 (73.7%) of the species recorded from mainland Australia being found in this state. Limited sequencing (COI only) undertaken when Heterick and Shattuck were revising the group was insufficient to provide a definitive statement of natural phylogenetic groupings, although the monophyly of the meat ants (*Iridomyrmex purpureus* and its allies) was strongly supported (Heterick & Shattuck [2011]). Other clusters suggested by that work are *I. dromus*, *I. hartmeyeri* and *I. pallidus*; *I. roseatus* and *I. minor*; and *I. hertogi*, *I. mjobergi*, *I. suchieri* and *I. suchieroides*. In addition to these suggested groups, based on the mitochondrial DNA profile, the stick-nest ants *Iridomyrmex conifer*, *I. setoconus* and *I. turbineus* form a natural phenotypic grouping.

Meat ants are very common in Western Australia and, of the nine still valid names resulting from the revision of the group by Shattuck (1993a), six refer to taxa (namely, *I. bigi*, *I. lividus*, *I. purpureus*, *I. reburrus*, *I. sanguineus* and *I. viridiaeneus*) that can be found here. Of these six taxa, *I. bigi* stands apart in both appearance — since the large eye is distinctive — and behaviour. This uncommon ant nests in compacted soil and occurs sparsely in the NT and QLD as well as WA. The nests are cleared of vegetation and debris and have a single entrance. The ant has an early morning and crepuscular foraging pattern (Shattuck 1993a). The remaining five taxa are very similar and can only be distinguished by colour patterns, inclination of the pronotum and the presence or absence of erect setae on the genae. Bright apple-green and purple iridescence characterise *I. viridiaeneus*, and, unlike *I. bigi*, this species usually forms the typical large, pebble-covered nests with multiple entrance holes associated with meat ants (but see below) and has the same aggressive behaviour. Northern *Iridomyrmex viridiaeneus* populations tend to have more reddish iridescence on the dorsum of the head than those in the south. This species can be found in drier, warmer inland areas in most Australian states, but is apparently absent from the ACT, Tas and Vic. *Iridomyrmex lividus*, a very dark ant with strong blue reflections, is most common in SA, where it can be found throughout the state, and in NSW. The species is less common in Vic and is found only in the very deep south of the NT. In Western Australia, it is mainly confined to the Nullarbor Plain. This species can be distinguished from meat ants of similar appearance by its nests, which contain a solitary entrance hole that lacks a cleared area around it or pebbles such as are found scattered around most meat ant nests.

The remaining three ants are very similar both in appearance and in their colour, which is orange or reddish-brown. They also all have large colonies with multiple nest entrances. The archetypal meat ant, *Iridomyrmex purpureus*, can be diagnosed by the gently arched appearance of the anterior pronotum when seen in profile. However, old material which has faded can be difficult to distinguish from specimens of *I. lividus*, which also has the gently arched anterior pronotum. The pronotal arch is much more bulbous in the remaining two species. *Iridomyrmex purpureus* is found in all mainland states but is absent from Tas. This form has several morphological and colour variants; including one with greenish-yellow reflections (normally bluish or violet) which are of a much lighter hue than the intense green seen in *I. viridiaeneus*. Another variant has erect setae on the genae (normally absent), while a third has pale setae (normally black in this meat ant) (Heterick & Shattuck 2011). This species is very familiar to nearly all rural Australians living in the drier areas, and its large, pebble-covered mounds are a minor nuisance in rural yards, tennis courts and other open areas in urbanised surroundings. The ants are very aggressive and will swarm on and bite an intruder at their nests. They are known for their ability to skeletonise dead vertebrates, but also ascend trees to seek out nectar and honeydew (Heterick & Shattuck 2011).

Iridomyrmex reburrus combines a strongly arched pronotum with hairy genae. Isolated individuals of the remaining meat ant species, *Iridomyrmex sanguineus*, may also have both features, so multiple specimens of a colony may need to be analysed to determine the species. Live or freshly killed specimens of *Iridomyrmex reburrus* also tend to be darker in colour than *I. sanguineus* workers. *Iridomyrmex reburrus* is essentially a Torresian species, with all authenticated records coming from the far north of Western Australia, the NT, and QLD. Both Heterick (2009) and Heterick &

Shattuck (2011) also report the species from the Mallee subregion in the south-east of Western Australia (Emu Rock and Gora Hill, respectively), but neither of these localities appear in any published collection data for the species, and they require verification. The occurrence of the ant in such southerly locations would be surprising in view of the immense distance between these and the location of authenticated records. Also, the known habitat preference of the ant, namely riparian or otherwise moist habitats (Andersen 2000; Heterick & Shattuck 2011), is not in accord with these two sites. Interestingly, a series of *Iridomyrmex purpureus* (WAM) was collected from north-east of Holt Rock, the coordinates almost matching those of the Emu Rock site for *I. reburrus*. *Iridomyrmex sanguineus* is found in the same areas as northern populations of *I. reburrus*, but its range extends down the west coast of WA as far as Geraldton, to near the South Australian border in the NT, and adjacent to the QLD–NSW border on the east coast. This very common ant has much the same behaviour as *I. purpureus*; however, both *I. viridiaeneus* and *I. sanguineus* may build small nests with two to four entrance holes (the nests are always large with numerous holes in the case of *I. purpureus*) (Greaves 1971).

Iridomyrmex discors, a medium-sized bright orange- or red-and-black ant that is frequently seen in sandy areas including beside urban footpaths, looks like a miniature meat ant, although its morphology suggests it is a close relative rather than a member of the inner circle. The one specimen sequenced comes out as a sister to all other *Iridomyrmex* on a COI tree, but this is a highly questionable placement and should be disregarded. Shattuck (1996a) placed this species close to the mostly eastern states *I. mayri* group, but more recent taxonomic analysis as well as the genetics suggest the superficial similarity between *I. discors* and the genuine members of the *I. mayri* group is due to convergence (Heterick & Shattuck 2011). The ant can be found in all mainland states but is absent from Tas. Nest holes can be single or part of a larger complex of entrances, but the area surrounding the hole or holes is not decorated with pebbles. Widespread nests of this ant are often an indicator of disturbance (Heterick 2009). As with the meat ants, this pioneer species is pugnacious, and workers will swarm on and bite an intruder. *Iridomyrmex discors* is a general predator and scavenger (Shattuck 1996a).

Another group that has been monographed are those ants that form the *I. calvus* species-group (Shattuck 1993b), although both molecular and morphological evidence suggests a reappraisal of the constituent species may be in order. The highly spectacular members of the *I. rufoinclinus* complex have a number of apomorphies that easily separate them from other *Iridomyrmex* and are likely to be only distantly related to the other two *calvus* complexes mentioned by Shattuck; indeed, such is their apparent distinctness that this author would not be surprised if molecular work disclosed them to constitute a new genus. However, no members of this complex have yet been sequenced to test their relationships within *Iridomyrmex*. Apart from the concave antennal carinae (the only feature they share with the other members of the *I. calvus* group), the *I. rufoinclinus* complex members possess the following very un-*Iridomyrmex*-like morphological features:

1. A strongly anteriorly inclined and elongate petiolar node that resembles that found in members of genus *Dolichoderus*.
2. A sloped rather than convex face to the first gastral tergite so that it is set back from the node rather than pressed against it when the gaster is fully engorged.
3. A strongly sclerotised cuticle.
4. A weakly sinuate clypeal margin rather than a strongly sinuate anterior clypeal margin with an anteromedial clypeal spur or prominence such as is found in most *Iridomyrmex* species.

Four members of the *I. rufoinclinus* complex can be found in WA, namely, *I. anteroinclinus*, *I. cappoinclinus*, *I. cephaloinclinus* and *I. rufoinclinus*. *Iridomyrmex rufoinclinus* is distinctive within its complex by virtue of its all-red head, the other three species possessing a wholly or partially black head capsule. The distribution of this ant is in the northern parts of the NP, where it tends to occur in riparian woodland and savanna. *Iridomyrmex anteroinclinus* has a black head and a bicoloured red-and-black mesosoma. This poorly known species is confined to the northern Kimberley region. *Iridomyrmex cappoinclinus*, distinguished by its bicoloured head capsule, is known to prefer habitats with *Acacia* and *Triodia* cover. One nest seen was in loose sand and had a single entrance hole (Shattuck 1993[b]). Isolated collections only of this rare species have been made in WA, the NT, SA, and QLD. The solitary WA record comes from 99.6 km SE of Newman. *Iridomyrmex cephaloinclinus*, which has a black head and red mesosoma, is by far the most common of the quartet and is found in WA, the NT, and QLD. In WA, collections of the ant have come from

the Gascoyne and Pilbara subregions, Barrow Island and the southern tip of the Dampierland subregion in the NP. This ant, unlike most dolichoderines, appears to be a solitary forager (Heterick & Shattuck 2011), but otherwise nothing is known of its biology.

Iridomyrmex hesperus, *I. nudipes* and *I. prismatis* belong to the *I. viridigaster* complex within the *I. calvus* group, although *I. nudipes* was not described until Heterick & Shattuck's (2011) global revision of the genus. *Iridomyrmex prismatis* was placed in the *I. calvus* complex by Shattuck (1993[b]), but the combination of matt cuticle, J-shaped setae on the underside of the head capsule and appressed setae on the mesosoma that it shares with *I. hesperus* and *I. nudipes* clearly indicate it should be transferred to the *I. viridigaster* complex. All three ants are very rarely encountered. *Iridomyrmex prismatis* can be distinguished from its near relatives by the black pigment of its cuticle (reddish or ochre in the other two species) and its uniform weak blue to bluish-green iridescence. Like the two remaining members of the *viridigaster* complex, *Iridomyrmex prismatis* is rarely seen but it has a broad distribution across southern Australia, occurring in WA, SA, Vic, and NSW. In Western Australia, *Iridomyrmex prismatis* is only known from the Esperance region and there is no information on its biology. *Iridomyrmex hesperus* has erect setae on the tibiae, but these are lacking in *I. nudipes*. *Iridomyrmex hesperus* is restricted to WA, where it has been collected a couple of times on or near the south coast and once near Kambalda in the eastern goldfields. The ant has been taken in mallee woodland and in a pitfall trap, but nothing more is known of its habits. *Iridomyrmex nudipes* evidently has a broader distribution matching that of *I. prismatis*, and has been found in WA, SA, Vic, and NSW. In WA, this ant is known to occur in the Coolgardie and Great Victoria Desert subregions where just two collections in total have been made. All that is known of the ant is that foragers have been collected from mallee stems (NSW) in mid-morning (Heterick & Shattuck 2011).

Several members of Shattuck's original (1993[b]) *I. calvus* complex have been synonymised, two (*I. albitarsus* and *I. notialis*) under I. *calvus* and two (*I. argutus* and *I. occiduus*) under *I. innocens*, leaving just the two species, *I. calvus*, and *I. innocens* (this latter epithet not being considered in Shattuck's 1993[b] revision) that occur in WA; to which, possibly, should be added a third: *I. mirabilis*. *Iridomyrmex mirabilis* is the most morphologically bizarre of all *Iridomyrmex* and has a number of autapomorphies, including a broadly concave anterior clypeal margin, a propodeum with dorsal spiracles that recalls the eastern states dolichoderine *Turneria*, and a low node that is almost *Tapinoma*-like. However, this ant has broadly concave antennal carinae and this makes the *I. calvus* group the best fit until the species can be sequenced. *Iridomyrmex mirabilis* seems to prefer sandy heathland habitats and has been collected as stray workers only a few times in the Dongara-Eneabba region, once on the south coast at Bandalup Hill near Ravensthorpe, once at Albany, and once in eucalypt sclerophyll woodland in Darlington, near Perth. The hand-collected Bandalup workers were foraging on *Kunzia similis* growing on gravel/laterite caprock. Other workers have been pitfall-trapped. However, this is all the information currently available on this fascinating tiny species.

The two species definitely allocated to the *I. calvus* complex are more conventional in appearance, and much more common than the members of the *I. calvus* group mentioned previously. They differ from *Iridomyrmex* falling outside the *I. calvus* group in having the anterior margin of the clypeus weakly to strongly concave between its lateral lobes, and the anteromedial clypeal prominence absent or denoted by a weak undulation (normally present in other *Iridomyrmex*). They also differ from the members of the *I. viridigaster* complex in having very few erect mesosomal setae (*I. calvus*) or in having a shiny as opposed to a matt, minutely sculptured cuticle (*I. innocens*). *Iridomyrmex calvus* is not as commonly seen as many small *Iridomyrmex* but is found occasionally in a variety of habitats including suburban yards and parks. The species is also widespread across all Australian states, including Tas, but is more common in the cooler, wetter south-west and south-east of the continent. Outside of Australia, this ant occurs in New Caledonia (which provided the material for the original description). The species is also found on the external territories of the Lord Howe and Norfolk islands. This ant ranges from pale brown (the form described as *I. 'notialis'*) to dark brown or black (*I. calvus/ I. 'albitarsus'*). Little is known of the biology of the species, but several reports record it foraging on trees and other vegetation, and the author has found it nesting under rocks, and also directly into soil in bushland adjacent to a south coastal beach. One specimen was collected from a pitfall trap set by the author in a yard in the old, established Perth suburb of East Fremantle, indicating this species may have

some tolerance of urbanisation. The distribution of *I. innocens*, by way of contrast, is restricted to south-western WA, where its stronghold is the wetter uplands of the Darling Range. Like its fellow, this attractively shiny ant comes in a variety of colour forms from pale ochre (*I. 'argutus'*) through reddish-brown to jet black (*I. innocens*/ *I. 'occiduus'*). This ant has been taken by fogging, indicating arboreal foraging (ANIC label data). In its typical habitat of tall, dry sclerophyll woodland nests of *I. innocens* can be discovered under rocks and logs; the ant has also been found nesting inside dead wood (Shattuck 1993[b]).

The remaining 40 species of *Iridomyrmex* were not monographed prior to the global revision of Heterick & Shattuck; however, most form clusters, usually of a couple to several species that have a morphological affinity or seem to be related based on mtDNA results.

The stick-nest ants, *I. conifer*, *I. setoconus*, and *I. turbineus*, are a closely linked group whose three members are separable only through an examination of their pilosity pattern; thus, *I. conifer* has a pronotum that is either glabrous or has just a handful of stout, erect setae; in *I. turbineus* the erect pronotal setae are relatively long and flexuous and number more than eight, while *I. setoconus* has genal setae that are numerous, short and straight (either absent or longer and curved in *I. turbineus* and absent altogether in *I. conifer*). However, all three species can be recognised by their characteristic conical propodeum. Morphological variation in *I. conifer* is discussed in Heterick & Shattuck (2011). All three species are confined to south-western WA, *I. conifer* having the greatest range. *Iridomyrmex turbineus* is mostly concentrated in the deep south-west, although there is one goldfields record, but *I. setoconus* has only been recorded east of Esperance on the south coast. Shattuck & McMillan (1998) discuss the interesting nest habits of *I. conifer* (it is likely that similar nesting behaviour is found in the remaining two species). In cooler months, mound nests are constructed using a range of available vegetation such as short lengths of grasses, reeds, *Banksia* leaves, and *Casuarina* cladodes. These are interspersed with small sand grains. The outer materials apparently are waterproofed by glandular secretions produced by the ants. Underground nests are excavated in late spring or early summer. Shattuck & McMillan (1998) identified *Iridomyrmex conifer* as primarily a nectar feeder, but the ant was also recorded feeding on honeydew and various small carrion, including small vertebrates (a honeyeater and skink lizards).

Iridomyrmex rufoniger and its allies form a morphologically fairly well-defined group of ants that are distinguished by a cordate head shape, a truncate and protuberant propodeum and a steeply rising pronotum. *Iridomyrmex rufoniger* and *I. chasei* have a demonstrably close relationship genetically. *Iridomyrmex gibbus* has not been sequenced, but its morphology strongly suggests that it belongs to the same complex of ants. Apart from the meat ants, *Iridomyrmex chasei* is perhaps the member of the genus *Iridomyrmex* with which most Australians would be familiar, as the large mounds of sand the species displaces around its nests are highly conspicuous and a minor irritant to those who like tidy lawns and bare, uncluttered patios and footpaths. *Iridomyrmex chasei* is ubiquitous throughout mainland Australia but, like many *Iridomyrmex*, it is absent from Tas. The species comes in both hairy and smooth-legged forms but can be distinguished from its congeners by the steep curve of the anterior pronotum (which is strongly arched at an angle of 60° or more). Like its larger relatives, the meat ants, this species is particularly aggressive and readily attacks and bites intruders, regardless of size. Foragers are often seen on urban paths as well as in bush areas and on tree-trunks foraging for prey, carrion, nectar and honeydew. Colonies are populous, consisting of many thousands of ants, and visible trails between satellite nests are formed as myriads of ceaselessly moving workers wear a small trench of a few millimetres deep into the soil. *Iridomyrmex rufoniger* is a slighter larger ant. The anterior pronotum is less strongly arched, the gaster has blue-green or greenish iridescence (lacking in *I. chasei*) and the hind tibiae always bear a few to many erect setae; otherwise it looks much the same as the preceding species. *Iridomyrmex rufoniger* has the same distribution as the former species but is much less common away from the eastern seaboard and there is only one old record from the Perth region. Nonetheless, this species has the propensity to be successfully transported overseas by human activities, and has been recorded from New Caledonia, New Zealand, and even Brazil. Even so, the ant is known mainly from a few intercepts, and has not established so as to constitute a pest in these countries (a small population may still persist in New Caledonia) (Heterick & Shattuck 2011). This ant has much the same foraging and nesting habits as *I. chasei*, but pitfall trap numbers suggest nests are smaller in size. This ant is known to tend the larvae of at least four lycaenid butterflies, and (like *I. chasei*) will occasionally enter houses, but it is not a serious pest (Heterick & Shattuck 2011).

The uniformly brown or blackish *Iridomyrmex gibbus* strongly resembles the small, *'concolor'* morph of *I. chasei*, but the pronotal arch is gentler than in that species (about 45°) and it has fewer pronotal setae. Records of *I. gibbus* in WA all come from the northern half of the state, where it has mainly been pitfall-trapped in the Pilbara subregion though it also occurs on Barrow Island. Outside of WA, the species is found in the NT and in far western QLD. The appearance of the ant and the clumped numbers in pitfall traps suggest it has similar habits to *I. chasei*, but its colonies are likely to be less populous.

Iridomyrmex difficilis is a small to minute species that has the general *habitus* of a very small *I. chasei* worker, but the pronotal arch is not as steep. Apart from its size, this species is characterised by a short antennal scape that barely if at all reaches the vertex, a humped pronotum, glabrous hind tibiae, rounded propodeum, and a fairly deeply impressed metanotal groove. Molecular data suggest a sister relationship with the *I. rufoniger* complex. Morphological variation within this taxon and the difficulties of separating it from other tiny *Iridomyrmex*, e.g. northern populations of *I. mjobergi*, are discussed in Heterick & Shattuck (2011). *Iridomyrmex difficilis* is a not uncommon member of the *Iridomyrmex* fauna in all mainland states other than the ACT and, although it has not yet been recorded, it probably also occurs there. This species occupies a wide range of habitats including those much modified by human activity, e.g. paddocks. Direct nesting into soil is common, although the species can also be found under rocks. One nest observed by the author near the Roebuck Plains Roadhouse east of Broome consisted of a tiny nest entrance, barely larger than a single worker, surrounded by a completely cleared circular area of soil several centimetres in diameter. The day was very hot, and ants emerging from and returning to the nest were moving extremely quickly. This ant tends the larvae of the lycaenid butterfly *Jalmenus evagoras* (Heterick & Shattuck 2011). *Iridomyrmex cyaneus* has not been sequenced, but its morphology points to a close relationship with *I. difficilis*. As its name suggests, this small, glabrous, black or brown species has strong bluish to pink iridescence throughout. Probably its most distinctive characteristic, however, is its extremely truncate propodeum, in which the dorsum is protuberant and may be abruptly raised, and the declivous face descends equally as abruptly; the separation between the two propodeal faces is even carinate in some workers. The propodeal spiracle is adjacent to the face of the propodeal declivity. This little metallic ant is strictly an inhabitant of arid parts, all collections coming from the far interior of NSW, inland SA, and inland WA. In common with so many other members of this genus, there is almost nothing known of its habits apart from the fact that WA specimens were pitfall-trapped in mulga woodland over calcrete (Heterick & Shattuck 2011).

Based on the results of COI analysis, the gracile, mainly northern species *Iridomyrmex minor* and *I. roseatus* appear to constitute another complex. To these should probably be added *I. anceps*, *I. azureus*, *I. elongatus*, and *I. xanthocoxa*, none of which have yet been sequenced. All taxa have an elongate body and appendages, and the head is an elongate rectangle, more rarely cordate. The vertex is either planar or gently to strongly convex. The species are predominantly reddish, brown with variegation due to infuscation or uniformly brown (*I. anceps*).

Iridomyrmex minor, as conceived here, is extremely morphologically variable (see discussion in Heterick & Shattuck [2011]) and poses major taxonomic problems. In some cases, the head is cordate and almost suggests a meat ant, while other populations have a narrow, elongate head. The antennal scape always surpasses the vertex by at least a third of its length, but it can surpass the vertex by less than half its length. Moreover, some populations, particularly one of the long-headed forms, can be glabrous but most have fairly long, erect setae on the pronotum and usually elsewhere on the mesosoma. While it is tempting to consider *I. minor* a complex containing several if not more species, there is no obvious morphological character, let alone characters, that will split them globally. Only two specimens have been sequenced, and there is no indication there of separate species. The distribution of *I. minor* reveals an interesting pattern, with very many records coming from northern areas in Western Australia, the NT, and QLD, but the ant also occurs southwards through SA, with one record coming from south-east of Adelaide. The ant appears not to occur in NSW, Vic, or Tas. Based on distribution maps, there appears to be a strong correlation between the occurrence of the ant and the tropical and desert areas of Australia and, to a lesser extent, the grasslands, with few records in the other biomes and none at all in temperate areas. In WA, records are scattered throughout the western half of the state from about Mt Magnet northwards. The ant occurs in a variety of habitats, but sandy areas appear to be preferred. The species usually nests directly in soil but one nest has been found under bark (Heterick & Shattuck 2011).

An ant that strongly resembles typical populations of *I. minor* in appearance is *Iridomyrmex azureus*, which can be distinguished from *I. minor* on the basis of its iridescent cuticle. This ant is found in all mainland Australian states except Vic and the ACT, but is predominantly seen in dry, hot desert areas. In Western Australia, isolated collections have all been from the arid interior of the state. Nothing has been recorded of the ant's biology, but, given its habitat, it is likely to be thermophilic. *Iridomyrmex roseatus* can easily be confused with *I. azureus*, since it has the same iridescence, but this species has hairy scapes and hind tibiae (both glabrous in *I. azureus*). *Iridomyrmex roseatus* is also rather more abundant, although its distribution approximates that of *I. azureus*, and it is found in the same Australian states. In WA, this species is a common inhabitant of drier northern and desert areas, where its appearance can easily lead to it being mistaken for a meat ant. On the other hand, it is not found in the cooler southern or south-western parts of the state. The species has been taken in malaise traps and at *Hakea* blossoms (Heterick & Shattuck 2011), but other information is lacking; a sad state of affairs, given the abundance of this ant and its probable importance in ecosystems where it occurs.

Iridomyrmex anceps is less gracile and has shorter, more compact appendages than its relatives. This is a plain brown ant with few easily recognisable characters, and is best determined by a combination of the short, erect setae on the pronotum (generally present and long in *I. minor*), its lack of iridescence, its uniform colour, and its generally shorter appendages. What is extraordinary about this ant is its enormous range. The species can be found as far afield as Iran, India, Nepal, Taiwan, Laos, Myanmar, Indonesia, Papua New Guinea, and various Pacific islands as well as occurring in northern WA, the NT, and QLD. The position taken by Heterick and Shattuck is that, despite its enormous range, this is a single species. This is contested by Hoffmann et al. (2011), who used morphometrics to dispute the assumption of monophyly. Like many *Iridomyrmex*, this species forages on the ground and on vegetation, and tends the larva of the lycaenid butterfly *Jalmenus evagoras* (Kitching 1999). *Iridomyrmex elongatus* is a very uncommon species that can be distinguished from similar ants by its strongly convex vertex and hairy hind tibiae. This taxon has been collected only four times; once in the NT and three times in WA. The Western Australian records are all from desert areas in the interior of the state. The ant has been collected in pitfall traps, indicating terrestrial foraging, but otherwise nothing is known of its biology. With its brick-red mesosoma and brown gaster and appendages the final member of this group, *Iridomyrmex xanthocoxa*, can easily be confused with typical *I. minor*. However, it is more robust in form with shorter appendages than *I. minor* and its colour and mesosomal outline are somewhat reminiscent of *I. discors*, to which this ant is unrelated. The distinctive feature is the bright orange-yellow fore coxae, these segments being always brown or orange-brown in *I. minor*. The ant has a restricted distribution in Australia, being confined to the Pilbara subregion, but is quite common where it occurs, and it is a regular feature of pitfall-trapped material taken from this subregion. The biology of *I. xanthocoxa* might be expected to be similar to that of *I. minor*, to which ant this species is undoubtedly closely related (Heterick & Shattuck 2011).

A suite of very common, small, light to medium brown species appears to have some affinity with the *I. minor* cluster, based on a COI tree. This group includes some of the small, anthropophilic *Iridomyrmex* most commonly seen by members of the public. In terms of sheer abundance and ubiquity in a variety of habitats, a couple of species rival *I. chasei* and *I. rufoniger*. *Iridomyrmex suchieri* is the most prominent of these. Under a microscope this ant can be quite difficult to distinguish from similar species, but a combination of a straight or at most weakly convex (or even slightly concave) propodeal dorsum, a fringe of short, curved erect setae on the vertex and glabrous hind tibiae is usually sufficient to enable its identification. *Iridomyrmex suchieroides* is very similar in appearance, but this species always has a shorter propodeal dorsum, short, erect setae on the sides of the head and the antennal scapes and hind tibiae are always glabrous. *Iridomyrmex suchieri* can be completely glabrous, but hairier individuals will always also have hairy antennal scapes and/or legs but lack the short setae at the side of the head. In their revision of *Iridomyrmex*, Heterick and Shattuck (2011) took the position that glabrous workers with the same profile as *Iridomyrmex suchieri* were a variant of *I. mjobergi*, although their morphology closely resembled *I. suchieri* and not *I. mjobergi*. Having now seen a large collection of wheatbelt ants taken by R. Didham and P. Yeeles, I now consider such specimens simply part of a broad variation within *I. suchieri*, ranging from very hairy populations (generally more mesic environments) to only weakly hairy or even glabrous populations (generally more arid environments). As well as occurring in all Australian states and territories,

Iridomyrmex suchieri has become established overseas in New Zealand and on some offshore islands. In New Zealand it is a minor domestic nuisance (Don 2007). In Australia, this species is a disturbance specialist that persists in the most highly modified habitats, and is often one of the first native ants to recolonise urban environments when exotic ant pests are removed through baiting or driven out through environmental management strategies (pers. obs.). In yards and on footpaths, etc., this species often coexists with *I. chasei*, but can be recognised by its less aggressive nature and its generally darker, more metallic appearance. The nests also tend to be smaller and are surrounded by discrete, roughly oval or circular mounds of soil rather than the large, amorphous piles of excavated sand or clay typical of *I. chasei* nests. *Iridomyrmex suchieroides* is likely to be the sister taxon of *I. suchieri* (Heterick & Shattuck 2011) but appears to be less common, although it occurs in all mainland Australian states. This ant also occurs in suburban Perth. The species can be separated from the very similar *I. suchieri* as described above. *Iridomyrmex suchieroides* shows subordinate behaviour in relation to other ant species, and it avoids interacting with them. The species also runs away on human approach, unlike its relative. Like most small *Iridomyrmex* this species is an adept climber when searching for food and has been taken in a malaise trap (Heterick & Shattuck 2011).

Iridomyrmex mjobergi is another nondescript little brown *Iridomyrmex* that exhibits evasive behaviour when confronted by a human. In the field workers are hard to capture as they hide under leaves and in twig litter. This ant also poses major taxonomic problems and, in an unpublished COI tree, is paraphyletic with the closely related *I. hertogi* falling within clades identified as *I. mjobergi*. This and the nature of the deep nodes suggest a complex of species could be involved here, but despite large morphological variation there are no character states that have been determined that will split the taxon, hence it is left provisionally as a single entity for the time being. Additional nuclear genes may help unravel this issue. As it stands, using a combination of (1) a short antennal scape that just surpasses the vertex, (2) a gently convex or truncate but not protuberant propodeum, (3) a weakly impressed metanotal groove and (4) the presence of a pair of erect setae (where they occur at all) or, perhaps, a small scattering of erect setae on the vertex but not an entire row, will serve to identify the majority of specimens. In addition, most WA *I. mjobergi* are evenly brown or greyish-brown in colour without strong iridescence, although they may have coppery reflections (rarely, populations near WA's south coast may possess yellowish-green reflections), the eye is moderate in size (large or small in several similar species), and the mandible is normally a bright yellow that contrasts with the colour of the much darker head capsule. The ant is ubiquitous throughout Australia, except for Tas, and extends into Papua New Guinea and Timor-Leste. In Western Australia this is one of the most frequently encountered small *Iridomyrmex,* but it does not seem to occur in metropolitan Perth. *Iridomyrmex mjobergi* will nest directly in soil or under stones in a variety of locations, and a nest has even been found inside an aluminium beer can! This ant is a good climber and has been taken on *Banksia* flowers (Heterick & Shattuck 2011). *Iridomyrmex hertogi* is a very rare northern species that may be the sister taxon to *I. mjobergi*. It is among the smallest *Iridomyrmex* and has very large eyes and an antennal scape that falls well short of the vertex. The species is known from a holotype and a paratype worker from Kakadu National Park in the NT and a couple of collections from the Cape Leveque area in WA. There is no recorded information on the biology of this ant.

An ant from the drier areas of the wheatbelt and goldfields that is very similar to *I. mjobergi* is *I. continentis*. The chief and probably only diagnostic differences between these two species are the slightly longer antennal scape on average in *I. continentis* (scape index 101-118) compared with *I. mjobergi* (scape index 92-108), and the triangularly flattened posterior propodeal dorsum. In *I. mjobergi* there may be a slight flattening posteriad on the propodeal dorsum, but this feature is much more accentuated in *I. continentis*, and the propodeal spiracle is placed near the dorsal surface of that sclerite. *Iridomyrmex continentis* is found in all Australian states except the ACT and Tas. The ant has been taken by beating and in pitfall traps but otherwise little is recorded of its biology, although it seems to prefer mulga woodlands.

Several pallid species that appear to be related and have a similar, characteristically asymmetrical eye include *I. dromus*, *I. exsanguis*, *I. hartmeyeri*, *I. macrops*, and *I. pallidus*. All of these ants appear to have predominantly nocturnal or crepuscular foraging behaviour. *Iridomyrmex pallidus* and *I. macrops* can be distinguished from the others by their hirsute tibiae and (in most cases) antennal scapes. *Iridomyrmex pallidus* is found throughout the northern Australian tropics but ranges into Papua New Guinea and other Melanesian islands. This species has a broad head, which enables museum material to be readily identified among

other pale or teneral *Iridomyrmex*. The ant nests in the ground, its nest sites being recognisable through small mounds of soil in tropical rainforest and tropical eucalypt forest. *Iridomyrmex macrops*, as the name suggests, has particularly large eyes and a much more southerly distribution, from about Kalbarri on the west coast of WA, through SA and into western NSW. The ant is only seen occasionally but has been found foraging at night on sandplain and on mallee trunks (Heterick & Shattuck 2011). *Iridomyrmex hartmeyeri* has one of the broadest distributions of any *Iridomyrmex*, being found in all mainland states except the ACT. However, like most *Iridomyrmex*, it is absent from Tas. This is a large ant, approaching the size of the smaller meat ants, and this alone is usually sufficient to distinguish it from smaller, similarly-coloured *Iridomyrmex*. Otherwise, it is identifiable by a combination of its slightly indented vertex, glabrous mesosoma (occasionally a tiny erect seta or couple of setae may be present), and glabrous hind tibiae.

Iridomyrmex dromus and *I. exsanguis* are very difficult to distinguish morphologically, slight differences in the propodeal angle being all that separates them. However, ants identified as *I. exsanguis* are always pale yellow or yellowish-orange, whereas *I. dromus* ranges from depigmented, off-white through shades of yellow, orange or brown to almost black in colour. The two ants have a broad range throughout Australia that in the case of *I. dromus* extends to Tas. Both are mainly nocturnal but will forage during the day in suitable conditions and tend to favour sandy areas such as dunes. They also both fill their nest entrances with sand when inactive, i.e. mostly during daylight hours. In view not only of the great range of colour, but also the size of the ant and shape of the mesosomal dorsum, what is here called *I. 'dromus'* may be found on closer analysis to consist of a small, cryptic complex of ants.

A cluster of specimens, all identified as *'I. bicknelli'*, are sister to the *I. dromus* cluster on a COI tree produced by the team that revised *Iridomyrmex*. Three deep nodes within the nominal taxon suggest this cluster may be a species complex, and it is certainly true that several morphological haplotypes of the ant occur throughout Australia. Workers of *I. bicknelli* from eastern Australia tend to be somewhat larger with a more convex vertex than the typical morph from south-western Australia, where the vertex is only weakly convex. The iridescence is also more bluish in these larger, eastern morphs. However, no clear-cut distinctions can be drawn when phenotypes from all populations are considered, hence the decision by Heterick & Shattuck (2011) to retain a single species for the present. *Iridomyrmex bicknelli* is one of a number of *Iridomyrmex* species that are able to tolerate the disturbance caused by human activities, and this ant is a common sight in urban environments in Australia, where it occurs in all states including Tas. Nonetheless, the species prefers cooler, moister, temperate climes, and tends to be replaced in native habitats in more northern areas by ants of a similar appearance within the *I. minor* cluster. Although *I. bicknelli* is often seen on footpaths, it has probably evolved to live in open, sandy, insolated situations, and this is the natural environment in which this fast-moving ant is most frequently encountered. Few ants are prepared to live in the dunes adjacent to white, sandy beaches, but this species thrives in such environments. *Iridomyrmex bicknelli* belies the aggressive disposition often attributed to *Iridomyrmex* species and is subordinate in regard to other ants and non-aggressive towards humans. Although the species has not been sequenced, *Iridomyrmex luteoclypeatus* is undoubtedly a close relative of *I. bicknelli*, with which ant it has likely been commonly confused in the past, particularly in regard to collections from drier, inland areas. The paler, brown coloration and the predominantly bright yellow clypeus are probably the best guide to this taxon when it is compared with its cousin. (The appearance of the vertex and the slope of the sides of the head mentioned by Heterick & Shattuck [2011] are probably less reliable indicators). *Iridomyrmex luteoclypeatus* is much less common than *I. bicknelli* and does not occur in urban situations. Collections have come mainly from dry, inland locations in WA, the NT, QLD, and SA. There is no material from the ACT, NSW, Vic, or Tas. In WA, definitive records come from the Tropicana Minesite, Mt Gibson, Carnarvon, and inland from Shark Bay. Much more northerly records (TERC) from the Kimberley region shown on AntWeb require verification. The ant forages diurnally and has been found on sand dunes, but nothing more is known about it.

Iridomyrmex agilis is superficially similar to *Iridomyrmex bicknelli* and appears to be fairly closely related, based on the genetics. The head capsule is elongate, as in *I. bicknelli*, but in this case, the eyes are situated below the greatest head breadth when the head is seen in full-face view. This and the large, pointed, anteromedial clypeal prominence are diagnostic characters for the group, which also includes one eastern states taxon that does not occur in WA. *Iridomyrmex agilis* is found in all mainland Australian states but appears to be absent from nearly all of QLD and all but north-

western Vic. Most WA records come from central inland areas and the species is not found in the SWP or in WA's northern tropical areas. In the field this fairly large ant is striking in its behaviour, as it runs rapidly over the ground in spiderlike fashion with its gaster raised. This is a generalist forager. At first glance, the handsome *Iridomyrmex coeruleus*, with its robust black or brownish body and bluish, coppery or yellowish-green iridescence, would seem to have little in common with *I. agilis*, yet the mitochondrial molecular data suggest a possible sister relationship. *Iridomyrmex coeruleus* is recognised by a combination of features, including the aforementioned iridescence, the large eyes, the pale mandible (often with a black tip), the broad, well-developed anteromedial clypeal prominence, and the long, white, J-shaped setae on the venter of the head capsule. The degree of variation over its range suggest more than one species may be involved. Records of this species are broadly but sporadically dispersed throughout mainland Australia but are concentrated in the NT and QLD, and the species has thus far not been seen in SA or Vic. The ant also occurs in south and eastern Papua New Guinea. In WA there are a handful of widely-spread records, each of them isolated from the others, in the central and eastern Kimberley, the Great Victoria Desert, the Pilbara coast and Barrow Island. In pitfall trap collections the species occurs as isolated individuals, but it has also been collected by pan traps and sweeping from trees and other vegetation (Heterick & Shattuck 2011).

Three related clades contain *I. brunneus*, *I. meridianus*, and likely relatives of *I. mayri* (an eastern Australian species). Among non-sequenced ants, based on their morphology, *I. splendens* is a close relative of *I. meridianus*, while *I. longisoma*, *I. omalonotus*, and *I. spurcus* may be Western Australian representatives of the *I. mayri* species-group.

Iridomyrmex brunneus is a medium-sized red-and-black or brown-and-black *Iridomyrmex* that has a phenotypic appearance similar to members of the *I. minor* group. However, the genetics indicate it is not particularly closely related to members of that group from which it can be distinguished by the virtual absence of an anteromedial clypeal prominence (strongly developed in the *I. minor* group). This ant is abundant in natural habitats in all states except Tas and is often associated with wood. Foragers are frequently seen trailing on both live and fallen timber, but the ant is a soil nester. Occasionally, this species is seen in settlements and may enter houses in country areas. In Alice Springs it has been recorded as a 'house pest' (Heterick & Shattuck 2011).

Iridomyrmex splendens and *I. meridianus* are two very similar, usually dark-bodied ants. Of the two, *I. splendens* is the most distinctive, and workers can generally be distinguished from similar, small, dark *Iridomyrmex* by their weak yellowish- to bluish-green iridescence, and the row of small, erect setae on the vertex. However, populations of non-iridescent brown-and-dark-brown and orange-and-light-brown workers do occur in some areas, and the regular, rounded propodeum as well as the fringe of setae on the vertex assists in the identification of these colour variants. *Iridomyrmex splendens* is rarely found away from well-watered areas, and its distribution reflects this: the species is found around the coastline of south-west and southern Western Australia (with one outlier in the Pilbara subregion), in south-eastern SA, in Tas, and along the eastern seaboard as far north as Cairns in QLD. The ant is absent from the NT. *Iridomyrmex splendens* is nearly always associated with fallen timber in dry sclerophyll woodland, and nests are commonly found under logs, although the species may also nest directly into soil or under litter. Workers are often seen foraging on trees. *Iridomyrmex meridianus* is most likely to be confused with dark specimens of *I. splendens* since it is almost identical in morphology: it of the same size, the antennal scape averages the same length, and the ant has the same weak yellowish- or bluish-green iridescence. However, the vertex sports only a few setae or a pair of erect setae, if they occur at all, and the mesosoma is glabrous or almost so, whereas the mesosoma carries multiple erect setae in *I. splendens*. The iridescence and glabrous appearance of the mesosoma combined with the longer antennal scapes usually also make it possible to separate the ant from populations of *I. mjobergi* that occur in the same area. The ant has two, very disjunct populations in the extreme south-west of WA and in south-eastern Tas. Most collections have been made in high rainfall, heavily forested areas, with nests being found under rocks and logs and in rotting wood (Heterick & Shattuck 2011).

Iridomyrmex brennani has not been sequenced, but its general resemblance to the two foregoing species may indicate a relationship. The ant is also more gracile, as with the *I. minor* cluster, and has longer antennal scapes than *I. meridianus* or *I. splendidus*, but the scapes are not as long as those of most of the species in the *I. minor* cluster. Diagnostic characters include one to six minute, erect setae on the dorsum of the mesosoma, and the variegated blackish-red and brown coloration. *Iridomyrmex brennani* is a rather rare species that seems to be associated with playas in southern inland WA, SA, and Vic (Heterick & Shattuck 2011).

Iridomyrmex longisoma, *I. omalonotus*, and *I. spurcus* are three hairy *Iridomyrmex* that appear to belong to the *I. mayri* species-group, although none has yet been sequenced. *Iridomyrmex longisoma* is currently known to be mainly confined to sandy coastal soils on the Swan Coastal Plain but has also been collected on the south coast from just west of Denmark to Bremer Bay. The ant can immediately be recognised by its bluish iridescence, gracile body (it is a dark grey ant that is very similar to *I. bicknelli* when seen in the field), and the presence of small, erect setae on the antennal scapes but not the hind tibiae. The occiput is rounded, and the occipital foramen is much higher on the head capsule than it is with *I. bicknelli*. Despite its restricted habitat, the ant is not uncommon and can be found in yards of suburban properties near the coast (such as the author's own property), where it is a general forager that nests in soil. *Iridomyrmex omalonotus* and *I. spurcus* are two extremely hairy denizens of drier inland areas. Their extreme hirsuteness (both antennal scapes and hind tibiae bear many erect setae), their rather flattened pronotum and their relatively small size distinguish these two species from other WA species in the genus. The erect setae on the scape and tibiae are distinctly longer than the greatest breadth of those two body parts in *I. spurcus* and shorter than the greatest breadth in the case of *I. omalonotus*. The latter ant has a broad but disjunct distribution in which the populations in south-western WA are separated from those in SA by the Nullabor Plain. The ant also occurs in NSW and Vic but not the ACT, the NT, QLD, or Tas. Morphological variation is discussed in Heterick & Shattuck (2011), who also remark on its nocturnal as well as diurnal foraging, its terrestrial nest denoted by a small mound, its frequent ascending of tree-trunks to forage, and its fondness for honey baits. *Iridomyrmex spurcus* has a much broader range than its close relative and is mostly found at lower latitudes so that there is little overlap in their distributions. The preferred habitat also tends to be more arid. Specimens have been collected in all states bar the ACT, Tas, and Vic. As is the case with *I. omalonotus*, this ant forages on trees, and it has been taken in a yellow pan trap (Heterick & Shattuck 2011).

Iridomyrmex angusticeps and *I. tenuiceps* are two very slender, large-eyed, greyish-brown *Iridomyrmex* of the northern arid zone and the tropics. They are obviously closely related to one another but, in light of the fact neither has been genetically sequenced, their broader affinities are unknown. The gracile morphology, the very narrow head, the large, slightly to moderately protuberant eyes and the strongly convex vertex easily set them apart from other WA *Iridomyrmex*. *Iridomyrmex angusticeps* has very short, bristly setae on its mesosoma, while *I. tenuiceps* has a glabrous mesosoma. In WA, *I. angusticeps* is known from a single collection in the northern Kimberley but has also been recorded from the NT and QLD. One record is very near the NSW/QLD border, so it is assumed the ant may also occur in northern NSW. Outside of Australia, this species is known to occur on the island of Mindanao in the Philippines and in Papua New Guinea. The Philippines workers were found in pineapple fields, but all Australian samples have been collected in natural environments in rainforest and *Acacia* shrubland. This species is a soil nester (Heterick & Shattuck 2011). *Iridomyrmex tenuiceps*, based on the records, is the commoner of the two species, and has also been found in the NT and QLD. In some cases, the range of the two species seems to overlap. However, there are currently no records of *I. tenuiceps* outside of Australia. Apart from the fact that *I. tenuiceps* is a terrestrial forager (most specimens have been taken from pitfall traps) nothing is known of the ecology of the species.

Two rare, morphologically aberrant *Iridomyrmex* with obscure affinities round out the discussion of the genus. *Iridomyrmex cuneiceps* has a head capsule that tapers sharply towards the vertex so that the vertex is bluntly wedge-shaped when seen in profile. This feature is unique among WA *Iridomyrmex*. This dark greyish ant is very uncommon, having been taken only six times from WA's arid interior. Nothing is known of its biology. *Iridomyrmex trigonoceps* is even more strikingly different from other *Iridomyrmex* and can be recognised at a glance because of its distinctly triangular head shape, the high placement of the eyes on the head capsule and the large mandibles. However, the unique, elongate second and third maxillary palp segments are its most peculiar feature, and this is what makes it particularly difficult for a researcher to ascertain its nearest relatives. Although nowhere common, this ant has a broad distribution mainly in arid or semi-arid northern areas in WA and the NT, but it has also been collected from Renmark in south-east SA. This suggests it has a much wider range than the relatively small number of records would suggest. All that is known of the ant is that the Renmark specimens were collected on a sand dune with mallee and *Triodia* vegetative cover, and the soil nest was indicated by a small mound (Heterick & Shattuck 2011).

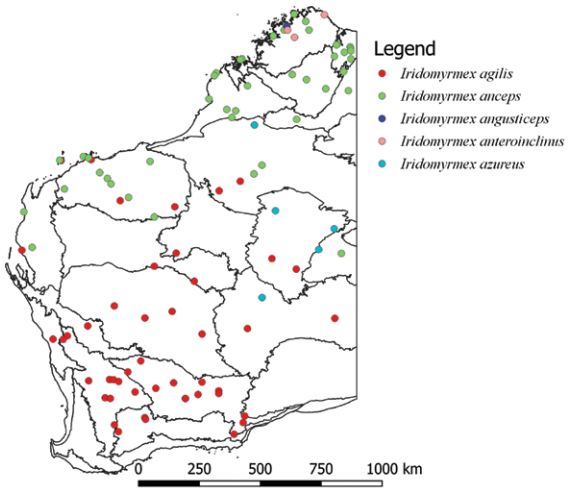

FIGURE 10 Distribution of *Iridomyrmex agilis*, *I. anceps*, *I. angusticeps*, *I. anteroinclinus* and *I. azureus*.

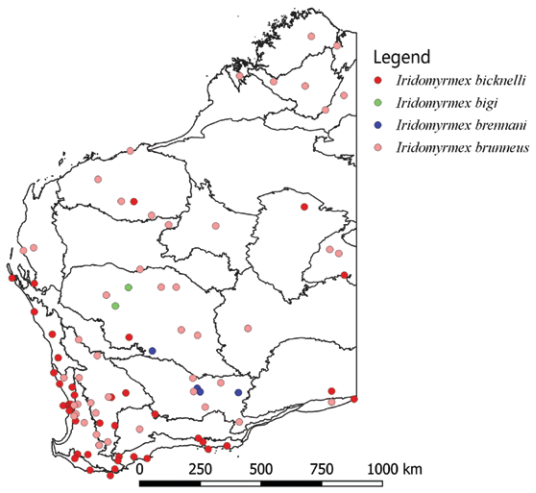

FIGURE 11 Distribution of *Iridomyrmex bicknelli*, *I. bigi*, *I. brennani* and *I. brunneus*.

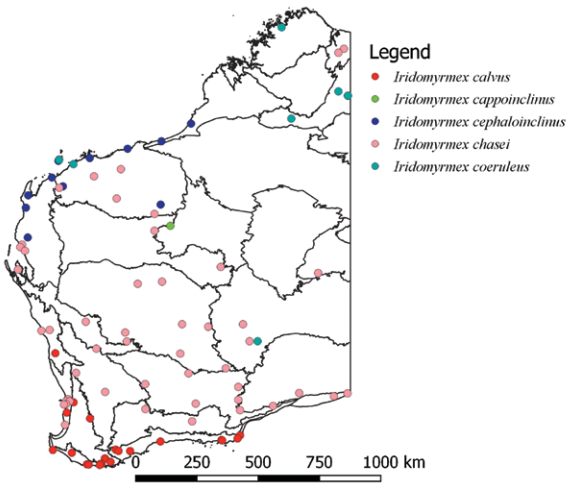

FIGURE 12 Distribution of *Iridomyrmex calvus*, *I. cappoinclinus*, *I. cephaloinclinus*, *I. chasei* and *I. coeruleus*.

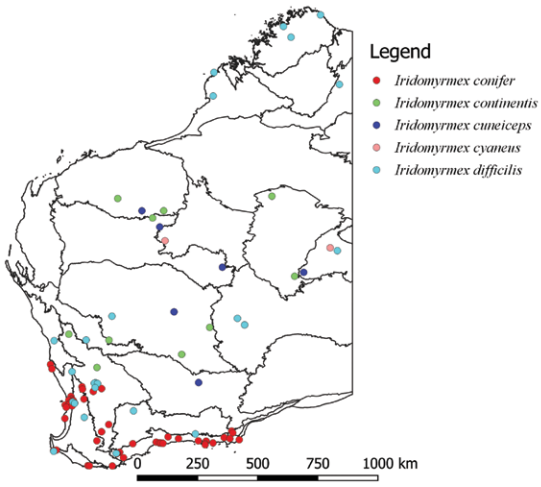

FIGURE 13 Distribution of *Iridomyrmex conifer*, *I. continentis*, *I. cuneiceps*, *I. cyaneus* and *I. difficilis*.

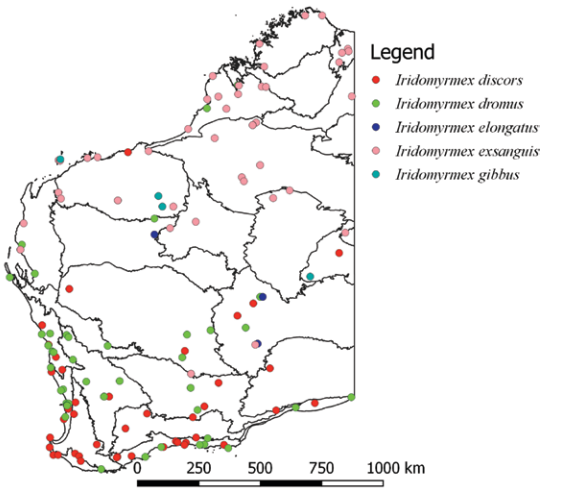

FIGURE 14 Distribution of *Iridomyrmex discors*, *I. dromus*, *I. elongatus*, *I. exsanguis* and *I. gibbus*.

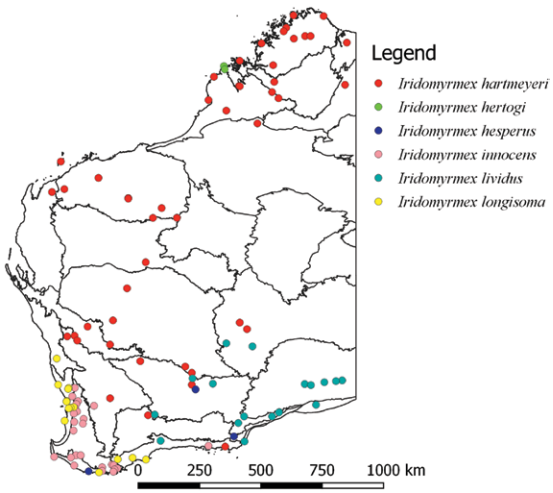

FIGURE 15 Distribution of *Iridomyrmex hartmeyeri*, *I. hertogi*, *I. hesperus*, *I. innocens*, *I. lividus* and *I. longisoma*.

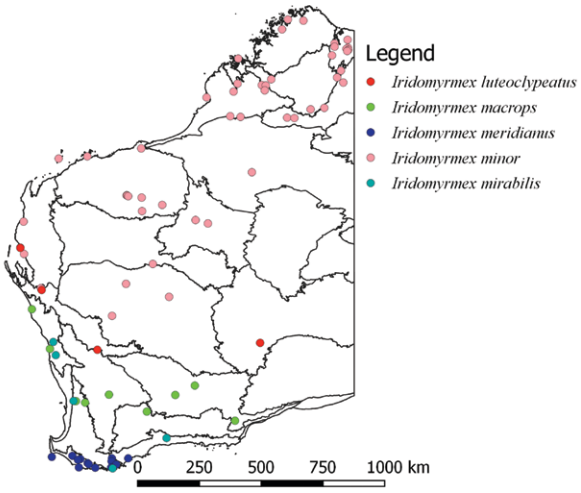

FIGURE 16 Distribution of *Iridomyrmex luteoclypeatus*, *I. macrops*, *I. meridianus*, *I. minor* and *I. mirabilis*.

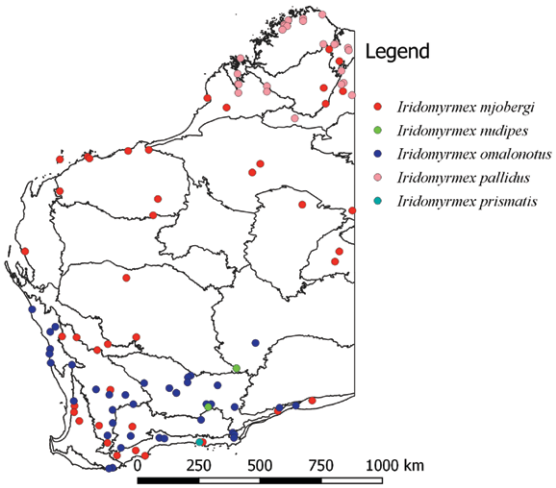

FIGURE 17 Distribution of *Iridomyrmex mjobergi*, *I. nudipes*, *I. omalonotus*, *I. pallidus* and *I. prismatis*.

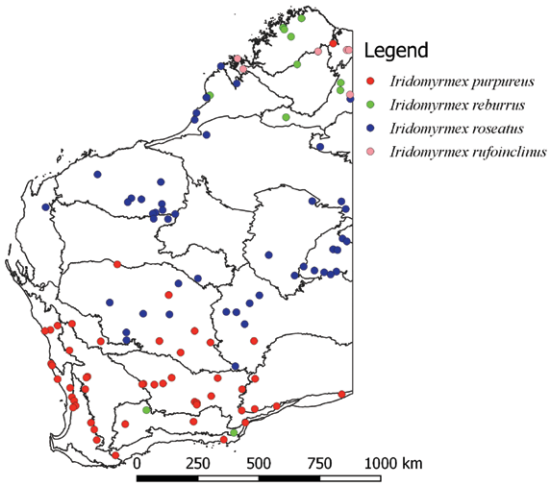

FIGURE 18 Distribution of *Iridomyrmex purpureus*, *I. reburrus*, *I. roseatus*, and *I. rufoinclinus*.

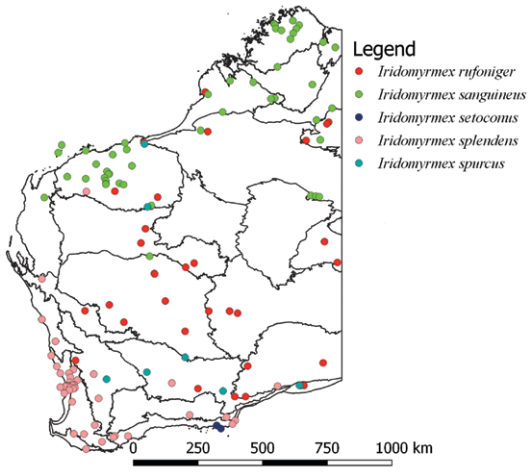

FIGURE 19 Distribution of *Iridomyrmex rufoniger*, *I. sanguineus*, *I. setoconus*, *I. splendens* and *I. spurcus*.

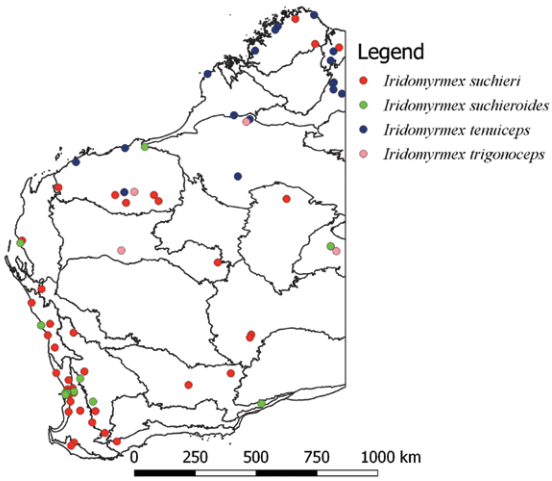

FIGURE 20 Distribution of *Iridomyrmex suchieri*, *I. suchieroides*, *I. tenuiceps* and *I. trigonoceps*.

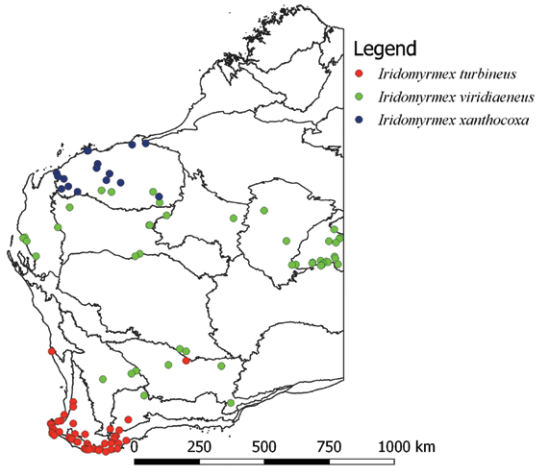

FIGURE 21 Distribution of *Iridomyrmex turbineus*, *I. viridiaeneus* and *I. xanthocoxa*.

Linepithema (Figure 22)

The Argentine ant (*Linepithema humile* Jerdon) is one of the two most important exotic ant pests established in WA, the other being the Big-headed ant, *Pheidole megacephala* (Fabricius). This is a small, nondescript brown ant that in the field resembles many small *Iridomyrmex* species. However, when crushed it does not give off the characteristic acrid odour associated with *Iridomyrmex* of similar appearance. Under the microscope, the low position of the eyes on the head capsule, the lack of an anteromedial clypeal prominence, and the non-angulate appearance of the posterior margin of the clypeus around the tentorial pits distinguish it from *Iridomyrmex*. The fairly elongate, weakly convex mesosoma also separates it from *Anonychomyrma* (which has a bimodal mesosomal dorsum) and *Doleromyrma* (in which the mesosoma is very compact, as in *Tapinoma*). A summary of its arrival, impact and distribution in WA can be found in Heterick et al. (2000). Most records come from metropolitan Perth, although the ant also occurs in several other large rural towns and cities in south-western WA. This species is also a problem in the ACT, NSW, SA, and Tas, but does not occur in the NT or QLD. *Linepithema humile* is principally an agricultural and environmental pest and is not normally physically injurious to humans. The capacity of an individual colony to link in peacefully with other *Linepithema humile* colonies, while retaining an antagonistic response to other ant taxa facilitates the growth of supercolonies of *I. humile*. This South American species also has multiple queens, an ability to move nest frequently, a capacity to feed on whatever is available and other traits associated with successful tramp species. The literature on the Argentine ant is voluminous, and the reader is referred to that literature for additional details on the ant.

Nebothriomyrmex (Figure 22)

This genus contains just the one species (*Nebothriomyrmex majeri*). The genus *Nebothriomyrmex* is the only indisputable monospecific ant genus found in WA. This unobtrusive little depigmented inhabitant of litter and white, sandy soils is restricted to suitable sites in the Esperance Plains, the Jarrah Forest, the Swan Coastal Plain and the Warren subregions of the SWP, and the Coolgardie subregion of the EP. The vertically ascending anterior pronotum, the anteriorly flat mesonotum, the angled posterior mesonotum and the narrow, truncate propodeum will distinguish this species from all other WA dolichoderines. In the dry sclerophyll woodlands of the Darling Range the ant nests in humus on the soil surface, but in coastal peppermint (*Agonis flexuosa*) thickets in Bremer Bay clustered colonies of ants have been found under rotting wood and around tree and shrub roots, where they may tend aphids or other Hemiptera (Heterick 2009).

Ochetellus (Figure 22)

Western Australia is rich in *Ochetellus* species, and at least five taxa have been identified from this state. Three species are limited to the wetter areas of the SWP, while two are found mainly in the Pilbara and Dampierland subregions. *Ochetellus* ants are easily distinguished from other WA Dolichoderinae by a combination of their slightly to moderately concave declivous propodeal face and the narrow, explanate petiolar node (this latter character particularly useful in separating them from small *Dolichoderus*).

Ochetellus flavipes, the well-known spinifex ant, is easily recognisable not only by its propodeum, which is prolonged in a narrow, raised spur, but by its resin-and-sand enclosed runways between *Triodia* (spinifex) hummocks. The ant builds shelters of the same materials to house mealybugs (*Prorsococcus acanthodus*) from which it obtains honeydew. Morton and Christian (1994) discuss this and other aspects of the ant's biology. This species is found in the north-west and the north of this state, not far from the coast, but also occurs widely throughout the NT, and has been recorded from far western QLD. One NT record from near the South Australian border suggests it might also occur in the far north of SA. *Ochetellus glaber*, or an ant approximating to its description, is extremely common throughout south-western Western Australia, where it is one of the few native ant species to constitute a domestic pest. The taxonomy, as it currently stands, is equivocal on the identity of this species (see Hoffmann et al. [2011]). There is also some doubt that the WA form is the same species as the most common morph of *O. glaber* on Australia's east coast, which tends to have a brownish or reddish tint to its cuticle. Ants that go under this specific name have also been introduced to Africa, the United States, China, Japan, New Zealand, and various Pacific islands. Within WA, this ant is very similar to several of its relatives but can be determined by its shining dark brown or black body (the body is matt in the very similar *O. punctatissimus* and reddish in an undescribed relative) and broad propodeal dorsum. Species records in WA are confined to the

SWP but *O. glaber* is ubiquitous in the Perth region, where it is commonly associated with wood or structures. In peridomestic situations it is often seen nesting within wall cavities, within fretted mortar between bricks and in cracks in timber, including telegraph poles and fence posts (pers. obs.). The ant forms slow moving trails in kitchens and pantries in search of food. In the wild, the ant feeds on small carrion and honeydew, and tends aphids and mealybugs. Many references to the ant and its biology can be found under the species entry in *Wikipedia*.

Ochetellus punctatissimus is easily confused with *O. glaber*, with which it is almost morphologically identical, but is recognisable through its matt, minutely sculptured head and body. If observed closely through a microscope in an oblique view, tiny appressed setae on the frons of the head can be seen to form a fine, greyish-white pubescence. The head in *O. glaber*, by way of contrast, is shining and smooth with only surface reticulation and the tiny, appressed setae are well-spaced and do not form a pubescence. *Ochetellus punctatissimus* has much the same range in the SWP as *O. glaber*, but it appears to favour coastal habitats (many records of *O. glaber* outside of metropolitan Perth are slightly further inland), although there is a very recent record from Kambalda. *Ochetellus punctatissimus* is also common in the Perth metropolitan area and its habits are likely to be similar to those of its close relative. Apart from its colour, *Ochetellus* sp. JDM 851 is identical with *O. glaber*. A nominal type specimen (CASENT0909529) is depicted in AntWeb alongside a type specimen of *Ochetellus glaber clarithorax*, but is clearly distinct. Forel treated this ant as a separate 'variety' of *O. glaber* but the type details including the name appear never to have been published. This ant is orange to reddish-brown with a darker gaster. The species has been recorded from Nippering, Bandalup Hill, and the Esperance region in the south coastal and southern wheatbelt regions, and from Zuytdorp in the northern sandplain. At least three of the four WAM records have been of specimens collected from vegetation: the Esperance workers were the result of a knockdown spray on blue mallee, the Bandalup Hill worker was taken from *Kunzia similis* growing on gravel/laterite caprock, and the Nippering worker was collected on unspecified vegetation. The Zuytdorp worker was collected from a wet pitfall trap.

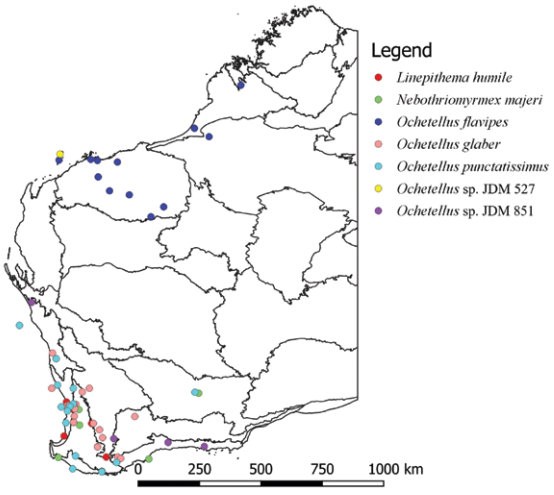

FIGURE 22 Distribution of *Linepithema humile*, *Nebothriomyrmex majeri*, *Ochetellus flavipes*, *O. glaber*, *O. punctatissimus*, and *Ochetellus* sp. JDM 527 and JDM 851.

Unlike the three *Ochetellus* mentioned in the previous paragraph, *Ochetellus* sp. JDM 527 is a northern species that seems to belong to a different radiation of the genus. Seen from above, the propodeum is a thin flange or shelf that overhangs the propodeal declivity, but this flange is not raised as in the rather larger worker of *O. flavipes*. *Ochetellus* sp. JDM 527 is only very occasionally seen in the Pilbara subregion (no specimen data available for maps) and it has also been collected on Barrow Island. The biology of the ant is unknown, terrestrial foragers only having been collected in pitfall traps.

Papyrius (Figure 23)

Perhaps the most distinctive feature of workers of the genus *Papyrius* is not visual but olfactory: workers emit an aromatic defensive aerosol that is reminiscent of some perfumes. This genus is formally diagnosed by having a PF of 5,3. Other useful characters include uniform dentition in the mandibles, a deeply incised metanotal groove and the appearance of the propodeal dorsum, which is often sinuous or has a small anterior protuberance or prominence. Two species and three subspecies have been described. The lack of monographic treatment of the group makes for a slightly problematic interpretation of the variable morphology seen in the WA members of the genus, but there appear to be two species that are able to be separated on physical characters. *Papyrius nitidus* itself has a broad distribution along Australia's west and east coasts, but there are few inland records. This species appears to be absent from the NT, SA, and Tas. In WA, *P. nitidus*, which can be separated from its relative by its smaller

size and the lack of erect setae on the vertex of the head, the first gastral segment and, often, the node, is mainly found throughout the SWP. However, outliers have been recorded from the western and northern Kimberley and the south-east coast. Colonies (not mapped) have been observed by the author in parts of the Swan Coastal Plain in the Fremantle, Melville and Swanbourne districts. *Papyrius* sp. JDM 666 is more-or-less confined to the jarrah forest of the Darling Range. This ant, which cannot be assigned to any of the named taxa, is larger and a little hairier than the smaller *P. nitidus*, and the vertex, the first gastral segment and the node possess erect setae.

Papyrius ants are almost always associated with trees or dead wood, and runways and nests covered with frass and plant fibres at the base of tree-trunks and the like are often a good guide to their presence (Shattuck 1999). Foraging is often on trees or timber and the ant is also known to tend lycaenid caterpillars for their secretions (Eastwood & Fraser 1999). This genus of ants may also constitute a minor nuisance in country areas by infesting timber materials (Heterick 2009).

Tapinoma (Figure 23)

As with the preceding genus, the number of *Tapinoma* species in WA is unclear due to questions over whether the ant here called '*Tapinoma minutum broomense*' is a single species or represents a small species complex of perhaps two ants. The well-known ghost ant (*Tapinoma melanocephalum*), however, is taxonomically uncomplicated, and this introduced species is common in some northern population centres. *Tapinoma* sp. JDM 981, with its huge eyes, is also easily characterised.

Native Western Australian *Tapinoma* can easily be confused with *Doleromyrma* species that lack a distinct petiolar node and have an identical mesosoma, but the half-moon shape of the posterior clypeal margin is definitive, as this suture is truncate in *Doleromyrma*. Apart from *Doleromyrma*, *Tapinoma* cannot be confused with any other WA dolichoderines. *Tapinoma melanocephalum* is called the ghost ant because its gaster and appendages are very pale and depigmented and almost invisible, while the head and mesosoma are a dark blackish brown. This partial camouflage creates an illusion: foraging aggregations of this tiny ant seem to float disconcertingly disembodied like minute black particles as they scurry over benches and table-tops in search of spilled fluids, sugar and crumbs. This exotic tramp species is occasionally found nesting in Perth (see Heterick, [2009]) but is much more common in population centres further north, such as Carnarvon, Port Hedland, Karratha, and Kununurra (M. Widmer, Department of Primary Industries and Regional Development, pers. comm.). The ant has spread throughout the warmer regions of the world, and can be found in specialised, heated environments in some of the cooler countries as well. In other parts of Australia, *Tapinoma melanocephalum* is known from the NT and north-east QLD. All records are from coastal centres, emphasising the reliance of this species on hot, moist conditions. The native range is unknown, but the likely provenance of the ant is likely to be the African or Oriental tropics in view of its adaption to such environments. This is the house ant *par excellence* and very many records are from indoors in houses, greenhouses and other buildings where the microenvironment is favourable (https://aepma.com.au/PestDetail/6/Ghost [accessed 22 Feb., 2019]).

Tapinoma minutum broomense is the species (or species complex) most commonly seen in WA. The typical morph has moderate-sized eyes, often with a darker fleck on the lower gena just below the eye. Another morph that is more uniformly yellow in colour has a smaller eye without the brown fleck below it. This form has been recovered from widely separated localities, from Jurien Bay in the south to Broome in the north. In all, *Tapinoma minutum broomense* has most frequently been collected from the south-western, mid-western and Pilbara regions of WA but this is likely to be an artefact of collecting effort, as there are several inland records where inventories have been undertaken for mining companies. *Tapinoma minutum broomense* has been seen to be nocturnally active by this author. He also notes that in dry sclerophyll woodland, nests are most often located under rocks or rotted logs or in the dense, compacted woody humus around the boles of large trees. Like its exotic cousin, this species can also enter houses and a specimen was taken from a sink in Broome (Heterick 2009). Herbers (1991) has examined the population biology of this or a closely related species. *Tapinoma* sp. JDM 981 is seen less frequently than the abovementioned *Tapinoma*, but it also has a very broad range, having been taken from Barrow Island in the north-west, in the vicinity of Giles Meteorological Station near the NT border in the east, at Madura on the Nullarbor in the south-east, at Gleneagle Forest near Perth in the SWP, and at several other localities within the area bounded by these geographic points. In some cases, this species seems to be sympatric with *T. minutum broomense*. *Tapinoma* sp. JDM 981 has been taken by pitfall traps and is likely to have a similar biology to *T. minutum broomense*.

Technomyrmex (Figure 23)

The genus *Technomyrmex* shares a lack of a distinct petiolar node with *Tapinoma* and *Doleromyrma rottnestensis*, but, in dorsal view, it has five visible tergites (thus separating it from *Tapinoma* species, which have four visible tergites), and the mesosoma has a number of stout, erect setae (thus separating it from both *Tapinoma* and *Doleromyrma rottnestensis*). Only one species, *Technomyrmex jocosus*, occurs in WA and, as discussed in the Introduction, this ant may have been introduced by human means to the Perth area where it is only known from highly urbanised surroundings. On the other hand, this species may occur naturally in the far south of WA. Here the ant inhabits thick, timbered country, in which environment it may be seen on karri trees as well as occurring in large population centres. Alternatively, since such a moist habitat experiences the same climate as is found on the Australian east coast that is the species' stronghold, *Technomyrmex jocosus*, once introduced, may simply have spread more readily into a native environment that suited it. *Technomyrmex jocosus* can only be found in mesic habitats around the Australian coastline and is totally absent from the NT and other semi-arid and arid parts of Australia. This species is also present on Tasmania's east coast and has been introduced to the North Island of New Zealand where it is not only a house pest but occurs in forest and open habitats. In that country *Technomyrmex jocosus* nests in rotting logs, under loose bark and under stones. The ants may also nest in wall cavities. Workers in the wild farm Homoptera, and their need for not only food but water is what drives them to enter buildings (https://www.landcareresearch.co.nz/discover-our-research/biodiversity/plants-invertebrates-fungi-and-bacteria/invertebrate-systematics/ants-wasps-and-bees/ants-of-new-zealand/technomyrmex-jocosus/ [accessed 22 February 2019]). When seen in the field or on or around buildings they have a conspicuous presence, as they are often seen progressing purposefully in wide trails of several ants abreast, quite unlike the foraging or movement patterns of ants like *Iridomyrmex* where individual workers frequently cover the ground unevenly or move in single file.

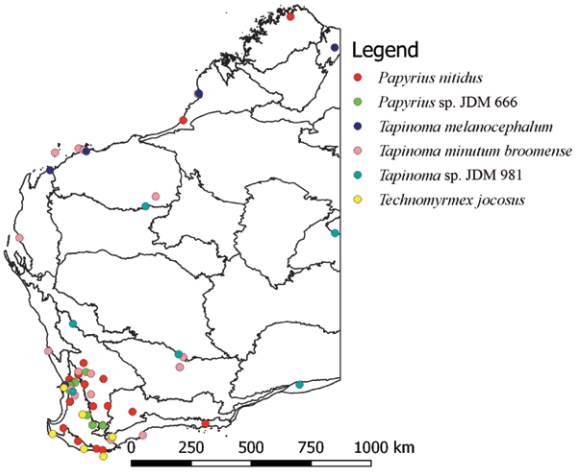

FIGURE 23 Distribution of *Papyrius nitidus*, *Papyrius* sp. JDM 666, *Tapinoma melanocephalum*, *T. minutum broomense*, *Tapinoma* sp. JDM 981 and *Technomyrmex jocosus*.

DORYLINAE

In most WA Dorylinae the mesosoma is attached to the gaster by a single distinct segment (the petiole) that is demarcated by a constriction in front and behind, the posterior constriction varying from a clear separation to a more-or-less shallow impression; the petiole has visible anterior, dorsal and posterior faces, the rear portion of the petiole being separated from the gaster by a marked constriction; the frontal lobes are not produced as thin, sharp lamellae nor are they located on a shelf-like frontoclypeal prominence that overhangs the mandibles; and, in *Lioponera*, *Ooceraea* and *Zasphinctus*, the upper surface of the pygidium is flattened, with a row of spinous or peg-like teeth on its edge. *Aenictus* has a quite different morphology and possesses two constricted waist segments (the petiole and the postpetiole). This genus also is eyeless, lacks pygidial spines (or these are present but reduced to one or two pairs of thick setae or cuticular projections) and frontal lobes so that the antennal insertions are always exposed. These ants have short mandibles and a fused pronotum and mesonotum that together form the promesonotum.

Aenictus (Figure 24)

The Australian members of the genus have been monographed by Shattuck (2008). Broadly speaking, *Aenictus* ants are known to have a nomadic lifestyle, raiding other social insects (other ants, social wasps and termites) and returning to their nest or bivouac. Raids can be diurnal or nocturnal (Shattuck 2008). Western Australia has two species of these rarely seen army ants. *Aenictus turneri* is the larger and more common of the two. In this ant pronotal sculpturing is limited to sections around the collar, the main body of the pronotum being smooth. Outside of WA, *A. turneri* is found most commonly along the QLD coast, extending into northern NSW, with one record from far inland NSW (Fowlers Gap). The ant is also found in and around Darwin and in the Kakadu National Park in the NT. In WA, several collections have been made

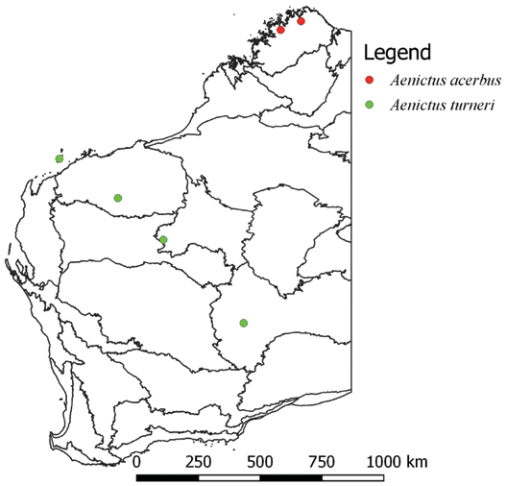

FIGURE 24 Distribution of *Aenictus acerbus* and *A. turneri*.

in inland desert areas, the Pilbara subregion and on Barrow Island. This species nests under rocks and logs. Regrettably, information on the local species, including *A. turneri*, is largely lacking. In *Aenictus acerbus* the sculpturing on the pronotal collar extends posteriorly on to the main pronotal body. This species is only known from the northern Kimberley, where it has been collected on a couple of occasions. Collection of this species has been by pitfall traps or pan traps (Shattuck 2008), but no other ecological information is available.

Lioponera (Figure 25–29)

United States myrmecologists believe *Lioponera* sp. JDM 574 is a *Lioponera* (partially based on molecular evidence), but it has many autapomorphies. The general habitus is of typical *Lioponera* (see below) but the middle tibiae lack spurs and the hind tibiae possess a simple spur only (the middle and hind tibiae always have a pectinate spur in *Lioponera*, according to Borowiec [2016]). The petiolar node is also flattened, but not marginate, with a median groove, as opposed to an at least partially marginate, flattened or slightly convex petiolar node in other *Lioponera* that is never grooved. The worker also lacks the coxal flange on the posterior edge of the hind coxa, and the parafrontal ridges typical of most *Lioponera*. Nor can the species be keyed out to any of the other genus-level taxa put forward by Borowiec (2016), and thus, this author regards its status as *Lioponera* as questionable, pending further testing. This species has been collected only a handful of times. Workers have been taken at Yorkrakine in the eastern wheatbelt, and Bungalbin Hill and Black Swan Gold Mine in the eastern goldfields. There is no other information available on this enigmatic ant.

With 24 described species (including a couple of ergatoids) out of a world total of 74 described species, Western Australia appears to be a centre of biodiversity for this genus. Along with the described taxa there are at least six undescribed species that can be found in this state. *Lioponera* ants are distinctive and unlikely to be confused with any other ant taxa: the petiolar node is at least partially marginate, the margins being distinct carinae; the hind coxa has a posterior flange produced as a vertical opaque or semi-transparent lamella; a metatibial gland is present and its opening is usually evident as a slit or a circular opening; and the compound eyes are large. Western Australian *Lioponera* are mentioned in keys such as those of Brown (1975) and Heterick (2009), but there has been no modern monographic treatment of the group that incorporates a discussion of their systematics. As a result of this restriction, the full ranges of the various species mentioned, based on verified reports, may also be more extensive than is able to be indicated here (see Andersen's [2000] coverage of the genus as it was then conceived). Most species are rarely seen but a few seem to be associated with disturbance and have been collected frequently. All *Lioponera* species prey on other ants.

Lioponera picipes differs from other WA *Lioponera* in that its petiolar node is more-or-less trapezoid in shape and lacks a posterior margin (all other nodes being square, rectangular, or roundly triangular, but if the latter then marginate posteriad). This species has only been recorded from Tammin in the wheatbelt, where Clark (1924a) saw several workers running about in dead grass beside the road. Nothing more is known about the ant, which has no other records in the ANIC, JDM, or WAM Collections. *Lioponera* sp. JDM 745 is a larger species that is superficially rather similar to *L. picipes*. The petiolar node has convergent lateral margins that end in a blunt angle surrounded by a lamella that is continuous or bifurcated. This species has been hand-collected from Geeraning Rock, in the far eastern wheatbelt, during the day, and pitfall-trapped at Black Swan Mine in the goldfields. Nothing more is known of this species. *Lioponera simmonsae* appears to be related to *L. picipes*, but the eye is larger and the petiolar node, when viewed dorsally, is horizontally rectangular with rounded posterior angles. The body is uniformly orange. This combination of characters distinguishes the species. There are several records of *L. simmonsae* from the Jarrah forest (Mundaring), the Warren (Denmark) and the Avon wheatbelt subregions of the SWP, and an isolated record from Shark Bay. In Mundaring, this species has been recorded (Clark 1924a) raiding

a nest of *Crematogaster testacea*. The raiding ants were removing pupae and larvae. The nest of this species is described by Clark as a small hole 'less than a quarter of an inch in diameter, on level ground.' The nest extended underground for '11 inches' (28 cm) and ended in an elongate chamber where the queen and her brood were found. *Crematogaster* larvae and pupae were found in the same chamber. *Lioponera* sp. JDM 942 is of a similar morphology to *L. simmonsae* but is a handsome bicoloured red-and-black. This northern species has been collected only a few times in the interior and on Barrow Island.

Lioponera brevicollis, *L. flammea*, *L. iovis*, *L. mjobergi* *L. varians*, and *Lioponera* sp. JDM 741 are all medium to large, red *Lioponera* with a distinct, curved, dorsolateral carina that extends from the posterior corners of the vertex towards the eye. *Lioponera varians* has a very large eye (eye length > 0.33 × length of side of head; length of eye > distance between eye and mandibular insertion), and this enables this species to be distinguished from the remaining five, in which the eye is smaller (eye length < 0.33 × length of side of head; length of eye ≤ distance between eye and mandibular insertion). This WA endemic was originally described from Lion Mill in the Jarrah Forest subregion, but recent collections have been from the drier interior of the state. *Lioponera brevicollis*, *L. flammea* and *L. mjobergi* have been recorded as having ocelli, but this may merely indicate that such individuals are ergatoids, as *L. flammea* and *L. brevicollis* workers without ocelli are also known. The distinction between *L. brevicollis* and *L. flammea* is dubious and contradictory in some respects. Clark (1924) distinguishes *Lioponera* ('*Phyracaces*') *brevicollis* from *L. flammea* based on its stouter, more compact mesosoma and larger size. This is contradicted by the appearance of the syntype ergatoid (not worker as stated by the website) of the latter on AntWeb. This specimen is identical (apart from the ocelli) with the worker of *L. brevicollis* also featured on AntWeb. However, the supposed syntype of *L. flammea* does not come from the type collection site (Lesmurdie Falls) but from Mundaring, which is some kilometers away. Also, the length of a *L. flammea* worker is given by Clark as 6.5 mm and that of *L. brevicollis* as 6.1 mm, being larger, not smaller. Based on the contradictory evidence presented in the publications and what is evident in the Automontage photographs, it is most probable both ants belong to the same species. However, they can both be distinguished from *L. mjobergi* in having convex sides to their petiolar node, which also has large teeth on the posterior angles. In *L. mjobergi*, a northern species, the node has barely convex sides and the posterior angles are smallish denticles. The author has collected *L. flammea* from a nest under a stone near Mt Randall in the Darling Range. This species and *L. brevicollis* (assuming they are distinct) appear to be limited to the Darling Range and its foothills from the Perth metropolitan area south to about Dwellingup. The exact identification of *L. mjobergi* is a little uncertain, given there is no type material available on AntWeb, but a species answering to Forel's (1918) description and illustration has been collected on Barrow Island, although the ant was originally described from Derby, much further north.

Unlike the preceding species, all of which are confined to WA, *Lioponera iovis* was described from QLD. However, this ant also has a reasonably broad distribution in WA, having been taken from the outer fringes of the SWP, the Pilbara subregion, and Barrow Island as well as from the northern Kimberley. The ant has quite a distinctive appearance compared with the other large, red *Lioponera* with a dorsolateral carina; viewed dorsally, the promesonotum is distinctly narrower than the propodeum in this species, and the erect setae on the head and antennal scapes are unusually long. *Lioponera* sp. JDM 741 can immediately be distinguished from other bright orange or red *Lioponera* by the broadly V-shaped propodeal carina. This species has been taken by hand collection and pitfall trap south of Newman and seems to prefer spinifex sandplain. A specimen from woodland near the Mt Gibson iron ore mine was collected in a wet pitfall trap.

The dark reddish *Lioponera* sp. JDM 1087 is somewhat similar to *Lioponera* sp. JDM 741 in terms of its morphology and possesses the same broadly V-shaped propodeal carina, but here the curved dorsolateral carina is blunt, and the integument is matt and coriaceous rather than smooth and shining. Erect setae on the mesosoma and antennal scape present in the former species are also absent and replaced by short, appressed setae, and the compound eye is twice as large. This species is known from a single pitfall-trapped worker collected on sandplain in the Queen Victoria Springs Nature Reserve.

Lioponera longitarsus stands apart from other WA *Lioponera* both in terms of its morphology and its biogeography. Unlike the latter, which were originally placed in the genus *Phyracaces*, this species has always been a *Lioponera*. The unique feature that distinguishes it from the other WA *Lioponera* (except for the ergatoid of *Lioponera* sp. JDM 746) is the smoothly rounded mesosoma that lacks a lateral carina. Colour pattern also separates this species from the ergatoid of *Lioponera* sp. JDM 746. Almost certainly *Lioponera longitarsus* is not native to this country, but may

have arrived by rafting (i.e. in vegetation) (see Introduction). Barech et al. (2017) suggests that the genus *Lioponera* originated in Africa and spread to the Indomalayan and Australasian regions; furthermore, these authors also suggest *Lioponera longitarsus* may be native to northern Africa. Whatever its provenance, this species now has a wide distribution throughout northern Africa, the Middle East, South and South-East Asia, New Guinea, and Australia. Within Australia the ant occurs in WA, the NT, and QLD. Both Brown (1975) and Barech et al. (2017) comment that this species may be a twig-nester, but this behaviour is unlikely, at least for WA populations, as local collections have included workers found crawling on footpaths away from shrubby vegetation. This is the only *Lioponera* collected from built-up areas in the Perth metropolitan area, confirming its status here as an introduction. However, this taxon is unlikely to have a deleterious impact on our native ants or other elements of our fauna due to its infrequent occurrence and its ecology. As well as a couple of Perth metropolitan records that include Fremantle, WA data on this species come from the Jarrah Forest, the Avon Wheatbelt, and the Warren subregions and from Barrow Island. Elsewhere, this species has been collected in habitats as diverse as a citrus orchard and savanna, emphasising its great adaptability (https://www.antweb.org/description.do?genus=lioponera&species=longitarsus&rank=species [accessed 3 October 2019)].

Five red *Lioponera* with visible ocelli are *L. angustata*, *L. clara*, *L. constricta*, *L. greavesi* and *L. sjostedti*. The large, dark red *Lioponera clara* is probably the easiest of these to identify since the third abdominal tergite (i.e. the upper segment behind the post-petiole) has a transverse carina that joins each side at a distinct angle. The other four species do not have this. This species has been recorded from the Flinders Ranges in SA, and Minnie Downs in QLD (as the junior synonym, *Lioponera princeps*), but other records are from Western Australia. Early mentions of the ant by Clark (1930b) include Cannington, Kalamunda, Mundaring, and John Forrest National Park, but recent finds have included captures much further east and north in the Avon Wheatbelt and Geraldton Sandplains subregions of the SWP, respectively. The propodeal declivity of *Lioponera sjostedti* lacks distinct lateral margins except for a small projection just below the propodeal angle, unlike the remaining species. Moreover, the petiolar node in this ant lacks a distinct anterior carina. This species is mainly found in the mid-west of WA to about the Kennedy Range, but there is one record from Kukerin in the south-east, in the Mallee subregion. *Lioponera constricta* and *L. greavesi* are morphologically identical and are formally separated only on size, *L. constricta* being the larger of the two putative species. The holotype of *L. constricta* is an ergatoid female that was found in an incipient soil nest, a single cell, under a log on a hillside in Armadale. This species and *L. greavesi* should probably be amalgamated under *'constricta'*, which is the earliest name, but a morphometric analysis of the two taxa would probably be desirable to see if the size differences hold up. *Lioponera constricta* is apparently known only from the holotype, but *L. greavesi* has a wide range that extends north into the Pilbara, and east at least as far as Kalgoorlie. The ant has also been taken near Carnarvon on the mid-western coast of the state, and at Bungulla in the Avon subregion. A worker taken at Calagiddy Road, near Carnarvon, was collected in *Acacia* shrubland over red clay soil as a solitary forager.

Lioponera angustata, like *L. constricta*, was described by Clark (1924b) from an ergatoid female. The unique specimen was found under a stone in John Forest National Park. The unarmed petiole and the extremely slender form are distinctive of the species. However, there is a strong likelihood that this ant represents no more than the ergatoid intercaste of *L. inconspicua*, which was also described by Clark in the same publication from material (a dealate queen and a worker) collected in the same national park. The node is the same in both cases and this (in the opinion of this author) is a giveaway; the coloration is also the same.

Three large or medium-sized, handsome red *Lioponera* that lack ocelli have a petiolar node that, in dorsal view, has its posterior angles produced as acute-angled flanges. These flanges are directed diagonally and outward, thus distinguishing the two species from other red *Lioponera* that lack ocelli. The petiolar node in *Lioponera clarki* and in *Lioponera* sp. JDM 941 is about twice as wide as long, compared with the almost square node in *L. punctatissima*, and the posterior angles in the former are large, acute-angled flanges, contrasting with the smaller, narrower flanges in *L. punctatissima*. Seen in dorsal view, the mesosoma in *L. clarki* is smooth and shining and has the usual *Lioponera* hourglass shape, being evenly concave in the middle. *Lioponera* sp. JDM 941 has an almost perfectly longitudinally rectangular mesosoma when seen in dorsal view, the cuticle finely marked with closely aligned longitudinal striae. The postpetiole is also finely punctate in *Lioponera* sp. JDM 941 but smooth and shining in *L. clarki.* Compared with the *Lioponera* taxa discussed thus far, except for *L. longitarsus*, *L. clarki* has a broad range that extends throughout WA. The species has also been taken in the far north of the NT.

Lioponera clarki is tolerant of disturbance and is one of the more abundant members of its genus in this state, and it often features in ant inventories conducted by environmental researchers (unlike most of its congenerics). At Eneabba, north of Perth, this ant was seen by the author on several occasions in relatively new mineral sand rehabilitation sites antennating the ground, presumably in search of prey. *Lioponera punctatissima* appears to be much less common than *L. clarki*, but also has a broad range, specimens having been collected from as far north as Mt Edith in the Pilbara, in the Avon Wheatbelt at Tammin, and at Mundaring in the Darling Range at the edge of the Perth metropolitan area. Clark (1924a) described the ant from a colony in Mundaring. The soil nest extended 19 inches (48 cm) underground and contained 160 workers, four queens and many larvae and pupae. Clark makes the comment that the ant hunts singly and has the habit of raising its gaster ('abdomen' = Clark) over its mesosomal dorsum when running about.

Lioponera sp. JDM 941 is known from only two records, both sets of specimens coming from widely separated localities. A single worker was pitfall-trapped at the ALCOA site in Jarrahdale, in Jarrah forest south of Perth, and three workers were pitfall-trapped in yellow sand at the one site in Queen Victoria Spring in the Great Victoria Desert. Nothing more is known of this species, but the contrast between the two sets of habitats in intriguing for such a rare ant.

Three or possibly four species complete the tally of uniformly red or orange *Lioponera*, these being *L. fervida*, *L. inconspicua*, a *Lioponera* near *inconspicua*, and *L. reticulata*. *Lioponera fervida* has the broadest range of any of the native Western Australian *Lioponera*, and has been recorded from NSW, QLD, and Vic in addition to WA. Within WA, this species has a distribution throughout the state that is mainly within 100 km of the coast. In keeping with its wide occurrence, this ant has a number of junior synonyms. However, a combination of a laterally impressed mesosoma, a wider than long dorsum to the petiolar node and smallish eyes (their length < 2 × distance between eye and mandibular insertion) is sufficient to distinguish *L. fervida* from the other species mentioned here. In most workers, the legs in this ant are also conspicuously darker than the head and body. Like *L. clarki*, this species has been collected on rehabilitated mineral sands sites in Eneabba, and workers have been hand-collected at night at Monkey Rock, north-east of Albany, and during the later afternoon at the Gibb River Road turnoff in the Victoria Bonaparte subregion of the NP. The latter worker was carrying a winged male which is pinned with the worker.

The taxon *L. inconspicua* requires clarification, as there may be two closely related species involved here. Both can be separated from similar taxa by the dorsal appearance of the petiolar node, which is distinctly wider than long and has unarmed posterior angles, and the large eyes (eye length ~2 × distance between eye and mandibular insertion). The syntype dealate queen and worker from John Forrest National Park have an almost flat petiolar node that is minutely punctate dorsally, whereas non-type worker material held at WAM has a clearly convex petiolar node when that sclerite is viewed in profile, and the dorsum of the petiolar node is smooth and shining when seen from above. Nonetheless, in all other morphological respects the two forms agree. Note: records in some databases of a 'type' specimen from QLD are almost certainly the result of confusion. Clark (1924b) gives the locality record for the syntypes simply as 'National Park' in his paper when he was clearly referring to John Forrest National Park in Western Australia, as is evident from the labels. For some unaccountable reason this site has been confused with a locality near Gordonvale, QLD.

The type material for *L. inconspicua* constitutes the only record for *L. inconspicua* (*sensu stricto*). The variant is broadly distributed with a record as far north as the Little Sandy Desert. Elsewhere, it has been collected at Cuballing and Katanning in the Avon Wheatbelt. The (likely holotype) of *Lioponera reticulata*, also collected from John Forrest National Park, has suffered from the same confusion as the abovementioned ant, and the species is also placed in QLD by the same databases. The mesosoma of this rarely seen little *Lioponera* is compact and longitudinally finely striate and has a superficial similarity to that of *Lioponera* sp. JDM 941, but the petiolar node is completely different and indicates the two species are not likely to be close relatives. The appearance of the mesosoma, combined with the flattened, matt, minutely punctate petiolar node and the finely sculptured gastral tergites combine to place this small, orange species apart from other small, reddish *Lioponera*. The Museum of Victoria holds the type; additional workers in the JDM Collection come from Gidgegannup (pitfall-trapped) and near the Jurien Bay turn-off (hand-collected).

Among the non-red *Lioponera*, *L. ruficornis* can be identified by its all black body and brown appendages. Workers of this ant can tend to vary considerably in size, but those seen are morphologically uniform. This species has also been recorded from Vic (AntWeb), but this single record is dubious, and the specimen imaged may belong to *L. turneri*, which has angulate occipital

lobes when seen in full-face view (rounded in *L. ruficornis*) (Andersen [2000] records *L. turneri* from the Kimberley — see the list under 'Additional Species' at the end of this volume). All other records are from WA, where the ant has been collected in the coastal south-west, in the goldfields and on Barrow Island. Clark (1924a) collected the species at Mundaring and Armadale. The Mundaring specimens used in his description came from a colony found under a piece of rotten timber. No queen was found in the nest. The Armadale workers were found running amongst large stones. Significantly, Clark remarks on the difference in size between the two sets of workers.

A red-and-black *Lioponera*, known only from a solitary, pitfall-trapped worker from the University of Western Australia's Future Farm at Ridgefield Farm, West Pingelly in the Avon Wheatbelt, is a striking beast, with its matt, black, foveate head and mesosoma making it immediately recognisable. The posterior propodeal carina is medially raised to form a small lip. Only some populations of *L. gilesi* have a similar colour pattern, but these are smaller ants and the head and body are shining and non-punctate and the posterior propodeal carina is not raised. An ant (*Lioponera* sp. JDM 746) which has some affinities and may be an ergatoid of this species has been collected at Mettler Lake Road and in Torndirrup National Park. In one of the specimens the mesosoma is smoothly rounded on to its lateral surfaces as in *L. longitarsus*, and there is an orange band on abdominal tergite IV. Furthermore, abdominal segment III is conspicuously narrowed. The remaining colour pattern along with the pitting and other sculptural features are as in the putative worker. This insect has every appearance of a wasp mimic (Heterick 2009). The two morphs are separated in the genus key in Part I, and may turn out to be different species.

Lioponera brevis, *L. elegans* and *L. nigriventris* are three tiny species in which the posterior angles of the petiolar node, seen from above, lack denticles or teeth and are often only sharp angles. The node is usually light-coloured but is occasionally darker. In *L. nigriventris* the head, mesosoma, petiolar node and post-petiole are all yellow or yellowish-red, the remaining gaster being brown or black. The other two species do not share this colour pattern, and the mesosoma and the post-petiole are generally darker in colour than the petiolar node. As is the case with numerous other WA *Lioponera* species, this ant was described by Clark (1924) from material collected at John Forrest National Park (unfortunately placed in QLD by certain databases,

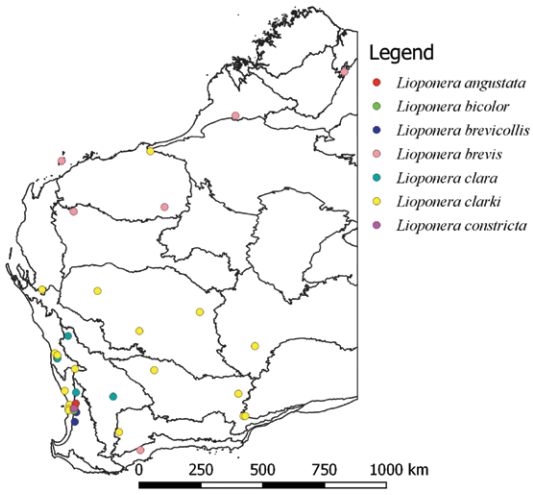

FIGURE 25 Distribution of *Lioponera angustata*, *L. bicolor*, *L. brevicollis*, *L. brevis*, *L. clara*, *L. clarki* and *L. constricta*.

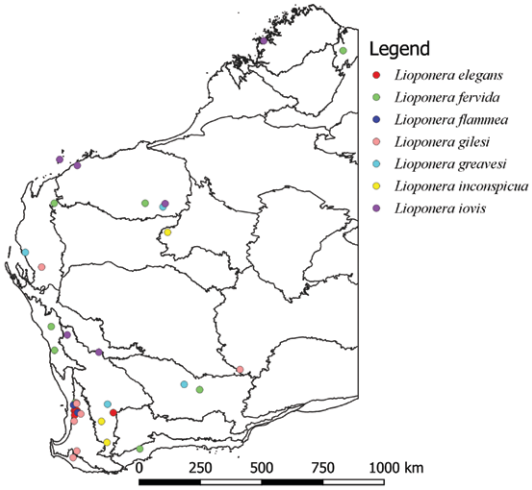

FIGURE 26 Distribution of *Lioponera elegans*, *L. fervida*, *L. flammea*, *L. gilesi*, *L. greavesi*, *L. inconspicua* and *L. iovis*.

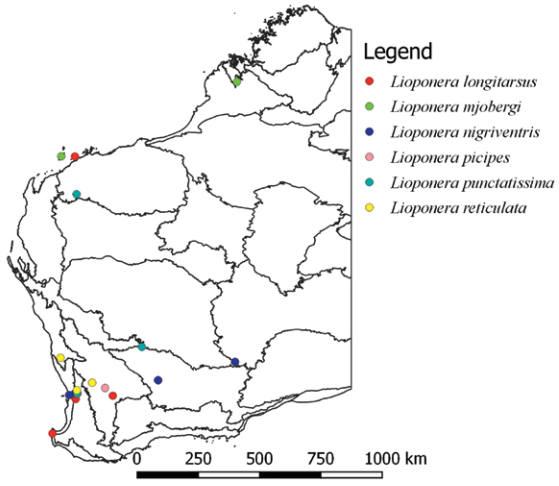

FIGURE 27 Distribution of *Lioponera longitarsus*, *L. mjobergi*, *L. nigriventris*, *L. picipes*, *L. punctatissima* and *L. reticulata*.

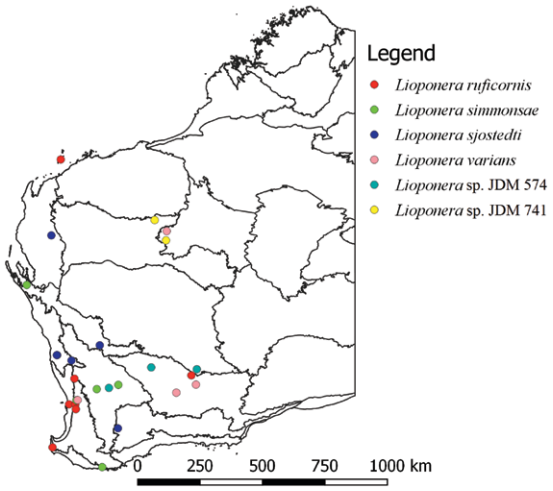

FIGURE 28 Distribution of *Lioponera ruficornis*, *L. simmonsae*, *L. sjostedti*, *L. varians*, and *Lioponera* sp. JDM 574 and JDM 741.

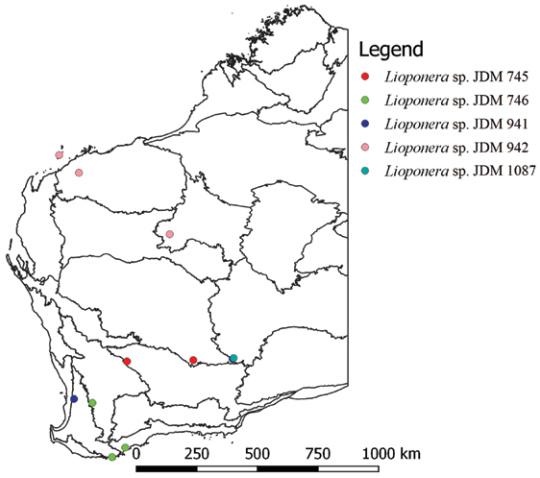

FIGURE 29 Distribution of *Lioponera* sp. JDM 745, JDM 746, JDM 941, JDM 942 and JDM 1087.

as mentioned above). Another worker was pitfall-trapped in Hollywood Reserve, a tiny patch of urban bushland not far from the Perth CBD. Other workers have been taken east of Southern Cross and at Queen Victoria Spring, indicating that, although it is not often seen, this unobtrusive little ant is capable of living in quite different habitats. In dorsal view, *Lioponera elegans* has an hour-glass shaped mesosoma compared with the almost perfectly longitudinally rectangular mesosoma of *L. brevis*. The former species occurs in two apparently disjunct populations: one in NSW around Sydney (from where the species was described by Brown in 1975) and Bathurst, and the other in south-west WA. However, the monophyly of this species needs to be tested, as the NSW workers seem to be larger than the WA workers and have smaller eyes. In other respects, workers from both regions appear to be identical. In WA, the species has been recovered from Corrigin, in the Avon Wheatbelt and in jarrah forest south-east of Perth. *Lioponera brevis* occurs throughout much of WA, and its range undoubtedly extends into the NT, at the least (see Andersen 2000). Only in the southern interior are records lacking, but little should be inferred from this as records of all ants are very low for this remote and scarcely sampled region. The species is quite common, especially in the north of the state. A large proportion of the records for this compact, tiny ant includes workers pitfall-trapped in Argyle diamond mine.

The remaining two species include an enigma: is *Lioponera bicolor*, a relatively large species known only from two colonies in the now built-up Perth suburb of Armadale, a critically endangered 'good' species, or are the syntype workers taken from those colonies merely representative of a population of particularly large *Lioponera gilesi*? For what it is worth, only size and the colour of the petiolar node (yellowish in *L. bicolor*, in contrast to the mesosoma, and brown in *L. gilesi*, the same as the mesosoma) separate the two species. However, size can vary considerably among *Lioponera* workers of the same species, and the infuscation of the petiolar node in *L. gilesi* workers tends to vary, although no specimens have been seen in which the node is uniformly pale as in *L. bicolor*. If the monophyly of *L. bicolor* is accepted, then the species would seem to be in a lot of trouble, as it has not been seen since it was described almost a century ago. Clark (1924) outlines the behaviour of the two colonies; both were involved in raiding or searching when found. One group of ants was seen raiding the nests of a small *Iridomyrmex*. Nests of both colonies were also identified, the entrances being directly into soil.

Lioponera gilesi was described from a nest found by Clark in Mundaring. Unlike its close relative, *L. bicolor*, it is quite common in the Perth area, particularly to the south and east of Perth, although it also occurs in the deep south, in the eastern desert and in the mid-west of the state. What is here called '*L. gilesi*', however, may be a small complex; workers from sandplain at Henderson (south of Fremantle) and at Queen Victoria Spring, and from semi-arid, red soil country at Meedo Station in the north-west have short but broad inwardly curved flanges at the posterior angles of the petiolar node, while workers from more heavily forested areas of the Darling Range and in the deep south of the state have small denticles directed posteriad. The latter

suite of workers also has smaller eyes. However, all other morphological features are shared by both groups of workers, and both have a head that can be uniformly orange or black or infuscated to varying degrees. If the workers are conspecific then possibly selection pressures operating in the two habitats result in the phenotypic differences mentioned. Clark (1924) mentions that the syntype workers were part of a nest found under a stone.

Ooceraea (Figure 30)

Ants in the genus *Ooceraea* were formerly placed in the portmanteau genus *Cerapachys*, but differ from that genus (and also *Lioponera* sp. JDM 574) in several particulars, namely: no portion of the body, including the petiolar node, is marginate; the hind coxa lacks a vertical lamella; the metatibial gland is reduced to an oval whitish patch or is undiscernible; and the eyes are absent or vestigial (large and well-formed in *Lioponera*). This genus also differs from *Zasphinctus* in that constrictions are absent from the anterior end of abdominal segments V and VI. Only the small, orange *Ooceraea australis* is definitely known to occur in WA where it has a wide though sparse distribution, having been recorded from the Perth metropolitan area and surrounding hinterland, Mt Brown near York in the Avon Wheatbelt, and the northern Kimberley. Elsewhere in Australia, this ant has been collected in the ACT, NSW, the NT, and QLD. Andersen (2000) mentions another species from the Kimberley near *O. biroi* (Forel). A specimen from Boongarie Island, in the Kimberley, believed to be of this taxon, is held in WAM/JDM Collection and has more intense, sometimes confluent, puncturation on the frons and mesosoma compared with south-western material assigned to *O. australis*, but this character does seem to be variable when other images under this name in AntWeb are examined. This species is likely to be a predator of the brood of other ants; this behaviour is known for other members of the genus (Borowiec 2016). Although *Ooceraea* is regarded as a non-army ant doryline (Borowiec 2016), the local species may have some army ant habits: workers of a large colony found under a stone on Mt Brown were attached to each other by the mandibles and the colony itself appeared to be bivouacking, there being no evidence of nest holes (Heterick 2009).

Zasphinctus (Figure 30)

The girdling constrictions on the anterior end of abdominal segments IV, V and VI render members of *Zasphinctus* distinctive and unlikely to be confused with any other Western Australian doryline. Western Australia is comparatively rich in this rare, cryptic genus of ants with six species definitely known for WA and others possibly occurring in the northern tropics (where four of the six species have been recorded). The habits of the local species have been little studied as far as is known but, based on observations made on other members of the genus (Borowiec 2016), they are likely to raid other ant species for their brood. Ergatoid females are common in this genus (André 1905; Clark 1924).

Zasphinctus duchaussoyi and *Z. occidentalis* are the only two West Australian members of the genus to have 11-segmented antennae, the antennae of the remaining four species all having 12 segments. These two species are separated by size and biogeography, the northern *Z. duchaussoyi* being appreciably smaller than the southern *Z. occidentalis*. *Zasphinctus duchaussoyi* has a wide distribution, and occurs in NSW, the NT, and QLD in addition to Western Australia. In WA, this species has been recorded from Barrow Island and from Ellendale Station in the Dampierland subregion of the NP but is also known to have been taken in the Pilbara region (not mapped). The Ellendale worker was taken from litter. *Zasphinctus occidentalis* is confined to south-western Australia, where most collections have been taken in the vicinity of the Perth metropolitan area in jarrah forest. One southern record comes from Moingup Spring in the Stirling Range. This species tends to nest under stones. This was the case with a collection made by the author near Byford, and also the type material collected by Clark at Mundaring. The nest is described by Clark (1924) as being of simple construction with a few small compartments connected by passages directly under the stone. Normal, obviously dealated queens were seen in this colony.

Of those species possessing 12-segmented antennae, *Zasphinctus imbecilis* is the one most frequently encountered. A shining integument, short antennal scapes reaching no more than half the length of the head capsule and small, well-separated hair pits only on the head and mesosoma are diagnostic of the species. In WA, this ant does not appear to occur east of the Darling Range, but it has a much more extensive range in eastern Australia where it may be found in the ACT, NSW, QLD, SA, and Vic. Most WA samples have come from jarrah forest south of Perth. Like *Z. occidentalis*, this species also likes to nest under rocks, but has also been found in or under rotted wood. The other named species, *Zasphinctus emeryi*, was described from workers collected on Baudin Island in 'NW Australia' (Forel 1893). This geographical note

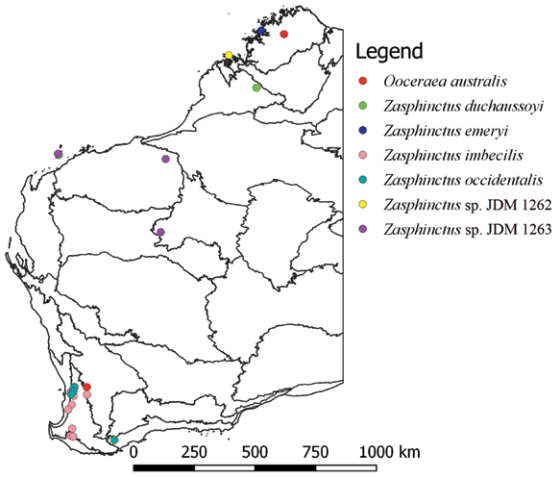

FIGURE 30 Distribution of *Ooceraea australis*, *Zasphinctus duchaussoyi*, *Z. emeryi*, *Z. imbecilis*, *Z. occidentalis* and *Zasphinctus* sp. JDM 1262 and JDM 1263.

poses a problem in that there are *two* Baudin Islands in WA, one in Shark Bay and one off the north-west Kimberley coast. While Forel *did* describe ant material from the Shark Bay region (from E. Wallabi Island), he seems to have used the term 'W Australia' for the more southern ant material and 'NW Australia' for ants from the top end, i.e. the northern Kimberley and the NT. A northern provenance of the type specimens of *Zasphinctus emeryi* is rendered more probable by the presence in the JDM Collection of a worker of this species collected from a berlesate undertaken on litter from near Prince Frederick Harbour. This mainland inlet in the northern Kimberley is just 50 km from Baudin Island. The close-knit foveae and the fine longitudinal striolae on the dorsum of the mesosoma serve to identify *Z. emeryi*. Unsurprisingly, given its remote habitat, no other specimens of this creature are known.

Of the two undescribed *Zasphinctus* species, *Zasphinctus* sp. JDM 1263 seems to be the more common. The shining cuticle of this species is similar to that of *Z. imbecilis*, but the hair pits are expanded to form distinct foveae that may be raised into tiny, ramifying striolae in some workers (but not the long, compacted striolae seen in *Z. emeryi*). The size difference between the workers available for analysis is quite marked in this ant. The larger workers are darker, but the morphology of all ants is identical. Workers have been taken from Barrow Island, and the Pilbara and the Little Sandy Desert subregions. The Barrow Island worker was hand-collected at night. *Zasphinctus* sp. JDM 1262 is much more gracile than the other *Zasphinctus* species, and has long antennal scapes that, when laid back, reach to well over half of the head length. The single specimen held at WAM was pitfall-trapped near a bore hole on Irvine Island in the northern Kimberley. A possible seventh species is represented by three males (WAM) collected at Lennard River Crossing, on the Gibb River Road. The cuticular sculpture and colour suggests *Z. steinheili* (Forel) but as no males of this species have been imaged, the identification is conjectural.

ECTATOMMINAE

Prior to 2003, the two genera *Heteroponera* and *Rhytidoponera* were closely associated within the subfamily Ponerinae. In 2003, Bolton removed *Heteroponer*a and *Rhytidoponera* from the Ponerinae, the former being placed in a new subfamily Heteroponerinae, the latter in Ectatomminae (a new status for tribe Ectatommini). Very recently, Feitosa et al. (2019) sank Heteroponerinae under Ectatomminae. Within this subfamily, the two WA representatives are retained in their respective tribes, i.e. *Heteroponera* in the Heteroponerini and *Rhytidoponera* in the Ectatommini.

Heteroponera (Figure 31)

Of the two genera in the Heteroponerini only *Heteroponera* occurs in Australia and WA. In WA, the genus comprises three species, two described and one undescribed. *Heteroponera imbellis* is reasonably common in mostly cryptic habitats, the other two species being exceedingly rare. In his (2003) monograph, Bolton did not consider his new subfamily to have an unequivocal apomorphy, but all WA *Heteroponera* share a single waist segment, a petiole with visible anterior, dorsal and posterior faces with the rear portion of the petiole separated from the gaster by a marked constriction, developed frontal lobes that partially obscure the antennal insertions, a pygidium that lacks spinous or peg-like teeth on its edge, a visible sting at the tip of the gaster — the gaster possessing a distinct constriction between the first and the second segments — a head with a fine but distinct median longitudinal ridge that runs uninterrupted from the vertex of the head to the anterior clypeal margin, and simple claws. Almost nothing is known of the biology of Australian species. Some taxa forage in leaf mould, under rocks and in rotten wood (Shattuck 1999), but their prey (assuming they are predators) seems to be unknown, and *Heteroponera imbellis*, which has been collected occasionally in suburban yards, may be more adaptable although it is also a litter dweller.

The enigmatic *Heteroponera majeri* belongs to a separate species-group, the *H. leae* species-group, and is characterised among the WA fauna by its larger size (HW approximately 2 mm compared with approximately 1 mm in the other two species) and in having an acuminate petiolar node (the node in *H. imbellis* and *Heteroponera* sp. JDM 732 being cuboidal or subcuboidal). *Heteroponera majeri* has been collected only three times on the western flanks of the Darling Range, but has not been seen for 40 years, despite many collections of ants being made in areas where it is known (or, was known) to occur. An application was unsuccessfully lodged by the author with the Commonwealth Government to have the species listed as 'critically endangered'. This species occurs in no other Australian state. This (likely) Gondwanan relic has been pitfall-trapped, but nothing more is known about it.

Heteroponera imbellis belongs to the *H. imbellis* species-group. *Heteroponera imbellis* has the smaller eye (EL > 0.15 × length of side of head) compared with *Heteroponera* sp. JDM 732 (EL > 0.28 × length of side of head), and its petiolar node is cuboidal and higher than long, whereas the node in *Heteroponera* sp. JDM 732 is subcuboidal and about as high as long. Most records of *H. imbellis* in WA come from the Perth region and the western and eastern slopes of the Darling Range, but there is one goldfields record. *Heteroponera imbellis* occurs in all mainland Australian states except the NT, but has not been found in Tas, despite the fact that that state would seem to have suitable habitat for this ant. This species has been collected in a Winkler sack and in sifted leaf mould and rotten wood but has also taken from litter affixed to the underside of a stone, in *Melaleuca lanceolata* woodland, in a riparian forest, in gully rainforest, in dry sclerophyllous forest, and in an old minesite. Occasional specimens have been collected in yards in outer Perth suburbs, but these have not been pinned. *Heteroponera* sp. JDM 732, based on Taylor's (2015) key, appears to belong to the *H. relicta* species-group, but cannot be further characterised (all the named species being restricted to the east coast). This ant has only been collected twice, once near Canning Mills in the Darling Range from dry sclerophyll woodland, and once from Kings Park (not pinned). Nothing is known about this species.

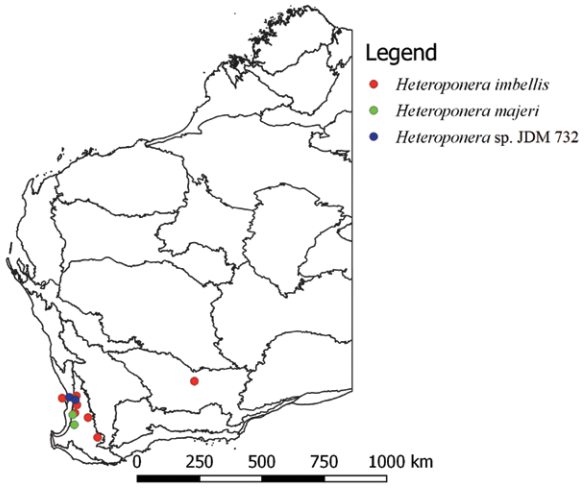

FIGURE 31 Distribution of *Heteroponera imbellis*, *H. majeri* and *Heteroponera* sp. JDM 732.

Rhytidoponera (Figures 32–37)

Of the two Australian genera now in the Ectatommini, only *Rhytidoponera* can be found in WA. With 37 species to be discussed here, WA has a healthy proportion of the fauna that occurs in Australia. Much of the *Rhytidoponera* fauna in this state has yet to be described (15 species on a current count). *Rhytidoponera* ants have a characteristic appearance; being uniformly brown or black, medium-sized to large ants with a solid, heavily sclerotised appearance. The gaster has a constriction behind the first segment, but it is not strongly impressed as with many Ponerinae. Some species are iridescent. The feature by which this tribe and genus is formally recognised, however, is quite subtle: the metapleural gland orifice (below the propodeum) is a longitudinal to oblique curved slit or crescent directed upward by a strip of cuticle. Additional, more readily discernible cues that apply to almost all *Rhytidoponera* are the tibial claw with a preapical tooth, and the small spine or tooth formed by the anterior angle of the pronotum, just above the front legs. *Rhytidoponera* ants are common in most WA habitats, with many supporting at least two or three species. Several opportunistic species have adapted to the disturbance created by urbanisation. Most *Rhytidoponera* are general predator-scavengers, though some prefer seeds, and will take honeydew (Shattuck 1999). Nests of WA species are probably mainly terrestrial, although arboreal nesters are known in the larger Australian context. Some will nest in rotted wood. A particular characteristic of this genus is that queens are absent in many taxa, and it is fertilised workers who produce brood (Shattuck 1999). Reichel (2003) discusses the systematics and taxonomy of the Australian *Rhytidoponera* but unfortunately did not publish her thesis. Her treatment of the species-groups is largely followed here.

The *R. aurata* species-group contains three WA species, which are distinctive because the corners of the occiput (the back part of the head, here associated with the vertex or the upper region of the head as seen from the front) are produced as

teeth, horns, or sharp angles. These ants also have the upper margin of the vertex projected forward, forming a characteristic horizontal occipital crest. *Rhytidoponera aurata* is distinguished from the other two species by its bright red coloration, the sharp angles of the occipital crest (these produced as teeth or horns in *R. cerastes* and *R. taurus*), its smaller size, and the weak medial indentation of the occipital crest, compared with the strong indentation seen in the other two species. *Rhytidoponera aurata* occurs in the Kimberley in WA and extends throughout the top end and into Papua New-Guinea. Nests of this species are usually directly into soil and are accompanied by a small mound. However, the ant may also nest in tree stumps and in crevices in rocks (Reichel 2003). *Rhytidoponera cerastes* has large occipital horns, which are directed vertically, as opposed to the sharp denticles directed laterally seen in *R. taurus*. *Rhytidoponera cerastes* is a very common inhabitant of native Kimberley environments from about Broome northwards. Eastwards, it extends into the western parts of the NT. *Rhytidoponera taurus* is easily the most common member of this trio, extending into all mainland Australian states except the ACT and Vic, although it is most common in the NT and WA. However, Reichel (2003) questions the monophyly of the species without splitting it into smaller units. *Rhytidoponera taurus* will nest directly into soil, in tree stumps and under logs. Where nests are made into soil, the nest entrance is slit-shaped and there is a mound (Reichel 2003). Workers are aggressive: the author experienced this when he disturbed a nest in spinifex country and the aroused ants emerged from their nest in a phalanx and approached him, each stridulating furiously.

A combination of very large eyes and an extremely short hind tibial spur characterise the two members of the *R. dubia* species-group found in WA. A very distinctive apical spur on the petiolar node that is directed posteriad distinguishes *R. tyloxys* from *R. dubia* group sp. JDM 904, in which the petiolar node terminates in a bluntly rounded apex. *Rhytidoponera tyloxys* has a broad distribution across WA from around Geraldton northwards. Further east, the ant also occurs in the NT and SA and there is a solitary record from Cape York in QLD. This species forages at dusk and at night, and known habitats include mallee, mulga and spinifex on sand or red soil (Reichel 2003). *Rhytidoponera dubia* group sp. JDM 904 (= Rhytidoponera sp. 25 ANIC) is known from Westonia in the Western Goldfields, from Ethel Creek Station in the Pilbara and from SE of Newman in the Murchison. This species also occurs in the NT and SA. Collections have been made in mallee and mulga (Reichel 2003). Reichel (2003) also identifies a third species from north-western WA, identifiable by its tiny size and a broad petiolar flange instead of a posteriorly directed spine. The author has not seen these specimens, but the appearance of the petiolar projection on specimens held in WAM varies considerably, and a normal-sized worker from Nanga Station in the Carnarvon subregion has a broad, thick flange at the apex of the node instead of a spine or spur, but in all other respects is identical with *R. tyloxys*. Possibly the two specimens mentioned by Reichel are simply nanitic workers of this particular population.

In three members of the *R. aciculata* group, namely, *Rhytidoponera mayri*, *R. mirabilis* and *R. quadriceps*, the occipital crest is prominent and strongly indented medially, with the posterior angles of the vertex forming blunt tubercles that are often seen to be projecting when the ant is viewed in profile. This feature sets them apart from the other members of their group (which is diagnosed primarily on molecular data — thus Reichel 2003) and from other WA *Rhytidoponera*. The large *R. mirabilis* clearly stands out among the three because of its lack of erect pilosity on its head and body and the mesh-like sculpture on its gaster. This species is confined to the extreme interior of Australia with all records close to the borders of the NT, QLD, and SA. The sole WA record is three workers from Mt Ant, near the NT border. Nothing is known of the habits of this species. *Rhytidoponera mayri* and *R. quadriceps* (here given revived status) differ in the appearance of the striae on the second gastral tergite (arched in the former and longitudinal in the latter) and the appearance of the angles of the occipital crest when the ant is seen in full-face view (expanded laterally and projecting beyond the side of the head in *R. quadriceps* and not expanded laterally in *R. mayri*). *Rhytidoponera mayri* is very common in mid-western WA and the Murchison subregion, but there is also a small, apparently disjunct population near Albany on the south coast. Elsewhere this species occurs in all Australian mainland states except the ACT. Like *R. taurus*, *Rhytidoponera mayri* builds entrances with slit openings. This taxon is an important seed dispersal agent (Reichel 2003, with associated references). *Rhytidoponera quadriceps* was made a junior synonym of *R. mayri* by Brown (1958), but Reichel adduces evidence that this species should be taken out of synonymy, and her position is adopted here (see Part I). *Rhytidoponera quadriceps* has a similar distribution to *R. mirabilis*, and there is one WA record from Blackstone, near the intersection of the WA, NT, and South Australian borders. This species also occurs in the southern part of the NT (Reichel 2003). There is no ecological information on this species.

The *Rhytidoponera metallica* species-group includes one of the best known ants in Australia, namely, the green-head ant (*Rhytidoponera metallica*). Other members of this group found in WA include *R. borealis*, *R. flavipes* (= *R. metallica* group sp. JDM 1023?), *R. inornata*, and *R. metallica* group sp. JDM 1098. The flattened eyes and iridescence dominated by blue, green or purple reflections is sufficient to set *R. metallica* apart from the others within its group, while its relatively small size, its well-developed occipital lobes, its short antennal scapes and its thick, rectangular petiolar node separate the taxon from other *Rhytidoponera* outside of the *R. metallica* group. This species is found in all Australian states except Tas but is largely absent from the northern half of Australia (except the QLD coast and central desert) and the interior of NSW. Because of morphological variability and some chromosomal and microsatellite DNA evidence, Reichel (2003) opines that there may be multiple cryptic species present within the broader taxon *metallica*. Among questionable WA material, an easily recognisable dark, rather smooth bluish form with a thin petiolar node that largely lacks sculpture is found in dry grassland and mallee woodland on the Nullarbor. This is believed to be *R. pulchra*, currently synonymised under *metallica*. As well as its distribution within Australia, *R. metallica* seems to have become established in New Zealand (https://www.landcareresearch.co.nz/discover-our-research/biodiversity/plants-invertebrates-fungi-and-bacteria/invertebrate-systematics/ants-wasps-and-bees/ants-of-new-zealand/rhytidoponera-metallica/ [accessed 5 March 2019]). *Rhytidoponera metallica* is an opportunist species that adapts well to urbanisation; it is known as a stinging nuisance in parks and gardens (Heterick 2009), but it is also an important seed disperser in native ecosystems, especially after fire (Beaumont et al. 2018).

Rhytidoponera flavipes (which appears to be the same as *Rhytidoponera* sp. JDM 1023 in the JDM Collection) is another iridescent species in the *R. metallica* group, and is separable from *Rhytidoponera metallica* group sp. JDM 1098 in having the first gastral tergite either smooth and shining with fine, transverse striae or with arched striae but is not uniformly reticulate-foveate, and the ant also has occipital lobes that are well-developed (the sculpture on the first gastral tergite is uniformly reticulate-foveate in *Rhytidoponera metallica* group sp. JDM 1098, which also has weak, inconspicuous occipital lobes). The former species is patchily distributed in drier habitats in mid-western WA, the Great Victoria Desert, the Little Sandy Desert and the Nullarbor. The two workers from Tropicana mine in the Great Victoria Desert have a thicker node and the first gastral tergite is more densely foveate than is the case with the other specimens, which are uniform in appearance, but they are being treated as conspecific for the moment until more material is available for comparison. The Little Sandy Desert material was pitfall-trapped in spinifex sandplain. The Nanga Station worker was taken in dry pits, but there are no other ecological data on the species. *Rhytidoponera metallica* group sp. JDM 1098, which is much more heavily sculptured than its relatives, appears to be confined to the Shark Bay region. This species has been taken in dry and wet pitfall traps but nothing more is known about it.

Rhytidoponera inornata is a small, non-iridescent species that is common in the south-west of the state but is not found elsewhere. This ant can be separated from *R. borealis*, the other non-iridescent *Rhytidoponera* in the *R. metallica* group, by the less well-developed occipital lobe (this part is large in *R. borealis*), the appearance of the anteroventral petiolar process and the shinier, less sculptured cuticle. Superficially, this taxon is very similar to species of the eastern Australian *R. victoriae* species-group, but there is no trace of an antennal scrobe in *R. inornata*, whereas this is a feature of the members of the *R. victoriae* group. Reichel (2003) mentions a similar form, known from two specimens taken from the Mallee subregion at Madura, with a massive petiolar node and finer, more regular striations on the first gastral tergite. The JDM Collection also possesses a worker from Madura with the same features mentioned by Reichel. The mesosoma overall is more massive and compact, in keeping with the appearance of the petiolar node. There is, however, a sufficient range of *R. inornata* material in the JDM/WAM Collections to reveal that the size of the petiolar node increases in workers in a west-east cline. The fine appearance of the first gastral tergite in the Madura sample is acknowledged, but the variability in appearance of this sclerite among workers taken all over the south-west and on the south coast is sufficient to allow for this feature to also be regarded as infraspecific. *Rhytidoponera inornata* appears to have similar seed-harvesting habits to its cousin *R. metallica* and is known to harvest ryegrass seeds (Twigg 1982). In native woodlands, this species is an important remover of the seeds of jarrah (*Eucalyptus marginata*), and also takes seeds of other native plants found in the south-west of the state (Majer et al. 2011). The ant nests directly into soil to a depth of about 25 cm (Majer et al. 2011), but also nests under stones, logs and rotting wood (Reichel 2003). *Rhytidoponera inornata* is tolerant of urbanisation but is less common in such settings than *R. metallica*. While both ants can be found in a locality they tend not to occur within the same site (Heterick 2009).

An extended and particularly prominent occipital lobe characterises *R. borealis*, which is found in the Kimberley. The range of this species extends across into the top end of the NT. Nests of the ant may be found in soil, in fallen timber and under rocks (Reichel 2003).

Another group of small *Rhytidoponera* is the *R. tenuis* species-group. While somewhat similar to members of the preceding species-group, the members of the *R. tenuis* group have a low node that is as wide as or wider than high. *Rhytidoponera tenuis* itself has a distinctively narrow head, and the hind tibial spur is very short, vestigial or absent, unlike that of similar-sized species where it is long. The scapes in *R. tenuis* are also longer than in the two members of the equally diminutive *R. anceps* species-group found in WA. Reichel (2003) claims '*tenuis*' is a species complex, but the view taken here is that this is difficult to demonstrate without molecular testing as the morphological characters attested are equivocal. In her thesis, that author separates *R. tenuis* (*sensu stricto*) from several other similar *Rhytidoponera* morphospecies, these known by ANIC voucher numbers only. At least one of these, *Rhytidoponera* ANIC sp. 34, occurs in far northern WA. This form supposedly lacks hind tibial spurs. Specimens referable to the *R. tenuis* group and collected from WA localities (Horse Creek [assuming this is WA as the state is omitted on the label], Ellendale and Cape Bernier) have been checked for this character. Unfortunately, no firm conclusions can be reached as the specimens reveal a bewildering variation, workers from Horse Creek having a short spine, a vestigial spine or only the hint of a nub, sometimes with different states on the same ant. Other characters, such as gastral sculpture, are also equivocal. For the purpose of this paper, therefore, all WA *tenuis*-like workers are treated as '*tenuis*'. *Rhytidoponera* '*tenuis*' occurs throughout the eastern and northern Kimberley. *Rhytidoponera tenuis* (*sensu lato*) is also found in the NT and QLD. Reichel (2003) comments that the NT form called '*Rhytidoponera* sp. 34 ANIC' (likely the same form as is found in WA) nests in soil, without a mound, in rotting wood lying on the ground and in termite mounds.

Rhytidoponera anceps, which, with its relative *R. anceps* sp. 44 ANIC and a newly discovered morphospecies are the representatives of the *R. anceps* species-group in WA, has a shorter, broader head than the former species, and the node is a low cube (narrow and rounded in *R. tenuis*). The bluntly triangular clypeus also separates this group from the ants in the *R. metallica* group, which have a rounded clypeus and lack a clypeal lamella. This little ant has an amazingly disjunct biogeography: while most populations occur east of the Great Dividing Range in QLD and NSW, the Western Australian population is located on and around the Esperance region — some thousands of kilometres away. Based on label data posted on AntWeb this small ant has catholic tastes in terms of habitat, having been found in a range of environments that include rainforest, wet and dry sclerophyll woodland, savanna and coastal scrub. Label data also indicate this ant frequently forages on vegetation and can ascend tree trunks. *Rhytidoponera* sp. 44 ANIC has an almost identical morphology to *R. anceps*, the only difference being the presence of coarse, irregularly spaced, arched striae on the first gastral tergite (fine parallel striae in *R. anceps*). This ant was given a manuscript name by John Clark but appears never to have been formally described. *Rhytidoponera* sp. 44 ANIC has been recorded on several occasions in the Albany region on the south coast. Because of its likely close relationship to *R. anceps*, this ant is presumed to have similar habits. Since the online publication of Part I, another morphospecies in the *Rhytidoponera anceps* species-group has been discovered within the old Curtin University Ant Collection. The taxon is close to *R. anceps* (*sensu stricto*), but the first gastral tergite has strong reticulation instead of concentric striae. The thirteen workers seen are confined to material from a third-year student project undertaken in and near Yanchep National Park in late 1989/early 1990.

Three members of the *Rhytidoponera convexa* species-group can be treated as a readily recognisable unit since they combine a horizontal occipital crest with a narrowly rectangular, almost squamiform (i.e. scale-like), upright petiolar node, and sculpture on the frons that is uniformly reticulate-foveate or foveate-striolate. Most of the remaining *Rhytidoponera* do not have a horizontal crest, but if they do then the petiolar node, if roughly rectangular, is sloped posteriad and the frons is generally reticulate-punctate or foveate only. Of these ants, *Rhytidoponera violacea* is far and away the best known species and is familiar to almost all residents in the Perth metropolitan area. This is because *R. violacea*, along with *Rhytidoponera metallica*, is an opportunist species that benefits from disturbance. This species is separable from the other two in its species-group by its uniformly black coloration, overall iridescence (absent or limited to the gaster in the other two species) and its narrow node that has a dorsal crest. *Rhytidoponera violacea* has a range that extends throughout much of southern

and central WA to southern parts of the NT. Colonies in the wild can be found in a variety of habitats from semi-arid to dry sclerophyll, but the ant appears to avoid the areas of heaviest rainfall in the deep south of the state. Disturbed areas in city suburbs such as parkland or large gardens, as well as paddocks in rural areas, are also favoured, and *Rhytidoponera violacea* is often seen on paths. This species is regarded as a keystone seed disperser in south-western WA, and this as well as other aspects of its biology are discussed by Lubertazzi et al. (2010). *Rhytidoponera convexa* group sp. JDM 1129 looks very like *R. violacea* and is easily confused with it. However, this ant has a more brownish tinge, iridescence (if present) is usually confined to the gaster and the petiolar node is thicker with a distinct dorsal face. There appear to be three disjunct populations of this species in mid-western WA, the Pilbara (including Barrow Island) and the Kimberley, and its habits are likely to be similar to those of *R. violacea*.

Rhytidoponera castanea (here revived from synonymy) looks like a brown, reddish or yellowish-orange version of the preceding two species and, apart from its generally lighter colour and lack of iridescence, has a slightly larger eye and a more heavily sculptured petiolar node (*Rhytidoponera carinata* is here relegated to a junior synonym [see discussion under 'Ectatomminae' in Part I]). This ant is confined to the Kimberley in WA, but its overall range extends to the NT and QLD. This is a very common inhabitant of savanna woodlands and other dry, open habitats (Reichel 2003).

Rhytidoponera sp. JDM 985 (which appears to be the same as *Rhytidoponera* sp. 18 ANIC in Reichel's 2003 revision) is a distinctive desert-dwelling species that is readily distinguished from other *Rhytidoponera* by a combination of its matt appearance, striolate cuticle with microreticulation within the tiny, parallel striolae, and the prickly, small, erect setae that cover the head, body, and appendages. This ant is found in the north-eastern goldfields extending through the Little Sandy Desert, Gibson Desert, and the Central Ranges. The range of the ant is likely to extend into the NT and northern SA. Reichel remarks that the distribution of *Rhytidoponera* sp. 18 ANIC is quite wide through the central Australian desert areas (map not available). The smooth, crestless frons and finely sculptured integument suggest a relationship somewhere near the *R. micans* complex but not within it, because of the erect setae (*R. micans* members are glabrous). A pitfall-trapped specimen was collected in a sand dune, but there are no other data on this species.

The three undisputed WA members of the *R. micans* complex lack a horizontal occipital crest, the upper vertex is rounded smoothly on to the sides of the head, and the head and body sculpture consists of very fine microreticulation overlaid with occasional small, scattered foveae. They lack erect pilosity (but this is also the case with other *Rhytidoponera*). The undescribed member of this little complex, *Rhytidoponera* sp. JDM 986, stands out from its fellows with its bicoloured body; the foreparts are dark ferruginous while the gaster is yellow (*R. flavicornis* and *R. micans* are both concolorous black or brownish-black). This species also lacks the striolae found in the other two species. The two known collections have been from the Little Sandy Desert. One collection of two ants was pitfall-trapped in a sand dune. There is little physical difference between the remaining two species; in *R. flavicornis* the fine striolae on the second gastral segment are evenly longitudinal, while these striolae are transverse and weakly arched in *R. micans*. The two ants are confined to Western Australia, and there appears to be little or no overlap in their ranges. *Rhytidoponera flavicornis* has the more northerly distribution, with most records concentrated around the coastal Gascoyne; but there are a couple of records from the edge of the Little Sandy Desert and a single mention from the central Kimberley. *Rhytidoponera micans* populations are mostly concentrated in mid-western WA, ranging from near the coast to the centre of the Murchison subregion. As is the case with so many ants, there is little biological information: AntWeb label data reveals both ants have been found in varied habitats, usually on yellow sand or red clayey soil, including, in the case of *R. flavicornis*, areas that have been denuded by feral animals (rabbits, goats). *Rhytidoponera flavicornis* is a common species in the Carnarvon hinterland, and foragers have been hand-collected in both the morning and evening.

The presence of a nuchal carina combined with the absence of a horizontal occipital crest help to identify the large-eyed *Rhytidoponera* sp. JDM 736 (the same species as *Rhytidoponera* sp. 26 ANIC in Reichel's 2003 revision). The rectangular node is reminiscent of the *Rhytidoponera reticulata* species-group, but the petiolar node is conspicuously higher than wide (as high as wide in the *R. reticulata* group) and the *R. reticulata* group have an occipital crest. The antennal scape is longer, and the ant is more gracile than are members of the *R. metallica* species-group to which workers also bear a faint resemblance. *Rhytidoponera* sp. JDM 736 is known in the JDM/WAM Ant Collections from

one worker hand-collected on Gladstone Scenic Lookout, a flat, limestone outcrop adjacent to the North-West Highway. Reichel (2003) mentions this species is known from a few collections (not listed) undertaken in the Mallee subregion in north-western Australia. The ant seems to be a localised taxon. A very different *Rhytidoponera*, but one that is also difficult to categorise, is the far northern *Rhytidoponera* sp. JDM 1372, with its oblong (much longer than wide when seen in profile) petiolar node and dense covering of short, erect, prickly setae. These features, combined with its bicoloured brown and light yellowish-brown body, make this species very easy to identify. The WAM has a number of workers collected at 'Yampi' and Watjulum ('Wotjulum') Mission in the northern Kimberley by Athol Douglas in 1955. Other data are lacking.

Six species of *Rhytidoponera* in two separate species-groups combine a symmetrical, square, rectangular or conical petiolar node with a reticulate or predominantly striolate frons. In the remaining *Rhytidoponera* the petiolar node is usually asymmetrical and the frons is predominantly punctate or finely microstriolate with scattered punctation and foveae.

The two members of the *R. convexa* species-group, namely, *Rhytidoponera* sp. JDM 1366 and *Rhytidoponera* sp. JDM 1370, differ from the other four species in having a combination of a conical or narrowly rectangular petiolar node (square, with or without a posterior overhang of the dorsal face in *R. 'crassinodis'*, *R. reticulata* and *Rhytidoponera* sp. JDM 1056), and a feebly developed horizontal occipital crest (the upper vertex rounds smoothly on to the sides of the head in *Rhytidoponera* sp. JDM 576). In *Rhytidoponera* sp. JDM 1366 the fine, longitudinal striolae of the frons diverge before the vertex, and are replaced posteriad by several transverse striolae. In its relative the longitudinal striolae continue uninterrupted to the vertex. The former also has many parallel striolae on the genae and mesosoma, whereas the sculpture of these parts tends to be reticulate-striate in *Rhytidoponera* sp. JDM 1370. Three workers of *Rhytidoponera* sp. JDM 1370 were hand-collected from a dry salt lake in mid-western WA, vegetated by samphire. They are not known otherwise, nor is anything known of their biology. This species bears a very close resemblance to R. *pilosula* Clark, but the erect setae are short and stout in appearance, not long and fine as in the eastern Australian species. Two workers of *Rhytidoponera* sp. JDM 1366 were hand-collected on a Pilbara minesite in a mallee-spinifex habitat, but nothing more is known of the species.

Rhytidoponera sp. JDM 576 is placed in the *R. reticulata* species-group with some hesitation; the worker can be distinguished from other members of the group by its smoothly rounded vertex (there is a feeble horizontal occipital crest in the other species) and the relatively narrow, rectangular node. The anteroventral petiolar process, however, is long and tapering, as in the other species (albeit it is flanged in many *R. 'crassinodis'*). This is a relatively common *Rhytidoponera* in central WA, occurring in the mid-western parts of the state from about Perenjori northwards to Shark Bay, and then inland in the northern and north-eastern goldfields at least as far north as Wiluna. Nest series have been hand-collected (JDM Collection) at Mt Crawford and 18 km south of Menzies but no nest data have been recorded. The predominant vegetation in this area is tall *Acacia* shrubland with low shrubs. *Acacia aneura* (mulga) is the main vegetation species. *Rhytidoponera* sp. JDM 1056 has a node that is very similar to that of *R. reflexa*, but the vertex of the head is weakly concave with a feeble horizontal occipital crest, not domed as in *R. reflexa*, and the erect setae are relatively long, fine and even flexuous. This latter character also serves to distinguish it from the remaining two species. This taxon is known only from two workers pitfall-trapped at the Argyle Diamond Mine site and a male believed to be of this species taken from Koolan Island, both sites being in the north-eastern and northern Kimberley, respectively.

Rhytidoponera reticulata is readily separated from *R. 'crassinodis'* by the appearance of the petiolar node, which has a distinct, acute, posterodorsal lip in this species but is evenly weakly inclined posteriad in *R. 'crassinodis'*. In WA, *R. reticulata* has been collected at several sites in the north and north-east Kimberley. Elsewhere it occurs in the NT and in Cape York in QLD. This species seems to have broad habitat preferences. Reichel (2013) comments that the species has been collected in open eucalypt woodland, mulga woodland and seasonally flooded grasslands. While there are little specific data, a label accompanying workers collected by P.S. Ward north-west of the Adelaide River in the NT notes that they were foraging nocturnally. The holotype specimen for *R. crassinodis* is believed destroyed by allied bombing in World War II. This type specimen was described by Forel as glabrous, whereas most workers have scattered erect setae over much of the body (Reichel 2003). As a neotype has not been erected, the name *'crassinodis'* is here enclosed in inverted commas to indicate the question mark hanging over the identity of specimens that seem,

based on other grounds, to belong to this taxon. Moreover, workers held in the JDM Collection reveal interesting variation in the degree of inclination in the anterior face of the petiolar node. In material from Barrow Island the anterior face of the node is vertical, but in mainland material it is inclined to varying degrees. In WA, specimens assigned to *R. 'crassinodis'* seems to be generally distributed throughout much of the State, but the ant is absent from the southern regions from about 29° S. Elsewhere this species is recorded from the NT, northern SA, and far western QLD. This common species can be found in a variety of habitats. These include open savanna woodland, mallee and saltbush flats (Reichel 2003). Reichel also mentions that the ant has been seen foraging at dusk and dawn.

The remaining six *Rhytidoponera* species belong to the *R. aciculata* species-group. This group is not morphologically well-defined, being identified on the basis of molecular data (Reichel 2003), but probably several complexes embrace these six species. All have either an asymmetrical petiolar node or a node that is short, cylindrical

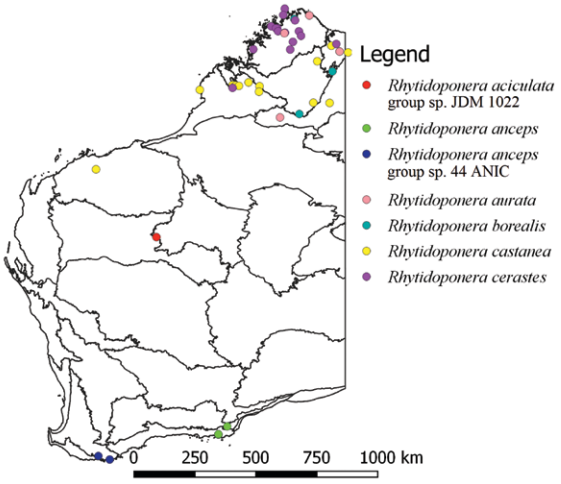

FIGURE 32 Distribution of *Rhytidoponera aciculata* group sp. JDM 1022, *R. anceps*, *Rhytidoponera anceps* group sp. 44 ANIC, *R. aurata*, *R. borealis*, *R. castanea* and *R. cerastes*

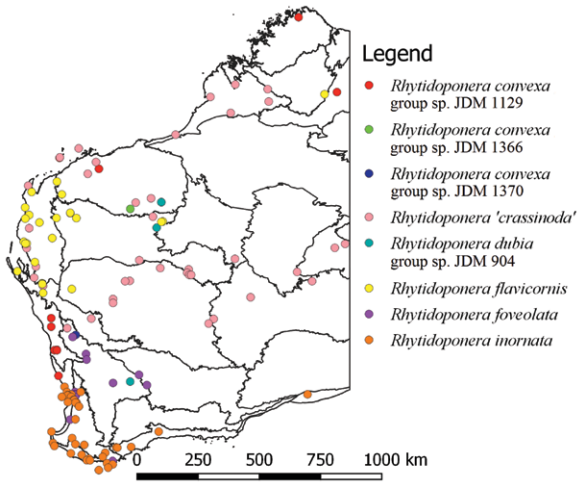

FIGURE 33 Distribution of *Rhytidoponera convexa* group sp. JDM 1129, JDM 1366 and JDM 1370, *R. 'crassinoda'*, *Rhytidoponera dubia* group sp. JDM 904, *R. flavicornis*, *R. foveolata* and *R. inornata*.

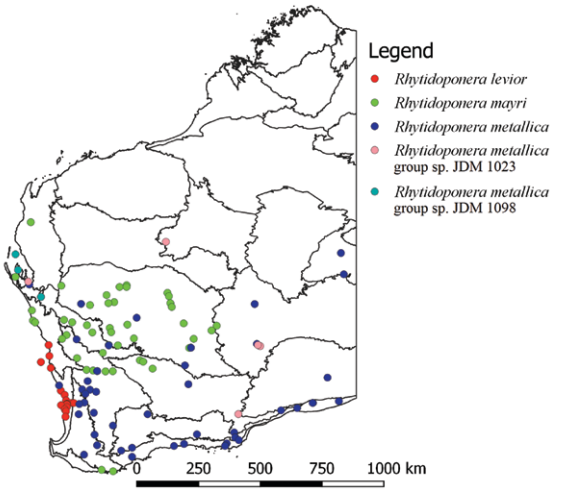

FIGURE 34 Distribution of *Rhytidoponera levior*, *R. mayri*, *R. metallica* and *Rhytidoponera metallica* group sp. JDM 1023 and JDM 1098.

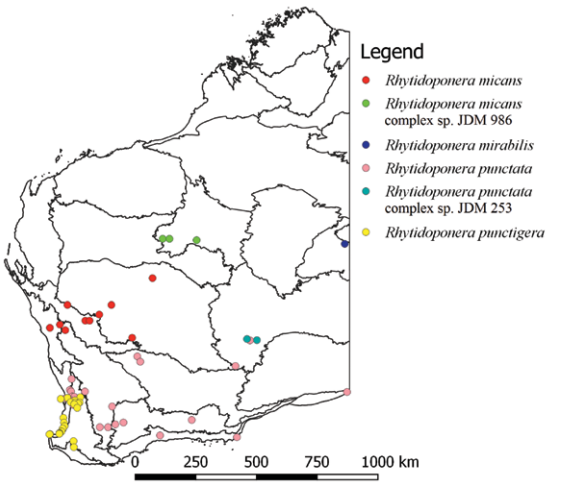

FIGURE 35 Distribution of *Rhytidoponera micans*, *Rhytidoponera micans* complex sp. JDM 986, *R. mirabilis*, *R. punctata*, *Rhytidoponera punctata* complex sp. JDM 253 and *R. punctigera*.

and convex above.

Rhytidoponera foveolata, one of several WA *Rhytidoponera* placed by Reichel (2003) in '*R. aciculata* group — other' is probably most easily recognised by the strongly reticulate-rugose sculpture of the frons and the mixture of tiny, raised striolae, scattered shallow punctation and microreticulation on the gaster, the other five species being much less strongly sculptured, especially on the gaster, which is either evenly microreticulate or has fine, parallel striolae. This species is mainly confined to the SWP, with the most easterly records coming from the junctions of the Avon wheatbelt and Coolgardie subregions. The ant is not particularly common, but most collections have been taken in dry sclerophyll woodland in the Darling Range. Some workers have been pitfall-trapped. There are few additional data. *Rhytidoponera aciculata* group sp. JDM 1022 and *R. punctigera* have a gastral sculpture consisting of fine, parallel striolae; the remaining three species having a gastral sculpture consisting of very small, even microreticulation. *Rhytidoponera aciculata* group sp. JDM 1022 and *R. punctigera* can easily be separated by the appearance of the petiolar node, the node being a punctate rounded square in the former and an asymmetrical cone in the latter. The biogeography is also different; the former species is known from two pins, each of two workers, taken from the edge of the Little Sandy Desert, whereas the latter species is confined to the jarrah-marri forests of the Darling Range and the *Banksia/Agonis* woodland of the Swan Coastal Plain. The four workers of *Rhytidoponera aciculata* group sp. JDM 1022 were pitfall-trapped on a sand dune, but nothing more is known about the species. *Rhytidoponera punctigera* is a diurnal forager: workers have been collected over white soil in peppermint scrub on the outskirts of the Australind settlement and on lateritic gravel on Talbot Road in the Darling Range. This is a very common species within its range.

The subtle, sculptural features of the gaster aside, *Rhytidoponera punctata* complex sp. JDM 253 is very similar in appearance to *R. aciculata* group sp. JDM 1022, but it is not known whether this indicates a genuine relationship or is due to convergence. The petiolar node in the former is, however, less massive and blocky than that in the latter ant. *Rhytidoponera punctata* sp. JDM 253 is a desert ant; the two known workers were collected at Tropicana minesite, one pitfall-trapped in soft grass, the other trapped on a sand dune with marble gum (*Eucalyptus gongylocarpa*) climax vegetation and spinifex hummock grass

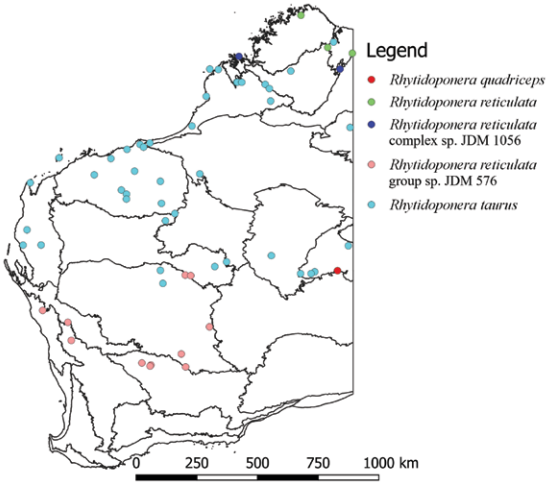

FIGURE 36 Distribution of *Rhytidoponera quadriceps*, *R. reticulata*, *Rhytidoponera reticulata* complex sp. JDM 1056 and JDM 576, and *R. taurus*.

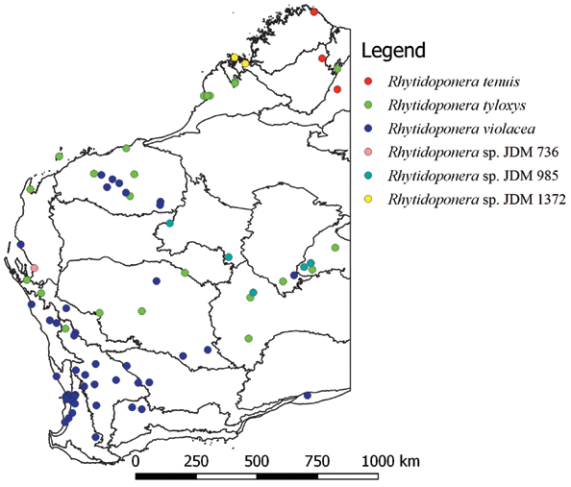

FIGURE 37 Distribution of *Rhytidoponera tenuis*, *R. tyloxys*, *R. violacea*, *Rhytidoponera* sp. JDM 736, JDM 985 and JDM 1372.

ground cover.

The differences between the remaining two species, namely, *R. levior* and *R. punctata* (the name *rufonigra* here being synonymised with the senior name — see the notes under *Rhytidoponera* in Part I), are very subtle. Both species share the same shaped petiolar node, which is slightly higher than wide and always slopes posteriad with a distinct angle between the dorsal face and sides when viewed in profile. The short spine of the anteroventral petiolar process in *R. punctata* contrasts with the mere small nub or spur in *R. levior*, but this feature is often difficult to see in specimens glued on points. Perhaps the best character is the appearance of the pronotum seen

in dorsal view; the pronotal foveae are very small and mostly separated from each other by more than their own width in *R. levior* but are larger and often contiguous in *R. punctata*. A medially interrupted occipital carina can also be seen in the latter (the head being viewed in profile) but is usually absent in the former. The biogeography is also subtly different: *R. levior* is exclusively an ant of the Geraldton Sandplains and Swan Coastal Plain, while *R. punctata* has a much more extensive range further inland and extends as far as Adelaide in SA. Erroneously reported to be confined to Rottnest Island (Crawley 1925; Reichel 2003), *Rhytidoponera levior* tolerates settlement to some degree, but its numbers in the Perth metropolitan area seem to be declining with increased urban infill. On weedy verges beside roads, the ant typically builds a nest with a large, single, untidy entrance without a mound. In less disturbed areas it has been taken on white coastal sand in a heathy dune and in dry sclerophyll woodland. *Rhytidoponera puncata* probably has similar habits to its near relative but ranges through a much greater variety of habitats and soil types, from white, sandy soil (e.g. in the Bullsbrook area) to the calcareous soils of the Nullabor Plain.

FORMICINAE

Members of the Formicinae are readily identifiable as ants with a single waist segment and a specialised pygidial funnel, the acidipore, which is capable of delivering a gaseous aerosol of formic acid for defence or offence. This group constitutes one of the two subfamilies that dominate WA ant communities. In fact, although the Myrmicinae boasts more genera in this state, the Formicinae has by far the greatest number of species, with enormously speciose genera like *Camponotus* and *Polyrhachis* being found in nearly all habitats outside of the most highly urbanised locations.

As is happening with the other major ant subfamilies, there has been much contemporary work on producing molecular-based phylogenies for the Formicinae. A recent paper by Ward et al. (2016) posits six major clades treated as tribes, four of which include Australian (and Western Australian) ant genera. *Oecophylla* remains as an isolated genus. Of particular interest, because of its largely Australian composition, is the tribe Melophorini, which contains the huge genus *Melophorus* (endemic to Australia) and eight other genera, only one of which is found outside of Australasia. Of the seven smaller Australasian genera, *Myrmecorhynchus*, *Notoncus*, *Prolasius* and *Stigmacros* can be found in WA, the other three being eastern Australian. The tribe Camponotini includes *Calomyrmex*, *Camponotus*, *Colobopsis*, *Echinopla* (not WA), *Opisthopsis,* and *Polyrhachis*, Plagiolepidini includes three genera reported from WA, namely *Acropyga*, *Plagiolepis* and *Lepisiota*, while tribe Lasiini includes WA representatives in *Nylanderia*, *Paraparatrechina* and *Paratrechina*.

Acropyga (Figure 38)

The genus has recently been revised on a global basis by LaPolla (2004). These depigmented little ants are immediately recognisable because of their short palps (PF 2,3), vestigial eyes and reduced number of antennal segments (9–11). The species most commonly seen in WA is *Acropyga myops*, which can be separated from the other WA species, *A. pallida*, by its larger size and the many suberect and decumbent setae on the mandibles (relatively few in *A. pallida*). In WA, this ant has been collected in the Darling Range, in the Avon wheatbelt and at a couple of localities in the Esperance region. However, *A. myops* is found in all mainland states, although it has been most commonly recorded in NSW, southern QLD, and the Adelaide Hills in SA. Western Australian samples have mostly been hand-collected from under rocks. This is unsurprising since the genus is exclusively fossorial and all known species tend mealy-bugs (LaPolla 2004). *Acropyga pallida* is also widespread and has also been found in all Australian mainland states, although it is predominantly coastal in its distribution. The range of this ant extends to Papua New Guinea, Indonesia, Malaysia and the Philippines, as well as large islands and archipelagos like New Caledonia. The only WA record (in LaPolla [2004]) is from Tunnel Creek National Park in the Kimberley. AntWeb label data indicate this *Acropyga* species has often been taken from litter berlesates. (Note: WA records in ANIC ascribed to this species on AntWeb are incorrect. This author has examined the material and found it consists of unrelated taxa; not *Acropyga* at all. These workers belong to the genera *Arnoldius* and *Plagiolepis*.)

Calomyrmex (Figure 38)

Calomyrmex ants are often spectacular and iridescent in appearance. In the field they resemble *Camponotus*, but unlike the latter they possess a metapleural gland and are monomorphic. The frons, however, is very similar to that of *Camponotus*, and, like that genus, the antennal sockets are placed on the antennal carinae well away from the posterior margin of the clypeus. This latter feature and the presence of a metapleural gland separates the genus from all other formicines

except *Opisthopsis*; but the eyes in *Calomyrmex* are only moderate in size (comparatively huge in *Opisthopsis*) and are placed on the sides of the head not on the corners, as in the latter genus. When disturbed, *Calomyrmex* workers secrete a pale white to orange exudate from the base of their mandibles, the colour dependent on the age of the ant. This exudate has a variety of roles, including that of a repellent (Shattuck 1999). These ants are general scavengers and also seek honeydew and nectar. Nests are directly into soil and have a single entrance. Like some other formicines and dolichoderines, these ants tend to run about the ground with their gasters elevated, especially when disturbed, and the erect, white, bristly setae on their legs are quite conspicuous.

Four species of *Calomyrmex*, one possibly undescribed, occur in WA. Based on colour pattern, *Calomyrmex glauerti* stands out from the other three species, which are more similar in appearance. This handsome species has a bright golden gaster due to thick pubescence that is gold in colour, together with golden erect and semi-erect setae. The foreparts are a contrasting dull matt black in some populations, but an iridescent green or purple in others. This exclusively Western Australian taxon can be found from approximately Geraldton northwards to the Pilbara subregion, and there is an isolated record from the Gibson Desert. *Calomyrmex purpureus smaragdinus* can be distinguished from the other two species by the lack of iridescence on the gaster, although the foreparts can show variable purple, green or olive-green iridescence. This is the species most likely to be seen by members of the public, as its distribution covers much of Western Australia from the Pilbara southwards, although it is absent from the Kimberley and the south-west of the State. The range of this ant extends eastwards at least as far as Adelaide in SA (the species being described from material collected at Parkside, an Adelaide suburb), and it may occur elsewhere in Australia. In drier parts of mid-western WA, especially on red clay soil, the ant may often be seen foraging on the ground and on the trunks of mallees.

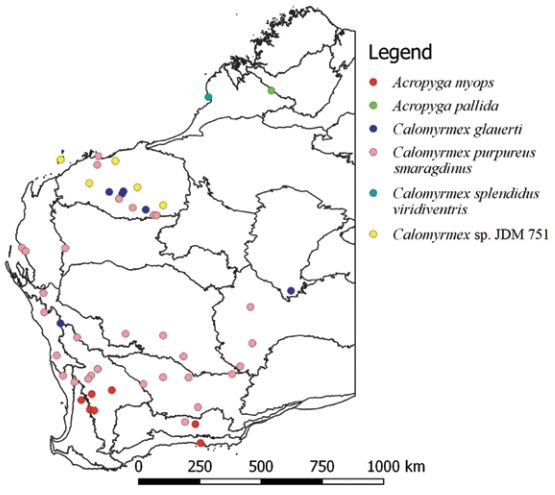

FIGURE 38 Distribution of *Acropyga myops*, *A. pallida*, *Calomyrmex glauerti*, *C. purpureus smaragdinus*, *C. spendidus viridiventris* and *Calomyrmex* sp. JDM 751.

In *Calomyrmex splendidus viridiventris* the gaster is variably coloured iridescent blue or green, but whatever the colour it always contrasts with the colour of the foreparts, which are also iridescent. The legs of this very beautiful ant, however, are not iridescent, and this feature enables the species to be distinguished from *Calomyrmex* sp. JDM 751, in which the legs are iridescent and concolorous with the body. The foreparts and gaster of the latter species are also concolorous, unlike the case with *C. splendidus viridiventris*. *Calomyrmex splendidus viridiventris* was described by Forel from material collected in the Kimberley (the exact locality is not given), but Forel also mentions localities in Cape York, QLD where the species occurs, so its likely range includes the NT (in support of this there is one ancient NT record [1933] in 'Atlas of Living Australia'). The only recent collection in WA of which the author is aware is of specimens collected by himself at a nest in a caravan park in Broome. However, since very little attention has been given to this genus, in all likelihood there are a number of additional specimens of this species among accessional material in collections outside of WA. *Calomyrmex* sp. JDM 751 is very similar to *Calomyrmex purpureus smaragdinus* apart from the iridescence on the gaster and legs and, although undoubtedly closely related to that species, this material cannot be readily assigned to an existing taxon. The specimens held in the JDM/WAM Collections appear to match Mayr's (1876) description of *Calomyrmex splendidus* but, whereas the antennal flagellum of the imaged syntypes (from QLD) is dark, the flagellum is light brown in the WA material, and there is more violet iridescence in the exoskeleton of the QLD types. Nevertheless, it should be mentioned that workers collected by W. M. Wheeler from Meekatharra in the northern goldfields and held by the Field Museum (USA) are placed under *splendidus* (AntWeb). If the local material proves to be *C. splendidus*, then the known range will extend to at least the NT and WA. Western Australian workers collected thus far are from the Pilbara subregion and Barrow Island, and most have been taken in pitfall traps.

Camponotus (Figures 39–58)

Camponotus is an immense genus found in all parts of the world; in WA this is also by far the most speciose genus, and the number of species, many of them undescribed, currently stands at 111. To put this in perspective, this is more than the total number of WA species in all genera for all subfamilies except the Myrmicinae. More than a third of all WA formicine ants are *Camponotus* species. Several taxa remain uncertain, e.g. *Camponotus scratius nuntius*, known from the holotype that was housed in Hamburg Museum, was probably destroyed during World War II. Forel's description of the ant makes it clear that this is *not* the species illustrated in McArthur (2014) p. 73. The latter species is what is here described somewhat tentatively as *C. peseshus* Bolton. Based on the description of the minor worker, the species is vaguely suggestive of *C. insipidu*s but is best left as a *species inquirenda* pending some material evidence coming to light. Ants can be placed in *Camponotus* or *Colobopsis* fairly easily, based on the absence of a metapleural gland, a PF of 6,4, and a first gastral tergite that is much less than half the length of the gaster. Unfortunately, minor workers of *Camponotus* and *Colobopsis* collected away from a nest cannot easily be separated without molecular analysis; but since only the easily recognisable *Colobopsis gasseri* is likely to be encountered by most people (a possible second *Colobopsis* species is extremely rare), in practice, anything else in WA will be *Camponotus*. As discussed in Part I, the WA *Camponotus* are here placed in fifteen species-groups and several complexes within the *C. claripes* species-group. One *Camponotus* species that appears to mimic *Calomyrmex* is unplaced. Most of these groups are recognised by myrmecologists and have appeared in publications and in online databases, but there are several novel combinations in this work.

Note: many Western Australian *Camponotus* ants currently labour under sub-species names that do not reflect their true status as good species. In at least one case, two such 'sub-species' (*C. cinereus amperei* and *C. cinereus notterae*) do not even belong to the same species-group. This author is raising *C. inverallensis* to species status only because *Camponotus churchetti* also becomes a junior synonym of *C. inverallensis* in this work. The other sub-species names are best left for a formal revision when they can be compared with the types of nominative species to which they have been linked.

The *Camponotus nigriceps* and the *C. wiederkehri* species-groups are two groups of distinctive *Camponotus* that have been revised, and this makes a useful entry to discussion of this huge genus. Nonetheless, additional, undescribed species within the *C. wiederkehri* species-group are included within the discussion.

Five species and a variety are included in minor worker and major worker keys to the WA members of the *C. nigriceps* species-group in Part I. This group was revised by McArthur & Adams in 1996, and the reader is referred to that monograph for general details on the biology of the group. All members of the *C. nigriceps* group share a protrusive anterior clypeal margin with the angles at the corners of the apron-like protrusion acute and less than a right-angle (the corners of the apron-like clypeal protrusion are a right angle or an obtuse angle in the *C. novaehollandiae* species-group whose members also have a protrusive clypeus). *Camponotus longideclivis* is the only group member in WA in which the underside of the head lacks erect setae. The minor and major workers of *C. longideclivis* also have a relatively short propodeal dorsum (< 0.2 × length of the posterior face). The holotype worker of this exclusively Western Australian species was collected in Dryandra State Forest less than 200 km SE of Perth, but most records of this relatively uncommon species come from the south-east coast in the Esperance Plains and Mallee subregions. *Camponotus clarior* is also easy to recognise, as this ant is uniformly honey-coloured (except for a portion of the gaster in some specimens) in both minor and major worker subcastes, whereas the remaining species are either bicoloured or uniformly dark. This species nests in hollow branches, and frass from the nest is deposited as a conspicuous cone under the nest (https://www.antwiki.org/wiki/Camponotus_clarior [accessed 21 March 2019]). The ant is not seen very often in WA but has been collected near Billabong Roadhouse in the mid-west of the state, at Queen Victoria Spring north-east of Kalgoorlie and in the vicinity of Balladonia at the edge of the Nullarbor Plain. The species also occurs in SA, Vic, and NSW.

The remaining members of the *C. nigriceps* species-group are very similar in appearance. A dissecting microscope is needed to separate *C. nigriceps* from *C. dryandrae* and *C. prostans*. This is because the diagnostic character is the appearance of the erect setae on the propodeum. In the former species these are ranged along the length of the propodeal dorsum, but in the latter two species they are clustered around the propodeal angle. *Camponotus nigriceps* comes in two colour variations: in the nominative form the first two gastral tergites are yellow, but in the variant called *Camponotus nigriceps 'perthianus'* (regarded by McArthur & Adams [1996] as a junior synonym) the first two tergites are black. This species is a

common feature of the ant fauna of drier areas of the Perth region and its hinterland, but it is widespread throughout the western half of WA. Elsewhere, this ant is found in all the mainland Australian states but is particularly concentrated in the southern half of the continent. Near Perth the populous colonies of this large species are often found in compacted soil around the boles of trees (Heterick 2009).

Camponotus dryandrae and *C. prostans* are only separable across their entire populations by the degree of pilosity on the venter of the head capsule (the former has > 20 setae that cover more than half the underside of the head, the latter < 20 setae that cover less than half the underside of the head). Since these setae can often be abraded, this character can be difficult to evaluate. Fortunately, most specimens of *C prostans* have a head and body that are concolorous dark brown to black, whereas the head and gaster are usually dark brown to black and the mesosoma is yellowish to red in *C. dryandrae.* Although limited to Western Australia, *Camponotus dryandrae* has a wide distribution throughout the State to as far north as the Pilbara, but most records are concentrated on and around the Darling Range. In the Darling Range nests of this species are often found in clayey soil under large rocks. *Camponotus prostans* has a much more limited range, occurring from just north of Perth, eastwards to about Ongerup and along the south coast at least as far east as Esperance. Based on the distribution maps, there is some overlap between the ranges of the two species, but *C. prostans* appears to prefer habitats with a higher rainfall.

The other species-group that has been fairly recently revised (Shattuck & McArthur 2002) and includes Western Australian taxa is the *C. wiederkehri* group, all members of which possess stout, bristly J-shaped setae at the base of the labium, thus making them easy to distinguish from other *Camponotus*. This is an important *Camponotus* group in WA, with 11 named species and an additional five undescribed WA species not covered in the revisionary work. Some of these ants are apparently rare and localised, collected on only one or two occasions, and only the minor worker is known for many members of the group. Strictly speaking, this should be the *Camponotus aurocinctus* species-group, as this is the earliest described species, but the group is called the *C. wiederkehri* species-group in Shattuck & McArthur 2002.

Four members of the *C. wiederkehri* group possess erect setae on the tibiae, thus separating them from the remaining species in which the tibiae are glabrous. *Camponotus setosus* is the only one of these four taxa in which the antennal scapes do not have erect setae. This ant, which is only known from a couple of collections of minor workers in the remote northern Kimberley, is particularly hairy and is clothed in long, silvery appressed and erect setae. Workers were found foraging in open *Eucalyptus* woodlands, but nothing more is known of the species. *Camponotus gouldianus* has a bluntly rounded dorsum to the petiolar node and abundant, overlapping pubescence on the gaster. The remaining species, *Camponotus terebrans* (dark) and *Camponotus 'terebrans'* (pale) have a thin, scale-like petiolar node and the gastral pubescence is less abundant, the individual appressed setae usually not overlapping. *Camponotus gouldianus* has an interesting distribution that seems to indicate that it has quite specific habitat preferences: thus, in WA it is found in the eastern half of the Coolgardie and Esperance Plains subregions, respectively, and skirts the southern boundary of the Nullarbor subregion. This preference may relate to vegetation type, soil horizon or both. Specimens have been collected on clay pan and mallee is the common climax vegetation. This species is particularly common in SA, which lies at the centre of its range, and it also occurs in the extreme south of the NT and in western parts of NSW and Vic.

'Camponotus terebrans' comes in two separate colour morphs. Unpublished molecular data and the fact that these two colour morphs attend separate taxa of lycaenid butterfly attest to the likelihood that they represent two good species. Both morphs feature in various research publications produced by the Department of Biodiversity, Conservation and Attractions, which has an ongoing interest in the welfare of several rare butterflies and moths (e.g. Williams et al. 2018). The dark morph is the nominative form and attends larvae of *Ogyris idmo*; the pale form attends larvae of the very rare and critically endangered arid bronze azure butterfly, *Ogyris subterrestris petrina*. The dark form of *Camponotus terebrans* is well-known and well-studied and has also been the subject of a lengthy taxonomic and ecological review (McArthur et al. 1998). The reader is referred to that paper for an account of the biology of the ant. In WA, the dark form of *C. terebrans* is widespread in the south-west of the State, reaching as far north as the lower parts of the Murchison subregion. However, most populations of the ant are concentrated in the western Darling Range and along the south coast, particularly west of Esperance. The species also occurs in SA, with smaller numbers of reports coming from NSW, southern QLD, Tas, and Vic. This is a particularly aggressive *Camponotus*, and major workers will not hesitate to attack and bite if their nest is disturbed.

They occasionally enter houses. Since it hasn't been officially recognised and separated as a distinct species, the range of the pale *Camponotus 'terebrans'* outside of known sites in WA is uncertain. This form is considerably less common than the dark morph, but known populations are located in the eastern and north-eastern wheatbelt and extend to the western goldfields (see Williams & Williams [2008], for a discussion of the species in relation to the butterfly it tends).

Camponotus postcornutus is another distinctive ant, with its almost semi-circular mesosoma when seen in profile and the acute posterior angles of its vertex. This *Camponotus* is a bright red with a black gaster in both worker subcastes. The range of the species almost exactly corresponds to the West Australian wheatbelt, with eastern outliers extending into the goldfields. Interstate, there is one old record from Blythe in the Adelaide Hills, but the species is not listed by McArthur in his 'Guide to the *Camponotus* Ants of SA' (2010), and, in the light of the known range, the record must be regarded as dubious. The blood red colour of this ant makes it quite conspicuous when it is foraging diurnally. Clark (1930a), who described the species, also mentions that it forages on tree-trunks as well as on the ground and is 'pugnacious'.

Three more *Camponotus* in the *C. wiederkehri* group are united in having a strongly impressed metanotal groove that rises abruptly at the commencement of the propodeum (compared with a weakly to moderately impressed metanotal groove that does not rise abruptly). The petiolar node in profile is also characteristic, being low, elongate or truncate with a very short anterior face compared with the long posterior face (this feature is rarely seen in the remaining taxa). Colour patterns are the main means of separating the three species. *Camponotus wiederkehri* group sp. JDM 924, known only from the minor worker, has bright red foreparts (dark red to black in the other two ants) and the gaster is the same colour as the foreparts anteriad and darker posteriad but never has golden bands (if the anterior gaster is the same colour as the propodeum [*Camponotus aurocinctus*] then golden bands are often present). *Camponotus wiederkehri* group sp. JDM 924 is known only from diurnal foragers on newly rehabilitated sand mined areas in Eneabba and a single, pitfall-trapped worker taken from the Kennedy Range National Park by the Department of Conservation and Land Management (now the Department of Biodiversity, Conservation and Attractions) researchers. In the well-known and spectacular *Camponotus aurocinctus* the propodeum and the anterior gaster are similar in colour, and the gaster often has golden bands. In *Camponotus versicolor*, the propodeum is darker than the anterior gaster, which always lacks golden bands. Populations of *Camponotus aurocinctus* are generally distributed throughout all the drier desert areas of WA, away from the coast. This species also occurs in the NT, inland NSW, SA, north-west Vic and, less commonly, in central QLD near the NSW border. While found in a variety of vegetation zones, *Camponotus aurocinctus* prefers sandy soils. *Camponotus versicolor* is limited to WA, where it has a much more restricted range, mainly in the goldfields and eastern wheatbelt, although it has been found on the south coast. Records in the JDM/WAM Collections are old and biological data on this ant are lacking.

Camponotus arenatus and *Camponotus wiederkehri* group sp. JDM 925, both known only from the minor worker, are similar to the abovementioned three ants, but the metanotal groove is less strongly impressed and the propodeum is distinctly convex. In the rest of the *C. wiederkehri* group the metanotal groove is vestigial or absent and the propodeal dorsum is straight or barely convex. *Camponotus arenatus* is easily separable from its close relative through its black head (the anterior pronotum is also often black), the other ant having a red head that is concolorous with the mesosoma (note: The WA *C. arenatus* workers lack the dark anterior pronotum and only the head is black; otherwise they are identical with the workers mentioned in the description of the species). *Camponotus arenatus* does not appear to be common in WA, with just a couple of records from the eastern and northern goldfields. There also scattered records from SA and what appears to be a solitary record from the NT. As with *C. versicolor*, biological data are lacking: the only label data indicate one worker was swept from mallee over red sand. *Camponotus wiederkehri* group sp. JDM 925 is even more poorly known from just one pinned minor worker. This species was found foraging diurnally along with very similar looking *C. wiederkehri* sp. JDM 924 workers in rehabilitated mine-sites in Eneabba. Only when one ant was pinned and examined under a microscope was it realised that two separate species were involved.

Probably the best known species in this group, with the possible exception of *Camponotus terebrans*, is *Camponotus wiederkehri*, the minor worker of which can be distinguished from the remaining members of the group by its large eyes, while the major worker has the anteromedial section of the clypeus produced as a square apron that is broadly emarginate (this part feebly convex and

barely extending beyond the lateral sectors of the clypeus in the remaining major workers of the *C. wiederkehri* species-group). In WA this large-eyed species is found throughout much of the state away from the forested SWP. Outside of WA, *Camponotus wiederkehri* has an extensive range throughout all the mainland Australian states, albeit records in NSW and Vic are nearly all from the far west of each state, respectively (the Atlas of Living Australia has one record from Wilson's Promontory, south-east of Melbourne). In the Western Australian wheatbelt, nests are often indicated by a low, saucer-shaped mound in red clay soil with a central entrance hole in the form of a slit. These nest sites may be decorated with small stones. Label data indicate that dominant vegetation types in habitat supporting this species include *Acacia* woodland, mulga, mallee, spinifex, eucalyptus open woodland, and savanna.

Camponotus donnellani and *Camponotus ceriseipes* complex sp. JDM 105 are known only from the minor worker. Subtle differences in pilosity patterns and the colour of the appressed setae on the gaster distinguish these and minor workers of the remaining three species in the *C. wiederkehri* species-group. The handsome, shiny chestnut brown *C. ceriseipes* complex sp. JDM 105 stands a little apart from the other ants as a fairly distinctive species. In the minor worker the gastral pubescence, seen from behind, is arranged approximately longitudinally without a clear demarcation along the midline of the gaster. The gastral pubescence in the other four taxa is separated by a midline, the pubescence on one side being oriented in a mirror image of the pubescence on the other side of the midline. This ant is known from several collections on the south coast and one from relictual bushland in a Perth suburb, but its possible occurrence outside of WA is unknown. The species has been hand-collected on white sand amidst woody debris in south coastal scrub, but there are few other data. *Camponotus donnellani* has few erect setae on the mesosoma, and the propodeal setae are clustered near the propodeal angle. In *Camponotus ceriseipes*, *Camponotus ceriseipes* complex sp. JDM 774 and *Camponotus prosseri* erect setae are abundant on the mesosoma and more-or-less evenly ranged along the length of the propodeum. *Camponotus donnellani* appears to be a rather rare although widespread species. In WA, specimens have been collected from Barrow Island and the adjacent Pilbara coast, on the Holland Track east of Hyden and in the Great Victoria Desert. The species also occurs in parts of the NT and SA. Label data indicates a preference for sandplain, and foragers have been collected on grass and spinifex.

The rest of the species-group, comprising *Camponotus ceriseipes*, *Camponotus ceriseipes* complex sp. JDM 774 and *Camponotus prosseri*, have been subject to confusion in several publications and three species are recognised here in place of the two species spoken of in Shattuck &McArthur (2002). As well as *C. prosseri* and *C. ceriseipes*, the third, very similar, species can be distinguished from *C. prosseri* by the more elevated propodeum and shape of the petiolar node, and from *C. ceriseipes* by the shape of the pronotum, viewed from above, and in subtle differences in degree and colour of appressed pilosity on the gaster. The major worker has a jet-black head. The head is dark reddish in the descriptions and images of the major workers of the other two species. The minor worker of *Camponotus ceriseipes* complex sp. JDM 774 is illustrated in McArthur (2014) as '*C. prosseri*' (p. 113 — compare with the Automontaged holotype *prosseri* minor worker [CASENT0172146] in 'AntWeb'). The antennal scapes are longer in the *C. prosseri* minor worker than they are in the other two species, but the longer propodeal face relative to the length of the declivous face (~2 times as long) and the typically strongly anteriorly inclined petiolar node are probably easier diagnostic characters to use. In the case of the major worker, the reddish head combined with a thick, non-scale-like node are sufficient to distinguish *C. prosseri* from *C. ceriseipes* and *C. ceriseipes* complex sp. 774. Specimens collected near the Madura Roadhouse are the only WA records regarded here as reliable, due to confusion with *Camponotus ceriseipes* sp. JDM 774. This makes *C. prosseri* a much rarer species in this State than the literature would suggest. Elsewhere, the species occurs in NSW and SA.

Camponotus ceriseipes is a second species caught up in the confusion between the three taxa. The shiny cuticle of a dark brown to black coloration (often with lighter patches) and the orange legs are probably definitive for the *C. ceriseipes* minor worker, but the globose sides to the pronotum when the ant is viewed dorsally together with gold gastral pubescence will confirm the identification of this species. (In *C. ceriseipes* complex sp. JDM 784, the minor worker has a black head and gaster and a red [sometimes infuscated] mesosoma, the sides of the pronotum are weakly convex but not globose, and the gastral pubescence is off-white but definitely not golden). In the major worker, the head of *C. ceriseipes* is reddish and lighter in color than the gaster, while in its relative both the head and gaster are black. The actual distribution of *C. ceriseipes* (as opposed to that appearing in the literature and current databases) is probably limited to the south coast of WA and SA.

In WA, this species can be found foraging in white sandy dunes in peppermint and *Melaleuca* coastal scrubland. *Camponotus ceriseipes* sp. JDM 774 is widely distributed in the SWP, including the Perth metropolitan area in suitable areas of urban bushland, but its range extends as least as far north as Exmouth. This ant probably also occurs in SA. Collections have mostly been made on sandy soil in dry sclerophyll woodland. A major and a minor worker, hand-collected in King's Park, were taken while tandem running.

Another well-defined group of mostly very common, tropical *Camponotus* is the *C. novaehollandiae* species-group. The head, seen in full-face view, is reminiscent of the members of the *C. nigriceps* species-group in that the anterior margin of the clypeus forms a squared-off, protrusive apron in both major and minor worker-subcastes. However, in the *C. novaehollandiae* species-group, the angles of the clypeal apron are not acute although they often approach a right-angle. Major workers also have a strongly convex head, the sides of which converge behind the eyes, and a deeply emarginate vertex. At an individual species-level some problems are encountered, and the molecular and morphological evidence that *C. crozieri*, *C. humilior* and *C. novaehollandiae* are good species is feeble. McArthur & Ley (2006) regarded the three taxa as morphologically distinct, but do not separate them in a key and neither does McArthur (2014) in his *A Guide to the Camponotus Ants of Australia*, apart from saying that *C. humilior* has a broader frontal carinae width than the other two species. This distinction does not hold up on comparison with type images of *C. novaehollandiae* in AntWeb. The inclination of the antennal setae mentioned by McArthur & Ley seems to be the only practicable way of separating out *novaehollandiae*; and all the WA '*crozieri*' seen have a uniform coloration so are here presumed to be conspecific. *Camponotus humilior* is doubtful, but again colour is used as a separator here. McArthur & Ley's molecular analysis used only two mitochondrial genes, and even here the three species are closely nested. Addition of nuclear genes in the analysis would have been interesting. However, the species status of *C. extensus* and *C. fieldeae* (here treated as the senior synonym of *C. spenceri* and *C. nigroaeneus xuthus* — see the notes under *Camponotus* in Part I) is much more robust. A very long, planar propodeal dorsum in both the major and minor worker distinguishes *C. extensus* from *C. fieldeae* (propodeal dorsum shorter and gently convex), while their uniform brown colour easily separates them from the other three species. The syntype major worker of *C. extensus* imaged in AntWeb was collected in Rockhampton, QLD, but a single minor worker pitfall-trapped near Rhodes Ridge in the Pilbara subregion is a good match for the description and is believed to belong to this species. If this assumption is correct, then the likely distribution of *C. extensus* is the tropical north of Australia, extending from WA's Pilbara region in the west to the mid-north QLD coast in the east. However, due to confusion with *C. novaehollandiae*, the actual occurrence of this ant is uncertain, although it appears to be much rarer than its closest relatives. (Note: the species appears to be correctly diagnosed by McArthur [2007], in which case its range on the east coast extends southwards to northern NSW.) Nothing is recorded of its biology. *Camponotus fieldeae* is a common ant in WA from the Gascoyne subregion northwards. This species regularly appears in inventory samples taken by pitfall trap and hand-collection from Pilbara subregion of WA, as part of biomonitoring exercises in mined areas, etc. Elsewhere, *C. fieldeae* is known to occur in the NT, QLD, and SA (McArthur 2007). As is so often the case, labels on pinned material provide little information on habits, but this ant has been collected in SA in open mallee with an *Acacia aneura*, *Eucalyptus concinna* and *E. socialis* overstorey, and an *Eremophila* understorey. The species can be found nesting under stones (holotype of *C. 'spenceri'*).

As far as this author can ascertain, examining subtle differences in the inclination of the setae on the antennal scape is the only foolproof way of distinguishing the minor worker of *C. novaehollandiae* from that of *C. humilior* and pale minor worker specimens of *C. crozieri* (although the latter is normally visibly bicoloured). This does not work for the major worker, however, and the shape of the head is the best recourse in distinguishing *C. novaehollandiae* from *C. humilior* (i.e. the sides of the head are weakly tapered anteriad and the vertex is moderately to strongly concave in *C. novaehollandiae*, whereas the sides of the head are strongly and evenly convex and the vertex is weakly concave in *C. humilior*). Both species are generally more-or-less uniformly yellow or tawny yellow and can normally be more easily separated from specimens of *C. crozieri*, but there is a small degree of overlap. However, even in very light-coloured major workers of *C. crozieri* the head is still brownish and the gaster is always dark (very rarely so in the other two species). Having said all this, the three putative species converge, the difficulties in separating all populations into one or the other taxon is considerable, and more work needs to be done to establish their bona fides as good species.

According to McArthur & Leys (2006), *Camponotus humilior* is the most strongly supported species of the three, based on molecular evidence.

In WA, this ant has been collected at several sites in the Kimberley and also at Pannawonica in the Pilbara subregion. *Camponotus humilior* also occurs in the top end in the NT and along the Eastern seaboard from Cape York to central NSW. McArthur & Leys (2006) mention that this ant, and the other two species under consideration here, only nest in clay soil, never in sand, and their nest entrances are well-hidden. These (mainly nocturnal) species are attracted to honey baits; hence, they probably seek out honeydew-producing Hemiptera and nectar in their natural environment. When disturbed they behave timidly but dominate other ants at honey baits. Label data on AntWeb also indicates that *C. humilior* workers have been found (at a nest?) in a hollow log and a dead branch. *Camponotus crozieri* has been collected in WA from Carnarvon northwards, but has not been collected, at least as yet, from the inland desert regions. The range in other states is approximately the same as that of *C. humilior*, except that the species seems not to extend beyond the NSW/QLD border. The author has found *C. crozieri* to be particularly common in biomonitoring samples collected from disturbed areas in the Pilbara, indicating it could be an opportunist. In support of this, the Carnarvon samples were taken from beside a caravan in a campsite well away from native habitat. This species has also been seen crawling on footpaths and ascending trees along Robinson Street that leads into the Carnarvon townsite. Within Australia, *Camponotus novaehollandiae* occupies the same range as *C. crozieri* but there are no records on the West Australian coast southwards past the tip of the North West Cape. As with *C. humilior*, this species occurs in rainforest and has been found nesting in rotting logs; it has also been found in a nest under a rotten log and foraging nocturnally on a tree. Savanna woodland is another habitat. Like *Camponotus fieldeae* and *C. crozieri*, this species frequently turns up in pitfall-trapped material sent from Pilbara minesites for analysis.

The *C. subnitidus* and *C. intrepidus* species-groups contain what are probably the largest and certainly the most spectacular WA *Camponotus*. Each is a small group that in the case of the *C. subnitidus* group contains three members, while the *C. intrepidus* group, which is much more common in eastern Australia, contains just two WA members.

An extremely attenuated head capsule, large, hemispherical eyes, an occipital carina and more than seven mandibular teeth characterise the minor worker in the *C. subnitidus* species-group. The major worker is distinctive because its huge size (HW ≥ 4 mm), combined with a glabrous, convex vertex and glabrous antennal scapes, and large numbers of teeth in the mandibles (i.e. ≥ 8). (Mayr's original [1876] description suggests the anteromedial margin of the clypeus in the syntype major worker(s) is emarginate, when it appears to be convex in workers seen by this author, but some leeway must be allowed here as the ant he described is most unlikely to be anything else).

Lack of erect setae under the head capsule in the minor worker and a triangular head capsule and a convex but circular outline to the mandibles in the major worker signify that a specimen in this species-group is *Camponotus rufus*. *Camponotus rufus* has a mainly coastal distribution in WA that extends from about Bunbury in the south to Nerren Nerren Station in the north. This species also occurs in SA. In WA localities harboring this species, *Banksia* and *Agonis* (peppermint) are often the dominant vegetation type, and the soil is white sand. *Camponotus rufus* also occurs in jarrah-marri woodland. The nest entrance is a single hole, around two centimetres in diameter. Apparently major workers can be very scarce in some circumstances; a large nest dug up by the author just east of Bullsbrook yielded many minor workers and males but not one major worker was seen.

Erect setae under the head capsule are found in both *C. subnitidus* and *C. tricoloratus*, but the appearance of the node in the minor worker (flattened and much wider than high in *C. subnitidus*; about as wide as high and conical in appearance in *C. tricoloratus*) and the median sector of the clypeus in the major worker (laterally extended on either side as an acute angle in *C. subnitidus* and only weakly produced without an obvious angle in *C. tricoloratus*) help to differentiate these two species. *Camponotus subnitidus* has two sub-species that are doubtfully distinct, but only *C. subnitidus* occurs in WA. *Camponotus subnitidus* is a rare, mainly eastern Australian species, known in WA from a single minor worker collected at Yampi Station in the northern Kimberley. Other records are from QLD. There are no biological data. *Camponotus tricoloratus* is a not uncommon inhabitant of the wheat-belt, goldfields and desert areas of WA, but is absent from the humid south-west corner and from the Kimberley region. The ant is very common in SA, with many records (particularly in the south-east), and also occurs in NSW, the extreme south of the NT and Vic. Disappointingly, all that is known of the biology is that this species has been taken in dry pitfall traps (WAM/CALM Survey material).

The vestiture of fine, sometimes flexuous and almost woolly, short, erect setae on the body and appendages, and a gaster that lacks pubescence

are the characters that characterise the two WA species placed in the *C. intrepidus* species-group. One glance at the head of the minor worker (the occipital sector produced as a thin tube around the foramen in *C. johnclarki*, and a convex vertex of normal appearance that is not thus produced in *C. molossus*) is sufficient for a researcher to identify the species. The major workers are more similar, but the node (scale-like in *C. molossus* and elongate and low in *C. johnclarki*), the length of the setae on the antennal scape and the appearance of the anteromedial sector of the clypeus (broadly produced in *C. molossus* and narrowly produced in *C. johnclarki*) help to differentiate the species. *Camponotus johnclarki* is a spectacular and rather uncommon species that is mostly confined to wetter areas of the south-west of WA. There are also a few records of the ant from south-eastern SA and a solitary record from north-west Vic. This taxon is sufficiently aberrant in appearance, particularly as regards the minor worker, to have acquired an interesting taxonomic history; being initially inserted in the genus *Notostigma* before being transferred to *Camponotus* (Taylor 1992) and placed in a monotypic species-group (McArthur 2007). However, placement in the *C. intrepidus* group appears justified based on a variety of shared characters in both major and minor workers (see above and also the species key in Part I). This ant appears to be an arboreal forager, which is where the author has seen the minor worker on a couple of occasions. The species has also been collected in Malaise traps, so this is more evidence that *Camponotus johnclarki* is a climber. On the other hand, the very elongate body, petiole and long legs may indicate a specialisation for moving around on waterlogged soil and litter. Mallee is the recorded vegetation type on labels, but WA material seen in the greater Perth region was in *Banksia* woodland. *Camponotus molossus* is a purely West Australian species, and its range is restricted to the Swan Coastal Plain, the lower reaches of the Geraldton Sandplains and the adjoining Darling Scarp. The species does not appear to be particularly common and the abundance of specimens in the WAM Collection probably reflects the fact that major and minor workers are large and conspicuous and have attracted the attention of amateur collectors. More recent specimens have mostly been pitfall-trapped in dry sclerophyll woodland.

Although much smaller, the three members of the *Camponotus leae* species-group exhibit certain similarities to the *C. intrepidus* species-group in respect of sculpture, pilosity and the conformation of the clypeus, and the two groups may be related. The uniform, conspicuous microsculpture of the body that tends to areolate-rugose, the typically short, erect white setae and the short, thick petiolar node distinguish the minor worker from the minor workers of other species-groups. Dense microsculpture, the abrupt descent of the mesonotum to the propodeum and the yellow, bristly, erect setae also identify the major worker of *Camponotus whitei*, the only member of the *C. leae* group for which the major worker has been illustrated. (McArthur [2007] gives a brief description of the major worker of *C. leae*, but this is not accompanied by a drawing or illustration, and there are no collection details or verification of the material described, nor are there any major workers corresponding to his description in JDM or WAM holdings.)

Camponotus whitei is by far the best known and most widely distributed member of the *C. leae* species-group. The minor worker lacks pubescence on the gaster, gastral pubescence being present in the remaining two members of the group This species is commonly seen in south-western Australia, especially in the Darling Range, but its range also extends to the Avon Wheatbelt, the goldfields and as far north as Ethel Creek station in the Pilbara. This ant is also common in other parts of the Australian mainland, where it is only absent from the ACT. The species occupies a wide range of habitats — mallee, *Eucalyptus/Callitris*, black oak/myall, black box, tea tree and 'sclerophyll woodland', being among a variety of vegetation types recorded on labels — but appears to prefer red or black clay soils to sand, and it has not often been recorded from coastal parts. Arboreal foraging in this species is evidenced by its capture in a yellow bucket trap and by beating and sweeping, but most captures have been in pitfall traps or hand-collections. Apart from the pubescence on the gaster, the *Camponotus leae* group sp. JDM 764 minor worker closely resembles that of *C. whitei*, and it is quite possible that inland, arid zone records for *C. whitei* outside of WA actually relate to this species. Specimens have been collected from Ethel Creek station (where this taxon is sympatric with *C. whitei*) and Mt Whaleback, both in the Pilbara. Apart from the bare collection details there are no other data for the species.

The *Camponotus leae* minor worker is distinguished from the minor workers of the preceding two taxa by its square petiolar node, which has a flat dorsum. The *C. leae* minor also has a longer antennal scape (exceeding the vertex by > half of its length compared with exceeding the vertex by ~0.33 × its length in the other two species). The Western

Australian specimens seen are hairier than the *C. leae* minor workers illustrated in McArthur (2010, 2014), and that author was originally inclined to regard them as a species related to *C. leae*, based on the presence of erect setae on the underside of the head in the unnamed species but absent in *C. leae* (McArthur 2010, p. 58). However, Wheeler does not mention this character in his original description, and the specimen illustrated on p. 59 does appear to have erect setae on the venter of the head capsule. McArthur seems to have had second thoughts on this particular character, and in his 2014 book on the Australian *Camponotus*, he acknowledges (erect) setae as being present on the underside of the head capsule in the *C. leae* minor worker. The major worker is unknown. If the species is accepted as monophyletic, then its range extends through much of arid and semi-arid Australia. The two specimens of *C. leae* in the JDM Collection were taken in the Murchison subregion, and other listed records (AntWeb) are from mid-western WA to the remote Gibson and Little Sandy Deserts. *Camponotus leae* has also been recorded in all other mainland states except the ACT and QLD, but it has been collected near the QLD border and is almost certainly also present in that state. Vegetation types where this species can be found include mallee and *Triodia*. Nests are recorded as being in sand, with a small turret and a slit entrance.

Camponotus sp. JDM 693 is a very rare and aberrant species that is also known from the minor worker only. This ant appears to be a *Calomyrmex* mimic and has the same densely hairy appearance and iridescence. However, the single known specimen is recognisable as *Camponotus* because it lacks a metapleural gland and also the deeply impressed metanotal groove and rounded, plate-like propodeum seen in *Calomyrmex*. Within WA, this unusual *Camponotus* is known from one pinned specimen taken in the Pilbara subregion, but its occurrence in other Australian states is unknown. There are no biological data.

The *Camponotus ephippium* group represents a large (13 named and three unnamed species in WA) and fairly easily recognised group that is predominantly arid and semi-arid in their occurrence. Minor workers of the more common species are often seen foraging in bushland and even town sites in WA's wheatbelt. Minor workers have a sinuous mesosoma with a concavity or angle at the metanotal groove, and the propodeum is weakly concave anteriad and flattened posteriad; only rarely it may be straight. Members of the *C. aeneopilosus* species-group may have a similar mesosomal profile, but minor workers have only five or six mandibular teeth and the body is rarely thickly pubescent, whereas C. *ephippium* group species are usually hairy and often have a thick pubescence, and their normal tooth count is seven to eight, occasionally nine, but six teeth is seen only rarely in one or two species and not always in both mandibles. The head of *C. ephippium* group minor workers is typically square when seen in full-face view, whereas that of *C. aeneopilosus* group minor workers is oval, and this is another useful distinguishing feature. The blocky, semi-phragmotic (truncated) head of the major worker is its most easily identified feature; otherwise, in this subcaste the scape in members of the group is very short, not reaching the vertex, the anteromedial margin is protruding, bidentate or at least strongly emarginate and the markedly sculptured mandible is also strongly convex.

Camponotus perjurus, placed in its own species-group by Shattuck and McArthur (2002), is here placed in the *C. ephippium* species-group. In fact, apart from the oddly narrowed vertex when seen in profile (a feature it shares with the unrelated *Iridomyrmex cuneiceps*, but with no other WA *Camponotus*), this species is an unremarkable member of the *C. ephippium* species-group, shares all the relevant diagnostic characters, and has the appearance of a close relationship with *C. capito ebeninithorax*. Only the minor worker has yet been identified. In WA, there are a few, mostly southern records, but one specimen was collected east of Cosmo Newberry in the Great Victoria Desert. The ant also occurs in inland SA. This species is probably more common than the few records suggest, as it appears to mimic members of the *Iridomyrmex purpureus* species-group in its morphology and its purple or green iridescence, and foragers have been collected in association with *Iridomyrmex spodopilus*, which belongs to that group.

The minor workers of *C. longifacies* and *C. sponsorum* are very small (HW ≤ 1 mm), and this fact alone is sufficient to separate them from other members of the *C. ephippium* species-group. Their major workers, similarly, are distinguished by their small size (HW < 1.7 mm, compared with HW > 2 mm in other major workers in this group). The minor worker of *C. sponsorum* is less gracile than its close relative, the anterior clypeal margin is straight, not strongly and evenly convex as in *C. longifacies*, and, in full-face view, the head is shorter, less than two thirds as long as wide; in *C. longifacies* the head is less than two thirds as wide as long. The appearance of the head is also important in distinguishing the major workers.

In *C. longifacies* the head is triangular with the sides divergent and broadest behind the eyes. In *C. sponsorum* the head is rectangular or ovate with the sides planar or convex. Additionally, in the former the mesosoma is strongly and evenly arcuate throughout its length when seen in profile, while in the latter the pronotum and the mesonotum are evenly convex, and the propodeum is planar, sloping towards its posterior angle when the ant is seen in profile. *Camponotus sponsorum* is quite widespread from about Perth northwards, although it has not been found in WA's deep south or the Kimberley. Interstate, the species is found in all mainland states except the ACT and QLD but is known from only isolated records in the NT and Vic. Habitats include a variety of woodland or heathland, and the nest, which is usually made directly into soil, may be turreted. Workers can often be seen foraging on tree trunks. *Camponotus longifacies* also occurs across much of this state south of the Kimberley but is seen less frequently. The species is found in all the other Australia states except for the ACT and Vic, but it is known only from isolated records in the NT and QLD. Almost nothing is known of its habits except that one label mentions a nest in sandy soil in pasture with *Callitris* present, and the nest was a 'neat crater'.

Another suite of *C. ephippium* group *Camponotus* can be readily identified and separated from the remaining members of the group by the hairy antennal scape, erect setae being absent from the scape in the other workers. The trio in which both major and minor workers have this character consists of *Camponotus bigenus*, *C. cinereus notterae* and *C. pawseyi*. The *Camponotus pawseyi* minor worker differs from the other two species in the degree of inclination of the erect setae on the tibiae, this being 60°. In *C. bigenus* and *C. cinereus notterae* the degree of inclination is at an angle of ≤ 20°. The major worker of *C. pawseyi* has erect setae on all surfaces of the antennal scape, and this is the character that best distinguishes it from *C. bigenus* and *C. cinereus notterae*. *Camponotus pawseyi* is not frequently encountered but is found over a large geographic area in WA, with specimens coming from the Avon wheatbelt, goldfields and the Pilbara. The species appears to be most common in SA (from whence derives the type material) and also occurs in NSW and Vic. As is the case with other *C. ephippium* species-group taxa (pers. obs.), the major worker of *C. pawseyi* has been observed blocking the entrance of the soil nest with its semi-phragmotic head, and, interestingly, the upper portion of the entrance shaft may be lined with silk (McArthur 2003).

The squared-off head with the eyes located at the posterior angles of the vertex sets the minor worker of *Camponotus bigenus* apart from the minor worker of *C. cinereus notterae*, in which the head is convex and rounded and the eyes are placed further down the sides of the head. The strongly developed, slightly flattened occipital lobes and larger head (HW > 3 mm) equally distinguish the major worker of *C. bigenus* from the major worker of *C. cinereus notterae*, which is smaller (HW ≤ 2.5 mm) and has occipital lobes that are less strongly developed and not flattened. *Camponotus cinereus notterae* is a conspicuous and very familiar member of the ant fauna of the lateritic soils of the Darling Range, but also occurs inland in the goldfields and in mid-western WA, at least as far north as Morawa. *Camponotus cinereus notterae* was described from Gooseberry Hill in WA. This species is not listed by McArthur in either of his major works on Australian *Camponotus* because he couldn't locate type material, nor do interstate records appear in AntWeb or the 'Atlas of Living Australia', so its presence in other states is here regarded as problematic. Label data for specimens from Lake Burrillgabby (east of Morawa), the northernmost record for this species, indicate nesting in red soil in saltbush/mallee remnant (woodland) near paddocks. *Camponotus bigenus* was described by Santschi from material collected in Townsville, and there are small differences in colour between minor workers from WA, which have a red anterior mesonotum and a gaster slightly less densely pilose than in the syntype minor worker (which has a concolorous black cuticle) imaged in AntWeb, but in other respects they are the same. The syntype major worker and a major worker from Wongan Hills are virtually the same. Nearly all the collections of this species in WA have been from the Avon Wheatbelt with a few in the adjacent subregions, but a minor worker has been collected from Marillana Creek in the Pilbara. The ant is also known to occur in NSW and QLD, but probably also occurs in SA and the NT. Western Australian minor workers have been collected on brown, 'fluffy' loam in woodland with *Callitris* and Morrel overstorey and in wandoo woodland as ground foragers.

The residue of this species-group can be divided broadly into predominantly northern species that lack erect setae on the underside of the head, and predominantly southern species, in which such erect setae occur. The four northern 'hairless' taxa are *Camponotus capito*, *C. ephippium narses*, *C. fieldellus* and *C. pellax*. Only the minor worker of *Camponotus ephippium narses* is included in the taxonomic key in Part I. As is the case with *Camponotus leae*, McArthur (2007) provides a brief description of the major worker without collection

details, verification or illustration. Nor does AntWeb possess an image of the major worker. The setae on the tibiae of the minor worker of *C. ephippium narses* are raised to about 20°, and the erect setae on the mesosoma are plentiful (> 50 setae). In the other three species, the setae on the tibiae are appressed and the erect setae on the mesosoma are more dispersed (≤ 25 setae). If McArthur's description holds true, then from Table 2 in his 2007 coverage the major worker is also hirsute and has raised tibial setae but lacks setae under the head capsule. There are only a couple of verified records of this ant from remote northern regions of WA (Atlas of Living Australia records from southern localities are likely misidentifications) and no biological data.

The hemispherical arc of the pronotum combined with the mesonotum when seen in profile immediately identifies the minor worker of *C. capito* when compared with *C. fieldellus* and *C. pellax*. A more subtle distinguishing character is the evenly short, well-spaced appressed setae on the metatibia (these setae of different lengths and overlapping in the other two *Camponotus*). The major worker can be distinguished from *C. pellax* by its shorter, more truncate propodeum and from *C. fieldellus* by its red-and-black coloration (all black in *C. fieldellus*). In a major worker in the JDM Collection, which is very pale, shriveled and possibly callow, the dorsum of the node is produced as a long, straight spine that is directed vertically. Apart from this peculiar and inexplicable feature, the ant is unremarkable. In WA, *Camponotus capito* appears to occur mainly in the Pilbara subregion, although there is a record from Lyndon Station in the Carnarvon subregion. This species has also been particularly well-collected in SA but occurs much less frequently in the other Australian mainland states with the exception of the ACT, where it is absent. Recorded habitats are mallee and *Triodia* (spinifex) scrub on/between a sand dune. The nest has a single entrance. One nest record mentions a cleared, compact 25 cm diameter disc around the nest entrance. The brick-red mesosoma sometimes with weak violet iridescence pulls the *C. pellax* minor worker apart from *C. fieldellus*, which has a black mesosoma; while its thick, truncated, anteriorly-inclined node and its long, planar, dorsal propodeal face render the major worker of *C. pellax* unique among major workers in this species-group. Based on its paucity in collections *Camponotus pellax* appears to be a rare species, although its range in a remote area of Australia may contribute to this impression. The only WA record held in the JDM/WAM Collections comes from Ellendale, in the Dampierland subregion in the Kimberley, and a handful of additional records are from the NT and QLD, from whence the type material was obtained. Santschi, who described the species, notes the similarity of the major worker to '*Iridomyrmex detectus*' (one or more of the various meat ant species, as now understood) (Santschi 1919), but there are no other biological notes or label data for the species. *Camponotus fieldellus* major workers have an all-black cuticle, as have many minor workers, although some minors have red or variegated heads. Minor workers also have gold pubescence on the gaster. Western Australian material has been collected from the northern Kimberley and Pilbara subregions. Elsewhere, this species certainly occurs in the NT (from where the types were obtained), but the numerous records from NSW listed in 'Atlas of Living Australia' are doubtful and require verification. As with *C. pellax*, this species is rarely encountered and there are no additional data.

The remaining species all have erect setae on the underside of the head. *Camponotus ephippium* can best be distinguished in both worker subcastes by the thick, whorls of setae on all surfaces of the hind tibiae that are inclined at an angle of ~15°. The minor worker also possesses a flattened, planar vertex and coarse, off-white pubescence on the gaster. A second diagnostic character for the major worker is the concave nature of its propodeal dorsum, making for a similar profile to the minor worker. Western Australian populations of this species are clustered in the Avon Wheatbelt subregion and the Carnarvon subregion, with solitary outliers in the Coolgardie (obscured on map), Esperance Plains and Murchison subregions, although the species undoubtedly occurs outside of these subregions. Ants from the south have a bright, cherry-red mesosoma with legs of the same hue, but ants from the north are variegated to a greater or lesser degree and have dark brown legs. The one goldfields record is black in colour. This lack of uniformity is here taken as an indication of infraspecific variation, all the workers clearly possessing the diagnostic characters. This species is also frequently encountered in other parts of Australia and has been recorded in all Australian mainland states. As well as occurring in a wide range of native habitats, *Camponotus ephippium* has been collected in paddocks, mine dumps and other disturbed environments, and also from tree-trunks. One record refers to a nest as a conical pile of pebbles, approximately 10 cm high.

The minor worker of *Camponotus ephippium* group sp. JDM 777 is a handsome red-and-black ant, and the only one of the remaining *C. ephippium* group species to lack gastral pubescence. The

colour pattern can vary considerably, although the gaster is always black; thus, the head and mesosoma can both be red, or the head can be red and the mesosoma black, or vice-versa, or the ant can have a variegated head or mesosoma. The major worker also lacks gastral pubescence, and additional characters for the major are the lack of erect setae on the lower genae, and the appearance of the anteromedial margin of the clypeus with its two stout denticles separated by a concavity. Most records of this ant are from the goldfields and eastern wheatbelt, although it is also known to occur on the south coast and in the south of the Pilbara. Because it is undescribed, its presence in other states is unclear, but conversations with Mr. Archie McArthur (now deceased) lead this author to believe it also occurs in SA. Label data mentions this ant as foraging on a shrub in sandplain/laterite heathland. The species has also been captured in pitfall traps. *Camponotus ephippium* group sp. JDM 1280 bears a surprisingly close resemblance to *Camponotus ceriseipes* sp. JDM 105, with which it is likely sympatric, but lacks the J-shaped setae on the underside of the head. Only the minor worker is known. Apart from the shiny, variegated brown-and-orange colour, the ant is easily recognised by its rounded vertex and virtual lack of erect setae on the genae. *Camponotus ephippium* group sp. JDM 1280 has only been recorded from Chingarrup, in the Gairdner district near the south coast, on two occasions. In both instances the workers were pitfall-trapped in woodland. While the species may have a localised range, the ant fauna of this part of Western Australia has not been well-collected, and this attractive little *C. ephippium* group *Camponotus* may also be looked for in large reserves like the Stirling Range and the Fitzgerald River National Parks.

The minor worker of *Camponotus ephippium* group sp. JDM 775 bears a very close resemblance to the South Australian *Camponotus fergusoni* McArthur, and may eventually prove to be that species, but it is best kept separate for the time being because of its greater hairiness on and under the head capsule; this species has abundant erect setae on the sides of its head and under the head, but such setae are sparse or lacking in the South Australian examples of *C. fergusoni*. Little can be said about the major worker of *C. fergusoni*, as no specimens of this subcaste have been Automontaged and colour photographic images reveal little or no difference between the major worker and a major worker of *C. ephippium* group sp. JDM 775 held at WAM. The minor worker of *C. fergusoni* has a slightly convex vertex and the occipital region is not subcarinate as in the last two species in this group that will be discussed, namely *C. capito ebeninithorax* and *C. dromas*. Moreover, the major worker of *C. ephippium* group sp. JDM 775 has a few erect setae on the antennal scape, and this character separates it from *C. capito ebeninithorax* and *C. dromas* major workers. The range of *Camponotus ephippium* group sp. JDM 775 in this state extends from the eastern edge of the Jarrah Forest subregion to the eastern and northern goldfields. Whether its range can be considered to extend to eastern Australia depends on a final decision as to its identity: *Camponotus fergusoni* is found in NSW, SA, and Vic. This ant frequently forages on trees: two workers were collected in a bark trap set on a wandoo trunk, and two other workers were taken in separate tree traps.

The taxon *Camponotus capito ebeninithorax*, as it is supposed to occur in Western Australia, may not be conspecific with the described species. The major and minor worker in the Western Australian form lack erect setae on the genae and are often, although not invariably, bright red. The described species has a red-headed major worker which also has a black mesosoma. This major worker (a syntype minor worker is not illustrated and it is unclear whether Forel saw any other specimens than the major worker he described) is here distinguished from *C. dromas* on the basis of mesosomal outline and colour. Western Australian minor workers assigned to *C. capito ebeninithorax* are readily separable from those of *C. dromas* by the presence of fine pubescence on the hind tibiae of the former species that is lacking in the latter species. The major workers of Western Australian *C. capito ebeninithorax* equally can be separated by the absence of short, erect setae on the lower genae and on the medial clypeal sector that are present in *C. dromas*. This ant is arguably the most common member of the *C ephippium* group in the south-west of this state away from the coast (where it is completely absent) and the wetter parts of the Jarrah Forest subregion. There is one record from Tropicana Mine in the Great Victoria Desert, but no records north of Eurardy Station, near Shark Bay. Populations are morphologically labile and also vary in colour, with worker samples from the more western parts of the ant's range being reddish with a black gaster, while goldfields samples are darker and more infuscated. The two minor workers from Tropicana mine are almost completely black with just a hint of red, and the mesosomal profile is bulbous with a pronotum that is steeply curved anteriad, as in *C. capito*. However, unlike *C. capito*, these ants have erect setae on the underside of the head and the diagnostic pubescence on the hind tibiae. Elsewhere, this species occurs in all

mainland Australian states except QLD. Label data reveals the native habitat of this species is always woodland, and this (rarely) includes mallee (i.e. the Tropicana samples). *Camponotus capito ebeninithorax* tolerates some human disturbance and has been taken from paddocks and adjacent to townsites. The extremely rare *Camponotus afflatus* Viehmeyer is morphologically identical to *C. capito ebeninithorax* but the probable holotype media worker illustrated on AntWiki has no erect setae under the head and lacks pubescence on the tibiae. This agrees with McArthur's description. The major worker is unknown. McArthur (2010) includes one WA record on his map for the species (p. 38), but, given its close resemblance to *C. capito ebeninithorax* and several other reddish members of the *C. ephippium* group, verification of the presence of this species in WA is needed. *Camponotus dromas* appears to be rare in Western Australia, the extreme western limit of its range, and only two pins of minor workers are held in the JDM/WAM Collections. The specimens from King Edward River in the Kimberley have the typical coloration (mainly black mesosoma with some red, and reddish legs), but the minor worker from Ethel Creek is somewhat smaller and the cuticle of all body parts is completely black. However, both sets of specimens have golden pubescence on the gaster and the setae on the tibiae are as described in the key in Part I. According to Andersen (2000), this is the most common monsoonal species in the *C. ephippium* group. As well as in the NT and WA, this ant also occurs in QLD. Because of confusion on databases with other species, there are no reliable biological data for *Camponotus dromas*, but it can be assumed to be ground nesting like other members its group.

Camponotus species-group A sp. JDM 26 resembles the *C. ephippium* group in having more than six mandibular teeth and also a long mesosomal outline when seen in profile. However, the propodeum of the minor worker has a unique and distinct concavity when seen in profile. The major worker also possesses this feature although it is less accentuated and looks more like a small transverse dent. The profile is strongly suggestive of *Camponotus owensae* Shattuck & McArthur, although the two species are not related. The colour of minor workers varies considerably from a uniform greyish brown through variegated grey-and-brown to red-and-black. The species is clearly undescribed and is here placed provisionally in its own monotypic group pending a thorough revision of Australian *Camponotus*. This ant is found in a wide variety of habitats, from the south-west corner of the State, through the Avon Wheatbelt, Great Victoria Desert, Mallee and Coolgardie subregions, as far north as the Arrowsmith River near Eneabba and north-east to Leinster in the Murchison. The occurrence of *Camponotus* species-group A sp. JDM 26 in other states is unknown. Biological data indicate a possible preference for sandy soils, and some workers have been swept or vacuumed from low foliage and flowers, plant species mentioned including *Acacia*, *Allocasuarina*, *Dryandra pseudoplumosa* and *Myoporum*. Vegetation communities where the species has been found include laterite/sandplain heathland and *Banksia* woodland.

The *Camponotus rubiginosus* species-group is a large one in WA but, because of their rarity or their localised or remote habitats, a number of individual taxa, in fact almost half of the WA members of this species-group (i.e. seven out of fifteen species), are undescribed. The minor workers are distinctive and can easily be placed in this group; all have only five mandibular teeth, the mesosoma is high with a distinct propodeal angle, the propodeum is only weakly laterally compressed, the head in full-face view is weakly to strongly triangular with the large eyes placed near the vertex, and the petiolar node is usually squamiform and always sharp when seen in profile. Much the same characters also identify the known major workers in this group (some of the species being known from the minor worker only). In addition, the anteromedial clypeal margin of the major worker barely extends beyond its lateral sectors and is usually weakly bidentate. Andersen (2000) mentions members of this group have a characteristic coconut odour when crushed.

The minor workers of five species within this group are black or blackish brown, these being *Camponotus evae zeuxis*, *Camponotus lownei*, *Camponotus simpsoni*, *Camponotus rubiginosus* group sp. JDM 296 and *Camponotus rubiginosus* group sp. JDM 1158. Their major workers are also conveniently black or blackish-brown, although the *Camponotus rubiginosus* group sp. JDM 296 major worker has brown patches on the occipital lobes, clypeus and lower genae. Both subcastes of the remaining species in the group are not uniformly black or blackish-brown.

Whorls of erect and semi-erect setae on the legs and antennal scapes are found within this group only in *Camponotus evae zeuxis*. *Camponotus evae zeuxis* has a wide, but apparently disjunct distribution within WA, with one population being found on the eastern side of the Jarrah Forest subregion in the south, and another population (or, possibly, two populations) in the Pilbara and in the western Kimberley. This species is common throughout Australia and occurs in all mainland states, although in Vic it is apparently confined to the far north-west corner. One minor worker

was found on *Acacia bivenosa*. Reproductives have been collected at lights. (Unfortunately, additional biological information recorded on some databases under the '*Camponotus evae zeuxis*' head does not relate to this species but to *Camponotus lownei*.) The *Camponotus lownei* minor worker has erect setae on both the lower genae and the underside of the head, but erect setae are absent from one or both locations in the other black *C. rubiginosus* group members. The *Camponotus lownei* minor worker also has raised setae on the tibiae and antennal scape and has been confused with *C. evae zeuxis* in the past, but here the setae are only raised to an angle of ~15°. The major worker is best identified by its all black coloration and the erect setae present on the lower genae and on the underside of the head. *Camponotus lownei* has a broad distribution in Western Australia excluding the south-west corner. Records from the inland desert regions are also sparse or lacking. This is a common Australian ant that is found in all mainland states. The species prefers sandy habitats and is commonly found in heathland, one record being from *Xylomelum/ Banksia* heath. The species is nocturnally active, in common with other members of its group, and has also been taken very early in the morning. A number of specimens have been collected on rehabilitated minesites. The minor worker of *C. rubiginosus* sp. JDM 1158 is matt or nearly so, in comparison with the other concolorous black *C. rubiginosus* group species which are glossy. The cuticle is finely and evenly foveate-reticulate. Like *C. simpsoni*, the major worker of this species lacks erect setae on the genae and the underside of the head, but its antennal scape is rather short, not reaching the vertex (in *C. simpsoni* the antennal scape reaches the vertex) and the sides of the head are weakly concave (weakly but evenly convex in *C. simpsoni*). This is very much a northern species, with a handful of specimens that have been collected in the Pilbara and east Kimberley. The occurrence of the taxon close to the NT border would indicate that it can also be found in that state. Nothing is known of the biology of this ant, all specimens having been collected in pitfall traps without other data.

A careful examination of the erect setae on the head is necessary to distinguish between the minor worker of *C. simpsoni* and the minor of *C. rubiginosus* group sp. JDM 296. In the former, erect setae are scattered over the frons and present on the lower genae (except in specimens from the northern Kimberley) but are absent from the underside of the head; in the latter, erect setae on the frons are paired but always absent from the lower genae, and erect setae on the underside of the head are present or absent. An additional helpful character is the elevation of the setae on the hind tibiae: in *C. simpsoni* these are raised to an angle of ~15°, but the setae are flat in *C. rubiginosus* sp. JDM 296. The holotype minor worker of *C. simpsoni* from Cape Wellington in the northern Kimberley lacks erect genal setae. Similar workers from the northern Kimberley also lacking this feature have been compared with specimens from other parts of this state. The latter are generally hairier and have short, erect genal setae, but the general morphology and the inclination of the setae on the antennal scapes and hind tibiae match in both sets of samples. Northern 'hairy' minor workers have dark, brownish coloured legs like the 'non-hairy' minors, but more southern specimens have legs that are orange or yellowish. More northern material is needed to see if there is a clinal pattern or whether there is sympatry of both forms, the latter of which would suggest separate species. For the present, these two forms are regarded as being infraspecific, albeit belonging to different populations.

The lighter, brown patches on the head and the flat, well-separated setae on the hind tibiae separate the major worker of *C. rubiginosus* sp. JDM 296 from the major of *C. simpsoni*, which is concolorous black and has overlapping setae on the hind tibiae elevated to an angle of ~10°. Allowing for the difference mentioned above, *C. simpsoni* has been collected in a few widely separated localities throughout the State, but this is likely to be understating its actual abundance. McArthur (2010) records the species from all mainland Australian states. Minor workers collected east of Hyden were found in abundance, foraging nocturnally on laterite/sandplain heathland. However, a minor worker from Bedfordale in jarrah/marri woodland was taken in the afternoon. The only other ecological reference is to this species nesting in soil. *Camponotus rubiginosus* group sp. JDM 296 has also been taken from a wide range of habitats but does not appear to extend further north than the Gascoyne. In all likelihood this common species also occurs in other states. Based on its appearance, it can easily be mistaken for *C. simpsoni*. There are quite a lot of data on habitat and microenvironment for this versatile species, as many recent collections have been made. A nest of this ant at Nanning Well, in the northern wheatbelt, is described as a simple hole made in light sand over laterite inclusions. However, at Quelagetting in the western part of the wheatbelt not far from Perth, a nest was uncovered in yellow loamy soil within York-salmon gum woodland. In jarrah forest, *Camponotus rubiginosus* group sp. JDM 296 has been collected in litter.

Litter was also the substrate for workers collected at Bibbawarra Bore near Carnarvon. These workers were also moving on planted grass. Finally, workers were taken from a nest at Nalya, near Brookton, in modified wandoo woodland next to a paddock.

The minor worker of *C. woodroffeensis* is the only minor worker within the *C. rubiginosus* species-group with a head and body that are uniformly brown, the legs being ochre-and-brown. Superficially, the body shape and colour of the minor worker would suggest inclusion in the *Camponotus discors* complex within the *C. claripes* species-group, but the major worker has the characteristic cephalic features and clypeus of the *C. rubiginosus* group and reveals the true relationships of this small species. The major worker can be distinguished from the major workers of similar relatives by the severely rectangular head when seen in full-face view, the blackish or variegated colour of the head and the noticeably bidentate anteromedial sector of the clypeus. This species is known in WA from two individuals, a major and a minor worker, collected at separate sites in the Pilbara. The ant also occurs in SA, and almost certainly in the NT (several records are very close to the NT/SA border). All that is known in terms of the species' biology is that the type material (from Mt Woodroffe in SA) was collected from spinifex near a rocky creek. The two WA specimens were pitfall-trapped. With their black head and gaster and rich red mesosoma and node, the major and minor workers of *C. armstrongi* cannot be mistaken for any other member of the *C. rubiginosus* species-group. Its vivid coloration makes this relatively common ant easy to spot in its native habitat. Nearly all records of this species are from the goldfields and drier southern parts of the State, including the Nullarbor. There is, however, one record from Ethel Creek in the Pilbara. Interestingly, as an aside, this cattle station is a source of many stand-alone records of ants that are otherwise only known from hundreds of kilometres south. This is more likely because of the extensive collecting done by a Curtin Masters student, Ms P. Varris, in the early 1990s, rather than an unusually rich ant fauna in this particular locality. *Camponotus armstrongi* is very widespread elsewhere in Australia and occurs in all mainland states and in the top end. Photographs on AntWiki show workers of this species at a turret nest with a single hole. This behaviour is not uncommon in desert-dwelling *Camponotus*. In sandplain/laterite heathland east of Hyden these ants were active on the ground very early in the morning. Another spectacular ant is *Camponotus macareaveyi*, which commenced its scientific journey as *Camponotus sanguinea* (McAreavey 1949). This latter name proved to be a junior homonym and the species was renamed *C. macareaveyi* by Taylor in 1992. Both the major and minor workers are a rich red in colour, which is unique within their species-group. The holotype major worker and a paratype minor worker were collected in Broome, but no other material belonging to this species is mentioned in printed or online sources (note: McArthur [2014] erroneously mentions the provenance of the type material as 'Trial Bay, NSW' [p. 128]). One can only assume this species is very rare. There are no biological data.

The major and minor worker of *C. rubiginosus* can easily be identified among the residue of the *C. rubiginosus* group by their combination of red, orange and black in their cuticle, the two subcastes of the remaining species being orange, brown or brownish-orange but without any red coloration in their cuticle. *Camponotus rubiginosus* is a tropical species and, within WA, its populations are confined to the Kimberley subregions. The range of *C. rubiginosus* extends across to the NT and QLD. Not a lot has been recorded of the ant's biology, but collections have been made in *Eucalyptus* woodland, and on two separate occasions nests have been found located in or under termite mounds.

Three rather attractive, rare, orange or reddish-orange species in the *C. rubiginosus* group can be lumped together on the basis of the impressed, foveate-reticulate sculpture in the minor worker. Only the minor worker, in fact, is known for C. *rubiginosus* group sp. JDM 695 and *C. rubiginosus* group sp. JDM 771, and the major worker of C. *rubiginosus* group sp. JDM 1038 has not been illustrated and its description in the key in Part I is based on written notes and the memory of the author, as this major is not represented in the JDM/WAM Collections. The deeply concave profile of the declivous propodeal face of the minor worker of C. *rubiginosus* group sp. JDM 695 immediately identifies it, as does the thick base of the petiolar node when also seen in profile (the petiolar node is squamiform throughout in the other two species). This is the most common species of the trio, and records cluster in the Pilbara and upper Murchison subregions in the north and in the Avon Wheatbelt and Coolgardie subregions in the south. Since the range of most Australian *Camponotus*, even rare species, is usually extensive in suitable habitat, this ant can also be expected to occur in SA and the NT, based on its wide distribution in WA. One worker was found at the base of a tree. The minor worker of C. *rubiginosus* group sp. JDM 771 is similar to the preceding species, and has the same foveate-reticulate sculpture, but the propodeum

is not concave. The one record comes from near Victoria Rock in the goldfields. As is the case for C. *rubiginosus* group sp. JDM 695, the only biological note for the sole known specimen of *Camponotus rubiginosus* group sp. JDM 771 is that it was also collected at the base of a tree, perhaps suggesting the members of this small semi-arid and arid zone complex nest around the boles of trees and forage in bark or twig litter. Nothing more is known of this ant. The *Camponotus rubiginosus* group sp. JDM 1038 minor worker has the same sculpture as the other three species on the head and mesosomal dorsum, but the sides of the mesopleuron and propodeum are finely striolate. The sole minor worker in the JDM Collection was found in *Eucalyptus torquata* woodland. Additional material for this species that includes major workers is held in another Australian institution, possibly the ANIC. The bulbous head and finely microreticulate sculpture identify the major worker of *Camponotus rubiginosus* group sp. JDM 1038, the remaining major workers having a convex or triangular but not bulbous head and only superficial imbricate sculpture.

Whereas many of the *C. rubiginosus* species-group in Western Australia have a semi-arid and arid distribution, *Camponotus andyyoungi* has been found in more humid south-western parts of this state. The minor worker has a combination of a moderate sized eye and a largely smooth and shining mesosoma, distinguishing it from the last two minor workers in this species-group to be discussed (these being either large-eyed or with a matt mesosoma). The major worker is also smooth and shining and is very like *C. gibbinotus* in appearance, but the bidentate, non-protruding clypeus is definitive for the species-group, and quite unlike the same part in *C. gibbinotus*. WAM has major workers as well as minor workers in a series from Toodyay, and the author notes the major worker has not yet been described. No major worker is known for *C. rubiginosus* group sp. JDM 1219 or *C. rubiginosus* group sp. JDM 1224. In this state, workers of *C. andyyoungi* have been collected from a tiny patch of suburban bushland which is part of Curtin University, as well as Toodyay in the Jarrah Forest and Monkey Rock in the Esperance Plains. The only other state from which the taxon has been collected is SA, but it has been recorded right on the border with the NT so can be pencilled in for that state as well. This ant has been collected in mallee over sandy soil. (The author notes the soil at Curtin University is also sandy). Other details are not recorded on the labels. The matt, orange *C. rubiginosus* group sp. JDM 1224 is known from two sites at the junction of the Jarrah Forest and Avon Wheatbelt subregions. The two minor workers taken in Dryandra State Forest were collected in an intercept trap placed on a wandoo (*Eucalyptus wandoo*) trunk. One minor worker was also found crawling on an ice-cream container lid in bushland east of Westdale. A single, tiny, large-eyed minor worker of *C. rubiginosus* group sp. JDM 1219 was collected at Ethel Creek by P. Varris in 1993–4. There is no other information on this species (note: although the paired pronotal setae in the minor worker of *C. rubiginosus* group sp. JDM 1219 are not placed adjacent to the promesonotal suture, the large eye and the position of the other erect mesosomal setae are the same as in minor workers of the *C. insipidus* species-group, and the ant may be more correctly placed in that group).

The *Camponotus michaelseni* group shares the high mesosoma and long propodeal declivity of the *C. rubiginosus* group, but here the propodeum in the minor worker is strongly laterally compressed and wedge-shaped when seen in dorsal view. In profile, the petiolar node is scale-like, ending in a sharp apex. Most minor workers in the group have six teeth (reduced to five in *C. rudis* and very rarely five in small workers of *C. tristis* and *C. michaelseni* sp. JDM 229). In addition to a propodeum that is narrowed posteriad as seen in dorsal view, the major worker has a vestigial metanotum (indicated by a narrow, transverse sector impressed anteriad and posteriad), and a head with moderately to strongly convex sides. The medial sector of the clypeus projects barely if at all beyond its lateral sectors, and the anteromedial margin is noticeably indented or emarginate only in the *C. oetkeri* major worker. (*Camponotus claripes* species-group major workers with a high mesosoma have an anteromedial clypeal sector that projects well beyond the lateral clypeal sectors and is often emarginate or distinctly emarginate or even bidentate. The sides of the head in these ants are usually planar, and if convex then only weakly so.) The head and body in both subcastes are always black, except for major workers of *C. michaelseni* group sp. JDM 1080 where the pronotum and gaster are dark brown.

The major worker of *Camponotus michaelseni* sp. JDM 1080 is identified by its dark brown rather than black pronotum and gaster. The anteromedial clypeal margin also has only a hint of indentation, compared with the pronounced broad emargination seen in the anteromedial clypeal margin in *C. oetkeri*, the only other member of the group found in northern WA. Fine, alveolate sculpture on the head and body and the fine, even microreticulation over the first two gastral tergites also make the minor worker of this species unmistakeable.

Camponotus michaelseni sp. JDM 1080 has been collected at two sites in the Pilbara and at Argyle diamond mine in the Victoria Bonaparte subregion of the Kimberley; its presence in the latter locality makes it all but certain this taxon has a range that extends into the NT. Workers have been collected in pitfall traps but nothing more is known of the ant. The other species whose range is as far north as the Pilbara is *Camponotus oetkeri*. Most major and minors of that species have a glabrous mesosoma. However, the inversely triangular form of the head in the minor worker when viewed full-face (albeit McArthur [2014] does not show this character distinctly in the specimen photographed), and the ovate, strongly convex head of the major worker when seen in the same orientation — together with the emarginate anteromedial clypeal margin in the latter — help to make identification of this taxon certain. *Camponotus oetkeri* has a very broad distribution in WA and probably occurs throughout the entire state except for the humid south-west corner. This species also occurs in all Australian mainland states but only rarely in the NT (in the extreme south) and QLD. In Lorna Glen station this ant has been found in deep red sand dunes covered with spinifex and mallee. In collections further south this species has been taken in laterite/sandplain heathland in litter, and near Madura Roadhouse on the Nullarbor Plain *C. oetkeri* was found on limestone soil in chenopod shrubland. Nests have been located under wood and even under a concrete slab. One minor worker collected off the Brookton Highway was found in an intercept trap on a marri (*Corymbia calophylla*) trunk. This *Camponotus* will tend blue butterfly larvae: at James Price Point north of Broome in the Kimberley, *C. oetkeri* workers were tending *Ogyris* larvae and pupae.

Camponotus tristis is another member of the *C. michaelseni* group that is easy to recognise because the black legs are concolorous with the body (in all other species except for the minor worker of *C. michaelseni* group sp. JDM 1080 they are lighter in colour than the body and often yellow or orange). This ant and *Camponotus rudis* were placed in the '*C. evae* species-group' (here part of the *C. rubiginosus* species-group) by McArthur (2007) on the basis of the sculpture of the mesosoma. However, a more comprehensive evaluation of the morphological characters aligns these two taxa with *C. michaelseni* and its relatives. Most workers of *Camponotus tristis* are matt in appearance but this can vary, some workers being quite shiny. The head of the major is conspicuously convex, almost semi-circular, giving this part a bloated appearance. The range of *C. tristis* roughly approximates the SWP but, like *C. oetkeri*, it eschews the wetter south-west corner and a few collections have been made in the goldfields. Interstate, this species occurs throughout the Eyre Peninsula and the Adelaide Hills of SA, extending into north-eastern Vic, and there appears to be a disjunct population in the north-east corner of NSW. There is some detailed ecological information on this species: the ant has been found nesting under a lateritic stone in open woodland near Brookton, and other habitat notes include references to mallee/saltbush (Caiguna Roadhouse), tall shrubland containing *Allocasuarina acuminata* and *A. lasiocalyx* (Merredin townsite), and two collections made on tree-trunks, one in an intercept trap (Brookton Nature Reserve) and one by hand (64 km E. of Southern Cross).

Camponotus rudis is easily pulled out from the four remaining species. In full-face view, the minor worker has a convex, domed vertex and the occipital carina is hidden and the sculpture of the head is finely alveolate. The other minor workers have a flattened frons above the eyes and the margin of the occipital carina is visible. The head of these ants also has superficial imbricate sculpture only. The major worker is small (HW > 2 mm) compared with the other major workers (HW ≥ 2.5 mm) and has many erect setae on the mesosoma (≥ 20) compared with relatively few erect setae on that body part (< 12). All JDM/WAM material pertaining to this species comes from wetter parts of the south-west and the southern coast from about Bremer Bay westwards. This ant is shown in a map on p. 70 in McArthur (2010) as occurring in discrete pockets in all Australian states bar Victoria. However, at least the single record from the Pilbara is known to be in error (it is a JDM Collection locality listed in the original description of the ant), and, in the view of this author, other northern records in Western Australia (i.e. from the Kimberley), the top end of the NT and a single record from NE QLD are also suspect and likely to be the result of confusion with one or more separate species. There is no evidence, based on JDM/WAM material, that this ant occurs in lower latitudes or away from the cooler, moister areas. This leaves the only likely authentic interstate records as NSW (the state containing the type locality) and southern SA. Most WA samples of this ant have been taken in forested areas. Material from the Stirling Range National Park was vacuum sampled from *Acacia veronica*. At Peppermint Beach on the south coast a minor worker was collected from a track in low, coastal scrub. Other data are lacking. The minor worker of *C. michaelseni* sp. JDM 229 is quite similar

to *C. michaelseni* and *C. tumidus*, but when viewed in profile the dorsal surface of propodeum is seen to be rounded smoothly over onto its declivous surface, unlike the other two ants where the dorsal and declivous surfaces of the propodeum are separated by a distinct angle. The smaller (HW > 2.5mm) major worker of *C. michaelseni* sp. JDM 229, when viewed full-face, has an anteromedial clypeal sector that is confluent with its lateral sectors (in its two larger [HW > 3–3.5 mm] relatives the anteromedial clypeal margin projects as a short, square apron), and the metanotal groove is barely indicated (weakly to sharply impressed in *C. michaelseni* and *C. tumidus*). *Camponotus michaelseni* group sp. JDM 229 is confined to sandplain on or near the coast. Most records have come from the Swan Coastal Plain, but there is one record from the Esperance region. The presence of the ant in other states in unknown, but it may occur where there is suitable habitat. Many records are from relictual native woodland in the Perth metropolitan area. Label data often indicates collection on sand, e.g. white quartzite sand, or from dune systems. Thus, in the emerging suburb of Lexia foragers were found on white quartzite sand in *Banksia* woodland with an *Adenanthos* understorey, while a worker from Carabooda was also collected on a sandy track in wooded sandplain. Other records include a minor worker from the Perth suburb of Kingsley that was collected in riparian woodland, and two minor workers from Buckland Hill that were taken from a rehabilitated limestone quarry. The Esperance minor worker came from a blue mallee plantation.

Camponotus michaelseni and *C. tumidus* are only separable in the minor worker subcaste, and that on the doubtful evidence of a single character, this being the depth of the metanotal groove. In the *C. tumidus* minor worker the metanotal groove is a distinct notch when seen in profile, but in *C. michaelseni* the metanotal groove is barely indicated if at all and the mesonotum and the propodeum are seamlessly joined. As far as this author can tell, the major workers of the two taxa cannot be meaningfully distinguished on morphological indicators. (The slightly more convex head in the Automontaged AntWeb *C. tumidus* major worker compared with the AntWeb *C. michaelseni* major image is almost certainly due to allometry.) *Camponotus tumidus* is undoubtedly rare, and there is no material in the JDM/WAM Collections. Apart from the original major worker described and a syntype minor worker, both from the outer Perth metropolitan area, other records in the Atlas of Living Australia are of reproductives or are of doubtful authenticity. In fact, based on morphology, *C. tumidus* has all the appearance of being no more than a rare variant of *C. michaelseni*. If synonymised, *C. tumidus* would be the junior synonym of *C. michaelseni*. More material is needed for confirmation, and molecular analysis of material belonging to both forms would be determinative. By way of contrast, *C. michaelseni* is one of the commonest *Camponotus* in the lateritic loam of the Darling Range near Perth, where its nests can often be found under large stones and small boulders. This species appears to be restricted to the south-west of WA, and in particular to the jarrah-marri forest of the Darling Range. The Stirling Range is the furthest east this species has been recorded among the JDM/WAM material. As with *Camponotus rudis*, workers from the Stirling Range have been collected with vacuum sampling of *Acacia veronica*. Major and minor workers from Bedfordale were collected from under a stone in jarrah/marri woodland in the afternoon. This species can evidently climb high up into the foliage of tall trees; specimens were collected from marri (*Corymbia calophylla*) by pyrethrum knockdown. *Camponotus michaelseni* is here regarded as the senior synonym of *Camponotus walkeri bardus*. The Automontaged *C. walkeri bardus* syntype lacks a head, but the presence of several erect mesosomal setae and the deeply impressed metanotal groove are consistent with *C. michaelseni* (or *C. tumidus*) but not with the other species discussed here.

The minor workers of the ten species in the *Camponotus aeneopilosus* species-group bear a passing resemblance to the minors of the *C. ephippium* species-group because of their long, sinuous profile. However, the relatively small eye is placed well down on the sides of the head (whose sculpture is typically densely foveolate), the propodeum may have a saddle and a raised, protuberant propodeal angle, and the mandible has six teeth. The body and the gaster especially are also not densely pubescent so that the cuticle is completely hidden, as in nearly all members of the *C. ephippium* group (the one exception being *C. aeneopilosus* group sp. JDM 1374). A variety of features in combination are needed to distinguish major workers in the group (see species key in Part I), but the most prominent ones are the mostly arcuate profile of the pronotum and mesonotum, the long propodeum whose dorsal surface meets the declivous face through a blunt angle, the barely projecting anteromedial sector of the clypeus which is usually incised or emarginate to some degree and convex only in the *C. inflatus* major, and the six-toothed mandible, which may be heavily

sculptured. Workers often have a shimmering yellowish sheen on the gaster, and the posterior membrane of the gastral tergites may be a bright golden. Several species are relatively common, but most are seen only rarely, and four of the ten members of the group are undescribed.

The *Camponotus chalceus*, *C. aeneopilosus* sp. JDM 1031 and *Camponotus aeneopilosus* group sp. JDM 1374 minor workers have a distinctly concave propodeum with the dorsal and declivous surfaces meeting in a raised angle, a feature lacking in the other minor workers in the group in which the dorsal surface of the propodeum passes more-or-less smoothly over to its declivous surface. The minor worker of *Camponotus aeneopilosus* group sp. JDM 1374 differs from the other two ants in having extensive downy pubescence on the body and gaster. Superficially, this species can easily be mistaken for *C. sponsorum* in the *C. ephippium* species-group, and it was only by carefully checking diagnostic characters in the latter that the interloper was discovered within unit trays of *bona fide C. sponsorum* minor workers. The giveaways are the mandible with only six teeth and the finely foveate-microreticulate sculpture of the head. Just three individual minor workers of this ant are known, all from sites within 250 km of Perth and to the north of the capital. One worker from Eneabba was taken on *Leptospermum* but there are no other data. The minor worker of *C. aeneopilosus* sp. JDM 1031 has a uniform vestiture of erect, bristly setae on the body; this is lacking in *C. chalceus*, where the erect setae are more sparse and well-spaced. Moreover, the former has uniformly black cuticle, whereas the latter is black with a red propodeum. The major worker of *C. chalceus* also has the red saddle of the minor worker, but the major worker of *C. aeneopilosus* group sp. JDM 1031 has a planar propodeum that is black like the rest of the ant. In WA, *Camponotus chalceus* can be found as far north as Shark Bay but most populations occur within the 600 mm isohyet. *Camponotus chalceus* also has a limited range in SA, from Ceduna, on the Eyre Peninsula, to the Adelaide Hills. *Camponotus chalceus* is always associated with wood, and nests have been found in stumps of *Xanthorrhoea* or logs (Wheeler 1934) and in *Banksia* (label data), and many collections have been made on the trunks of various trees. Vegetation communities where the ant occurs include jarrah/marri woodland, sandplain heath and *Banksia* woodland. The soil type is usually sand, often white sand. This is also one of the few *Camponotus* to tolerate urban densification, and in Perth suburbs workers can fairly frequently be seen on the trunks of street trees or crossing footpaths, particularly where the verges contain patches of native vegetation. They can also be found in other areas with relictual native vegetation or regrowth such as the bushy perimeters of ovals or large yards. *Camponotus aeneopilosus* sp. JDM 1031 is much less common than the preceding taxon, and the three collections made have all been at the intersection of the Jarrah Forest and the Avon Wheatbelt subregions. Two minor workers (now lost) were collected in an intercept trap ex jarrah (*Eucalyptus marginata*) in Dryandra State Forest (Heterick 2009), but there are no other data. Since this ant is undescribed, populations in other states are unknown.

Both subcastes of *Camponotus scotti* and *C. aeneopilosus* group sp. JDM 430 have a head and body that are variegated black, brown and orange; furthermore, the overlapping appressed setae on the head and body are long, golden and conspicuous. The major worker of *C. aeneopilosus* group sp. JDM 430 has a matt or dully shining head and mandibles with deeply impressed, longitudinal pits and other rugulose sculpture. The anteriorly rugose, hairy head, in fact, is quite similar in appearance to the heads of majors in the *C. claripes* complex. The major worker of *C. scotti* has a moderately shining head and mainly smooth mandibles. The minor workers can also be easily separated on the appearance of the cuticle, *C. scotti* having a shining, even glossy head and mesosoma, and C. *aeneopilosus* group sp. JDM 430 having a matt, dull head and mesosoma. The WA range of *Camponotus scotti* appears to be limited to the western flanks of the Darling Range, with no records south of Dwellingup. Elsewhere, it has been recorded from eastern NSW and south-eastern SA. McArthur (2003) mentions that this species is ground-nesting and is often found foraging on tree-trunks during the day. In WA, a minor worker was taken in an intercept trap on a jarrah tree. The range of *C. aeneopilosus* group sp. JDM 430 is the converse of *C. scotti* in that it has been collected on the eastern flanks of the Darling Range, where the Jarrah Forest adjoins the Avon wheatbelt subregion. As this is yet another undescribed *Camponotus*, nothing is known about its occurrence in other states. The species has only been pinned a handful of times and seen in a couple of additional collections taken within its range. However, the few label data suggest this is also a tree-foraging ant; a minor worker in Dryandra State Forest was collected in an intercept trap on a Marri trunk, while another minor worker taken 20 km N. of Williams was collected at the base of a tree. A worker from Kojonup was pitfall-trapped.

Camponotus cinereus amperei is a very common faunistic feature of semi-arid habitats, where it can be seen running rapidly over the ground and upon the trunks of trees with its gaster elevated. Both red-and-black and black forms of the ant are known; the red-and-black workers or mainly black workers with some red on their mesosoma are found in mid-western WA in the Carnarvon and Gascoyne subregions, the concolorous black morph being ubiquitous elsewhere in the ant's range. The minor worker of this species lacks erect setae on both the underside of the head and the lower genae; the remaining minor workers in the group have erect setae on one or both sectors of the head. This feature, together with the shiny appearance of the head and the mainly smooth mandibles, also identifies the major worker. This species is readily distinguished from the eastern Australian *C. cinereus*, which has yellow gastral pubescence. Such pubescence is completely lacking in the Western Australian species, in which the appressed gastral setae are very short, well-separated and pale. *Camponotus cinereus amperei* has a broad distribution in the southern third of the state excluding the Darling Range and south-western and southern coastal parts. This distribution extends into the Carnarvon and Pilbara regions, but there are no northern inland or central desert records. The ant has also been recorded throughout SA, and north-eastern Vic, with isolated records from NSW and the south of the NT. There is a strong likelihood this species can also be found in southern QLD. *Camponotus cinereus amperei* is particularly common in mallee woodland but can also be found on sandplain heath and in wandoo woodland. One nest was located under moss near a tree.

In profile, the red-and-black *C. aeneopilosus* sp. JDM 1108 bears a striking resemblance to *C. innexus*, which also belongs to the *C. aeneopilosus* species-group, and its red-and-black livery causes it to stand out among the other representatives of this species-group. However, the minor worker (the only subcaste known) differs from *C. innexus* in features of its clypeus (the anteromedial clypeal margin is uniformly convex not deeply emarginate as in *C. innexus*) and the outline of the vertex is planar, not convex. (*Camponotus innexus* itself may occur in this state; records of the species are shown at sites in the Nullarbor and in Cape Arid National Park on the map on p. 96 of McArthur [2010], but there are no WA records listed in AntWeb or Atlas of Living Australia nor is any material housed in the JDM/WAM Collections, and so the records require verification — although the presence of this species in WA is perfectly conceivable, given its biogeography and an Atlas of Living Australia record from Wilson's Bluff near the SA/WA border.) Both known individuals of *C. aeneopilosus* sp. JDM 1108 were taken in wet pitfall traps by WA Museum staff on Nerren-Nerren Station near Shark Bay. The remaining three species are broadly similar. The minor worker of *C. inflatus* is very hairy, its hirsute mesosoma (> 30 erect setae) as well as the broad golden bands on the gastral tergites pulling it apart from the minors of *C. hartogi* and *C. pitjantjatarae* (≤ 20 erect setae; gold gastral tergite bands narrow or absent), while the evenly convex anteromedial clypeal margin of the *C. inflatus* major worker is unique among the WA major workers in the *C. aeneopilosus* group. Local (JDM/WAM) material for the species comes from the Pilbara, Little Sandy Desert and Gascoyne subregions, but historical accounts (e.g. Wheeler 2008) also locate *C. inflatus* in the Murchison subregion. *Camponotus inflatus* is also found in inland part of the NT and SA. Workers forage on plants for nectar and scavenge dead animal material. Nests (in the NT) are associated with *Acacia aneura* (mulga) and have single or multiple entrances (Conway 1991). Wheeler (1908), reporting on the findings of earlier researchers, and also Conway (1991) affirm the significance of the repletes of this species as a source of nourishment for Aboriginal people living in desert areas.

Camponotus hartogi is an uncommon species. McArthur opines that it may be a synonym of *C. innexus* and, in his 2007 publication, separates the two on the basis of the vertex (*C. innexus* convex, *C. hartogi* mainly planar); however, this distinction does not hold up based on AntWeb images of both species. On the other hand, the appressed setae on the gaster in *C. hartogi* are relatively long and overlapping and the gold gastral bands are prominent, while the appressed setae on the gaster of *C. innexus* are short and well-spaced and non-overlapping, and the gaster appears to lack distinct gold bands. The colour difference of the mesosoma (concolorous black in *C. hartogi*) should probably also be considered. The minor worker of *C. pitjantjatarae*, the other *C. aeneopilosus* group species discussed here, also lacks the gold bands, and its head in full-face view is trapezoidal but oval in *C. hartogi*. The *C. hartogi* major worker can be distinguished from the major worker of *C. pitjantjatarae* in the appearance of the mandibles (with deeply impressed pits and other rugulose sculpture in *C. pitjantjatarae*, mainly smooth in *C. hartogi*) and the sheen of the head capsule (moderate in *C. pitjantjatarae*, head matt or with a very dull sheen in *C. hartogi*). In WA, *C. hartogi* has been taken in a couple of locations on the south coast.

Interstate, this species is recorded from the ACT, NSW, QLD, SA, and Vic, but rarely. The only label data indicate the species has been found in logs or nesting under a log. *Camponotus pitjantjatarae* is an arid area ant that is easily confused with *C. cinereus amperei* but has a differently shaped head and possesses erect genal setae and also erect setae under the head. Major workers may have an orange head. In WA, this species has been collected in an arc from Mt Willoughby, just north of Northampton near the mid-western coast to Plumridge Lakes in the Great Victoria Desert. This species has also been taken from southern NT and northern SA. Nothing has been recorded of the ant's habits.

The minor workers of the compact little *C. insipidus* species-group are among the smallest Australian *Camponotus* and are only around 3–4 mm in total length (HW ≤ 0.60 mm). Apart from their minute size (for a *Camponotus*), the minor workers are distinctive in having a pair of erect pronotal setae that are situated close to the mesonotal suture (in similar-looking members of the *C. claripes* species-group, these setae are always in the middle of the pronotum). The eyes are also large and rather flattened, and the vertex is not narrowed behind the eyes as in similar ants from other groups. The antennal scapes are relatively short and exceed the vertex by < 0.50 × their length. Major workers are not as distinctive but can still be identified by the lack of erect setae on the lower genae, their head in the form of an inverted triangle, the high mesosoma when seen in profile, and the abruptly declivous propodeum. As in workers of the *C. rubiginosus* species-group, both subcastes have five mandibular teeth. This suite of species seems to be adapted to sandplain habitats.

The minor worker of *C. darlingtoni* is separated from its allies by the appearance of the propodeum in profile, this part being planar with the dorsal and declivous surfaces separated by a slight bend, not convex with the dorsum smoothly rounded over onto the declivity as in the other species. The major worker has a profile similar to workers of the *C. aeneopilosus* group but has only five mandibular teeth. *Camponotus darlingtoni* is mainly an ant of south-western sandplain and is confined to suitable localities in the south-west corner of the State to about Jurien Bay in the north and just east of Albany along the south coast. This species mostly avoids the thicker jarrah-marri forests of the Darling Range. Interstate, the species can be found in SA. This species is here regarded as the senior synonym of *C. christmasensis* McArthur (see Part I). Wheeler (1934), who described the species, found it to be common under logs and stones on Rottnest Island. The ant also nests in dead wood, having been found in tunnels under bark in an old *Banksia* stump. *Camponotus darlingtoni* is tolerant of urbanisation to some degree and is occasionally found in suburban yards with suitable large native trees such as eucalypts where it can forage and nest under fallen litter or in dead wood. *Camponotus insipidus*, here regarded as the senior synonym of *C. minimus* (see Part I), is one of the most common *Camponotus* in the south-west of this state and can be found in many types of habitat. The minor worker is separated from the minor of *C. scratius* in lacking erect setae under the head capsule, and from the minor worker of *C. insipidus* group sp. JDM 1256 in its smaller eye and its variegated head and mesosoma (*C. insipidus* group sp. JDM 1256 being overall a depigmented yellow). The minor worker of *Camponotus insipidus* displays a great deal of variability in its colour patterns, ranging from dark body and pale appendages to dark or pale body and dark appendages. In the goldfields a spectacular morph with black or dark brown head, gaster and legs and orange mesosoma occurs. The lack of erect setae under the head is also a good way to identify the major worker of *C. insipidus*, compared with *C. scratius*, which possesses such setae. The major worker of C. *insipidus* group sp. JDM 1256 is not known. *Camponotus insipidus* can be found in the same localities as *C. darlingtoni* but has a much broader distribution that extends to drier, semi-arid areas in the goldfields. A major worker from Argyle Diamond Mine in the east Kimberley is tentatively assigned to this species, but this large-eyed specimen is thousands of kilometres north of other records (see Figure 47) and may represent a separate though very similar taxon (possibly it is the major worker of *C. rubiginosus* group sp. JDM 1219 — see comments on the minor worker above). *Camponotus insipidus* is equally common in other parts of Australia and can be found on all mainland states. Dry sclerophyll woodland, *Banksia* woodland and spinifex sandplain are just a few of the vegetation communities known to harbor this ant, which sometimes forages on trees. Nests can be found under rocks and logs. Colonies may persist in built-up areas and the species is occasionally found in large suburban yards with suitable habitat.

Camponotus scratius is always found on sandplain. Known populations reveal a disjunct range, with records from North West Cape and Barrow Island in the north that are separated by some hundreds of kilometres from southern populations. These are mostly clustered in the coastal areas around Perth and north to Jurien Bay, but there are a few records from Denmark on the south coast,

and the ant has been collected in the goldfields on sandy soil. The ant occurs in much of eastern SA and there is a solitary record from the NSW coast. *Camponotus scratius* has been recorded at least three times in *Acacia rostellifera* scrub, as well as in *Melaleuca lanceolata* woodland and in *Banksia/Allocasuarina* sandplain. Colonies of this species are often found under rocky limestone inclusions in sandy soil in vegetated coastal dunes in the Fremantle/Henderson area. *Camponotus scratius* is here regarded as the senior synonym of *Camponotus samueli* McArthur (see Part I). The tiny, depigmented *Camponotus insipidus* sp. JDM 1256 has been found in the drier parts of the SWP away from wetter, heavily timbered areas. For a long while this minute species was regarded as simply a colour variant of *C. insipidus* but is here separated from that species by its larger eye and its lack of colour. The few records mapped probably underestimate its range and abundance, as additional samples seen in inventories have not been retained. The species has been hand-collected in grey, sandy, lateritic soil in an *Allocasuarina*/ samphire community at Calingiri in the northern wheatbelt and in sandplain/laterite heathland east of Hyden. A nest series was also obtained at Canna. The Kwongan may be the natural stronghold of this species.

The large *Camponotus claripes* species-group (19 species, 11 undescribed) includes some of WA's most common and widespread sugar ants that repeatedly appear in invertebrate consultancy inventories and collections done for conservation purposes. This group can be subdivided into three recognisable smaller groups or complexes. The largest of these is the *C. claripes* complex, which also includes most of the undescribed taxa (six). The minor worker of the *C. claripes* complex has a strongly laterally compressed propodeum; the head in full-face view is much longer than wide with the sides parallel or divergent posteriad; the head behind the eyes is strongly convergent towards the vertex; the eyes are large (eye width ≥ 0.25 × length of side of head) and the antennal scape is long. If the ant is viewed from above, the junction of the pronotum and the mesonotum is evident as a transverse line or ridge. The major worker in this complex has the following characteristics: the head is oval, rectangular or broadly triangular; the sides of the head in most taxa have many short, erect setae (the lower genae are also often pitted or have other sculpture); the anteromedial margin is emarginate or bidentate to varying degrees (planar but not crenulate in a single species that has up to eight mandibular teeth); the antennal scapes are relatively long, always exceeding the vertex; with the one exception mentioned above, major workers have six mandibular teeth; the mesosoma is broadly arcuate in profile, and the dorsal and declivous faces of the propodeum ascend at an angle > 45° but < 90°.

Camponotus claripes group sp. JDM 63 is usually recognisable in that both the major and the minor worker possess seven or more mandibular teeth (only in *Camponotus claripes* complex sp. JDM 939 do minor workers occasionally have seven teeth). Most records come from the Swan Coastal Plain and the south coast, west of Albany, but recently several dwarfed minor workers (nanitics?) believed to be of this species were collected at gold mine sites in the Kambalda region, and a minor worker has also been recovered from Tropicana minesite in the Great Victoria Desert subregion. This ant should also be looked for in SA. *Camponotus claripes* group sp. JDM 63 is a denizen of sandplain, and collecting data reflects that. Information gleaned from labels includes: *Banksia/Allocasuarina* sandplain, grey over yellow sand; *Banksia* open woodland, *Adenanthos* understorey, white quartz sand; on ground in coastal woodland; and *Banksia* woodland in white soil. Some specimens have been collected nocturnally. *Camponotus claripes* group sp. JDM 63 is tolerant of urbanisation, and inclined wedge-shaped mounds consisting of large crumbs of yellow or white sandy soil around a filled-in hole are a sign of its presence in grassy, suburban lawns. *Camponotus claripes* group sp. JDM 939 is very similar to the preceding, and occasionally the mandible has seven teeth. The head of the very gracile minor worker is attenuated behind the eyes, and the petiolar node is a low cone with a small, apical denticle — the ant, in fact, looks very much like members of the *C. subnitidus* group. The (usually) six mandibular teeth and the parallel-sided head capsule are, however, indicative of its true relationships. The head of the major worker has pitted sculpture around its lower genae, with many small, erect setae, but it is not bulbous (as in *Camponotus claripes* group sp. JDM 288) and is yellowish-orange or orange in colour. This major worker also has very hairy frons and genae, unlike the major worker of *C. claripes* complex sp. JDM 63, which is glabrous (but the mandibles are of the same shape). This suite of features is not shared by remaining members of the group. *Camponotus claripes* complex sp. JDM 939 is predominantly found in the western Eremaean subregions (e.g. Carnarvon, Gascoyne, and Pilbara), but at least one minor worker that is probably of this species has also been collected in the Dryandra State Forest,

south-east of Perth. The range of the ant outside of WA is unknown. Little has been recorded of the species' habits or associations, but specimens pitfall-trapped at the edge of the Little Sandy Desert were taken in spinifex sandplain, while another worker trapped in the same general area was in calcrete mulga woodland. Workers collected at Lyons River Crossing were on sand amidst riparian woodland. Finally, the minor worker from Dryandra was taken in a bark trap set on a *Eucalyptus wandoo* trunk. Based on their very similar morphology, *Camponotus inverallensis*, *C. claripes* complex sp. JDM 63 and *C. claripes* complex sp. JDM 939 appear to be part of an almost cryptic clade within the complex.

The *Camponotus elegans* minor worker is a dark brown species with mottled brown-and-ochre legs, a long and almost planar propodeal dorsum when seen in profile, and a weakly emarginate anteromedial clypeal margin. When seen in dorsal view the propodeum is not as strongly laterally compressed as in its relatives (although the propodeum of ethanol preserved specimens often collapses inward, rendering this a less helpful feature). However, where identification is doubtful, the eyes, which are usually smaller than in its close relatives (eye length ~ 0.25 × length of side of head, compared with eye length ≥ 0.30 × length of side of head) may be a useful character. The major worker is visibly gracile, with hairy lower genae, a uniformly dark brown head, mesosoma and gaster and mottled but mainly pale legs. Seen in profile, the dorsal propodeal face is rather elongate (slightly longer than its declivous face) and inclined at an angle of 45° (inclined at an angle of ≥ 60° in most of its near kin). Current Western Australian records of *Camponotus elegans* are confined to the Jarrah Forest subregion from about Moora in the north to Boyup Brook in the south. This species appears to be more common in south-eastern Australia, and occurs in all the Australian states with the exception of the NT. This is one of the few *Camponotus* that is common in Tas. There is almost no biological information on this ant, save that it appears to have arboreal habits: a minor worker was taken off marri (*Corymbia calophylla*) at Karragullen and other minor workers were collected from tree traps at Dwellingup. *Camponotus marcens* poses a taxonomic conundrum because of species confusion in the syntypes of the major worker and scrambled descriptions (see Excursus 1 in Part I). However, the minor worker can be correctly associated with the major worker, despite the problems with the type material. The colour pattern is definitive for both worker subcastes, particularly the minor worker, which is bright yellowish with a bicoloured yellow-and-black gaster. The head of the major worker in full-face view has the usual pitted, hairy lower genae, and is black anteriad grading to brownish towards the vertex. The mesosoma, legs and the first gastral tergite are dull orange, with the remaining gastral tergites grading brown or dark brown to black. *Camponotus marcens* is confined to the south-west of WA, with local records from Carnamah in the north to Hopetoun on the south coast. This species is perhaps most common in the areas of Jarrah forest in the Darling Range. Geikie Gorge in the Kimberley, included in the locality data for this species by McArthur (2009), is not in keeping with its known range and likely represents a misidentification. The minor worker of this timid species is often seen running up and down tree-trunks. If approached, it will rapidly dart to the other side of the trunk from the observer. Specimens have been obtained by pyrethrum knockdown, but nests are in soil; one nest was found under a rock in loamy earth.

Three undoubtedly closely related species that frequently forage and even nest in living timber (in the case of *C. peseshus*) are *Camponotus claripes* complex sp. JDM 779, *Camponotus claripes* complex sp. JDM 767 and *Camponotus peseshus*. The minor worker of *Camponotus claripes* complex sp. JDM 779 is the only member of the *C. claripes* complex to have a matt frons with fine, areolate microsculpture, the other minor workers being more-or-less glossy with only superficial, imbricate sculpture. The major worker is more difficult to identify, especially as an isolated specimen, but is rather matt (much less shiny than the otherwise very similar *Camponotus claripes* complex sp. JDM 767 and *C. peseshus*); with a few erect setae on the antennal scape (otherwise found in this complex only in *Camponotus claripes* complex sp. JDM 767). The minor worker of *Camponotus claripes* complex sp. JDM 779 comes in two colour forms; namely, dark chocolate brown (mesosoma very matt) and dull orange (mesosoma with a dull sheen), and it is possible — although unlikely — that two species could be represented here. Most collection records of *Camponotus claripes* complex sp. JDM 779 come from the eastern margin of the Darling Range, but one minor worker has been collected at Norseman in the Coolgardie subregion. The ant is likely to occur in suitable habitat in SA and possibly other states but has probably been confused with *C. claripes* in the past (e.g. McArthur 2007, 2010). This species, like many of its relatives, is often taken on trees; in this case, several records come from wandoo (*Eucalyptus wandoo*) or powderbark (*Eucalyptus*

accedens) wandoo trunks (hand collection and bark trap). The Norseman specimen was apparently tending a cicadellid, and the latter is glued on a point with the ant. *Camponotus claripes* complex sp. JDM 767 has the identifying features noted in discussion of the preceding species, i.e. erect setae on the antennal scape and glossy cuticle. The legs are yellow-orange in both subcastes and the underside of the head in the major worker typically has more than 50 erect setae. This ant tends to be found in more densely forested areas than *C. claripes* sp. JDM 779 and seems to be confined to the Darling Range and its immediate hinterland. The observations made regarding the broader distribution of *C. claripes* complex sp. JDM 779 in Australia probably apply to this near relative of *C. claripes* also, except that it may require a more humid, cooler environment than the former species. However, the closest relative of *C. claripes* complex sp. JDM 767 is almost certainly *C. peseshus*, an even more arboreal species, from which it differs only in the degree of hairiness. Possibly the former represents a founder population of *C. peseshus* that became separated from the parent population at some stage in the past, and hairiness evolved in allopatry. Like *C. claripes* sp. JDM 779, *Camponotus claripes* complex sp. JDM 767 has also been taken in bark traps, but on marri on this occasion. Other specimens have been pitfall-trapped; one major worker being trapped in revegetated *Verticordia/Banksia* woodland.

The minor worker of what is here tentatively called *Camponotus peseshus* (formerly known as *C. nitidiceps* Viehmeyer) lacks erect setae on the lower genae, and the appressed setae on the hind tibiae are short and do not overlap. In the remaining species, these two conditions do not occur together, i.e. the lower sides of the head either possess erect setae or the appressed setae on the hind tibiae are longer and overlap. The major worker shares these two characters and is even easier to recognise; it is the only six-toothed member of the *C. claripes* complex in which the genae are glabrous (McArthur [2014] states that the minor worker lacks erect setae on the underside of the head, but an examination of the JDM/WAM minor workers indicates that this is true for only a minority of the ants). The WA populations of this species show some variation in the appearance of the minor worker: specimens from near the south coast are similar in colour to the syntype minor workers from Liverpool, NSW, and have the same emarginate clypeus but have six-toothed mandibles (stated to be five-toothed in the NSW type material). Minor workers from the Perth region and the south-west are lighter in colour (the mesosoma is variegated brown-and-yellowish) and have a planar or slightly convex anterior clypeal margin. The major workers appear to be more homogenous (although only one major worker from near the south coast was available for inspection). This species often nests in living or dead timber and is apparently capable of gnawing out its own nest chambers in tree-trunks, although it may also utilize existing tunnels made by bark beetles, termites, etc. (see cover illustration in the book by Heterick [2009]). Significantly, the syntype workers of *C. peseshus* were also collected in a rotting tree branch well above the ground, strengthening the likelihood that the WA material is conspecific with *Camponotus peseshus*. In WA, the ant appears to be confined to the south-west corner of the State and does not occur north of the Swan Coastal plain. The position adopted here is that the ant also occurs in NSW, and in all likelihood it also occurs in SA and Vic. *Camponotus peseshus* is not only common in the Perth metropolitan area but it is also a minor pest in houses throughout the south-west, where the first sign of its presence in the roof cavity is often frass and other materials appearing on the lounge carpet. As a result, occasional specimens have been submitted to the author by aggrieved householders for identification. This ant will also enter suburban kitchens in search of dead house crickets, sweet foodstuffs, etc. One of the syntype major workers of *Camponotus claripes nudimalis* Forel may belong to this species (see Excursus 1 in Part I).

Camponotus claripes complex sp. JDM 288 is another unfortunate victim of the confusion relating to *Camponotus claripes nudimalis* and *Camponotus marcens*. In this case, a major worker (CASENT0910373) has been imaged on AntWeb as a syntype worker of *C. marcens*. However, the minor worker has never been described (see discussion under Excursus 1 in Part I). Minor workers are distinguished by their relatively small size (HW ≤ 0.80 mm), more-or-less uniform honey-coloured body and appendages and lack of erect setae on the lower genae. The narrow head of the minor, its small size and its overall appearance is reminiscent of members of the *C. insipidus* group, but the position of the pronotal setae and the long antennal scape place them in the *C. claripes* group. The bulbous, bloated appearance of the head and the matt rugosity of the lower genae, which, however, lack erect setae, make the major worker unmistakable among otherwise similar members of the *C. claripes* complex. While not as commonly collected as some of its near relatives, this species can be found in the Jarrah Forest and Avon Valley subregions, but its occurrence in other parts of Australia is unknown. Most collections

have been by hand in open woodland; wandoo and powderbark wandoo are the tree species mentioned on labels. Such collections have been made of ants foraging on the ground or on the trunk of eucalypts.

Camponotus claripes has rarely been collected in WA. One of the two records mapped for this monograph is of the major worker of *C walkeri* Forel that was collected from Baudin Island in Shark Bay (*not* Baudin Island off the Kimberley coast as mapped in AntWeb) and is here made a provisional junior synonym of *C. claripes* (see Part I). However, apart from a single minor collected near Caiguna on the Nullarbor Plain, there appear to be no other JDM/WAM records of this ant that come from WA. The minor worker of *Camponotus claripes* can be confused with several other species, most notably *C. inverallensis*, but differs in its broadly emarginate or notched anteromedial clypeal margin and its monotonic brown coloration. The major worker has a glossy, uniformly black or blackish head, with erect setae on the lower genae, but does not have erect setae on the antennal scape. The body (including the gaster) is uniformly dark, and, when seen in profile, the dorsal face of the propodeum is ≤ the length of its declivous face. This combination of characters serves to identify the major worker of this species. The actual range of *C. claripes* in Australia is uncertain, since there is a strong likelihood that this ant has been and continues to be confused with other species; however, apart from type material from QLD, the JDM/WAM holdings also include QLD specimens. Logically, this species is also likely to be found in SA (although the colour pattern of the specimens on p. 77 of McArthur [2010] is suspicious), NSW and Vic. The form *C. claripes piperatus*, although synonymised with *C. claripes* by McArthur (2009), is likely to be genetically distinct. The Caiguna worker was collected in the evening on light clay soil in partially cleared mallee/saltbush scrub near the Caiguna roadhouse. It was foraging in twig and leaf litter. The large (HW > 0.90 mm) *C. claripes* complex sp. JDM 1345 is known only from the minor worker. Apart from its size, this species is markedly bicoloured, with a dark brown or blackish head and gaster and an orange to light brown mesosoma. The propodeal angle has ≥ 4 erect setae (≤ 3 erect setae in minor workers of its relatives). *Camponotus claripes* complex sp. JDM 1345 has been taken on the Nullarbor and also on the eastern edge of the Darling Range, south-east of Perth. Although it does not appear to be common, this species probably has a broad range in southern WA, extending into SA, at least. The two Dryandra minor workers were collected on a bark trap on a wandoo trunk, and the Madura specimens were also collected off a eucalypt trunk in chenopod shrubland. Two minor workers from near North Bannister were collected from under a stone in mixed jarrah/marri woodland.

Camponotus inverallensis (here raised to species — see Part I for details) is the most common member in the *C. claripes* group in this state, and arguably one of the most abundant and commonly seen of all WA *Camponotus* species; it also becomes the senior synonym of *C. churchetti* McArthur in this work. The two-toned brown (above) and yellowish (below) colour pattern of the head when the minor worker is seen in full-face view distinguishes this species from minors of *C. claripes* (head generally uniformly dark although the clypeus alone may be yellowish), while the appearance of the propodeum in profile sets *Camponotus inverallensis* apart from *Camponotus claripes* complex sp. JDM 288, in which the propodeum is evenly convex (convex anteriad, thereafter planar in *C. inverallensis*). The major worker is non-gracile, the length of the dorsal face of the propodeum ≤ length of its declivous face, the declivous face of propodeum is inclined at an angle of ≥ 60°, the mesosoma is glossy, the head has light orange tones in patches on the clypeus, the genae, on the occipital lobes and between the frontal carinae, and the anteromedial clypeal margin is feebly emarginate without a hint of a notch. This suite of characters serves to distinguish the major worker from its nearest relatives. In WA, concentrations of this species seem to be thickest in and around the Darling Range, but it can be found as far east as the Great Victoria Desert and at least as far north as Ethel Creek in the Pilbara (obscured in map). However, there are as yet no records from the south coast or the extreme south-west corner of the State. *Camponotus inverallensis* was described from Inverall, NSW and, in view of its ubiquity and broad range in WA, could also be expected to occur in southern QLD, SA, and Vic. Nests of this species are often found under rocks, logs and fallen branches. Minor workers are timorous and feign death when disturbed. Like most of its relatives, this species regularly forages on vegetation and has been taken in a bucket trap. Other specimens have been captured by hand or in pitfall traps.

Three of the six species in the *Camponotus discors* complex are undescribed; the three named species are very common, but the unnamed species are seldom seen, and, in the case of *Camponotus discors* complex sp. JDM 599, are known from a single series. Minor workers are generally similar to members of the *C. claripes* complex, but if viewed from above, the line indicating a vestigial

metanotal groove is lacking in this complex and the propodeum is usually not strongly laterally compressed. The anteromedial clypeal margin is often weakly arched, convex or crenulate with a small protuberance at the midpoint, but it is never planar, notched or broadly emarginate. The colour is predominantly ochre or brown or a blend of these colours. Most species also seem to be nocturnal. The major worker (known for four of the species) is best identified by the crenulate, planar anteromedial clypeal margin (which may, as in the minor worker, bear a small protuberance) and ochre, brown or blackish colour of the body that may be a monotone or variegated. The head is typically triangular and concave above.

Camponotus discors complex sp. JDM 599 is known only from the minor worker. Four individual specimens were collected at Ophthalmia Dam in the Pilbara many years ago. Nothing more is known about it. This striking little ant is unlike any other WA *Camponotus*, its large eye, the small, bristly, erect setae on the antennal scape and its raised mesonotum rendering it unmistakable. Most minor workers of *Camponotus consectator* (here treated as the senior synonym of *C. discors angustinodus* — see Part I) and all minor workers of *Camponotus* sp. JDM 1104 have small, erect setae on the genae, but these are lacking in the remaining members of the complex. Where the minor worker of *C. consectator* lacks these setae,

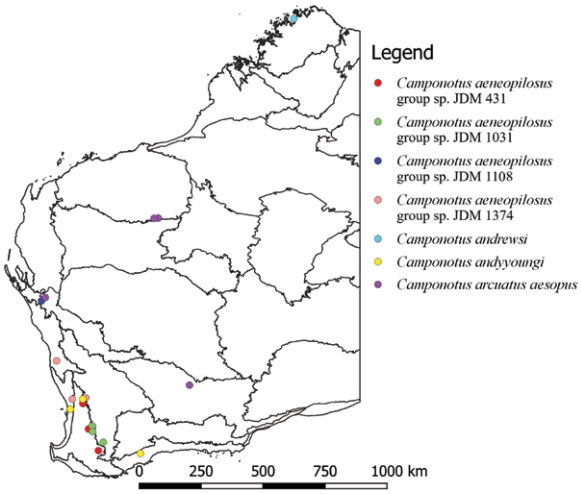

FIGURE 39 Distribution of *Camponotus aeneopilosus* group sp. JDM 431, JDM 1031, JDM 1108 and JDM 1374, *C. andrewsi*, *C. andyyoungi* and *C. arcuatus aesopus*.

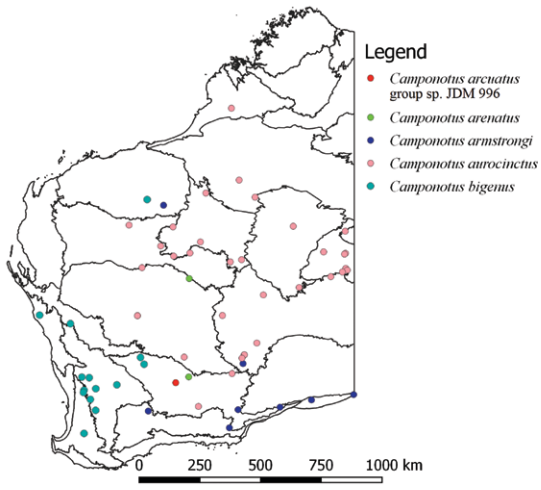

FIGURE 40 Distribution of *Camponotus arcuatus* group sp. JDM 996, *C. arenatus*, *C. armstrongi*, *C. aurocinctus* and *C. bigenus*.

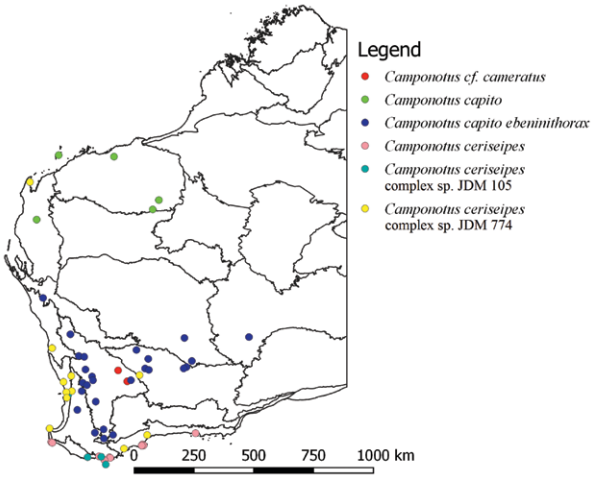

FIGURE 41 Distribution of *Camponotus* cf. *cameratus*, *C. capito*, *C. capito ebeninithorax*, *C. ceriseipes* and *Camponotus ceriseipes* complex sp. JDM 105 and JDM 774.

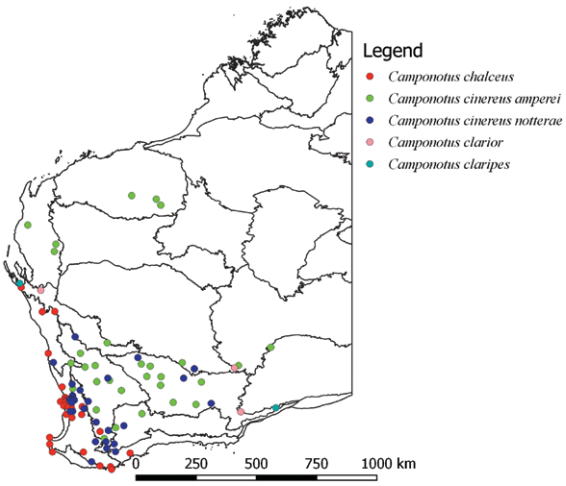

FIGURE 42 Distribution of *Camponotus chalceus*, *C. cinereus amperei*, *C. cinereus notterae*, *C. clarior* and *C. claripes*.

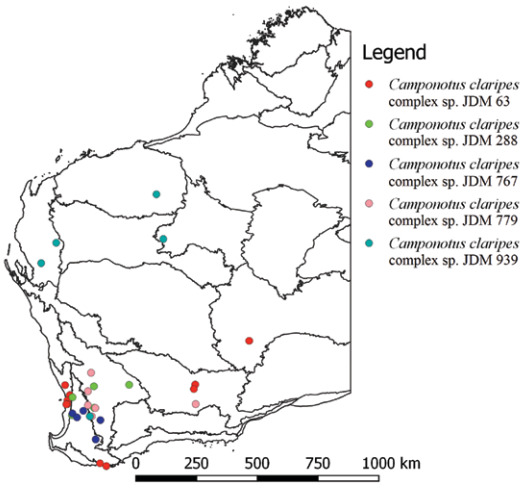

FIGURE 43 Distribution of *Camponotus claripes* complex sp. JDM 63, JDM 288, JDM 767, JDM 779 and JDM 939.

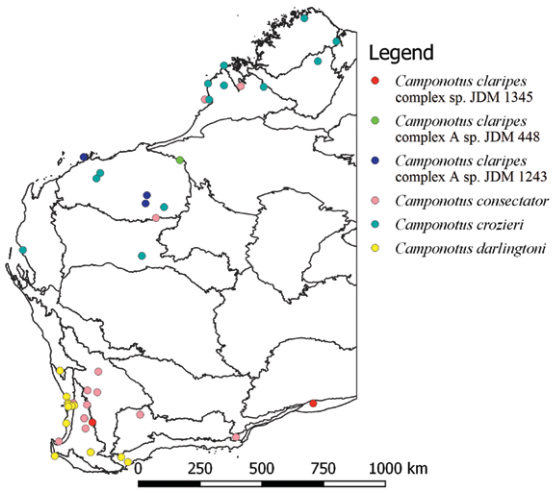

FIGURE 44 Distribution of *Camponotus claripes* complex sp. JDM 1345, *Camponotus claripes* complex A sp. JDM 448 and 1243, *C. consectator*, *C. crozieri* and *C. darlingtoni*.

it is indistinguishable from the minor worker of *C. gibbinotus* and requires an associated major worker for identification to be made. The genae of the major worker of *C. consectator* usually also possesses these erect setae, but where they are lacking the major can still be separated from the *Camponotus gibbinotus* major by the colour of the head (brown, with or without lighter patches versus uniformly yellowish or light ochre) and the mandibles (dark brown with a lighter brown strip versus uniform reddish-brown), and from *C. discors* by the colour of the mesosoma (concolorous in *C. consectator* versus light pronotum, darker mesonotum plus propodeum in *C. discors*). In both the minor and major workers of *C. discors* complex sp. JDM 1104 the small, erect setae are found along the entire margin of the head, on the frons and on the underside of the head capsule, but in *C. consectator* the erect setae on the sides of the head are confined to the lower genae and may be reduced to one or two near the articulation of the mandible, especially in the minor worker. In some workers the genal setae are lacking entirely (as mentioned above). *Camponotus discors* complex sp. JDM 1104 is occasionally found in the Carnarvon region and western Pilbara and has also been collected at Westonia in the eastern wheatbelt and at Lorna Glen in the eastern Murchison. The occurrence of this undescribed species in other states is unknown. The Westonia major worker was hand-collected at night in *Allocasuarina* thicket, and the Lorna Glen material was found on upland plain on grit and mudstone soil in mulga country. Some of the other specimens were pitfall-trapped but additional data are lacking.

Camponotus consectator has been collected at widely separated localities throughout the entire State, but mainly in the eastern margins of the Darling Range and in the western wheatbelt. Minor workers from Broome are larger and concolorous orange and may represent a different species, but they are otherwise a match for the southern material. *Camponotus consectator* was described from a queen but the holotype locality is 'New Holland', so the exact provenance of the specimen is unknown. Based on McArthur (2010), the range of this ant (erroneously called '*Camponotus cowlei*' by McArthur) includes all Australian mainland states except Victoria; however, the ant has been collected on the NSW/Vic border, so its range undoubtedly includes Victoria as well. Nests have been found under stones. Soil types include yellow loam, white sand, and 'light soil/clay'. Associated vegetation communities include mallee woodland, York/salmon gum, and mixed woodland (jarrah/marri/wandoo). (Note: This ant forms a tight complex with *C. discors* and *C. gibbinotus*: this author has sought to distinguish what seem to him to be three distinct forms, but integrated taxonomic analysis that involves molecular work may reveal additional cryptic species, or, conversely, may collapse at least two of these species into one taxon.)

Camponotus discors complex sp. JDM 772 is a very small (HW ≤ 0.80 mm), gracile, colour variable species that is known only from the minor worker. This ant shares with some very small *C. gibbinotus* minor workers a five-toothed mandible, but the head is brown to blackish and the vertex is convex, whereas in *C. gibbinotus* the head is yellow, and

the vertex is mostly planar. The remaining two species always have a six-toothed mandible. This ant is similar to *C. fraseri* McArthur but lacks semi-erect setae on the antennal scape. The species is quite uncommon and is only known from three localities on the Kwongan sandplain north of Perth and from Jandakot. This seems to be a sandplain taxon, a worker taken 15 km E. of Eneabba being pitfall-trapped in shrubland on white sand on laterite, while another worker, pitfall-trapped in a sand-mine control area just south of Eneabba, was captured in mixed low heath.

The minor worker of *C. discors* and the minor worker of *C. gibbinotus* are structurally almost identical, but the former has a head capsule that is mainly brown or dark brown and there is generally a strong contrast between the pale pronotum and the darker head and mesonotum, whereas the latter has a mainly yellow or orange head (often with a tawny tinge to the vertex) and a pronotum that is concolorous with the head and mesonotum or only slightly paler. The major worker can also be distinguished on head colour (yellowish or ochre in *C. gibbinotus*, brown with or without a few paler patches in *C. discors*) and colour of the mandible (uniformly reddish-brown in *C. gibbinotus*, and dark brown with a lighter strip beside the mandibular teeth in *C. discors*). The distinctly lighter-coloured pronotum also serves to distinguish the *C. discors* major worker from majors of *C. consectator* with glabrous genae. Note: There is a slight doubt about the identity of WA material labelled *'discors'* in that the syntype minor worker appears to have a more convex head, similar to *C. guidae* McArthur 2007. However, the head is damaged and possibly distorted, and the colour agrees well with WA material. The major worker also agrees with the syntype major. *Camponotus discors* has a generally arid area distribution, with most records away from the coast. The ant also occurs in QLD and SA and almost certainly can be found in NSW and the NT, based on records near state borders. The species has been hand-collected early in the morning on degraded scrubland on light red soil, and known habitats are mulga, mallee and spinifex. Red sandy soil is also mentioned on one label.

Camponotus gibbinotus is possibly the most widespread of all WA *Camponotus*; the species mostly seems to avoid the coastal sandplain that can be found south of Shark Bay around to the WA/SA border, but has been collected just about everywhere else. This ant has been mapped by McArthur (2010) for all mainland Australian states, and this is likely true, although some reservations are expressed here because of possible confusion with *C. discors* (McArthur's 2007 key does not adequately distinguish between the two species, and *C. discors* is not mentioned at all in his 2010 South Australian *Camponotus* guide). The following vegetation complexes or significant tree species are associated with *C. gibbinotus*: *Acacia/Hakea* shrubland with *Plectrachne* ground cover; York/salmon gum remnant woodland; heathland; halophytic shrubland; and mulga, mallee and spinifex woodland. At least one specimen has also been collected in a bark trap on a wandoo trunk and another in a bucket trap on an unspecified

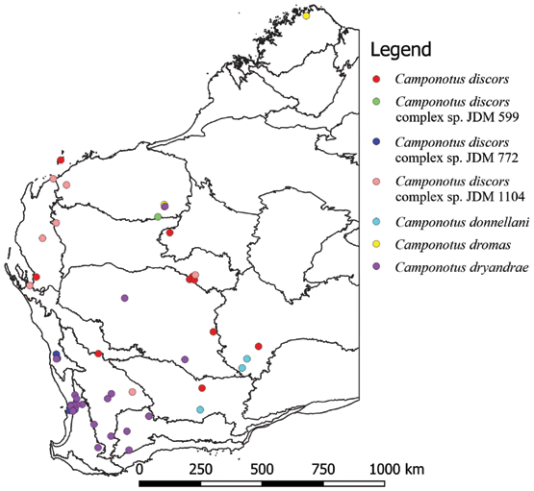

FIGURE 45 Distribution of *Camponotus discors*, *Camponotus discors* complex sp. JDM 599, JDM 772 and JDM 1104, *C. donnellani*, *C. dromas* and *C. dryandrae*.

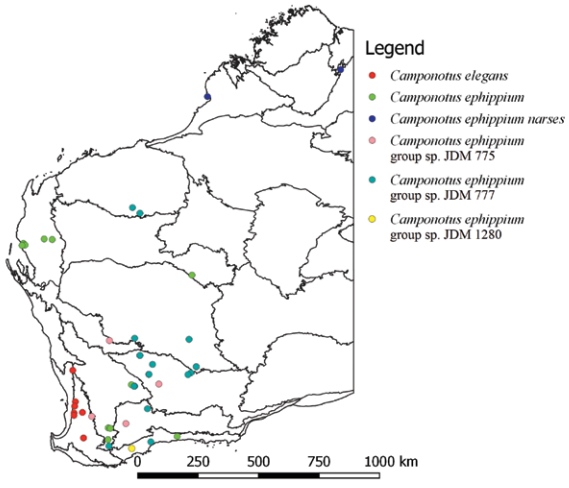

FIGURE 46 Distribution of *Camponotus elegans*, *C. ephippium*, *C. ephippium narses* and *Camponotus ephippium* group sp. JDM 775, JDM 777 and JDM 1280.

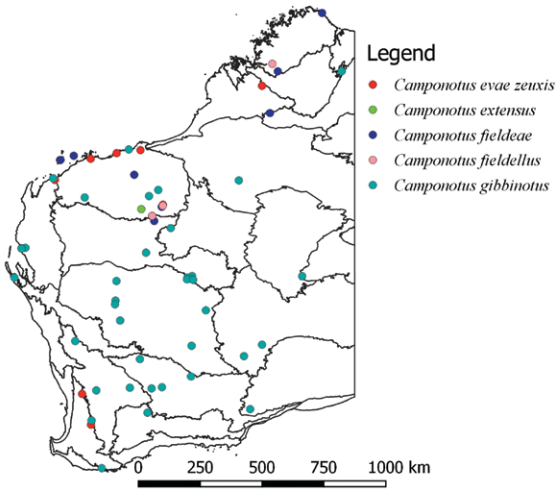

FIGURE 47 Distribution of *Camponotus evae zeuxis*, *C. extensus*, *C. fieldeae*, *C. fieldellus* and *C. gibbinotus*.

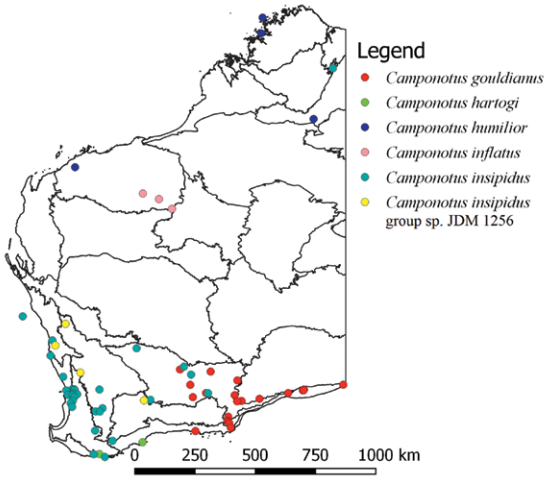

FIGURE 48 Distribution of *Camponotus gouldianus*, *C. hartogi*, *C. humilior*, *C. inflatus*, *C. insipidus* and *Camponotus insipidus* group sp. JDM 1256.

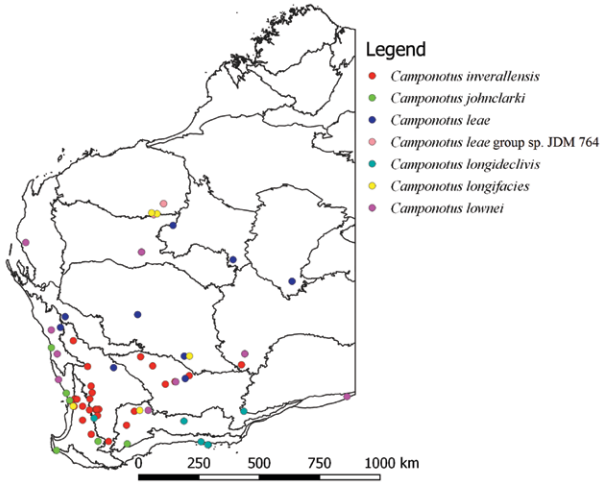

FIGURE 49 Distribution of *Camponotus inverallensis*, *C. johnclarki*, *C. leae*, *Camponotus leae* group sp. JDM 764, *C. longideclivis*, *C. longifacies* and *C. lownei*.

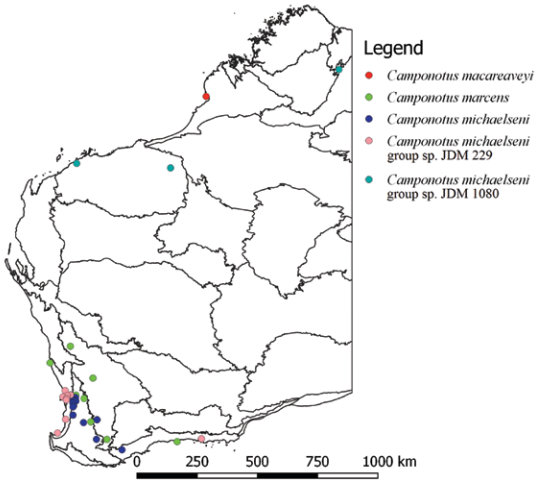

FIGURE 50 Distribution of *Camponotus macareaveyi*, *C. marcens*, *C. michaelseni* and *Camponotus michaelseni* group sp. JDM 229 and JDM 1080.

tree species. Soil types include lateritic sandplain, yellow loamy soil and kaolinised slopes in breakaways. The author has frequently seen this ant while collecting in woodland at night; usually, a minor worker will be spotted standing stationary at the end of a grass blade or fallen twig, slowly testing the surrounding air with its antennae.

Camponotus claripes group complex A sp. JDM 448 and *C. claripes* group complex A sp. JDM 1243 are two *C. claripes*-like species found in the north of the State. Both are very rare or localised. Their true affinities — apart from the fact they are obviously members of the *C. claripes* species-group — are unclear, hence their provisional placement in a separate complex for the time being. The minor workers of these two taxa share with the *C. claripes* complex the elongate propodeum that is straight in profile, large eyes, and an elongate antennal scape, but, when seen in dorsal view, they lack the line that indicates the separation of the mesonotum and the propodeum, and the propodeum is less laterally compressed. However, they lack the high propodeum seen in minor workers of the *C. discors* complex and are otherwise coloured. *Camponotus claripes* group complex A sp. JDM 448 is distinguished from its fellow by its smaller, less protrusive eyes and its red-and-black body (the body is brown in *C. claripes* group complex A sp.

JDM 1243). Only a single minor worker is known for this attractive, enigmatic species, and it was collected in the northern Pilbara on the edge of the Great Sandy Desert. The sole specimen was pitfall-trapped, but nothing more is known about the ant. The major worker of *C. claripes* group complex A sp. JDM 1243 is generally *C. claripes*-like, but the antennal scape barely reaches the vertex, the vertex itself is convex medially with the occipital angles almost lobate when seen from above (reminiscent of the *C. ephippium* species-group), the head in full-face view is parallel-sided and the genae are glabrous. *Camponotus claripes* group complex A sp. JDM 1243 is known from three locations in the Pilbara subregion only, including a nearshore island (Enderby Island). The occurrence of this species outside of WA is unknown. The Enderby Island workers were taken in red sand, and the mainland material was taken from two separate minesites.

Two groups with few WA representatives complete the discussion of WA sugar ants. The largely Indomalay *C. reticulatus* species-group is represented by *C. andrewsi*. Both major and minor worker are easily identifiable as belonging to this group when seen in profile, as the propodeum is concave. This species also has large eyes and broadly separated frontal carinae that are evenly curved throughout their length. In several *C. aeneopilosus* group species such as *C. chalceus*

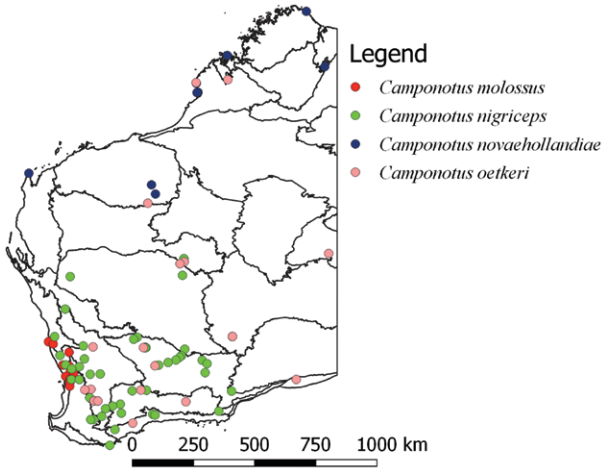

FIGURE 51 Distribution of *Camponotus molossus*, *C. nigriceps*, *C. novaehollandiae* and *C. oetkeri*.

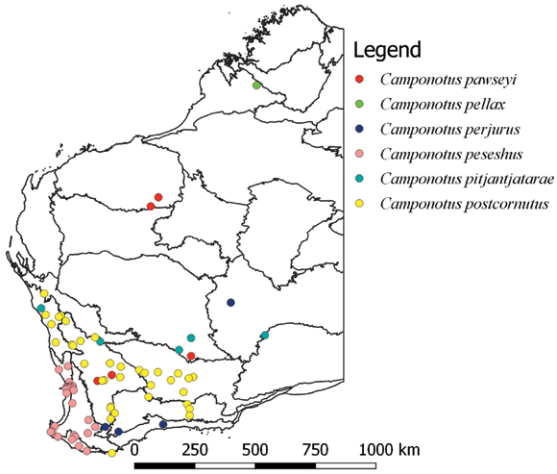

FIGURE 52 Distribution of *Camponotus pawseyi*, *C. pellax*, *C. perjurus*, *C. peseshus*, *C. pitjantjatarae* and *C. postcornutus*.

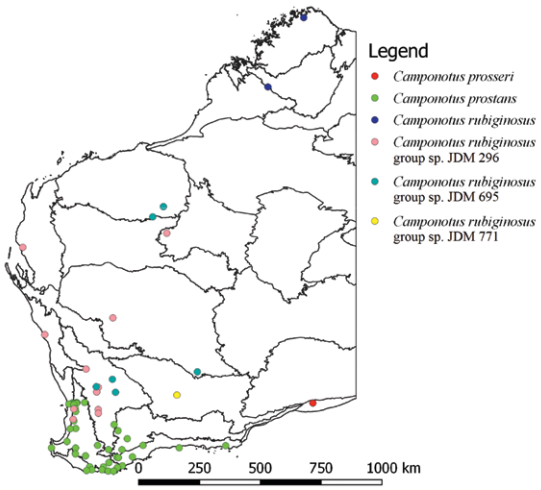

FIGURE 53 Distribution of *Camponotus prosseri*, *C. prostans*, *C. rubiginosus* and *Camponotus rubiginosus* group sp. JDM 296, JDM 695 and JDM 771.

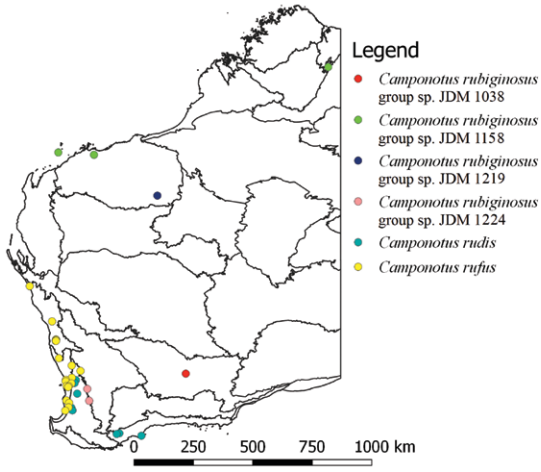

FIGURE 54 Distribution of *Camponotus rubiginosus* group sp. JDM 1038, JDM 1158, JDM 1219 and JDM 1224, *C. rudis* and *C. rufus*.

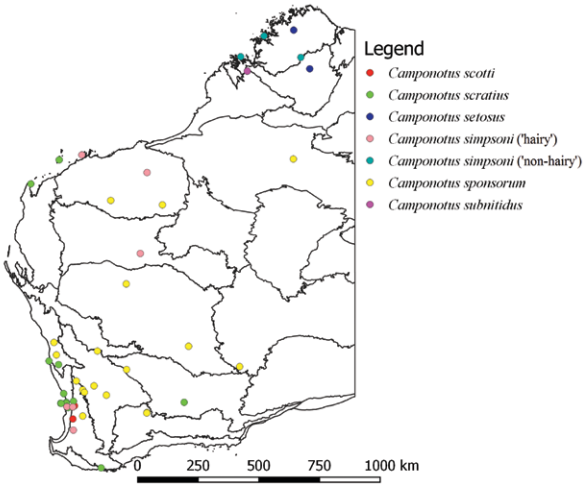

FIGURE 55 Distribution of *Camponotus scotti*, *C. scratius*, *C. setosus*, *C. simpsoni* ('hairy'), *C. simpsoni* ('non-hairy'), *C. sponsorum* and *C. subnitidus*.

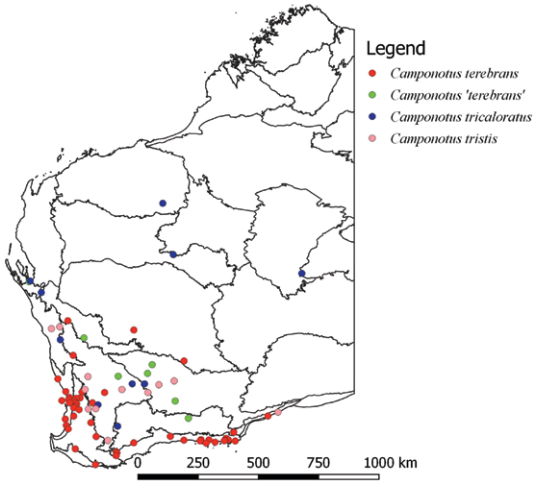

FIGURE 56 Distribution of *Camponotus terebrans*, *C. 'terebrans'*, *C. tricaloratus* and *C. tristis*.

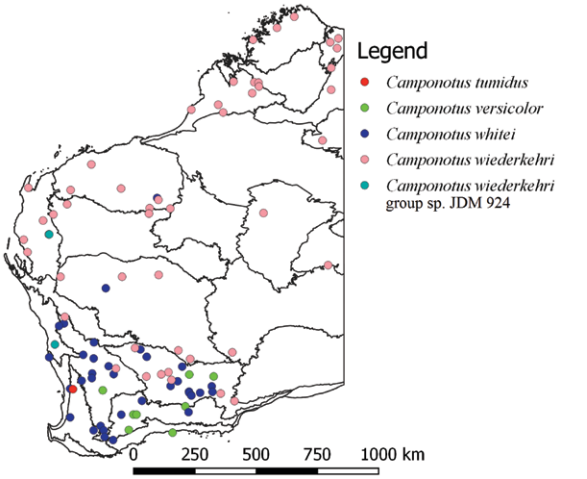

FIGURE 57 Distribution of *Camponotus tumidus*, *C. versicolor*, *C. whitei*, *C. wiederkehri* and *Camponotus wiederkehri* group sp. JDM 924.

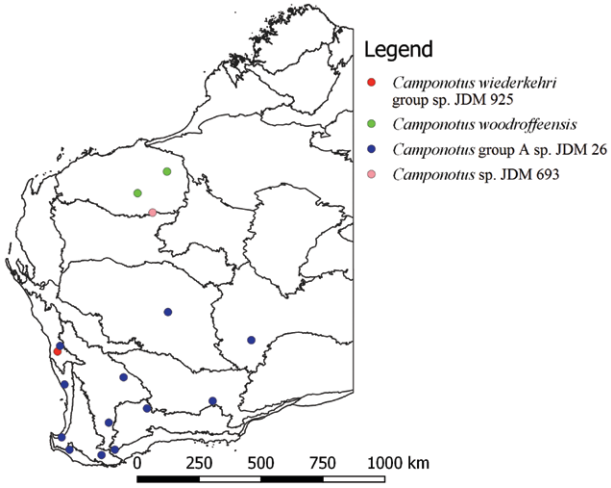

FIGURE 58 Distribution of *Camponotus wiederkehri* group sp. JDM 925, *C. woodroffeensis*, *Camponotus* group A sp. JDM 26 and *Camponotus* sp. JDM 693.

that share the concave propodeum, the eyes are moderate in size and the frontal carinae are sinuate. The sole JDM/WAM record of *C. andrewsi* is a minor worker that was collected in a malaise trap on Middle Osborn Island in the northern Kimberley. *Camponotus andrewsi* was described from Christmas Island, and is likely to also occur in the NT (this may be the species illustrated in Fig. 31b in Andersen [2000]).

The *Camponotus arcuatus* species-group is characterised in the minor worker by having a broadly arcuate mesonotum and propodeum when these parts are seen in profile, and a narrowly to broadly triangular head, seen in full-face view. The sides of the head diverge posteriad. The major worker (known only for *Camponotus* cf. *cameratus*) also has a strongly arcuate mesosoma when this part is seen in profile. The minor worker of *Camponotus arcuatus* group sp. JDM 996 differs from the minor worker of the other two species in its black-and-red coloration (*Camponotus arcuatus aesopus* and *Camponotus* cf. *cameratus* both being black ants), and also in the row of paired bristly setae that are located close together on either side of the midline of the narrow propodeum. The sole known worker of this species was collected at Dedari in the goldfields. *Camponotus arcuatus aesopus* is known only from the description, the type material believed to have been destroyed in the war. However, the description of the minor

is sufficient, given the very singular appearance of this ant, for extant material to be identified. In this species the profile of the minor worker (the only subcaste known) is almost completely hemispherical (more elongate and sloping in the minor of *Camponotus* cf. *cameratus*), and, when viewed full-face, the eyes are placed near the vertex, which is folded on to the genae through a blunt angle (best seen in profile). The head of the minor worker of *Camponotus* cf. *cameratus*, viewed full-face, has evenly convex sides and a weakly convex vertex without an angle. *Camponotus arcuatus aesopus* is known from several widely scattered records in the southern half of WA. There are no label data, but the ant has been seen foraging on bushy shrubs (pers. obs.). The Atlas of Living Australia lists two ancient records of this species, one from SA, and one from Vic, but they do not appear on AntWeb and require verification. The species here called '*Camponotus* cf. *cameratus*' is likely the actual species, but the WA minor workers appear to be slightly less hairy than eastern states workers, judging by AntWeb images. The minor only has been collected in this state. Collections have been made at a couple of locations in the eastern wheatbelt. Elsewhere, the ant is known to occur in NSW and QLD. Two minor workers collected at Carrabin were taken in *Eucalyptus capillata* woodland. The Mukinbudin minor worker was hand-collected in the Mukinbudin Caravan Park.

Colobopsis (Figure 59)

The genus *Colobopsis* was resurrected by Ward et al. (2016), but the adult workers cannot easily be distinguished from those of *Camponotus* based on morphology. *Colobopsis* major and minor workers can be separated from other formicines (apart from *Camponotus*) by a combination of mesopleural gland absent; PF 6,4; a first gastral tergite that is less than half the length of the total length of the gaster; and spines or sharp angle absent from mesosoma and petiole. For those *Colobopsis* or *Colobopsis*-like species occurring outside of Fiji and New Caledonia, the antennal insertions are diagnostically useful (positioned at about the midlength in *Colobopsis*, and usually in front of the midlength in *Camponotus*) as are the lateral extensions of the clypeus (they appear to be absent in *Colobopsis*, being separated from the rest of the clypeus by a sulcus or at least an impression, and prominent in *Camponotus*). *Camponotus* pupae are always enclosed in cocoons, but in *Colobopsis* the pupae are naked. The *Colobopsis* major worker (here known only for *Colobopsis gasseri*) has a phragmotic head used for blocking the entrance hole to the nest, and all species are strictly arboreal.

Colobopsis gasseri has a smoothly rounded propodeum and the mesosoma is without erect setae or pubescence. *Colobopsis* (?) sp. JDM 927 has the propodeum tapered to a ridge dorsally, and the mesosoma is pubescent with erect setae on all body surfaces. *Colobopsis gasseri* is very common in WA and is seen just as often in suburban gardens on vegetation, especially tree branches, as in its native environments. In WA, this species is restricted to the south, where it has been recorded as far north as Kalbarri and east to about the Fraser Range. No collections have been made in the south-western tip of the state. Outside of WA, *Colobopsis gasseri* has been recorded from all states except for the NT. The ant has not been recorded from rainforest, and its most frequent habitat is eucalypt woodland, but it also occurs in *Banksia* woodland, mallee and sandplain heathland. There is even one record from sugar cane. Colonies of *C. gasseri* are typically found in eucalypt branches or trunks and, according to McArthur (2010), they do not make galleries in the wood but avail themselves of existing tunnels made by other insects, notably termites. *Colobopsis* (?) sp. JDM 927 is doubtfully *Colobopsis*, as it appears to have distinct lateral extensions to the clypeus, despite its generally *Colobopsis*-like appearance, and may belong to *Camponotus* (*Myrmamblys*). The major worker would be determinative for this species' proper assignment to a genus should it be found. Minor workers of *Colobopsis* (?) sp. JDM 927 are known only from two locations (Yanchep and the Eneabba district) on coastal sandplain north of Perth. Both sets of specimens were pitfall-trapped, the Yanchep workers in jarrah/tuart woodland, and the Eneabba workers on a crest with vegetation associations on the label given as '*Pileanthus filifolius*' and '*Eremaea beaufortioides*'.

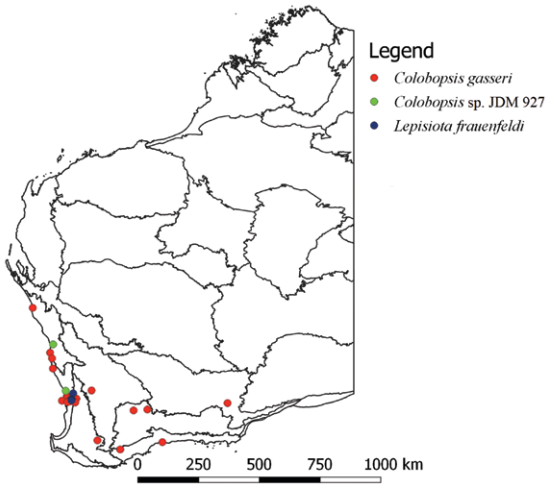

FIGURE 59 Distribution of *Colobopsis gasseri*, *Colobopsis* sp. JDM 927 and *Lepisiota frauenfeldi*.

Lepisiota (Figure 59)

Lepisiota is an exotic genus known in this State only from recent incursions of the browsing ant (*Lepisiota frauenfeldi* [Mayr]). This species is somewhat similar in appearance to the native genus *Stigmacros*, but the mesonotum is strongly constricted anteriad and almost tubelike, a condition not seen in native formicines, and the propodeal spiracle is situated just below the propodeal angle. In similar *Stigmacros*, the mesonotum is not constricted in such a fashion, in fact may be at its widest point in this sector, and the propodeal spiracle is located laterally adjacent to the propodeal face and about halfway down the propodeum. Usually this spiracle is directly under a prominence, denticle or small spine. This species came to the attention of WA authorities in 2013 when an incursion was identified at Perth airport. Several additional infestations have since been discovered in and around the airport and also at the RAAF base at Pearce. The infestations at this point of time appear to have been eradicated but there is now statewide monitoring of this pest. The ant has also been detected at Darwin, in the NT, and activities to curb its spread are still ongoing in that state. Browsing ants eat and displace native ants and other insects and also farm and protect scale insects that can damage plants and carry plant diseases; they thus pose a potent threat not only to the environment but also to agriculture and horticulture, and, consequently, Australian trade.

Melophorus (Figures 60–72)

Melophorus workers can readily be assigned to that genus because of their elongate, tear- or comma-shaped propodeal spiracle, a psammophore that is usually present on the clypeus, other curved, elongate setae on the mandibles and on the underside of the head, and a tuft of J-shaped setae on the ventral mouthparts. Workers are polymorphic. An astonishing 78 species (84% of a total of 93 species known for this endemic Australian genus) occur in WA. The genus was recently revised by Heterick et al. (2017), and the reader is referred to that publication for additional details and the explanation of abbreviations used in this text. Unless specifically attributed to other authors, information on habits, preferred habitat, etc. below is to be found in Heterick et al. (2017) or comes from label data.

The *Melophorus potteri* species-group comprises three species found in WA. These ants have a large, oblique propodeal spiracle situated well before the declivous face of the propodeum so that is bisects much of the propodeum. The mandible is modified and lacks teeth or has tiny, even denticles only in two of the species, and these two species have a PF of 3,4. *Melophorus pelecygnathus* has an edentate mandible or just the smallest of crenulations along the mandibular edge, the PF is 3,4 and the anterior margin of the clypeus is straight. Its shovel-like mandibles confer upon this rarely seen species a spectacular appearance. Only a couple of widely separated collections have been made in WA at Kwelkan in the Avon wheatbelt and at the boundary of the Great Victoria Desert and Murchison subregions. This species is also found in NSW, QLD, and SA. The habits of the ant are unknown but are almost certainly specialised. The much more common *Melophorus potteri* has distinguishable mandible teeth, the mandible is expanded distally, and workers usually have a protrusive anteromedial clypeal margin. This widespread ant is found from the Darling Range eastward, in the inland deserts and at least as far north as the Pilbara. *Melophorus potteri* has been found in all Australian states except the ACT. This species raids termite mounds and carries off the adult termite workers. The third member of the group, *M. macroschismus*, has a PF of 6,4, the mandibles have a more conventional appearance, are not expanded distally and have the 5-toothed condition found in most *Melophorus*. *Melophorus macroschismus* is mostly confined to WA, where it has only been collected in the Avon wheatbelt, the Coolgardie subregion and the southern edge of the Yalgoo subregion, with one additional record (TERC) from SA. The major worker is unknown; neither is anything known about its habits.

The extraordinary minor worker of *M. majeri* has a horse-headed appearance with very long, thick antennal scapes, and a carinate mesosoma. This ant is the only *Melophorus* known to possess short propodeal teeth. The major worker is more conventional in appearance but also carries the propodeal teeth. The hind tibia also lacks an apical spur — unusual in *Melophorus*. Because of its aberrant appearance, this *Melophorus* is placed provisionally in own monotypic species-group. This rare, white sandplain species has been collected only three times, once from a nest at Wellstead east of Albany, once in Cape Arid National Park, and once from near Eneabba in the Geraldton Sandplains subregion. The nest was contained within rotted wood under the soil surface.

The *M. fulvihirtus* species-group contains just two members, one of which is found in WA. Like the following species-group (the *M. anderseni* species-group), molecular analysis may reveal this group to be part of the large *M. biroi* species-

group, despite several synapomorphies (no material was available for PCR analysis at the time of the generic revision). *Melophorus barbellulatus* is distinct from other *Melophorus* in its vestiture of small, peg-like bristles that cover the head and mesosoma combined with flattened pronotum and mesonotum and a very short, stout apical metatibial spur. This rarely seen species has been collected in several WA locations from Boddington in the south, Kellerberrin in the east and as far as Tardun in the mid-west of the state. The ant also occurs in SA and Vic. The other species in the group, *M. fulvihirtus* (not found in WA), is known to raid meat ants' nests, presumably carrying off their brood, but there are no ecological data on *M. barbellulatus*.

The *M. anderseni* species-group is another small group that includes raiders of other ants. *Melophorus anderseni* itself does not occur in WA, but three other members of the group can be found in this state. As is the case with most of the species found in these small specialised groups (i.e. the *M. potteri*, *M. majeri*, *M. fulvihirtus* and *M. anderseni* species-groups), the workers are very rarely seen and may require quite specific environmental conditions and (in the case of ant and termite raiders) adequate populations of their prey species. *Melophorus andersenioides* belongs to the same species complex as *M. anderseni*, and has the same thick quadrate petiolar node as well as the characters it shares with all the members of the broader group, namely, the very short maxillary palps that do not reach the neck and have a pointed, awl-shaped terminal joint, mandibles with a strongly oblique masticatory margin, and an absent metatibial apical spur. The mandible bears four teeth. *Melophorus chrysus* and *M. subulipalpus* have a node that in profile appears as a thickened scale. In WA, *Melophorus andersenioides* has been collected in a couple of localities in the mid-west of the state at Eneabba and Nerren Nerren Station. This species also occurs on Australia's east coast in northern NSW and southern QLD. *Melophorus andersenioides* nests in red soil and there is circumstantial evidence it is a social parasite of the common meat ant *Iridomyrmex purpureus* (its near relative *Melophorus anderseni* is a stealth raider of the northern meat ant *I. sanguineus*). *Melophorus chrysus* is glossier than its close relative *M. subulipalpus* and has a smoothly rounded pronotum and bright yellow coloration. Some populations also have fine, long, erect setae on the legs (the '*pillipes*' condition, an infraspecific feature of some *Melophorus* species, especially in the *M. fieldi* species complex), a feature not found in *M. subulipalpus*. *Melophorus chrysus* has only been collected twice in WA; once in the Pilbara and once at Wungong catchment, just south of Perth. The ant is also found in NSW, QLD, and SA. Vegetation associations for this species include mallee (most collections) and marri forest, and at least one sample has been taken on sandy soil. A collection taken near Adelaide was found in galleries of *Melophorus laticeps*, but it is not known if this association is deliberate or simply a case of one species taking advantage of the nest space provided by the other. *Melophorus subulipalpus* has a flattened pronotum, a matt appearance and is ochraceous in colour. The major worker is unknown. Workers have been collected a few times in WA in the Coolgardie, Gascoyne, Pilbara and Great Victoria Desert subregions. There is also one South Australian record. The South Australian specimen was collected on a dune, but nothing more has been recorded for this taxon.

In contrast to the small specialist *Melophorus* groups, the *M. aeneovirens* group contains a large number (19 species) of *Melophorus* with generalist habits. These *Melophorus* species are immediately identifiable by their gracile appearance, their long, obliquely descending propodeum and their developed, apron-like anteromedial clypeal margin, which covers the base of their mandibles and is often protrusive when seen in profile. The ammochaetae (long, curved hairs) on the clypeus are, with one exception, arranged along or just above its anterior margin and are often coarse. *Melophorus nemophilus* is the exception. This species evidently belongs to the broader *M. aeneovirens* species-group but the ammochaetae in this case are fine and placed at about the midpoint of the clypeus. The anteromedial clypeal margin is not produced but is evenly rounded and does not cover the base of the mandibles. However, the propodeum is of the normal, obliquely sloping form. Based on its morphology and molecular data, this species is placed in its own complex. *Melophorus nemophilus* is generally distributed in the drier southern regions of WA. Elsewhere, it occurs in NSW, SA, and Vic. Unlike a lot of its congeners, this very lithe species often climbs the smooth trunks of eucalypts in search of nectar and honeydew (as seen by this author). Several workers have also been taken in malaise traps. Common habitats include duneland, mallee woodland and spinifex.

The nearest relatives of *M. nemophilus*, again based on morphology and molecular data, belong to the *M. bagoti* complex. The ammochaetae in this complex are arranged slightly above the

anteromedial clypeal margin, which comes to a point that may be blunt or sharp. In the remaining members of the *M. aeneovirens* group, the ammochaetae are positioned on the anteromedial clypeal margin which is more broadly rounded and is often deeply or shallowly notched but does not come to a point. Of the two species in the *M. bagoti* complex, *M. bagoti* itself is by far the best known. This is a spectacular, large orange ant that is a characteristic part of the insect fauna of the Australian deserts. Along with *Camponotus inflatus*, some workers of *M. bagoti* act as living reservoirs of honeydew and nectar and were sought as a vital food source by Aboriginal tribes that lived in desert areas. *Melophorus bagoti* can be separated from the other member of its complex, *M. gracilipes*, by the five rows of preapical spines on its metatibia (the normal two pairs of spines are found in *M. gracilipes*). *Melophorus bagoti* does not occur in the moist SWP but is found in all the remaining areas of WA. This species also occurs in the other Australian mainland states with the exception of the ACT and Vic. Recently, this animal has been chosen as a subject in studies of how ants orient in featureless landscapes, and its thermophilic behaviour and nest structure have also been examined. *Melophorus gracilipes* is very similar to *M. bagoti* in appearance, and the metatibia needs to be examined in order to identify it to species. *Melophorus gracilipes* has a range that embraces approximately the middle third of WA but is absent from the south-west corner and the Kimberley; its distribution probably also extends into the NT and SA. The species has a wide tolerance of different vegetation communities, and these include hummock grassland, mulga woodlands, acacia woodlands that include spinifex, and several sorts of sclerophyll woodlands. Arthropod carrion is included in the diet of the ant.

The large *Melophorus aeneovirens* complex, comprising 16 WA species, is one of four large complexes within the genus *Melophorus* that are well represented in the state, the others being the *M. biroi* complex (currently comprising 14 species but see below), the *M. fieldi* complex (22 species) and the *M. wheeleri* complex (10 species), these last three complexes being part of the *M. biroi* species-group. The *M. aeneovirens* species complex contains ants that are morphologically very similar to the *M. nemophilus* and *M. bagoti* complexes but can be distinguished by the appearance of the anterior margin of the clypeus and the positioning of coarse ammochaetae on that margin.

Melophorus canus is one of the more striking members of this group. The workers are matt and shagreenate with many long, flexuous setae over silvery pubescence. The main teeth of the mandible are supplemented by small or indistinct denticles, the number of teeth and denticles being six or more. The head of the minor worker in full-face view is also indented below the eye, giving the head a bell-shaped appearance. *Melophorus canus* has been found in several widely dispersed sites throughout WA. While not particularly common in collections, this species is found in all Australian mainland states except the ACT. Named vegetation associations for this species include limestone mallee and box pine, but it also occurs in a variety of other habitats. Ecological data are lacking. Another distinctive ant in this complex in which the head of the minor, in particular, is peculiarly flattened, is *Melophorus platyceps*. The worker palps are short, not reaching the neck, and the dorsum of the mesosoma is planar after the anterior pronotum, with just a vestigial metanotal groove in the minor worker and this part only weakly impressed in the major and media workers. *Melophorus platyceps* is found occasionally in the Avon Wheatbelt subregion, but appears to be more common in south-eastern SA and is also found in western parts of NSW and Vic. Greenslade (1979) suggests the flattened head of the minor worker is an adaptation to foraging under bark, and this possibility is given some currency by the fact this species has recently been collected in bee intercept traps set on the base of eucalypts in the Avon Wheatbelt subregion. Most collections have been in mallee woodland.

Melophorus attenuipes is a very small *M. aeneovirens* group member that appears to be mostly confined to mid-western WA. The minor worker can be identified by its small size (HW $\leq$ 0.50 mm, compared with HW > 0.50 mm in the remaining members of the group), and the conspicuous attenuation of the hind femur, which commences at about the midpoint. The media worker also exhibits this attenuation. In full-face view, the vertex of the minor is also strongly domed. The major worker is best identified by the flattened anteromedial margin of the clypeus, which does not extend beyond its lateral flanks (this part is protrusive to varying degrees in the remaining known major workers in the group). Collections have been made from the Kalbarri National Park to the central Pilbara. This species has been taken in pitfall traps but nothing more is known about it.

Four members of the *M. aeneovirens* group have tibiae with fine, appressed setae in additional to stout, socketed appressed to decumbent setae. Of these four taxa, *M. sulconotus* stands out

readily, as the profile of this ant is unmistakeable; the pronotum is flattened posteriad and the mesonotum is also flattened before descending to the metanotal groove. *Melophorus sulconotus* has been found in the far north of WA, near the NT border. This ant also occurs in the NT (including Groote Eylandt). Genetically, this species appears to be close to *M. rufoniger*, although the appearance is quite different. Hand-collected minor specimens taken next to the Victoria Highway near Kununurra were part of a colony that decorated their nest with pebbles that were much larger than the ants. Morphologically understood, *Melophorus griseus* and *M. gibbosus* seem to form a natural complex with *M. canus* (described above), and genetic sequencing, done for *M. canus* and *M. griseus*, supports the morphology. *Melophorus griseus* and *M. gibbosus* can usually be separated from *M. curtus* (the remaining member of the foursome) by the short, erect setae on the antennal scape and tibiae (the scape and tibiae are glabrous in *M. curtus*). The minor workers of the first two species also have a bell-shaped head when seen in profile (head square or oval in *M. curtus*). The frons of the *M. gibbosus* major worker (the major worker of *M. griseus* is unknown) is uniformly distinctly microreticulate, but partially shagreenate in *M. curtus*. In full-face view, the minor of *M. griseus* can be distinguished from the minor of *M. gibbosus* by its narrowly semi-oval frontal triangle and raised and laminate frontal carinae, the frontal triangle of *M. gibbosus* being triangular and the frontal carinae being flattened and not laminate or raised at the edge.

In WA, *Melophorus griseus* appears to be confined to the east Kimberley, but also occurs in the NT and QLD. No nests of this species have been identified, but it is described as being extremely timid (Heterick et al. 2017) and has been seen foraging among workers of the superficially similar *Iridomyrmex minor*. *Melophorus gibbosus* is more of a southern form, and its known range in WA extends from the Avon Wheatbelt to the Great Victoria Desert. Outside of WA, the species can be found in all mainland states except the NT, but the ant is generally rare. Vegetation associations for *Melophorus gibbosus* include *Eucalyptus maculata* open forest, *Callitris* woodland and paddock, but other ecological information is lacking. *Melophorus curtus* is a problematic species. Along with *M. biroi* and *M. turneri*, this taxon exhibits an uncomfortable amount of morphological variation leading to the possibility it could represent a complex of two or more species. However, no specimens were available for genetic sequencing when the *Melophorus* genus was being revised, and no morphological characters have been found that could be helpful in splitting the populations. The two most dissimilar worker morphs — a hairy, compact, short-legged form and a gracile, more glabrous form — both occur in WA. The compact brownish morph is fairly easily identifiable through the features mentioned in the key, but the gracile, reddish-and-dark-brown/black morph can often only be distinguished from typical specimens of *M. castaneus*, *M. praesens* and *M. rufoniger* by a careful examination of the pilosity of the tibiae. *Melophorus curtus* has not often been found in WA, although widely dispersed collections have been made throughout the State, and is much more common on the east coast. Populations of the various forms of this species are particularly abundant in NSW and QLD, but can be found in all Australian mainland states apart from the ACT and SA. As usual, label data are scant, but the ant seems to be often associated with black soil and has been collected in dry sclerophyll woodland and savanna, most frequently by pitfall trapping.

Three relatively small members of the *M. aeneovirens* species-group have a compact, sometimes quite arcuate mesosoma when seen in profile and also, when seen in profile, the mesosternal outline is strongly convergent with the outline of the dorsum of the mesonotum. In the remaining six members of the species-group the outline of the mesosoma is more elongate and gracile, and its outline is either straight or describes a weak arc. The mesosternal outline and that of the mesonotum are weakly convergent or subparallel.

The minor worker of *M. teretinotus* (the major worker is unknown) is easily the most striking of these three smallish *Melophorus*, the mesonotum and the propodeum being confluent, and the metanotal groove obsolete (i.e. lacking). This rather peculiarly shaped species is seen occasionally in pitfall-trapped collections made by environmental consultants, and current records come from Barrow Island, the Pilbara and the Kimberley region. The species also occurs in the NT. Based on a single gene (wingless [Wg]) this ant is most closely related to *M. praesens*, but nothing is known of its biology. The other two species, *M. aeneovirens* and *M. kuklos*, are very similar but can be distinguished by the strongly arcuate outline of the mesosoma in *M. kuklos* (much less pronounced in *M. aeneovirens*) and the recurved clypeus in *M. aeneovirens* that contrasts with a straight or weakly and broadly curved clypeus in *M. kuklos* (this part seen in profile). Additionally, the clypeus does not protrude over

the apical curve of the mandible in *M. aeneovirens* but is produced as a narrow flange that is notched or even forked at its midpoint in *M. kuklos*. *Melophorus aeneovirens* is among the most common of all *Melophorus*, particularly in the southern states, and was the first member of its genus to be described. As with many widespread, common species, there is a fair degree of morphological and colour variation (which ranges from light orange to almost black in the minor worker), and this includes the degree of compression of the dorsum of the propodeum and the appearance of the metanotal groove, which can be weakly to strongly incised. However, the appearance of the clypeus is invariable and serves to characterise this taxon. Unfortunately, despite its ubiquity, no specimens were available for sequencing to cement the assumption of monophyly of the various populations. Because this species is particularly common around capital cities, early collections have resulted in a number of junior synonyms, five in all. In WA, *M. aeneovirens* is particularly common in the Darling Range and south-west coastal areas but is more patchily distributed north of Shark Bay and in the dry interior. The ant also occurs in all mainland Australian states. Unlike many *Melophorus* that nest directly into soil, this species often nests under leaves and stones (Lowne 1865). This ant has been recorded from a variety of habitats, mostly well-watered forest, and can be found in grassy lawns in suburban properties. *Melophorus kuklos* is confined to the Torresian zone, and there are just two WA records from the northern Kimberley. The only other records all come from the NT. Specimens have been collected from such habitats or microhabitats as a rocky outcrop, eucalypt savanna and rainforest. The WA minor worker from Augustus Island was found in a malaise trap.

Melophorus clypeatus is unique in respect of its anteromedial clypeal margin, which is produced as a narrow, rectangular flange with a planar or weakly indented margin (this margin has a different appearance in the remaining five species in the *M. aeneovirens* group). *Melophorus clypeatus* is apparently a very rare species in WA and is known only from major and minor workers from two sites in the Pilbara subregion, one bordering the Great Sandy Desert subregion. Isolated records from interstate come from the NT and QLD (TERC). This species has been captured in ethylene glycol pitfall traps, but nothing is known of its habits. Note: there is confusion over the records for this ant and another uncommon species in the *M. biroi* species-group, *M. orthonotus*. Original locality records suggest two sites for this species and only one for *M. clypeatus*, but the 'types' in the published text in the revision shows the reverse, although the maps do not. These records cannot be readily checked as all specimens are regarded as types and no material has been retained in WA institutions. Despite the original locality data, which showed *M. orthonotus* as occurring only at one site, the provisional position taken here is that *M. clypeatus*, known from two specimens only, has been collected at the two sites shown on Figure 62, and *M. orthonotus*, known from ten major and minor workers has also been collected from two sites, shown on Figure 68. Since all records are in the same subregion, the issue is not a substantial one.

Melophorus tenuis (known definitely only from the minor worker) can also be readily identified by its dorsoventrally flattened head. A larger worker (possibly a media or a major worker) was briefly inspected in the TERC Ant Collection, and this specimen seems to have the same flattened head. *Melophorus tenuis* in WA is so far known only from the North Kimberley subregion. This species also occurs in the top end of the NT. A *Melophorus tenuis* worker from Morgan River, WA, was collected in an ethylene glycol pitfall trap in open savanna woodland dominated by *Eucalyptus tetradonta* and *E. miniata* over shrubs and low annual grasses on sandstone-derived soil.

In terms of appearance, the remaining four species are much of a muchness. *Melophorus mullewaensis*, known only from one pin of two damaged minor workers from Mullewa in mid-western WA, is characterised by the flattened pronotum (this part is convex in *M. castaneus*, *M. praesens* and *M. rufoniger*). Apart from the barest of collection details (even the name of the collector is lacking), everything else concerning this ant is a blank. The best identifying feature of the common *M. rufoniger* is the projecting anteromedial clypeal flange that protrudes over the basal half of the mandibles (best seen in profile). In *M. castaneus* and *M. praesens*, the clypeus is broadly and gently convex and protrudes over the base of the mandibles only. The minor and media workers have a slight medioccipital protuberance that is also found in *M. praesens* but not *M. castaneus*. Colour is also a helpful diagnostic feature for many minor worker specimens: the foreparts of this species are tan, orange or crimson but never brown although the gaster is brown, whereas the minor of the other two species typically has brown foreparts; less commonly these are black or light

reddish-brown. Major workers of *M. rufoniger* are noticeably larger than their two counterparts (HW of large major workers ≥ 3 mm compared with HW of large major workers ≤ 2.3 mm), and this size difference serves to distinguish this particular subcaste. *Melophorus rufoniger* appears to have a disjunct distribution in the state, with one band of collection sites in mid-western WA and the goldfields, a solitary Pilbara record and a further band in the Kimberley. This, however, may be an artefact of collecting effort, as far fewer collections have been made in remote desert regions in WA's interior. This ant is also very common in the eastern states, where it is readily confused with the almost identical and equally common *M. curtus* (see above for the features that will separate the two species). In fact, all Australian mainland states support populations of *M. rufoniger*. On a five-gene tree, this species is a sister to *M. praesens*. The species is probably a generalised scavenger, like most of its group, and has frequently been taken on both red and yellow soil in a variety of vegetative zones — *Eucalyptus* savanna, sclerophyll woodland, riparian woodland, mallee, *Callitris* woodland and *Melaleuca* woodland, to name just a sample.

The presence or absence of a slight medioccipital protuberance helps in discriminating between the minor workers of *M. castaneus* (absent) and *M. praesens* (present). In all subcastes the appearance of the appressed setae on the gaster is equally helpful in determining the species; in *M. castaneus* the appressed setae are very short and well- separated, whereas, in *M. praesens*, these setae are longer and overlapping, or at least almost touching. Another feature that is evident in typical minor worker samples is the flattened, elongate propodeum (sometimes with an anterior peak) found in *M. praesens*. The propodeum is usually symmetrically rounded in *M. castaneus* and never has an anterior peak. *Melophorus castaneus* has been found at several locations in WA's interior from the Great Victoria Desert in the south to the Ord Victoria Plain in the far north-east but is not common in WA. However, this widespread species is found in scattered populations in inland areas in all mainland Australian states. No specimens were available for sequencing. Despite not being particularly common, *M. castaneus* does occur in modified habitats such as paddocks and rehabilitated grasslands. *Melophorus praesens* has also been found at scattered sites over a vast stretch of WA, generally in arid or semi-arid locations. Like its relative, this species occurs in all Australian mainland states. Among the *Melophorus* species successfully sequenced for five genes, *Melophorus praesens* is the sister taxon to *M. rufoniger* (see above). Collections come from a variety of habitats, but label data are scant. Note: discussion regarding morphological variation in this taxon in the recent *Melophorus* revision is now thought to apply to *M. curtus* more properly.

The remaining 52 WA *Melophorus* taxa nearly all belong to the large and very successful *M. biroi* species-group, which represents the most successful and adaptable radiation of the genus in Australia. These ants are often ubiquitous in a variety of habitats, and during the warmer months half-a-dozen or more species can be found nesting and foraging in the same native habitat. Some in the *M. fieldi* complex are even active in fine weather during the cooler months. Unlike the rarer groups, many of these species are of uniform appearance and pose considerable taxonomic difficulties for the morphological taxonomist and other researchers who have an interest in identifying them. Often only the pilosity patterns can be used to distinguish between species. All species have a compact propodeum, five mandibular teeth (except for some taxa within the *M. wheeleri* complex) and a clypeus that does not protrude over the retracted mandibles. Three species are placed in the *M. ludius* species-group based purely on their DNA, since their overall morphology is indistinguishable from members of the *M. biroi* complex.

Two members of the *M. biroi* complex, namely *M. mjobergi* and *M. postlei*, have a distinctive *facies*; the area around the frontal carinae and the median sector of the clypeus is deeply recessed in the major worker and in this subcaste the torulus (antennal sclerite) forms a pedunculate flange around the antennal insertion, the clypeal psammophore in all subcastes is on or just above the clypeal margin, and the minor workers are covered with bristly, short, erect setae. Only one north-western WA population of *M. lanuginosus* (in the *M. fieldi* complex) shares some of these characters, but in that ant minor workers are hairy with thick, long, unmodified setae and have a thatch of long white setae on the pronotum that is lacking in *M. mjobergi* and *M. postlei*, and the clypeal psammophore is to be found at the midpoint of the clypeus. Moreover, the midline of the head capsule in the major and media workers of this aberrant population has a short, vertical flange not found in the two *M. biroi* complex species. The appressed setae in all workers of

M. mjobergi are dispersed and relatively thick and do not obscure the underlying cuticle, which is shining in appearance. In *M. postlei* these setae are fine and closely packed, forming a pubescence that hides the underlying cuticle, which is matt. In northern WA, especially in the Kimberley, *M. mjobergi* is possibly the most common *Melophorus*, and occurs in many habitats. However, this species does not occur south of the Pilbara subregion. Perhaps surprisingly, given its profusion in northern WA, this taxon seems otherwise found only in the western NT. Known habitats include various types of grassland and woodland and even a station rubbish dump with lots of wood litter and the grassy verge next to a service station. Occasionally this species will forage on flowers of shrubs. Based on a five-gene tree this species is the sister of *M. postlei*. The latter is a much less common ant in WA and is known from just two sites, one in the north-western Kimberley, and one in the southern Gascoyne bordering the Murchison subregion. Outside of WA, this species is not uncommon in the top end of the NT (including nearshore islands) and almost certainly also occurs in QLD. The only ecological note is that the species has been collected in mallee over sand.

The remaining WA members of the *M. biroi* complex (and the three members of the *M. ludius* species-group, which all occur in WA) can be characterised by sharing a combination of the following features which, taken together, are diagnostic for the group:

1. The metatibia of the major worker has only one preapical spur.
2. The clypeal psammophore is placed anteriorly at or just above the anterior margin of the clypeus in the minor worker, and often also the major worker.
3. The head is typically although not invariably dorsoventrally compressed in the minor worker, with the eyes placed high on the sides.
4. The species are small or smallish (HW of smallest minor 0.36 mm, average HW of smallest minors 0.46 mm; HW of largest known major 1.29 mm, average HW of largest majors [where known] 1.05 mm).

Melophorus graciliceps and *M. lissotriches* are two of the larger and particularly hairy members of this complex, whose probable phylogeny aligns them closely with *M. mjobergi* and *M. postlei* (this is supported by an unpublished three-gene tree that places these four ants in the same clade). They also share the same pubescence but have modified setae and lack the recessed areas on the frons found in the major worker of *M. mjobergi* and *M. postlei*. The modified setae (which range from flattened to clavate) and fine silvery pubescence may be found in other members of the *M. biroi* complex, but not in combination. These two close relatives can be separated by the nature of the eye in the minor worker when seen in full-face view (moderately convex and bulging well beyond the outline of the head capsule in *M. lissotriches*, but only weakly convex and barely breaking the outline of the head capsule in *M. graciliceps*), the profile of the mesosoma, also in the minor worker (sinuous in M. *lissotriches* and mostly planar in *M. graciliceps*), and the nature of the frontal carina and cuticle of the head in the major worker (frontal carinae straight or weakly convex, the cuticle matt weakly shining and pitted in *M. lissotriches*; frontal carinae concave, the cuticle smooth and shining in *M. graciliceps*). *Melophorus graciliceps* has been collected at several sites in WA, mostly in the Avon Wheatbelt subregion. This species also occurs in the other southern Australian states and southern QLD, but is not found in the ACT or the NT. The ant has been found mostly in mallee or savanna, often on sand; there is one record from a paddock. Six workers from Yathong in NSW were taken in a malaise trap. *Melophorus lissotriches*, in general, is found in drier areas than its relative and tends to have a broad distribution in northern as well as southern areas. Western Australian collections have been in the Murchison, but this ant occurs in all mainland states except the ACT and Vic. *Melophorus lissotriches* nests in red soil and brown soil, and label data indicate the following vegetation associations: box-pine scrub, savanna woodland and *Callitris* woodland, as well as a paddock. Lowery (cited in Heterick et al. [2017]) remarks that the ant is active at high temperatures (in this case 40˚C) and moves extremely fast over the ground. The foragers resembled pale *Iridomyrmex*.

Two of the three members of the *M. ludius* species-group (i.e. *M. pusillus* and *M. translucens*) have an easily recognisable combination of morphological features that place them apart from the third member of their species-group (*M. ludius*) and the remaining 10 members of the *M. biroi* species complex. These morphological features include small size (HW of small minor workers 0.50 mm ≤, HW of known major workers ≤ 0.80 mm); the visibly thin cuticle of the mesosoma, where the mesonotum is translucent to varying degrees; and the general lack of sculpturation,

particularly on the mesopleuron which is either completely smooth or has only vestigial sculpture. Both worker subcastes have a narrow, obliquely elongate propodeum and an elongate spiracle (≥ 0.67 × length of propodeum, measured along the spiracle) in *M. translucens*, but in *M. pusillus* major and minor workers the propodeum is not narrow and elongate, and the propodeal spiracle is shorter (≤ 0.50 length of propodeum, measured dorsoventrally). The eye is also rather large in *M. pusillus* (EL 0.15–0.21; EI 31–40) but of only moderate size in *M. translucens* (EL 0.12–0.15; EI 20–36). *Melophorus pusillus* has been taken at several widely separated localities in the interior of WA from the Pilbara in the north to the eastern goldfields in the south but is probably quite common throughout its remote habitat. This ant is also known to occur in all mainland Australian states. The genetic sequencing, based on one specimen, places this species as a sister taxon to *M. potteri*, but the morphological indicators do not match in the least and the linkage is likely due to long-branch attraction. Workers have been taken on dunes and in a malaise trough, but there are no other ecological data. *Melophorus translucens* is a WA endemic and has been collected in a few sites on the Swan Coastal Plain and once in the eastern Darling Range, all collections having been made on white sand, but has not been collected elsewhere. On a five-gene tree, this species falls just outside *M. hirsutus* (eastern states) plus *M. pusillus*. A nest was uncovered during the day in white beach sand amid low shrubs just east of Swanbourne Beach, but other data are scanty.

Melophorus cuneatus is another morphologically unique WA endemic. The propodeal dorsum of minor and media workers is greatly narrowed and almost acuminate and the metanotal groove is very deeply impressed. The mesonotum of the minor worker is hypertrophied so that the metathoracic spiracle is situated on the underside in a distinctly lateral position. The major worker does not stand out to the same degree, but the propodeal dorsum is much shorter than the declivous face, and this subcaste, along with the minor and media workers, has weak pubescence and a fair number of short, bristly, erect setae on the mesosoma. Only the minor worker of *M. propebiroi* has weak pubescence, but the major worker of that species is unknown, although it is likely to have a relatively longer propodeal dorsum (based on the appearance of the minor subcaste). *Melophorus cuneatus* is only known from the narrow strip of the Swan Coastal Plain, where all collections have been made between Binningup, just north of Bunbury, to Perth. The species is occasionally found in relictual dry sclerophyll bushland in and around suburban Perth, but nothing more is known about it. *Melophorus propebiroi* is probably a close relative of *M. cuneatus* and is the only member of the *M. biroi* species complex to share the weak gastral pubescence and plentiful short, bristly, erect mesosomal setae found on the latter. Only the minor worker has been collected. *Melophorus propebiroi* has a known range that almost overlays that of *M. cuneatus*, being found only on the Swan Coastal Plain from Bunbury in the south to approximately Gingin in the north. Like the former species, *M. propebiroi* is mainly known from pitfall-trapped workers taken in dry sclerophyll woodland. Occasionally it is found in relictual woodland in the Perth metropolitan area.

The minor worker of *Melophorus argus* (the major worker is problematic) stands alone in having a glabrous and bimodal mesosoma, when seen in profile, and a rounded propodeum. The mesopleuron is distinctly sculptured. The petiolar node is thickly squamiform, unlike the patently flattened node found in similar ants. This is a northern species that is confined to the northern Kimberley (known from the Prince Regent National Park in WA) and the top end of the NT. A possible major worker, similar to that of *M. marius*, was briefly noted in the TERC Collection by this author; otherwise nothing is known of the ant apart from the fact it has been pitfall-trapped. *Melophorus latinotus* is an uncommon ant with the general appearance of *M. propebiroi*, and may well belong to the same little clade as that species and *M. cuneatus*, but the minor worker (the major worker is unknown) can be distinguished from that ant and all others in its species complex by its matt, dull appearance and the uniform, minute, net-like microreticulation of the cuticle of the head and mesosoma. The specimens seen also have a transverse row of short, stout setae placed across the middle of the pronotum. The propodeum is weakly rounded and forms a slight angle between the dorsal and the declivous faces of the propodeum. *Melophorus latinotus* has been collected on three occasions north of Perth at Yanchep (one site) and Eneabba (two sites), respectively, but nothing more is known about it.

The remaining six taxa in the *M. biroi* complex and *M. ludius* are quite similar and require a suite of characters to be looked at in order for an identification to be made. In *M. gracilis* and *M. ludius* the major worker has a posterior clypeal margin that, when viewed in full-face view, is

straight along its length and does not descend at the sides due to the bulge of the clypeus. The minor worker of both species has a glossy mesosoma with any sculpture being vestigial, whereas the cuticle of the other species is duller with shagreenate, microreticulate or imbricate sculpture, especially on the mesopleuron. *Melophorus ludius* major workers have a compact profile with a raised mesonotum and a narrow, rounded propodeum, whereas the tiny *M. gracilis* major workers have an elongate, smoothly bimodal mesosoma when seen in profile. The *M. ludius* minor worker is usually glabrous (compared with the *M. gracilis* minor worker that has a pair or several long, erect setae on the pronotum) and always lacks erect marginal setae on the first gastral tergite (both these and additional erect setae can be found on the *M. gracilis* minor worker). *Melophorus ludius*, which comes in several colour forms including yellow, orange-and-brown and concolorous brown, occurs throughout WA, but is most common in the SWP including Perth suburban lawns and gardens, where the tiny minor workers may be mistaken for swift moving mites. *Melophorus ludius* is equally common in other Australian states and occurs throughout mainland Australia. *Melophorus ludius* was not able to be sequenced for five genes in the recent revision of the genus, but a three-gene tree places it as the sister of *M. pusillus*. The western minor worker of the species diverges somewhat from the eastern Australian form that supplied the type material (WA minor workers are smaller and have shorter antennal scapes and are almost always glabrous, whereas the large eastern form of the minor worker may have pronotal setae), but these differences could not be tested by molecular methods due to lack of suitable eastern states material. *Melophorus ludius* can be found in many habitats including sand and red loam soil, and one nest was even found under a rock — an unusual location for a *Melophorus* nest. Vegetation associations include *Eucalyptus maculata* open forest, *Eucalyptus largiflorens* woodland, 'sandstone scrub', paddock, *Casuarina* woodland and mulga bushland. Workers have also been retrieved from pitfall traps baited with faeces. *Melophorus gracilis* is more restricted in its distribution, being confined to WA and, in particular, to the Pilbara and southern Kimberley where, however, it can be locally common. Despite its similarity to *M. ludius*, *M. gracilis* comes out as a sister taxon to *M. 'biroi'* genetically (but see below for complications concerning the interpretation of the latter). *Melophorus gracilis* nests directly into sandy soil and workers have been seen carrying ant carrion.

Melophorus dicyrtos workers, especially the minor workers, can be very handsome, glossy ants with fine, imbricate sculpture around the mesopleuron and metapleuron. The species is usually not hard to pick, as the propodeum in both the major and the minor subcastes is noticeably protuberant and strongly truncate, with an elevated dorsal surface that is much shorter than the declivous surface. The metanotal groove is typically a deep, V-shaped notch. Most workers have long, flexuous setae, but these may be short and bristly. The species is also one of the larger members of its complex (HW of minor worker ≥ 0.65 mm, HW of major worker ≥ 1.25 mm). Only a few collections of *M. dicyrtos* have been made in WA, mostly from the Kimberley or Pilbara, but one dried husk believed to be of this species has come from the Zuytdorp area, near Kalbarri in the mid-west of the state. Collections elsewhere in Australia come from the top end of the NT and north-eastern QLD. This species is a climber, as is evidenced by the fact that specimens have been taken in yellow pan traps and flight intercept traps. Vegetation associations include vine scrub (over yellow basalt), eucalyptus savanna and closed woodland. Samples have also been collected from faeces-baited pitfall traps. The species has not been sequenced.

The minor worker of *M. microreticulatus* can be identified by its large eye (EI ≥ 40), its small size (HW ≥ 0.40 mm), the lack of erect setae on the mesosoma and first gastral segment and the reticulated sculpture over all or most of the mesosoma. As with *M. ludius* and *M. gracilis*, the major worker has an even posterior clypeal margin that is not arched and does not descend at either side, but this ant can be separated from the other two by its microreticulate sculpture. While it is probably a not uncommon component of the *Melophorus* fauna in drier areas, there have been few collections of *M. microreticulatus* in WA, and these have come from widely dispersed sites such as Leinster in the northern goldfields, Kambalda and the Southern Cross region in the southern goldfields and near Canna in the mid-west of the state. This little ant is also found in the east in all Australian mainland states. The only successful sequencing was for COI for a slightly aberrant minor worker, and while the results are not conclusive, they suggest this small species may be related to a clade that includes *M. gracilis*, *M. mjobergi* and *M. postlei*. Specimens have been collected in several sorts of eucalypt woodland and from a paddock. *Melophorus minimus* is a fourth

Melophorus species in which the major worker has an even posterior clypeal margin that is not arched and does not descend at either side. This is possibly the smallest *Melophorus*, and *M. minimus* minor workers are among Australia's smallest formicines (HW as little as 0.33 mm) being rivalled for this honour only by a few species of *Paraparatrechina* and *Plagiolepis*. Apart from these features, the *M. minimus* minor worker can be recognised by a propodeum that is strongly truncate and cuboidal and descends at an angle of ~90°, and its large eye (EI 40–41). The major worker is similar to the dark morph of *M. ludius* but is smaller (HW = 0.47 mm, compared with compared with HW > 1 mm) with a larger eye. In WA, *M. minimus* is known only from Tropicana minesite in the Great Victoria Desert. This minute species is otherwise known from a few scattered records in NSW, QLD, and SA, but is probably more common than the scant data suggest and has been overlooked due to its small size. No sequencing has been undertaken, and little is known of the ant's habits. Most specimens have been pitfall-trapped, and vegetative associations include remnant brigalow, savanna woodland and mulga.

Melophorus biroi (here treated as the senior synonym of *M. castanopus*) and *Melophorus marius* (here given revived status) are likely sister taxa, although no specimens of *M. biroi* have been available for sequencing. (References to '*M. biroi*' in Heterick et al. [2017] actually refer to *M. marius*.) These two species can be hard to separate, the chief difference being pilosity pattern; in the *M. biroi* minor worker erect setae can be found on the mesosoma (occasionally lacking due to abrasion) and on the first gastral segment. These setae are usually few in number and short, stout and bristly, but in very rare instances can be plentiful, long and flexuous. The minor worker of *M. marius* lacks such erect setae in those parts of the body. The major workers can best be distinguished by the appearance of the mesosoma in profile: in *M. biroi* the mesosoma is flattened and all sclerites are on the same plane (this is also true of the minor worker), but in *M. marius* the mesosoma in profile is bimodal and the pronotum and mesonotum are rounded. *Melophorus biroi* is mapped only for a likely minor worker (which differs slightly from typical eastern Australian material) taken from Dongolocking Nature Reserve in the southern part of the Avon Wheatbelt subregion. Another minor worker from WA seen in the TERC Collection may also belong to this species; however, the ant is undoubtedly rare in the state. *Melophorus biroi* is particularly common in south-eastern SA, and is definitely known to occur in the ACT, NSW, Tas, and Vic, and is also likely to be found in southern QLD.

Melophorus marius, as it stands, is likely to constitute a species complex that could include perhaps as many as half-a-dozen cryptic species across Australia. Several of these are likely to occur in WA. However, the molecular data do not agree with the morphological variation; thus, at the time of the *Melophorus* revision the authors were not able to split the component species in a workable key based on the morphology. The nominal species *marius* can be found throughout the breadth of WA, and also in all other Australian states including Tas. In WA, most of the morphs are of the *M. marius* type; in the south these ants are typically attractively bicoloured with tawny orange foreparts and brown gaster. A distinctive, largish black morph is common in the Kwongan heathland north of Perth. In the Pilbara, on Barrow Island and in other drier areas further north can be found a large-eyed form, which seems to correspond to '*M. fieldi propinqua*'. Dark brown or reddish forms intermediate between the black morph and the smaller orange-and-brown morph can be found in a variety of locations in WA, including *Banksia* woodland north of Perth. All of these forms vary in colour and size and eye size but seem not to have any discrete features that unequivocally pull them apart. However, in northern WA and in arid areas some workers may be found that are distinctly more highly sculptured, and those with larger eyes may even meld into *M. microreticulatus* in appearance. Finally, a collection in the Kimberley of foraging minor workers yielded two strikingly different morphospecies, one of which was of the typical *M. marius* form, while the other had a peculiarly planar mesosoma with only a hint of a metanotal groove. This was unexpected, as the ants were within a metre or so of each other and were assumed to be nestmates. These were sequenced and measured with the other *M. marius* samples, and produced anomalous results, but the two strikingly different forms were nested together in three- and five-gene trees. Clearly, more work needs to be done to untangle the systematics of this little *Melophorus*. *Melophorus marius*, as it is currently understood, inhabits all manner of vegetative habitats and soil types, but is not generally found in built-up areas.

The *M. oblongiceps* group is a monotypic complex. The workers of the sole species,

Melophorus oblongiceps, are uniform in appearance, the minor workers closely resembling the major workers, unlike other *Melophorus*. The maxillary palp is very short, with palp segments IV–VI barely longer than segment III, the entire palp barely reaching the middle of the underside of the head. However, the mandibles are long (the apical tooth of each mandible reaching the tentorial pit on the opposite side of the head). The medial sector of the clypeus is uniformly convex and protuberant, and the anterior clypeal midpoint is a small blunt angle. The combination of all these characters is sufficient to enable the identification of this species. Until fairly recently, this ant was believed to be restricted to the Lake Eyre basin in SA. However, since the *Melophorus* revision workers have been collected in the Kambalda district. The attempted sequencing of one specimen was successful for four nuclear genes but not COI so phylogenetic placement of *M. oblongiceps* is conjectural, but it may occupy a place somewhere near the *M. wheeleri* complex. Based on label data, the species may be adapted to foraging on the damp margins of salt lakes. This ant has also been found nesting on a lake margin.

Another small clade of salt lake dwellers is the *M. brevignathus* complex, of which only *M. marmar* occurs in WA. The head of major, media and minor workers is characteristically square, with the eyes placed at about the midline. The mandible is also distinctive, being narrow and coarsely striated with parallel, longitudinal striae. As with *M. oblongiceps*, the maxillary palps are short, reaching from about the middle of the underside of the head to the neck sclerite in any given worker. The anterior margin of the clypeus is sinuate, and projects as a bluntly triangular extension or a flattened dimple in the major and media worker. In WA, *Melophorus marmar* has been collected at Lake Lefroy in the Kambalda district and at Lake Austin, South of Cue. Outside of WA, the species also occurs in SA in the Lake Eyre Basin. Genetic sequencing suggests a relationship close to the *M. wheeleri* complex. This author has observed *M. marmar* nesting in the dry lakebed of Lake Austin and collecting seeds, leaves and possibly carrion from the lake surrounds. The nests of the ant were highly conspicuous because of their raised cup-shaped entrances composed of red soil. These were four to five centimetres above the surface of the lakebed and stood out when seen against the white salt encrusting the lake. This extension of the nest entrance is probably to avoid the nest being waterlogged. Some nests were more than forty metres from the edge of the lake.

The *M. wheeleri* complex consists of 10 species in WA. Taxa for which some of the biology is known are mostly or wholly granivorous. The major worker of this clade cannot be mistaken for any other *Melophorus* due to the hyper-development of the mandible for crushing vegetable material. This member is short, massive and elbowed so that it is directed posteriad. There may be a dorsal and a lateral mandibular face separated by a carina (e.g. in *M. laticeps* and its relatives), but this is lacking in major workers of other species. The maxillary palps tend to be short, barely extending beyond the neck sclerite in most species, if they even reach that far. The anterior margin of the clypeus is generally planar or weakly concave in the large major workers, and often of the same appearance in media and minor workers. While the major worker is distinctive, media and minor workers may be easily mistaken for members of the *M. fieldi* complex, but often have more than five teeth, in fact up to 15 in one species (always only five in *M. fieldi* complex workers).

Melophorus 'Group K' (TERC) is an enigmatic species, but clearly belongs to the *M. wheeleri* complex. Specimens are held in TERC and are not available for loan, but those seen are black or blackish-red, and have a mandible that has more than nine teeth, in fact, up to 15, on its masticatory margin. This renders them easily distinguishable from all other *Melophorus* in their complex. There is one WA record for this species, from Purnululu in the far eastern Kimberley. Other records are from the NT. There is no other information on this ant available.

Melophorus caeruleoviolaceus has some strong similarities to *M. setosus* and *M. solitudinis* (these latter are currently placed in the *M. fieldi* complex on morphological grounds, although they have no molecular data as yet), and shares the same types of modified setae, although those in *M. caeruleoviolaceus* are only spatulate at their ends. However, minor workers can have six mandibular teeth, the major worker has a planar or weakly concave anterior clypeal margin, and all subcastes have the short maxillary palps associated with the *M. wheeleri* complex. This species is set apart from others in its complex by its vestiture of modified setae and the iridescence found particularly in the major and media subcastes. *Melophorus caeruleoviolaceus* has been collected in WA on only three occasions, all in arid environments (Pilbara, Little Sandy Desert fringing the Great Victoria Desert, and Central Ranges). Nonetheless, this species has a broad range in the rest of Australia, despite the paucity

of collecting, and the ACT and Victoria are the only mainland states in which it does not occur. Gene sequencing places this species squarely in the *M. wheeleri* complex, although its sister taxon is uncertain (see discussion below under *M. parvimolaris*). *Melophorus caeruleoviolaceus* has been pitfall- trapped and taken in grassland, but there are no other ecological data.

Melophorus prominens is one of several taxa that appear to be closely related to the very common *M. wheeleri*, which gives its name to this complex, but the species has not been genetically sequenced to confirm this. *Melophorus prominens* major and media workers have the anterior margin of the clypeus produced anteromedially as a broadly angulate projection that is directed anteriad at an approximate right angle (when seen in profile). The major worker of this species also usually has only three distinct mandibular teeth, the fourth being reduced to an angle (the major worker of other members of the complex has four, five or up to 15 distinct teeth). Minor workers are hairy, possess a convex anterior clypeal margin and have a minutely striate mandible with six or more teeth. This can be enough to identify them, but major workers may be needed for confirmation of the species. *Melophorus prominens* appears to be confined to WA, with most collections coming from the Pilbara subregion. However, the ant has been taken as far south as the Yalgoo subregion (TERC holdings contain a pin of ants from Strathburn, QLD, that may belong to this species, but that requires verification). Label data record one specimen as carrying grass seeds — the only ecological note — and the species is likely to be granivorous, like *M. wheeleri*.

Melophorus wheeleri itself is a morphologically and colour variable species, but morphs found in WA are dark reddish-brown or blackish-crimson and very similar in appearance to *M. prominens*. In this species, the anterior sector of the clypeus of the minor worker is folded back towards the mandible, and the clypeal psammophore is placed on a distinct ledge that may be carinate (strongly so in in the junior synonym *M. omniparens*). The minor worker mandible has five to nine teeth and denticles. The head, mesosoma and gaster of all workers are glabrous, and the small, inconspicuous, appressed setae on the gaster are normally separated by more than their own length. (Where this is not the case and the setae are more elongate, then the ant is glossy and weakly sculptured.) Major workers are relatively large (HW of large major worker ≥ 2.60 mm). Other members of the complex with a folded-back clypeus have long, whitish setae that overlap and form a weak pubescence on the gaster, and the ant is either matt or has only a weak sheen. The major worker of such species is also smaller, with a head width only around half the size of the *M. wheeleri* major worker. *Melophorus wheeleri* is found in much of arid and semi-arid WA but is mostly absent from south of latitude 30° S. This species also occurs in the NT, QLD, and SA, and the far north-west corner of NSW but is absent from the ACT, Tas, and Vic. All the *M. wheeleri* sequenced in the *Melophorus* revision form a monophyletic group, but the glossy red *M. omniparens* form (which could represent a genetically separate taxon) was not sequenced; however, this morph probably does not occur in WA and the material from this state comprise a morphologically homogenous group. This species appears to be an obligate granivore, and its large pebble nests are typically decorated with plant remnants such as seeds and husks.

Melophorus parvimolaris and *M. xouthos*, both visibly smaller than *M. wheeleri*, are the other two members of the *M. wheeleri* complex that have a folded-back anterior clypeal margin. Both of these ants have long white appressed setae on the gaster that form a weak pubescence, and the cuticle is shagreenate and/or microreticulate and is generally matt, although it may have a weak sheen. *Melophorus parvimolaris* is quite a small ant (HW of minor worker > 0.70 mm), while the minor worker of *M. xouthos* (the major worker is unknown) is larger (HW > 0.90 mm) and is bicoloured, with tawny orange foreparts and antenna and black gaster and legs (the legs having a bluish iridescent sheen). In WA, *Melophorus parvimolaris* has been collected in the mid-west of the state from the Murchison subregion to the Pilbara. This species also occurs in the NT. On a five-gene tree this ant appears as the sister taxon to *M. caeruleoviolaceus*, but morphological indicators and other molecular data suggest the latter species is likely to be closer to *M. chauliodon* in its phylogeny. The author has observed small workers of this species collecting seeds near Kumarina in the northern Murchison, and *M. parvimolaris* is likely to be granivorous. *Melophorus xouthos* is an ant of extremely xeric environments, and the few collections made have come from inland desert areas. In WA the ant has been taken twice at the edge of the Little Sandy Desert, and there has been one collection from inland SA. Odd, wingless, worker-like *Melophorus* males in the JDM Collection are believed to belong to this species. A five-gene tree situates

M. xouthos next to *M. fulvidus* and on a three-gene tree next to *M. perthensis* (both of the latter are in the *M. fieldi* complex). These findings are counter-intuitive, and, in any case, branch support for the placements is weak. Specimens from the Little Sandy Desert were collected on a dune crest over red sand with a scattered shrub and spinifex vegetative layer, but this is all that has been recorded for *M. xouthos*.

The most salient shared character of the minor worker of the closely related *M. laticeps* and *M. pelorocephalus* is the broad head capsule that is expanded towards the mandibular insertions. This feature is so accentuated in *M. pelorocephalus* that, in full-face view, the appearance of the head borders on the grotesque. Major workers of these two species have a distinctive mandible with a strong, longitudinal carina that separates the mandible into a horizontal and a vertical plane. The basal tooth is on the horizontal plane and is slightly offset, while the sub-basal tooth has both a horizontal and a vertical aspect. Media and minor workers have a weaker mandibular carina, or a blunt angle approximating to it. Workers always have a glabrous mesosoma (most workers of *M. purpureus* and some *M. chauliodon* major workers have erect setae on the mesosoma).

The degree of the anterior expansion of the head capsule is mainly what separates *M. laticeps* and *M. pelorocephalus*. The head of the latter is strongly trapezoidal but only weakly so in *M. laticeps*, and *M. pelorocephalus* has a strongly oblique masticatory margin to its mandible; the masticatory margin of the mandible is only weakly oblique in *M. laticeps*. *Melophorus pelorocephalus* also has a bicoloured head with an upper frons that is distinctly darker than the lower frons; the upper frons is also darker than the mesosoma. In *M. laticeps* the head and mesosoma are uniformly tan to orange-tan. *Melophorus laticeps* has been collected in the Murchison, Gascoyne, Pilbara and Little Sandy desert subregions, but has a much more extensive range in NSW, QLD, and the SA. A few collections have also been made in the NT and Vic, but the ant is absent from the ACT and Tas. Sequencing of both this species and *M. pelorocephalus* strongly confirms their sister-species status. There are no label data or other information concerning the habits of *M. laticeps*, but the conformation of the mandible suggests granivory. The ant has been collected on red soil. Mulga woodland is a known habitat, and the ant has also been collected on or around apple bush in the NT. In WA, *Melophorus pelorocephalus* has only been collected in the interior, namely, on the fringes of the Little Sandy Desert and in the Great Victoria Desert. This species has also been found in the extreme north of SA and would be expected to occur in the NT. A large major worker is not known for this ant. The only data available on *M. pelorocephalus* are that it has been collected on red sand covered by spinifex and low shrubs in the Little Sandy Desert.

The last two species that definitely belong to the *M. wheeleri* complex are *M. chauliodon* and *M. purpureus*. The major and media workers of *M. chauliodon* can be distinguished from the *M. purpureus* major and media workers by the offset basal tooth on the mandible, which is often developed as an upwardly curved tusk, especially in WA populations (the tusk tends to be less developed in populations on the other side of the Nullarbor). Minor workers are separable on the basis of eye shape; the eye is an elongated ellipse in *M. chauliodon* and spheroidal in *M. purpureus*. *Melophorus chauliodon* is one of a tiny number of native ant species that seems to have benefited from urbanisation. Nests of this ant can be seen anywhere in Perth and in adjoining areas on the Swan Coastal Plain where there are patches of white sand and low shrubs and herbs (or grass and weeds in suburban yards and verges). Most collections of *M. chauliodon* have been taken on the Swan Coastal Plain, but some have been made much further afield such as in mid-west of the state as far north as Carnarvon, inland to the Murchison and near to the WA/SA border. This taxon is very common in the arid interior of Australia, where it has been found in all mainland states except the ACT and Victoria. Molecular sequencing using five genes has led to a confusing result, with *M. chauliodon* falling within the middle of the *M. fieldi* complex, but when only cytochrome oxidase subunit 1 (COI), Wingless (Wg) and Rhodopsin (LR) were considered, this ant lined up with other *M. wheeleri* complex species. Label data indicate *Melophorus chauliodon* has been collected on red clay soil, mulga woodland and suburban lawn. Personal observation by the author confirms it also nests in white or grey sandy soils. In metropolitan Perth this is not only one of the two most commonly seen *Melophorus*, but in the summer months this is also one of the most common ants on Perth street verges, along with the equally abundant *M. perthensis*. This species is likely granivorous, based on the structure of the mandible. *Melophorus purpureus* is found in the south and south-west, with isolated

records in the goldfields and mid-west of the state, but to date there have been no interstate records. This species seems most common along the south coast to about Esperance. Molecular sequencing of the southern form indicates a sister or near sister relationship with *M. wheeleri*, which this species morphologically closely resembles. A nest examined near Lancelin was in white soil and had an unremarkable entrance hole similar to that of other small *Melophorus* species in the *M. fieldi* complex. Specimens from Kadji Lake in the mid-western WA differ from southern material in their darker coloration and sparse erect setae on the mesosoma (the southern form may be glabrous). As mentioned in the *Melophorus* revision, these morphological differences may be significant; however, the more northern form has not been sequenced. Based on its morphology and likely close relationship with *M. wheeleri*, *M. purpureus* is probably granivorous, but there are no label data on its ecology.

There remains an enigmatic *Melophorus*, whose associations are unclear. The minor worker of this species, or allele, has the appearance of *Melophorus sulla*, including the two-toned head capsule (orange above, pale ochre below), but the major worker has the *M. wheeleri* crushing mandible. No members of this morphospecies were available for sequencing. The few WA collections of this uncommon morphospecies have come from the mid-west of the state and station country around Wiluna.

Workers in the *M. fieldi* complex have a generalised body plan. Both major and minor workers possess similar-shaped mandibles with five mandibular teeth. In profile, the maxillary palps are long, at least in the minor worker, and reach the mesopleuron when the head of the ant is moderately inclined. The anterior margin of the clypeus in all workers is usually gently and evenly convex and often possesses an anteromedial protuberance or dimple. The *M. fieldi* species complex is the most populous and biodiverse complex in the genus with 22 taxa, and most species are common and widespread. Several closely related species that include *M. turneri* can be found foraging in cooler weather in spring and autumn. This is believed to be a secondary adaptation. Also found in this complex is the strange phenomenon called in the *Melophorus* revision the *M. 'pillipes'* condition, after a species now relegated to junior synonymy under *M. turneri*. Workers from populations exhibiting this trait have fine, long, non-flexuous setae on the appendages and often long setae on the body as well. The degree of this pilosity is variable, and sometimes only a handful of such long setae are present. This condition is not seen outside of this complex, except in *M. chrysus* in the *M. anderseni* species-group. Because of their abundance and widespread occurrence, 15 of the 22 taxa in this group (i.e. 68%) have been able to be genetically sequenced, with varying degrees of success.

Three *Melophorus* that include all members of two taxa (*M. ankylochaetes* and *M. incisus*) and some populations of a third (*M. hirsutipes*) have a shining gaster that lacks genuine appressed setae. Instead, the gaster of these ants sports curved, erect and semi-erect setae and a few decumbent setae. The antennal scapes and legs also bear whorls of many fine, straight setae (these workers should not be confused with other members of the *M. fieldi* complex with the *'pillipes'* condition that still have appressed setae on the gaster). Among this trio, all subcastes of *M. incisus* are easily identifiable because of their globose pronotum and propodeum and the deeply incised sulcus that separates these body parts. Most WA collections of this ant have been from the Pilbara northwards, but there is one eastern wheatbelt record. Apart from these records, the ant is also known from the NT and QLD. Genetic sequencing confirms a sister relationship between this ant and the rather similar *M. ankylochaetes*. Foraging minor workers were aspirated from the crest of a small dune near Eighty Mile Beach in the Dampierland subregion, and from tussock grass in seaside dunes in Port Hedland, but other ecological data are lacking. *Melophorus ankylochaetes*, the sister taxon to *M. incisus*, lacks the deep grooves on the mesosoma, and can be separated from hairy *M. hirsutipes* by the narrow, squamiform petiolar node in the major and media workers (the node is a low, rounded tubercle or thick and erect in *M. hirsutipes*) and the shining head in the major worker, while the minor worker has a rounded propodeum and a head and mesonotum that are shiny in appearance (the minor worker of *M. hirsutipes* has a broadly truncate propodeum and is matt or has only a dull sheen, while the major worker has a matt and sometimes even a rugulose head). *Melophorus ankylochaetes* has a broad range in WA but collections are well-separated, with several having been made in eastern parts of the SWP, in the mid-west of the state, one in the Pilbara and one in the eastern Kimberley. Elsewhere in Australia this species has been recorded in scattered localities in NSW (next to the Victorian border), the NT, and QLD, but it has not recorded from the ACT, SA, or Tas. Ecological data indicate this species has

been aspirated on red soil and loam in mulga and mallee woodland, respectively, and has been collected in a dung pitfall trap (*Melophorus hirsutipes* is discussed as a complete taxonomic unit below).

Another hirsute *Melophorus* is *M. sericothrix*. The morphology of the minor worker strongly suggests *M. mjobergi* and its relatives, and this ant has been confused with *M. mjobergi* in the past in the JDM holdings. Both ants are covered in a fine pubescence, have many short, stout, erect setae that may be curved and possess the same truncate propodeum. The cuticle is matt or dully shining and the head in both cases is dorsolaterally compressed. However, the placement of the *M. sericothrix* minor worker in the *M. fieldi* complex is confirmed by the more anterior placement of the clypeal psammophore and the presence of more than one preapical spur. The major workers of the two species are very different, and the *M. sericothrix* major worker has a clypeal psammophore placed at the midpoint of the clypeus, multiple preapical spurs on the metatibia and lacks the recessed area around the frontal carinae found in *M. mjobergi*. The dorsoventrally compressed head of the minor worker and the shining, unsculptured cuticle of the antennal scape in the major worker are what most obviously separate *M. sericothrix* from *M. microtriches*, the other species in the *M. fieldi* complex that has fine, thick pubescence (note: the pubescence in species like *M. lanuginosus* is coarse and shining white). *Melophorus sericothrix* is confined to the south-west of WA, where it has been collected in sandplain to the west of the Darling Range and in wandoo woodland and mallee to the east. The species also occurs in SA, and almost certainly in NSW and Vic, given that one SA record (Taplan) is near the border of both states. Sequencing of old alcohol material during the *Melophorus* revision was unsuccessful for this species. The only ecological notes are that this ant has been taken in mallee woodland, in litter (hand-collected) and in white sand over limestone in shrubland.

Melophorus paramorphomenus is an odd-looking ant, particularly in the minor subcaste, such that, at a cursory glance, it would appear to be closely related to *Melophorus cuneatus*. However, the position of the clypeal psammophore, the non-platelike petiolar node, the possession of multiple preapical spurs and the long maxillary palps place it firmly in the *M. fieldi* complex. In this species the metanotum is developed and apparently confluent with the mesonotum and often extends over the propodeum, which is wedge-shaped and acuminate above when seen in profile. The metanotal suture is obsolete, and its position is indicated by a furrow (more obvious in the major worker). The metathoracic spiracle is lateral and situated within the metanotal sector. *Melophorus paramorphomenus* has occasionally been collected in mid-western WA, extending northwards to Barrow Island, and in the Murchison subregion, but has not been recorded from any other state to date. Sequencing of this species has been attempted but was unsuccessful. Specimens have been pitfall-trapped and workers and a queen were collected from a nest in red loam soil north of the Billabong Roadhouse near Shark Bay, but other ecological data are lacking. The dull yellow, orange (media, minor workers) or orange-and-brown (major worker) *M. fulvidus* is another easily recognisable member of the *M. fieldi* complex. All subcastes are uniformly microreticulate; the petiolar node of the minor and media workers is thick and tuberculate in shape, while that of the major worker is squamiform; the apical tibial spur is absent; and the mesosoma of the media and minor workers is matt and glabrous, while the major worker has approximately a dozen short, bristly, erect setae. In WA, *M. fulvidus* occurs in the Pilbara and in parts of the Kimberley. Isolated collections have also been made interstate on the NSW/Vic border, in the NT and in QLD, but there are no records from the ACT, SA, or Tas. One specimen has been sequenced, and in a five-gene tree falls within the *M. wheeleri* complex. This is anomalous and was probably brought about by the uninformative signals coming from the histone (H3) and Abdominal A (AA) genes. On a four-gene tree, this species appears as a sister of *M. bruneus*, which is more in keeping with its morphology. Queensland foragers of *M. fulvidus*, collected in box-pine scrub over red soil by Bede Lowery, were active at 104° F (40° C) and are described as being 'very fast'. Other samples have been collected in pitfall traps in mulga woodland.

Melophorus microtriches is a very common species in the *M. fieldi* complex and is one of several hirsute *Melophorus* in which the lower metafemur and the metatibia have whorls of erect setae directed at 45–90° to the surface of the limb. The other ants in which this feature occurs all belong to '*pillipes*' populations of *Melophorus* species that include other conspecific populations that do not exhibit this phenomenon, and they are discussed below in conjunction with a broader diagnosis of their species. Unlike these other hairy *Melophorus*, all specimens of *M. microtriches* have hairy legs.

This ant can be identified by the nature of the setae on the legs (erect setae on metatibia shorter, stout, length of longest setae < greatest width of tibia, compared with erect setae longer, fine and length of longest setae > greatest width of tibia in *Melophorus* with the *'pillipes'* condition); appressed pubescence on the gaster and metatibia, and the matt appearance of the tibiae and the antennal scape (the other *Melophorus* in the complex have more-or-less smooth and often shining tibiae and antennal scapes, and the gaster is usually without overlapping appressed setae that form a pubescence). *Melophorus microtriches* can be found throughout WA, including patches of relictual bushland within Perth suburbs. The species is also found in all Australian mainland states — usually well inland — except the ACT and Vic. On a five-gene tree, *M. microtriches* is sister to *M. hirsutipes* + *M. inconspicuus*, and this is a satisfying result in view of the morphology of these three species, and it also has strong branch support. Substrates on which *M. microtriches* has been collected include gravel, red clay soil and sand. Vegetation associations include mulga, riparian woodland and paddocks. The ant may also be found in the bushier street verges and occasionally parkland native gardens.

Melophorus bruneus and *M. fieldi* are two very similar ants that have 'bug-eyed' minor workers (the major workers also have rather large eyes). However, in this complex in which most taxa are uniform in appearance and difficult to distinguish from one another, the researcher will need to carefully examine a suite of characters to separate out these two species. In this case, *M. bruneus* and *M. fieldi* can be pulled apart from the ruck of other *Melophorus* species by a combination of: a relatively large eye (eye length 0.50 × length of side of head in minor worker, ~0.33 × length of side of head in major worker); periphery of the upper frons (in full-face view) surrounded to about the level of the eyes with short, bristly, erect setae that are often flattened distally; minor worker small (HW ~0.56–0.59 mm); head of major worker non-iridescent, relatively smooth and gleaming; and clypeal psammophore fine and placed at about the midpoint of the clypeus. The two species can be fairly easily separated in respect of the minor worker (concolorous blackish-brown with a dull, silky sheen and with a pronotum that rises gradually to its junction with the slightly humped mesonotum without any obvious convexity in *M. fieldi*; and variable shades of brown or dark reddish-brown without a dull, silky sheen, and with a pronotum that is smoothly convex and meets a mesonotum lacking a median hump in *M. bruneus*). The minor worker in *M. fieldi* also has straight, short, bristly setae (length of longest setae ≤ greatest length of antennal scape), whereas the minor of *M. bruneus* often has erect setae on the mesosoma that are numerous and flexuous (length of longer setae ≥ greatest width of antennal scape). More glabrous forms of *M. bruneus* exist — just to make things more difficult — but here the appressed setae on mesosoma are long and conspicuously pale, and the head is strongly microreticulate. The major and media workers of *M. fieldi* (with the exception of the holotype major worker of *M. fieldi*, which is orange-yellow) are concolorous brown, and the appressed setae on the gaster are short and do not overlap. The corresponding subcastes in *M. bruneus* are of the same colour, but can be distinguished by the longer, overlapping appressed setae on the gaster. The setae on the body also tend to be numerous in the latter species, lending a shaggy appearance to major and media workers. *Melophorus bruneus* tends to occur in the drier inland areas of WA, although there is one record from the North-west Cape. Many more records come from over east, where this species occurs in all mainland Australian states except the ACT and the NT. *Melophorus fieldi* appears to have a more southerly range throughout drier south and central parts of WA, sometimes on or near the coast, and has not been collected north of Newman in the southern Pilbara. This species occurs in all mainland states except QLD but is seen less often than its cousin. Sequencing for *M. fieldi* was not successful for all five genes used, although a four-gene tree placed it as the sister of *M. perthensis*. Given numerous differences between these two ants, this is unlikely to represent the true phylogeny. *Melophorus bruneus* has a single, simple nest hole, and appears to prefer red, lateritic soil. Workers are timid. Vegetation associations on labels mention *Callitris*, *Eucalyptus dumosa*, mallee, scribbly gum, savanna and heath. *Melophorus fieldi* has been collected on red, loamy soil in mallee scrub and in dry sclerophyll woodland.

Melophorus setosus and *M. solitudinis* are two rather uncommon, arid areas species that have modified setae (the setae may be distally thickened, clavate or spatulate), as well as unmodified setae. Other *Melophorus* in the *M. fieldi* complex may have thickened setae, but they are not modified as described. The appearance of the appressed setae on the appendages is the best way to distinguish between these two ants; in *M. solitudinis* they are thick and mostly separated from each other by more than

their own length, whereas in *M. setosus* they are abundant, fine and strongly overlapping. Head sculpture also differs in the two species (the head in matt and microreticulate in *M. solitudinis*, but pitted and weakly gleaming with superficial microreticulation in *M. setosus*). Neither of these two species has been sequenced. Western Australian records for *M. setosus* are confined to a couple in the Pilbara subregion and one in the Dampierland subregion. This species also occurs in the NT, where it appears to be more common, and in QLD. Foragers have been collected in brigalow scrub. Andersen (2007) suggests it has an association with *Monomorium rothsteini* ('*rothsteini* group' in Andersen) nests and could be a nest raider. *Melophorus solitudinis* has been collected at two sites in the Great Victoria Desert, but has not been found elsewhere and nothing is known of its habits. Possibly it has a very restricted range.

Melophorus orthonotus is unusual in that it has an elongate propodeum in both major and minor worker subcastes, with the propodeal angle indicated only by a faint curve. The metanotal groove is only weakly impressed, and the mesonotum and mesopleuron are not separated by a suture or even an impression; moreover, the mesosternal outline is strongly convergent anteriad with the outline of the mesonotum. While the outline of the mesosoma is reminiscent of the *M. aeneovirens* species-group, the shape of the clypeus and the placement of the clypeal psammophore betray the real affinities of this ant. In WA, *Melophorus orthonotus* is known from two collections made on the boundary of the Pilbara and Great Sandy Desert subregions. Only the media and major workers have been recovered. To date, *M. orthonotus* has not been collected in any other Australian state, and no specimens have been sequenced. Known samples have been collected in ethylene-glycol pitfall traps, but that is all the information recorded for this species. *Melophorus sulla* (*sensu lato*) is a common semi-arid and arid area species that is differentiated from other *Melophorus* in its species complex by its pale, depigmented ochre or yellow coloration (the gaster may be light brown, but the very pale foreparts separate members of this species from lightly-coloured *M. longipes* or *M. turneri*, which also often have erect setae on the mesosoma). In full-face view, the head is often two-toned with the frons darker than the clypeus, genae and mandibles. The mesosoma is glabrous. The *M. 'pillipes'* condition is not found in this species. The existence of a *wheeleri*-like major worker in a few populations is discussed above. Apart from this, consistent subtle differences in colour, in the appearance of the clypeus, and anomalies in output for the COI gene render the taxonomy of *M. sulla* difficult and problematic. The reader is referred to Heterick et al. (2017) for a fuller discussion of this taxon, including the possible existence of cryptic species. *Melophorus sulla*, as here understood, is widespread throughout much of WA, but there is a lack of records in the south-east of the State and the species is absent from the wetter south-west corner of WA. Most interstate records of the ant come from the NT and SA and it is much less common in the eastern third of Australia. There are no records of the species from the ACT, Vic and Tas. For what it is worth, *M. sulla* is the sister to *M. marmar* (which is here placed in a different species complex) on both a five-gene and a four-gene tree, but this is counter-intuitive, based on the morphology. Heterick et al. (2017) mentions the interesting pattern of 'pulses' of workers of this species streaming from the nest in the middle of the day, interspersed with periods when there was no activity at the nest entrance. Vegetation associations mentioned in label data include *Casuarina*, mallee, *Eucalyptus dumosa*, gidgee, Kwongan bushland, mulga and heathland. Soil types include 'sandy waste', red soil, brown 'fluffy' loam, and yellow sand. A number of collections have been made on dunes.

Melophorus isaiah is a square-headed, arid area form that bears more than a passing resemblance to *M. oblongiceps*, but the much longer maxillary palps of the former are a good identifier. The unique feature in *M. isaiah* (the name itself is a pun on this character) is the very high placement of the eyes on the sides of the head capsule, in the top half of the head, in all subcastes. This species is known in WA from a couple of series collected in the Kalgoorlie and Kambalda regions, respectively. A few collections have also been made in SA and one in the NT. No specimens were available for sequencing in the generic revision of *Melophorus*. There are no data on this ant, apart from one mention of a pitfall trap, but, based on the sites where it has been collected, it may have a riparian or lacustrine association similar to *M. marmar* and *M. oblongiceps*. *Melophorus major* has an unremarkable appearance and would be readily confused with typical workers of *M. turneri*, except that the clypeal psammophore is placed very low on that sclerite, just behind the anterior clypeal margin in the minor worker, and well below the midpoint of the clypeus in the major worker. The eye is also rather large (eye length 0.20–0.25 × length of side of head in major worker, 0.33–0.50 × length of side of head in minor worker). This combination is not found

in the remaining eight members of the *M. fieldi* complex, although large-eyed workers are found in some similar-looking populations of *M. turneri* and also in *M. eumorphus* and *M. vitreus*. The definition of this species still requires clarification, since the syntype major and minor worker of this species, described by Forel from workers collected at an undisclosed location in the Kimberley, have smaller eyes than a series assigned to this taxon that was taken in Wiluna, some thousand kilometres south. Both sets of specimens, however, exhibit the very low placement of the clypeal psammophore. The only other collection has been from Moree, in NSW. This species is probably not rare, but specimens seen in inventory work by this author have probably been assigned to *M. turneri* or *M. turneri* relatives, which *M. major* very closely resembles in its general morphology. *Melophorus major* has not been sequenced, and there are no ecological data.

The minor worker of *Melophorus eumorphus* is very small (HW < 0.55 mm) and large-eyed (eye length approximately 0.40 × length of side of head capsule). Its size and the relatively narrow dorsoventral aspect of the head in this ant might suggest a member of the *M. biroi* species complex, but the clypeal psammophore is placed well above the anterior margin of the clypeus, the palps are long, the petiolar node is thick and roundly cuboidal in the minor worker, and the legs are long and spindly, not compact as in *M. biroi* and its allies. The distinct mesopleural sculpture and the cuboidal node in the minor worker, and the small size (HW ≤ 0.73 mm) and the large eye (eye length approximately 0.38 × length of side of head capsule) of the major worker also serve to separate this taxon from other members of its complex. *Melophorus eumorphus* is an inconspicuous member of the ant fauna of the Great Southern region of WA and has been taken a few times in the eastern and the northern wheatbelts. Other collections have been made in NSW and SA. Only one specimen has been sequenced, and its placement as sister to *M. perthensis* on a five-gene tree and a sister to *M. longipes* on a three-gene tree have little branch support and more work is needed there. Workers have been collected from mallee woodland over red loam, and from a paddock. The frequent mention of dunes for specimens collected in SA strongly suggests this ant also nests in sandy soils.

Melophorus perthensis is a very familiar sight in Perth yards, gardens and street verges, where it vies with *M. chauliodon* as the most common *Melophorus* in the greater Perth area. *Melophorus perthensis* can be distinguished in both subcastes from a number of near relatives by the smoothly rounded pronotum and the strongly, evenly convex and elongate mesonotum that together with the pronotum forms an almost perfect hemisphere, the truncate propodeum with a protuberant dorsum in the minor worker, the uniformly brown coloration in the minor worker (the gaster may be slightly darker) and the brown or orange-brown major worker. The *M. 'pillipes'* condition is not found in this ant. *Melophorus perthensis* is distributed throughout the state from the southern coastline to at least the Pilbara. Interstate records come from all mainland states except the ACT and Vic. The species is comparatively well-known compared with other *Melophorus*, and is an omnivore, feeding on seeds and other plant material and invertebrates. This taxon prefers low ground cover and a shady understorey (this and other detailed information on its ecology can be found in Majer et al. [2011]). In drier regions, *Melophorus perthensis* can be found in mallee scrub on red soils. *Melophorus vitreus* is a very glossy, smallish *Melophorus* that can be mistaken for *M. turneri*. However, the petiolar node is rather thick and rounded above (squamiform in similar ants), the body is gracile, the clypeus is rounded and protuberant, the eye is very large (eye length ≥ 0.50 x length of side of head), and the mesopleuron is completely smooth or with the most superficial of reticulate patterns. The '*M. pillipes*' pattern occurs in most populations. In WA, this species can be found from the mid-west of the state and the eastern goldfields to the southern Pilbara; this species also occurs in the NT and SA. Limited sequencing (one specimen) places it as sister to *M. ankylochaetes* plus *M. incisus*. This ant has been collected in mallee, and on lateritic sandplain with a covering of small trees and proteaceous heathland understory.

Melophorus turneri and a closely related, almost cryptic species, *Melophorus longipes*, can be distinguished from the three remaining species (*M. hirsutipes*, *M. inconspicuus* and *M. lanuginosus*) by the short, inconspicuous appressed setae on the gaster, which are separated from each other by more than their own length when the gaster is moderately distended. The cuticle of these two species is most often glossy and shining with vestigial or weak shagreenation or other sculpture, and the petiolar node in the minor worker, seen in profile, is often squamiform (the node in the same view in *M. hirsutipes*, *M. inconspicuus* and *M. lanuginosus* is usually not truly squamiform and may be bent distally). These two species can only be separated with difficulty, but the critical distinction is the length of the metafemur which is

shorter and stouter in *M. turneri* (≤ 0.75 × length of mesosoma) and longer and thinner in *M. longipes* (≥ 0.90 × length of mesosoma). The metafemur in *M. longipes* also tends to be attenuated towards its junction with the metatibia. The *M. turneri* major worker is very similar to the major of *M. longipes*, but its mesonotum is generally moderately convex in profile (compared with flat to weakly convex in profile), and the metafemur is uniformly pale brownish ochre to yellowish with the tibia the same colour as the femur (metafemur changing from yellow to depigmented off-white distally in *M. longipes*, and there the tibia is uniformly off-white). *Melophorus turneri* was recently made the senior synonym of one full species (*M. pillipes*, which has the *'pillipes'* condition) and two subspecies (*M. turneri aesopus* and *M. turneri candida*). The types of *M. turneri aesopus* are identical with the types of *M. turneri*, but *M. turneri candida* is a short, compact, large-eyed form that could conceivably be pulled out of synonymy on further examination, as could *M. pillipes* (the types of the latter are particularly glossy and the propodeum and petiolar node are very high). *Melophorus longipes* does not manifest the *M. 'pillipes'* condition.

Melophorus turneri is very common in western parts of WA but has not been recorded in the eastern deserts and in the Perth metropolitan region, where its place is taken by *M. perthensis*. This ant is also abundant throughout the remainder of mainland Australia but does not occur in Tas. The molecular data reveal a somewhat confusing pattern with some polyphyly, but no clear-cut morphology has been identified and the nuclear genes output demonstrate a different pattern to COI. This may be due to hybridisation. On a five-gene tree *M. turneri* is outside of a clade that includes *M. microtriches* and *M. hirsutipes* plus *M. lanuginosus* (see Heterick et al. [2017] for a fuller discussion). *Melophorus turneri* is clearly very adaptable and has been found in a great variety of habitats. References to mallee scrub and sandy soils are repeated in label data, and these are likely to be among the preferred environments. However, this ant is frequently taken in paddocks and has even been collected amid mangroves. *Melophorus longipes* has a similar distribution in WA, albeit it does not seem to occur in latitudes south of Perth. Elsewhere in Australia, it also has a more restricted distribution and apart from WA, is confined to SA and the extreme south of the NT. Although the genetics show all populations of this species clustering together, its nearest relative is undetermined. On a five-gene tree, *M. longipes* is placed as sister to *M. lanuginosus*, but branch support is weak. Mallee is mentioned as a habitat in all vegetation references and sand dunes and a salt lake are also mentioned, which is in keeping with the mostly xeric environments from which this species has been recorded.

Melophorus hirsutipes, *M. inconspicuus* and *M. lanuginosus* are three very similar, sometimes shaggy or bristly species. The *M. 'pillipes'* condition is found in *M. hirsutipes* and *M. lanuginosus*, but not in *M. inconspicuus*. *Melophorus hirsutipes* reveals an extraordinary amount of morphological variation; namely, from shining, weakly shagreenate, long-legged workers with a flattened petiolar node (mainly southern) to matt, strongly striate or

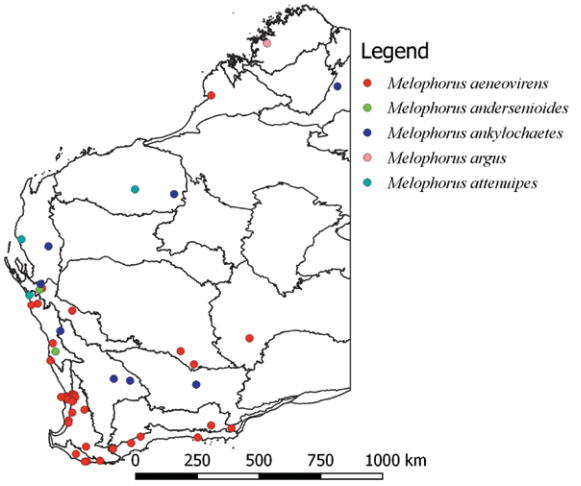

FIGURE 60 Distribution of *Melophorus aeneovirens*, *M. andersenioides*, *M. ankylochaetes*, *M. argus* and *M. attenuipes*.

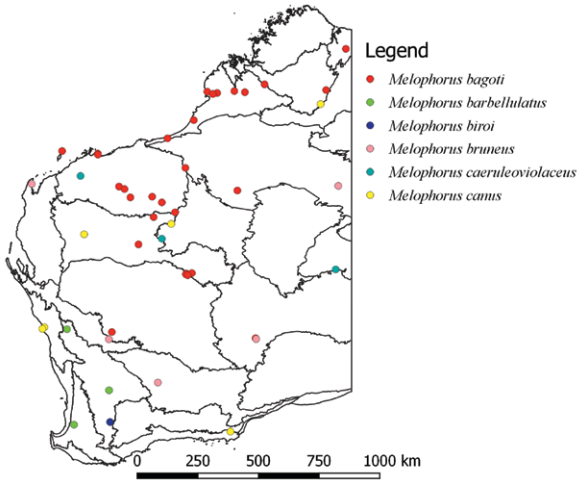

FIGURE 61 Distribution of *Melophorus bagoti*, *M. barbellulatus*, *M. biroi*, *M. bruneus*, *M. caeruleoviolaceus* and *M. canus*.

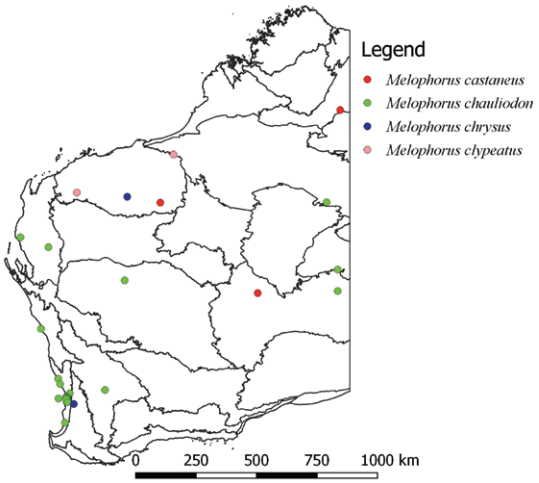

FIGURE 62 Distribution of *Melophorus castaneus*, *M. chauliodon*, *M. chrysus* and *M. clypeatus*.

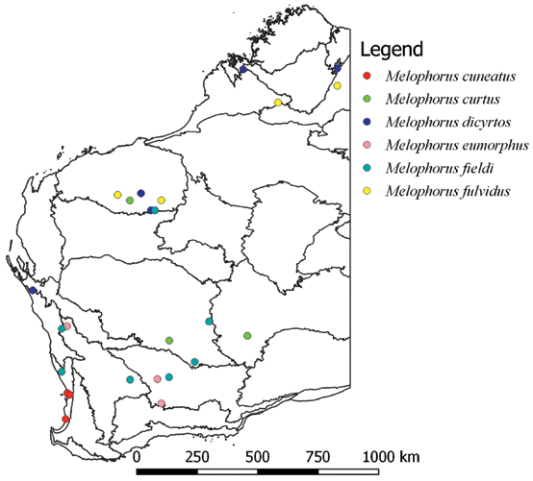

FIGURE 63 Distribution of *Melophorus cuneatus*, *M. curtis*, *M. dicyrtos*, *M. eumorphus*, *M. fieldi* and *M. fulvidus*.

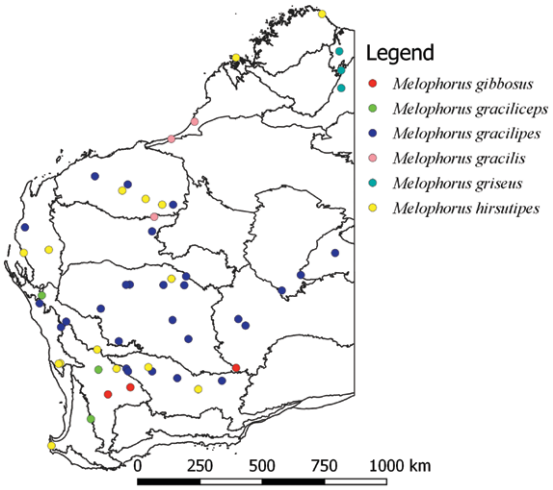

FIGURE 64 Distribution of *Melophorus gibbosus*, *M. graciliceps*, *M. gracilipes*, *M. gracilis*, *M. griseus* and *M. hirsutipes*.

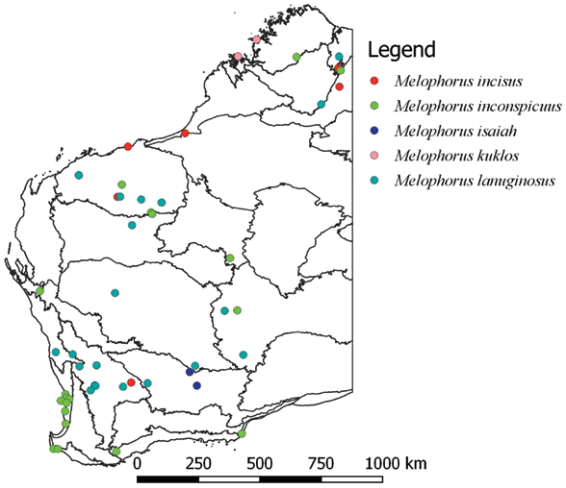

FIGURE 65 Distribution of *Melophorus incisus*, *M. inconspicuus*, *M. isaiah*, *M. kuklos* and *M. lanuginosus*.

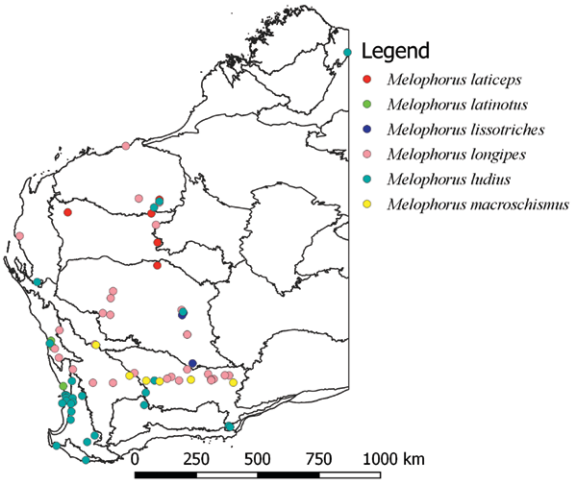

FIGURE 66 Distribution of *Melophorus laticeps*, *M. latinotus*, *M. lissotriches*, *M. longipes*, *M. ludius* and *M. macroschismus*.

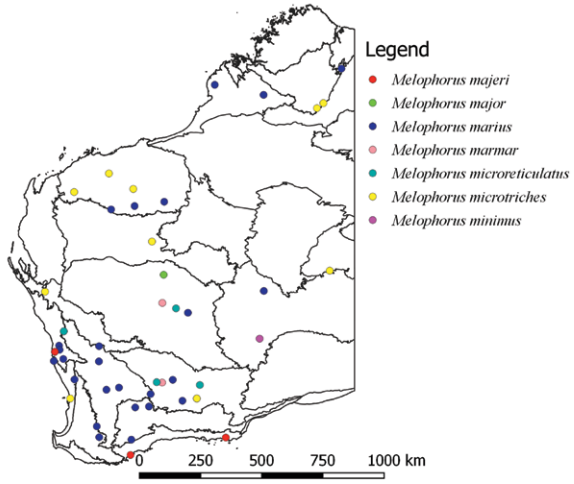

FIGURE 67 Distribution of *Melophorus majeri*, *M. major*, *M. marius*, *M. marmar*, *M. microreticulatus*, *M. microtriches* and *M. minimus*.

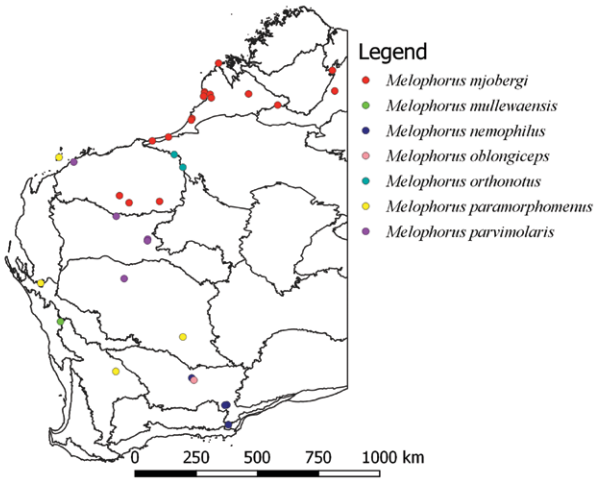

FIGURE 68 Distribution of *Melophorus mjobergi*, *M. mullewaensis*, *M. nemophilus*, *M. oblongiceps*, *M. orthonotus*, *M. paramorphomenus* and *M. parvimolaris*.

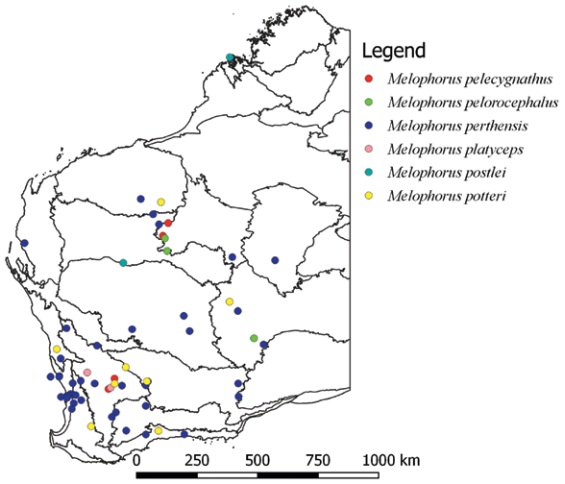

FIGURE 69 Distribution of *Melophorus pelecygnathus*, *M. pelorocephalus*, *M. perthensis*, *M. platyceps*, *M. postlei* and *M. potteri*.

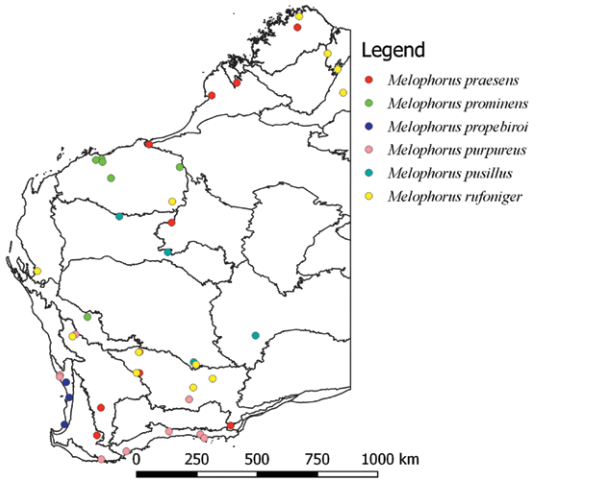

FIGURE 70 Distribution of *Melophorus praesens*, *M. prominens*, *M. propebiroi*, *M. purpureus*, *M. pusillus* and *M. rufoniger*.

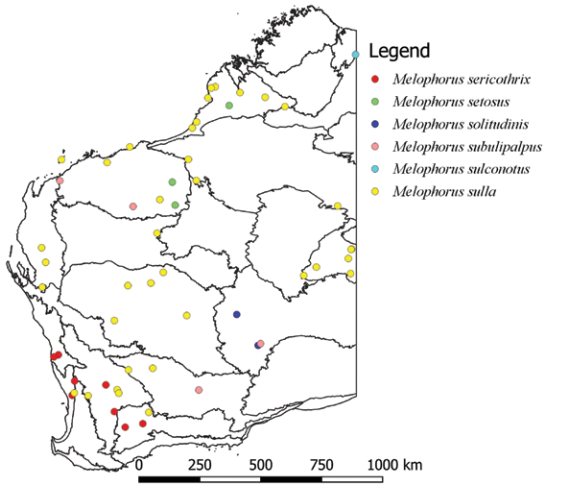

FIGURE 71 Distribution of *Melophorus sericothrix*, *M. setosus*, *M. solitudinis*, *M. subulipalpus*, *M. sulconotus* and *M. sulla*.

rugose workers with a globose pronotum and a node of a rounded tumulus or elliptical shape (majors) or a thick, tapered vertical scale (minors) (‘*hispidus*’; more common in northern WA). However, these extremes are connected by morphs with intermediate features, more commonly seen in eastern Australia. What also connects this bewildering set of phenotypes is the appearance of the erect setae on the mesosoma. These are long, flexuous and curved (those on the pronotum and the anterior mesosoma curved posteriad, those on the posterior mesonotum directed anteriad and those on the propodeum curved both ways). In ‘*hispidus*’, the flexuous setae, admittedly, are much shorter and the fine ‘*pillipes*’ setae are absent from the tibiae, but the globose pronotum is distinctive compared with *M. inconspicuous* and *M. lanuginosum*. Erect mesosomal setae in the remaining two species are occasionally long but they are not curved as above, and they are more commonly short, straight and bristly. The appressed setae in *M. hirsutipes*, while rather long in the main, do not form the silvery pubescence seen in *M. lanuginosus*, and the petiolar node of the minor worker, apart from the ‘*hispidus*’ morph, when viewed in profile is thick (about 0.7 × as wide as high) and its dorsum may be noticeably directed posteriad. (The petiolar node in *M. inconspicuus* and *M. lanuginosus* is thinner, is less than 0.7 × as wide as high, and is either

straight or weakly bent posteriad). *Melophorus hirsutipes* has a very wide range in WA, extending from the northern Kimberley coast to the capes in the extreme south-west. This wide range extends eastwards, where this species can be found in all mainland Australian states. The molecular data for *M. hirsutipes* reveal the same polymorphisms as *M. turneri*, but the three-gene tree (including COI) shows inconsistencies compared with the five-gene tree that may be explained by hybridisation. On a five-gene tree *M. hirsutipes* is the sister of *M. lanuginosus*, and this has reasonable branch support and is also supported by the morphology of the two ants. *Melophorus hirsutipes* (and its close relative, *M. lanuginosus*) seem to favour heathland, but other vegetation associations include mulga, hummock grassland and sclerophyll woodland. Red soil seems to be the preferred soil type.

Its long, coarse, silvery, appressed pubescence on the mesosoma and gaster separates the worker of *M. lanuginosus* from the worker of *M. inconspicuus*. The erect setae in the former are also longer than those of the latter, and the petiolar node in the minor worker is relatively thick (about 0.6 × as wide as high) and also not a true scale in the major worker, whereas the node in *M. inconspicuus* is quite thin and squamiform in the minor worker and a true scale in the major worker. A strangely aberrant population of *M. lanuginosus* that seems morphologically to converge on the appearance of *M. mjobergi* is to be found in the Packsaddle Range in the Pilbara. In WA, *M. lanuginosus* has a broad range, approximating that of *M. longipes*, but seems to be marginally less abundant. Like *M. longipes*, it is also absent from latitudes south of Perth. There are sparser records from NSW, the NT, and SA, but the ant is likely to be underrepresented on distribution maps, and almost certainly it also occurs in Vic. The species seems to favour dry environments and has been found in highly modified habitat in a small townsite in mid-western WA (Miling); in more natural surroundings *M. lanuginosus* has been collected over yellow sand in heathland and from a dune. *Melophorus inconspicuus* also has a very broad range in WA and, unlike its likely closest relatives, is quite common in mesic, cooler habitats in the south-west corner of the state. A couple of morphs of the worker (one matt brown with a smaller eye; one black and moderately shining with a larger eye) occur but only one worker of the former morphospecies was able to be sequenced, so little can be said about the variation. Over east, this species occurs in all major jurisdictions except the ACT and Tas. No particular habitat seems to be preferred, and associated vegetation zones include Banksia woodland, dry sclerophyll, *Casuarina*, *Eucalyptus largiflorens*, mallee, heath, savanna, box-pine scrub and 'arid woodland'. Soil types include red and white sand. Some samples have been collected near rivers, others from dunes and clay pans.

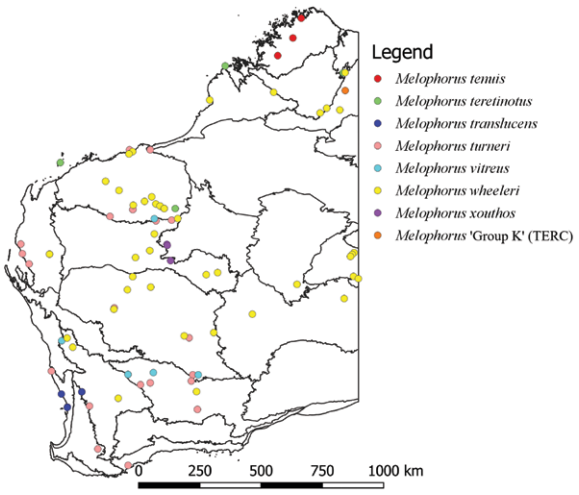

FIGURE 72 Distribution of *Melophorus tenuis*, *M. teretinotus*, *M. translucens*, *M. turneri*, *M. vitreus*, *M. wheeleri*, *M. xouthos* and *Melophorus* 'Group K' (TERC).

Myrmecorhynchus (Figure 73):

The arboreal *Myrmecorhynchus* is rarely encountered in WA, and is represented by one species, *Myrmecorhynchus emeryi* André. This formicine has a combination of 12 antennal segments; a metapleural gland; antennal sockets that are inserted so that they abut the posterior clypeal margin; an oval or rounded propodeal spiracle that is not placed immediately adjacent to the propodeal declivity; erect setae on the body that are not stout and paired; broadly separated frontal carinae; eyes placed at about the midpoint of the head; and a distinctly polymorphic worker caste. Records of *Myrmecorhynchus emeryi* in WA have come from the lower part of the Great Southern, the south coast near Denmark and Walpole, and from around Esperance. This species also occurs in the ACT, NSW, QLD, SA, and Vic but is absent from the NT and Tas. The species frequently nests in dead branches, twigs and vines, but will nest on the ground at times, mostly at the base of a tree but also under rocks and, more rarely, under moss. Habitat types include mallee, sandstone scrub, several types of sclerophyll woodland and rainforest (Shattuck 2015). Shattuck (ibid.) mentions that the ant is known to feed at extrafloral nectaries, but other data on its diet are lacking.

Notoncus (Figure 73)

Five species of *Notoncus* (four described, one undescribed) are found in WA. The genus has much the same diagnostic characters as *Myrmecorhynchus*, to which it is closely related (Moreau et al. 2006), but here the eyes are placed at about the midpoint of the head and the frontal carinae are broadly separated. *Notoncus hickmani* differs from the other four species in that the scutellum, prominent in the other WA *Notoncus*, is absent or undifferentiated in this ant, and does not form any prominent process apart from a low ridge in some workers. Moreover, the humeri of the pronotum are rounded and do not project. *Notoncus hickmani* is a common ant in the south-west of WA, where it occurs as far north as Mullewa at the edge of the Yalgoo subregion, and as far east as Kalgoorlie in the eastern goldfields. This ant can also be found in relictual bushland in the Perth region, and very occasionally in bushy street verges and gardens with an abundance of natural vegetation. This species is also found in other southern Australian states; namely, NSW, SA, Tas, and Vic. In natural surroundings, *Notoncus hickmani* has most often been found in mallee and heath, but also occurs in wet and dry sclerophyll woodland dominated by *Eucalyptus*. This ant is a ground nester, usually under some sort of cover, such as rocks, logs or bark. *Notoncus* sp. JDM 487 shows the same humeral development as *Notoncus capitatus*, *N. enormis* and *N. gilberti*, but is unique in its overall depigmented colour (the head is darker), and its narrow propodeum. The propodeal angles are developed as small denticles. The other three species are shades of orange or brownish in coloration, the propodeum is broad, and the propodeal angles, if present, are normally not developed as denticles. Thus far, *Notoncus* sp. JDM 487 is known only from a handful of series from a tiny patch of relictual bushland in Canning Vale in the heart of suburban Perth, from Mondurup, south of Jerramungup, and from Cape Arid. Nests of *Notoncus* sp. JDM 487, which lack an obvious entrance, have been found around the roots of *Calytrix flavescens* A. Cunn., Myrtaceae (Heterick 2009) in Canning Vale, and it is possible this *Notoncus* tends root aphids or other root sucking Hemiptera. The species is only known from WA. *Calytrix flavescens* has a range from Geraldton to Jerramungup, and if there is an association between *Notoncus* sp. JDM 487 and this plant, the ant may occur more broadly than these few collections would suggest.

Notoncus gilberti is the member of the genus with which most Perth residents would be familiar, as it is not uncommon in backyards and street verges, and it has been known to enter houses in search

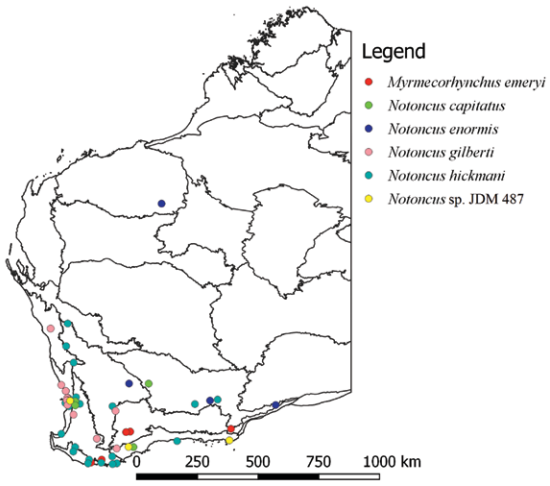

FIGURE 73 Distribution of *Myrmecorhynchus emeryi*, *Notoncus capitatus*, *N. enormis*, *N. gilberti*, *N. hickmani* and *Notoncus* sp. JDM 487.

of food (Heterick 2009). In terms of morphological structure, this ant is very similar to *N. capitatus* and *N. enormis*, but, unlike them, the ant is mainly smooth and shining, the propodeum is smooth or only superficially sculptured, the first gastral tergite is sparsely punctate and the appressed setae are well separated and do not form a pubescence, and the mandibles are finely striate over the dorsal surface (smooth and shining in the other two species). *Notoncus gilberti* occupies much the same range as *N. hickmani* in the Swan Coastal Plain and the Jarrah Forest but has rarely been collected east of the Darling Range and appears to be absent from most of the Esperance Sandplain and Mallee subregions except for their western fringes. This species has also been recorded in all Australian states except the ACT (although it probably occurs there), the NT and Tas. *Notoncus gilberti* may have a different preference to *N. hickmani* in terms of vegetation communities, being found in coastal heathland on at least a couple of occasions. However, it is also found in open woodland, once amidst a stand of degraded tuart (*Eucalyptus gomphocephala*) and exotic weeds. Other collections have been made in a suburban property, on a street verge and at the edge of a sandy beach. In suburban environments, this species is tolerant of sown lawn. The remaining two species are pubescent, at least in part. In *N. capitatus*, this pubescence is found on the body, the head and mesosoma are finely sculptured, the ant is smaller (HW < 1.6 mm), and the propodeum is rounded. In *N. enormis*, by way of contrast, appressed pubescence is almost entirely restricted to the gaster, the head and mesosoma are coarsely sculptured, the ant is larger (HW > 1.9 mm), and the propodeum is angular. *Notoncus capitatus* is

known in WA from just a few scattered collections in the Perth metropolitan area, near Southern Cross and south of Jerramungup. This species is more common in the eastern states, where it occurs in the ACT, NSW, QLD, SA, and Vic, but is absent from the NT and Tas. Habitats are quite varied, including rainforest, a *Pinus radiata* plantation and both dry and wet sclerophyll woodland. *Notoncus enormis* has quite different habitat requirements to the other WA *Notoncus* species, and it has the widest WA range of any member of the genus, one collection being made as far north as Ethel Creek in the Pilbara subregion. Other collections have also been made in arid or semi-arid areas at Bodallin, near Southern Cross, at Caiguna Roadhouse on the Nullarbor and 120 km W. of Balladonia on the Eyre Highway. The only other state where this species is known to occur is NSW. Vegetation associations include *Eucalyptus*, mallee/saltbush, *Banksia*, *Casuarina*, *Acacia/Hakea* shrubland and *Plectrachne* ground cover. Collections have nearly always been made under rocks or stones.

Nylanderia (Figure 74)

Nylanderia (minus *Paraparatrechina* and *Paratrechina*, which were recently removed from the cluster of taxa that comprise the genus) is a small but taxonomically troublesome group in WA. The exact number of taxa, or how they can be identified, is still a work in progress, and the keys in Part I are an effort to make the best sense of the variation found in WA specimens. *Nylanderia* can be diagnosed as a formicine genus with a combination of 12 antennal segments in the worker, a metapleural gland, antennal sockets that are situated immediately adjacent to the posterior margin of the clypeus, a round or oval spiracle that is not immediately adjacent to the declivous face of the propodeum, pairs of large, dark, stout setae on the upper surface of the head and body, erect setae on the antennal scape, and six to seven mandibular teeth. Workers in WA are either yellow (two undescribed species are recognised here) or brown/blackish (at least three species here, probably all named). The two yellow species are separated purely on eye size (with further investigation, this feature may be found to be splitting one good species). All JDM specimens of *Nylanderia* sp. JDM 1123 are currently on loan to S. O. Shattuck, formerly of CSIRO. *Nylanderia* sp. JDM 1163 has minute eyes, with 10 facets or less. *Nylanderia* sp. JDM 1123 has a larger but still small eye with more than 10 facets. All specimens have been taken in pitfall traps. Records have come from the Pilbara (*Nylanderia* sp. JDM 1123) and the Kimberley (both species). The tiny eye and depigmented body suggest these two species (or one species) have a fossorial or cryptic lifestyle, but nothing is known of the biology. Whether these ants occur interstate is not known, but a range that extends at least to the NT is likely.

Nylanderia cf. *obscura* is a large blackish species that can be distinguished from the remaining two dark *Nylanderia* by the fine, appressed pubescence on the pronotum and frons that is lacking in *N. glabrior* and *N. rosae*. Based on AntWeb images of type material, there is a high likelihood that the species that occurs in WA is indeed *N. obscura*. Also based on the behaviour of Perth populations, which are invariably peridomestic, the ant is a likely introduction to the Perth metropolitan area where it constitutes a minor pest by digging large quantities of sand around dwellings and depositing it on paths and patios. This species is very common in certain parts of Perth where it can also be found on footpaths, road verges and in lawn on ovals. Badly abraded pinned specimens from the Kimberley tentatively assigned to this species may occur naturally in that region. Outside of WA, the ant is supposedly found in all Australian states, including Tas, as well as New Zealand, Papua New Guinea and a number of Pacific islands. However, it is not certain that all these records, especially those from overseas, involve the same species.

The remaining species are almost intractable to morphological separation, and what is offered here needs to be augmented by molecular data when this becomes available. This may result in additional species being identified, especially in populations from northern WA. The setation of the antennal scape and the mesopleuron appear to be the most useful characters in a diagnosis: in *N. glabrior*, the mesopleuron is always glabrous, the erect setae on the scape are all of the same length and the appressed setae on the scape are often flat. If the latter are raised at the base, then they are oriented parallel to the scape distally. The erect setae on the mesosoma also appear to be sparser in this species, and mainly separated into two size classes of long and short setae. In *N. rosae* the mesopleuron usually has scattered, fine, appressed setae (these, however, are difficult to see and may be abraded), the erect setae on the antennal scape are noticeably of different lengths and are oriented to the scape at an angle, and the erect setae on the mesosoma reveal gradations of length. *Nylanderia glabrior* occurs in the Perth metropolitan area (obscured on the map), where it appears to be native, and has also been collected in the Pilbara and the Kimberley (note: *Nylanderia* species, probably *N. glabrior*, have also appeared in JDM inventories from various parts of south-western WA in the past, but these records have not been kept). *Nylanderia glabrior* is also found in all Australian

states except Tas. Outside of Australia, this species has also been recorded from virtually the same overseas nations and territories as *N. obscura*, but the caveat that applies to that taxon also applies to *N. glabrior*. *Nylanderia rosae*, as understood here, has mainly been collected in the Pilbara, Barrow Island and the northern and eastern Kimberley, with a solitary record from Eucla, near the WA/SA border. This species is recorded from the other Australian states except for the NT, but, unlike the previous two species, has not been found outside of Australia or its territories. Most records of *N. rosae* come from various natural environments, but it also occurs on grazed areas, pastures, mined areas and parklands. WA *Nylanderia* specimens under 'South Pacific *Nylanderia*' on AntWiki have been assigned various informal names by S. O. Shattuck. As far as the author can tell, at least two of these species fall under those discussed above, e.g. *Nylanderia* 'high-prop' is *Nylanderia* sp. JDM 1123 while *Nylanderia 'deserticola'* is probably *N. rosae*. *Nylanderia* 'low-prop' exhibits some differences and although it may also be *N. rosae*, it could belong to a new species.

Oecophylla (Figure 74)

The green tree ant (*Oecophylla smaragdina*) is the only member of its genus to occur in WA. This species and its behaviour are familiar to many Australians, even those with no interest in insects. Formally defined, *Oecophylla* species are formicines with a 12-segmented antenna but lacking a metapleural gland and have shortish palps (PF 5,4) and a low, rounded petiole. The mandible has 10 or more teeth. These features are not found in any other Australian formicine. In WA, the distribution of *Oecophylla smaragdina* is limited to the north and west Kimberley, where it reaches as far south as Derby. Other Australian states where it occurs are the NT and QLD. This is a widespread species throughout the Asian tropics, and it occurs in New Guinea, New Caledonia and all the countries of the Indomalay Peninsula. *Oecophylla smaragdina* is mainly found in rainforest, but also occurs in eucalyptus scrubland. The behaviour of this charismatic species is well-known, including its use of larval silk to weave leaves together to form a large arboreal nest. These ants can pose a nuisance because of their sharp bite, which they irrigate with formic acid from their acidipore. However, because they prey on injurious herbivorous or sap-sucking insects that can damage plantation trees, they have been used as biological control agents (Shattuck 1999).

Opisthopsis (Figure 75)

Opisthopsis cannot be mistaken for any other genus. As in *Camponotus* and several other formicine genera, the antennal sockets are located well away from the posterior clypeal border. *Opisthopsis* is easily separated from the other formicine ants that share this feature, however, by its huge eyes that are placed at the angles of the vertex so that they form part of the outline of the head. The strange jerky, staccato gait of *Opisthopsis* workers has earned them the soubriquet of 'strobe ants' in some quarters. The reasons for this means of locomotion are unclear, but researchers posit that it may provide camouflage from predators, or simply be part of the energetics of high-speed locomotion (Waters & McGlynn 2018). The biology of this group is little studied apart from Wheeler's (1918) monograph, and they may be generalist

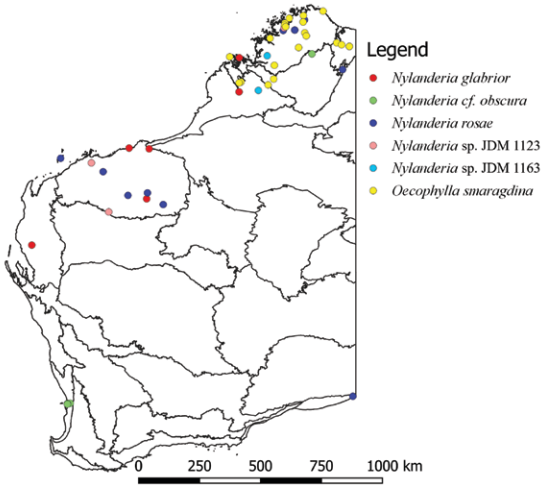

FIGURE 74 Distribution of *Nylanderia glabrior*, *Nylanderia* cf. *obscura*, *N. rosae*, *Nylanderia* sp. JDM 1123 and JDM 1163, and *Oecophylla smaragdina*.

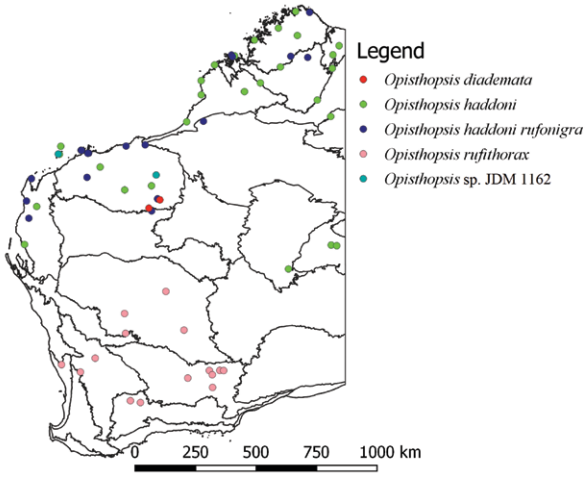

FIGURE 75 Distribution of *Opisthopsis diademata*, *O. haddoni*, *O. haddoni rufonigra*, *O. rufithorax* and *Opisthopsis* sp. JDM 1162.

scavengers. An eastern states species is not uncommon around rubbish bins (Heterick, 2009). Five species of this very distinctive ant genus (four described and one undescribed) occur in WA.

Two species of *Opisthopsis* have a head that is largely black or brown. In the other three species, the head is either entirely yellowish or orange or is largely pale and the vertex and occiput are black. The undescribed *Opisthopsis* sp. JDM 1162 has an entirely brown mesosoma, the gaster is blackish-brown and the head is brown, darkening anteriad. This is a Pilbara species, and its occurrence in other states is unknown. The few specimens collected have been pitfall-trapped. Nothing is known of the biology, but it is assumed it will be similar to that of other *Opisthopsis*. *Opisthopsis rufithorax* has an orange mesosoma, and the first two gastral segments are also entirely orange; however, the remaining gastral segments and the head are black. This is the most southerly species of the genus in WA, and the only *Opisthopsis* whose range extends into the SWP. Nevertheless, this ant is absent from the wetter south-west corner and from the south coast. Northwards, its range extends well into the Murchison (and possibly beyond), and eastwards the species is common in the Coolgardie subregion, thus indicating its preference for semi-arid habitats. Elsewhere, this species is a common feature of the ant fauna in all Australian states except the ACT, Tas and Vic. Vegetation associations recorded for the species are those typical of semi-arid habitats; namely, mallee, box-pine, *Callitris* and *Casuarina* forest, mulga and dry sclerophyll woodland including that dominated by *Eucalyptus maculata*. The ant has been recorded climbing tree trunks and branches. This species is also recorded from dune and red soil situations.

Opisthopsis diademata is identical to *O. rufithorax*, except for the coloration of the head, which is partially yellowish or orange (the frons) and partially black (vertex and occiput). This subtle difference has probably confused researchers unfamiliar with the distinction (as it did this author!) and could account for some northern records for *O. rufithorax* on maps that should be corrected by being assigned to *O. diademata*. In WA, *O. diademata* is currently known from the Pilbara and Gascoyne subregions, but records are few although the ant is probably not uncommon. Other records (AntWeb) come from NSW, the NT, QLD, and SA. Based on label data, this species is most often found in mallee and mulga but can occur in spinifex and *Acacia* woodland. One record is from a golf course, and another from a *Rhytidoponera* mound among *Callitris*. Like the preceding species, this ant can also climb trees.

The remaining two *Opisthopsis* species, i.e. *O. haddoni* and *O. haddoni rufonigra*, are similar in that they have an entirely yellowish or orange head and mesosoma. The gaster is completely black in *O. haddoni rufonigra*, but the coloration of the gaster in *O. haddoni* is the same as for *O. diademata* and *O. rufithorax*. Both ants are confined to the north and central regions of WA, mostly north of the Tropic of Capricorn. Over much of the western part of their WA range these two species overlap, but *O. haddoni* is also found in the eastern desert areas of WA, from which regions *O. haddoni rufonigra* seems to be absent. In the eastern states, *O. haddoni* is present in the NT and QLD (as far south as Brisbane) and may conceivably occur in the far north of SA. *Opisthopsis haddoni* is most common in savanna woodland, but also occurs in rainforest and dry sclerophyll eucalyptus woodland. This species has been recorded on a number of occasions nesting in termite mounds (also, see Wheeler, 1918). However, the fact it has also been collected in intercept, malaise and pan traps is an indicator it often forages on trees. *Opisthopsis haddoni rufonigra* also occurs in the NT and QLD but does not extend as far south as its close relative. Label data also indicates certain differences in habitat preferences, with this ant found in riparian woodland, sandplain box-pine, spinifex, and open mulga/spinifex woodland. This species, like the others, spends a lot of its time foraging on trees.

Paraparatrechina (Figure 76)

These minute ants were fairly recently removed from the clade that included *Nylanderia* and *Paratrechina*. They are said to be generalists and frequently exhibit a mutualistic relationship with hemipterans (LaPolla et al. 2010). Like *Nylanderia*, *Paraparatrechina* have pairs of large, dark, stout setae on the head and body. However, they lack erect setae on the antennal scape, and they have just five mandibular teeth. They can be distinguished from *Paratrechina* in having erect setae on the propodeum (lacking in *Paratrechina*) but not on the legs (present in *Paratrechina*) and in having pairs of erect setae on the head (the setae in *Paratrechina* are unpaired on the head). Three species have been identified in WA to date, but because differences between species are subtle and because these tiny ants are easily overlooked in collections, this number could rise. *Paraparatrechina minutula* group sp. JDM 916 is the species most often seen in the southern parts of WA, including the Perth metropolitan area, but there are isolated records from Cataby, north of Perth, the inland mid-western areas, and Talandji, in the Carnarvon subregion. This species requires close inspection to distinguish it from the very similar *Paraparatrechina minutula*. If this is done, it will be found *Paraparatrechina minutula* group

sp. JDM 916 has only five pairs of erect setae on the frons (six to seven in *P. minutula*), with a gap between the pair on the vertex and the second pair directly below them. Also, the small, appressed setae on the frons are stout, distinct and barely overlapping and do not form a dilute pubescence (these setae are fine, overlapping and form a weak pubescence in *P. minutula*). The occurrence of this species in other states is unknown but likely. This ant has been found in sandplain, but nothing more is known about it. *Paraparatrechina minutula* is a common and widespread species in other parts of Australia but is rare in WA, where it has been recorded from widely scattered locations; namely, the Perth metropolitan area, on Barrow Island and in the Kimberley. This species, like *Paraparatrechina minutula* group sp. JDM 916, is light ochre to brownish in colour, thus separating it from *Paraparatrechina minutula* group sp. JDM 1250, which is a bright lemon yellow. *Paraparatrechina minutula* is ostensibly found in all Australian mainland states, in Papua New Guinea, in the Solomon Islands and in several smaller Pacific islands within Micronesia. However, a revision of the genus may well uncover multiple species in what is here called *P. 'minutula'*. *Paraparatrechina minutula* has been found in a very large variety of habitats over its range, including rainforest, various types of dry sclerophyll forest, mangroves, savanna woodland, among birds nest ferns on an island and in a rotting palm frond accompanying a nest of *Anoplolepis gracilipes* (F. Smith). In most cases workers have been extracted from leaf or other forms of litter or from under stones and rotten logs. The bright yellow *Paraparatrechina minutula* group sp. JDM 1250 is known from several collections in the west Kimberley, where it was found to be locally common in monsoon vine thicket, and also from Mount Hardman, near the Ellendale Diamond Mine. The occurrence of this species in other parts of Australia, as well as its biology, has still to be investigated.

Paratrechina (Figure 76)

Only the exotic brown crazy ant, *Paratrechina longicornis*, is found in WA. The sole WA representative of this genus can be diagnosed as discussed under *Paraparatrechina*. South of the Kimberley, this species is only found in highly disturbed, usually urban settings. Thus, it has been collected in the heart of Fremantle and in Carnarvon and is to be found in highly disturbed sites on Barrow Island, such as the airport. In the Kimberley, however, there are many records from bushland. The brown crazy ant is a pantropical tramp species that can be found in all tropical countries and most of those with a warm temperate

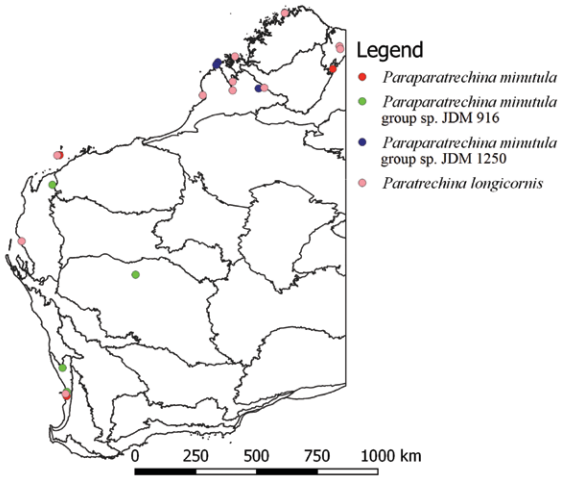

FIGURE 76 Distribution of *Paraparatrechina minutula*, *Paraparatrechina minutula* group sp. JDM 916 and JDM 1250, and *Paratrechina longicornis*.

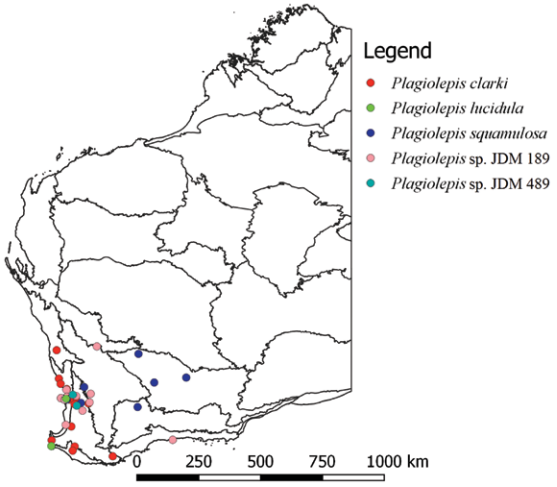

FIGURE 77 Distribution of *Plagiolepis clarki*, *P. lucidula*, *P. squamulosa*, and *Plagiolepis* sp. JDM 189 and JDM 489.

climate. Even in countries at higher latitudes it can survive in suitable conditions, e.g. in greenhouses and indoors situations where there is central heating. Particularly concerning, apart from its invasiveness, is its tendency to foster and protect damaging, sap-sucking Hemiptera. This ant species does not sting and has a weak bite, but it is one of the most serious domestic and environmental pests among all of the ants, and there is an extensive literature on various aspects of its biology.

Plagiolepis (Figure 77)

As with *Paraparatrechina*, *Plagiolepis* species in WA are difficult to identify due to their small size and uniform appearance. Five species, three described and two undescribed, are recognised here (and one sub-species is relegated to synonymy), but

there may be more or fewer species following a revision of the group. *Plagiolepis* workers can be characterised as belonging to this genus through their antenna, which has 11 segments, and their long palps (PF 6,4). These little ants are likely to be generalists, although their biology has not been studied in detail. Repletes occur in at least some Australian species, as they do with *Camponotus* and *Melophorus*, but unlike the latter they are too small to attract attention.

Plagiolepis clarki (which may include more than one species) and *Plagiolepis* sp. JDM 189 are each depigmented yellowish or yellowish-white with small eyes (EI < 0.20), the remaining three taxa having larger eyes (EI ~0.30) and generally darker coloration. *Plagiolepis clarki* (here synonymised with *P. clarki impasta*) is the smaller of these two ants (HW < 0.45 mm, compared with HW ≥ 0.50 mm), and its antennal scape does not attain the vertex (in *Plagiolepis* sp. JDM 189 the antennal scape exceeds the vertex of the head by > 2 × its greatest width). *Plagiolepis clarki* appears to be mainly confined to the wetter coastal regions of the SWP, where collections have been made in the Geraldton Sandplains, Jarrah Forest, Swan Coastal Plain and Warren subregions. This species (as *P. clarki impasta*) is also found in NSW. There is a difference in type of pilosity and the appearance of the mesometanotal suture when workers from coastal sandplain north of Perth (pilosity raised, giving the ant a furry appearance, and the mesometanotal suture is often visibly impressed) are compared with workers from further south (pilosity flattened and the mesometanotal suture is indistinct or obsolete), but in other respects these populations are very similar and the conservative position that they represent a single species has been adopted here. At least in WA, this ant occurs in sandy coastal heathland and in dry sclerophyll woodland and most specimens have been pitfall-trapped. *Plagiolepis* sp. JDM 189 represents a larger version of *P. clarki* and occupies much the same range as that ant but has only once been collected north of Perth (Mt Gibson iron-ore mine). The odd collection has also been made in the Avon Wheatbelt and Esperance Sandplain. Since the species is undescribed, its occurrence in other Australian states is unknown, but probable given its reasonably broad range in this state. Most collections have been made in white or, less commonly, grey over yellow sand, and vegetation associations on labels include *Banksia* woodland with *Adenanthos* understorey, *Banksia/Allocasuarina* sand plain, jarrah/marri/wandoo woodland and coastal heath. The nest of this species is often indicated by a small turret of sand.

Plagiolepis lucidula is a tiny chestnut brown ant with a highly glossy appearance due to a lack of any sort of surface sculpture. *Plagiolepis squamulosa* differs in being matt and microreticulate and *Plagiolepis* sp. JDM 489, although also relatively smooth and shining, is pale yellowish-brown. *Plagiolepis lucidula* has been recorded from the Perth metropolitan area (i.e. from East Fremantle and Perry Lakes [both obscured on the map]), and also Rottnest and Hamelin Bay. Despite the paucity of records, this species is likely to be not uncommon on the Swan Coastal Plain, although the evidence suggests it is confined to it. *Plagiolepis lucidula* was described from workers found under stones at Rottnest. This author, however, frequently found it nesting in the open in grey, sandy soil in the backyard of his former home in East Fremantle, despite the presence of *Pheidole megacephala* in large numbers. The nest entrance was minute and barely larger than the ant itself. Moreover, this species only appeared during the cooler, wetter months of the year when most of the other ant species present were quiescent. *Plagiolepis* sp. JDM 489 is a smaller species (HW < 0.30 mm) than *P. squamulosa* (HW > 0.45 mm), shining, pale yellowish-brown (versus matt brown to blackish-brown in *P. squamulosa*), and the antennal scape barely exceeds the vertex (in *P. squamulosa* the scape exceeds the vertex by about 2 × its greatest width). This species is known from two series and has been collected in dry sclerophyll woodland in the western scarp of the Darling Range. Because of its minute size, it has probably been overlooked in other collections and is likely to be more common than these scant records suggest. Nothing is known of the range or biology of this species. *Plagiolepis squamulosa* has the widest distribution for the genus in WA, being found in relictual bushland in the Perth metropolitan area as well as in the Geraldton Sand Plains, the Jarrah Forest, the Swan Coastal Plain and in the eastern goldfields. However, there are no verified records of this species from other states (apart from a very dubious record for NSW in the Atlas of Living Australia). This species has been collected while crawling on shrubbery on Clontarf Hill near Fremantle and has also been taken at the base of large sand dunes near Geraldton (the type material) and on coastal sand plain with limestone outcrops.

Polyrhachis (Figures 78–87)

With 62 species currently recognised from WA (23 of these undescribed), *Polyrhachis* represents one of three huge formicine genera, the others being *Camponotus* (111 species) and *Melophorus* (78 species). The combined total number of species within these three genera constitutes over 30%

of the ant species recorded for the State, and the number of undescribed species for *Camponotus* and *Polyrhachis* alone (i.e. 59 species) — *Melophorus* was recently revised — also represents slightly over 30% of the undescribed ant taxa recognised for WA in this work. On a national scale, the number of *Polyrhachis* species may even exceed that for *Camponotus*, and the genus already includes many more named taxa than *Melophorus*.

The *Polyrhachis* fauna of WA appears to fall fairly neatly into four distinct clades that are usually regarded as subgenera, although these have not as yet been successfully defined in a formal description. The species taxonomic keys in Part I provide practical means of separating these four clades insofar as WA *Polyrhachis* workers are concerned. The genus itself includes monomorphic formicines that have 12-segmented antennae, lack a metapleural gland, have long palps (PF 6,4) and possess a gastral tergite that is approximately half as long as the total length of the gaster (much less than half the total length of the gaster in the closely related genus *Camponotus*). Western Australian *Polyrhachis* also have sharp angles and/or spines on the petiolar node, something that is not seen in WA *Camponotus* (although spiny *Camponotus* can be found in other countries, e.g. subgenus *Phasmomyrmex*). The subgenus *Hedomyrma* is a small, compact, tropical group in WA that includes two species, *P. consimilis* and *P. terpsichore*. Ants in the *Hedomyrma* clade have a pronotum that is much shorter than the mesonotum plus the first (proximal) sector of the propodeum; the frontal carinae are conspicuously flared; in dorsal view, the promesonotal suture is impressed and the metanotal suture is feebly indicated or completely absent; distinct spines are present on the pronotal humeri; and the appendages are long relative to the body (short in at least subgenera '*Campomyrma*' and *Chariomyrma*, except for the enigmatic *P. sokolova*, which shares a number of the features mentioned above, but has sharp, triangular processes on the pronotal humeri rather than distinct spines).

The sides of the head and the antennal scapes in *Polyrhachis consimilis* have many short, erect, bristly setae, and the sculpture of the mesosoma is coarsely rugose-reticulate. This is in contrast to the head and antennal scapes in *P. terpsichore*, which lack erect setae. In the latter, the sculpture of the mesosoma is finely striate. In the JDM Collection, *Polyrhachis consimilis* is known from several records from the west Kimberley coast. In fact, this species appears to be confined to the northern Kimberley (Andersen 2000). Two workers were collected in a creekside cave near Wotjulum Mission, but other data are lacking. *Polyrhachis terpsichore* is likewise known from several series from the coastal west Kimberley (Mt Trafalgar and Mitchell Plateau). This species also occurs in the NT where it was described from the queen but, like the foregoing species, nothing is known about its biology.

Polyrhachis sokolova is an aberrant member of the subgenus *Chariomyrma* but shares many of the attributes of the *Hedomyrma* subgenus. However, the pointed, triangulate humeral angles and the uninterrupted arc of the dorsum of the petiole (which has a median plateau in members of the subgenus *Hedomyrma*) betray its true affinities, which were recognised by Kohout (Kohout 2013b). Indeed, this taxon has had a chequered career. First placed in subgenus *Hagiomyrma* (to which it clearly does not belong because of its armed pronotum), it was referred to *Chariomyrma* by Kohout in 2013, because of its laminate pronotal margins and spinous humeri. Kohout suggested comparison with *Polyrhachis constricta*. The placement is confirmed by Mezger & Moreau's (2016) phylogenetic analysis. However, *P. sokolova* is quite different to typical members of that subgenus: the frontal carinae are narrowly separated and flared, the long appendages are totally dissimilar to the short, compact appendages in most *Chariomyrma*, and the proportions of the mesosoma also differ. This taxon shares with other *Chariomyrma* a node in which the paired dorsal spines are connected through an arc without being interrupted by a median plateau or a protuberance as in similar looking *Hedomyrma*. In WA, known records are from the North West Cape and the western Kimberley; however, this ant has a broad distribution across northern Australia (NT, QLD, and WA) that extends into Papua New Guinea, New Caledonia and the Aru Islands. This species has a peculiar biology that involves a semi-marine nest. *Polyrhachis sokolova* excavates its nest in intertidal mud at the bases of mangroves, the ensuing mound having a small entrance. The nests are submerged at high tide but are not completely inundated internally owing to ingenious nest architecture. Foraging workers are capable swimmers that propel themselves using only their forelegs (Robson 2010; Narendra et al. 2013).

The remaining subgenera are much larger. *Polyrhachis* (*Hagiomyrma*) contains 14 species, including two undescribed taxa that were apparently not seen by Kohout when he revised the genus in 2013 (Kohout 2013b). In addition, '*Polyrhachis* (*Hagiomyrma*) sp. JDM 936' was sent to Rudi Kohout for his revision, but no specimens were retained in the JDM Collection, its details are not known, and the reviser is now

deceased. However, almost certainly this species is conspecific with a named species in this key. The association of this voucher number with '*Polyrhachis* sp. JDM 900' (*P. bohemia*) (Heterick et al. 2010) suggests it could be that species.

In this group, the mesosomal dorsum is carinate or otherwise has a distinct margin; the pronotal humeri are rounded in WA species; the propodeal spines are directed posteriad; and the petiolar node has two well-separated spines that arise from the dorsum of the node. These are also directed posteriad and may be hooklike. (Unfortunately, Kohout [2013b] uses the terms 'promesonotum' and 'promesonotal' in his key to *Polyrhachis* [*Hagiomyrma*] workers. This is misleading, as these terms are properly applied to ant subgenera [most notably the Myrmicinae] in which the pronotum and mesonotum are fused together to form one sclerite. In the above case it is actually the carinate lateral margins of the mesonotum that are diagnostically significant.) The subgenus is broken up into species-groups and, to some extent, species-complexes by Kohout (2013b) building on some preliminary observations by Andersen (2000). This splitting is based purely on morphology and is not sharply defined and, indeed, Kohout confesses that the various taxa 'intergrade on morphological grounds.' Three of those species-groups (the *P. ammon*, the *P. penelope* and the *P. schenckii* species-groups) include WA *Polyrhachis*. In general, for practical purposes, these three groups fall naturally into their own sectors in the taxonomic key in Part I, with the large *P. ammonoeides* with black cuticle and hooklike petiolar spines occupying the *P. ammon* species-group, the orange or reddish species the *P. schenckii* species-group, and the smaller black species the *P. penelope* species-group. Only two species from the *P. ammon* species-group are merged with the other species-groups in the key. The undescribed *Polyrhachis* sp. JDM 1235 has the same hooklike petiolar spines as P. *ammonoeides*, however, and obviously should be placed next to that species. Only *P. cracenta* (in the *P. ammon* species-group) is keyed out in the middle of the members of the *P. penelope* species-group on the basis of the appearance of the antennal scapes and the propodeal spines, but it is appreciably larger than most members of the *P. penelope* species-group (HW ≥ 1.62 mm versus HW ≤ 1.59 mm for the eight taxa incorporated into that species-group).

Most of the constituent species have bodies that are completely black or dark brown, although the legs may be lighter in colour. Three otherwise-coloured species represent a departure from this norm and occupy the *P. schenckii* species-group. The worker of *Polyrhachis* (*Hagiomyrma*) sp. JDM 1344 is a pale brownish-yellow with a darker head (the other species are reddish-orange or reddish with a dark brown gaster). This species has an anterior margin to the clypeus that has two conspicuous indentations and is otherwise different in appearance to the clypeus of workers of *P. schenckii* and *P. bohemia* (which have an evenly crenulate anterior margin when the ant is seen in full-face view). The sole known worker of this species was collected in a malaise trap at Python Cliffs in the western Kimberley. The reddish-orange *Polyrhachis schenckii* has a hairy antennal scape with whorls of short, erect setae. Like several other members of subgenera *Hedomyrma* and *Hagiomyrma*, *P. schenckii* is known from the north-western Kimberley. Outside of WA, this species has been recorded from NT's top end and from Cape York in QLD. Extralimital populations of this species also occur in Papua New Guinea. This ant nests on the ground under cover of a stone, a piece of wood or a grass tuft in open eucalypt forest and savanna woodland (Kohout 2013b). The antennal scapes in the reddish-and-dark-brown *P. bohemia* are smooth and lack erect setae. This ant was described from material from the Ord Victoria Plain subregion in the southern Kimberley, but most WA populations occur much further south in the Gascoyne and Pilbara. Offshore, this ant has been recorded from Barrow Island (not marked on the map as its presence on the small island entirely mirrors the presence of another *Polyrhachis*). The species also occurs in the NT and QLD. *Polyrhachis bohemia* is a soil nester in arid and semi-arid habitats, but Kohout (2013b) does not supply additional information on its ecology.

The two large members of the *Hagiomyrma* subgenus that fall into the *P. ammon* species-group have down-curved, hooklike petiolar spines. In the other taxa to be discussed, the petiolar spines are horizontal and obliquely elevated. *Polyrhachis ammonoeides* possesses short, erect setae on the antennal scapes (the scapes are smooth in *Polyrhachis* [*Hagiomyrma*] sp. JDM 1275) and lacks strong golden-yellow pubescence on the dorsal mesosoma (present in *Polyrhachis* [*Hagiomyrma*] sp. JDM 1275). *Polyrhachis ammonoeides* is a common ant, endemic to coastal and near coastal parts of WA and found nowhere else, whose range extends from Perth to Karratha. This species is ground-nesting (Kohout 2013b) and is typically seen foraging in white, near shore dunes. *Polyrhachis* (*Hagiomyrma*) sp. JDM 1275 is also found on coastal sites from Shark Bay to the North West Cape. The author found nests of the species in pale yellow sand near the old whaling station at Carnarvon.

Polyrhachis weiri is a *Hagiomyrma* subgenus taxon in the *P. penelope* species-group with erect setae on the antennal scapes and lateral mesonotal margins that converge strongly posteriad. Most collections of this species have been taken in the NT's top end, and there is only one record from the eastern Kimberley, near the border with the NT. Essentially nothing is known about this ant. Better represented in collections is a similar species, *Polyrhachis melanura*. *Polyrhachis melanura* populations that have erect setae on the antennal scape are set apart from the very similar *P. pilbara*, *P. seducta* and *P. tanami* by the fine, dense microreticulation of the mesosoma (more coarsely striate or microreticulate in the latter) and those that lack such setae are distinguished from other *Polyrhachis* (*Hagiomyrma*) by their short propodeal spines (sub-parallel and shorter than the distance between their bases) and the broadly flat or only weakly concave dorsum of the petiole between its spines. *Polyrhachis melanura* is very common on Barrow Island, where it is by far the most frequently encountered member of its subgenus, and there are also a number of records in the Kimberley. The *P. melanura* from Barrow Island (not known to Kohout, apparently, as not listed by him) seen by the author differ from the diagnosis in Kohout 2013b in respect of the erect setae on the antennal scapes. Those from the Pilbara, where the species also occurs, have glabrous antennal scapes as in the species diagnosis. In all other respects, however, the populations agree. (This species was recorded in the Pilbara in a 2002–2007 CALM survey [Heterick et al. 2010], but specific localities have not been specified and the species was wrongly ascribed to *P. crawleyi*.) *Polyrhachis melanura* is also widely distributed along the northern Australia seaboard in the NT and QLD. This is a species of the open forests and savanna woodlands, where it nests in the ground under rock or wood (Kohout 2013b).

Polyrhachis pilbara, also relatively common on Barrow Island, is similar to P. *melanura*, but has a more coarsely striate-reticulate mesosoma. This species always has erect setae on the antennal scapes. The ant can be separated from *P. seducta* and *P. tanami* by the closely appressed golden pubescence on the gaster that completely obscures the cuticle, the cuticle of the gaster being partially visible under more diluted pubescence in the other two species. *Polyrhachis pilbara*, as the name suggests, is largely concentrated in the Pilbara subregion, but is also found in the adjoining Gascoyne subregion. This ant is apparently restricted to WA and its known habitat is mulga and spinifex (Kohout 2013b), but nothing has been recorded of its habits. *Polyrhachis seducta* is set apart from *P. tanami* in Kohout's (2013b) key by the very short, bristle-like setae on the mesosoma (in the latter they are purportedly longer and may attain half the diameter of the eye in length, and they are directed posteriad). Unfortunately, Kohout (2013b) does not specify exactly how long the 'short, erect, bristle-like' setae are in *P. seducta*. *Polyrhachis seducta* is found only on Barrow Island. Essentially nothing is known about this ant except that it is a ground forager. *Polyrhachis tanami* supposedly differs in the particular mentioned above, but a specimen collected from a coastal site between Karratha and Mardie has the longer setae of *P. tanam*i (and appears to belong to that species), but they are mostly straight. This suggests that *P. seducta* and *P. tanami* (collected some 1500 km further east and known only from two specimens) may belong to a single species that has been sampled only at well-separated points along a biogeographic and morphological continuum. This author also notes that the measurements and indices for the two species provided by Kohout (2013b) completely overlap except for the PMI (Promesonotal Index), which varies only incrementally.

Polyrhachis (*Hagiomyrma*) species that lack erect setae on the antennal scape (excepting some populations of *P. melanura*) include *P. cracenta* (which is properly placed in the *P. ammon* species-group), *P. crawleyi*, *P. clarki* and *P. anderseni* (*P. penelope* species-group). The first two taxa differ from the latter two taxa in having very long, strongly divergent propodeal spines that are individually longer than the distance between their bases, the remaining ants having less strongly divergent or even parallel spines that individually are distinctly shorter than the distance between their bases. *Polyrhachis cracenta* lacks erect setae, except for the gastral tergites, and the appressed pubescence is very dilute. *Polyrhachis crawleyi*, the largest of the *P. penelope* species-group taxa in WA and the only one approaching *P. cracenta* in size, has erect setae of variable length on the mesosoma, and appressed, golden pubescence on the body, which is particularly dense on the gaster. In WA, *Polyrhachis cracenta* is known from a single record in the Mitchell Plateau in the northern Kimberley. This rare species has also been collected in the NT and QLD. Reports by researchers and collectors suggest that it is a ground-nesting ant that prefers to nest at the base of trees. This species has been confused with *P. ammonoeides* in the past (Kohout 2013b). *Polyrhachis crawleyi*, like many of

its relatives, is an exclusively Kimberley species in WA; unfortunately, prior to Kohout's (2013b) revision of the *Hagiomyrma* subgenus, material in the JDM Collection that actually belonged to other species as well as this one was published under the name of *P. 'crawleyi'*. Elsewhere, *P. crawleyi* is found in the NT and QLD. This species is uncommon across its range and is restricted to open eucalypt forest and savanna woodlands, where it nests in grassless tracts directly into the soil (Kohout 2013b).

Polyrhachis clarki and *P. anderseni* can be teased out by an examination of the petiolar spines (widely divergent and oblique in *P. clarki* and parallel or only weakly divergent and moderately elevated in *P. anderseni*), the propodeal spines (slender and divergent in *P. clarki* and parallel or only weakly divergent in *P. anderseni*) and the posterior face of the petiolar node (convex but not distinctly swollen in *P. clarki* and distinctly swollen towards its base in *P. anderseni*). *Polyrhachis clarki* is a very rare species, known only from the type series collected in Geraldton many years ago, and from a collection south-west of Marble Bar. There are no ecological details. *Polyrhachis anderseni* is a much more common species and has been collected on a number of occasions in the eastern and northern Kimberley. This species also occurs in the NT. *Polyrhachis anderseni* has interesting nesting habits in that it builds its nest inside rock crevices or on the sides of rock walls (Kohout 2013b).

Western Australian *Polyrhachis* that belong to the subgenus *Chariomyrma* (five described and five undescribed species) are a smaller and taxonomically less well covered clade. A number of species seem to be localised, and additional taxa may occur in the Kimberley. Unfortunately, Kohout passed away before he was able to revise this group. With the exception of *P. sokolova* (described above), members of this subgenus have the following distinguishing features: the dorsum of the mesosoma, particularly the anterior pronotum, is convex; the humeral angles are nearly always armed with a small, sharp spine or denticle, the mesonotal and propodeal margins are sinuate and may be incised to form small lobes or protrusions; thick pubescence is often present on the head and mesosoma; the propodeal angle is armed with gently sinuate spines, which are round in cross-section and directed posteriad at an oblique angle to the propodeum; and, in dorsal view, the petiolar node is armed with two long, curved petiolar spines, these being confluent and constituting a single, uninterrupted arc in all WA species.

Polyrhachis (*Chariomyrma*) sp. JDM 1204 is easily identified as the only *Chariomyrma* with rounded humeral angles. In dorsal view, the marginal lamina of the pronotum is smoothly continuous from the posterior margin of the pronotum to the neck sclerite. This species is only known from two workers collected on the Carson Escarpment in the northern Kimberley over thirty years ago by Professor Jonathan Majer. No other details are available. *Polyrhachis cyrus* is also easily identified by virtue of its light orange legs, all other WA *Chariomyrma* having black or very dark red legs. *Polyrhachis cyrus* is known in WA from an alate queen collected in a malaise trap in Prince Frederick Harbour, which signifies the presence of one or more populations of this species in the area. The range of this attractive little *Polyrhachis* extends across into the NT and QLD, and it may also occur in the extreme north of SA. Extralimital populations of *Polyrhachis cyrus* can be found in Papua New Guinea and New Caledonia. The ant is known to nest in hollow branches.

Polyrhachis (*Chariomyrma*) sp. JDM 808 belongs to a clade that includes *P. appendiculata* Emery. These ants have stout, strongly recurved propodeal spines, and the laminate margin of the mesonotum together with the outline of the propodeum may be broken to form one or more narrow processes. This very small *Polyrhachis* is common on Barrow Island but is also found less frequently on the adjoining mainland in the Pilbara subregion. This species, or a very similar ant, is also found in the NT, but ecological or habitat notes are lacking.

Polyrhachis (*Chariomyrma*) sp. JDM 1274 has flattened eyes, a character it shares with *Polyrhachis* (*Chariomyrma*) sp. JDM 807, but the propodeal spines are short, each spine being shorter than the distance between the spines across the propodeal base (at least as long as the propodeal base in *Polyrhachis* [*Chariomyrma*] sp. JDM 807), and the posterior face of the petiolar node is glabrous and has parallel, transverse grooves that become arcuate towards the base of the node (in *Polyrhachis* [*Chariomyrma*] sp. JDM 807 the posterior face of the node has appressed setae and the sculpture consists of transverse striae that are not continuous across the node). As is the case with several other WA *Chariomyrma*, *Polyrhachis* (*Chariomyrma*) sp. JDM 1274 is known from just the one series. The two workers were collected from a yellow pan trap in Ellendale by an environmental consultant working for the Kimberley Diamond Company. *Polyrhachis* (*Chariomyrma*) sp. JDM 807 has the flattened eyes just mentioned. These do not break the outline of the head, and this serves to

distinguish the species from the other *Chariomyrma* mentioned below. (*Polyrhachis* [*Chariomyrma*] sp. JDM 1273 is very similar, but in this case the eyes are weakly convex and just break the outline of the head, and the appressed pubescence on the head and mesosoma is more strongly golden in colour as opposed to the greyish or pale yellow pubescence of the head and mesosoma in *Polyrhachis* [*Chariomyrma*] sp. JDM 807. In *P. gab*, *P. lata* and *P. senilis*, the eyes are strongly convex, and the appressed pubescence on the head and mesosoma, if present, is white or whitish.) *Polyrhachis* (*Chariomyrma*) sp. JDM 807 is a common ant in the Pilbara and occurs as far south as the North West Cape and the northern Gascoyne, but its occurrence outside of WA is not known. Despite a number of pins available for examination, there are no ecological or habitat data on labels. The appressed pubescence on the gaster may be greyish or pale yellow, but this colour difference appears to be an individual trait only. *Polyrhachis* (*Chariomyrma*) sp. JDM 1273 is easily the most widespread ant in its subgenus in WA, and the fact it appears to be undescribed is surprising. Workers have been collected from the northern boundary of the Pilbara subregion, from the Central Ranges subregion near the WA/SA border, from the Murchison and Yalgoo subregions, and even from the edge of the SWP. This ant also occurs in the NT, at the least (a number of pins from NT-collected material being held in the JDM Collection). Sadly, most specimens in the JDM/WAM Collections are quite old, the labels provide basic information only and there are no habitat or other data. Workers recently taken at Jokers Tunnel near Yalgoo were found on a rocky hill.

The appearance of the antennal scape separates *Polyrhachis gab* from *P. lata* and *P. senilis*. The antennal scape in *P. gab* has only sparse erect setae, these being mostly confined to the outer edge of the scape, and their length is less than the greatest width of the scape. In the other two species, the antennal scape often has numerous erect setae, and these occur on all surfaces and the length of the longest setae is as wide as or wider than the greatest width of the scape. Also helpful is the appearance of the pronotum in dorsal view. In the case of *P. gab*, the appressed setae on the pronotum form a thick pubescence that hides the cuticle; in *P. lata* and *P. senilis* the appressed pubescence on the pronotum is dilute or lacking. There are two distinct size classes in WA specimens of *P. gab*, but the position taken here is that they simply represent different populations of the same species, as no other distinguishing morphological feature can be identified. Workers in the JDM Collection from Beverley Springs, Kununurra and Port Wyndham are appreciably larger than workers from Christmas Creek, Gibb River, Katherine (NT), and King Edward Island. In WA, populations of *P. gab* appear to be confined to the Kimberley, where it is common. In other parts of Australia, *P. gab* can be found in the NT and in QLD. All three species have broadly similar habitat preferences for open forests and woodlands, particularly places where grass cover is thin and there are bare rocky patches. These ants are normally ground nesting, generally under grass roots, rocks or logs or in rotting logs, but they occasionally nest under the bark of trees (Kohout 1988). *Polyrhachis senilis*, when seen in full-face view, has dense white pubescence on the frons that completely obscures the underlying cuticle, and this is the best way to distinguish this species from *P. lata*, in which the off-white pubescence on the frons is more dilute so that the underlying cuticle can be seen. The situation is reversed on the pronotum, which is devoid of pubescence in *P. senilis*, whereas in *P. lata* dilute, off-white pubescence that obscures some of the cuticle is present. Like *P. gab*, *Polyrhachis senilis* is also very common in the Kimberley region, but its range extends much further south and well into the Carnarvon subregion. This is also one of the more common *Chariomyrma* species in the Pilbara. Like *P. gab*, P. *senilis* is found across Australia's northern coastline, including the NT and QLD as well as WA. *Polyrhachis lata* appears to have a disjunct range in WA, with populations in the Kimberley being broadly separate from those in the Carnarvon subregion. Elsewhere, this species is known from the NT (Andersen, 2000) and QLD.

The premier clade or subgenus of *Polyrhachis* in WA, with 20 described species and 16 undescribed species, is unquestionably those ants that used to be called '*Campomyrma*'. However, the monophyly of the Australian representatives with members of the subgenus from South-East Asia (which were first credited with the sub-generic name) has been brought severely into question by the molecular work of Mezger & Moreau (2016). For this reason, the subgenus as it relates to Australian ants is placed within quotation marks. Kohout was embarking on revision of the subgenus in his final papers, but only managed to complete the revision of the *P. gravis* and the *P. micans* species-groups. Other species-groups discussed below are those suggested by additional sources (e.g. AntWiki; Andersen 2000) and/or which seem to this author consistent with the taxonomy of the respective taxa.

Despite the lack of a formal diagnosis, WA ants in this subgenus are easily identified. To begin with, the dorsum of the mesosoma is typically flat; in profile the mesosoma is usually weakly but sometimes strongly convex and distinctly laterally carinate (except for *P. femorata*); pubescence is usually absent from the head and body, but if present, then it does not obscure the underlying sculpture; the humeral angles are usually acute or weakly dentate, more rarely rounded but are never armed with spines; the mesonotal and propodeal margins are simple; the propodeal angles are unarmed or armed with dorsoventrally flattened, horizontal or upwardly curved denticles of varying lengths, but never with stout, rounded spines; the petiolar node is generally thin and broad but may be narrow and thick, and is typically armed with two distinct dorsal and two lateral spines but one or more spines may be lost, and the petiole is entirely unarmed apart from rounded flanges in some species. In addition to the taxa discussed below, Andersen (2000) mentions a rare, ostensibly highly distinctive species from the northern Kimberley which has long propodeal spines directed posteriad and conspicuous basal flanges on the gaster. This species, if indeed it belongs to '*Campomyrma*', is likely to fall within the *P. sidnica* complex, but cannot be identified among the material seen by this author.

Polyrhachis femorata is a distinct '*Campomyrma*' species, and the only WA member of the *P. femorata* species-group (*sensu* Kohout 2007). The ant is easily recognised by having the lateral margins of the mesonotum and propodeum with an edge that is not sharply carinate. Moreover, in dorsal view, the humeri are rounded with only a hint of an obtuse angle. In full-face view the frontal carinae are broadly separated. In this State records of *P. femorata* are strongly clustered around the Swan Coastal Plain and the western Darling Scarp, and, in particular, the Perth metropolitan area. The ant, however, has its main stronghold on the east coast, including Tas, but there are no records from the NT or SA. This species nests in living or dead wood, and locally has been found in marri and jarrah trees (including a rotting branch on a living jarrah tree). *Polyrhachis femorata* is tolerant of urbanisation and can be found in suburbia. The author found a colony nesting in a living branch of a jacaranda (belonging to genus *Jacaranda*; an exotic in Australia) at his former home in East Fremantle.

Eight *Polyrhachis* in the *P. gravis* group revised by Kohout (Kohout 2013a) can be found in WA. This group of ants has a head that is rounded towards the base of the mandibles; post-ocular lateral ridges are present, and form distinct, narrowly rounded corners posteriad; the eyes are placed close to the corners of the vertex; in dorsal view, the pronotal humeri are angular or narrowly rounded; the mesonotum and propodeum are strongly convergent posteriad; the propodeal angle is armed with short, upturned teeth; and the petiolar node is usually armed with a pair of dorsal teeth or spines and a pair of lateral teeth or spines, the latter never being distinctly longer than the former (in *P. pseudothrinax* and *P. unicornis* there is a single, median, dorsal spine). The WA members of the group are often rare or, at least, localised, and our awareness of most of them is based on one or just a handful of collections. The biology or even the preferred habitat of almost all species is totally unknown. From just a few detailed records, Kohout (2013a) describes the members of the species-group as being mostly denizens of the monsoonal and arid regions of WA, and terrestrial nesters that house their colonies under rocks, pieces of wood or grass tufts.

Polyrhachis pseudothrinax and *P. unicornis* are characterised by having only a single dorsal petiolar spine. In *P. pseudothrinax* this spine is long and acute, and this species also has angular humeri and smaller, distinctly convex eyes. *Polyrhachis unicornis* has a short, blunt petiolar spine, acutely denticulate pronotal humeri and the eyes are larger and only moderately convex. In WA, *Polyrhachis pseudothrinax* has a range that extends through the northern and western Kimberley, but it has not been found in central and eastern parts of that region. The species also occurs in the NT and QLD. Details of the biology of this species do not appear to be available. *Polyrhachis unicornis* appears to be restricted to the Dampierland subregion of the Kimberley and has been found nowhere else to date. Nothing has been recorded of the ant's habitat or biology. *Polyrhachis capillata* has long, thin, abundant pilosity, unlike the pilosity of other members of its species-group, which is generally sparser, shorter and bristly. This species is known from just three worker specimens — the holotype and paratype collected in Kalgoorlie, and a worker recently pitfall-trapped in West minesite (Kambalda). Nothing more is known of this ant. *Polyrhachis palmerae* is another rare, localised species known only from the northern Kimberley. The worker has a slender petiolar node, higher than wide (about as high as wide in the remaining species in the species-group), the dorsal spines are not separated at their base (noticeably separated in the other species) and the appendages are light orange (black or dark reddish-brown in the other

members of this species-group). As is the case with most of the other *P. gravis* species-group *Polyrhachis* our knowledge of this species stops with its physical description.

Polyrhachis curtospinosa has short, stout, tooth-like petiolar spines that are distinctly shorter than the lateral spines, and sparse bristly pubescence (virtually lacking on the dorsum of the mesosoma and petiole). The remaining three species in the species-group have slender, dorsal petiolar spines that are distinctly longer than the lateral spines, and bristle-like pubescence is present on most body surfaces, including the dorsum of the mesosoma and petiole. Only one specimen of *P. curtospinosa* is known from WA, that coming from an unspecified location in the eastern goldfields. The presence of at least one population of the ant in WA is surprising, given how far it is from the other known populations in northern parts of the NT and the Mt Isa Basin in QLD. Nothing is recorded of the ant's habitat preference or biology. The anterior margin of the first gastral tergite has a strongly raised carina in *P. opacita*, and that is the sole distinguishing feature of the species. This is yet another ant whose description is based on a single collection (two workers from Coral Bay in the mid-west) and about which nothing further is known.

The remaining two species in the species-group, namely, *P. gravis* and *P. hespera*, are much of a muchness in appearance, and are distinguished by subtle features: in *P. gravis* the antennal scape is longer (SL > 125 versus SI 115), the pronotal humeri is narrowly rounded with the posterior pronotal margins shallowly emarginated (versus pronotal humeri distinctly angular) and the greatest width of the pronotum is at the middle of the sclerite, whereas the greatest width of the pronotum is across the humeri in *P. hespera*. Compared with other members of its species-group, *P. gravis* has a broad range in WA, although its occurrence is sporadic. Collections have been from arid and semi-arid regions of the goldfields, the western desert and the north-west, including Barrow Island. The range of the species extends across the NT into western QLD. *Polyrhachis gravis* has mostly been collected in mulga and spinifex country. *Polyrhachis hespera* is known only from the holotype and one other worker housed in the JDM Collection. Both were taken at Eneabba in mid-western WA. Nothing more is known about the ant.

The *Polyrhachis micans* species-group, as conceived by Kohout (2013a), refers to those '*Campomyrma*' species that have a large, high petiolar node and a scale-like petiole with four prominences which range from four sub-equal spines to two elongated dorsal spines and two lateral angles at the other extreme. In profile, the mesosoma is strongly convex, the eyes are very large and placed near the corners of the vertex, and a post-ocular carina is present. However, to this author's mind, there are too many structural similarities (e.g. as regards the appearance of the head and the clypeus) between this suite of ants and those assigned by Kohout to the *P. schwiedlandi* species-group for these two clades to be regarded as distinct species-groups. Certainly, the heads of workers in this species-group — as well as the conformation of the propodeum — have a strong resemblance to those of many members of the *P. schwiedlandi* group. The ants related to *P. sidnica* have a distinct type of node that is more robust, the eyes are usually smaller, the posterior propodeal processes generally differ, and the sculpture of the mesosoma tends to be less obviously longitudinally striate or striolate than in the *P. micans* or *P. schwiedlandi* clades. Nonetheless, a similar conformation of the clypeus is common to all three groups; hence they are treated here as separate complexes within the *P. micans* species-group (notwithstanding, the *P. sidnica* clade may turn out to be distinct on a molecular analysis). The only WA representative from the *P. micans* complex is *P. prometheus*, which has a strongly convergent propodeum reminiscent of the *P. gravis* species-group. The lateral processes of the petiolar node are reduced to mere dull humps. The species in WA seems to show two disjunct populations, with one in the east Kimberley and one in the Pilbara, but this may be an artefact of collecting. This species is widespread and also occurs in the NT and QLD. The biology of the members of the *P. micans* group (= *P. micans* complex here) is described by Kohout (2013b) in identical terms to that of the *P. gravis* species-group.

The *Polyrhachis schwiedlandi* complex is biodiverse in WA and virtually taxonomically unknown; only three of the 12 species currently recognised in this State have been described, and others may await discovery. Most are known from one or two specimens but several (e.g. *P. inconspicua* and *Polyrhachis* sp. JDM 1010) are commonly seen in collections, particularly from the Pilbara and Barrow Island. The most distinctive feature of these ants is the longitudinally depressed or flattened upper gena (that may be demarcated by a carina) and presence of a post ocular ridge. Other identifying characters include the appearance of the propodeal angle (which usually carries a pair of small, upturned denticles or is squared off or a flange, but never has spines or flattened, dentate processes), the thin, scale-like petiolar node, which is usually flanged above, sometimes notched,

but only armed with teeth in one taxon, and the invariable lighter colour of the femora and tibiae (which are yellow to reddish-brown, although the fore coxae are usually black) compared with the black mesosoma.

Polyrhachis sp. JDM 670 is a rare exception to the usually all-black coloration of these ants, as the gaster is yellowish with diffuse, brownish, dorsal infuscation. Records of this species are sparse and come from arid or semi-arid central regions of WA. The occurrence in other states of this species and the other undescribed members of the complex is unknown. Specimens from 100 km south-east of Newman were pitfall-trapped in mulga woodland. A dealated queen was also hand-collected on red soil in a saltbush/mallee remnant near paddocks in mid-western WA. The dorsum of the petiolar node is a single acute angle in *Polyrhachis* sp. JDM 1086, which is known from one damaged worker collected by (then) CALM researchers at Queen Victoria Spring Nature Reserve. There are no other data for this ant. *Polyrhachis* sp. JDM 1012 is the only member of the *P. schwiedlandi* complex to possess a pair of dorsal spines. This species has been collected in the mid-north near Capricorn Roadhouse and 100 km south-south-east of Newman. The latter specimens (three workers) were collected by pitfall trap in mulga woodland. In *Polyrhachis* sp. JDM 1011 the flanged dorsum of the petiolar node is inclined posteriad. Two species may be involved here, as the only two specimens differ somewhat in appearance, with one being shiny with orange legs and the other matt with dark reddish legs. There are also small differences in the shelf-like posterior carina of the propodeum. However, these differences may also be accounted by biogeography, the shiny worker having been hand-collected at Cape Bernier in the northern Kimberley and the matt worker having been collected at Pannawonica in the Pilbara. A Flickr photograph of a living sample of the matt morph, sitting on a rock, is available online (https://www.flickr.com/photos/myrmician/7710265338). This may be the same ant as the pinned specimen, since the photographer is the person (F. Bokhari) who collected the pinned ant, and the locality is also the same.

Polyrhachis sp. JDM 805 and the remaining species in the complex also have a dorsal flange to their petiolar node, but this is inclined vertically. In *Polyrhachis* sp. JDM 805 the dorsum of the propodeum terminates in a posterior flange that overhangs its declivous face. The other taxa have a propodeum that is armed with denticles at the propodeal angles or the propodeum terminates in a transverse carina or angle. As with several other species in this group, one collection has come from some 100 km SSE. of Newman. The other worker represented in the JDM Collection was taken at Marandoo in the Pilbara. There are no other details for this species. There is a degree of perplexing variability regarding what constitutes *P. schwiedlandi* itself; mainly this has to do with the degree of convergence of the lateral margins of the propodeum. In the case of two separate pins (the single workers on each being identical) the sides of the propodeum are parallel, and the propodeal angles are distinct and slightly raised. In a third, smaller specimen with darker legs, the propodeum is strongly attenuated posteriad and terminates in a gentle transverse angle and the posterior propodeal corners are inconspicuous. The material on AntWeb (images of two ants, including a syntype) reveals an intermediate state, with the propodeum moderately attenuated anteriad. The variability allows for the possibility of more than one species, but equally for infraspecific variation, given the Australia-wide range of this ant. The position taken here is the conservative one. What unites all these specimens is a gena that is strongly depressed with a post-ocular carina that terminates at the outer margin of the eye. There is also a carina between the upper gena and the underside of the head. In profile, the pronotal humeri extend over the sides of the pronotum as a distinct shelf, and, in full-face view, the sides of the head are straight or even concave. These features combined are not seen in other members of the complex. *Polyrhachis schwiedlandi*, as here understood, has been taken in arid or semi-arid habitats in WA, including the Coolgardie, Carnarvon, Murchison and Pilbara subregions. Elsewhere, this species occurs in all Australian states except Tas and Vic. All that has been recorded of this ant is that it has been collected on the ground while foraging nocturnally, and that it occurs in dry sclerophyll woodland.

Polyrhachis inconspicua and *P. io* are readily discerned because of impressed cuticle that forms an annulus around the compound eye. Other features include a petiolar node with dorsal processes present as discrete short denticles or acute angles and separated by a broadly U-shaped margin (versus a petiolar node that either lacks dorsal processes, or these are present as broad denticles separated by a V-shaped emargination or indistinct angles separated by a broad undulation), lateral denticles produced as small teeth or spines, and eyes that are placed very close to the posterior angles of the vertex. These are both small species (HW ≥ 1.30 mm). In *P. inconspicua* the first gastral tergite has fine, uniform alveolate or alveolate-striolate sculpture, and, in rear view,

the propodeum has a straight or weakly undulant posterior carina. In *P. io* the first gastral tergite has coarse, costulate-microreticulate sculpture, and, in rear view, the propodeum lacks a posterior carina and the propodeal angles are produced as two unconnected denticles. *Polyrhachis inconspicua* is a common ant from about the North West Cape northwards and is also found on Barrow Island. This species is found around the northern coastline of Australia and is also found in the NT and QLD to south of Brisbane. Despite the ubiquity of the species, there appear to be no ecological data from labels or other sources although the sheer variety of localities where the ant has been collected suggests it is tolerant of multiple habitats. One worker from the Glenelg River in the Kimberley was collected from rainforest. *Polyrhachis io* is a much less common ant that has been collected from the west Kimberley, and also occurs in the NT. Nothing on its biology appears to have been published. Also likely to belong to this cluster, despite the annulus around the eye being incomplete, is *Polyrhachis* sp. JDM 1201, known from one worker from Walcott Inlet in the Kimberley. When seen in profile, the propodeum forms a convexity separate to that of the pronotum and mesonotum. The appressed setae of the antennal scape are fine and overlapping and form a dilute pubescence (this feature shared with *P. inconspicua* and *P. io*). In the remaining species the propodeal outline is part of the general arc of the mesosoma, and the appressed setae of the antennal scape are stout and well-separated. Andersen (2000) mentions one Kimberley species (*Polyrhachis* sp. JDM 1201?) in this little species cluster that has a prominent dorsal propodeal ridge.

Polyrhachis sp. JDM 1009 is similar to *P. schwiedlandi* and probably closely related. As in *P. schwiedlandi*, the head is longitudinally depressed below the eye, but the two planes are not separated by a carina, nor are the pronotal humeri extended over the sides of the pronotum as a distinct shelf. The femora are a dark brown or blackish-brown. (In *Polyrhachis* sp. JDM 1010 and *Polyrhachis* JDM 1200 the head is not depressed below the eye and the femora are pale yellow.) This species has been collected in the Pilbara and upper Murchison. There are no other details. *Polyrhachis* sp. JDM 1010 and *Polyrhachis* sp. JDM 1200 can be most easily distinguished by a visual inspection of the propodeum from above: in the former, the propodeum is only weakly attenuated (if at all) towards its posterior angles, whereas, in the latter, the propodeum is strongly attenuated posteriad (width of posterior margin of propodeum ≤ 0.5 × width of anterior margin). The colour patterns of the legs also vary; in *Polyrhachis* sp. JDM 1010 all tibiae (apart from their articulations with the other leg segments) are pale yellow to yellowish-orange, but in *Polyrhachis* sp. JDM 1200 the hind tibiae are dark brownish-yellow and distinctly darker than the fore- and mid-tibiae. The mesosomal sculpture is also subtly different, the sculpture of the mesosoma of *Polyrhachis* sp. JDM 1200 consisting of short, beaded striae that are indistinct from a distance, while the sculpture of the mesosoma in most workers of *Polyrhachis* sp. JDM 1010 consists of distinct long striae that are clearly visible from a distance. *Polyrhachis* sp. JDM 1010 is common on Barrow Island and is broadly, although sparsely, represented in collections from other arid and semi-arid parts of WA from the Pilbara southwards. Workers in the more southern regions are smaller and reveal subtle clinal(?) differences in the sculpture of the mesosomal dorsum when compared with northern material. In the former the longitudinal striae are less impressed, and they lack the concentric striations on the pronotum distinctive of northern workers. The northern morph has been collected in dry pitfalls, but more information is available on the southern morph. In the Eneabba region a worker has been collected on *Banksia attenuata* and *Eremaea beaufortioides* sandplain flats, while at Tropicana minesite in the Great Victoria Desert another worker has been pitfall-trapped amid *Casuarina*. The closely related *Polyrhachis* sp. JDM 1200 is known from two workers collected many years ago in the Newman area in the southern Pilbara/northern Murchison and a pitfall-trapped specimen collected more recently on Hope Downs Station. No further details are available.

The *Polyrhachis sidnica* complex is about the same size as the *P. schwiedlandi* complex and almost as poorly known (10 species, six undescribed). In general, these species have a more southerly, mesic distribution in WA than the taxa thus far discussed. They are here placed tentatively within the *P. micans* species-group but are likely more distantly related to *P. micans* than are the members of the P. *schwiedlandi* complex. The petiolar node in this clade is characteristically thick and granulated in appearance, unlike the smooth scale seen in the *P. micans* and *P. schwiedlandi* complexes. Dorsal spines as well as lateral teeth or spines are always present on the petiolar node, but the dorsal spines are usually of the same size or longer than the lateral spines; the node in full-face view is about as high as wide and, while it may be flattened or curved anteriorly, it is not trapezoidal. In dorsal view the humeral angles are angular or rounded but not dentate. Collections for all species are sparse in WA except for the common and

widespread *Polyrhachis phryne*. Data for the other taxa suggest these ants are mainly or wholly soil nesters, in at least one case in rotted wood, but they also frequently forage on trees as well as on the ground. Nocturnal foraging has been recorded.

Polyrhachis hirsuta is readily recognisable because of its vestiture of long, white, erect setae on the head, body and appendages, such setae being absent in other members of the complex. The species is rare in WA, with just two known occurrences, namely, in Sawyer's Valley, east of Perth, and in Margaret River in the extreme south-west corner of the state. The ant is more common along the eastern seaboard where it can be found in the ACT, NSW, QLD, and Vic. Stray, nocturnal foragers of this species have been collected from tree trunks, and the solitary vegetation association is dry sclerophyll woodland. Three other *Polyrhachis* species — *Polyrhachis phryne*, *Polyrhachis* sp. JDM 118 and *Polyrhachis* sp. JDM 703 — have fine, overlapping, appressed setae on the first gastral tergite, the other species in the complex having only short, well-separated appressed setae that do not form a pubescence. *Polyrhachis* sp. JDM 703 differs from the other ants with pubescent gasters in having the propodeal dorsum longitudinally rectangular (> 1.5 × longer than wide), and the propodeal angles produced as tiny, upturned teeth. The gaster is intensely punctate and in some individuals may be finely and densely striolate. The latter species have a propodeum that is square or trapezoid and as wide as or wider than long, and the propodeum terminates in upwardly curved angles, dentate flanges, or teeth. *Polyrhachis* sp. JDM 703 has a reasonably broad range that extends from at least the area around Newman in the lower Pilbara, east to the Great Victoria Desert and southwards to just north of Perth. As with other undescribed members of this species complex, the occurrence of this ant outside of WA is unknown. Foragers have been found on vegetation and on the ground and have been collected in dry pitfall traps, but otherwise their biology is unknown.

Polyrhachis phryne is probably the best known member of the *P. sidnica* complex. This species differs from *Polyrhachis* sp. JDM 118 in having the propodeal angles produced as upwardly curved, dentate flanges about as wide as long across their base (in *Polyrhachis* sp. JDM 118 > 2 × as long as wide across their base) and, in full-face view, the dorsal spines of the petiolar node are visibly closer to one another than they are to the lateral spines (the dorsal and lateral spines of the petiolar node are equidistant from one another in *Polyrhachis* sp. JDM 118). *Polyrhachis phryne* is common in the vicinity of Perth, where it is occasionally seen in relict suburban bushland or large yards with native shrubs and trees, and has a mainly coastal distribution along the south-west and southern coast as far as the SA border. This species occurs in all states except the NT and Tas. *Polyrhachis phryne* is an adaptable ant and, as well as from suburban lawns and other unlikely places, has been collected in a *Pinus radiata* plantation (on two occasions), from a rehabilitated limestone quarry, in sandplain heath, in mallee/saltbush, in degraded tuart (*Eucalyptus gomphocephala*) woodland with a ground cover of exotic weeds, and from a branch of *Eucalyptus caesia*. Kohout and Taylor (1988) mention this species generally nests under stones (except in the dry, calcareous soils of western SA), prefers dry sclerophyll forests and woodlands, and is a nocturnal forager on tree trunks. In WA, this species has been collected in a yellow pan trap. *Polyrhachis* sp. JDM 118 has been collected in the vicinity of Perth, in the southern wheatbelt and along the south coast at least as far east as Esperance. This species has also been collected in heathland near Pink Lake in Esperance, and a nest was discovered under rotted wood in sandplain just north of Perth.

Polyrhachis sp. JDM 804 has a peculiar facies. The head, in full-face view, has distinctive rounded bosses or small tubercles above the eyes, and the eyes themselves are very convex and almost conical. The humeral angles are broad, bluntly to sharply dentate and elevated above the rest of the anterior pronotum. This ant has been incorrectly identified as *P. 'leae'* in other publications (e.g. Heterick [2009]), but does not agree with the *P. leae* type material from Tas imaged on AntWeb. The appearance of the petiolar spines (which are equidistant from one another) as well as the propodeal teeth, suggest this species is closely related to *P. sidnica*. Nearly all records of *Polyrhachis* sp. JDM 804 have come from the forested areas of the Darling Range, but there is one record from Boxwood Hill, near the south coast. The latter specimen was found foraging on sandplain heath, but workers from Dryandra were collected in a bark trap set on wandoo. After acceptance of this manuscript, a single specimen of a worker that is similar but not identical to the above taxon was found in old Curtin University wet material being investigated before disposal. This worker lacks the bosses mentioned above and the surface sculpture of the pronotum and mesonotum consist of longitudinal striae (finely imbricate sculpture in *Polyrhachis* sp. JDM 804). The eyes are also larger. Otherwise the worker closely matches workers of *Polyrhachis* sp. JDM 804. In all likelihood this is a new species belonging to the same complex, but

more material is needed to verify this because of the biogeographical separation. The worker was collected somewhere in the eastern or northern goldfields during the expedition led by W.F. Humphries in the 1980s, but nothing else is known about it.

Two rare *Polyrhachis* in the *sidnica* complex, *Polyrhachis* sp. JDM 802 and *Polyrhachis* sp. JDM 1384, each known from a single series and just one or two specimens, have the lateral processes of the petiolar node reduced to short, stout, denticles that are much shorter than the dorsal spines. In *Polyrhachis ops*, *P. sidnica* and *Polyrhachis* sp. JDM 390 the lateral spines are the same size or longer than the dorsal spines. *Polyrhachis* sp. JDM 1384 is known to science from a single specimen collected from Whitlock Island, a tiny inshore island of just 5.24 ha that lies adjacent to Jurien Bay in the Geraldton Sandplains subregion. This species is separable from *Polyrhachis* sp. JDM 802 because of its all-dark appearance, including the reddish-black appendages (*Polyrhachis* sp. JDM 802 has pale yellow legs) and larger size (HW > 1.2 mm as opposed to ~1 mm). Apart from basic collection details, nothing more is known of this specimen. The same applies to the two workers of *Polyrhachis* sp. JDM 802, which were collected many years ago in Torndirrup National Park, near Albany on the south coast.

Seen in full-face view, *Polyrhachis sidnica* has lateral spines that are on only a fractionally lower plane than the dorsal spines. This is a smaller species than *Polyrhachis ops* or *Polyrhachis* sp. JDM 390 (HW ≤ 1.50 mm compared with HW ≥ 1.95 mm) and the propodeal angles are produced as flattened spines directed posteriad, their length ≥ 2 × their width across their base (versus propodeal angles produced as upcurved dentate flanges at a maximum about as long as wide across their base). In WA, *P. sidnica* occurs in the SWP to about Eneabba in the north and also in the goldfields. Interstate, this species has been recorded from the other mainland states except for the ACT, the NT, and Tas. Near Hyden, in the Mallee subregion, this species has been collected on sandplain/laterite heathland foraging on the ground at night. Other collections have also been made on coastal dunes and in scrubland. *Polyrhachis ops* is a relatively smooth species with a moderately shining, finely microreticulate-striolate cuticle. In dorsal view, its mesonotum is weakly trapezoid with an anterior margin that is slightly broader than its base, the whole sclerite being about as wide as long; the propodeal angles are also produced as upcurved dentate flanges at a maximum about as long as wide across their base. *Polyrhachis* sp. JDM 390 differs in being matt with the sculpture of the mesosoma coarsely reticulate-striolate, In dorsal view, the mesonotum of this species is narrowly trapezoid with an anterior margin that is much broader than its base, and the whole sclerite is visibly much wider than long; the propodeal angles are raised but are not dentiform. *Polyrhachis ops* is restricted to the southern WA coastline to about Esperance. One ancient (1924) record from north-east QLD ascribed to this species may be referable to a taxon, also found in that region, which is currently languishing under an unavailable quadrinomial; however, this species (illustrated in AntWeb) is definitely not *P. ops*. *Polyrhachis ops* workers taken near Albany have black legs; those taken much further east have orange legs. The ant has been taken in a blue mallee plantation and in pitfall traps, but that is the limit to what is known about the species. *Polyrhachis* sp. JDM 390 has been recorded on the eastern flanks of the Darling Range from pitfall traps, but that is the extent of our knowledge.

The *P. macropus* species-group is a small, compact clade of *Polyrhachis* in which the lateral spines of the petiole are inclined obliquely at an angle of ≥ 60°. These spines are thin and distinctly longer than the dorsal spines. In full-face view the petiolar node is narrow, distinctly higher than wide; in profile the node is trapezoidal anteriad, the pronotal humeri, when seen in dorsal view, are dentate. The constituent species (three described, one undescribed) have gracile bodies and long legs, except for *Polyrhachis* sp. JDM 1189. This pulls them clearly apart from the other, much more compact *Polyrhachis* (‘*Campomyrma*’) groups.

The worker of *Polyrhachis* sp. JDM 1189 has shorter legs than its fellows in the *P. macropus* species-group and its bodily proportions are more typical of the other *Polyrhachis* (‘*Campomyrma*’) species-groups. This species can also be distinguished by its upturned propodeal spines. This small member of the group is known only from a couple of collections in the Pilbara subregion and may occur elsewhere in Australia, but there are no data other than the basic collection details. In dorsal view, the surface of the mesosoma in *P. macropus* is finely striate-reticulate when seen from a distance, not leathery in texture as in *P. pyrrhus* and *P. zimmerae*; also, in dorsal view, the sides of propodeum are visibly convex, but straight or only weakly convex in the other two ants. In WA, *P. macropus* is mainly to be found in the inland Carnarvon, Gascoyne, Murchison, and Pilbara subregions. This species also occurs in the NT and SA. *Polyrhachis macropus* is well-enough known to have a common name — the ‘mulga ant’. The nests, raised well above the ground to avoid flooding in rainfall events,

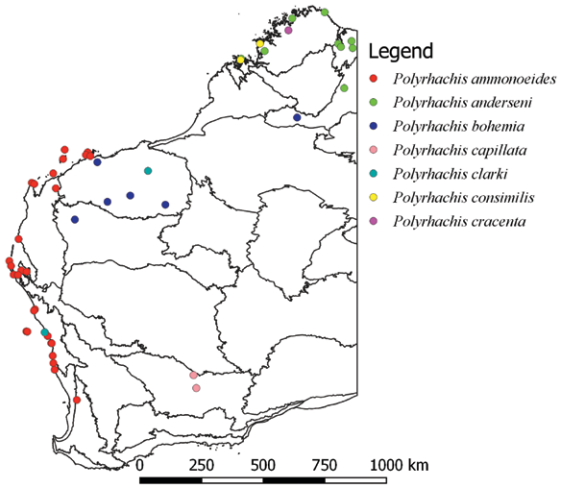

FIGURE 78 Distribution of *Polyrhachis ammonoeides*, *P. anderseni*, *P. bohemia*, *P. capillata*, *P. clarki*, *P. consimilis*, and *P. cracenta*.

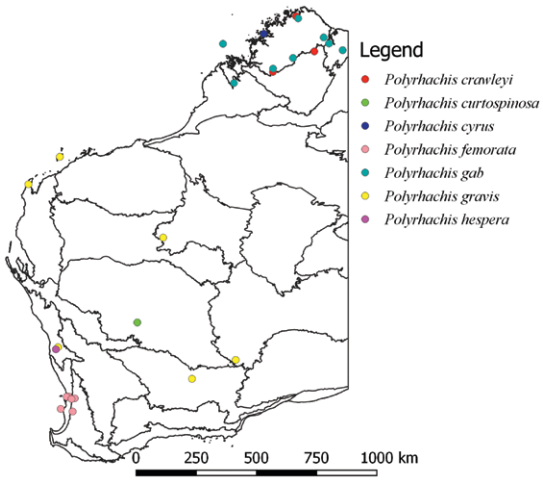

FIGURE 79 Distribution of *Polyrhachis crawleyi*, *P. curtospinosa*, *P. cyrus*, *P. femorata*, *P. gab*, *P. gravis*, and *P. hespera*.

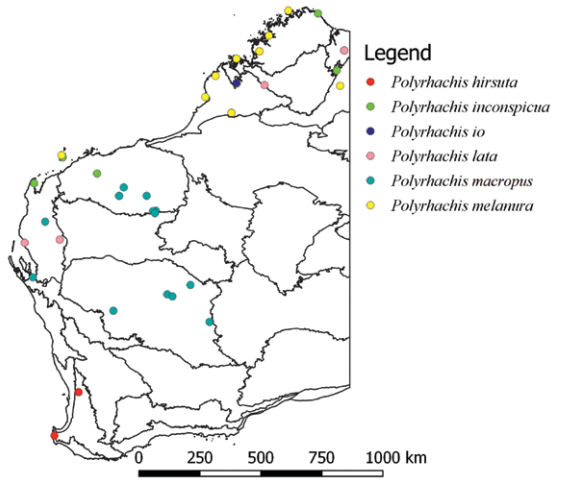

FIGURE 80 Distribution of *Polyrhachis hirsuta*, *P. inconspicua*, *P. io*, *P. lata*, *P. macropus* and *P. melanura*.

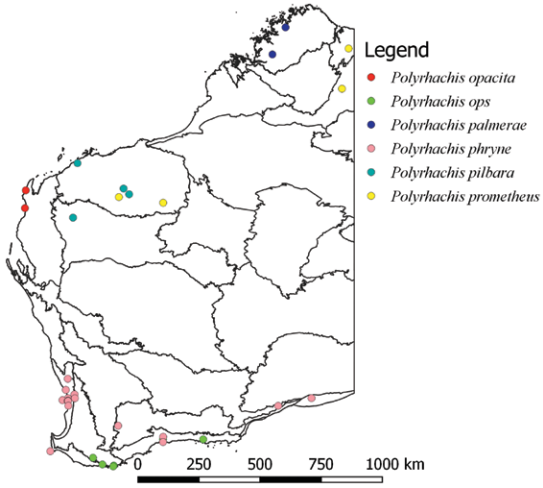

FIGURE 81 Distribution of *Polyrhachis opacita*, *P. ops*, *P. palmerae*, *P. phryne*, *P. pilbara* and *P. prometheus*.

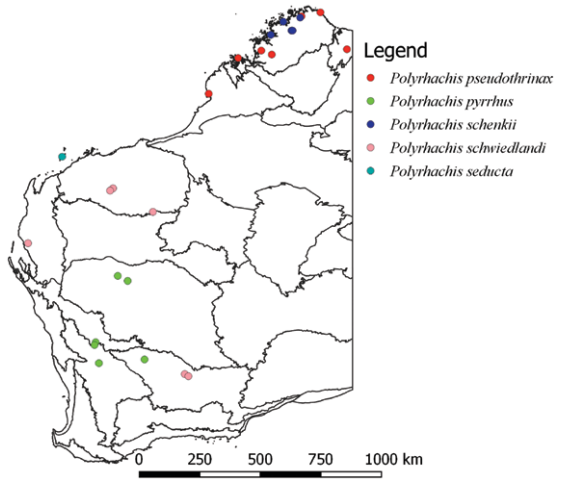

FIGURE 82 Distribution of *Polyrhachis pseudothrinax*, *P. pyrrhus*, *P. schenkii*, *P. schwiedlandi* and *P. seducta*.

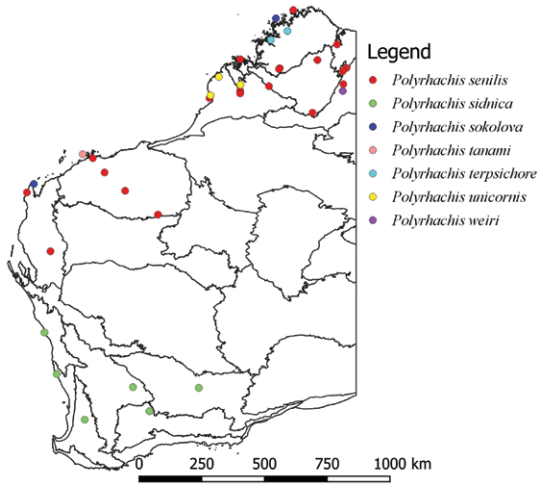

FIGURE 83 Distribution of *Polyrhachis senilis*, *P. sidnica*, *P. sokolova*, *P. tanami*, *P. terpsichore*, *P. unicornis* and *P. weiri*.

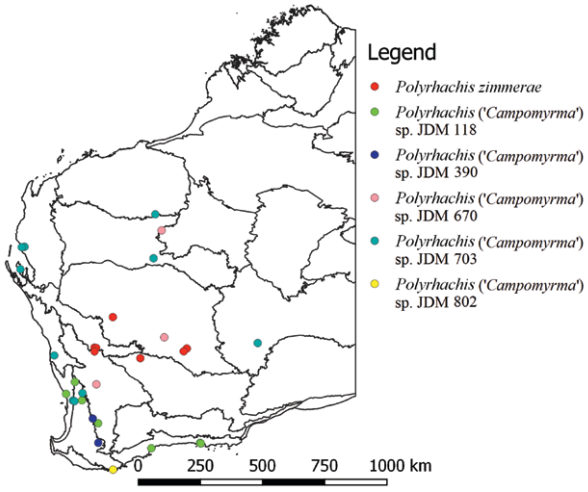

FIGURE 84 Distribution of *Polyrhachis zimmerae* and *Polyrhachis* ('*Campomyrma*') sp. JDM 118, JDM 390, JDM 670, JDM 703 and JDM 802.

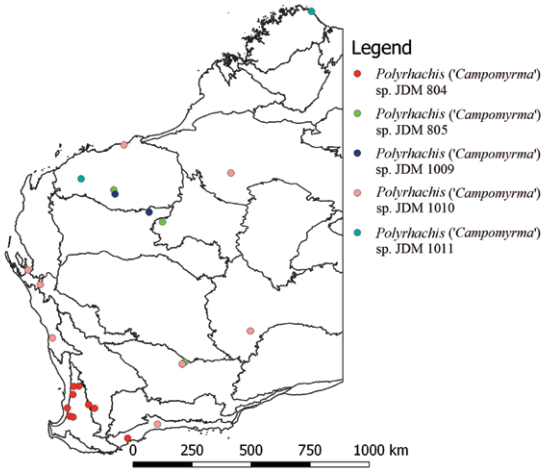

FIGURE 85 Distribution of *Polyrhachis* ('*Campomyrma*') sp. JDM 804, JDM 805, JDM 1009, JDM 1010 and JDM 1011.

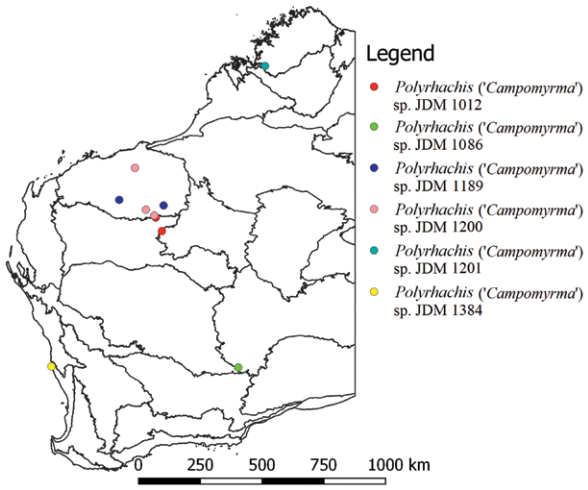

FIGURE 86 Distribution of *Polyrhachis* ('*Campomyrma*') sp. JDM 1012, JDM 1086, JDM 1189, JDM 1200, JDM 1201 and JDM 1384.

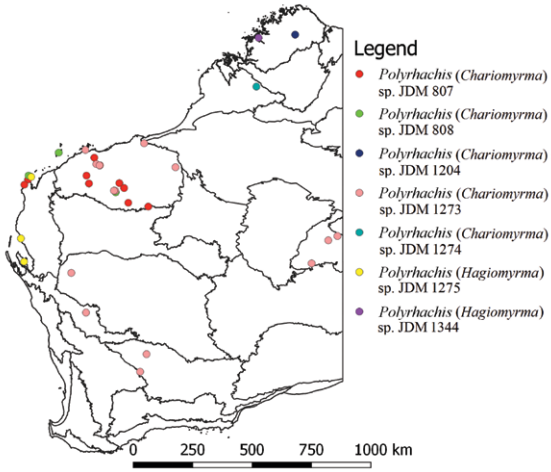

FIGURE 87 Distribution of *Polyrhachis* (*Chariomyrma*) sp. JDM 807, JDM 808, JDM 1204, JDM 1273 and JDM 1274, and *Polyrhachis* (*Hagiomyrma*) sp. JDM 1275 and 1344.

are mostly in red soil and are usually thatched on the sides with needle-like mulga phyllodes. The appearance of the propodeum in dorsal view (≥ 2.5 × as long as wide and with a weak median groove in *P. pyrrhus* pinned material and ≤ 2 × as long as wide and usually without a weak median groove in *P. zimmerae* pinned material) and the dorsal excrescences of the petiolar node (always spinous in *P. pyrrhus* but reduced to short denticles or nubs in *P. zimmerae*) separate the remaining two species. These two ants occur in much the same areas in WA, mainly the northern wheatbelt and northern goldfields, and on Charles Darwin Reserve they are sympatric. *Polyrhachis pyrrhus* has also been recorded in the NT, NSW, and QLD and, based on the proximity of records close to the SA border, occurs in SA also. Nests of this species observed by this author at Bunketch in the northern wheatbelt had a peculiar appearance, as though they were broken flasks or amphora buried in the clay soil, and these nests had very large entrance holes. *Polyrhachis pyrrhus* prefers mallee, mulga or *Acacia/Casuarina* associations and nests in lateritic gravel, clay, or light soil. The range of *P. zimmerae* in other Australia states is unclear, but NSW is known, and SA is likely. This ant prefers *Mulga bowgada* woodland and red-brown clayey loam in WA. The species will also nest in yellow lateritic sand. The nest on several labels is described as an 'elliptical bund' with a declivous entrance.

Prolasius (Figure 88)

In WA, *Prolasius* is a smallish genus consisting of seven species (four described, three undescribed). Most members of the genus are uncommon to very rare and nearly all are confined to the coolest, wettest part of the state in the south-west corner and along the western south coast. *Prolasius* ants have a 12-segmented antenna, a metapleural gland, antennal sockets that are situated well above the posterior margin of the clypeus, the clypeus itself is convex, acutely angled medially (often with a complete or at least partial median longitudinal carina) and terminates in a small denticle or protuberance (which is sometimes slightly bifurcated), and the propodeal spiracle is round and is placed immediately adjacent to the declivous face of the propodeum. As a group, their biology is almost unknown but several species, none of which is found in WA, take eucalypt seeds (Ashton 1979).

Prolasius flavicornis, *P. hemiflavus* and *Prolasius* sp. JDM 109 lack pubescence on the gaster formed by densely overlapping fine, appressed setae, the other four species all having this character. *Prolasius flavicornis* is a brown species, in contrast to *P. hemiflavus* and *Prolasius* sp. JDM 109, which are shades of yellowish or light yellowish-brown in colour. *Prolasius flavicornis* is known in WA from two extremely biogeographically separated single workers, one taken in the north-western Kimberley, and the other in jarrah forest near Dwellingup not far south of Perth. This extraordinary range, with no collections in between, has no easy explanation. In fact, the genus is otherwise almost unknown in northern Australia, except for the very humid band along the north-east coast of QLD. (There are just two NT records of genus *Prolasius*, both from near Alice Springs, and a single record from north-west QLD, near the NT border [all records in the 'Atlas of Living Australia'].) Other known occurrences of *P. flavicornis* are in NSW and Vic. Both WA workers were pitfall-trapped, the Ellendale (Kimberley) sample in a dry pitfall trap. A worker taken in Vic was collected under a rotting branch in *Nothofagus* forest. *Polyrhachis hemiflavus* and *Prolasius* sp. JDM 109 are more similar in appearance, but in the former the erect setae on the mesosoma are confined to one pair on the pronotum, and, in profile, the mesonotum is compact and much deeper than wide. The setae on the antennal scape are also fine and decumbent. *Prolasius* sp. JDM 109 has at least two pairs of erect setae on the pronotum, at least one pair (often two pairs) on the mesonotum, and, in profile, the mesonotum is more elongate than is the case with the former species and is often nearly as wide as deep. Moreover, semi-erect setae are present along the length of the antennal scape. The sites at which *P. hemiflavus* has been collected in WA are near the south coast, except for one collection at Jarrahdale in jarrah forest. Other records have all come from Victoria. Nests have been found under rocks or stones, and one worker was collected in a tree trap indicating (probably nocturnal) arboreal foraging. Other specimens have been collected in pitfall traps. Most records of *Prolasius* sp. JDM 109 are from the Darling Range, but there is one record from the Avon wheatbelt. The occurrence of this undescribed species in other states is unknown. This ant, like the preceding, also forages arboreally, and has been taken in an intercept trap on a marri tree. Other workers have been collected in pitfall traps set in the soil.

Along with *P. wheeleri*, *Prolasius antennatus* is the species most likely to be seen by Perth residents, as it is found occasionally in relictual bushland in the Perth region. This ant can best be identified as a hairy, dark brown or blackish *Prolasius* with stout, erect setae on the legs and antennal scapes. *Prolasius wheeleri*, *Prolasius* sp. JDM 551 and *Prolasius* sp. JDM 1120 are generally less hairy and lack stout, erect setae on the legs and antennal scape (fine, sub-erect setae can be seen on the antennal scape in *Prolasius* sp. JDM 551). Most collections of *P. antennatus* have been from the SWP — the Swan Coastal Plain, the Jarrah Forest and the western south coast — but there is one Pilbara record. There is a small doubt about the identity of the single worker, taken about 25 km north of Newman, as the head and mesosoma are glabrous. However, structurally it is identical with the other workers, and stout erect setae are retained on part of the gaster which has crumpled inward. The ant appears to be abraded, which may account for the lack of setae on the body. The species is likely to be a WA endemic. Specimens collected in *Eucalyptus diversicolor* (karri) forest were found under stones and leaf and twig litter. Most of the other workers seen have been collected in pitfall traps. The erect setae on the shiny, brown *Prolasius* sp. JDM 1120 are fine and pale, with just one prominent pair on the pronotum, and the erect setae on the gaster have the same appearance. *Prolasius* sp. JDM 551 is a pale species, while *Prolasius wheeleri*, although it is of similar colour, is matt and the erect setae on the mesosoma and gaster are stout and dark. *Prolasius* sp. JDM 1120 is known from two records from the Jarrah Forest and Tingledale, in the Warren subregion. The Tingledale specimen(s) could not be located at the time of writing. The Huntly (Jarrah Forest) worker was pitfall-trapped.

Prolasius wheeleri is here regarded as the senior synonym of *P. reticulatus* (see Part I for details). This species is quite distinct from *Prolasius* sp.

JDM 551, both in terms of its colour (blackish to brownish-orange compared with yellowish), its matt appearance (*Prolasius* sp. JDM 551 is shining) and the sculpture of the clypeus (fine, arched striolae across the clypeal expanse are directed towards the midline of the clypeus in *P. wheeleri*, while the clypeus is glossy and unsculptured in *Prolasius* sp. JDM 551). *Prolasius wheeleri* is possibly the most common of the WA *Prolasius* and is represented by a number of collections, mostly in the Jarrah Forest south and east of Perth and along the south coast, but the ant has also been collected in relictual bushland in the Perth suburbs of Canning Vale, Eglinton, Kings Park and Reabold Hill. This species also occurs in the ACT and NSW (at least). Workers collected diurnally on white sand in *Banksia* sandplain were carrying alate termites. Workers were also collected at Australind over the same soil type in *Banksia/Agonis* woodland. Other locations include a bush track in low coastal scrub. This species forages on trees, as evidenced by the collection of multiple workers in intercept traps on wandoo. In Black Mountain, Canberra, the same species has been picked up in sifted litter (leaf mold and rotten wood). *Prolasius* sp. JDM 551 is mainly confined to the deep south of WA, with all collections bar one (from the Darling Range near Jarrahdale) coming from the south coast as far east as Esperance. This species may require moist, dense thicket; the Darling Range worker was collected in an unmined stream zone, and three workers were taken from Boronia Swamp Road, near Bremer Bay. Other labels also suggest collection in high rainfall locations. As with nearly all undescribed species, the presence of this ant in other Australian states in unknown.

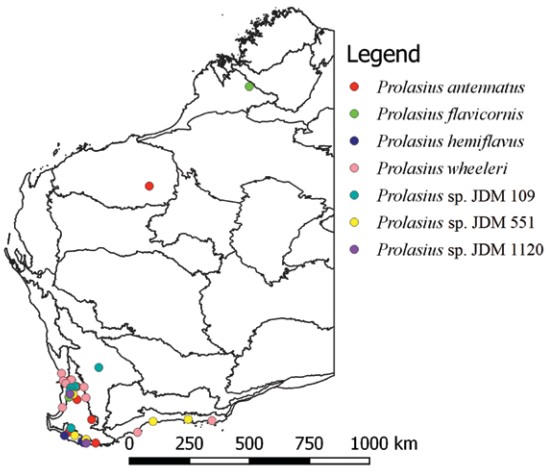

FIGURE 88 Distribution of *Prolasius antennatus*, *P. flavicornis*, *P. hemiflavus*, *P. wheeleri*, and *Prolasius* sp. JDM 109, JDM 551 and JDM 1120.

Stigmacros (Figures 89–94)

Stigmacros is a moderately large genus in WA. The biology of *Stigmacros* is poorly known but these ants are regarded as general predators and, in the experience of the author, WA species forage mainly on the ground, being mostly seen in situations where there has been a build-up of leaf and twig litter. Although the genus was monographed by the Jesuit priest and amateur taxonomist Father John McAreavey in 1957, much of his taxonomy relied on trivial and misleading characters with the result that some species were given multiple names while many WA taxa were apparently not seen by him and have remained undescribed. As a consequence, no fewer than 10 of McAreavey's 'species' in two genera, namely, *Prolasius* and *Stigmacros*, become junior synonyms in this work — almost a half of all the species synonymised in this monograph. Seven of McAreavey's names are here made junior synonyms of the one ant, *Stigmacros clivispina* (Forel)! In this work 35 WA species (19 named, 16 undescribed) are recognised. McAreavey divided the genus into six subgenera: *Campostigmacros*, *Chariostigmacros*, *Cyrtostigmacros*, *Hagiostigmacros*, *Pseudostigmacros* and *Stigmacros*. To the mind of this author, just three of these putative subgenera — *Campostigmacros*, *Chariostigmacros* and *Cyrtostigmacros* — seem to have justification and are here treated as species-groups. An additional clade, that includes a single species with several apomorphies, can be added to these species-groups.

At a genus level, *Stigmacros* is easily recognised as a group of formicine ants with 11-segmented antennae, long palps (PF 6,4), a propodeum (and often a petiolar node) armed with spines, denticles or protuberances, a mesonotum that is not constricted anteriorly, and a propodeal spiracle that is located laterally adjacent to the declivous propodeal face and about halfway down the propodeum, often directly under a prominence or denticle.

A small clade (just two species) of small, highly sculptured *Stigmacros* correspond to McAreavey's subgenus *Chariostigmacros*. These have the transverse ridge (actually, the metanotum) specified by McAreavey, which has a concave posterior face. On close inspection, small longitudinal costulae (one being particularly prominent) can be seen connecting this sculpture with the anterior propodeum. The metathoracic spiracles are not readily visible (mostly visible in other *Stigmacros* except for those assigned by McAreavey to *Campostigmacros*). These features and the extreme rugosity and alveolate and microreticulate sculpture of the cuticle easily

distinguish the two constituent species from other *Stigmacros*. The Western Australian material for *Stigmacros hirsuta* (which in WA may actually be two species, not necessarily including *S. hirsuta* itself) does not exactly match the holotype, which is from Kuranda, QLD. The specimen from the Little Sandy Desert completely lacks lateral spines on the petiolar node, while these spines in the Kimberley specimen are small, though sharp. The eye of the former also appears to be smaller and the colour of both specimens is paler. Nonetheless, the shape and sculpture of the mesosoma, at least in the Argyle Diamond Mine worker, are identical to the holotype. The Argyle Diamond Mine specimen is likely to be *S. hirsuta*. While there may be at least two species in a small complex involved (especially in view of the biogeography), equally, the ant could be very variable over a large range — which is the view taken here. More material is needed.

Stigmacros hirsuta has a smaller eye (EL < 0.25 × length of side of head) that is oriented longitudinally on the side of the head, and erect, thickened setae that are regularly arranged in widely spaced pairs on the mesosoma, especially its lateral margins. In profile, the eye of *Stigmacros* sp. JDM 833 is very large (EL > 0.35 × length of side of head) and oriented obliquely on the side of head; and the erect, thickened setae on the mesosoma (where present) are reduced to a solitary pair on the pronotum. *Stigmacros 'hirsuta'* has been collected once in the northern Kimberley and once in the Little Sandy Desert subregion. The species was described from Kuranda in QLD, the only other recorded locality. The ant from the Little Sandy Desert was pitfall-trapped in *Acacia* woodland over sandstone. The Argyle Diamond mine worker was also pitfall-trapped. *Stigmacros* sp. JDM 833 has only been collected in the goldfields region (near Widgiemooltha and at Black Swan Mine, north-east of Kalgoorlie). The Widgiemooltha worker was hand-collected in the early afternoon near the Coolgardie–Esperance Highway in dry sclerophyll woodland dominated by salmon gum (*Eucalyptus salmonophloia*).

In a largish group of *Stigmacros* (12 species) the mesosoma is flattened and the sides of the mesonotum are defined by a carina that separates its dorsal face from its lateral face. The pronotum may also be carinate. The mesopleuron is deeply impressed and overhung by the mesonotum (except for *Stigmacros* sp. JDM 341); the node frequently has distinct dorsal or/and lateral teeth and the forefemur is often conspicuously large and bulbous. This suite of taxa corresponds to McAreavey's subgenus *Campostigmacros*, except for *Stigmacros* sp. JDM 341. In the latter, the dorsum of the mesosoma and the gaster are pubescent (not pubescent and often glabrous in McAreavey's *Campostigmacros*), the cuticle of the mesosoma is matt and microstriolate (typically glossy and unsculptured apart from hair pits in McAreavey's *Campostigmacros*), the mesopleuron is not impressed but is on the same vertical plane as the lateral surface of the mesonotum (mesopleuron always deeply impressed and overhung by the mesonotum in McAreavey's *Campostigmacros*), the propodeum is flattened and square dorsally without a median furrow or slight concavity, in rear view its sides straight and vertical (in species formerly assigned to *Campostigmacros*, with the exception of *Stigmacros* sp. JDM 831, the narrowly trapezoid propodeum usually has a median furrow, a slight concavity or a dorsal surface that descends obliquely to the declivous surface and is confluent with it, in rear view the sides of propodeum being divergent posteriad), and, in profile, the petiolar node in *Stigmacros* sp. JDM 341 is rather thick (in profile, the node is typically scale-like in McAreavey's *Campostigmacros*). For these reasons *Stigmacros* sp. JDM 341 is here placed in a species-group of its own, *Stigmacros* species-group A. The species is generally uniform in appearance, but the node in some workers is orange although in most it is black, like the rest of the body. This taxon is currently known from disjunct populations in the Perth metropolitan area and in the vicinity of Newman in the Pilbara, but many other specimens have been seen, though not pinned, and the natural range of the ant is likely to envelop all the mapped sites. This species has been collected several times in the Fremantle region (one such collection is shown on the map and one is obscured) in relictual coastal scrub over calcareous sand. However, no notes on the biology of the species have been recorded for label data.

The remaining 11 species all belong to the species-group that was formerly subgenus *Campostigmacros*. *Stigmacros spinosa* and *Stigmacros* sp. JDM 831 are morphologically a little removed from the other members of the group in terms of the development of the propodeal spines. *Stigmacros spinosa* is a spectacular species in which the propodeal spines and the pair of dorsal petiolar spines are very well developed and directed posteriad. However, the lateral petiolar spines are either vestigial or are reduced to small teeth. *Stigmacros spinosa* was placed in subgenus *Hagiostigmacros* by McAreavey along with two other species that occur in WA, namely, *Stigmacros barretti* and *Stigmacros punctatissima*. Apart from

its spinous appearance, *S. spinosa* appears not to be related to the other two species: *S. spinosa* has the characters that situate it fairly in the species-group that was formerly *Campostigmacros*, whereas, based on their morphology, *S. barretti* and *S. punctatissima* agree with McAreavey's diagnosis for *Cyrtostigmacros*. Two species here ascribed to *S. spinosa* may be represented among the WA material; the specimens from the south-east of the state are acceptably close to the type material, but the spikier worker from the mid-west of the state may be a distinct taxon (see Heterick [2009] for discussion on this matter). As understood in this monograph, the species ranges throughout the drier parts of southern WA, extending as far north as Shark Bay. This ant also occurs in NSW. A worker from Redross Goldmine near Kambalda was pitfall-trapped in *Eucalyptus salubris* woodland, while the worker from Eucla was extracted from rotting wood. The very pale *Stigmacros* sp. JDM 831 is very similar to *S. spinosa*, but the spines above the propodeal spiracle are more developed and actually much longer than the dorsal propodeal spines and the lateral petiolar spines are also well-developed and the same length as the dorsal petiolar spines. Only in this species does the propodeum depart from the trapezoid model found in other members of the species-group; here it is narrowly longitudinal. *Stigmacros* sp. JDM 831 appears to be very uncommon and has only been collected on a couple of occasions, both in the Perth metropolitan region. The only pinned worker was hand-collected in *Banksia* woodland in Jandakot at night, while a dealate queen was hand-collected in Canning Mills. In this case, as is the case with other undescribed *Stigmacros*, the occurrence of the species interstate is unknown.

All of the remaining species in this clade have the characteristic trapezoid propodeum. Four handsome *Stigmacros* species with a black mesosoma and dark brown to yellowish gaster and appendages can be differentiated from the other members of the species-group, in which the mesosoma is lighter-coloured. *Stigmacros anthracina* has distinct, longitudinal sculpture on the mesonotum whereas *S. brachytera*, *S. elegans* and *Stigmacros* sp. JDM 1045 have a smooth, glossy mesonotum with, at most, surface microreticulation only. *Stigmacros anthracina* also has tiny denticles at the posterior propodeal angles while the other three species have propodeal angles only or the propodeal angles are obsolete. In WA, collections of *S. anthracina* have been confined to the northern Jarrah Forest subregion (largely obscured on Figure 89 by other species records). This species was described from material collected at Mt Lofty, SA — the only interstate record for this species. The biology of this ant is unknown, although it apparently prefers thickly forested, moist environments. *Stigmacros brachytera* is a much more common species that can easily be pulled apart from *S. elegans* and *Stigmacros* sp. JDM 1045 by virtue of its strongly dorsolaterally compressed head that possesses a weak subcarinate postocular ridge (this feature is lacking in *S. elegans* and *Stigmacros* sp. JDM 1045) and its rather small eye (EL ≤ 0.18 × length of side of head) compared with the other two ants (EL ≥ 0.25 × length of side of head). Like *S. anthracina*, *S. brachytera* prefers moist, humid environments but has a more coastal distribution than the former species, and all collections have been made from the edge of the Darling scarp around the south-west and southern coasts from the Perth region to Albany. There are no interstate records for this species, which appears to be restricted to south-western WA. A number of samples have been pitfall-trapped, but the only available label data (two workers collected at Torbay, west of Albany) read: 'white sand, coastal scrub[,] much woody debris'.

Stigmacros elegans has a large eye (EL ≥ 0.30 mm) that is separated from the mandibular insertion by less than its own length, in dorsal view the propodeum is seen to possess a median furrow, and, in full-face view, the petiolar node is slightly emarginate above. This small suite of characters contrasts with *Stigmacros* sp. JDM 1045 in which the eye is smaller (EL ~0.25 mm) and separated from the mandibular insertion by about two times its length, the propodeum is flat in dorsal view with no hint of a median furrow, and, in full-face view, the petiolar node is platelike and convex above. Unlike the preceding two species, *S. elegans* is most commonly found in drier, inland areas, although there is a record from the Helena Valley near Guildford. The species also has an extensive range in WA and has been collected as far north as Ethel Creek Station in the Pilbara. The species was originally described from Nyngan, NSW, but there are no records from any other Australian state to date. *Stigmacros elegans* has been found in association with various vegetation types; workers have been collected from the ground in Brookton (disturbed wandoo woodland), Dowerin (woodland near the townsite) and Bunketch (gimlet woodland over clay soil). *Stigmacros* sp. JDM 1045 has been seen just twice, having been collected once from the Durokoppin Nature Reserve, north of Kellerberrin, and found (as a

mutilated half of a worker) in a scat of a sandhill dunnart caught near the Tropicana minesite in the Great Victoria Desert. This species may have a range that is largely in remote, infrequently collected areas, which could account for the paucity of records.

In *Stigmacros* sp. JDM 622 the dorsal and lateral surfaces of the pronotum are separated by a carina and, in full-face view, the dorsum of the petiolar node is emarginate, its angles being in the form of small teeth. These apomorphies distinguish the species from *S. aemula*, *S. epinotalis*, *S. pilosella* and *Stigmacros* sp. JDM 827 (most workers), which all lack a carina on the pronotum. This pretty, shiny little species has been collected near Brookton and Boddington. The Brookton workers were collected in a patch of relictual wandoo bushland not far from the town, and their nest was uncovered under a house brick. In *Stigmacros aemula* and *Stigmacros* sp. JDM 827 the propodeum has a flattened or weakly concave dorsum to the level of the propodeal angles, those angles being distinct. In *Stigmacros epinotalis* and *S. pilosella* the propodeum has a dorsum that slopes posteriad, and the propodeal angle is weak or absent. The former pair are easily separated, since *S. aemula* has a completely glabrous head and body (the gaster and often the pronotum having a few short, stoutish, erect setae in *Stigmacros* sp. JDM 827) and is mostly strongly bicoloured, with the head and gaster much darker than the mesosoma and node (the foreparts and the gaster being concolorous or the gaster just slightly darker than the foreparts in *Stigmacros* sp. JDM 827). *Stigmacros aemula* is very common in the Perth region and is the *Stigmacros* species most likely to colonise highly disturbed habitats like parks, unkempt lawns and suburban gardens. This species occurs in natural environments on the Swan Coastal plain at least as far north as Lancelin, and its range extends south-east into the Stirling Range and into the Coolgardie subregion. There are interstate records from NSW, southern QLD, and Vic, but a record from the extreme tip of the Cape York Peninsula is very suspect. Generally, even in backyards, this species has been collected in twig litter, but one worker from Takalarup on the south coast was found foraging on a tree. Another, from the north Stirling Range National Park was vacuumed from *Dryandra pseudoplumosa*. This species has also been found in heathland, foraging on white sand in *Allocasuarina* twig litter. The soil nest is betrayed by a small, inconspicuous mound with a tiny, single entrance. *Stigmacros* sp. JDM 827 generally has a carinate margin to its mesonotum, but one large worker from Mt Gibson Station has only an angulate mesonotal margin, and this specimen will come through the key under the species-group McAreavey designated subgenus *Cyrtostigmacros*. Possibly the dry semi-arid habitat is responsible for this particular phenotype, the other specimens having been collected in a more humid environment. Other collections have been from Jarrahdale and Martin in the western foothills of the Darling Range. The Jarrahdale workers (two) were collected on a planted site of marri and jarrah, while the Mt Gibson worker was taken in a York gum site.

The differences between *S. epinotalis* and *S. pilosella* are debatable, these being reduced to the presence of fine, erect setae on *S. pilosella* (which are absent in *S. epinotalis*) and the lighter coloration of the head in *S. pilosella*, which is only slightly darker, if at all, than the mesosoma (in *S. epinotalis*, the head is much darker than the mesosoma). However, both of these features are variably developed, and the remaining morphology is identical. Moreover, the range of the two species also promotes suspicion — *S. epinotalis* is found in wetter, coastal locations in the south-west and south-east of the state, whereas *S. pilosella* is found in drier inland areas and to the north of the range of *S. epinotalis*. Possibly this is one variable species that would benefit from modern molecular genetic analysis. *Stigmacros epinotalis* was described from Booang (= Booanya), south of Balladonia, but all recent records have been much further west, around the south-west coastal regions from Perth to Manjimup. This ant appears to be endemic to WA. The species has been pitfall-trapped but otherwise no data have been collected. *Stigmacros pilosella* has been collected from the Shark Bay area, in the Avon wheatbelt, near Kambalda and in the Great Victoria Desert. There is also one Kimberley record. The species was described from NSW but has not been recorded from any other state to date. The Tropicana workers were pitfall-trapped in soft grass, a worker from Merredin was found under *Acacia* leaf litter, and foragers from Wooramel were found in riparian woodland, but there are no other significant details.

The species-group termed subgenus *Cyrtostigmacros* by McAreavey has 21 species; it is the largest *Stigmacros* species-group in WA. This clade, as conceived here, also takes in the *Stigmacros*, *Pseudostigmacros* and part of the *Hagiostigmacros* subgenera described in McAreavey's (1957) revision. The workers of this group typically have a convex mesonotum, sometimes this part is flat, but it is always non-

carinate; the mesopleuron is only weakly impressed if at all; and the node usually lacks dorsal teeth, while the lateral teeth are weakly developed or absent (except for two taxa in the *S. barretti* cluster); and the fore-femur is not conspicuously enlarged and is usually of the same dimensions as the other femora. A number of the species described in McAreavey's *Cyrtostigmacros* key (McAreavey 1957) are separated on the basis of features that seem totally inadequate for the task. Apart from *S. flava*, whose workers are uniformly pale, there seem to be only two forms in WA, these being *S. clivispina* (Forel), which has a narrow petiolar node, and another light-coloured form that has a broad node which I am calling *S. occidentalis* Crawley, the earliest name. *Stigmacros clivispina* can be light or dark-coloured or of intermediate coloration, but the head and gaster are virtually always darker than the mesosoma. Lighter-coloured *S. clivispina* can only be satisfactorily distinguished from *S. occidentalis* by the shape of the node. Based on examination of type specimens at ANIC, *S. clivispina* has at least seven synonyms, all of these being species described by McAreavey. A syntype of *Stigmacros castanea* McAreavey was supposedly collected in Mundaring, based on an ANIC record, but McAreavey only mentions seeing eastern Australian material. The specific identity of the syntype is therefore questionable.

Among the more distinctive species within this clade are *Stigmacros* sp. JDM 1046 and *Stigmacros* sp. JDM 1237. In these ants the rounded propodeum lacks propodeal angles and the spiracular teeth are reduced to mere nubs or protuberances. The node is a very thick scale, the dorsum of which is slightly indented medially. In *Stigmacros* sp. JDM 1237 the entire surface of the mesosoma is matt and covered with fine, longitudinal striolae, while in *Stigmacros* sp. JDM 1046 the mesosoma is smooth and shining apart from a few striolae on the lower mesopleuron and propodeum. These are evidently rare species, both known in the WAM/JDM Collections from one or two specimens. The author has seen an additional worker of *Stigmacros* sp. JDM 1046 in the TERC Collection. *Stigmacros* sp. JDM 1046 has been collected from Kodj Kodjin, in the Avon Wheatbelt subregion and on the shores of Lake Lefroy, near Kambalda, while the solitary worker of *Stigmacros* sp. JDM 1237 was found in Drovers Cave National Park in mid-western WA. *Stigmacros* sp. JDM 1237 was collected on calcareous heathland with a shallow (~ 1 mm) soil surface, but there are no details for *Stigmacros* sp. JDM 1046.

Stigmacros barretti is one of just two *Stigmacros* in this species-group in which the dorsum of the petiolar node carries strongly developed spines that are directed posteriad. The other species, the undescribed *Stigmacros* sp. JDM 832, also has strongly developed dorsal petiolar spines directed posteriad, but lateral petiolar spines are lacking and the propodeal spines are reduced to very short denticles (both sets of spines are well-developed in *S. barretti*). These ants, like the foregoing, are very rare and known from single specimens in WA, although *S. barretti* is not uncommon in eastern Australia and has been found in the ACT, Tas and Vic. As with other species of *Stigmacros* that have been described from eastern Australian material, western populations of *S. barretti* differ somewhat from those on the east coast. In this case, the propodeal spiracular spine of the sole WA worker in the JDM Collection is shorter than in the Automontaged type specimen and the eye is a little larger; otherwise they are a good match. *Stigmacros barretti* is clearly a close relative of *Stigmacros punctatissima* McAreavey and *Stigmacros* sp. JDM 1367. Eastern Australian records consistently point to *S. barretti* being lithocolous (i.e. nesting in rock crevices), or, at least, nesting under rocks. This species has been collected in dry sclerophyll, coastal scrub and degraded rainforest. The single WA worker was collected in a dry pitfall trap. *Stigmacros* sp. JDM 832 was hand-collected in dry sclerophyll woodland in the Darling Range, but nothing more is known about it.

The remaining species are what might be considered as 'typical' of the species-group and include several very common Darling Range taxa. In dorsal view the propodeal dorsum is square, flattened and often has a longitudinal, medial indentation or, in the case of a couple of tiny species, is a narrow transverse rectangle. Five of the constituent species (*S. inermis, S. termitoxena* [part only], *Stigmacros* sp. JDM 396, *Stigmacros* sp. JDM 1091 and *Stigmacros* sp. JDM 1367) are notable in having erect setae on the mesosoma, but the other 12 members of the clade are glabrous. *Stigmacros inermis* stands alone in possessing many erect setae on its appendages, and only a vestigial spiracular spine (this part well-developed in the other ants). This was the sole taxon placed in subgenus *Pseudostigmacros* by McAreavey (1957), but, in the opinion of this author, it fits the morphological model for the species-group he denominated subgenus *Cyrtostigmacros* without any reservations and does not require placement in a separate clade. This brown-and-light-brown ant is quite common in the eastern flanks of the

Darling Range, the wheatbelt and the eastern goldfields, and there is one Pilbara record. As well as occurring in WA, this ant can also be found in NSW. Like many other *Stigmacros*, this species has been collected in twig and bark litter, but at least occasionally forages on trees, and has been collected in an intercept trap set on a marri trunk. Habitat notes indicate a preference for lateritic sandplain and other light clay soils. Vegetation associations include marri, York gum, salmon gum, mallee/saltbush, and proteaceous heathland.

Stigmacros termitoxena (part — others are glabrous) and *Stigmacros* sp. JDM 1091 — some workers of *Stigmacros* sp. JDM 827 come out here as well — differ from *Stigmacros* sp. JDM 396 and Stigmacros sp. JDM 1367 in having very short, stout erect setae on the mesosoma, these being very few in number (≤ 6) and confined to the pronotum and mesonotum. In the other two ants, the erect setae on mesosoma are more numerous (> 9) and occur on the propodeum as well as on the pronotum and mesonotum. These setae may also be fine and long in the latter. *Stigmacros termitoxena* and *Stigmacros* sp. JDM 1091 differ in the profile of the mesonotum (convex in *S. termitoxena*; rather flat in *Stigmacros* sp. JDM 1091), the metanotal groove (distinct but broadly rather than deeply impressed in *S. termitoxena*; narrow and deeply impressed in its relative); the nature of the mesothoracic spiracles (indicated by small tubercles oriented dorsally in *S. termitoxena*, and indicated by small processes on the margin of the mesonotum that are directed posteriad in *Stigmacros* sp. JDM 1091) and the appearance of the clypeus in full-face view (distinctly carinate, the median longitudinal carina terminating on the anterior clypeal margin as a small denticle in *S. termitoxena*, and without a distinct carina and more-or-less evenly convex in *Stigmacros* sp. JDM 1091). *Stigmacros termitoxena* appears to be confined to WA, but has a broad range in this State, from the Darling Range to the eastern goldfields in the south, with what may be a separate population in the northern Gascoyne and Pilbara subregions. The type material came from a termitarium of *Nasutitermes* (*Tumulitermes*) *peracutus* Hill. The only other ecological information is that foragers from east of Hyden were taken in sandplain/laterite heathland. *Stigmacros* sp. JDM 1091 is known from one series collected at Queen Victoria Spring from a pitfall trap set in yellow sand.

A single series of *Stigmacros* sp. JDM 396, collected from Wongamine, can be distinguished from *Stigmacros* sp. JDM 1367 by the appearance of the petiolar node (petiolar node medially weakly emarginate dorsally and with short lateral denticles in *Stigmacros* sp. JDM 396, and armed with a pair of blunt dorsal teeth and well-developed lateral teeth in *Stigmacros* sp. JDM 1367) and the cuticle (head and mesosoma moderately shining, with superficial microreticulation in *Stigmacros* sp. JDM 396, compared with head and mesosoma dull and uniformly microreticulate in *Stigmacros* sp. JDM 1367). However, the appearance of a badly damaged and somewhat abraded specimen from Alcoa, Jarrahdale is a cause of some perplexity. This has the fine pubescence found in *Stigmacros* sp. JDM 396, but the cuticle appears to be matt and the petiolar node has definite teeth compared with the short, broad denticles in the Wongamine specimens. The spiracular teeth are also longer and resemble those of *Stigmacros* sp. JDM 1367. This worker, despite these features, would seem to be closely aligned with *Stigmacros* sp. JDM 396. Whether it belongs to one or the other or represents a third taxon, or even whether all populations belong to one variable species can only be solved by finding more material. The four known series of *Stigmacros* sp. JDM 1367 are all quite uniform in appearance although ranging broadly across WA (the subregions of Avon Wheatbelt, Carnarvon and the Pilbara are represented here), and this uniformity makes it more likely that *Stigmacros* sp., JDM 396, at least, is genetically separate from this ant. Specimens taken at Boodalin Soak, north of Westonia, were hand-collected at night in *Acacia/Hakea* shrubland with *Plectrachne* ground cover. Two other series were pitfall-trapped, one in dry traps. Specimens of what is here called *Stigmacros* sp. JDM 396 were all collected in wet pitfall traps, but there are no other data.

Stigmacros reticulata is a white sandplain species that is easily recognisable because of its black or variegated black-and-brown body. The tibiae, the antenna, the mandibles and the articulations of the legs are pale yellowish and conspicuously paler than the rest of the ant. This species was placed in *Campostigmacros* by McAreavey (1957) but lacks the marginate mesonotum, and the propodeum, seen from above, is square, not trapezoid. *Stigmacros reticulata* is mainly found in the Swan Coastal Plain and Geraldton Sandplains subregions, but also occurs in the goldfields. The species is definitely known only from WA; a QLD record requires verification. Specimens from Lancelin were collected in heathland over white sand among *Allocasuarina* twig litter. Workers and an alate queen collected further inland in the northern Perth suburb of Lexia

were taken in *Banksia* open woodland with an *Adenanthos* understorey. When foragers of this species are disturbed, they freeze and feign death. *Stigmacros punctatissima* and *Stigmacros* sp. JDM 1067 appear to be closely related to S. *termitoxena* and its allies, most of the remaining species in the species-group being predominantly jarrah forest dwellers that include *S. clivispina* and its relatives. The former pair of taxa, when viewed full-face, have a petiolar node that is deeply emarginate, its dorsum produced as two blunt teeth and the lateral teeth are small but spinous in appearance. The ants discussed below either do not have an emarginate dorsum to the petiolar node or this feature is only weakly developed; lateral petiolar teeth are also lacking or vestigial. In dorsal view, the mesosoma in *Stigmacros punctatissima* is matt and uniformly alveolate, and the gaster has dilute pubescence, its underlying sculpture consisting of very fine, longitudinal striolae that can be seen in some lights. In dorsal view, the mesosoma in *Stigmacros* sp. JDM 1067, on the other hand, is weakly and superficially areolate and moderately shining, and the appressed setae on the gaster are well-spaced and do not form pubescence. The underlying sculpture in this case consists of superficial microreticulation only. In WA, *Stigmacros punctatissima* is known only from one specimen taken at Kambalda in the eastern goldfields. Interstate, it has been found in NSW and certainly occurs in Vic (based on a record from near the NSW/Vic border). *Stigmacros punctatissima* has been taken on low vegetation in wet sclerophyll forest and on the slope of a hill or mountain. Other data are lacking. *Stigmacros* sp. JDM 1067 has only been taken in coastal heath near Guilderton Lighthouse.

The worker of *Stigmacros* sp. JDM 1001 is a spectacular orange-and-brown ant that cannot be mistaken for any other species. The propodeum, while flat and square, lacks carina (if the propodeal dorsum is square then lateral propodeal carina are always present in the remaining nine species, including the glabrous form of *S. termitoxena*, and there is a longitudinal median groove). The only specimens were hand-collected by the author in low shrubland just west of the Eucla Pass.

Four very small (HW ≤ 0.45 mm), shiny, yellow ants — *S. pusilla*, *S. rectangularis*, *S. froggatti* and *Stigmacros* sp. JDM 115 – are among those included in McAreavey's (1957) revision under the subgenus *Stigmacros*. Although these ants broadly fit in his '*Cyrtostigmacros*' as defined here, they are not necessarily all closely related. Morphologically they are united in possessing a mesosoma that, seen in profile, is rather flat and smooth without a metanotal ridge or metathoracic tubercles and, in dorsal view, a propodeum that is either a narrow transverse rectangle, not defined laterally by carinae, or is defined by two prominences separated by a longitudinal median furrow. The other four species are all larger (HW > 0.50 mm), matt or only weakly shining. They also have a weakly developed metanotal ridge with metathoracic spiracles indicated by small prominences; in dorsal view, the propodeum is hollowed out medially and defined laterally by carinae.

Stigmacros pusilla has distinctive, sharp propodeal angles directed vertically and well-developed humeral angles (the humeri are rounded in the other three ants). Unlike *S. rectangularis*, *S. froggatti* and *Stigmacros* sp. JDM 115, which have been collected only in the SWP (except for one specimen of *S. rectangularis*), this ant occupies drier inland areas in this State; the three workers and one queen collected have come from the eastern wheatbelt and the eastern goldfields. Interstate, this species is known to occur in the ACT, NSW, and Tas, and almost certainly also occurs in Vic. A queen and a worker collected east of Southern Cross were unearthed at the base of a tree, while a further worker, taken just east of Merredin, was captured while foraging on the limb of a mallee. A third worker has been taken from the shores of Lake Lefroy, near Kambalda. *Stigmacros rectangularis* has a relatively long antennal scape (which extends beyond the vertex by about 0.30 × its length), compared with a much shorter antennal scape extending beyond the vertex by about 2 × its width; the eye is large (EL ~0.30 × length of side of head, compared with EL < 0.30 × length of side of head, and usually < 0.25 × length of side of head); and, in dorsal view, the propodeum is nearly flat, weakly and broadly emarginate posteriorly, and longer (its length ~0.67 × its width), compared with a propodeum that, in dorsal view, is either a broad, narrow ridge, its length very much less than its width, or bimodal in appearance (best seen in rear view) with each of the propodeal angles raised as a rounded prominence. All WA material of *S. rectangularis* has been collected in the Jarrah Forest, with the exception of one outlier from the Pilbara (such a disjunct distribution has already been noted for several other *Stigmacros* species and probably represents a dearth of collecting in the regions of the EP separating the Pilbara from the SWP, rather than genuinely separated populations). This species appears to be endemic to WA. Unfortunately, the few specimens seen have mainly been pitfall-trapped and there is no additional

information.

Differences in the colour (the head light brown or tawny yellow, the mesosoma yellow to tawny yellow, the gaster brown or yellow anteriad and brown posteriad, and the flagellum of the antenna brown and distinctly darker than the scape in *S. froggatti* versus concolorous yellow in *Stigmacros* sp. JDM 115) and the appearance of the propodeum (propodeum lacking a posterior carina, being either a weakly defined transverse rectangle much wider than long, or two rounded prominences separated by a broad, longitudinal medial furrow in *S. froggatti*, and the propodeum weakly concave medially and defined posteriad by a strong carina in *Stigmacros* sp. JDM 115) separate the otherwise very similar *S. froggatti* and *Stigmacros* sp. JDM 115. However, what is here called '*froggatti*' may actually consist of two species; two of the ants have a flattish to distinctly flat mesonotum, and the propodeal angles, seen in profile, are rounded and obsolete. This is different to both McAreavey's (1957) description of the worker and also the images of five type specimens on AntWeb in which the mesonotum is distinctly convex and the propodeal angles are sharp. A tiny, all-yellow worker is much more similar in appearance to the type workers and has a convex mesonotum — although the propodeal angles are still blunt rather than sharp. More material is needed to check the degree of variation in this taxon in WA, although McAreavey makes a point of noting that he examined a very large number of specimens from NSW and found little variation. What makes this more complicated is that the type material itself seems to include more than one species. Genetic sequencing might be helping in resolving the species boundaries of this little group of taxa. A gynandromorph, believed to belong to this species, is most similar to the tiny all-yellow worker and has the convex mesonotum. All WA material comes from the western Jarrah Forest and the Swan Coastal Plain. Interstate records come from NSW and Vic. The two workers queried here were collected from rotting wood at Stirling Dam and from a tree trunk in the Perth suburb of Bullcreek, respectively. The tiny yellow worker and the gynandromorph were both pitfall-trapped in jarrah forest south of Perth. The minute *Stigmacros* sp. JDM 115 resembles a tiny version of the *S. froggatti* type workers, but the propodeum is a flattened, posteriorly carinate transverse rectangle. This is easily the most common of the four(?) species discussed here and has often been collected in the Jarrah Forest subregion by Curtin University personnel. There is also one record from Denmark on the south coast. Most material referrable to this species has been pitfall-trapped in soil or hand-collected in leaf and twig litter or under damp moss (pers. obs.), but the Denmark worker was taken in a tree trap.

The final five *Stigmacros* discussed here are very similar in appearance and probably closely related. A large eye (EW ≥ 0.30 × length of side of head) separates *Stigmacros* sp. JDM 1135 and glabrous examples of *S. termitoxena* from *S. clivispina*, *S. flava*, and *S. occidentalis* (EW ≤ 0.20 × length of side of head). In *Stigmacros* ps. JDM 1135 the worker is compact (in dorsal view, the mesonotum is approximately as long as wide); also seen in dorsal view, the mesometanotal suture is visible as a transverse groove above the metathoracic spiracular prominences; in full-face view, the antennal scapes are short, surpassing the vertex by slightly more than their greatest width. With *Stigmacros termitoxena* the worker is less compact (in dorsal view, the mesonotum is approximately 1.3 × longer than wide); also, in dorsal view, the mesometanotal suture is indistinct, and, in full-face view, the antennal scapes are longer, surpassing the vertex by approximately a third of their length. *Stigmacros termitoxena* has been discussed above. *Stigmacros* sp. JDM 1135 is known from two collections, one from the Avon Wheatbelt and one from Tropicana mine. The Depot Dam worker was hand-collected late pm, while the Tropicana worker was pitfall-trapped in *Casuarina* woodland. Nothing more is known about the species.

Stigmacros flava, *S. occidentalis* and *S. clivispina* pose a conundrum: how many species are there? Apparently, they also confused McAreavey (1957): he seems to have given more than half a dozen names to the same species. Based on this author's research, *Stigmacros aciculata*, *Stigmacros brooksi*, *Stigmacros clarki*, *Stigmacros extreminigra*, *Stigmacros ferruginea*, *Stigmacros glauerti*, and *Stigmacros sordida* all seem to be junior synonyms of *S. clivispina* and are relegated to that status in this monograph. In future, other names may also be demonstrated to be junior synonyms of this very common and widespread species. *Stigmacros armstrongi* seems to be a junior synonym of *S. occidentalis* and is also reduced to synonymy here. However, *Stigmacros flava* is retained as a species for now, based on its uniformly pale coloration (except for the posterior of the gaster). In the other two species at least the gaster and petiolar node are brown. *Stigmacros flava* is known only from two extant syntype workers collected from Mundaring, although McAreavey examined 28 workers in all. The ant has not been

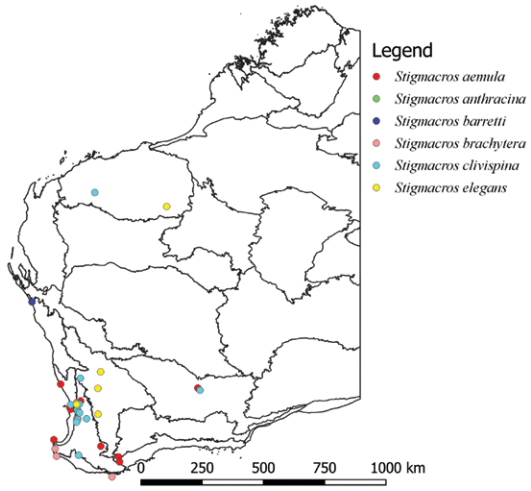

FIGURE 89 Distribution of *Stigmacros aemula*, *S. anthracina*, *S. barretti*, *S. brachytera*, *S. clivispina* and *S. elegans*.

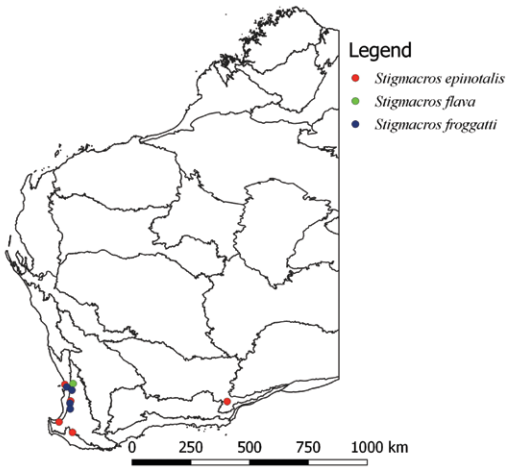

FIGURE 90 Distribution of *Stigmacros epinotalis*, *S. flava* and *S. froggatti*.

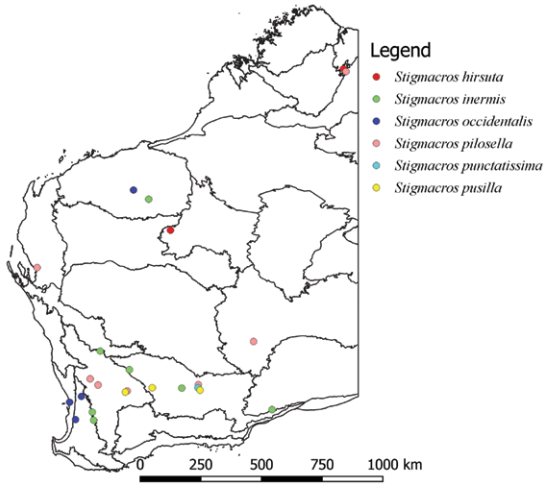

FIGURE 91 Distribution of *Stigmacros hirsuta*, *S. inermis*, *S. occidentalis*, *S. pilosella*, *S. punctatissima* and *S. pusilla*.

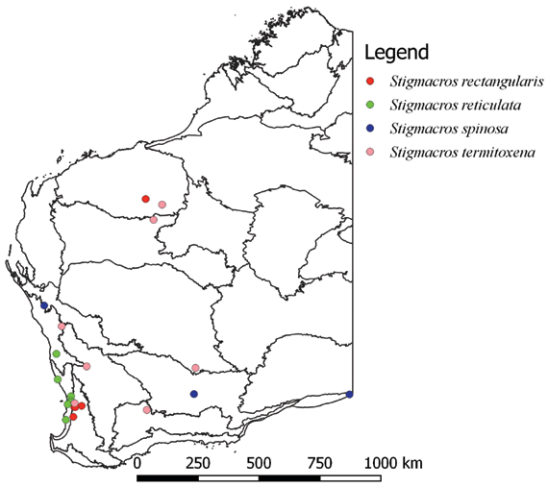

FIGURE 92 Distribution of *Stigmacros rectangularis*, *S. reticulata*, *S. spinosa* and *S. termitoxena*.

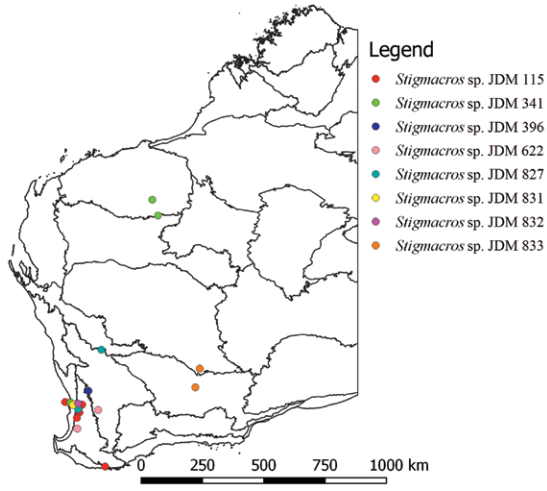

FIGURE 93 Distribution of *Stigmacros* sp. JDM 115, JDM 341, JDM 396, JDM 622, JDM 827, JDM 831, JDM 832 and JDM 833.

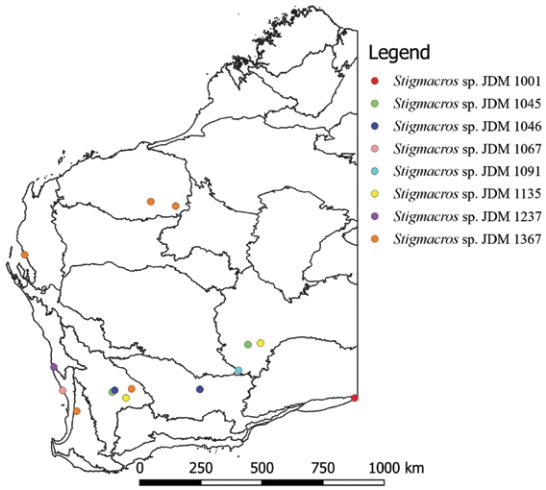

FIGURE 94 Distribution of *Stigmacros* sp. JDM 1001, JDM 1045, JDM 1046, JDM 1067, JDM 1091, JDM 1135, JDM 1237 and JDM 1367.

seen in any other state to date. The evidence for its being a good species is flimsy and is based purely on colour, but in view of the known variation in colour in *S. clivispina*, which it otherwise resembles, future research may well sink this taxon. The differences between *S. clivispina* and *S. occidentalis* that are posited in the species key are very subtle but seem to be consistent among all specimens examined. In the case of *S. occidentalis*, when seen in rear view, the sides of the petiolar node are convex and the node may bear tiny lateral denticles, the imbricate sculpture of the mesosoma is generally less intense than in its near relative, and the colour of the mesosoma is yellow. In *S. clivispina*, when seen in rear view, the sides of the petiolar node are straight and always lack lateral denticles, the imbricate sculpture of the mesosoma is generally more intense, and the colour of the mesosoma is typically brown, but lighter-coloured morphs (possibly tenerals) can frequently be seen as can very dark individuals. *Stigmacros occidentalis* has mostly been collected in and around Perth in jarrah forest and on the Swan Coastal Plain but, as has been demonstrated previously in the case of other species, there is inevitably one perplexing outlier from the Pilbara. Interstate, this species occurs in SA and in NSW (in the latter as '*S. armstrongi*'). The specimens hand-collected from West Angeles minesite in the Pilbara were taken in spinifex and mulga scrub. Workers of *S. clivispina* are very variable in appearance, even within nest series, and range from brown-and-grey to blackish, but typically they are brown with a darker head and gaster. Outside of the Perth metropolitan area, where *S. aemula* is the species most commonly seen, *S. clivispina* is ubiquitous and almost always crops up in ant collections taken in jarrah and marri forest. Within WA, collections of *S. clivispina* have mainly been made in the Darling Range and the adjoining Swan Coastal Plain, but there are isolated records from the eastern goldfields and the Pilbara. Outside of WA, *S. clivispina*, under one or other of its junior synonyms, has been recorded from all mainland states except the NT. Most of the pinned JDM/WAM material has been pitfall-trapped, and this type of collection rarely includes biological or habitat notes, but a hand-collected worker from Gleneagle was found under a lateritic rock in dry sclerophyll woodland (jarrah/marri), specimens from Walebing were hand-collected in road verge heath remnant near paddocks over limestone laterite inclusions, and a specimen from just east of North Bannister was taken from the trunk of *Eucalyptus wandoo* in mixed woodland (jarrah/marri/wandoo).

LEPTANILLINAE

Only one genus and species from this subfamily of tiny army ants, *Leptanilla swani*, occurs in WA. This subfamily has two waist segments, the mandibles are short and triangular, the pronotum and mesonotum are not fused and have a flexible join between them, eyes are absent, and the tarsal claws are simple.

Leptanilla (Figure 95)

Members of the genus are specialist predators of geophilomorph centipedes, and queens feed on their larvae via a specialised duct on the abdomen by which the queens can obtain haemolymph (Masuko 1990). *Leptanilla* species are fossorial, living in subterranean locations and are thus highly cryptic. Its minute size (TL ~1 mm) also makes *Leptanilla swani* difficult to detect. *Leptanilla swani* was described in 1932 from a colony collected from under a large stone at Chittering, in the Darling Range, north-east of Perth, but no workers have been seen in this State since that time. However, the minute males (under 1 mm in length) have been recorded from widely dispersed localities including Barrow Island, Jarrahdale and the Pilbara, suggesting that this species is not rare, and workers could be found using specialised techniques (e.g. subterranean pitfall traps). Members of the genus have been recorded from all Australian states except Tas and Vic but, with the exception of a few QLD records, these captures involve the alate males. Nearly all accounts come from forested areas, particularly rainforest.

MYRMECIINAE

This subfamily, which includes the notorious bull ants or inch ants, is the polar opposite of the preceding subfamily in terms of visibility since most species are large to very large and have a formidable sting. In WA, there are two genera (one monotypic and not seen for many years in this State) and 42 species, of which 41 have been described while one appears to be undescribed. Myrmeciinae (genus *Myrmecia*) can be characterised as having two distinct waist segments, long, mainly straight, toothed mandibles that are attached directly adjacent to the genae, and very large eyes positioned close to the mandibular attachment.

Myrmecia (Figures 95–103)

With 41 species, *Myrmecia* is a significant genus in WA. Although few *Myrmecia* are found in settled areas in WA (which is the case in Tas and Vic), visitors to the bushier parts of the south-west of

the state may see upwards of 20 species — some of them huge ants. *Myrmecia* are far less common in arid and northern areas; only *Myrmecia desertorum* is commonly seen in the northern deserts and the Kimberley. These ants are rightly feared for their sting (commonly mistaken for their 'bite', which is not significant and only mildly painful), and this sting can cause severe allergic reactions and even life-threatening anaphylaxis in some people. *Myrmecia* are primarily generalist predators but also take nectar and plant juices (Shattuck 1999). The WA fauna can be divided into seven species-groups (following Ogata & Taylor, who partially revised the genus in 1991). Colony foundation and other particulars of the biology of a number of WA species are discussed in detail by Wheeler (1933).

Among Western Australia's, and probably Australia's, smallest bulldog ants are members of the *M. urens* species-group. Apart from their rather dainty appearance, these ants are characterised by having an occipital carina, while the subapical portion of the mandible lacks a supplementary tooth (since this tiny feature may be abraded or concealed by remnants of plant or animal tissue, close, careful inspection under a high powered microscope is required, sometimes of more than one worker). Ogata & Taylor (1991) despaired of separating most of the species within this group and left the bulk of the taxa unresolved as a species complex of *M. urens*. This author believes such a conclusion is not ineluctable, and those component taxa that occur in WA can be identified and, with one exception, referred to described species. *Myrmecia urens*, itself, is readily identified by the widened base to its mandible (which is universally pale). This feature is mentioned by Clark (who provides meaningful separators for three of the four *M. urens* taxa covered here in his 1951 monograph) but, curiously, not by Ogata & Taylor. In WA, *M. urens* seems to have a mainly coastal or near coastal distribution from Northampton, in the mid-west of the state, to the Stirling Range National Park in the east. Because it has been lumped with other taxa, the range of this ant in other states is uncertain, but it is known to occur in NSW since it was described from Sydney. Clark (1951) also records it from QLD, SA, Tas, and Vic. Like other small *Myrmecia*, this species frequently forages on low vegetation; workers from the Formby Nature Reserve, near the Stirling Range, were vacuum sampled from *Acacia acuminata*. Another worker from west of Gnowangerup was taken on *Casuarina huegeliana*. A third specimen from Northampton was also taken on an unnamed *Acacia* species.

The very small and apparently undescribed *Myrmecia urens* group sp. JDM 71 has the following apomorphies: the sculpture of the pronotum consists of concentric striae over indistinct surface sculpture; in dorsal view, the dorsum of the petiolar node is longer than wide and shining with diffuse surface sculpture only, and always has a conspicuous brown, medial infuscation, the rest of the node being a dirty orange; and the mesonotum is also shining and unsculptured apart from superficial microreticulation. The other species possess a pronotum that is coarsely striate-reticulate, and the dorsum of the petiolar node is always other-sculptured. This small, dull-coloured species is often overlooked, and only a few specimens have been pinned. Samples come from the Perth region, and Denmark and Hopetoun on the south coast. The occurrence of *Myrmecia urens* group sp. JDM 71 interstate is not known. The few specimens taken have mainly been pitfall-trapped, but one of the Denmark workers was collected on *Jacksonia*.

Myrmecia exigua and *M. infima* are easily the most common and widespread of the four *M. urens* species-group taxa in WA. These two species require careful examination to separate. In the case of *M. exigua*: in dorsal view, the dorsum of the petiolar node in smaller workers is distinctly trapezoid, longer than wide, its anterior margin shorter than the posterior margin, while the petiolar node in large workers is about as long as wide but still trapezoid (versus: in dorsal view, the dorsum of the petiolar node is rounded or square, as wide as long or wider than long); on close inspection, the petiolar node is seen to be covered with dilute pubescence that converges to form a visible midline when the node is viewed obliquely; (versus: the appressed setae on the petiolar node are more dispersed, not forming a visible midline when the node is viewed obliquely), and, in full-face view, the mandible is yellow, much more rarely dusky yellow, without apical darkening, the pubescence on the clypeus and lower genae are fine and shining yellowish-white, and the mandibles are visibly longer than the head (versus: in full-face view, the mandible colour ranges from yellow with obscure darkening apically to distinctly bicoloured yellow basally and blackish in the apical half, the pubescence on the clypeus and lower genae is coarse and white, and the mandibles are barely as long as the head at a maximum and may be visibly shorter than the head). Based on descriptions and Automontaged photographs of type material, *Myrmecia exigua* appears to be a senior synonym of *M. rubicunda* (Clark) and *M. infima* of *M. nigra*

Forel and *M. dichospila*, a dealated syntype queen of which appears on AntWeb. Populations of *Myrmecia exigua* are almost completely restricted to the SWP, particularly the south-west coastal, and south coastal areas, but one outlier exists in the Great Victoria Desert. Interstate, this species also occurs in Vic and almost certainly in SA. This rather attractive, red-and-black species with pale legs is common in coastal scrub between Kalbarri and Capel, and workers at Lancelin have been taken among *Allocasuarina* twig litter in heathland over white sand. There are also a few Avon wheatbelt records, but the ant avoids heavily forested, upland areas. *Myrmecia infima*, while it boasts some coastal records in WA, tends to be found in thicker, forested areas of tall trees (especially jarrah and marri) than its relative, and there are several goldfields records. This species also occurs in SA. Workers have been collected in twig and leaf litter in mixed (i.e. jarrah and marri) woodland, in heathland and in mallee.

A second species-group that possesses an occipital carina is the *M. gulosa* species-group. However, in this group of ants (that are much larger in size) a supplementary ventral tooth is present in the subapical portion of the mandible. This is the most speciose of the *Myrmecia* species-groups found in WA and consists of 17 described taxa. The clade also includes some of our largest and most impressive ant species.

Myrmecia forceps is one of the very large Bulldog ants, and a real 'inch ant' with a body that extends for about that length and a head that is more than half as wide as a man's little fingernail. The appearance of the mandible, which is convex in appearance with only three enlarged teeth apart from the apical tooth, identifies this species immediately. Most specimens have come from the northern Jarrah Forest subregion and the western and southern wheatbelt just inland of the Darling Range, but there is one individual record from 70–75 km ENE. of Norseman in the Coolgardie subregion. This ant is widely distributed in Australia and is found in all the mainland states with the exception of the NT. *Myrmecia forceps* has been recorded in numerous vegetation zones that include mallee, salmon gum, marri and wandoo. Soil types include sandstone, limestone, lateritic loam and 'silurian soil'. The nest is of equably variable appearance, some nests being described as a simple hole in the ground, while others are accompanied by a small mound that may or may not be covered. Still other nests are described as 'a small covered crater'. Nests may be closely associated with the nests of other bulldog ants (e.g. *M. fuscipes* and *M. pyriformis*). This is a timid species.

The remaining species all have four to five enlarged mandibular teeth. In the case of *Myrmecia erecta* and *Myrmecia regularis* the colour of the mandible is reddish-brown to dark brown, the same colour as the head. The other ants in the species-group have light yellowish to light reddish-brown mandibles that are a distinctly lighter shade than the head. The apex of the gaster in *M. regularis* is reddish to yellowish, while in *M. erecta* it is dark brown to blackish-brown. *Myrmecia erecta* is very rare in this state and has been collected on only a couple of occasions, once at Karragullen, near Perth, and once near Junana Rock in Cape Arid National Park. This species also occurs in SA. *Myrmecia erecta* is known to forage nocturnally on the ground or on tree trunks, and the type series (SA) was taken in mallee and dense scrub over sandy limestone soil (Ogata & Taylor 1991). The Karragullen worker was collected from marri (now *Corymbia calophylla*) by pyrethrum knockdown. No nest data appear to have been published. *Myrmecia regularis* is almost entirely restricted to the Warren subregion, where it is the most common bulldog ant in the karri and tingle forests. Nor does this species occur in other Australian states. Although this ant may nest directly into the ground, frequently queens choose to found their colonies in rotting wood, under logs or stones or in underground termite mounds. Wheeler (1933) records the species as preferring damp, black earth under logs or large stones. As well as in karri and tingle habitats, the species occurs in tree heath and in marri forest.

Another pair of bulldog ants in this species-group has a yellowish apex to the gaster (the remaining ants having a dark brown to blackish-brown gastral apex). In the case of *M. analis* the basal portion of the gaster is dark blackish-brown, but the basal portion of the gaster is reddish-brown in *M. nigriscapa*. Western Australian populations of *M. analis* are concentrated along the extreme south-western and southern coast from Cape Naturaliste to at least Esperance, with inland records no further north than Nyabing at the boundary of the Avon Wheatbelt and Mallee subregions. *Myrmecia analis* is unlikely to occur interstate. This is a sandplain species, typically occurring where there is a mix of *Banksia* and *Nuytsia* (two AntWeb records), and heathland. However, the ant can also be found near swamps. Like *M. regularis*, this species may nest in termitaria, but at other times directly into soil, where the nest may be indicated by a low mound. There is also one record of a nest under rock. *Myrmecia nigriscapa* has a range that takes in the coast between the capes and extends northwards to about the latitude of Perth, where it is found in

the Jarrah Forest. Most records, however, emanate from the lower Swan Coastal Plain, where they coincide with the healthiest stands of tuart forest. Clark (1951) also mentions records from the south coast (Albany and Denmark), but there have been no identified recent collections for major Australian institutions from there, and these old records require verification. Interstate, this species is particularly common in SA and Vic, with isolated records from NSW, QLD, and Tas. *Myrmecia nigriscapa* is a timorous species: when the nest is disturbed this author has found the workers cower in the nest chambers, whereas, under the same circumstances, other large, red bulldog species of very similar appearance quickly emerge to confront the intruder. At Australind, nests of the species were found in *Banksia/Agonis* woodland. Other samples of this ant have been collected in a pine forest and on coastal dunes.

Four species — *Myrmecia arnoldi*, *M. picticeps, M. rubripes and M. rufinodis* — have a mandibular shaft that is generally even in width and is not narrowed basally (the other seven species have a mandibular shaft that is narrow at its extreme base and broadened over the basal quarter to the basal fifth). None of these four south coast species is common, and no workers of *M. picticeps* are held in the WAM Collection. *Myrmecia picticeps* has a particularly short petiolar peduncle, when seen in profile, this peduncle being at most as long as the node, and not reaching the apices of the hind coxae when they are extended posteriad. The petiolar peduncle in the other three ants is longer than the petiolar node and reaches or exceeds the apices of the hind coxae when these are extended posteriad. *Myrmecia picticeps* is a fairly large and conspicuous species, and the fact that a worker has not been seen in WA since the species was described by Clark in 1951 is a real concern. Only a dealated queen pitfall-trapped at Holyoake in the Jarrah Forest has been collected since 2000, and that specimen is currently at Manjimup (Department of Biodiversity, Conservation and Attractions). The only worker material definitely known is the holotype and a paratype from Albany. An ancient, dealate queen from Busselton and a male are all that is held in the JDM/WAM. The species purportedly also occurs in SA and Vic (Atlas of Living Australia), but the Victorian material has been investigated by this author and found to belong to a different, although very similar species. The veracity of the sole SA record, collected at Mt Lofty in 1950, has not yet been checked. In short, this species should be regarded as at least data deficient, if not actually endangered. Nothing is known of its biology. The WA endemic *Myrmecia rubripes* has short, erect setae on the pronotum, these being shorter than those found on the first funicular segment of the antenna. (The setae on the pronotum are longer than those on the first funicular segment in the case of the other two species). This ant is known only from a couple of records in the Ongerup/Boxwood Hill area near the south coast and appears to be highly localised. The only biological notes for this species are associated with the Boxwood Hill workers, which came from a nest in soil under dead vegetation in sandplain heath.

Colour pattern helps to differentiate between *M. rufinodis* and *M. arnoldi*. In the former, the petiole and postpetiole are light yellowish- to reddish-brown, contrasting with the more darkly coloured mesosoma and gaster (sometimes the median sector of the pronotum and propodeum are partially light-coloured); in *M. arnoldi* the petiole and post-petiole are dark brown to black, and concolorous with the mesosoma and gaster. *Myrmecia rufinodis* is known in this State from two records from the remote south-eastern region. Label data are silent about the WA populations of this species, and biological notes come from interstate populations of this ant in SA and Vic. Collector Bede Lowery records it as 'very aggressive' with a nest that is a large, open-topped mound. Other specimens have been found under rock. Most collections have been made in mallee, particularly limestone mallee and *E. diversifolia*; other collections have come from box-pine and heath. *Myrmecia arnoldi* is the most frequently seen of the four bulldog species with the straight mandibles, and is distributed throughout the southern and central wheatbelt, the south coast and the eastern goldfields. However, it doesn't penetrate the jarrah forests of the Darling Range. The species may be restricted to WA, although there is at least one SA record attributed to *M. arnoldi* (records from SA require verification, in view of the similarity between this species and other dark bulldog ants that have a wider range). The one note concerning the nest is that it is a 'volcano nest' (presumably meaning steep-sided and converging to a narrow apex at the entrance hole). Habitat is recorded as 'mallee' and 'limestone mallee'. The ant has also been found near the edge of a lake.

Myrmecia pavida is one of several darkish bulldog ants with basally narrowed mandibles that pose awkward taxonomic problems because of their very similar morphology and coloration. This species has not been well-characterised in the literature. Ogata and Taylor (1991) distinguish it based on the dark clypeus, but Clark (1951) describes the clypeus as yellow! The fact is that the clypeus is variable in colour. In most workers there is a diffuse brown patch at the centre of

the yellow clypeus, but this can be lacking. This feature is also found in other dark *Myrmecia*, so is not a helpful character; hence a choice of characters in the taxonomic key. *Myrmecia fuscipes* is the ant most likely to be confused with *M. pavida*, and some workers also have the darkened clypeus, but the legs are darker than the mesosoma in dorsal view. Most *M. pavida* can be distinguished from *M. vindex* by the completely yellow clypeus in the latter, and its generally lighter mesosomal colour, but identification is problematic in a very small number of cases. This species is linked with *M. arnoldi*, *M. rubripes* and *M. rufinodis* by Ogata & Taylor (1991), but the shape and dentition of the mandible are very different, and the species is here regarded as more likely to have its closest affinity with *M. gratiosa* and *M. vindex*. Workers of this species are colour variable, being brownish-yellow to blackish with the head being either concolorous with the mesosoma or darker, but, when viewed from above, the leg colour is lighter than the mesosoma or the same colour, but is never darker (unlike *M. fuscipes*, in which the legs are conspicuously darker than the mesosoma). Unlike workers of *M. gratiosa* and most *M. vindex*, there is typically a degree of infuscation of the median clypeal region that ranges from light to intensely dark and varies equally in extent. Another helpful characteristic is that the erect setae on the pronotum are invariably short; at maximum the same length as the width of the antennal scape but mostly shorter. This species has a range in this state that extends from the lower Jarrah Forest subregion (about the latitude of Bunbury) along the south coast to just east of Esperance. The range of the ant extends into SA. This species occurs sympatrically with *M. rubripes* in Boxwood Hill, and, like that species, its nest has been found in soil under dead vegetation. Other records mention a large mound nest with a small entrance hole. Vegetation associations include sandplain heath and mallee.

Myrmecia fulgida is a huge (worker length 25 mm) bulldog ant of a matt, dark crimson appearance. In this species, the setae on the head and mesosoma are long and thick, those on the posterior corners of the head extending beyond the outer margins of the eye. In the other bulldogs, the relevant setae on the head are short and thin and do not extend beyond the margins of the eye. *Myrmecia fulgida* is not particularly common, but its range extends though the eastern parts of the WA wheatbelt and into the Mallee. The ant is confined to WA. A large nest was observed by the author at Carrabin but no specimens were collected and the details of the nest were not recorded, although the workers emerging from it after disturbance were noted to be even more impressive in size than typical *M. gratiosa*, *M. vindex*, *M. desertorum*, etc. One worker collected from the same site on another occasion was pitfall-trapped in an *Allocasuarina* thicket.

Myrmecia desertorum and *M. fuscipes* are closely related to *M. pavida* and *M. vindex*, and these four ants can be very difficult to distinguish. *Myrmecia pavida*, and the way in which it can be determined, has already been mentioned. *Myrmecia desertorum* and *M. fuscipes* share with *M. pavida* the very dark head, which is similar to the gaster in coloration (head lighter in colour than the gaster in *M. vindex*), and the mesosoma and the nodes are yellowish to dull brownish-orange, just a little darker than the yellow mandibles (mesosoma and nodes light reddish-brown to dark brown and much darker than the mandibles in *M. gratiosa*, *M. nigriceps* and *M. vindex*). The legs are yellowish to dull orange and concolorous with the mesosoma in *M. desertorum* and dark brown and much darker than the mesosoma in *M. fuscipes*. *Myrmecia desertorum* has the widest range of any of the *M. gulosa* species-group in WA, and occurs throughout almost the entire state, only being absent from the Warren and the lower Jarrah Forest subregions. Interstate, this species occurs in all Australian mainland states. *Myrmecia desertorum* builds huge mound nests up to two metres across (Ogata & Taylor 1991), and workers are typically very aggressive and will pour out of the nest to attack an intruder should they be disturbed. This ant has been recorded from a variety of different woodland habitats, mostly mallees in drier areas, as well as from an old vineyard and from a nest under *Eucalyptus aspera* (rough-leaved ghost gum). *Myrmecia fuscipes* has a more restricted range in southern WA; mostly it has been taken in the drier eastern regions of the goldfields, the Great Victoria Desert, the Nullarbor and north of Esperance, but it has recently been collected at Meenaar, near Northam, on the eastern fringe of the Jarrah Forest. Interstate, the range of the species extends into NSW, SA, and Vic (although records from NSW and Vic are very scanty). This species has been recorded as building a large nest, which may be of a crater appearance. Vegetation associations include *Casuarina*, mallee and limestone mallee, myall and saltbush plain. Red soil and sandy soil are both mentioned in label data. Ogata and Taylor (1991) mention that this species usually does not create a mound over its nest, which is often constructed near a stone or the base of a tree, and behaves timidly and evasively at the nest when disturbed.

Myrmecia nigriceps is only occasionally seen in WA — all records being from the SWP — although it is very common in the eastern states. The critical diagnostic feature is the presence of numerous, small, erect and sub-erect setae along the antennal scape (although abrasion may make diagnosis difficult), since *M. gratiosa* and *M. vindex* have only a few minute setae at the extreme tip of the scape. Workers have been collected at scattered locations between New Norcia at the northern tip of the Jarrah Forest and Borden near the Stirling Range. This species has been recorded from all mainland Australian states. Vegetation associations indicate a preference for dry sclerophyll timber, and collections have been made in *Callitris* forest, mallee and open grassland. One collection was made in woodland near an old vineyard. Sandstone, red and sandy soils are mentioned in label data. One nest examined lacked a mound.

The colour of the head separates *M. gratiosa* (head light reddish-brown and concolorous with the mesosoma) and *M. vindex* (head dark reddish-brown and distinctly darker than the mesosoma). The gaster in *M. gratiosa* is always black, whereas the base of the gaster is blood red in the variety '*basirufa*' (formerly a sub-species of *M. vindex*) within *M. vindex*. *Myrmecia gratiosa* is one of the most common bulldog ants in and around Perth. This species is also the only bulldog ant species in the Perth region implicated in ant sting anaphylaxis (Gilhotra & Brown 2006). *Myrmecia gratiosa* is restricted to the south-west of WA. Nonetheless, there have been very many collections made of this light reddish ant, from Kalbarri in the mid-north to near Esperance on the south coast, coastal areas being preferred. However, *Myrmecia gratiosa* eschews the jarrah forest south of Perth, and there are only a handful of collections from the wheatbelt and none from the arid regions of the State. All soil records mention grey or white sand, and sometimes the presence of dunes. Vegetation types include *Allocasuarina*/Samphire, Peppermint scrub, *Eucalyptus* open forest, marri/jarrah and paddock. The nest is of the crater type. Like *M. gratiosa*, *M. vindex* is confined to the south-west of WA. *Myrmecia vindex* has much the same western range as its close relative but is more tolerant of heavily forested areas. This species is also more common in the wheatbelt. *Myrmecia vindex* has been recorded on sand, but also on sandy loam. This species can persist in relictual bushland and the bushier parkland in Perth, even in very small areas that are largely denuded of vegetation (e.g. in the inner suburb of Mosman Park next to the Swan River). Vegetation mentioned includes *Corymbia calophylla*, *Eucalyptus camaldulensis* and mallee. The ant ascends trees and has been captured by pyrethrum knockdown and yellow pan trap, and its nest is a large mound.

The *Myrmecia cephalotes* species-group is a small clade of colourful, mainly desert-dwelling *Myrmecia*. Along with *Myrmecia desertorum*, these are among the few *Myrmecia* that occur in WA's arid inland and northern subregions. They are easily identified as to species-group by the simple spinous posterior spur on the metatibia (the other *Myrmecia* having a pectinate posterior tibial spur). The three WA species — *M. callima*, *M. cephalotes* and *M. hilli* — are all inhabitants of remote areas in this state and thus are mostly known from a few collections only. *Myrmecia cephalotes* has at least a partly, sometimes wholly dark first gastral tergite that contrasts with the orange postpetiole (these segments are concolorous in the other two ants). The degree of infuscation of the first gastral tergite varies; the syntypes worker illustrated on AntWeb have only a reduced pale patch on either side of the first gastral tergite, but in workers recently (2012) collected at Lake Lefroy the entire base of the first gastral tergite is pale. To date, this species has been collected in the Coolgardie and Murchison subregions. Interstate, *M. cephalotes* occurs in NSW, QLD, and SA. (This species has not as yet been recorded from Victoria: the ascription of this species to Victoria in AntWeb is due to confusion over the precise locality of 'Coopers Creek' where a syntype was collected; this was actually Coopers Creek in northern SA, not the Gippsland town of Coopers Creek.) The species has been collected on or near the sandy margins of salt lakes and has been found among samphire. Other associated vegetation types are *Acacia victoriae* and tobacco bush. *Myrmecia callima* has an entirely reddish-brown gaster and, in full-face view, the mandibles are broad, their outer borders convex. In *Myrmecia hilli*, the two apical segments of the gaster are blackish and the rest of the gaster is light reddish-brown and, in full-face view, the mandibles are slender and their outer borders are virtually straight. *Myrmecia callima* is the most frequently encountered member of the trio in WA and has been taken in several of WA's extensive desert regions as well as the eastern and northern goldfields and the central wheatbelt. Unfortunately, there is almost no information on this species, the only label note being that the specimens had been collected in 'sandy, low scrub'. *Myrmecia hilli* has been collected on four occasions in WA in the Little Sandy Desert, the Gascoyne and the Murchison. Elsewhere, this species occurs in NSW, the NT, and SA. Nothing is known of its biology.

The *Myrmecia picta* species-group members are small bulldog ants that superficially resemble those in the *M. urens* species-group, and they also lack a supplementary ventral tooth. However, they also lack an occipital carina, and this is the most useful distinction between the two clades. There are two WA species in this group. In full-face view, the sub-basal portion of the mandible in *M. fucosa* is only slightly broadened, and the erect setae on the clypeus reach the basal quarter of the mandible. The pronotum is light-reddish-brown. In full-face view, the sub-basal portion of the mandible of *Myrmecia picta* is distinctly broadened, and the erect setae on the clypeus do not reach the basal quarter of the mandible. The pronotum is black. *Myrmecia picta* is the more common of the two species and is found mainly in the drier areas of the south-west and the goldfields, avoiding the very wet south-western corner of WA, although it does enter the northern Jarrah Forest subregion. This species is also common in other parts of Australia and is found in all mainland states except the NT. Away from the jarrah forest, mallee is a favoured habitat, but the ant has also been collected in spinifex, mallee, box and *Callitris* forest, and from a paddock. Many workers have been collected directly from vegetation such as mallee stems, either by hand or by intercept trap (one record from *Eucalyptus wandoo*). The ant nests in soil. *Myrmecia fucosa* is known in this State from just one record from Queen Victoria Spring. This species is also definitely known from SA and Vic, and almost certainly also occurs in NSW. The Queen Victoria Spring worker was pitfall-trapped in yellow sand in an unburnt control site. Other specimens have been collected in mallee and spinifex. The nest is described as a small pad with a neat hole in the centre.

The *M. pilosula* species-group, which includes the notorious jack-jumper ants, is a larger concern, with nine WA species recognised here. These ants also lack the occipital carina but possess a supplementary ventral tooth and have dentition strongly developed along the entire inner margin of the mandible. In *M. rugosa*, *M. michaelseni* and *M. varians* the erect clypeal setae are long and reach to at least the basal quarter of the mandibles. *Myrmecia rugosa* differs from the other two species in having a distinctly sculptured post-petiole (post-petiole with only vestigial sculpture in *M. michaelseni* and *M. varians*) and in having bright yellow gastral pubescence in fresh specimens (orange pubescence in *M. michaelseni* and off-white or dull yellowish in *M. varians*). In WA, *Myrmecia rugosa* is strictly confined to the Swan Coastal Plain, where it occurs from just north of Perth to Cape Leeuwin in the south. Based on ant data in AntWeb and the Atlas of Living Australia, this species purportedly also occurs in NSW, QLD, and SA, but Ogata & Taylor (1991) and Taylor & Brown (1985) list only WA for this species, and it would be peculiar indeed if a taxon so restricted in WA should also occur more widely thousands of kilometres away. These extralimital records should therefore be regarded as dubious. Sparse ecological data indicates this species frequently forages on trees and has been caught in tree traps on several occasions. *Myrmecia rugosa* has also been taken by beating (*Acacia* sp.). Inspection of several features is needed in order to distinguish *M. michaelseni* from *M. varians*, namely: the nature of the erect setae on pronotum (mostly longer than the length of the first segment of the antennal flagellum in *M. michaelseni*, and mostly shorter than the length of the first segment of the antennal flagellum in *M. varians*); the appearance of the clypeus (clypeus without yellow pubescence in *M. michaelseni*, but this part may have yellowish pubescence in *M. varians*); the curve of the mandible (mandible of more-or-less the same width throughout its length in *M. michaelseni*, but noticeably tapered along its length in *M. varians*); and the appearance of the gastral pubescence (gaster with bright orange pubescence in *M. michaelseni*, but gastral pubescence off-white to yellowish in *M. varians*). *Myrmecia michaelseni* has two population aggregates in WA, one in the south-west corner including the Perth region and one in the Esperance region; however, this may be an artefact of collecting effort. *Myrmecia michaelseni* is probably confined to WA; two isolated records from NSW and one from SA found in the 'Atlas of Living Australia' probably do not relate to this species. The ant occurs in dry sclerophyll forest, itemised label data listing mallee, salmon gum woodland, *Viminaria* and jarrah/marri. The species may nest under suitable rocks, and foragers have been found on litter, tree-trunks and in one case in or on a termite mound. Within WA, *Myrmecia varians* prefers more xeric habitats than the two preceding species, and records range from the wheatbelt in the western part of its range to the goldfields and the mid-west of the state. There is one isolated record from the Kimberley. This species is also widespread throughout Australia and occurs in all mainland Australian states. Vegetation associations recorded are equally varied — box, mallee, limestone mallee, *Callitris*/red gum, salt bush, spinifex and wandoo. This species forages both on the ground and on vegetation and nests in sandy soil, one nest entrance being described as a 'hole in [the] ground' (label data).

Two more members of this species-group, namely, *M. chasei* and *M. ludlowi*, can be distinguished by the length of the erect setae on the hind tibia, these being abundant and long and in some cases as long as or longer than the greatest width of the tibia. In the remaining ants in the species-group, the erect setae on the hind tibia are sparse and always shorter than the maximum width of the tibia. In *M. chasei*, the mandibles are yellow to light fawn, lighter than the head; in a full-face or oblique view, the upper part of the head has more-or-less straight striae, the space between the striae being smooth. In *M. ludlowi*, the mandibles are dark fawn to dark brown, often nearly concolorous with the head; in a full-face or oblique view, the striae on the upper part of the head are rather ragged in appearance with dimples or semi-reticulate spaces between them. Populations of *Myrmecia chasei* are plentiful in the vicinity of Perth, but fewer in the central Jarrah Forest subregion. However, the ant is also common in the karri and tingle forests around Manjimup and along the south coast as far as Esperance. This ant and its close relative are likely to be confined to WA, despite extralimital records from QLD and SA in AntWeb. (Notwithstanding this likelihood, *M. chasei* may occur in SA, and the records there should be checked.) *Myrmecia chasei* is associated with sandy habitats such as sandplain heath, coastal dunes and sandstone. Mallee is also mentioned. As with most bulldog ants, foragers may be found on the ground or on trees. *Myrmecia ludlowi* is confined to coastal sandplain from Perth southwards around the capes to about Northcliffe and is not found anywhere else. This ant probably has much the same habits as its close relative, but label data throws little light on this, and is mostly lacking. Workers from the Stewart Highway were collected from near roadside ponds, another specimen was collected from the ground and the only other mention is of a specimen from Mirrabooka collected 'in herbs' (presumably in a garden).

Myrmecia imaii is the only member of the *M. pilosula* complex that occurs in WA and is endemic to this state. This complex is particularly strongly associated with severe allergic reactions to stings (Davies et al. 2004). Although most medical reports relate to *M. pilosula* and other eastern states species, these ants being more common on the eastern seaboard, a colleague of this author had a severe reaction to a sting that involved *M. imaii*. This species should therefore also be regarded as potentially hazardous. *Myrmecia imaii* is easily recognised within its species-group by its all black head and mesosoma. There are a couple of very old records of *M. imaii* from just east of Perth, but more recent records are all from near the south coast. There are two aggregations of the latter; these are sites east and west of Albany and sites in the Esperance district. Specimens collected by the author near Torbay were very aggressive around their nest, which was decorated. The nest was in sandy soil in coastal scrub. *Myrmecia dispar* is another darkish ant. This species has a combination of dark brown mandibles, which are concolorous with the head, and whitish pubescence on the clypeus. In *M. elegans* and *M. occidentalis* the mandibles are usually lighter in colour, but if they are dark then the pubescence on the clypeus is yellowish. Most WA records of *M. dispar* come from the Esperance Plains subregion, but there is one record east of Hyden in the Coolgardie subregion. The species also occurs in NSW, QLD, SA, and Vic. *Myrmecia dispar* is found on red soil and is associated with such vegetation communities as black box, *Casuarina*, red gum, *Callitris*-box, mallee and salt bush. Nests have been recorded under tree cover and under a flat rock. One forager on vegetation in a eucalyptus/pine plantation was recovered after a chemical knockdown. *Myrmecia elegans* and *M. occidentalis* are rather similar ants that can be easily confused. However, in *M. elegans* the pubescence on the clypeus is yellowish and, in full-face view, the antennal scape does not exceed the posterior border of the head, whereas in *M. occidentalis* the pubescence on the clypeus is whitish and, in full-face view, the antennal scape exceeds the posterior border of head by about half the length of the first segment of the antennal flagellum. Populations of *Myrmecia elegans* are mostly concentrated in the Kwongan down to the northern Jarrah Forest and across to the Mallee and Esperance Plains subregions. Outliers come from Banjawarn Station in the mid north and Madura in the south-east. This species also occurs in south-eastern SA and its range probably extends into Vic. In the Jarrah Forest this species has been recorded from mixed woodland (i.e. jarrah/marri/wandoo). Further east it is found in mallee. The ant frequently forages on trees, and foragers have been gathered by hand and also from intercept traps on tree trunks. *Myrmecia occidentalis* has a slightly more northerly and semi-arid range than its close relative, with most specimens coming from the Kwongan region of the Geraldton Sandplains, the central wheatbelt and the south-eastern wheatbelt. Outside of WA, this species is known from a couple of SA records. The ant has been collected on flowers of *Leptospermum* and from beating *Acacia* sp. Habitat records include mallee and sand dunes on low coastal scrub. *Myrmecia occidentalis* is extremely common in rehabilitated mineral sand mines in Eneabba, where it is an early coloniser.

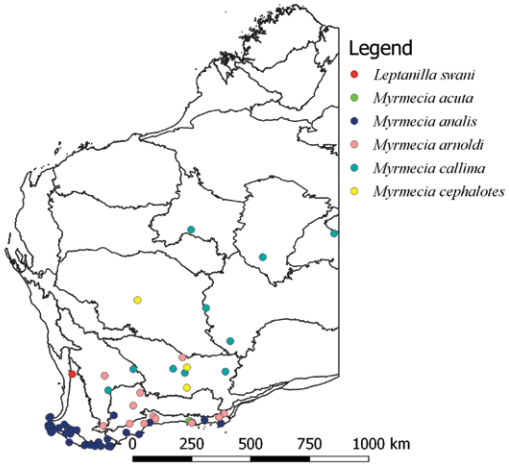

FIGURE 95 Distribution of *Leptanilla swani*, *Myrmecia acuta*, *M. analis*, *M. arnoldi*, *M. callima* and *M. cephalotes*.

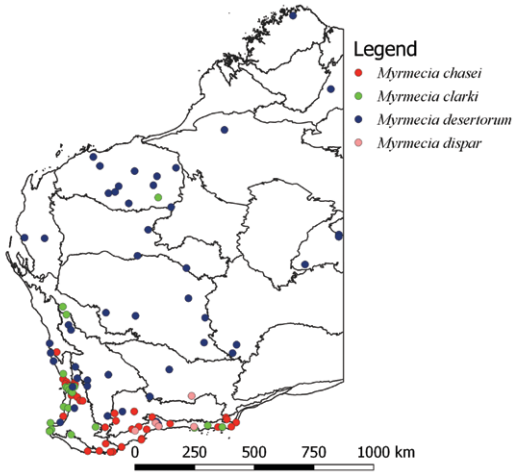

FIGURE 96 Distribution of *Myrmecia chasei*, *M. clarki*, *M. desertorum* and *M. dispar*.

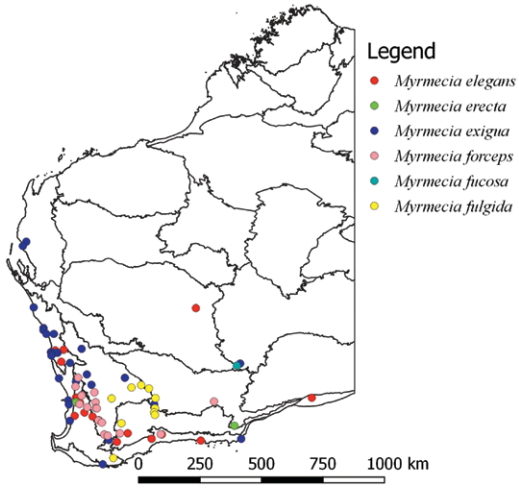

FIGURE 97 Distribution of *Myrmecia elegans*, *M. erecta*, *M. exigua*, *M. forceps*, *M. fucosa* and *M. fulgida*.

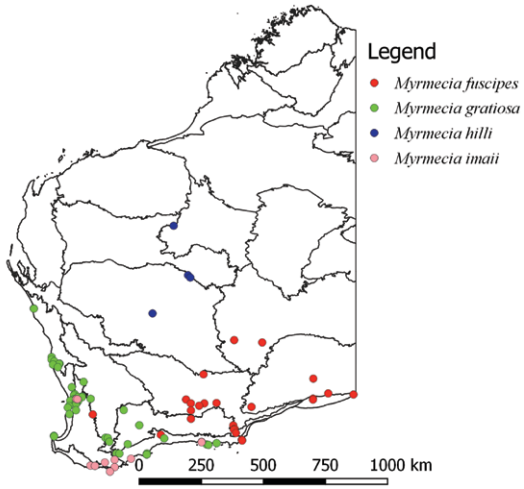

FIGURE 98 Distribution of *Myrmecia fuscipes*, *M. gratiosa*, *M. hilli* and *M. imaii*.

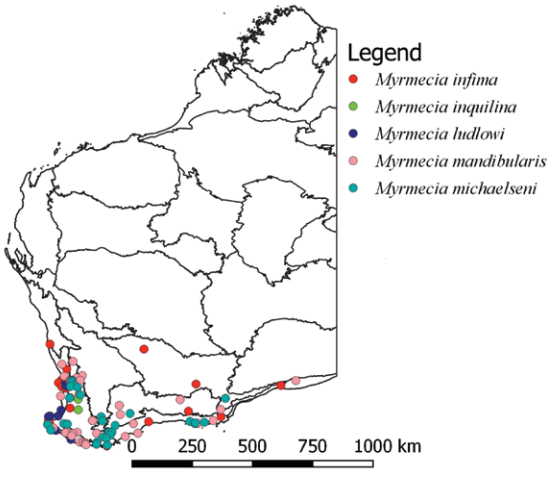

FIGURE 99 Distribution of *Myrmecia infima*, *M. inquilina*, *M. ludlowi*, *M. mandibularis* and *M. michaelseni*.

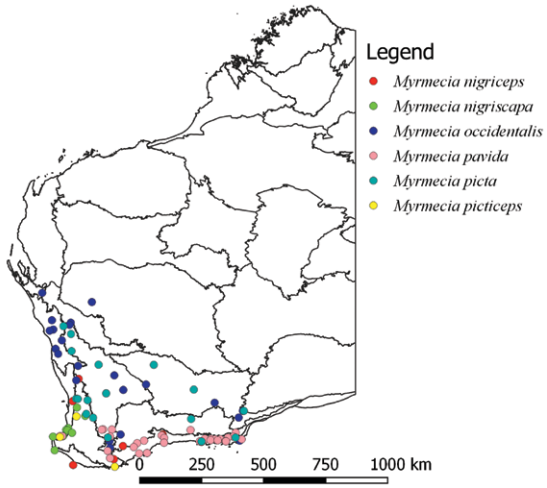

FIGURE 100 Distribution of *Myrmecia nigriceps*, *M. nigriscapa*, *M. occidentalis*, *M. pavida*, *M. picta* and *M. picticeps*.

Myrmecia mandibularis is a spectacular and familiar species that, because of its long, curved, edentate mandibles, jet black body colour and deep yellow gastric pubescence, is not readily confused with other bulldog ants. This is the only WA species within the *M. mandibularis* species-group. Members of the *M. tepperi* species-group also have mandibles that are edentate to varying degrees, but *M. mandibularis* differs from them in having long clypeal setae, directed anteriad, that are about half the length of the mandible. The corresponding setae in the *M. tepperi* species-group are much shorter. *Myrmecia mandibularis* occurs from about Perth southwards, and along the south coast to the Nullarbor Plain. Interstate, its range extends into SA and Vic. This species is equally at home in jarrah and marri forest in the wetter areas and in mallee in the drier areas. Although not confined to sandy soil the ant has frequently been collected in coastal dunes and other white, sandy habitats. The author has often seen this species foraging on bark in jarrah forest. The species may nest directly into soil, its nest indicated by a low mound, but, equally, it often nests under rocks or logs.

The final species-group discussed here is the *Myrmecia tepperi* species-group. Like *M. mandibularis*, the mandibular teeth are strongly reduced or absent in its members, but they lack the long clypeal setae. There are five described species. *Myrmecia tepperi* and *M. clarki* have a uniformly blackish-brown body, whereas workers of the other three taxa are bicoloured, with a blackish-brown head and gaster and reddish mesosoma and petiole. *Myrmecia tepperi* has dark brown mandibles and the dorsum of the second and following gastral tergites have gold pubescence; *Myrmecia clarki* has yellowish mandibles and the dorsum of the second and following gastral tergites has sparse, white pubescence. *Myrmecia tepperi* in WA is mainly found in the Jarrah Forest with additional records from the Mallee subregion and the south coast as far east as the Nullarbor. This species also occurs in the ACT, NSW, SA, and Vic. *Myrmecia tepperi* prefers dry sclerophyll woodland as a habitat, and has been found in mixed jarrah, marri and wandoo woodland, in limestone mallee and in mallee woodland (often near the coast). This species has frequently been collected from nests under rocks, and, on one occasion, under a log, and has also been collected from tree trunks. *Myrmecia clarki* has a broader distribution in WA than *M. tepperi* but appears to mainly avoid the Jarrah Forest subregion. Most collections have come from the Swan Coastal Plain and the south coast in the Esperance district, with a few from the northern wheatbelt and the Pilbara (i.e. Ethel Creek, that odd repository of many ants that otherwise are only known from hundreds of kilometres south). This species, however, has not been recorded outside of WA. In the deep south of the state, this ant has been taken on a granite outcrop in karri forest, and from tree heath. Further north, *M. clarki* has been collected in *Banksia* woodland over white sand, and in marri forest. Nests have been found at the base of trees, under stones, under logs and in a termite mound. Wheeler (1933) mentions the species' preference for nesting under flat stones in forested areas.

Myrmecia testaceipes is an uncommon species that can be distinguished from *M. acuta* and *M. swalei* by its reddish-brown legs that are approximately

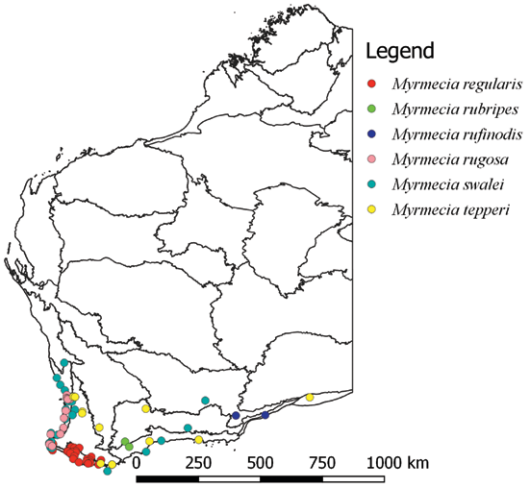

FIGURE 101 Distribution of *Myrmecia regularis*, *M. rubripes*, *M. rufinodis*, *M. rugosa*, *M. swalei* and *M. tepperi*.

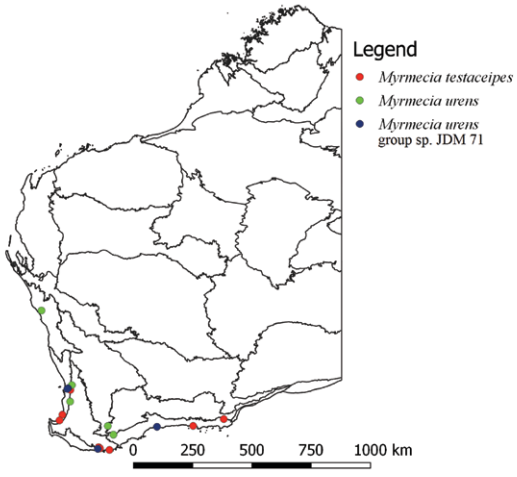

FIGURE 102 Distribution of *Myrmecia testaceipes*, *M. urens* and *Myrmecia urens* group sp. JDM 71.

concolorous with the mesosoma, and the postpetiole that is usually lighter in colour than the gaster (in *M. acuta* and *M. swalei* the legs are distinctly a darker brown than the mesosoma and the postpetiole is dark in colour and concolorous with the gaster). In WA, *M. testaceipes* is a purely coastal form that has been recorded from the Swan Coastal Plain, in the Albany district, Esperance and near Mt Ragged in the Cape Arid National Park. This species also occurs in NSW, SA, and Vic. All ecological data associated with labels for the taxon mention mallee habitat. One soil note refers to red granite soil. *Myrmecia testaceipes* will nest directly in soil but also uses rocks as cover for its nests. As with many bulldog ants, this species forages on trees as well as on the ground.

Ogata and Taylor (1991) distinguish between *M. acuta* and *M. swalei* using four characters, namely the labral process (pointed in *M. acuta* and rounded in *M. swalei*), the striation of the head around the occipital region (non-reticulate in *M. acuta*, reticulate in *M. swalei*) the more abundant mid-tibial pilosity in *M. acuta* and the generally more inflated mesosoma in *M. acuta*. In the opinion of this author, the last two characters are vague and probably of little consequence, leaving the sculpture of the head and the nature of the labral process as the only two substantive characters. Around 30 workers of *M. swale*i are available for inspection in the JDM/WAM holdings. Although there are no unequivocal workers of *M. acuta* in these holdings, the degree of variability of the *M. swale*i material casts considerable doubt on the validity of *M. acuta* as a discrete taxon, since smaller specimens of *M. swalei* show variable development of the labral process, right down to the acutely pointed condition, while larger workers have a more broadly developed process. Moreover, smaller workers also exhibit proportionately less cephalic sculpture than larger ones. The two taxa are being left as separate entities here, however, until type or topotype material can be examined. Based on AntWeb records, *M. acuta* has been collected only twice — from the type locality in Esperance and at Spalding in SA. The type material includes workers collected at 6 pm in the evening while foraging on flowering shrubs. Nearly all *M. swalei* records come from on or near the coast, where the ant occurs inland from Jurien Bay in the lower mid-west of the state around to at least the Fraser Range in the Coolgardie subregion. A record from Onslow on the north-west coast of WA (ANIC, on AntWeb) is almost certainly incorrect. Interstate, this species can also be found in SA. This species favours white sand and coastal scrub. Records mention limestone mallee, mallee, swamp mallee, peppermint scrub, coastal heath and wooded sandplain. Foragers can be found on tree trunks and low shrubs. No information is available on nesting habits.

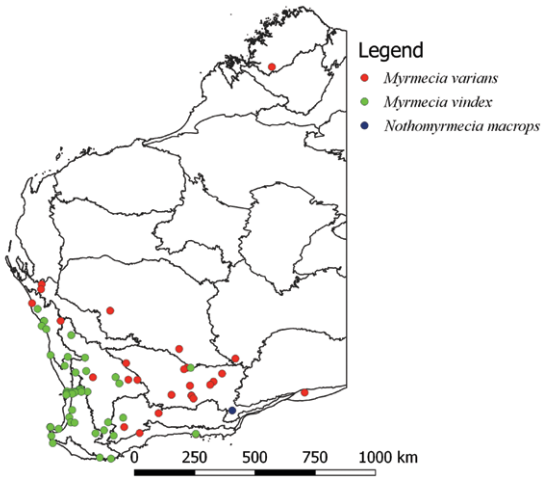

FIGURE 103 Distribution of *Myrmecia varians*, *M. vindex* and *Nothomyrmecia macrops*.

Nothomyrmecia (Figure 103)

The very rare *Nothomyrmecia macrops* is the sole member of its genus. This ant has only the one waist segment, and can be diagnosed as a large, honey-coloured ant with a petiole with visible anterior, dorsal and posterior faces that are separated from the gaster by a marked constriction, frontal lobes that partially or fully obscure the antennal sockets, a pygidium that lacks peg-like or spinous teeth, a visible sting, a gaster without a distinct constriction between the first and second segments, and elongate, triangulate mandibles that are attached near the corners of the head and are armed with intermeshing teeth along their entire margin. The petiolar node in this species is low and rounded. *Nothomyrmecia macrops* was named in 1934 from two workers supposedly collected in the Russell Ranges, near WA's south-eastern coast, but was not seen for many years afterwards. The species was fortuitously rediscovered by myrmecologist R. W. Taylor near the Eyre Peninsula (SA) town of Poochera in 1977. Since that time a number of colonies have been discovered in western SA, but the ant continues to remain elusive in this State. This species is a strictly nocturnal forager, and largely remains below ground in winter, and appears to favour mallee rather than heath. Well-credentialed search parties have failed to find the ant in the area of WA in which it is believed to occur, and possibly it is confined to SA (https://www.antwiki.org/wiki/Nothomyrmecia [accessed 8 October 2019]).

MYRMICINAE

Myrmicine ants can readily be recognised by their possession of two waist segments, the appearance of their mandibles, which are usually short and triangular but if long then armed with teeth only at the tip and not crossed when at rest, their fused pronotum and mesonotum, and the presence of frontal lobes that in full-face view obscure or partially obscure the antennal bases. The antennae are always inserted above the clypeal margin, and eyes are usually present. The Myrmicinae are a major subfamily in WA, with 238 species in at least 22 genera discussed here, and in terms of biodiversity are exceeded only by the Formicinae with 328 species and 17 genera. Despite their generally small or even minute size, the Myrmicinae are tolerably well-known taxonomically, with just 70 undescribed species (i.e. 29.4%) out of the taxa considered here, which is roughly comparable with the situation obtaining with the Formicinae (90 undescribed taxa, i.e. 27.4%). However, around half of the undescribed myrmicines (at least 34 taxa) are within the large genus *Meranoplus*, the group most sorely in need in revisionary work out of all the ant genera found in WA. Myrmicines exhibit arguably more variation in morphology than any other subfamily of ants, with independent clades of specialist predators that have elongate, trap-jaw mandibles, polymorphic specialist granivores, 'thief ants' that steal eggs and brood, and slender arboreal forms, as well as generalised species. However, Australia lacks the fungus growers of other countries, particularly the Americas. As with the Formicinae, worker polymorphism has arisen several times among the genera represented in WA.

More myrmicine species are represented by single specimen records or just the one series than is the case for other ant subfamilies. This may be due to the very localised ranges and small colony size found in some taxa but may also be due to the high degree of specialisation found in many myrmicines such that suitable habitat or food sources are naturally patchy.

Correct placement of its numerous genera within an evolutionary framework has long bedeviled ant systematists working on the huge, hyperdiverse subfamily Myrmicinae. However, recent molecular phylogenetic work has now produced a robust phylogeny that includes six major clades defined as tribes (Ward et al., 2015). Western Australian myrmicine genera can now be placed confidently within four of these six tribes as follows: tribe Attini: *Colobostruma*, *Epopostruma*, *Mesostruma*, *Orectognathus*, *Pheidole* and *Strumigenys*; tribe Crematogastrini: *Adlerzia*, *Cardiocondyla*, *Carebara*, *Crematogaster*, *Mayriella*, *Meranoplus*, *Podomyrma*, *Stereomyrmex* (not sequenced; placement based on morphological or genetic similarity to sequenced taxa), *Tetramorium* and *Trichomyrmex*; tribe Solenopsidini: *Austromorium*, *Chelaner* (as '*Monomorium*' [Ward et al., 2015]), *Monomorium*, *Solenopsis* and *Syllophopsis*; and tribe Stenammini: *Aphaenogaster.* Among the more interesting outcomes is the placement of the members of the former tribe Dacetini (specialised predators that include trap-jawed species) within the far more inclusive tribe Attini. However, *Strumigenys*, while still placed within the Attini, is now revealed to be only distantly related to its former colleagues from the superceded tribe Dacetini.

Adlerzia (Figure 104)

Adlerzia is an inconspicuous monotypic genus, with the single species, *Adlerzia froggatti*, turning up occasionally in collections made between Dongara on the mid-western coast and Albany on the southern coast. The species also occurs in all other Australian mainland states except the NT. *Adlerzia froggatti* has an antennal scape that passes above the eye when at rest, the antenna consists of 11 segments with a three-segmented club, the postpetiole is attached to the front of the gaster, the clypeus below the antennal sockets is smooth and not raised into a sharp-ridged edge, the sting lacks a lamella, the femora and tibia are not swollen and bulbous, the dorsum of the mesosoma has a defined metanotal groove, the PF is 4,3, and the worker caste is dimorphic with large-headed major workers as well as small minors. Most collections have been made from pitfall traps or from nests found under rocks. The species inhabits a variety of vegetation zones — jarrah and other dry sclerophyll eucalypt forests, riparian forest, wet sclerophyll, shrubland and heath — and appears to prefer sandy habitats, but essentially nothing is known of its biology. The presence of a large-headed worker caste may suggest granivory is important for *Adlerzia froggatti*, but there is as yet no evidence to support this hypothesis.

Aphaenogaster (Figure 104)

Aphaenogaster is a small genus in WA, with four representatives, all described. *Aphaenogaster* is characterised in the taxonomic key by a number of features, but just five will suffice to distinguish the genus when in hand: namely, the presence of a well-developed eye; a 12-segmented antenna with a four-segmented club; an anterior clypeal margin with numerous unpaired setae; (seen in profile); the propodeum on a lower plane than the promesonotum, with the posterior sector of promesonotum forming a steep, sloping bridge; and a PF of 4,3. This genus is also monomorphic.

The evidence of this ant in the Australian bush is more indicated by the presence of its distinctive, borehole-shaped nest entrances than by the sight of the actual workers, which mostly stay within the nest. The species are believed to use their nest-holes as pitfall traps to capture invertebrates, whose remains have been found in the upper chambers of nests, and they are also known to tend root aphids (Shattuck 1999), but much of the biology of the Australian taxa remains conjectural. Shattuck (2008) has recently revised the Australian fauna.

The four WA species are not easy to distinguish and close attention must be paid to characters of the cephalic setae and the striae on the mandibles. *Aphaenogaster kimberleyensis* has the setae on the venter of the head capsule randomly distributed so that they do not form a psammophore. The setae in the other three taxa are located laterally so as to form a psammophore. In WA, the former species has only been recorded from coastal or near coastal parts of the Mitchell plateau in the north-west Kimberley. There is also one record from outside WA in the Kakadu National Park, NT. Limited data on the biology indicate this species nests in sandy soil, and it has been collected in both *Eucalyptus* woodland and *Allosyncarpia* rainforest. *Aphaenogaster mediterrae*, *A. barbigula* and *A. poultoni* have a more southerly range. In *Aphaenogaster mediterrae*, the eye is relatively large (EL ~0.25 × length of side of head), and the antennal scape is relatively long (scape exceeds vertex by ≥ 2 × its greatest width). In the other two species the eye is relatively smaller (EL ~0.23 × length of side of head), and the scape is relatively short (scape exceeds vertex by ≤ 1 × its greatest width). *Aphaenogaster mediterrae* is known in the Pilbara from one record from Ethel Creek, but all other records are from much further south, where the ant eschews the wetter south-west corner and populations are concentrated in the semi-arid mallee country of the lower EP, most notably in the Coolgardie subregion. Records of this species stretch all the way to the WA/SA border. The known range of *Aphaenogaster mediterrae* continues in SA to about Adelaide. Most nests are in sand and display the characteristic cone or funnel-shaped entrances (Shattuck 2008).

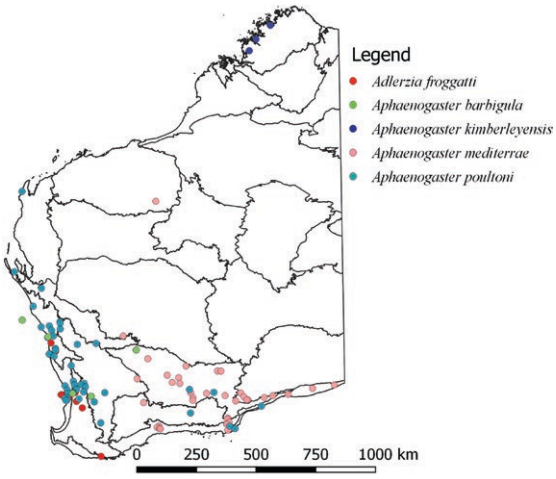

FIGURE 104 Distribution of *Adlerzia froggatti*, *Aphaenogaster barbigula*, *Aphaenogaster kimberleyensis*, *Aphaenogaster mediterrae* and *Aphaenogaster poultoni*.

Shattuck's (2008) key is here modified slightly to render the two very similar species *A. barbigula* and *A. poultoni* easier to distinguish. Thus, *A. barbigula*, when seen in profile, has a petiolar peduncle that is shorter and the petiolar spiracle is placed just in front of the node. The mandibular sculpture is composed of regular-sized striations (this character from Shattuck's revision is accepted here, although almost impossible to identify in practice). *Aphaenogaster poultoni* has a petiolar peduncle that is longer, the petiolar spiracle is placed well ahead of the anterior face of the node and, in full-face view, the mandibular sculpture is seen to be composed of irregularly sized striations. *Aphaenogaster barbigula* is regarded by Shattuck (2008) as not occurring in WA, despite his mentioning paralectotypes from several WA localities. This species is, in fact, sympatric with *A. poultoni* in parts of WA, although much less common. Records mentioned by Shattuck come from the Houtman Abrolhos (Wallabi Island), Beverley, Dongara and Gooseberry Hill. Inland records (WAM) come from Clampton, in the northern goldfields. Elsewhere, this species occurs in NSW, QLD, SA, and Vic. Shattuck (2008) mentions vegetation associations for this semi-arid species as including *Callitris*, mulga, woodlands (including *Triodia* spinifex), savanna and grasslands. Nests are mostly in sandy soil, including red soil, and have large, deep craters around the entrance. *Aphaenogaster poultoni*, which is confined to WA, is found on and near the south-west and the mid-west coasts as far north as the North West Cape, with a smaller number of inland records from the Avon, Carnarvon, Esperance Sandplain, Mallee and Yalgoo subregions. This species is not uncommon in the vicinity of Perth in remnant woodland. Shattuck (2008) mentions this species as being found in coastal scrub, jarrah forest, dry, sandy sclerophyll, mulga and mallee. The nest is dug directly into soil and has a large crater at the entrance. Additional records from WAM/JDM holdings mention degraded tuart (*Eucalyptus gomphocephala*) woodland, *Banksia* woodland and mixed *Banksia/Xylomelum* heath over yellow sand. One nest from Brookton was under a dead shrub.

Austromorium (Figure 105)

This tiny genus, consisting of just two species (both described), was revised by Shattuck in 2009. *Austromorium* is a genus with monomorphic workers with a well-developed eye; a 12-segmented antenna with a three-segmented club; a slightly projecting bicarinate anterior clypeal margin with paired setae just inside the clypeal angles with paraclypeal setae beside them; short, triangular mandibles with four or five teeth, a PF of 2,2 and (seen in profile) a mesosoma that forms a uniform arch interrupted by a shallow metanotal groove. *Austromorium flavigaster* had been known for many years prior to Shattuck's revision, but was variously lumped with other genera (*Xiphomyrmex* [Clark 1938], *Chelaner* [Bolton 1976], *Monomorium* [Bolton 1987], Myrmicinae *incertae sedis* [Heterick 2001] and *Rogeria* [Heterick 2009]). In his revision, Shattuck erected a new genus to accommodate this and one other species, *Austromorium hetericki*. *Austromorium flavigaster* is recognisable in having a smaller body (head width < 0.85 mm) than its relative; the gaster is banded (honey-yellow anteriorly and posteriorly, and brown medially) or uniformly yellow, and the propodeal lobes are developed as sharp spines posteriorly. *Austromorium hetericki* has a larger body (head width > 1.30 mm), the gaster is uniformly coloured dark brown, and the propodeal lobes are large and rounded posteriorly. Most collections of *A. flavigaste*r have been taken in the vicinity of Perth, on the Swan Coastal Plain and the western Jarrah Forest, with scattered collections from the Avon Wheatbelt, the southern Jarrah Forest, and the Warren subregions. An isolated record comes from Cape Arid National Park. This species can tolerate a certain amount of disturbance and is occasionally found in Perth suburban yards and the bushier parks in the Perth metropolitan area. Elsewhere, this ant has been recorded from all Australian states except the NT. This species was found to be common in a seeded plot in a rehabilitated bauxite mine at Jarrahdale, 45 km SE of Perth, where it was assumed to have a role in seed harvesting (Majer et al. 2013). However, Shattuck (2009) refers to it as a general scavenger. The ant nests in soil, often at the base of trees, and is mostly associated with dry sclerophyll woodland and mallee (Shattuck 2009). *Austromorium hetericki* is an uncommon species with a restricted range from about Eneabba on the Geraldton Sandplains to Perth and is not found in any other state. This species has been collected in *Banksia* woodland with *Adenanthos* understorey and also in calcareous heath, always over sand and often white sand in dune systems. Nothing is known of its habits.

Cardiocondyla (Figure 105)

With the exception of *Cardiocondyla wroughtonii* (in the *C. wroughtonii* species-group), the remaining species of *Cardiocondyla* found in WA (in the *C. nuda* species-group) share a frustratingly similar appearance, so that morphological species-level characters used to distinguish them are very subtle and require unusually close inspection. The genus *Cardiocondyla* can be determined by the following characters: in profile, the antennal scape in a resting position passes above the eye and antennal scrobes are absent; the postpetiole is attached to the front of the gaster; the petiole has a developed node and is not flattened; the antenna is 12-segmented and has a 3-segmented club; the clypeus below the antennal sockets is smooth, and not raised up into a sharp-edged ridge; the tip of the sting lacks a lamella; the eye is of moderate size; the anterior clypeal margin possesses an anteromedian seta, which is often accompanied by other paired setae; the palp formula is 5,3; the clypeus in full face view is a flat, broadly projecting apron with a depression extending from the antennal sockets (which form a small concavity on either side of the apron); and, in dorsal view, the postpetiole is larger than the petiole. The genus is monomorphic. Select groups within this genus (including Australian taxa) were revised by Seifert (2003) and by that author with the assistance of colleagues (Seifert et al. 2017).

Cardiocondyla wroughtonii is distinctive compared with *C. atalanta*, *C. nuda* and *C. paranuda*. In this species, the metanotal groove (seen in profile) is distinct and the propodeal spines are well-developed and thin, longer than they are wide across their base. In the other three species, the metanotal groove is weakly developed or absent, and the propodeal angles are developed as short teeth, about as wide across their base as they are long. *Cardiocondyla wroughtonii* is a pantropical species, probably originating in South-East Asia, that is now widespread throughout the world's tropical and subtropical regions (https://www.antwiki.org/wiki/Cardiocondyla_wroughtonii [accessed 26 June 2019]). A couple of records from this state centre on the Mitchell Plateau in the north-western Kimberley, with one specimen mounted out of a series that was found in berlesates from near Manning Peak in Prince Frederick Harbour, and was probably collected from vine thicket. This species nests in vegetation. New colonies of this polygynous ant are often founded by nest splitting (Seifert 2003).

Cardiocondyla paranuda is best discriminated from *C. atalanta* and *C. nuda* by the length of the appressed gastral setae. In the former, these setae are short and clearly separated from one another, so

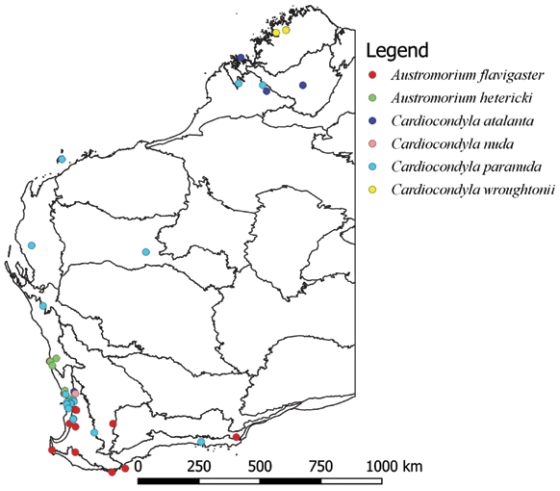

FIGURE 105 Distribution of *Austromorium flavigaster*, *A. hetericki*, *Cardiocondyla atalanta*, *C. nuda*, *C. paranuda* and *C. wroughtonii*.

that the setae do not touch or overlap. In the other two species the appressed gastral setae are longer and touch each other or overlap. In his 2003 paper, Seifert mistakenly assigned *C. paranuda* to Tunisia, rather than WA, based on labelling confusion by the collector H., Heatwole. The taxonomic key also requires the reader to undertake laborious and (in many instances, impractical) morphometric measurements to arrive at a species determination. In a subsequent paper (Seifert et al. 2017), the author corrected the labelling error and, by means of colour photographs, also provided practical ways several *Cardiocondyla* species, including *C. paranuda*, could be distinguished, although the formal species complex and species keys retained the Numeric Morphology Based Alpha-Taxonomy (NUMOBAT) system employed in the key in the earlier paper. In WA, *Cardiocondyla paranuda* appears to have a broad distribution throughout the entire state, from the south coast to the Kimberley, but most collections are from the Perth region, where the ant is a particularly common member of the depauperate ant fauna found in built-up areas. This species is abundant in lawns, yards, and street verges and is frequently seen crawling on paved surfaces. *Cardiocondyla paranuda* is also found in NSW, the NT, QLD, and SA, and is the only *Cardiocondyla* species occurring in inland Australia (Seifert et al. 2017). The species nests directly into soil or under stones, and between pavers in built-up areas. *Cardiocondyla atalanta* is best differentiated from *C. nuda* by the head and mesosoma being weakly shining, and the areolate sculpture on their surfaces is partially effaced (the appearance of the head and mesosoma is matt and their surfaces are covered with distinct areolae in *C. nuda*). Other differences mentioned by Seifert et al. (2017) are a less elongate head and scape, a higher petiole and a higher and wider postpetiole in *C. atalanta*, but these features may be difficult to assess with a lot of material because of infraspecific variability. Seifert et al. (2017) mention a record of this species from Goyamin Pool, Chittering, near Perth, but this is puzzling since all other WA records come from the Kimberley. In other parts of Australia, the ant occurs in NSW, the NT (including nearshore islands), and QLD. *Cardiocondyla atalanta*'s range also extends to Norfolk Island, Lord Howe Island and Papua New Guinea. Colony structure and behaviour seems to be the same as for *C. nuda* (Seifert et al. 2017). A worker taken at Ellendale Station in the Kimberley was captured in a yellow pan trap.

Cardiocondyla nuda may have been introduced to Australia, since its known range is Australasia and Oceania in the western Pacific (including the islands of Fiji and Samoa), but this is not known for sure. Certainly, this species does not appear to be native to Perth, where it only occurs in highly disturbed habitats. There is a possible record from Koolan Island, in the Kimberley (Seifert 2003; not mapped), but other WA records are confined to the Perth region. In other parts of Australia this species occurs in the NT, QLD, Norfolk and Lord Howe Islands and the islands of the Torres Strait. Across this country this species has been taken in a variety of natural and modified habitats. A nest of the ant has been found under a stone. Most specimens have been collected using methods adapted for ground fauna in litter, e.g. berlesates, pitfall traps, yellow trays and Winkler sacks. Malaise traps have also been successful, indicating this species will forage off the ground.

Carebara (Figure 106)

Although four species (two described and two undescribed) have been recorded from WA, they are all rarely encountered, and the biology of three of them is virtually unknown. Members of this genus have short, triangular mandibles, antenna with nine or eleven segments including a two-segmented club, a postpetiole attached to the front of the gaster, and propodeal angles armed with spines, denticles or thin, elongate flanges. The eyes may be much reduced, and the worker caste is dimorphic or polymorphic. In the case of two of the species, known from one or a few records, the major worker has not yet been collected. Three of the WA species (previously placed in *Oligomyrmex*) are tiny and cryptic, while *C. affinis* (previously placed in *Pheidologeton*) is an aggressive surface predator and scavenger that forms foraging columns.

Carebara affinis has a propodeal angle that is produced as a sharp spine in major, media and minor workers, and the eye, although small, is multifaceted. In the other three species, the propodeal angle is unarmed, each angle bearing a flange that descends along the sides of the propodeal declivity, and the eye is minute, represented by a single facet, or is absent altogether. Local WAM/JDM holdings have only one WA record of this species, from Prince Frederick Harbour in the north-western Kimberley. Within Australia this ant also occurs in the NT and QLD, but also has an extensive range overseas in China, India, Indonesia, Malaysia, Myanmar and Papua New Guinea. In extralimital habitats, *Carebara affinis* is often active in places like rubber plantations, botanical gardens, palm plantations and various types of rainforest. While columns are often active on the soil surface, including nocturnally, workers have mostly been extracted from sifted litter, from rotten logs, from under bark and from leaf mould, often by the use of Winkler sacks. Nests can be under stones or under bark. *Carebara* sp. JDM 440 is a tiny, matt, yellow species in which the minor worker (the major worker is unknown) has the sides of the head and mesosoma completely covered in areolate sculpture. The eye is reduced to a single facet, indicated by a tiny, black fleck. *Carebara cornigera* and *Carebar*a sp. JDM 1131 have at least the sides of the promesonotum smooth and shining, and the eye is barely visible or is completely absent. *Carebara* sp. JDM 440 is known only from three separate collections near Karragullen in the Jarrah Forest south-east of Perth. A small series of foragers was collected from under a flat sheet of rock lying on top of a rocky outcrop next to the Brookton Highway. In *Carebara* sp. JDM 1131 the head is distinctly dorsoventrally flattened and, in full-face view, presents as a longitudinal rectangle (HW ~0.50 × HL), the setae on the sides of head and on the antennal scape are erect, and the colour of the ant is a depigmented creamy-yellow. In *Carebara cornigera*, the head is not distinctly dorsoventrally flattened and, in full-face view, presents as a squarish rectangle, (HW > 0.75 × HL), the setae on the sides of the head and on the antennal scape are sub-decumbent, and the colour of the ant is a bright yellow. *Carebara* sp. JDM 1131 is known from a single minor worker collected by means of a Winkler Sack on Barrow Island. *Carebara cornigera*, here regarded as an introduction from the eastern states, is known in WA from two minor workers collected from the small yards of separate inner suburban houses in Perth, one in East Victoria Park and one in Maylands. The native range of this species is NSW and QLD. Both WA specimens were collected from lawn by means of pitfall trap. The East Victoria Park lawn was infested with the introduced tramp *Tetramorium bicarinatum*, and termite-infested wood and litter were also present at the latter site (Heterick et al. 2013). In their paper, Heterick et al. surmise that the species may have been able to persist by feeding on termites.

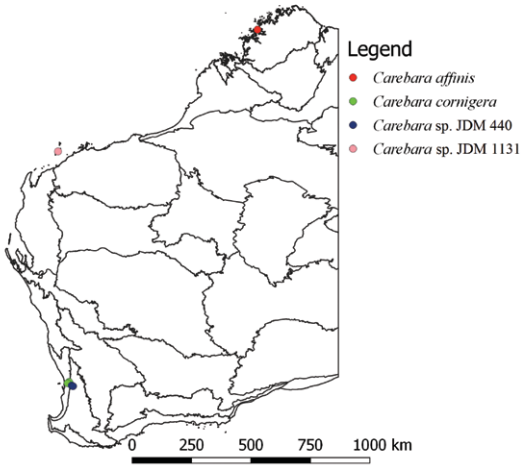

FIGURE 106 Distribution of *Carebara affinis*, *C. cornigera* and *Carebara* sp. JDM 440 and JDM 1131.

Chelaner (Figures 107–112)

Note: When many Australian ants formerly in genus *Monomorium* were reassigned to the revived genus *Chelaner*, which occurred when this monograph was in preparation, the declension of the species-level names ending in *'-nigrum'* changed to *'niger'*, in keeping with the suffix of the genus *Chelaner* (Latin second declension, masculine). In three instances (all involving the species *Chelaner flavoniger*), the species name is incorrectly declined as *'flavonigrus'* in Part I (i.e. in the species list on page 12, in the species key on page 160, and in the caption to Figure 763 on page 162). This error was discovered too late for it to be rectified in Part I.

Chelaner keys out with *Monomorium* until couplet 21 in the species taxonomic key in Part I. However, in the species for which the sexual forms are known the wing veins are tubular and cross veins m-cu and cu-a are always present and entire. Workers in the *C. whitei* species-group can be distinguished from other *Chelaner* in the following particulars: the mandible always has four well-developed teeth (compared with five teeth, primitively, but these may be fused or reduced resulting in two, three or four teeth — but the latter only in two taxa); workers are always strongly sculptured, at least on the mesopleuron and propodeum, with small workers predominantly microreticulate, rarely with foveate sculpture (and then on the head only), and large

workers strongly impressed with longitudinally rugose or costate sculpturing (compared with sculpture often reduced or absent, the worker smooth or shining or shining with regular foveae, and the sculpture not as above in the four-toothed taxa); the petiole has a relatively long pedicel and a bluntly conical node (petiole and node various but often cuboidal or squamiform, and not as above in the four-toothed taxa); and the clypeus is broadly excised (except in *C. striatifrons*), the clypeal carinae typically developed as strong teeth, or multiple teeth in some taxa, or at least short denticles, (clypeus bicarinate and medially narrowly excised, the clypeal carinae developed as short denticles or sharp angles, or the clypeus only weakly bicarinate and not or barely medially excised, the clypeal carinae not developed as teeth or angles). Among the WA members of the remaining *Chelaner* species-groups, only *Chelaner durokoppinensis* and *C. elegantulus* have mandibles with four teeth, and these species are clearly closely related to five-toothed forms and have a morphology that is quite dissimilar to the species in the *C. whitei* species-group. In *C. elegantulus* the basal two teeth are greatly reduced and the uppermost tooth is tiny and offset, suggesting tooth no. 5 has been lost sometime in its evolution.

In Sparks et al. (2019) three members of the *C. whitei* species-group; namely, *C. bicornis*, *C. striatifrons* and *C. whitei*, cluster together in the Bayesian tree for COI in Fig. 4 (apparently sequencing of *C. striatifrons* was unsuccessful for the two nuclear genes — wingless and elongation factor 1a F2 — used by the team). They are nested within clusters of other members of the genus, which suggests that despite several apomorphies they are at least congeneric with ants in the remaining *Chelaner* species-groups. Thus, while these eight morphologically well-defined taxa form a robust species-group within *Chelaner* (equating to the *C. whitei* group of Heterick [2001]), they do not fall outside the other *Chelaner*. Although, of the *Monomorium* taxa discussed by Sparks et al. (2019), only a species near *M. fieldi* was used by Ward et al. (2015) in their analysis of the Myrmicinae on a global basis, the results of Sparks et al. (2019) corroborates the findings of the earlier team that the genus *Monomorium* as it was understood in 2015 is a paraphyletic assemblage.

Chelaner striatifrons is a distinctive member of the *C. whitei* clade, with distinctive longitudinal costulate sculpture on the frons. In full-face view, the anteromedial sector of the clypeus is weakly emarginate and passes over to its lateral sectors through a broad convexity. The other members of this clade have different sculpture on the frons and the clypeus is deeply excised. This is a monomorphic species. All bar one of the records of *C. striatifrons* derive from WA localities, from the Carnarvon subregion in the north to the Avon Wheatbelt subregion in the south. The one exception is from Mt Whinham in SA, near the NT/SA border. From this it can be inferred that the ant also occurs in both of these states. The nest of this species has a small, simple entrance hole (Heterick 2001). In Merredin townsite, in the Avon Wheatbelt, this ant was hand-collected in tall shrubland dominated by *Acacia acuminata* and *A. lasiocalyx* (label data). The minor worker of *Chelaner whitei* group sp. JDM 1178 (the major and media workers are unknown) bears a close superficial resemblance to the minor worker of *C. pubescens* and *C. rufoniger*. However, in the former, the metanotal groove is obsolete (always present in *C. pubescens* and *C. rufoniger*) and part or all of the head bears scattered foveae (head completely smooth except for hair pits, or with other sculpture in *C. pubescens* and *C. rufoniger*). *Chelaner whitei* group sp. JDM 1178 is known only from a single collection of two minor workers pitfall-trapped south of Arrowsmith, in the Eneabba district. They were collected in a site characterised by the presence of *Conospermum triplenervium* (tree smokebush) and *Acacia blakei* in low sandplain.

Chelaner anthracinus is another small species. The minor and media worker are easily recognised by their obliquely orientated eye whose anterior margin is usually separated from the mandibular insertion by less than the width of the eye (most pronounced in the smallest minor workers, where the anterior margin of the eye almost abuts the mandibular insertion). In all workers the frons of the head is smooth and shining except for striolae around the frontal carinae, and the clypeal carinae are extended over the anterior clypeal margin as two single teeth with a broadly V-shaped emargination between them. The body is uniformly black or dark to light brown. In other members of this clade the head is usually matt and sculptured; if the frons of the head is smooth and shining (some workers of *C. bicornis*), then the ant is distinctly bicoloured with black or dark brown foreparts and yellow or reddish gaster, and the anteromedian clypeal carinae is always broadly U-shaped and often produced as multiple teeth or denticles. In profile, the eye of all subcastes is orientated along a longitudinal axis, or nearly so, and not noticeably elongate, its anterior margin separated from the mandibular insertions by much more than the width of the eye. A specimen of the major worker of *C. anthracinus*, previously unknown, has only recently been recovered from Cave Rocks Gold Mine, near Kambalda. *Chelaner anthracinus* is not very common but has a known

range that extends from the eastern edge of the Jarrah Forest to the eastern goldfields and north to about Carnarvon. Thus far, this species has not been recorded from any other Australian state. Nearly all samples of the ant have been pitfall-trapped and the only label data available (two minor workers hand-collected near Bunketch in the northern wheatbelt) mentions the habitat as being mallee woodland. The ants were collected on the ground on light soil/clay. *Chelaner pubescens* is yet another small species and the tiniest of the clade. The only workers seen have been minors along with a possible media worker. Apart from the small size (HW ≤ 0.52 mm) the minor worker is immediately identified through the overlapping decumbent and subdecumbent setae on the first gastral tergite, which lacks erect and suberect setae. The colour is pale, ranging from tawny yellow with the head slightly darker to a concolorous yellow. Small minor workers from related species have well-separated erect and suberect setae present on the first gastral tergite and are concolorous brown or brown-and-reddish-brown. This species is confined to sandplain with just a handful of records from Fremantle north to the Arrowsmith District north of Eneabba, and a very recent record (October 2019) from Lake Lefroy in the eastern goldfields. Specimens have been collected from a nest in sandy soil in Mosman Park, while workers pitfall-trapped in Piney Lakes Reserve a few kilometres south were from sandplain regrowth in an old pine plantation. The Lake Lefroy worker was collected on quartz sand and silt sediment. The solitary worker pitfall-trapped north of Eneabba has exactly the same collection details as the two workers of *C. whitei* group sp. JDM 1178 and came from the same transect, but all three workers were collected in different plastic vials. Presumably this is a habitat that favours myrmicines from this group which likely include small seeds in their diet (based on the appearance of the clypeus).

The remaining four species include quite large workers. *Chelaner majeri* is a monomorphic taxon and is red or has crimson-red foreparts, although the head is anteriorly infuscated in some workers, and the gaster and the legs are red-brown. The ant is matt in appearance, with finely and evenly microreticulate sculpture over the entire head and mesosoma. *Chelaner bicornis*, *C. rufoniger* and *C. whitei* are polymorphic. In *C. rufoniger* the ant may have a reddish mesosoma, but then the head and gaster are black and the mesosoma is moderately shining with some smooth spaces and longitudinal rugae on the sides. The other two species have no red in their colour scheme. *Chelaner majeri* has a localised range in the mid-west of WA, with records coming from an area bounded by Morawa on the west and Mt Magnet on the east. This species does not occur in any other Australian state. *Chelaner majeri* has been collected in mallee, but otherwise nothing is known of this rare ant.

Chelaner whitei has a large eye (EW ≥ 0.25 × as long as length of side of head) compared with *C. rufoniger* and *C. bicornis* (EW ≤ 0.20 × length of side of head). The range of this ant in WA describes a crescent-shaped arc from the southern Pilbara, down through the northern and eastern goldfields and into the Nullarbor and Hampton subregions. The species does not occur at all in the SWP. The ant is also found in all Australian mainland state except the ACT. *Chelaner whitei* appears to be particularly adapted to red soil and saltbush ground cover, and label data often mention these two factors. Other vegetation types that appear on labels include mallee, spinifex, *Callitris*, samphire, Myall, and hummock grassland. Stray foragers have been collected at night, and the species has also been taken at the edge of a salt lake. This species is a granivore that mainly harvests the seeds of ephemeral grasses and forbs. A discussion of its granivory is to be found in Davison (1982).

In *Chelaner rufoniger* the major and media worker are dissimilar in morphology to the minor worker (the major and media worker being hirsute with a rugose propodeum, and the minor worker having shorter setae and a microreticulate propodeum), and the gaster is the same colour as or darker than the mesosoma. The major and media worker of *C. bicornis*, on the other hand, have a similar morphology to the minor worker (allometric monophasy), and the gaster is always lighter in colour than the mesosoma in WA populations. *Chelaner rufoniger* has mainly been taken along the strip of coastal plain between Yalgorup National Park in the south and Carnarvon in the north, but it also occurs further inland as far east as the southern Murchison and Kalgoorlie. Interstate, the ant can be found in NSW and SA. The species nests in the ground and the nest entrance is a small hole. Soil substrate can vary from light soil/clay to yellow sand. A nest near Kenwick, in the Perth metropolitan area, was in damp or waterlogged clay soil. Samples from drier areas have been collected in mallee but have also been obtained in *Callitris* woodland and on a rural golf course. Although the habits of this taxon do not seem to have been studied, the appearance of the clypeus and mandible suggest it is a granivore like *C. whitei*. The dark form of *C. bicornis* (*C. 'macareaveyi'*) found in the eastern Australian states does not occur in WA, although ants with intermediate colouration have been found at Tardun in the mid-

west of the state. In WA, *Chelaner bicornis* is found in the drier eastern parts of the SWP, and its range extends to the Coolgardie subregion. This species also has a very broad distribution in other parts of Australia and occurs in all mainland states. The appearance of the clypeus and mandible suggest that this species, like *C. whitei* which it closely resembles, is also granivorous. Vegetation associations include *Callitris* forest, mallee, and grasslands. Foragers have been collected on basalt and in leaf and twig litter. Red soil is mentioned on one label. Another label mentions a number of foragers were seen following rain. As with other members of this clade, workers and queens possess functional stings, and workers collected many years ago and held in the Department of Primary Industries and Regional Development are said to have caused the deaths of poultry in south-western towns after they were ingested by the birds.

The 24 remaining members of *Chelaner* were assigned to five species-groups within *Monomorium* by Heterick (2001) (namely, the *C. falcatus* group, the *C. insolescens* group, the *C. kilianii* group, the *C. longinodis* group and the *C. rubriceps* group). However, molecular data to support these five species-groups at the current moment are ambivalent or lacking (e.g. Sparks et al. [2019]). The groupings therefore are discussed as they are presented in Heterick (2001). Nominally, the clade consists of 20 described taxa and four undescribed taxa. However, several species within these groups are contentious, the most important of these being *C. leae*, which varies enormously, from a bright yellow form with a square (*C. 'leae'*) or rounded (*C. 'hemiphaeus'*) propodeum, a rugulose morph found mainly in the ACT, and a spectacular bicoloured rainforest form — all found on the east coast — to a smooth brown morph in SA and ferruginous morphs with strong propodeal denticles (*C. 'flavipes'/'insularis'*) and tiny yellow ants (*C. 'occidaneus'*) in WA. Sparks et al. (2019) and unpublished data from the QLD Museum strongly hint that *C. leae* may be polyphyletic, but for the present the molecular data are weakly supported and there are no morphological means to comfortably separate the morphospecies.

The *C. longinodis* species-group is a fairly distinctive entity. Seen in profile, the petiolar node is elongate, barrel-shaped, and usually much longer than high. If the node is about as long as high, then the ant has extensive and pronounced rugosity on the sides of the mesosoma and the head is square, about as wide as long. In members of the other groups, seen in profile, the petiolar node is not elongate and barrel-shaped, and it is usually as high as long or higher than long, and projects well above the petiolar peduncle. In the main, the species are not rugose as they are in the *C. longinodis* species-group (except for one member of the *C. insolescens* species-group and *C. xantheklemma*, which have longitudinally rectangular heads). Within the *C. longinodis* species-group the large-headed *Chelaner bifidus* is a stand-out because of its two-toothed mandible, the other members of the group having three teeth (*C. capito*) or five teeth (*C. flavoniger* and *C. longinodis*). Within WA, *C. bifidus* appears to be confined to the eastern Kimberley, and it is no surprise that this ant also occurs in the top end of the NT and in Cape York in QLD. This species has been found foraging on the ground in *Eucalyptus* open forest and in savanna, but other data are lacking. *Chelaner capito*, with three mandibular teeth, is definitely known only from the holotype, which was collected in the Great Victoria Desert. No biological data accompany the holotype. A male (in WAM), believed to be of this species, was taken from flowers of *Wahlenbergia* near Giles Meteorological Station. Presumably this is an ant with a localised distribution in the interior desert areas of WA and (perhaps) the NT and SA.

Chelaner flavoniger and *C. longinodis* are separable on the basis of structure, sculpture and colour pattern. In full-face view, *C. flavoniger* has a trapezoidal head that is narrowest at the vertex, the frons is longitudinally striate, the sculpture on the sides of the humeri is restricted to microreticulation, and the head and gaster are orange or yellow contrasting with the dark blackish-brown to black mesosoma and nodes. In full-face view, the head of *C. longinodis* is rectangular, the frons is longitudinally striate-reticulate; the humeri are longitudinally rugose, and the ant is otherwise coloured (usually the foreparts are reddish or orange-and-reddish with or without infuscation of the head, and the gaster is brown or black). *Chelaner flavoniger* has mostly been collected from the far northern wheatbelt, but there is one old record of a worker collected south-west of Coolgardie in the eastern goldfields. There are no interstate records. This uncommon species makes a nest that is identifiable as a mound with a small nest hole. Other data have not been recorded. *Chelaner longinodis* is also confined to WA, but occurs close to major population centres, hence is much better represented in collections than its three closest relatives. Samples of this species have been collected from southern parts of WA from Perth as far east as Widgiemooltha and the Cape Arid National Park on the south coast. The ant has been seen in relictual areas of woodland within the Perth metropolitan area but does not persist after clearance of bushland. Collections have been made

on sandplain, particularly where it is vegetated by heath. Other vegetation associations include closed low shrubland, *Eucalyptus torquata* woodland and sclerophyll woodland (*Eucalyptus marginata/ Corymbia calophylla*). Grey soil is mentioned on one label. The species is a ground nester, and one nest in the open is described as having a small, circular entrance.

Chelaner crinitus is the only representative of the *C. kilianii* species-group to be found in WA. This species and its relatives have as a postpetiole a curved, horizontal cone (seen in profile) that is widest at its junction with the gaster. This species is vanishingly rare in this state, being known from two workers, a queen and a male collected many years ago at Mundaring (a record regarded by Heterick [2001], as dubious), and a dealate queen collected in the Avon Wheatbelt more recently by Raphael Didham and Peter Yeeles. Elsewhere, this species occurs in the ACT, NSW, SA, and Tas. This ant is pale with rather small eyes, and the scant label data suggest it may have a specialised lifeway; specimens have been located in a *Myrmecia pilosula* nest (ACT), a *Myrmecia forficata* nest (NSW) and in a gallery of *Pseudoneoponera* (label = '*Bothroponera*') (SA). A small nest series has been collected from under a stone. The ant has also been collected in a flight intercept window/trough.

The *C. insolescens* species-group is superficially suggestive of some species in the *C. rubriceps* species-group, but the appearance of the petiolar node signifies the identity of the clade. Seen in profile, the petiolar node is strongly inclined posteriad, with the anterior face of the node much longer than its posterior face; also seen in profile, the ventral surface of the petiole has a characteristic small indentation just before the articulation of its posterior socket with the postpetiole, and the postpetiolar ventrite may have a strongly protruding anterior lip. In similar but not closely related ants, the petiolar node, seen in profile, is not strongly inclined as above, and its anterior and posterior faces are of equal length or the posterior face is only slightly shorter than the anterior face; the ventral surface of the petiole lacks a small indentation just before the articulation of its posterior socket with the postpetiole, and the postpetiolar ventrite is usually without a strongly protruding anterior lip. This species-group was left as an unresolved complex by Heterick (2001), but after inspection of much material in the TERC Collection, the author here recognises four species within this group as occurring in WA. *Chelaner insolescens* species-group sp. JDM 1381 and *C. insolescens* species-group sp. JDM 1174 are larger species compared with two smaller close relatives (HW ≥ 1 mm compared with HW ≤ 0.8 mm), and the mesosoma is largely or wholly smooth and glassy in appearance; the petiolar peduncle is also relatively long, its length ≥ width of node. In the other two ants the cuticle is often largely matt and microreticulate, and the petiolar peduncle is relatively short, its length ≤ width of node. In full-face view, the head of *Chelaner insolescens* species-group sp. JDM 1381 is weakly to strongly inversely trapezoid, its sides converging towards its vertex, with the vertex concave; also, seen in full-face view, the pronotal sector is distinctly convex. In full-face view, the head of *Chelaner insolescens* species-group sp. JDM 1174 is roundly rectangular, its sides more-or-less straight and the vertex planar or gently convex; also, seen in full-face view, the pronotal sector is very weakly convex to planar. In WA these two species occur in sympatry in parts of the northern Kimberley, but while *C. insolescens* species-group sp. JDM 1174 is confined to that area, *C. insolescens* species-group sp. JDM 1381 is also found further south in the Pilbara and the Gibson Desert. Both species almost certainly occur in the NT, but their occurrence in other states in unknown. All or most specimens have been pitfall-trapped but there is no information on their habits.

Chelaner insolescens and *C. insolescens* species-group sp. JDM 1382 also form a pair. Seen in profile, the mesosoma of *C. insolescens* species-group sp. JDM 1382 is noticeably though weakly bimodal, with a slight hump around the pronotal sector and a dip in the mesonotal sector; the eye is large (EL ≥ 0.20 × HL), and the mesonotal sector and the propodeum are predominantly longitudinally striolate ('*Chelaner longinodis*-like'). In profile, the mesosoma of *C. insolescens* is evenly planar or weakly concave without being noticeably bimodal; the eye is smallish to relatively large in different populations, but is usually ≤ 0.20 × HL, and the mesosoma is predominantly matt and microreticulate with any longitudinal striolae being few and short and located in the katepisternal region of the mesonotum ('*Chelaner leae*-like'). The distribution of *Chelaner insolescens* sp. JDM 1381 is broadly sympatric with the other three members of the species-group in the northern Kimberley, to which it is confined, but *C. insolescens* occurs as far south as Barrow Island. There are no data on *Chelaner insolescens* sp. JDM 1381, and its occurrence in other states in unknown. *Chelaner insolescens*, based on label data, has been found in pindan woodland (JDM specimen). Other records of the species nesting under stone in rainforest and also occurring in

savanna cannot be accepted with any certainty in the absence of photographs of the specimens, as they may relate to other members of the species-group. This species certainly also occurs in the NT, based on the close proximity of some WA records to the NT border.

Two dainty little species represent the *Chelaner falcatus* species-group in WA, these being *C. decuria* and *C. elegantulus*. In full-face and dorsal views, the frons and promesonotum of these two species possess fairly densely packed foveae; in rear view, the propodeum has a flat, V-shaped area that descends from the middle of the promesonotum and extends to the base of the propodeum, this area demarcated by a carina that is interrupted only by the propodeal spines and the propodeal lobes. The metanotal groove is obsolete and gastral pilosity is restricted to short, appressed setae spaced much more than their length apart. The other thirteen species in the *C. rubriceps* species-group do not have a foveate frons and the promesonotum is not as above, and otherwise the taxa lack this combination of characters. *Chelaner decuria* has only 10 antennal segments, whereas *C. elegantulus* has the normal complement of 12 segments. *Chelaner decuria* is confined to the wetter parts of the SWP, mostly inhabiting the coastal plain north to Geraldton and the south coast as far as Esperance, and does not occur in other states. This species is seen occasionally in relictual woodland in the Perth metropolitan area. Colonies can be found on white or yellow sand. Vegetation associated with this ant is typically shrubland such as *Xylomelum/Banksia* heath, but the species also occurs in dry sclerophyll woodland, including cultivated woodland, with one record from a blue mallee plantation. The nest entrance is a tiny hole, barely larger than an individual worker, not surrounded by excavated sand. Workers are nocturnally active. *Chelaner elegantulus* is a very similar species that is distinguished from *C. decuria* by the 12-segmented antenna, and this ant also has a larger eye. In WA, *Chelaner elegantulus* prefers drier, lower rainfall areas, and it occurs predominantly in the central wheatbelt and the eastern goldfields; the species can also be found in NSW and SA. Like *C. decuria*, *C. elegantulus* typically occurs in shrubland; records mention *Acacia/Hakea* shrubland with *Plectrachne* ground cover and also mulga. One worker was taken on a roadside in a small country town. The preference for shrubland, together with morphological features such as strong clypeal teeth and stout, narrow mandibles, suggest that this and the aforementioned species are granivores that occur in areas that are very productive of small seeds (notwithstanding, husks were not seen around the nest of *C. decuria* mentioned above).

The *C. rubriceps* species-group is the least taxonomically clear-cut of the *Chelaner* species-groups that occur in WA and may prove on more detailed analysis to be a heterogeneous assemblage of species, some of which either belong elsewhere or require a separate species-group to be erected to house them. Some of the members of the group as it currently stands, notably *C. rubriceps* and its close relatives (all eastern states taxa), appear to have an ancient evolutionary history, and morphologically almost identical relatives occur in island masses like New Caledonia and New Zealand that have been separated from Australia since the time of the dinosaurs. However, the crown-group origin of Solenopsidini including *Chelaner* is some millions of years younger, many of these groups arising during the Eocene (Ward et al. 2015). *Chelaner rubriceps* and its allies are mainly dwellers of rainforest and are rather large species with swollen femora and a shining appearance. These ants frequently forage on vegetation and may be predominantly arboreal. This suite of species appears to be completely absent from WA, the assemblage being replaced by mostly smaller, gracile, and more sculptured ants in what is here called the *C. leae* species complex. These taxa are ground nesting and mainly also forage on the ground.

Chelaner rubriceps species-group sp. JDM 1175 is a northern form, easily recognised by the very large lip formed by the projection of the enlarged postpetiolar ventrite that is highly conspicuous when the ant is viewed in profile. No other WA *Chelaner* has such a feature. This small species is not seen very often but has turned up occasionally in collections from Barrow Island and the Pilbara region. Specimens from Barrow Island have been collected in a Winkler sack and those from the mainland in ethylene glycol pitfall traps, but nothing more is known about this species, or whether it occurs in other states. *Chelaner sublamellatus* was described from a single worker collected by a malacologist on a granite face on North Twin Peaks Island in the Recherche Archipelago while the collector was looking for snails. Since that time other workers have been found in jarrah woodland not far south of Perth. The propodeal spines and the longitudinal striae on the head are unique to this species among the WA members of the *C. leae* species complex. Interestingly, the holotype has seven mandibular teeth, four of them tiny denticles. The mainland

specimens, while clearly belonging to the same species, have five distinct mandibular teeth (the norm for this group of ants). *Chelaner sublamellatus* appears to be very close to the eastern Australian *C. sculpturatus*, and a thorough examination of multiple workers of both species would be helpful in establishing whether WA's *C. sublamellatus* represents a range extension of *C. sculpturatus*, although there is a strong likelihood that they are two good species. A worker from Jarrahdale was collected in a winter leaf litter sample put through a Tullgren Funnel while another worker from Wungong catchment was pitfall-trapped in upland jarrah forest in a dieback-free control plot. The relatively small eyes and long, thin sting point to a possible cryptic lifestyle so far unknown to us.

Six species within the *C. leae* complex appear to be closely related. *Chelaner brachythrix*, *C. centralis*, *C. durokoppinensis*, *C. euryodon*, *C. leae* ('*flavipes*'/*insularis*', and '*occidaneus*' morphs) and *C. xantheklemma* share a head that, in full-face view, is smooth and shining and without sculpture or almost so (ignoring setae-bearing pits and striae extending from frontal carinae and around antennal insertions). *Chelaner bihamatus*, *C. legulus* and *C. longiceps* also appear to form a taxonomic unit and, in full-face view, the head in these taxa has extensive and distinct sculpture on the frons, and the frons is usually matt. The uniformly microreticulate *C. punctulatus* is probably closely related to *C. rubriceps* species-group sp. JDM 1175, and also shares its northern range, while the closest relatives of *C. lacunosus*, which has a longitudinally striated head, are unclear although it has a passing resemblance to some morphs of *C. longiceps*.

Chelaner euryodon is an uncommon but widespread ant in which the basal tooth is enlarged, and the anteromedial sector of the clypeus is strongly and sharply convex and protrusive, features not seen in the other species mentioned above. This species is also unusual for the *Chelaner rubriceps* specie-group in exhibiting a degree of polymorphism, with big-headed major workers. In the other five smooth-headed species, seen in full-face view, the basal tooth is at most the same size as other preapical teeth and is often smaller; the anteromedial sector of clypeus is weakly convex and less protrusive or is concave with a 'V' or 'U'-shaped emargination, and the major and minor workers are less dissimilar and are either monomorphic or exhibit monophasic allometry. In WA, samples of *C. euryodon* come from the eastern goldfields, the lower Jarrah Forest and north of Cape Arid National Park. This species has a wide distribution in Australia, and has also been taken in NSW, QLD, and SA. The preferred habitat, at least in WA and SA, appears to be saltbush and other salt-tolerant ground cover or heathland, but mallee is also mentioned. Populations in the eastern states also colonise box woodland. The soil type used as a nesting substrate can also vary, from black soil in QLD to sand (SA). Nests of this species have most frequently been found under cover, either under a stone or under a shrub; a large series was taken in St George, QLD from under a small shrub in sandy debris. *Chelaner xantheklemma* is another uncommon species, whose distinctive mesosomal and propodeal rugosity, with the appearance of wrinkled orange peel, gives rise to its scientific name. The propodeum of this species is rounded without distinct propodeal angles, and the ant has a yellow head and gaster and orange mesosoma and nodes. Other orange ants in the group do not share this combination of colour pattern and sculpture, and their propodeal angles are often sharp and distinct, or even denticulate. In this State, *C. xantheklemma* is known from a single worker from near Kellerberrin and three workers from Mt Gibson Station at the intersection of the Avon Wheatbelt and Yalgoo subregions. The only other localities on record for this species are in SA, where it is known from sites near Sevenhill and Clare, in the Clare Valley. Oddly enough for this very uncommon species, the Mt Gibson workers come from grazed as well as ungrazed land under York and Salmon Gum cover. Workers from Sevenhill have also come from grassy paddocks. Why a species with such a localised distribution should be so tolerant of disturbance is something to ponder. Two nests in the grassy paddocks mentioned were found under a rock, as was another nest on a bare ridgetop in the same area. Even rarer is *C. durokoppinensis*, known only from three workers collected at two sites about 10 km apart in the Avon Wheatbelt. This species is very similar to and probably the sister species of *C. xantheklemma*, from which it differs only in having four instead of five mandibular teeth and in being less rugose. The colour pattern is exactly the same and the propodeal lobes are characteristically expanded in both species. The two ants also appear to occur in sympatry. Nothing is known of this species apart from the bare collection details.

Chelaner brachythrix is a small, ochraceous ant whose entire range in Australia is restricted to the Kwongan and central parts of the Avon Wheatbelt. The species looks rather like a small worker of *C. leae*: in profile, the metanotal groove is strongly

indented and the propodeum is rounded without distinct propodeal angles, and the erect setae are very short and straight, their length ≤ the length of the eye (which is quite small in this ant). In superficially similar specimens of *C. centralis* and *C. leae*, seen in profile, the metanotal groove is only weakly indented or is barely visible, the propodeal angles are often sharp or armed with very short denticles, and the erect setae are often curved or suberect, the longest setae much longer than the length of the eye. This is a sandplain species, with foragers collected on white sand over laterite in one instance. The preferred habitat is shrubland and mixed low heath.

Workers of *Chelaner centralis* require careful examination to distinguish them from workers of the *'C. flavipes'/'insularis'* morph of *C. leae*. The anteromedial appearance of the clypeus is the best character to use as it is invariable for both species. In the former, seen in full-face view, the clypeus possesses a V-shaped notch between the clypeal carinae, the median seta is positioned at the centre of the notch, and the clypeal carinae are produced as blunt teeth (generally these are tawny brown ants with a rather thick, sub-rectangular petiolar node). In similar workers of *C. leae*, seen in full-face view, the clypeus is medially and smoothly excavate to varying degrees between the clypeal carinae, the excavate area not extending right though the clypeus so that the midpoint of the clypeus is not indented but is either straight or a tiny convexity on which the median seta is situated. The clypeal carinae are either rounded at their junction with the anterior margin of the clypeus or are produced as weak, obtuse angles but never as blunt teeth. *Chelaner leae* is very colour variable and sometimes bicoloured but yellow and orange tones predominate, and the petiolar node is generally thickly squamiform and less commonly sub-rectangular. *Chelaner centralis* exhibits weak monophasic allometry. This is a widespread species that can be locally common. In WA, specimens have been taken from the east side of the Darling Range, the Avon Wheatbelt, Gascoyne, Murchison, and Pilbara subregions, but this is likely only a subset of the true range of the ant in this State. The species also has a very broad range throughout Australia and has been recorded from every mainland state. As well as being found in native environments such as *Callitris* woodland and Eucalypt open woodland, *C. centralis* can tolerate some degree of disturbance and even urbanisation, and workers have been collected from a colony found in the drive of a service station at Wudinna (SA). In Kew (Vic) specimens were collected in a park. This ant appears to be active both diurnally and nocturnally.

The difficulties surrounding the taxonomy of *C. leae* are set out in Heterick (2001). This is far and away the most taxonomically demanding ant in the *Chelaner* formerly placed under *Monomorium*. WA lacks the spectacular bicoloured forms found in temperate rainforest in south-east QLD and northern NSW, and also the bright yellow or orange, smoothly shining morph with fairly large eyes, indented metanotal groove and rounded propodeum seen in Victoria (*'hemiphaeus'*) and a rugulose form found around Canberra. The different worker morphologies seen in WA can be represented approximately as follows (there are small variations within these basic forms):

1. A large, hairy, bicoloured morph with yellow head, legs and gaster and reddish-orange mesosoma and nodes. The propodeal angles are bluntly and obtusely denticulate. Almost the entire mesopleuron and propodeum, seen in profile, has longitudinal striae overlying microreticulation, and the ventral surface of the petiole lacks a lobe. Specimens come from Dryandra State Forest and Karragullen.
2. *'flavipes'/'insularis'*: a medium-sized to moderately large, concolorous yellowish or light orange morph. Nest series indicate most workers are around the same size. The propodeal angles are rounded. The microreticulation is the same as for (1), but longitudinal striae are absent. Common.
3. *'occidaneus'*: a very small, yellow morph superficially similar in appearance to several small yellow *Monomorium*. Only pitfall-trapped specimens are represented in local holdings. The propodeal angles are rounded and mesopleural and propodeal microreticulation is present but more superficial than in (1) and (2). This form has a distinct subpetiolar lobe that is absent in the larger morphs. Workers from the Pilbara area that are approximately the same size have a flatter promesonotum and a slightly larger and longer eye but are otherwise the same. Common. (Note: several males are included in a series from Brookton. The appearance of the body is exactly the same as Fig. 162 in Heterick [2001] but cross-vein m-cu is lacking in the four males seen.)
4. A medium-sized brown morph collected from Dryandra State Forest, Karragullen and Boronia Swamp Road, near the south coast. This form has a larger eye, and the foreparts are brown and the gaster is chocolate. The structure and sculpture of the mesopleuron and the propodeum are as for (1).

The collection localities for (2) and (3) are often the same, and a number of these are in the Perth metropolitan area. Given the very similar appearance of the morphs, the overwhelming likelihood is that they are simply different-sized workers of the same species. The case for this also applying to (1) is less clear, although the author excavated two workers corresponding to (1) and (2) when he dug below a rotten stump, making it highly likely they came from the same nest. Morph (4) is of greatest interest because of its colour contrasts and the larger eye. Nevertheless, the morphology and sculpture of this morph are identical with or very similar to what is seen in the other morphs, and do not include the discrete differences across all workers noted for the also very similar *C. centralis*. Thus, although there may be a case for two or three species here, it is much more likely that, if this ant is eventually split following a careful, integrated revision of the material currently called *'leae'*, the splitting will be done along biogeographical lines, populations from the eastern states exhibiting much greater variation than can be demonstrated for WA populations. *Chelaner leae* is common in wetter parts of the SWP, but there is an interesting absence of material collected east of Albany and west of Esperance. The species is much less common north of the SWP, but there have been scattered records from the Pilbara and from Barrow Island. *Chelaner leae* is found in all Australian states, including Tas, but is principally concentrated in the coastal and near coastal parts of the southern states, and is only sparsely represented in collections from Australia's north and its arid interior. Material has been gathered from a wide variety of habitats including both wet and dry sclerophyll, but this ant appears to particularly like damp, humid locations, and label data reveal a number of samples have been taken from moss, leaf litter, damp bark, rotting wood and the like. Similarly, service ant identifications carried out by the author for corporations and other groups using ants as bioindicators reveal this species is very often associated with watercourses. Nests have often been found under or between rocks and stones, and on one occasion in the bark of a tree. Collection methods point to the cryptic nature of many colonies, since the ant has frequently been extracted from berlesates and taken in pitfall traps and once by stick brushing. *Chelaner leae* also forages arboreally on occasions, and samples have come from pyrethrum knockdowns and from a flight intercept/trough trap.

Like many of its ilk, *Chelaner punctulatus* is rarely seen. This species is similar in appearance to *C. leae* but can be separated from similar species by the visibly flattened mesosoma, when this part is viewed in profile, with a distinct, subcarinate separation of its dorsal surface from its sides. The ant is also uniformly microreticulate and the eye is relatively large (EL ~0.30 × length of side of head). In similar species the mesosoma, viewed in profile, is more-or-less planar or weakly undulate but is not distinctly flattened, and the mesosoma is rounded on to its sides. Furthermore, the ant is not uniformly microreticulate but always possesses other sculpture, and the eye is relatively smaller (EL ≤ 0.25 × length of side of head). *Chelaner punctulatus* is known from a handful of specimens collected in the Little Sandy Desert and on Barrow Island. This species is not known from other states, All that is recorded for the ant, apart from the collection details, is that mainland specimens have been collected on a sand dune in a permanent invertebrate pitfall trap.

Chelaner bihamatus and *Chelaner legulus* are possibly sister species. Both differ from *C. lacunosus* and *C. longiceps* in lacking propodeal angles, the dorsal and declivous surfaces of the propodeum being confluent or nearly so. In *C. lacunosus* and *C. longiceps* the propodeal angles are present as sharp, upturned angles or short teeth directed posteriad. Colour and sculpture separate *C. bihamatus* and *C. legulus*: in *C. bihamatus* the mesosoma and the nodes are concolorous brick-red without infuscation, and the frons has mainly microreticulate sculpture, whereas the posterior sector of the promesonotum and the propodeum, at least, are black and conspicuously darker than surrounding red or reddish areas (the nodes also are often dark) in *C. legulus*. In this ant, moreover, the frons has irregular longitudinal striolae and some reticulate as well as microreticulate sculpture. The known distribution of *C. bihamatus* in WA is in two clusters, one in the Avon Wheatbelt and also on the Swan Coastal Plain just north of Perth, with a second cluster in the south-east of the state in the eastern goldfields, Cape Arid National Park and the western edge of the Nullarbor. The species also occurs in NSW, SA, and Vic. Most labels that record habitat details for this species mention mallee or limestone mallee as the climax vegetation associated with the ant, but specimens collected from Beonaddy Swamp, north of Perth, came from a site dominated by tuart (*Eucalyptus gomphocephala*), jarrah and marri. A specimen from Dryandra State Forest was taken on wandoo. This species ascends tree trunks to

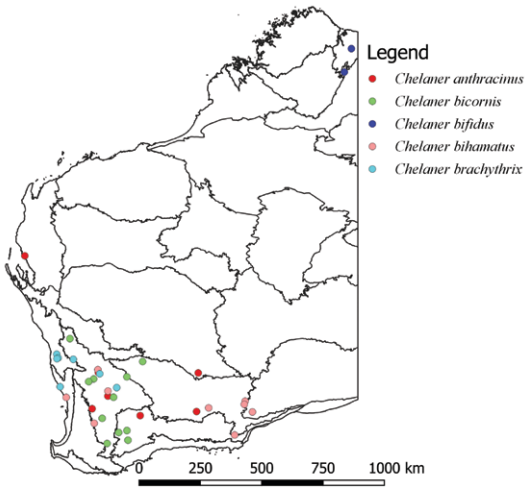

FIGURE 107 Distribution of *Chelaner anthracinus*, *M. bicornis*, *M. bifidus*, *M. bihamatus* and *M. brachythrix*.

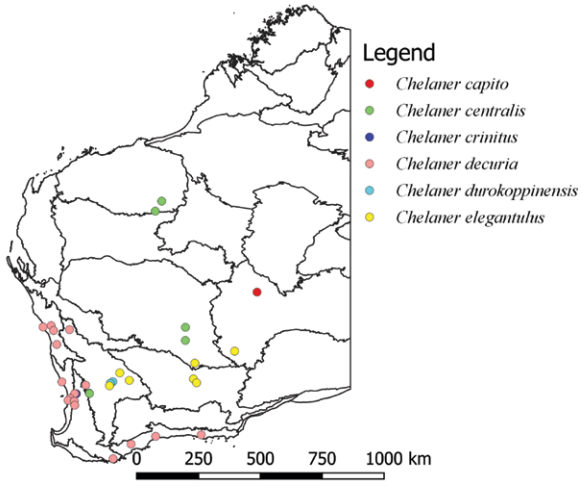

FIGURE 108 Distribution of *Chelaner capito*, *C. centralis*, *C. crinitus*, *C. decuria*, *C. durokoppinensis* and *C. elegantulus*.

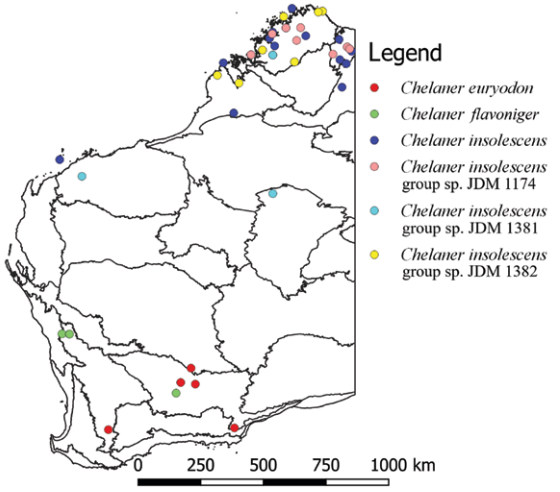

FIGURE 109 Distribution of *Chelaner euryodon*, *C. flavoniger*, *C. insolescens* and *Chelaner insolescens* group sp. JDM 1174, JDM 1381 and JDM 1382.

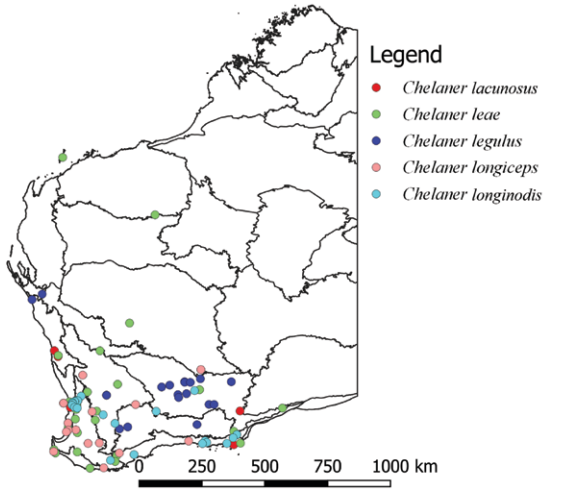

FIGURE 110 Distribution of *Chelaner lacunosus*, *C. leae*, *C. legulus*, *C. longiceps* and *C. longinodis*.

forage and is active diurnally and nocturnally. The only soil type mentioned is a sand dune. Unlike its cousin, *C. legulus* is confined to WA, where its stronghold seems to be the Coolgardie subregion, with smaller populations in the Avon Wheatbelt, Shark Bay area and the Mallee subregion. This species is known to nest in the ground but, like its cousin, has frequently been collected while foraging on mallee trunks.

Some populations of the very variable *C. longiceps* resemble *C. lacunosus*, but the two species are easily distinguished. In *C. longiceps*, seen in profile, the promesonotum rises smoothly and evenly from its articulation with the head, the propodeal angles are variably developed as small angles through to small teeth, but are usually directed vertically, and the legs are yellow-brown, either the same colour as the mesosoma or darker than the mesosoma. In *C. lacunosus*, seen in profile, the promesonotum rises abruptly from its articulation with the head with its neck sector separated from the rest of the promesonotum by a feeble transverse carina (best viewed from above), the propodeal angles are developed as short, thin teeth directed posteriad, and the legs are light yellow, distinctly lighter in colour than the yellowish-brown mesosoma.

Chelaner lacunosus was placed in the (then) *Monomorium falcatum* species-group (now *C. falcatus* species-group) by Heterick (2001), but

it lacks the combination of characters diagnostic for the species-group which is mentioned in the taxonomic key. Furthermore, the head is longitudinally rectangular, and the eyes are small, making it easily distinguishable from the square-headed, large-eyed workers of the *C. falcatus* group. On further consideration, the affinities of this interesting little species clearly lie with the *C. leae* complex in the *C. rubriceps* species-group. *Chelaner lacunosus* is not common in WA but has been taken on the Swan Coastal Plain at Mandogalup, south of Perth, at Eneabba on the Geraldton Sandplains and in the south-east of the state at Queen Victoria Spring and Cape Arid. Interstate, the species occurs in SA,

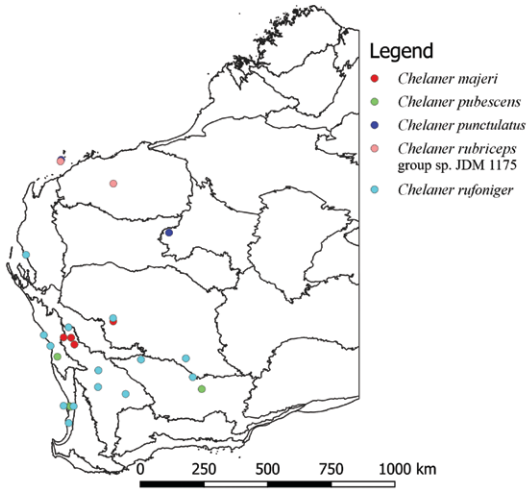

FIGURE 111 Distribution of *Chelaner majeri*, *C. pubescens*, *C. punctulatus*, *Chelaner rubriceps* group sp. JDM 1175, and *C. rufoniger*.

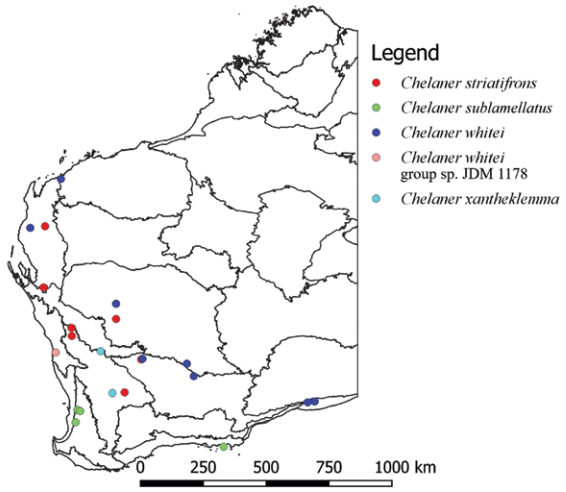

FIGURE 112 Distribution of *Chelaner striatifrons*, *C. sublamellatus*, *C. whitei*, *Chelaner whitei* group sp. JDM 1178 and *C. xantheklemma*.

which provided the type material. The species is a denizen of sandplain and has been found on white sand on laterite and white sand on limestone. Vegetation associations are mallee and low heath shrubland, and berlesates and pitfall traps have been the collection methods used to take this small, inconspicuous species. The Mandogalup worker was collected near an ALCOA tailing pond in a 5-year rehabilitation site. *Chelaner longiceps* is one of the few species in this clade that is commonly seen in WA's Jarrah Forest subregion. This species is mainly found in the wetter parts of the SWP, but an outlier comes from Black Swan Mine in the south Murchison. *Chelaner longiceps* has quite a broad range in other parts of Australia, and is definitely recorded from NSW, QLD, and SA, and certainly could also be found in Vic., since a couple of SA records are next to the SA/Vic border. The worker of this species is variable in appearance but there is overlap between the populations. Broadly speaking, among the variation two general forms can be identified — one with a broader node, no infuscation in the posterior mesosoma and a more distinctly emarginate clypeus; the other with a narrower node, infuscation of the posterior mesosoma present or absent and a weak V-shaped indentation of the anteromedial margin of the clypeus. However, both forms share similar sculpture, pilosity and colour patterns (apart from the posterior mesosoma), tilt of the propodeal spines or angles, etc., and there is some overlap in the generally more salient differences. The ant has been found in a range of different vegetation zones — limestone mallee, mallee, box pine, *Melaleuca lanceolata* and *Banksia/Agonis*, to name just those mentioned on labels. Sandy soil (including white sand) seems to be preferred. There is one record of a specimen taken in a chalet and another of a sample collected near a disused service station. Other samples have been gathered from litter or from near a termite mound, and there is at least one berlesate. *Chelaner longiceps* is also known to forage in the late afternoon.

Colobostruma (Figure 107)

Seven species of *Colobostruma* have been recorded from WA. This genus was revised by Shattuck in 2000. *Colobostruma*, formerly in tribe Dacetini (the trap-jaw myrmicine ants), is now in the enlarged tribe Attini as a member of the *Daceton* genus group. However, this more inclusive clade does not include *Strumigenys* (Ward et al. 2015). The appearance of this genus is sharply defined: in profile, the antennal scape in the resting position passes below the eye or across its lower margin, and elongate depressions to receive the antennae that run below the eye are usually present but are

weakly developed in this genus; the triangular to elongate-triangular mandibles, when fully closed, touch or nearly touch along their entire length, and have teeth along the entire masticatory margin. In profile, the base of the mandible is angled downwards as it passes under the clypeus and, in dorsal view, wing-like lamellae are present on the sides of the petiole and generally the postpetiole (absent in one species). This genus and its close relatives *Epopostruma* and *Mesostruma* are monomorphic. These ants are likely specialist predators of (small) invertebrates (Andersen 1991). Species generally have small colonies of less than 100 workers, and nests can be found in soil, under rocks or in cracks in rocks, or in rotten logs. When disturbed, workers feign death (Shattuck 2000).

Colobostruma cerornata is the only WA member of the genus in which the lateral postpetiole has the sides approximately vertical and not expanded outward. This species also shares with some *C. elliotti* a four-segmented antenna, the other species having at least six segments in the antenna. *Colobostruma cerornata* is not encountered frequently but can be found in drier areas of the Kwongan, the Avon Wheatbelt and the eastern goldfields. Outside of WA, the ant occurs in SA and Vic. This ant seems to be restricted to sandplain and has mostly been collected in heath. Vegetation types mentioned on labels are mallee and *Melaleuca leuropoma/Banksia attenuata*. Samples have mostly been collected in pitfall traps and soil samples, but *C. cerornata* has also been collected by sweeping at night. *Colobostruma nancyae* is another species with a distinctive profile; in this case, when viewed laterally, the dorsum of the mesosoma is broadly arched, and the propodeum is low, its posterior face greatly reduced (approximately the same height as the petiolar peduncle) and with very narrow, thickened lamellae. More conventional *Colobostruma* when seen in the same view, have the dorsum of the mesosoma at most weakly convex, with a high propodeum, its posterior face at most only slightly less in height than the petiolar node and with broad, thin lamellae. This rather large, very compact species is confined to WA, is undoubtedly uncommon, and does not seem to have been collected since the mid 1980s. Nonetheless it has a relatively wide distribution, with records coming from near Moore River, north of Perth, several localities in and around the Jarrah Forest and in the Esperance district. Little is known about the ant, but it has been taken at sugar baits set on eucalypt trunks and in nocturnal sweeps, suggesting it ascends trees and shrubs while foraging for nectar and honeydew. Habitat includes sand heath and dry sclerophyll woodland.

Colobostruma mellea is, perhaps, the most common of the *Colobostruma* species occurring in WA and appears not infrequently among the fauna collected from pitfall trapping in the Jarrah Forest. In this dainty species the wing-like flange of the postpetiole contains translucent windows along both anterior and posterior margins, the anterior margin being formed by a band of thickened integument. In the remaining four species the wing-like flange of the postpetiole contains a translucent window on its posterior margin only. *Colobostruma mellea* was described from Tardun, in mid-western WA, but recent collections have come from the Jarrah Forest subregion, with several separate series being taken by pitfall trap in the Wungong catchment. There is also one isolated record from SA. Vegetation records include jarrah, mallee and heath. Jarrah records are from upland, dieback-free control areas. *Colobostruma elliotti* can be distinguished from *C. australis*, *C. froggatti* and *C. papulata* by having a four- or five-segmented antenna, the other species all having a six-segmented antenna. In WA, *C. elliotti* is known from a couple of collections from the Swan Coastal Plain, one record from near Eneabba in the Kwongan, one record from the western Jarrah Forest, and one from the Esperance Sandplain. This species has one of the widest ranges of any of the WA *Colobostruma* species and is also found in NSW, SA, Tas, and Vic. Records come from coastal heath, mallee, dry sclerophyll and 'dry mossy sclerophyll'. Many collections have been made from rock crevices or from under rocks, particularly mossy rocks, and there is one record from a rotten log (presumably from a nest). Berlesates account for several captures. A student collection from Jarrahdale included two workers taken by hand from litter in a *Corymbia calophylla* (marri) plot.

The appearance of the antennal scape differentiates *C. australis* from *C. froggatti* and *C. papulata*, the scape lacking a ventral lobe and being gently elbowed in the former species, while the scape is strongly elbowed and has a lobe in the latter two species. *Colobostruma australis* is known in WA only from one very old (1955) record from Thomas River Station, near Esperance on the south coast. This species is much more abundant on the east coast, where it occurs in the ACT, NSW, QLD, and Vic. This ant is always associated with litter, and collections come from sifted litter, leaf mould, rotten logs and similar types of debris. Winkler Sacks and berlesates account for the majority of specimens. Vegetation types include sandplain heath, snow gum woodland, wet sclerophyll and rainforest. When seen in full-face view, *Colobostruma papulata* differs from the last species,

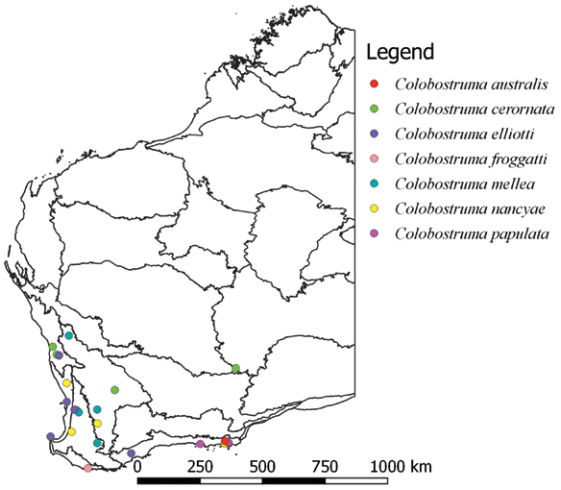

FIGURE 113 Distribution of *Colobostruma australis*, *C. cerornata*, *C. elliotti*, *C. froggatti*, *C. mellea*, *C. nancyae* and *C. papulata*.

C. froggatti, in having the ridges immediately in front of the eyes nearly parallel or diverging anteriad (these ridges converging anteriad in *C. froggatti*). *Colobostruma papulata* is known from just two collections totalling three workers taken many years ago, one from Esperance and one from Cape Arid (the Esperance Sandplain appears to be a hotspot for *Colobostruma* species, with at least four species being recorded there, and others likely). This species has not been recorded from any other state. One collection of the ant was taken in a nocturnal sweep in scrub heath, but there are no more data available. *Colobostruma froggatti* is another very uncommon species in WA, with two records from Eneabba (obscured on map) and Coalmine Beach on the south coast, respectively. Interstate, this ant has been recorded from the ACT, NSW, SA, Tas, and Vic. As with most other *Colobostruma*, litter sampling using Berlese Funnels has been most successful in extracting workers from leaf litter but sweeping of coastal scrub has also been productive. This species has also been recorded from grass tussocks. Vegetation associations include dry and wet sclerophyll and mallee.

Crematogaster (Figures 114–116)

With 16 species (15 described and one undescribed), *Crematogaster* is a moderate-sized genus in WA. Unlike *Colobostruma*, most of the constituent species within this genus are common and well-represented in collections. With their gaster attached to the upper surface of the heart-shaped gaster, their low, flat, nodeless petiole and their 11-segmented antennae, *Crematogaster* workers are unlikely to be mistaken for any other genus in WA. They can be aggressive, and their stings are adapted to deliver venom topically or even as an aerosol (Rifflet et al. 2011). WA species include arboreal forms, while others nest into the soil. In the case of *Crematogaster queenslandica rogans*, nests are made into rotting wood or roots underground and a line of nest entrances on the soil surface connect to these (pers. obs. and label data). *Crematogaster* are generalist predators but will tend Hemiptera for honeydew and also the larvae of some butterflies (Shattuck 1999).

Two subgenera are identified among the WA taxa, following Blaimer (2012). Members of the subgenus *Orthocrema* have, in dorsal view, a postpetiole that usually lacks a median impression or is merely impressed posteriad; if the postpetiole is distinctly bilobed then, in dorsal view, the shape of the petiole is rectangular or ovo-rectangular. Taxa in subgenus *Crematogaster* have a postpetiole that is bilobed with a sharp, distinct, median impression, and the form of the petiole is other than rectangular or ovo-rectangular. Seven species of WA *Crematogaster* are here assigned to the first subgenus, and eight to the second. *Crematogaster eurydice* is known only from the queen, so is not considered here, apart from appearing on a map. In this work, the taxa *Crematogaster bipartita* and *C. clarior* are elevated to species level, while *C. dispar*, *C. pythia*, *C. frivola sculpticeps*, *C. laeviceps broomensis*, *C. laeviceps chasei*, and *C. rufotestacea dentinasis* become junior synonyms of *C. rufotestacea*, *C. clarior*, *C. frivola*, *C. laeviceps*, *C. laeviceps* and *C. rufotestacea*, respectively (see Part I for details). In all likelihood other current subspecies of the *C. queenslandica* complex that key out in separate couplets are also distinct genetically, but these are being left for a proper taxonomic revision.

Crematogaster queenslandica gilberti has a postpetiole with a broad, shallow division between the lobes and, when viewed in profile, the mesosoma has three rows of erect setae. Other ants in the subgenus *Orthocrema* have a postpetiole that is only weakly demarcated into two sectors or has a posteromedian impression only or is distinctly rounded and undivided. Viewed in profile, the mesosoma of these species has just two lines of erect setae. *Crematogaster queenslandica gilberti* has a broad distribution in WA that takes in much of the western part of the State, and it probably also occurs in the drier, eastern deserts where there has been much less collecting. The type material comes from QLD, and the ant likely occurs in the NT as well. This species is a ground nester and is nocturnally active. Workers in sandplain/laterite heathland east of Hyden were found nesting under a *Borya* clump.

Two small species in the *C. queenslandica* complex can be distinguished by the presence of an erect bristly seta on either side of the propodeum, just anteriad of the propodeal spine. In *C. bipartita* the posterior sector of the mesonotum, when seen in dorsal view, is microreticulate and not delimited by a transverse carina; its overall colour is brown, apart from the darker posterior gaster. The overall appearance is the same as *C. queenslandica*, including the stout erect bristle at the base of the propodeum. However, the different appearance of the posterior promesonotum and the different colour in the imaged type specimen dictate that it be kept as a separate taxon until more material can be examined. This ant is superficially similar to *C. rufotestacea*, but the latter is a temperate species with a different anterior clypeal margin and lacks the erect propodeal bristle; consequently *C. bipartita* is raised to species in this work. In *C. queenslandica* the posterior sector of the mesonotum, when seen in dorsal view, is longitudinally striate (the striae being a continuation of the sculpture of the anterior promesonotum) and is delimited from the propodeum by a raised, transverse carina; the overall colour is pale yellowish fawn apart from the darker posterior gaster. *Crematogaster bipartita* is known only from the type series collected in Broome. The workers were found living under the bark of a eucalypt. *Crematogaster queenslandica* is a common species from the Pilbara to the northern Kimberley and is also found on Barrow Island. The range of this ant extends to the NT and QLD (whence comes the type material). This species is ground nesting (Andersen 2000) and foraging and most WA specimens have been pitfall-trapped. Workers from Middle Lagoon north of Broome were taken in pindan/savanna woodland. *Crematogaster xerophila* is another distinct species that has, in dorsal view, a promesonotum with large reticulate sectors that are bounded by longitudinal and transverse striae in addition to more superficial sculpture, and the surface is matt. In *C. queenslandica* cf. *froggatti*, *C. queenslandica rogans* and *C. rufotestacea* the promesonotum, in dorsal view, consists mainly of fine, longitudinal striae (mostly confined to the anterior and lateral sectors) with small reticulations present or absent, or the sculpture is reduced. The mesosomal surface is smooth and shining. *Crematogaster xerophila* in WA occurs in the drier eastern and northern parts of the SWP and reaches about the latitude of Shark Bay. *Crematogaster xerophila* was described from northern SA and almost certainly its range extends into the NT. This ant ascends trees, although it is not known whether it also nests in them, and has been collected in tall shrubland dominated by *Acacia acuminata* and *Acacia lasiocalyx*.

The very compact mesosoma in dorsal view is what sets *C. queenslandica* cf. *froggatti* apart from *C. queenslandica rogans* and *C. rufotestacea*. The mesosoma is only weakly attenuated posteriad (width of promesonotum at metanotal groove > 0.50 × width of promesonotum across the humeri). The WA material does not quite accord with eastern states types appearing on AntWeb, but is here treated as likely conspecific. The worker is tan in colour. In the other two ants, in dorsal view the mesosoma is less compact and more strongly attenuated posteriad (width of promesonotum at metanotal groove < 0.40 × width of promesonotum across the humeri), the worker being either uniformly brown or bicoloured (head and gaster yellowish-brown and mesosoma yellowish). *Crematogaster queenslandica* cf. *froggatti* has been collected in WA on three occasions in the south-east sector of the SWP. The nominal species also occurs in NSW. Specimens from Hyden cemetery were collected in mallee woodland. The only other note (Jacup) mentions collection on soil and in litter. In dorsal view, the postpetiole of *C. rufotestacea* is narrow and square, its dorsal surface smooth without any trace of a median division; in full-face view, the anteromedial clypeal margin of this species is emarginate and bounded on either side of the emargination by a short but distinct denticle. In dorsal view, the postpetiole of *C. queenslandica rogans* is broad, with a poorly defined median indentation dividing the structure into two weakly defined lobes; in full-face view the anteromedial clypeal margin of this species is weakly emarginate, the emargination bounded by a pair of small flanges at most, never denticles. *Crematogaster rufotestacea* is often weakly bicoloured, with the brownish head and gaster darker in colour than the yellowish mesosoma, but uniformly brown workers do occur. The mesosoma is usually very shiny and often completely smooth. In *C. queenslandica rogans*, on the other hand, the ant is usually uniformly brown and the mesosoma is sculptured and tends to matt or nearly so. *Crematogaster rufotestacea* is mainly found on the Swan Coastal Plain and the wetter western flanks of the Darling Range, where it is abundant, with just scattered records on the eastern side of the Darling Range and on or near the western south coast as far east as Denmark. The species seems to avoid the thicker central parts of the Jarrah Forest. In the east, *Crematogaster rufotestacea* is known to occur in at least NSW and Vic. This species has

been found in a variety of habitats, including karri (*Eucalyptus diversicolor*) forest, *Banksia/Agonis* woodland and coastal scrub. The ant may nest in burnt wood as well as directly into soil and has been found under a heavy moss layer. At other times workers have been retrieved from leaf and twig litter or other woody debris. White sand is mentioned on a couple of occasions. *Crematogaster queenslandica rogans* occurs sympatrically with *C. rufotestacea* throughout much of the south-west coastal part of its range, but that range extends further inland into the eastern and northern wheatbelts, north into the Kwongan and along the south coast as far east as Caiguna. This species was described from NSW but has not been recorded from other Australian states thus far. The ant is mainly found on light soils such as white coastal sand and sandplain laterite, and the vegetation listed on labels includes sandplain heath, *Banksia/Agonis* woodland, coastal heath, steppe and mallee woodland. This species is recorded as creating subterranean nests along roots, and a nest has also been found under a stone.

Three members of the subgenus *Crematogaster* have a glabrous mesosoma, the remaining five possessing erect setae on that part of the body. *Crematogaster longicephala curticeps* often has an unarmed propodeal angle, but if the angle bears denticles or spines these are short, their length < 1.5 × their width across their base. (This species is doubtfully distinct from *C. longicephala* Forel, but as no specimens or specimen images of the latter are available at present, WA material is allocated to the former taxon, which has the colour pattern that Wheeler mentions in his description.) In *Crematogaster mjobergi* and *C. whitei* the propodeum is armed with longer spines, their length > 3 × their width across their base. Collections of *C. longicephala curticeps* form two clusters, one cluster being from Perth and taking in coastal parts of the northern Swan Coastal plain and north-eastern and eastern goldfields, the second based in the Pilbara (the coast around Karratha, and also Ethel Creek). However, a very recent (2019) record comes from Carnarvon. The latter collection indicates the ant probably occurs continuously between Perth and the Pilbara. This species also occurs in the NT. Most records are of hand collections from mallee trunks and branches. There is one pitfall trap record (implying ground foraging in addition to arboreal foraging) and others are likely, but the nesting habits of *Crematogaster longicephala curticeps* have not been recorded.

Crematogaster whitei is covered with intense microsculpture. In full-face view, the head is matt, densely and almost uniformly areolate. In dorsal view, the posteromedial sector of promesonotum and propodeum of *C. whitei* are uniformly weakly concave, the continuity of this concavity only being interrupted by the metanotal groove. In the case of *C. mjobergi*, in full-face view, the head is mainly smooth and shining, the only distinct sculpture being very small longitudinal striolae on the lower genae and in a patch within and above each frontal carina. In dorsal view, the promesonotum and the propodeum are distinct, the propodeum having a separate though narrow dorsal surface anteriorly, this rounding smoothly over onto the declivous propodeal face. *Crematogaster whitei* is found in semi-arid areas of southern WA, well away from the wetter, tall-timbered Jarrah Forest and south coast. This species was described from SA near the NT border, and certainly occurs in the latter state as well. *Crematogaster whitei* forages on small trees and shrubs, such as 'tea tree' (label) and *Banksia hookeriana* as well as on mallee trunks and branches. Habitat includes sandplain/laterite heathland. In WA, *Crematogaster mjobergi* only occurs in the northern Kimberley, but the ant was described from Mareeba, QLD, and most likely also occurs in the NT. The type material (from a nest?) was found living under the bark of a eucalypt. Other specimens have also been collected in *Eucalyptus* woodland, and one was taken in a malaise trap.

Crematogaster frivola is one of the more common species of *Crematogaster* found in the SWP. While the general appearance is of a rugose *C. laeviceps*,

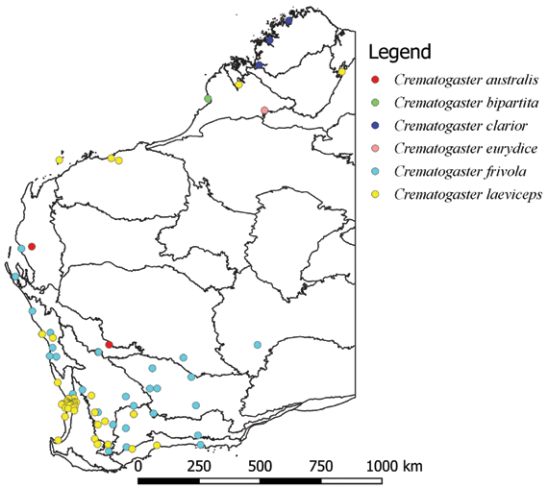

FIGURE 114 Distribution of *Crematogaster australis*, *C. bipartita*, *C. clarior*, *C. eurydice*, *C. frivola* and *C. laeviceps*.

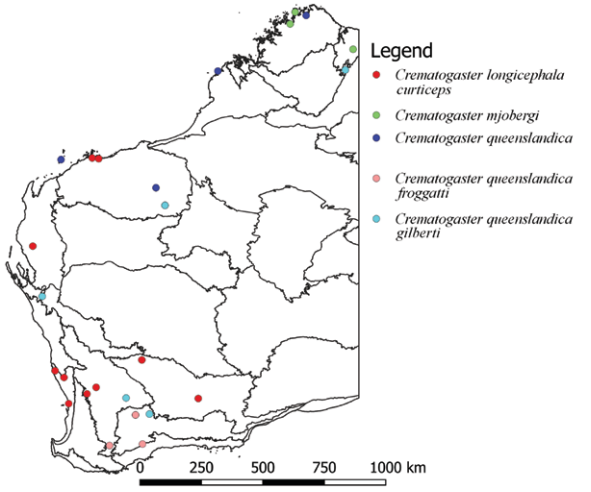

FIGURE 115 Distribution of *Crematogaster longicephala curticeps*, *C. mjobergi*, *C. queenslandica*, *C. queenslandica froggatti* and *C. queenslandica gilberti*.

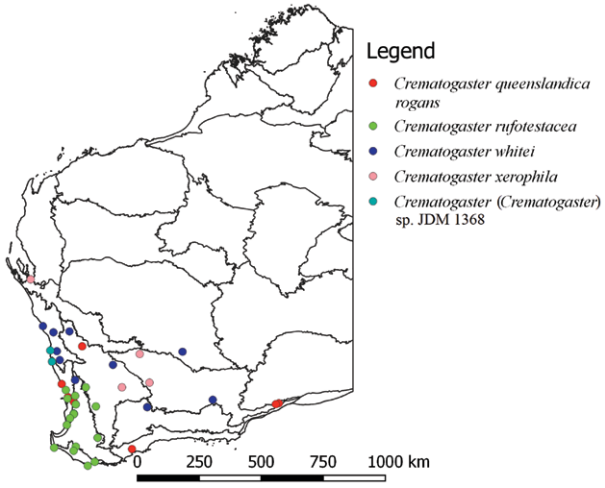

FIGURE 116 Distribution of *Crematogaster queenslandica rogans*, *C. rufotestacea*, *C. whitei*, *C. xerophila* and *Crematogaster (Crematogaster)* sp. JDM 1368.

workers can be separated from *C. laeviceps* and other relatives by the matt, variably longitudinally striate or rugose-reticulate promesonotum, the other ants being mainly or totally smooth and shining on this part of the body. The latter may have at most a sculptured ridge (denoting the vestige of the promesonotal suture) or very fine longitudinal striae. *Crematogaster frivola* has a range that extends as far north as Carnarvon on the west coast, throughout the wheatbelt and into the eastern goldfields and as far east as Esperance on the south coast. The ant is occasionally recorded in the Perth region, but avoids the thicker, tall timber woodlands of the Jarrah Forest and the western south coast. This species is confined to WA. Samples have been taken in a range of habitats including garden, closed low shrubland, mixed *Xylomelum/Banksia* heath, modified wandoo woodland and mallee. Most recently, workers were collected near Carnarvon in *Eucalyptus camaldulensis* thicket containing *Acacia* and vines. Soil types include yellow sand and red clay soil. Most specimens have been collected from tree-trunks, although this species also forages on the ground.

Crematogaster clarior (including specimens of *C. 'pythia'*) and *C. australis* have a petiole that, in dorsal view, is flared anteriorly and has distinctly developed blunt or sharp lateral angles. In *C. laeviceps* and *Crematogaster* sp. JDM 1368 the petiole is not so distinctly flared, and its lateral margins are weakly to strongly convex anteriorly without forming distinct angles. *Crematogaster clarior* can be distinguished from *C. australis* by its carinate promesonotal humeri (these are rounded in *C. australis*) and its longer propodeal spines (≥ 2 × longer than wide across their base, compared with ≤ 1.5 × longer than wide across their base). In WA, *C. clarior* has been taken on the northern Kimberley coast in rainforest. This species (as *C. clarior* and *C. pythia*) was described from QLD and likely also occurs in the NT (see mention of this or a similar species in Andersen [2000]). No other details are available. *Crematogaster australis* has been recorded in WA from collections near Paynes Find, Mt Gibson and Rocky Pool, respectively. Although only eight workers are included in the collections, they reveal large allometric variation, particularly in relation to head size. This species was described from QLD. The worker from Paynes Find was hand-collected from a tree trunk, while the Mt Gibson specimens were collected from an ungrazed site with York gum cover. The tiny Rocky Pool worker came from a cajeput (*Melaleuca leucodendra*) limb; the tree being situated next to the Gascoyne River. No other data are available on the taxon.

Seen in profile, the propodeal spines of *C. laeviceps* (here regarded as the senior synonym of *C. laeviceps broomensis* and *C. laeviceps chasei*) are directed horizontally; the erect setae are longer, especially on the appendages, those on the tibia being often nearly as long as the greatest width of the tibia; the erect setae on the gaster are numerous, and the decumbent setae on the gaster are spaced much less than their length apart. Seen in profile, the propodeal spines of the undescribed *Crematogaster* sp. JDM 1368 are directed distinctly obliquely; the erect setae are shorter, especially on the appendages, those on tibia being less than half as long as the greatest width of the tibia; the erect

setae on the gaster are sparse, and the decumbent setae on the gaster are often spaced twice their length apart. In WA, *Crematogaster laeviceps* records are clustered in three aggregations, namely, the SWP where most records occur (again, there are few records from the Jarrah Forest subregion and these are all in the west and east), the Pilbara and Barrow Island, and the Kimberley. Interstate, the ant occurs at least in Victoria, but its occurrence in other states is uncertain because of its confused association with *C. clarior*, here regarded as a distinct species. In the south-west of the state, *C. laeviceps* is easily the most common *Crematogaster* species, and in the Perth metropolitan area it is also one of the most common of the native myrmicines. In and around Perth the ant can be seen almost anywhere where there is a stand of local eucalypts, including in parks, along streets and in suburban yards. In WA, this species is one of the few tree nesters among southern ant taxa, and has catholic tastes in host trees, *Acacia rostellifera*, *Allocasuarina*, *Melaleuca lanceolata*, *Banksia*, sandalwood and wandoo being mentioned on labels. *Crematogaster laeviceps* will also forage — and probably nest — in non-native tree species and has been taken on a branch of *Jacaranda mimosifolia*. *Crematogaster* sp. JDM 1368 has only been recorded at a couple of coastal sites between Jurien Bay and Dongara and may be restricted to select habitats in the coastal strip between Perth and Geraldton. Although the species bears a striking resemblance to *C. laeviceps*, this is a ground nester. A series from Gum Tree Bay was collected at light by night, while a couple of workers collected near Jurien Bay jetty were taken from a nest made into the side of the mound nest of *Myrmecia desertorum*.

Epopostruma (Figure 117)

With nine species, WA has a good representation of this genus; however, all but three species are known only from one or a handful of records in this State. This genus is easily identified; the antennal scape in the resting position passes below the eye and sits in elongate depressions (scrobes) on the sides of the head, and the thin and linear mandibles, when fully closed, are separated by a broad gap for most of their length and touch only at the tips. *Epopostruma* is closely related to *Colobostruma* and *Mesostruma* (Ward et al. 2015). Their specialised trap-jaws enable them to capture soft-bodied prey like Collembola, but they are also attracted to honey baits. Workers form small colonies of around 100 workers, and nests may be found in open soil or under rocks, logs and sticks or crevices in rocks. Nests are often found at the base of trees (Shattuck 1999). The genus was revised by Shattuck in 2000.

Epopostruma frosti and *E. lattini* are two *Epopostruma* in which the sides of the petiole, in dorsal view, are expanded to form spines or flanges, and the lateral postpetiolar extensions form sharp teeth or spines. *Epopostruma frosti* is a large species. In full-face view, the area immediately above the eye is furnished with a small tooth (the same area in *E. lattini* is developed as a rounded angle only). *Epopostruma frosti* is not uncommon in and around the northern Jarrah Forest and the eastern edges of the Darling Scarp in WA, and there are isolated single records from the eastern goldfields and the Hampton subregion, respectively. In SA, this species has been recorded from a number of localities throughout the state, and it also occurs in NSW. These ants nest in the ground under rocks, logs and leaf litter and forage nocturnally on both the soil surface and on tree trunks, where they are attracted to honey and sugar baits. Trees mentioned on labels include mallee, marri, powderbark wandoo, low scrub heath and 'tall gums'. Tree-trunk foragers have been collected in both bark and intercept traps. *Epopostruma lattini* is a less common but still widespread species. In WA, this ant has been collected at Goomalling (obscured on map), Salmon Gums and Canegrass Mine, north-north-west of Kalgoorlie. *Epopostruma lattini* also occurs in SA. Like *E. frosti*, this ant has a taste for honey baits, and has been collected in the evening at such baits set on mallee trunks. One worker was also collected from a tree-trunk in the afternoon, while another forager was collected from leaf litter.

Like the former two species, *Epopostruma mercurii* and *E. sowestensis* have the sides of the postpetiole expanded laterally in the form of thin spines or flanges, but unlike them the lateral postpetiolar extensions form solid, winglike flanges. In *E. mercurii* the petiolar spines are well-developed, and the bases of the propodeal lobes and the spines are not connected by flanges. In *E. sowestensis* the petiolar spines are indistinct and reduced to sharp angles, and the posterior face of the propodeum has broad, distinct flanges that connect the bases of the spines to the propodeal lobes. *Epopostruma mercurii* has only been collected at two sites in mid-western WA, in the northern Avon Wheatbelt subregion. Apart from the basic collection details, no other data are available for this endemic Western Australian species. *Epopostruma sowestensis* is also restricted to WA, where it has been collected in Dryandra State Forest and Kojonup. This ant has been captured in pitfall traps and also in intercept traps set on wandoo trunks.

In dorsal view, the sides of the postpetiole in the remaining five species is not expanded laterally but is approximately vertical or vertical anteriad with only the posterior corners forming spines or angles. In *E. monstrosa*, seen in profile and in dorsal view, the anterior face of the postpetiole is flattened and extended laterally with the anterior corners forming sharp angles (as contrasted with the anterior face of the postpetiole not so flattened or extended laterally in the other four ants). This species has been collected just a couple of times in WA, once near North Bannister on the Albany Highway and once in Goomalling townsite. The ant is more common on the east coast, where it occurs in NSW, QLD, and Vic. This taxon is associated with a wide variety of vegetation throughout its range, including box, *Eucalyptus wandoo*, heath and scribbly gum. Workers have been taken from nests under a rock, stone or wood, in swamp, at the base of eucalypts, from leaf litter and from tree trunks. On a couple of occasions their nests have been adjacent to those of other ant species (*Notoncus gilberti* and *Papyrius nitidus*), although there is no indication of an association with these species. Workers collected on/around a *Eucalyptus wandoo* tree in Goomalling townsite were active in mid-morning.

In *E. inornata* and *E. natalae* the anterior half of the first gastral tergite is smooth (or nearly so) and shining, with at most only very weak, indistinct and generally widely spaced rugae; however, in *E. quadrispinosa* and *E. kangarooensis* the anterior half of the first gastral tergite (and sometimes the posterior half as well) is distinctly sculptured (although often the sculpturing is very fine), sometimes resulting in a matt appearance. In *E. inornata*, in dorsal view, the dorsum of the petiole is rounded, lacking spines, and the pronotal humeri are rounded and lack teeth. In *E. natalae*, in dorsal view, the dorsum of the petiole and the pronotal humeri are armed with distinct teeth. *Epopostruma inornata* is known to science from a single collection (four workers) taken over 40 years ago in Karragullen in the western Jarrah Forest and, apart from year of collection, collector and locality, nothing else is known of the species. *Epopostruma natalae* is known in this State only from a dealated queen collected on Bluff Knoll, in the Stirling Range. In parts of the eastern states this species is not uncommon, however, and it has been recorded from the ACT, NSW, SA, Tas, and Vic. Most collections in the eastern states have been taken in dry sclerophyll (tree species have not been recorded), but there has also been some collecting from wet sclerophyll and heath. Nests are invariably located under a rock or at the base of a tree; one such record mentioning the presence of a mossy clump. Soil type is mentioned as sand in two instances and 'dry white powder soil' [sic] in another. There also seems to be a preference within this species for establishing colonies on hillsides or hill summits.

Epopostruma quadrispinosa can be distinguished from *E. kangarooensis* in that, in dorsal view, the posterolateral corners of the postpetiole are flat or rounded (these being thin, angular flanges in *E. kangarooensis*). This species has a broad distribution in WA, specimens having been taken as far afield as Mt Farquahar in the Pilbara, Redross Goldmine (south of Kambalda), Madura and Tropicana Minesite in the Great Victoria Desert. Interstate, this species has been recorded from the ACT, NSW, QLD, and SA. This is an arid area species, with vegetation associations mentioned on labels including box-pine, *Eucalyptus salubris*, mulga, saltbush and savanna. Red soil is mentioned as a substrate. Ants have generally been collected in litter, particularly *Eucalyptus* leaf litter, and also through sweeping low shrubs, hand collecting from on a rock or in a rock crevice and in a yellow pan trap. Pitfall traps and berlesates have been involved with non-manual captures. Despite its close resemblance to *E. quadrispinosa*, *E. kangarooensis* prefers much wetter habitats, and the couple of WA records come from remnant bushland on Curtin University Campus and Dwellingup. As its name implies, *Epopostruma kangarooensis* was described from Kangaroo Island, SA, the only other state where it is currently known to occur. The Dwellingup specimen was collected in a pitfall trap but there are no other data.

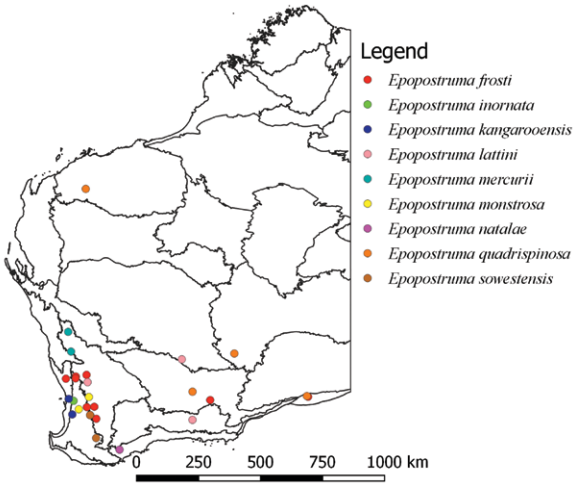

FIGURE 117 Distribution of *Epopostruma frosti*, *E. inornata*, *E. kangarooensis*, *E. lattini*, *E. mercurii*, *E. monstrosa*, *E. natalae*, *E. quadrispinosa* and *E. sowestensis*.

Mayriella (Figure 118)

This genus can be characterised as follows: In profile, the antennal scape in the resting position passes above the eye, and the antennal scrobes (deep in this genus) run above the eye; the antennae are 10-segmented with a weakly defined two-segmented club; the postpetiole is attached to the front of the gaster and has a distinct node; propodeal angles are present, these being armed with denticles, spines or thin, elongate flanges; the clypeus is not medially notched with a single anteromedian seta but is broadly medially concave; and the eye is elongate and narrowed to a point anteriad. This genus has monomorphic workers and has been monographed by Shattuck & Barnett (2007), although the WA species was not included in the revision. The genus is represented in the State by a single known worker of a wholly West Australian species, *Mayriella occidua*. This singleton was captured in the Nuyts Wilderness near Walpole on the south coast and, apart from the fact it was collected among pines by means of pitfall trap (http://www.walpolewilderness.net/walpolewilderness/project_thestudy.asp [accessed 4 July 2019]), nothing more is known about it.

Meranoplus (Figures 118–127)

This genus is superficially similar to *Mayriella* and can be characterised in the following way: In profile, the antennal scape in the resting position passes above the eye, and the antennal scrobes (deep in this genus) run above the eye; the antennae are nine-segmented with a weakly defined three-segmented club; and the upper surface of the promesonotum forms a broad shield whose extensions often project out and above the sides of the mesosoma. The promesonotal shelf is normally distinctive and enables these ants to be easily recognised. This genus is easily the largest myrmicine genus in WA in terms of species. Andersen (2006) has reviewed the Australian *Meranoplus*. His particular division of species-groups is not followed here for the WA species, as my understanding is that the deeper divisions within the Australian radiation of the genus are somewhat fewer than those posited by Andersen, notwithstanding a number of common clades are agreed on. Other undoubtedly unique groups (e.g. the spectacular *M. armatus* species-group) are not found in Western Australia.

Unlike most of the other ant genera discussed in these two volumes the true diversity of *Meranoplus* in WA is not adequately known. This is partly because many of the taxa appear to be localised and poorly represented in collections, and partly because the genus appears to be particularly rich in the Kimberley, and many taxa collected by TERC from this region have not been databased on AntWeb and are only mentioned generically in publications (albeit several keys by Andersen [e.g. 2000, 2007] present coverage of this northern fauna at an informal subgenera or 'radiations', species-group and species complex level with a few groups identified down to the species level). The exception to this deficit in species-level information is the *M. diversus* species-group that was monographed by Schödl in 2007. Other holdings from the Kimberley region (e.g. in ANIC, CAS, JDM, and WAM) are based on relatively few collecting trips. Thus, 60 taxa (34 of which are undescribed) are discussed here, but the true number of species for the State could easily approach or even exceed 70. Andersen (2007) presents an overview of 18 informal species-groups, but his presentation is only partially followed here, as the WA fauna sorts into three distinct major clusters with some of Andersen's 'groups' seeming to represent a lower level of evolution, perhaps more comparable to species complexes. Others do not appear to occur in WA. Thus, in this work, WA *Meranoplus* are separated into the *M. diversus* species-group, the *M. fenestratus* species-group and the *M. dimidiatus* species-group (further broken down into a number of species complexes). Members of the *Meranoplus diversus* species-group are granivores; other species are probably mainly generalist scavengers and omnivores. When disturbed, *Meranoplus* workers roll into a tight ball and retract their antenna into the antennal scrobes and also their legs under the flanges and extensions of the promesonotal shield. In this stationary position they resemble small brown or orange seeds, and are often difficult to distinguish from surrounding debris, tiny pebbles and soil particles. The genus is ground-nesting and monomorphic.

The *Meranoplus diversus* species-group monographed by Schödl (2007) contains 13 WA species (notwithstanding, Andersen [2006] mentions other unnamed members in this group with WA representatives, but these have not been seen by this author, hence are not evaluated here). In this suite of *Meranoplus* the posterior (dorsal) sector of the clypeus is developed as a massive plate that is often keeled, fluted, striate or otherwise configured, that fits between the anterolateral frontal (genal) lobes; in profile, the true anterior clypeal sector is strongly concave and hidden below the posterior sector; and the head is often very large in relation to the mesosoma, in dorsal view its sides extending beyond the anterior promesonotal angles. In other *Meranoplus*, the posterior sector of the clypeus is not so developed, and the anterior

clypeal sector is exposed; the head is also smaller in relation to the mesosoma, in dorsal view its sides falling within the anterior promesonotal angles. The *M. diversus* species-group is predominantly Eremaean and Torresian in its distribution, with only a couple of species extending into the SWP. In *M. occidentalis*, *M. duyfkeni*, *M. ajax*, *M. snellingi*(?), *M. unicolor* and *M. berrimah* the promesonotal shield with its posterolateral and posterior projections is short and at most bluntly rounded or triangular, the lateral margins of the shield not or only slightly overhanging the lateral mesosomal sides and the propodeal declivity. In *M. diversus*, *M. deserticola*, *M. crassispina*, *M. oxleyi*, *M. mcarthuri*, *M. taurus* and *M. arcuatus* the promesonotal shield with its posterolateral and posterior projections is well developed, the acute or narrowly rounded projections of the shield distinctly overhanging the lateral mesosomal sides and the propodeal declivity.

In *M. occidentalis* paired projections between the posterior angles of the promesonotal shield are absent, and the eye is very large (EW 0.37–0.42 mm, EI 0.23–0.26). In its closest relatives paired projections between the posterior angles of the promesonotal shield are present, at least as minute denticles, and the eye is distinctly smaller (EW < 0.35 mm, EI < 0.22). This purely West Australian species is confined to the Carnarvon, Gascoyne, and Pilbara subregions, but is quite common within their borders. At Minilya Station, numbers of this species were seen to be active in the early morning; they were moving in narrow columns on red clay soil near the carpark. Surprisingly, dealated queens outnumbered workers. Most specimens seen have been pitfall-trapped. *Meranoplus duyfkeni* has four mandibular teeth and the anterior margin of the clypeus is bluntly bidentate. The remaining species in this cluster have three mandibular teeth and the clypeus has a different conformation. In WA, *M. duyfkeni* has been recorded in two clusters in the west Pilbara and at scattered sites in the Kimberley, respectively. The ant also occurs in the NT. Workers seen have been pitfall-trapped but there is no information on the habits or habitat preference of the species.

Meranoplus ajax is a large *Meranoplus* with a conspicuous, dorsal median keel-like carina that immediately identifies it. Other carinate projections of the clypeus are variably developed. *Meranoplus snellingi*(?), *M. unicolor* and *M. berrimah* have a dorsal sector of the clypeus that has (at most) a weak keel but may be represented instead by a flattened lamina. *Meranoplus ajax* has a widely scattered but broad distribution in the northern parts of the EP and in the Kimberley. The range of the ant extends into the NT, QLD, and SA. Schödl discusses morphological and pilosity variability seen in the species throughout its range but concludes (with a degree of caution) that this variability is infraspecific. Andersen (2006) identifies two undescribed relatives of *M. ajax* from the Kimberley, but they have not been seen by this author who therefore cannot comment on their validity. This species has been found foraging nocturnally in *Eucalyptus* woodland. A pin of three workers of an ant species with the anterior clypeal margin structured as a conspicuous, gently emarginate lobe projected up and outward in an arc with small, dentate, lateral processes are here referred to *M. snellingi*, although the petiolar node in the WA ants is more triangular in the exclusively NT workers seen by Schödl. The three workers were captured in a permanent invertebrate (dry) pitfall trap in mulga woodland south-east of Newman.

In contrast to *M. snellingi*(?), *M unicolor* and *M. berrimah* have an anterior clypeal margin that is flat and concave with an anteriorly rectangular or emarginate process that may, nonetheless, extend beyond the frontal lobes. *Meranoplus unicolor* is a larger species (HW 1.78–2.37 mm) and, in full-face view, the dorsal clypeal lamina seldom surpasses the anterior clypeal margin; moreover, the first gastral tergite is entirely coarsely striate to striate-and-punctate. More than one taxon may be involved; see Andersen (2006), who identifies three undescribed relatives of this species from the Kimberley. As is the case with *M. ajax*, the variations mentioned by Andersen have not been seen by this author, who again cannot comment on their validity. *Meranoplus berrimah* is a smaller species (HW 1.58–1.80 mm) and, in full-face view, the dorsal clypeal lamina usually distinctly surpasses the anterior clypeal margin, and the first gastral tergite is microreticulate without striation. In WA, *Meranoplus unicolor* has a largely coastal distribution that extends from the Pilbara to the Kimberley. This ant, as understood here, has a very broad distribution in northern mainland Australia that also takes in the NT, QLD, and SA. Ground nests of this species have been recorded, and collections have been made in *Eucalyptus* open forest and hummock grassland with low shrubs. *Meranoplus berrimah* has a more restricted distribution and there is just the one collection from the Mitchell Plateau in WA. Otherwise, it is only known from the NT. The single WA worker, taken at Camp Creek in the Mitchell Plateau, was collected near its nest entrance, which consisted of a single hole. Plant material (possibly grass seed

husks) surrounded the hole. Interstate collections have been made in savanna and eucalypt open forest and have involved workers taken as foragers and from a ground nest, respectively.

Meranoplus diversus, *M. deserticola*, *M. crassispina* and *M. oxleyi* have a posterior petiolar face that is evenly and conspicuously costate. These are concolorous or bicoloured species. *Meranoplus macarthuri*, *M. taurus* and *M. arcuatus* have a posterior petiolar face that is reticulate-rugulose and are distinctly bicolored species. In *M. diversus* the dorsal ocular margin is well separated from the lower scrobal margin, but the dorsal ocular margin is very close to or confluent with the lower scrobal margin in *M. deserticola*, *M. crassispina* and *M. oxleyi*. *Meranoplus diversus* occurs almost throughout the drier regions of WA, with the limits of its range defined by records from Durokoppin in the Avon Wheatbelt in the south, Derby in the Kimberley in the north, and near Warburton in the north-east. The species also occurs in the NT and SA. There are no data on the biology of the ant. *Meranoplus deserticola* is larger than *M. crassispina* and *M. oxleyi* (HW 1.65–1.80 mm, compared with HW 1.15–1.50 mm), and the frontal carinae are distinctly narrower than the head width (frontal carinae less obviously narrower than head width in the other two species). *Meranoplus deserticola* is known in this State from a few records from the arid interior. Unfortunately, the sole JDM specimen of *M. deserticola* (originally designated *Meranoplus* sp. JDM 987) does not have a label. However, it is known that the ant was collected by Bob Bromilow SE. of Newman, WA in the mid 1990s. The coordinates used for mapping distribution are those corresponding to the collection locality for the next voucher number on the list (*Meranoplus* sp. JDM 988, all three workers of which were collected 102.8 km SE. of Newman). The species also occurs in the NT and SA. As with the preceding taxon, nothing is known of its biology.

Meranoplus crassispina has long and massive propodeal spines, those in *M. oxleyi* being shorter. *Meranoplus crassispina* is apparently a very rare species known from a handful of records. The only WA specimen is a worker from the Kimberley district collected by Mjöberg over a century ago. More recent material has all come from a couple of sites near the NT/SA border. Nothing is known about this ant. *Meranoplus oxleyi* is a relatively small member of this species-group, with three WA records — two from the Kimberley and one from the edge of the Little Sandy Desert adjacent to the Pilbara. Other records come from the NT. As with so many of these ants, informative label data are missing. *Meranoplus mcarthuri* is a well-defined taxon, with a broadly concave anterior clypeal margin and five mandibular teeth, *M. taurus* and *M. arcuatus* having a relatively narrow clypeal concavity and just four mandibular teeth. *Meranoplus mcarthuri* is one of only a couple of ants within this species-group to penetrate the SWP, with the only sample of the species known from WA coming from Morawa. This ant, however, is rather more broadly distributed elsewhere in mainland Australia than most of its comrades and is known to occur in NSW, the NT, SA, and Vic. Unfortunately, label data are lacking for *M. mcarthuri*, as they are for most of the *M. diversus* species-group.

In *M. taurus*, the anterolateral clypeal corners are acutely directed anteriad, and the posterior and posterolateral projections of the promesonotal shield are short and apically bluntly rounded with translucent flanges. The scapes are also short (SI 47–53). In *M. arcuatus* the anterolateral clypeal corners are less acutely directed anteriad, and the posterior and posterolateral projections of the promesonotal shield are strongly developed. The scapes are longer (SI > 56). *Meranoplus taurus* is a most attractively bicoloured smaller member of the group (at least in WA), and can be found in the Gascoyne and Pilbara subregions. This species has perhaps the widest distribution of any of the *M. diversus* species-group taxa and occurs in all the Australian mainland states and territories except the ACT. Specimens from near the Gascoyne Junction Road turnoff were hand-collected from roadside vegetation, and a series from the Pilbara were pitfall-trapped, but that is all that is known about the species. *Meranoplus arcuatus* is a semi-arid and desert-dwelling form, and collections in WA have come from the Murchison, Gascoyne and Little Sandy Desert subregions. This species also occurs in SA. Specimens pitfall-trapped at the edge of the Little Sandy Desert were collected in mulga woodland. The type material from Lake Marmion was also pitfall-trapped.

The *Meranoplus fenestratus* species-group is also well-defined and includes six named species in this State and four undescribed species. Most of these ants are relatively common. In full-face view, the clypeus in this group is not a distinct hexagon, the anterior clypeal margin is broad with its sides only weakly convergent towards the anterior clypeal border, the clypeal margin is strongly emarginate, folded posteriad at the level of the frontal lobes and with the anterior clypeal margin often not visible, and, in full-face view, the lamellar development of the anterior margin of the antennal scrobe is often

sufficient to partly or fully obscure the eyes (never the case with members of *M. dimidiatus* species-group).

Within this species-group, *Meranoplus testudineus* is a true 'turtle ant', with extensive lamellae on the antennal scrobes, the sides of the promesonotal shield and the first gastral tergite. The postpetiole is flattened. In this regard the ant superficially resembles another 'turtle ant', *Meranoplus* sp. JDM 867, but the structure of the clypeus is quite different, and the similar appearance is here put down to evolutionary convergence; the two species are likely not closely related. Similarly (and contrary to the assertion put forward by Andersen (2006]), *Meranoplus testudineus* and species in the *M. froggatti* species complex are not closely related and are here placed in different species-groups. *Meranoplus testudineus* is confined to the north-western Kimberley. The extensive development of protective flanges in this species suggests some sort of specialised lifestyle, but the habits of this interesting little ant are completely unknown.

The remainder of this species-group cluster around two basic phenotypic forms: the species that include *M. ferrugineus* have extensive areolate or reticulate sculpture on the upper frons and, usually, on the dorsum of the promesonotal shield (reduced in *M. oceanicus*) and the petiolar node seen in profile is thick with a distinct dorsal face, except in *Meranoplus* sp. JDM 424. The promesonotal shield, in dorsal view, has small to moderate-sized oval fenestrae and is not massively square. This group includes *Meranoplus ferrugineus, M. oceanicus*, *Meranoplus* sp. JDM 267, and *Meranoplus* sp. JDM 424, and the range of all these species in this State is restricted to areas from Carnarvon southwards. A second phenotypic form within this species-group includes *M. fenestratus*, *M. mjobergi*, *M. pubescens*, *Meranoplus* sp. JDM 866 and *Meranoplus* sp. JDM 1268. *Meranoplus* sp. JDM 866 is restricted to southern areas, *M. fenestratus* is mainly southern and the remaining three species have their range in the northern parts of the State. In all these species, the promesonotal shield is massively square, the fenestrae are mostly moderate to large in size and the posterolateral fenestrae may be weakly to strongly lachrymiform (tear-shaped). Areolate sculpture is absent from the frons and promesonotal shield and the latter is smooth or has a few longitudinal striae only. The petiolar node seen in profile is typically squamiform or wedge-shaped without a distinct dorsal face in *M. mjobergi*, *M. pubescens* and *Meranoplus* sp. JDM 1268, but the node is thicker, and a dorsal face is present in *M. fenestratus* and *Meranoplus* sp. JDM 866.

Meranoplus oceanicus is a widespread species and differs from other members of the group which possess coarse areolate-rugose sculpture on the promesonotal shield, in having striate-microreticulate sculpture on this sclerite. The surface of the shield is also duller in appearance in this instance compared with these other ants. Moreover, seen in profile, the dorsal face of the postpetiole in this species overhangs its posterior face as a sharp lip, which is not the case in *M. ferrugineus, Meranoplus* sp. JDM 267, and *Meranoplus* sp. JDM 424. The anterolateral fenestrae in workers from Fitzgerald River National Park are very small and the posterior angles of the promesonotal shield are digitate (these fenestrae are of moderate size and the posterior angles are bluntly dentate in other workers), but the ants otherwise conform to the diagnosis given in the key, and the position taken here is that these differences are likely due to infraspecific variation. *Meranoplus oceanicus* occurs at least as far north as Carnarvon, and has been collected broadly throughout the SWP, and as far east as Clampton goldmine in the Coolgardie subregion. This species can be found interstate in NSW, QLD, SA, and Vic. A specimen from Sawyer's Valley, near Perth, was hand-collected from the bole of a tree and workers from Bibbawarra Bore, near Carnarvon, were hand-collected in the afternoon in 'low, prickly scrub damaged by rabbits and goats'. Other data are lacking. The distinguishing feature in *Meranoplus* sp. JDM 424 is that, seen in dorsal view, the posterior angles of the promesonotal shield are gently recurved and directed inward. In *M. ferrugineus* and *Meranoplus* sp. JDM 267 these angles are not recurved but are directed obliquely at ~40° to the vertical. This species is most commonly found in the coastal mid-west of the state in areas around Geraldton, but has also been taken at Yoothapina, in the Murchison and at Mukinbudin in the Avon Wheatbelt subregion. The occurrence of this ant in other states is not known. Vegetation associations on labels mention *Banksia attenuata* and *Melaleuca leuropoma* on sandplain, and also 'low prickly scrub [over] lateritic caprock'. The Mukinbudin worker was hand-collected in a caravan park in town.

Meranoplus ferrugineus and *Meranoplus* sp. JDM 267 are much of a muchness, but the overall appearance of *M. ferrugineus* is distinctly shining with a rather polished appearance, and the alveolate-rugose sculpture of the promesonotal shield is more deeply impressed, while the overall appearance of *Meranoplus* sp. JDM 267 is matt to weakly shining and not polished in appearance, and the sculpture of the promesonotal shield is

superficial. The western range of *M. ferrugineus* is from the Perth region southwards to about Bunbury. The great bulk of records come from the Swan Coastal Plain with a few from the western and eastern Jarrah Forest. A collection from south-west of Kojonup in the south-eastern Jarrah Forest represents an outlier. A single aberrant locality record ('Pilbara locality') for a damaged worker is not shown on the map because of its lack of specificity but is highly suspect since it is more than a thousand km north of all other records. The Atlas of Living Australia has an ancient record from Stradbroke Island in QLD, but this is undoubtedly a misidentification, and the ant is almost certainly confined to this State. This species has been found on both lateritic and white soil, including sandplain, and with a variety of vegetation associations including *Banksia attenuata* and *Melaleuca leuropoma*, *Banksia/Agonis* woodland, jarrah/marri woodland and a vegetated dune. Nests are in open soil and gravel has been mentioned as a substrate. *Meranoplus* sp. JDM 267 has a very similar distribution pattern to *M. ferrugineus* and occurs sympatrically with it in a number of localities in and around the Perth region, but it has also been gathered near the Capes and on the western south coast. Like its close relative, this ant is likely to be confined to this State. Vegetation notes on labels suggest this species prefers heathland, with *Banksia* open woodland with *Adenanthos* understorey and *Banksia/Allocasuarina* sandplain being vegetation associations mentioned. White quartz sand, or grey sand over yellow sand are the recorded soil types.

Meranoplus sp. JDM 1268 is distinctively bicoloured, with brown foreparts and a yellow gaster; the other four species in this cluster are concolorous or bicoloured, but if bicoloured then the gaster is darker than the mesosoma. There is only one record from local holdings, collected in the Carson escarpment in the Kimberley over 30 years ago. The worker was captured in rainforest, but nothing more is known about the species although its range can reasonably be presumed to extend to the NT. *Meranoplus* sp. JDM 866 is a southern analogue to the northern *M. mjobergi* and is probably closely related as a sister species. Seen in dorsal view, the worker has elongated posterior angles to the promesonotal shield that extend beyond the posterior lamella of the shield by ≥ 1.5 × their width across their base, and these angles are incurved. The posterior angles each also contain an elongate fenestra. In *Meranoplus fenestratus*, *M. mjobergi* and *M. pubescens* the posterior angles of the promesonotal shield, seen in the same view, extend beyond the posterior lamella of the shield by ≤ 1 × their width across their base, and these angles are not incurved. Fenestrae are present or absent within the posterior angles. *Meranoplus* sp. JDM 866 occurs from the eastern edge of the Jarrah Forest subregion into the Avon Wheatbelt and also in the Kwongan north of Perth, but it has not been collected in the wetter south-western tip of WA. The occurrence of the species elsewhere in Australia is unknown. This small forager ascends tree-trunks and has been collected in an intercept trap set on the trunk of a wandoo, but nothing more is known of its habits. However, it is not uncommonly seen in pitfall-trapped ant samples taken within its range. The thick, rectangular petiolar node that is wider than long and has a flattened dorsal surface is the chief character that can be used to set *M. fenestratus* apart from *M. mjobergi* and *M. pubescens* (the latter have a much thinner squamiform or cuneate node). In addition to this, the frons of *M. fenestratus* is largely free of distinct sculpture except for areolate-rugose areas on the occipital corners, contrasting with the pronounced longitudinal striolae seen in *M. mjobergi* and *M. pubescens*. *Meranoplus fenestratus* has chiefly been recovered from drier areas of the SWP east and north of Perth, and extends into the eastern goldfields, but there are records from Barrow Island, much further north. In all likelihood the range of the ant is continuous along the mid-western and Gascoyne coasts. The species also nominally occurs in NSW, the NT, SA, and QLD, but these records, particularly from northern sites, need to be verified due to the likelihood of this ant being confused with the very similar *M. pubescens*, which has a more northerly distribution. As evidence of the need for caution, the worker specimen assigned the unavailable quadrinomial *Meranoplus pubescens fenestratus christmasensis* (described from QLD), which is incorporated in AntWeb under *M. fenestratus*, appears to be *M. pubescens*. The species has been found in wandoo woodland. One sample of *M. fenestratus* collected in SA was taken from a eucalypt tree, but this ant is recorded as a soil nester, sometimes under cover (such as a strip of bark used by a colony collected south-east of Brookton).

In profile, the posterior face of the postpetiole in *M. pubescens* is distinctly emarginate, its dorsal face overhanging the posterior face as a sharp lip; in full-face view, the frons is weakly striolate with other, microreticulate sculpture evident. In profile, the posterior face of the postpetiole in *M. mjobergi*, on the other hand, is more-or-less vertical; in full-face view, the frons of the latter

species has mostly regular, longitudinal striolae with other sculpture largely effaced. *Meranoplus mjobergi* has a range in WA that extends from the Pilbara to the northern Kimberley. Elsewhere, this species has been recorded from QLD (and almost certainly also occurs in the NT) and its range extends to Papua New Guinea. Schödl (unpubl. label data) regarded WA specimens held in the WAM as a related species, possibly on account of the slightly thicker node in the worker type material, but an examination of syntype images featured on AntWeb shows the latter to be very much like Schödl's 'sp. 25'. A further worker, collected from Lennard River Crossing has been placed in Schödl in a third species, namely 'sp. 24a', undoubtedly because of its long setae; the morphology of this ant, however, is identical with that of 'sp. 25'. Moreover, the tendency of some populations of wide-ranging *Meranoplus* species to exhibit different pilosity patterns that appear to reflect infraspecific variation has already been noted. The specimen from Lennard River Crossing was collected in a window trap in tussock grass savannah. Specimens collected from Barrow Island were taken in a 5-day pitfall trap. Other data are lacking. In WA, *M. pubescens* is restricted to the Kimberley. The type material for the species was likely collected when the NT was governed by NSW in the mid nineteenth century, thus the collection locality of 'Adelaide NSW' is probably Adelaide River in the NT (and not 'Adelaide, SA' as shown on AntWeb). This species also occurs in QLD. Records from NSW and Vic (Atlas of Living Australia) are less certain. No biological data have been recorded for this species.

The residue of the WA *Meranoplus* (37 species, 30 of them undescribed) comprises a separate clade, the *M. dimidiatus* species-group. These species have a varied morphology but share a common clypeal conformation that presents as a regular hexagon projecting beyond the frontal lobes and, while it may be curved posteriorly, this projection is not folded back as in the case of the *M. fenestratus* species-group (where the anterior clypeal margin is often hidden). In most cases the sides of the projecting clypeus are convergent towards its anteromedial margin, which may be excavate (as in *Meranoplus* sp. JDM 988) or straight and with or without small denticles at its angles (most species). In two species; namely, *Meranoplus* sp. JDM 988 *and Meranoplus* sp. JDM 1378, the clypeus projects only slightly beyond the apices of the antennal lobes and the anteromedial margin is broad and its width is much more than half the distance between the frontal lobes; in the other species the projection is more accentuated and the width of the anteromedial margin is equal to approximately half the distance between the frontal lobes. All members of this clade, even those with extensive laminiform development elsewhere on the body, have relatively narrowly separated frontal carina, such that the eyes are always completely visible when the ant is seen in full-face view. This situation contrasts with the appearance of workers of the *M. fenestratus* species-group is which the eyes are often partially or fully obscured by the relatively widely separated frontal carinae. All members of the *M. dimidiatus* species-group also have at least reticulated and more commonly areolate sculpture on the head and promesonotal shield, and these surfaces are never smooth as they are in around half of the *M. fenestratus* group taxa.

Although various researchers (e.g. Andersen and Schödl) refer to a number of these species and their non-WA representatives as constituting a species-group they call the *Meranoplus hirsutus* species-group, their aligning of widely occurring WA *Meranoplus* material with that group of ants is doubtful, as the clade may not occur here, or, if it does, it includes only a small number of species from the far north of the state. An Australian *Meranoplus* described earlier than *M. hirsutus*, namely, *Meranoplus dimidiatus*, however, shares the diagnostic features of the clade, although this ant and its near relatives also share unique features among themselves. Notwithstanding that *M. dimidiatus* is treated as a distinct species-group by the two authors mentioned, the synapomorphies within the *M. dimidiatus* clade appear to this author to represent a lower evolutionary level. For this reason, *M. dimidiatus* and its near kin are regarded as a species complex here, while they and the rest of the taxa in the more inclusive clade form the *M. dimidiatus* species-group.

The *M. dimidiatus* species-group is currently perhaps taxonomically speaking the most poorly known larger clade of ants in this country. Most undescribed Australian *Meranoplus* belong to this clade, and undoubtedly this group will expand as the WA M*eranoplus* fauna becomes better known — hopefully, through a properly integrated modern revision in the not too distant future. Within this species-group, *Meranoplus dimidiatus* and its relatives form a reasonably well-attested species complex (in the sense understood here), as do the *M. froggatti* complex comprising *M. rugosus* and its relatives. Other suggestions, such as the placement of the spectacular *M. minimus* and another ant that rivals *M. testudineus* in the development of the promesonotal shield within their own discrete

species-complexes, are more tentative and need robust testing. On the other hand, the author has been unable to erect a discrete grouping for *M. similis* and probable relatives, despite one or two conspicuous features, as their evolutionary radiation appears to be very recent and the notable morphological characters are accompanied by many similarities with other members of the species-group. Thus, *M. similis* and a number of ants of roughly the same appearance are left in the (probably) unresolved grouping here called the *M. puryi* species complex.

Meranoplus minimus superficially resembles some of the members of the *M. fenestratus* species-group in its large, square shield and the relatively widely separated frontal carina that are ridged with lamellae. The narrow, dorsally flattened postpetiole with its overhanging lip also is suggestive of species like *M. oceanicus*. However, the anteromedial clypeal projection betrays its true affinities with the *M. dimidiatus* species-group. Nevertheless, this ant cannot be easily pigeonholed with other taxa within the species-group and is here assigned its own species complex. In WA, *M. minimus* is to be found in east Kimberley and it also occurs in the top end of the NT. The only biological information comes from Crawley (1918), who described the species; he notes that the type workers were collected from a nest indicated by a small hole on a gravel ridge.

Meranoplus sp. JDM 867 is a highly anomalous member of the *M. dimidiatus* group, and the development of large fenestrae and lamellae on the promesonotal shield parallel the same development in *M. testudineus*. The petiole and postpetiole are also somewhat similar, although the ants are unrelated. This species cannot be mistaken for any other and its relatives are unknown; consequently, it is here placed in its own species complex for the time being. A profile and dorsal shot of *Meranoplus* sp. JDM 867 (wrongly labelled as *M. testudineus*) can be seen in Andersen (2006). This is a wide-ranging species that occurs throughout WA's desert regions and into the Kimberley, and most probably extends into the NT. This ant has been hand-collected in low scrub in South Hedland and by pitfall trap in Ethel Creek, but there is no other information on the species. *Meranoplus* sp. JDM 955 is another spectacular, moderately sized *Meranoplus* that may require transfer to an entirely separate species-group when it is properly understood, as its features are unique among the WA *Meranoplus* fauna. This ant has strongly longitudinally costate sculpture on the frons and concentric costulae on the sides of the petiolar node and on both anterior and posterior faces of the node. The posterolateral and posterior angles of the promesonotal shield are long and jaggedly downcurved. The species is known from two workers from the Kimberley, but likely also occurs in the NT. A worker from Ellendale in the Dampierland subregion was collected from a beer trap, presumably in the form of a bucket or bottle hung from the limb of a tree. Another worker from Argyle Diamond Mine was pitfall-trapped. Note: the species is illustrated by photographs in Andersen (2006) labelled '*M. hirsutus*', but his ant is not related to the purported NHM syntype (presumably, now a paralectotype) of *Meranoplus hirsutus* illustrated on AntWeb. Nor does Andersen's '*M. hirsutus*' agree with the lectotype for the species chosen by Taylor (1990) (a separate worker of *M. hirsutus* is illustrated in Taylor [2006]). In his 1876 description of *Meranoplus hirsutus*, Mayr seems to have incorporated type material from two separate taxa, of which the lectotype from Gayndah, QLD, represents the material used in the formal Latin diagnosis of the species, and the AntWeb 'syntype', from Sydney, represents 'small workers' aligned with the species by that author in his general description. While the Sydney 'syntype' appears to fit the diagnosis for the *M. puryi* species complex, the QLD type material in all likelihood belongs to a different species complex, or even species-group — the so-called the '*M. hirsutus* species-group' of Andersen, Schödl, et al. — that is poorly represented in WA, if at all, and any taxa present are likely to be confined to the northern Kimberley. This mainly rainforest-dwelling suite of ants that includes, e.g. *M. hirsutus*, *M. beatoni* and *M. schoedli*, is characterised by a much broader than wide promesonotal shield with large fenestrae.

Meranoplus sp. JDM 1255 is the fourth *Meranoplus* to be placed in a monotypic species complex within the *M. dimidiatus* species-group. The small worker is thickly clothed in downy, plumose, semi-decumbent setae. The promesonotal shield is finely areolate, with just one tiny median fenestra on either side of the shield and a moderate-sized lamella held between two cuticular extensions on the posterior margin of the shield. The clypeus is widely excised and extends only fractionally beyond the apices of the frontal lobes. A robust denticle is positioned on either side of the anteromedial clypeal projection. Costate sculpture in the form of chevrons is present on the posterior face of the petiolar node. Such a combination of features is not paralleled in any other WA *Meranoplus*, although individual characters such as the petiolar sculpture are not uncommon in other northern forms. This ant, represented by a solitary

worker from Chile Creek in the JDM Collection, is, however, also known from more extensive holdings in the TERC Collection. All collections have been from the north-west Kimberley and, given its limited known range, this ant is probably a WA endemic. This species appears to correspond to Group C, Complex A in Andersen (2006). The individual in the JDM Collection was collected just outside monsoon vine thicket.

Among the *Meranoplus* represented by multispecies complexes in WA the *M. froggatti* species complex (comprising *M. rugosus*, *Meranoplus* sp. JDM 677, *Meranoplus* sp. JDM 922 and *Meranoplus* sp. JDM 1101) is relatively easy to recognise by reason of the characteristic hemispherical appearance of the postpetiole when seen in profile (its anterior face declivous and its posterior face evenly curved), and the dentate appearance of the posteromedial projections of the promesonotal shield — and often the posterior angles of the shield as well — when seen in dorsal view. The lateral and posterolateral fenestrae are large to very large in this complex. An additional feature are the small to pronounced flanges at the base of the first gastral tergite that fold narrowly inward to create the U-shaped emargination to receive the postpetiole.

The entire gaster is coarsely sculptured with longitudinal costulae or striate-reticulation in *Meranoplus* sp. JDM 922 and *Meranoplus* sp. JDM 1101. In *Meranoplus rugosus* and *Meranoplus* sp. JDM 677, coarse sculpture is either lacking or is restricted to the anterior sector of first gastral tergite; otherwise the gaster is finely and evenly microreticulate or imbricate. The gaster is striate-reticulate and, in full-face view, the head is moderately shining and has areolate sculpture in *Meranoplus* sp. JDM 922, but in *Meranoplus* sp. JDM 1101 the gaster is longitudinally costate and, in full-face view, the sculpture of the head is matt and microreticulate.

Meranoplus rugosus is a smaller species than *Meranoplus* sp. JDM 677 (HW ≤ 0.90 mm compared with HW > 1 mm) and, seen in rear view, the gaster may have coarse striae on the anterior sector of the first gastral tergite (these are variably developed and may be fine and difficult to discern on some specimens). Coarse striae are never seen in *Meranoplus* sp. JDM 677, in which the gaster is finely and evenly microreticulate with only fine striolae near the base of the postpetiole. In WA, *Meranoplus rugosus* is restricted to wetter parts of the SWP, including the western south coast. Workers from populations in the high rainfall areas of WA's deep south have longer, more plumose setae than those further north although the placement and inclination of the setae is the same (pilosity patterns of this nature are also seen in several other widespread *Meranoplus* species). This ant is particularly common in Perth, where it may be found not infrequently in unkempt yards and gardens, on street verges and in parkland. The difference between this species and the eastern states *M. froggatti* is debatable. Quite understandably, *Meranoplus rugosus* and its allies are referred to as 'the *M. froggatti* group' by Andersen (2006), and the image for *Meranoplus froggatti* Forel, described from Victoria, indicates that this species clearly belongs to this species complex, and may indeed be identical with *M. rugosus*. Andersen (2006) separates them purely based on a dark macula on the promesonotal shield in *M. froggatti* that is pale or lacking in *M. rugosus*. However, enough doubts exist that I would need to see the type material before deciding on synonymy. This species has a wide preference of a number of different vegetation associations, including *Allocasuarina*, *Banksia* woodland, Tuart woodland and heathland, while workers taken from a nest in Manjimup are likely to have been captured in tall karri, tingle or jarrah forest. Other samples have come from suburban lawns. Soil type mentioned is white quartz sand.

Meranoplus sp. JDM 677 has the broadest range of any of the members of the *M. froggatti* species complex, and is found in the Coolgardie, Gascoyne, Murchison and Gascoyne subregions of the EP, and in the Avon Wheatbelt in the SWP. The occurrence of this and the other two undescribed species in other states is unknown, but, based on their distribution, *Meranoplus* sp. JDM 922 and *Meranoplus* sp. JDM 1101 are likely to be endemic to WA, while *Meranoplus* sp. JDM 677 may have a range that extends across the WA border. Virtually nothing is known about the latter, workers having been collected in pitfall traps or, in one case, as a dry exoskeleton. *Meranoplus* sp. JDM 922 is known from a couple of collections in the coastal mid-west, but one of these is an extensive series from two nests in Wicherina, east of Geraldton. These specimens were captured in mixed *Xylomelum* and *Banksia* heathland over yellow sand. Workers taken at Eneabba were found in mixed low heath. *Meranoplus* sp. JDM 1101 is the *M. froggatti* complex representative found in the Shark Bay region and in the Gascoyne, where it is known from two workers. The worker from Nerren Nerren station was collected in a wet pitfall trap and the worker from Kennedy Range National Park was taken in a dry pitfall trap but, unfortunately, this is all the available information on the species.

The *Meranoplus dimidiatus* complex is another well-attested complex within the *M. dimidiatus* species-group although the characters used to distinguish this complex from other members of the *M. dimidiatus* species-group are mainly subtle (see accumulation of characters in the taxonomic key). In general, these ants may be most easily distinguished by their concolorous dark body or dark foreparts and yellow or orange gaster, the lack of conspicuous fenestrae or laminiform development on the promesonotal shield and the prominence of marginal spines and denticles on the shield, the lack of abundant erect or sub-erect setae on the body and the short nature of the appressed or decumbent setae on the gaster, the narrowly separated, straight frontal lobes that expose both the eye and proximal portion of the antennal scrobe, and features of the petiole and postpetiole. This group of ants is almost untouched by taxonomy, *M. dimidiatus* being the only described species.

When *Meranoplus dimidiatus*, *Meranoplus* sp. JDM 1144 (some workers), *Meranoplus* sp. 1 (TERC) and *Meranoplus* sp. 2 (TERC) are viewed dorsally, the promesonotal shield is seen to lack posterior cuticular protrusions or a lamella between the posterior promesonotal angles. The promesonotal shield in *Meranoplus* sp. 1 (TERC), seen in dorsal view, is a completely entire rectangle that lacks any protrusions or angles to break its symmetry. The propodeal spines in this species are fine and long and distally pale. In the other three species, seen in dorsal view, the promesonotal shield sports at least posterior spines or dentate angles. This species appears to be not uncommon, with most collections being taken at various localities in the Kimberley, but one outlier was found on the Canning Stock Route in the Little Sandy Desert. In all likelihood this ant also occurs in the NT, at least. There are no other data for this or the following species. *Meranoplus* sp. 2 (TERC) appears to be a very rare species, with just one worker in the TERC Collection. The promesonotal shield is striking; the posterior angles are prolonged as straight, elongate spines directed posteriad at 90°. The specimen lacks any lateral cuticular protrusions, and the posterior margin of the shield is broadly and evenly excavate between the posterior spines. This species also has rather large eyes. The solitary worker was collected in Purnululu National Park in the eastern Kimberley.

In *Meranoplus dimidiatus* and a few workers of *Meranoplus* sp. JDM 1144 the posterior angles of the promesonotal shield, in dorsal view, are seen to be developed as blunt denticles or digitate spines directed posterolaterally, and lateral cuticular protrusions on the shield are present. The posterior angles of the promesonotal shield in *M. dimidiatus* are in the form of short, triangular extensions only, their length approximately equal to their width across their base. In *Meranoplus* sp. JDM 1144 the posterior angles of the promesonotal shield are in form of long, blunt, digitate spines that are much longer than their width across their base. *Meranoplus dimidiatus* occurs from about Geraldton on the mid-western coast (the type locality for the species) to the Pilbara, and it also occurs on Barrow Island. The Atlas of Living Australia also records this species from NSW and Vic, and Wheeler & Wheeler (1973) described the larvae of an ant from SA purported to be this taxon, but the likelihood (judging from the distribution of the species in WA) is that the ant(s) discussed in these sources is/are a near relative. There are no label data for this species. *Meranoplus* sp. JDM 1144 (all workers) is known in this state from just three collections from near Yalgoo to the Pilbara and is probably restricted to WA. The Yalgoo material was hand-collected from gravelly soil and from a tree trunk, while the more northern captures were pitfall-trapped. Other information is lacking.

Meranoplus sp. JDM 491 is one of the few members of this complex with a distribution in the wetter parts of south-western WA. The petiolar node and the postpetiole of this very localised species are squamiform and glossy and without sculpture, while the posterior angles of the promesonotal shield extend as long spines that are slightly curved outward at the tip. Other species in the complex have sculpture on at least the postpetiole. For unknown reasons *Meranoplus* sp. JDM 491 appears to be restricted to a few square km on the western Darling Scarp around Bedfordale and Gleneagle Forest and has been found nowhere else. Workers have been pitfall-trapped or hand-collected from nests located under lateritic rocks in jarrah/marri forest. *Meranoplus* sp. JDM 627 is another highly distinctive species with a more typical semi-arid distribution. In the worker, seen in dorsal view, the posterior angles of the promesonotal shield form digitate projections joined by a lamella that stretches continuously between them without being interrupted by posterior cuticular protrusions. In the remaining species in the complex the posterior angles of the promesonotal shield are relatively short and dentate, not digitate, and the posterior lamella (if it exists) is confined to and joins two cuticular protrusions that arise from the posterior promesonotal margin inside the posterior angles.

Meranoplus sp. JDM 627 is widespread and relatively common through the Avon Wheatbelt and parts of the Mallee and Coolgardie subregions, but extends as far north as the Pilbara. The occurrence of this ant interstate is unknown. Many acquisitions of the ant have been made from mallee woodland, but the species has also been captured in sandplain heath. Collections have been made in twig and leaf litter and from the trunks of salmon gums. Soil types mentioned are sandplain and light clay. *Meranoplus* sp. JDM 423 is the species most easily mistaken for *M. dimidiatus*, as the promesonotal shield virtually lacks fenestrae or developed lamellae. This species can be distinguished from the very similar *Meranoplus* sp. JDM 1071 and *Meranoplus* sp. JDM 1144 (i.e. those workers with cuticular extensions on the posterior margin of the promesonotal shield) by the relatively long appressed and erect setae on the gaster (appressed setae slightly overlapping and erect setae longer than the length of the eye, versus appressed setae well-spaced and not overlapping and erect setae shorter than the length of the eye in the other two species). *Meranoplus* sp. JDM 423 tends to have has a rather more westerly range than *Meranoplus* sp. JDM 627 and has mostly been collected on the Geraldton Sandplains as well as the Avon Wheatbelt and Mallee. However, a couple of WAM series taken on Mundrabilla Station, on the southern edge of the Nullarbor, leads one to suppose the range of this ant extends at least into SA.

In dorsal view, the promesonotal shield in *Meranoplus* sp. JDM 1071 is laterally and posteriorly weakly laminiform, the propodeal spines short and dentate; also seen in dorsal view, the postpetiole is an inverted triangle. In the residue of workers of *Meranoplus* sp. JDM 1144 the promesonotal shield, seen in dorsal view, lacks laminiform development on its lateral and posterior margins, the propodeal spines are long and digitate, and the postpetiole is globose. What is known about *Meranoplus* sp. JDM 1144 is discussed above. *Meranoplus* sp. JDM 1071 is only known from four series but has a very broad range in both moist and semi-arid habitats, where its most southerly record is from the Worsley Alumina development deep in the Jarrah Forest and its most northerly record is from the Marillana mine in the Pilbara. The species has also been recorded from the Shark Bay region and Durokoppin Nature Reserve in the Avon Wheatbelt. Specimens have all been pitfall-trapped and nothing more is known about this ant.

Meranoplus sp. 4 (TERC) is a small, dark, *Meranoplus* of unknown affinities, although its widely rectangular promesonotal shield may place it somewhere near the *M. hirsutus* clade. The wide shield, together with the small, enclosed fenestrae on the sides (which lack any cuticular protrusions) and a continuous posterior lamella on its rear margin, the coarsely areolate sculpture, and the narrowly rectangular petiolar node and squamiform postpetiole make this species easy to recognise. This ant is known from two workers from the west Kimberley, but there are no other details.

The remaining 20 species are here consigned to the *M. puryi* species complex, although this may prove to an unacceptably miscellaneous assemblage on more rigorous investigation. However, all these ants are united in the following characters: they are mostly yellowish or orange (although the head may be darker); the fenestrae of the promesonotal shield are often developed and distinct; abundant non-marginal erect and/or decumbent setae are often present on the promesonotal shield, these being light in colour; appressed and decumbent setae on the gaster are light in colour (except in some specimens of *Meranoplus* sp. JDM 623) and often thickly overlapping to form a fine pubescence (dark specimens in the *M. puryi* complex with reduced fenestrae and lamina are always hairy with pale setae); in full-face view, the frontal carinae are usually gently sinuate and may have laminae; in profile/rear view, the petiole is always sculptured, often with costulae or reticulation on its rear face, and the postpetiole is usually about as high as wide, and rounded and never an inverted triangle in dorsal view.

As with the *M. dimidiatus* species complex, the members of the *M. puryi* complex are largely undescribed (16 out of 20 species). While many of these ants have a sameness about them that makes them hard to differentiate, apart from those with extensive promesonotal lamellae and large fenestrae, two small desert species; namely, *Meranoplus* sp. JDM 988 and *Meranoplus* sp. JDM 1378, are easily distinguished due to their broad, weakly projecting anteromedial clypeal sector. The former, in dorsal view, has the posterior margin of the promesonotal shield consisting of a continuous lamella, without spinous protrusions of any sort; cuticular angles are weak or absent on the lateral margins of the shield and the anteromedial clypeal projection is broadly excavate between two stout denticles. The latter ant, in dorsal view, has the posterior angles of the promesonotal shield developed as small, lamellate spines; cuticular angles are also present on the lateral margins of the shield and the anteromedial clypeal projection is more-or-less planar. *Meranoplus* sp. JDM 988 has

been found in a couple of adjoining localities in the Great Victoria Desert and on the western fringe of the Little Sandy Desert. This species has something of the appearance of *M. similis* (although it is not hairy as in the latter) and shares a similar shape of petiolar node, and the two species may be related. Workers have been pitfall-trapped but there are no other data. *Meranoplus* sp. JDM 1378 is known from a single series collected east of Wiluna in the Murchison and appears to be closely related to *Meranoplus* sp. JDM 673, despite the difference in the appearance of the anterior clypeal margin. The reniform eye bolstered by cuticle on its outer edge is distinctive in both taxa. The occurrence of these ants in other states is unknown. *Meranoplus* sp. JDM 1378 was placed in the *M. hirsutus* group by Schödl but is not near that group of *Meranoplus*. Nothing is recorded on the labels apart from basic collection data.

In *M. similis* and six other species, of which at least some may be closely related to *M. similis*, the promesonotal shield, in dorsal view, is flat and square with extensive laminiform development on its lateral and posterior margins, the posterior lamina sports a broad membrane, and the posterolateral cuticular protrusions are not conspicuously enlarged. In profile, the petiolar node is characteristically thickly squamiform to narrowly trapezoidal (except in *Meranoplus* sp. JDM 1107 in which it is low and triangular), with a declivous anterior face and a sinuous posterior face, and often both petiole and postpetiole have extensive rugose or costulate sculpturing. In the remaining eleven species the promesonotal shield, in dorsal view, is variable in appearance but is commonly circular and dorsally rounded or trapezoidal and broadest at the humeral angles without extensive laminiform development as described above. The posterior lamina is often confined to a membrane between two cuticular protrusions within the posterior angles of the shield, and lateral lamellae are reduced. Posterolateral cuticular protrusions are usually conspicuously broadened and often extended as dentate processes that are both broader and longer than the posterior angles of the shield. In profile, the petiolar node is low and thick and bluntly wedge-shaped above, and frank costulate sculpture, when present, is confined to the posterior face of the petiolar node.

In *Meranoplus* sp. JDM 1276, in rear view, both the petiolar node and the postpetiole have nested, concentric costulae. In other species in this cluster, in rear view, costulate sculpture on the rear face of the petiole, if present, is in the form of chevrons or longitudinal ribs, and the sculpture of the postpetiole is also not as above. Western Australian specimens seen (TERC) have all come from the eastern Kimberley, but the ant also occurs in the NT (WAM holdings). Apart from basic collection data no other details are available. *Meranoplus* sp. JDM 1025 is known from a single worker. In this taxon, when seen in profile, the postpetiole is narrow and squamiform and, in full-face view, this body part is trapeziform and widest across its dorsal margin, the angles being bluntly acute. Related forms, when seen in profile, have a postpetiole that is roundly rectangular or hemispherical and not as above. *Meranoplus* sp. JDM 1025 is evidently a desert species, having been collected at the edge of the Little Sandy Desert, SSE. of Newman. The solitary specimen was collected by means of a permanent pitfall trap set on a sand dune. The rear face of the petiolar node in *Meranoplus* sp. JDM 865 has costulate sculpture in the form of chevrons nested within one another. The sculpture of the rear face of the petiolar node in *Meranoplus similis, Meranoplus* sp. JDM 1107, *Meranoplus* sp. JDM 1145 and *Meranoplus* sp. 4 (TERC) is reticulate, weakly costulate, longitudinally costulate or a mixture of the three, but not in the form of chevrons. This northern species has been found in the eastern Kimberley, Broome and Barrow Island, and its range probably extends to the NT. The Barrow Island specimens were collected by hand at night and by suction trap respectively. The Broome worker was hand-collected in low coastal scrub on red soil.

The sculpture of the petiolar node in *Meranoplus* sp. 3 (TERC), seen in profile/rear view, consists mainly of deep costulae in the form of parallel, longitudinal ribs. The sculpture of the petiolar node in *Meranoplus similis*, *Meranoplus* sp. JDM 1107 and *Meranoplus* sp. JDM 1145, seen in profile/rear view, consists of a mixture of costulae and rugose reticulation (*M. similis*) or weakly defined striae and microreticulation (*Meranoplus* sp. JDM 1107 and *Meranoplus* sp. JDM 1145). The anterior angles of the gaster are lamellate. *Meranoplus* sp. 3 (TERC) has been found in Beagle Bay in the western Kimberley and may be endemic to WA. The specimen seen was collected (probably by pitfall trap) as part of a Kimberley fire project. This species has a very strong similarity to *M. similis* and may be a northern counterpart of that southern species. *Meranoplus* sp. JDM 1107, seen in profile, has a low triangular petiolar node compared with the high, trapezoidal petiolar node seen in *M. similis* and *Meranoplus* sp. JDM 1145. The promesonotal shield in *Meranoplus* sp. JDM 1107, while still lamelliform, is less developed than

in the other two species, while the eye is rather large and the anteromedial clypeal margin is narrow and strongly projecting (broader and less projecting in *M. similis* and *Meranoplus* sp. JDM 1145, for instance). These characters, together with the shape of node, strongly suggest the affinities of this medium-sized species lie with *Meranoplus* sp. JDM 673, a very common and widespread ant in the southern half of the State. *Meranoplus* sp. JDM 1107 is only known from a few collections but appears to have a broad distribution in WA's semi-arid areas and may also occur in the NT and SA. Specimens have been collected in the eastern and northern goldfields and in the Pilbara. Workers and dealate queens were hand-collected at night near Westonia, in the eastern goldfields, in *Acacia/Hakea* shrubland over *Plectrachne* ground cover.

The well-known *Meranoplus similis* can be distinguished from *Meranoplus* sp. JDM 1145 by its smaller eye (EL ≤ 0.25 × length of side of head capsule compared with EL ≥ 0.30 × length of side of head capsule) and its general hairiness (*Meranoplus* sp. JDM 1145 being much less hairy with only a few short, erect setae compared with many long, erect setae in the former). In WA, *Meranoplus similis* is confined to the SWP, where most collections have been taken from the Swan Coastal Plain. Collections have also been made at Durokoppin Nature Reserve in the Avon Wheatbelt. However, the taxon was described from material collected in Killalpaninna in SA's far interior. This species prefers to establish colonies on sandy soil. Specimens have been collected in *Banksia/Agonis* woodland and in wooded sandplain. This ant is occasionally found in sandy soils with relictual native vegetation at suitable sites in the heart of suburban Perth, one series being collected in Mosman Park on sand amid exotic weeds and a few native shrubs. *Meranoplus* sp. JDM 1145 is another ant that looks a lot like *M. similis*, apart from the features mentioned above, and is likely closely related to that better-known species. Just a handful of workers are known, all collected at or near Lake Lefroy near Kambalda in the eastern goldfields. They were collected by pitfall trap but nothing more can be said about them.

The remaining 11 taxa are a hodgepodge, being united only in sharing the following characters: in dorsal view, the promesonotal shield is variable in appearance, but is commonly circular and dorsally rounded, or it may be trapezoidal and broadest at the humeral angles but it always lacks the extensive lamelliform development described above; the posterior lamella is often confined to a membrane between two cuticular protrusions within the posterior angles of the shield, and the lateral lamellae are reduced; posterolateral cuticular protrusions are usually conspicuously broadened and often extended as dentate processes that are both broader and longer than the posterior angles of the shield (especially seen in *M. curvispina* and a few relatives); fenestrae are small and may be vestigial; in profile, the petiolar node is low and thick and bluntly wedge-shaped above; and frank costulate sculpture, when present, is confined to the posterior face of the petiolar node. Several forms, most notably *M. aureolus* and *M. curvispina*, are highly variable and are probably small species complexes that are intractable to morphological analysis alone.

Meranoplus sp. JDM 889 (possibly two species) has distinct, longitudinally costulate sculpture on the posterior face of the petiolar node. The posterior face of the node is otherwise sculptured in the remaining 10 species. This little ant, here recognised only from two workers from widely separated localities, appears to belong to the *M. curvispina* cluster and shares several similarities with *M. curvispina*. The worker from Argyle Diamond Mine in the eastern Kimberley has a flattened promesonotal shield and is bicoloured dark-brown-and-yellowish, while the worker from Pannawonica in the Pilbara has a dorsally convex promesonotal shield and brownish-orange head and orange mesosoma and metasoma. Nonetheless, the sculpture, the nodes and the development of the margins of the promesonotal shield are very similar, and the balance of probabilities is that the two specimens merely represent biogeographical variation within the same species. Given its occurrence in the eastern Kimberley, the range of this taxon probably extends into the NT, at least. The two workers were pitfall-trapped, but nothing more is known about them. *Meranoplus* sp. JDM 931 is a striking little bicoloured brown-and-yellow ant that is found in the Kimberley. The occurrence of this animal interstate is not known. This species has several apomorphies, namely; in full-face view, the anteromedian clypeal margin is broadly excavate between pronounced clypeal teeth; in profile, the sides of the petiolar node are furrowed with coarse rugae; and gaster also has longitudinally striate sculpture that may be shallowly or deeply impressed. The specimen from South-west Osborne Island is part of a collection of 'Rainforest Ants', but the pitfall-trapped ant from Ellendale seems to have been taken in savanna (based on Google Maps). No additional data are available.

The tiny *Meranoplus* sp. JDM 674 is another distinctive species, notable for its minute size (HW < 0.70 mm), its very large, bug eye (EL ≥ 0.50 ×

length of side of head) and its compact, rounded promesonotal shield that lacks distinct lamellae or fenestrae. Similar-sized ants have a smaller eye (EL ≤ 0.35 × length of side of head) and lamellae, although variably developed, are always present. *Meranoplus* sp. JDM 674 is widespread through arid areas of the state and there is biogeographical variation evident, specimens from the Pilbara having longer spines on the margins of the promesonotal shield and areolate or microreticulate development at the base of the gaster, whereas workers from the eastern goldfields have shorter promesonotal spines and more-or-less evenly shagreenate gasters. The species likely occurs elsewhere in arid Australia. These diminutive ants are not uncommon in pitfall samples, but there are no specific label data for them.

Two very small species share a promesonotal shield that, seen in dorsal view, has the posterior angles of the promesonotal shield weakly forked. These latter may extend as nubs that are often indistinguishable from the surrounding posterior lamella, or else the anterior fork protrudes as a sharp, lamelliform angle only that barely extends beyond the posterior lamella. In *Meranoplus curvispina*, *Meranoplus linae*, *Meranoplus* sp. JDM 673, *Meranoplus* sp. JDM 967, *Meranoplus* sp. JDM 1133 and *Meranoplus* sp. JDM 1377 the posterior angles of the promesonotal shield are prominent as dentate or digitate spines that extend well beyond the posterior margin of the promesonotal shield (the lamella generally being reduced to a membrane stretched between two cuticular protrusions within the propodeal angles).

Meranoplus aureolus, as discussed here, is quite possibly a species complex. The distinctive characters are: a shining metasoma (nodes and gaster); seen in profile, erect setae present and usually numerous on the mesosoma; the gaster with mainly fine, even microreticulate sculpture although a few faint striolae may be visible near the postpetiole; and, seen in dorsal view, a promesonotal shield that is trapezoid and broadest across the humeri. (The generally similar *Meranoplus* sp. JDM 1146 has a metasoma that is matt; erect setae are virtually lacking on the mesosoma; the gaster has feeble and indistinct areolate sculpture overlying microreticulation; and, seen in dorsal view, the promesonotal shield is more-or-less square.) Tawny brownish-orange or brown WA workers with a paler gaster seem to closely approximate the syntype of *Meranoplus aureolus*, although the petiolar node, seen in profile, is fractionally thicker in the type material described by Crawley and illustrated on AntWeb. The median fenestrae are reasonably large and the posterior lamella is well-developed. More commonly seen is a yellow to tawny yellow form (the head may be a little darker) in which the median fenestrae are reduced to a small to vestigial membrane that is not enclosed, and the posterior lamella is also narrower in some specimens but in others it is large and gives the promesonotal shield the appearance of a longitudinal rectangle (the shield is trapezoid in brown *M. aureolus* and in lighter-coloured forms with a reduced posterior lamella). In workers from mid-western WA the postpetiole tends to be flattened above, but in specimens from other sites in the state the postpetiole is generally convex above. A single bright yellow worker from Eneabba has a developed lamella around the entire promesonotal shield, a shortish anteromedial clypeal projection with two distinct denticles on either side of a fine anterior lamella (the projection is longer and the anteromedial margin is indistinctly lamellate or crenulate in its colleagues), a marked anteroventral postpetiolar process (lacking in other workers from the mid-west of the state), a thick petiolar node, a distinctly flat postpetiolar dorsum and an anterodorsal postpetiolar lip although, in other respects, it appears to conform to the general appearance of the paler form of the ant. Such is the degree of variability in colour and morphology, however, that no distinct features can be extracted from the large amount of material available that would satisfy the erection of separate morphological species. The Eneabba worker has the best claim to being pulled out of this ruck of nondescript specimens, but more material is needed to see if the features mentioned above vary at all. *Meranoplus aureolus* has been collected mainly from the west of this state as far north as the eastern Kimberley and in WA's deep south-east as far east as Madura. This ant was described from the NT, and such is its general ubiquity in the NT and WA that other purported records from NSW and QLD (Banks Island in the Torres Strait) listed in the Atlas of Living Australia are perfectly credible. The species probably can also be found in SA. JDM and WAM records indicate this ant likes to nest in white sand, with label data indicating vegetation associations as mixed *Xylomelum* and *Banksia* heath and also *Banksia* woodland. Specimens have been hand-collected, taken in an intercept trap on a wandoo trunk, separated out in a Tullgren funnel, and collected in pitfall traps. The type material came from a nest indicated by a small hole on a gravel ridge. The entrance hole was not accompanied by a mound or crater (Crawley 1921). *Meranoplus* sp. JDM 1146 is known only from a single worker from Ethel creek in the Pilbara — just one of very many formicid singletons collected by Ms Philippa Varris in her

Master's Research project in this location in the mid-1990's. No other data are available for this ant.

Meranoplus linae is yet another small (HW ~0.6 mm), nondescript species although it is somewhat larger than *M. aureolus*. The posterior angles of the promesonotal shield of this little brown northern species, when viewed from above, are seen to be dentate and about 1.5 × long as the posterolateral cuticular extensions above them, the former directed at an angle ≥ 60° to the horizontal plane; fenestrae (if present) are reduced to a tiny median window midway along the lateral margin of the promesonotal shield, and a small lamina between two cuticular extensions inside the posterior angles of the promesonotal shield. In the case of the remaining five species in this morphological cluster the spines formed by the posterior promesonotal angles, when seen in dorsal view, are directed posteriad at an angle ≤ 45° to the horizontal plane, or the ant is tawny orange with more developed fenestrae and larger in size (HW ≥ 0.70 mm). *Meranoplus linae* is recorded in this State from Ethel Creek in the Pilbara and from Argyle Diamond Mine in the eastern Kimberley. The species was described from QLD, and undoubtedly also occurs in the NT. Western Australian workers have been collected by pitfall trap but there are no biological data associated with them.

Meranoplus sp. JDM 967 is similar to the above, in that the posterior angles of the promesonotal shield are directed posteriad at an angle ≥ 60° to the horizontal plane, the posterior angles in the other four ants being directed posteriad at an angle ≤ 45° to the horizontal plane, these spines being thin and digitate. (The spines at the posterior angles are also long and digitate in *Meranoplus* sp. JDM 1377, but they are more obliquely slanted and the ant is differently coloured.) This attractive ant, which has tawny brownish-orange foreparts and a light orange gaster, is restricted to the south coast of WA, and thus far has only been taken at three localities between Jerramungup and Esperance. The occurrence of this species outside of WA is not known. The specimens from Monkey Rock and Coramup Creek were hand-collected in woodland or heathland, but no biological data have been recorded on the labels. Two workers collected in the Fitzgerald River National Park were collected on the ground. *Meranoplus* sp. JDM 1377 is unusually dark for a member of the *M. puryi* species complex in that most populations are coal-black or black-and-orange. This feature alone is sufficient to distinguish the species from its relatives, but the long, digitate, posterior spines on the promesonotal shield are also a helpful character, the spines in *M. curvispina*, *Meranoplus* sp. JDM 673 and *Meranoplus* sp. JDM 1133 being dentate and usually quite short. This species seems to be very localised, all of the many collections in WAM coming from Denmark, on the south coast. The ant is likely to be restricted to a particular habitat in this high rainfall area and its occurrence in other Australian states is highly improbable. Few data have been recorded on labels, although some ants have been collected at night. An anthocorid bug is mounted with one worker along with the notation 'inquilines' (presumably the bug was taken from a nest of the ants). The widespread, common and rather variable *Meranoplus* sp. JDM 673 is separable from *Meranoplus curvispina* and *Meranoplus* sp. JDM 1133 by its larger, reniform eye (EL ≥ 0.30 × side of head, compared with EL < 0.30 × side of head), and larger, more developed lateral fenestrae on the promesonotal shield (up to two on each side), these being much reduced or even absent in the latter two species. Pilosity in this species can vary markedly along a cline, from many short, bristly and dark erect setae in some southern populations to mainly appressed or decumbent setae of a fine, pale, filamentous appearance in some northern populations (see species taxonomic key in Part I). *Meranoplus* sp. JDM 673 occurs widely throughout the Kwongan and Avon Wheatbelt and also the eastern goldfields but only occurs on the eastern margin of the Jarrah Forest subregion. Single outliers have been found at Ethel Creek in the Pilbara (as is the case for so many other ants), and also on the western edge of the Great Victoria Desert. In all likelihood this species also occurs in SA, but this has not been verified. Vegetation associations mentioned in labels include saltbush/

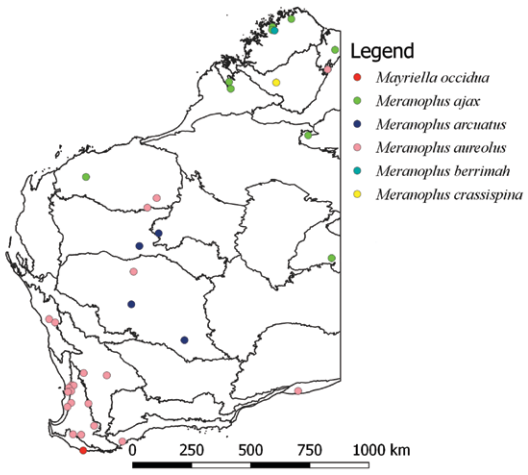

FIGURE 118 Distribution of *Mayriella occidua*, *Meranoplus ajax*, *Meranoplus arcuatus*, *Meranoplus aureolus*, *Meranoplus berrimah* and *Meranoplus crassispina*.

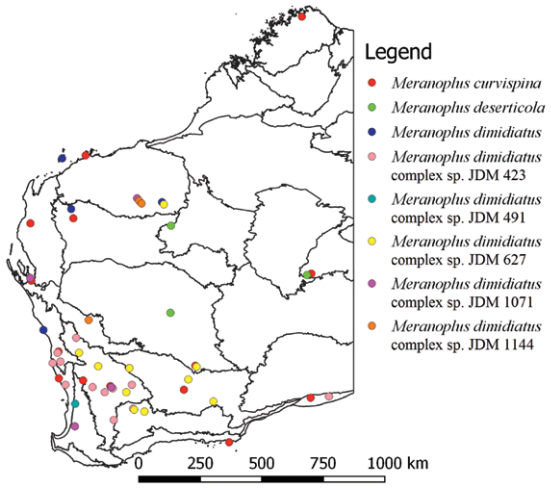

FIGURE 119 Distribution of *Meranoplus curvispina*, *M. deserticola, M. dimidiatus* and *Meranoplus dimidiatus* complex sp. JDM 423, JDM 491, JDM 627, JDM 1071 and JDM 1144.

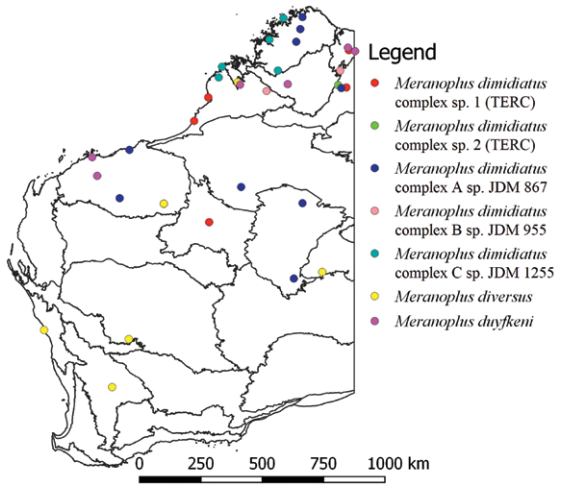

FIGURE 120 Distribution of *Meranoplus dimidiatus* complex sp. 1 (TERC), 2 (TERC), *Meranoplus dimidiatus* complex A sp. JDM 867, *Meranoplus dimidiatus* complex B sp. JDM 955, *Meranoplus dimidiatus* complex C sp. JDM 1255, *Meranoplus diversus* and *M. duyfkeni*.

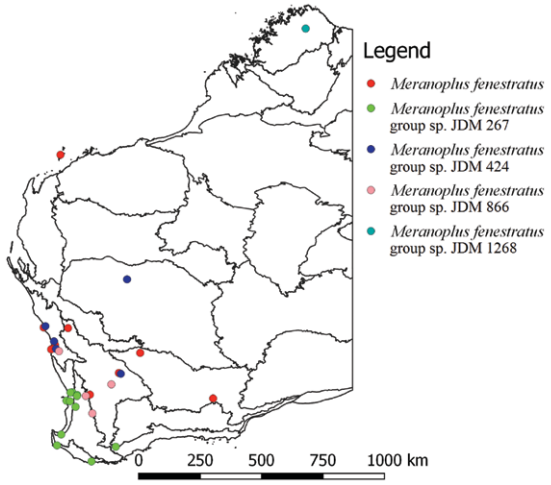

FIGURE 121 Distribution of *Meranoplus fenestratus* and *Meranoplus fenestratus* group sp. JDM 267, JDM 424, JDM 866 and JDM 1268.

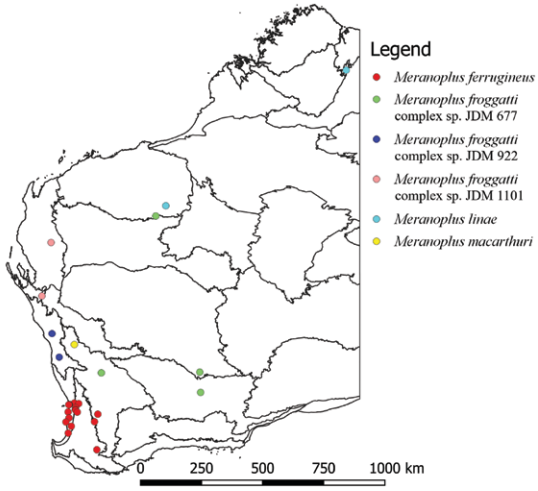

FIGURE 122 Distribution of *Meranoplus ferrugineus*, *Meranoplus froggatti* complex sp. JDM 677, JDM 922 and JDM 1101, *M. linae* and *M. macarthuri*.

mallee remnant, road verge heath remnant, mallee woodland/*Allocasuarina* thicket and open woodland. Specimens have been collected in small country towns at a caravan park (Mukinbudin) and at the base of street trees (Goomalling). A nest at a historical reserve in Nanning Well, near Kellerberrin, was made in sand over lateritic gravel.

Like *Meranoplus aureolus*, *Meranoplus curvispina* is likely a small species complex, but, as with the former ant, the taxonomic boundaries are unclear morphologically because of the degree of variability. Schödl (2004) examined this species in relation to *Meranoplus puryi* (not identified in WA), but limited the scope of his paper to these two taxa, leaving a broader revision for a later date. Unfortunately, he did not live to complete that revision. In the broad sense, the taxon has the following characters: seen in dorsal view, the outline of the promesonotal shield is trapezoid and widest across the humeri; also in dorsal view, the spine formed by the posterior angle of the promesonotal shield is often slightly to moderately shorter than the lateral spine directly above it, the latter is often also distinctly broad and conspicuous; and, seen

in dorsal view, the promesonotal shield is coarsely reticulate. *Meranoplus* sp. JDM 1133, when seen in dorsal view, has a more-or-less square outline to the promesonotal shield which, if anything, is slightly wider posteriad; also, in dorsal view, the spine formed by the posterior angle of the promesonotal shield is distinctly thick and longer than the lateral spine directly above it; and, seen in dorsal view, the promesonotal shield is finely areolate. Western Australian ecotypes of *Meranoplus curvispina* in local holdings can be characterised as follows:

1. Typical ecotype: the posterolateral spine of the promesonotal shield is downcurved and notably longer than the denticle formed by the posterior angle of the shield, and the propodeal spines are noticeably long and curved; orange (this form agrees closely with the lectotype imaged on AntWeb) — Black Swan Mine (north-east of Kalgoorlie), Calingiri, Durokoppin Nature Reserve, Madura, Minilya Station.
2. Mid-western ecotype (Schödl 'sp. 49'): the posterolateral spines are represented by a short, broad denticle that barely extends beyond the lamella on the side of the shield and is approximately the same size as the posterior spines; the propodeal spines are short, thick and only weakly curved; light orange — Lancelin, Nanga Station.
3. Gascoyne and Pilbara ecotype (Schödl 'sp. 48'): the shield virtually lacks fenestrae and lamella, the posterolateral spine is large, dentate and straight and the propodeal spines are long and barely curved at just the very tip; this form is darker than 1 and 2 and brown to dark brown in colour with a paler gaster —– Barlee Range, Enderby Island.
4. Northern Kimberley ecotype: very small, with indistinct protrusions and lamellae on the sides of the promesonotal shield; brown with a paler gaster — King Edward River.

Local material for ecotypes 1–3 has not been taken in sympatry, and visible differences seem to revolve mainly around minor degrees of development of the margins of the promesonotal shield, the propodeal spines and colour, rather than discrete 'either-or' characters. Moreover, the pinned material for 3 presents only one colour morph of this northern morphospecies, and the author has also seen orange workers with the larger spines. In his view 1, 2 and 3 most likely represent different populations of the same species whose morphology coalesces in areas where they come together. On the other hand 4 may well represent a separate, though related

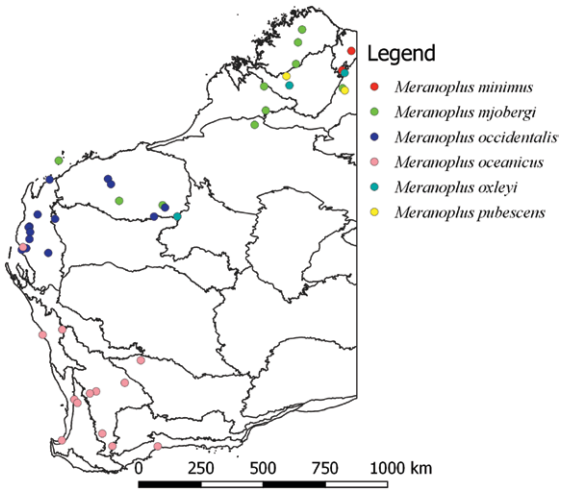

FIGURE 123 Distribution of *Meranoplus minimus*, *M. mjobergi*, *M. occidentalis*, *M. oceanicus*, *M. oxleyi* and *M. pubescens*.

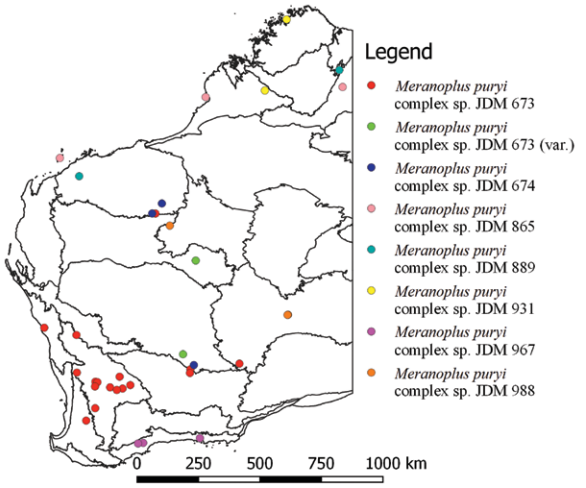

FIGURE 124 Distribution of *Meranoplus puryi* complex sp. JDM 673, JDM 673 (var.), JDM 674, JDM 865, JDM 889, JDM 931, JDM 967 and JDM 988.

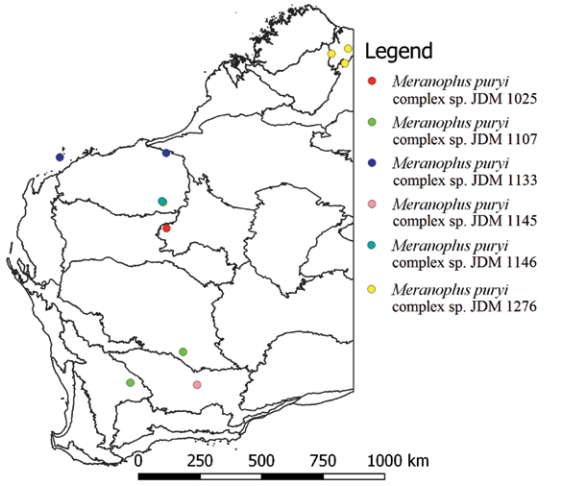

FIGURE 125 Distribution of *Meranoplus puryi* complex sp. JDM 1025, JDM 1107, JDM 1133, JDM 1145, JDM 1146 and JDM 1276.

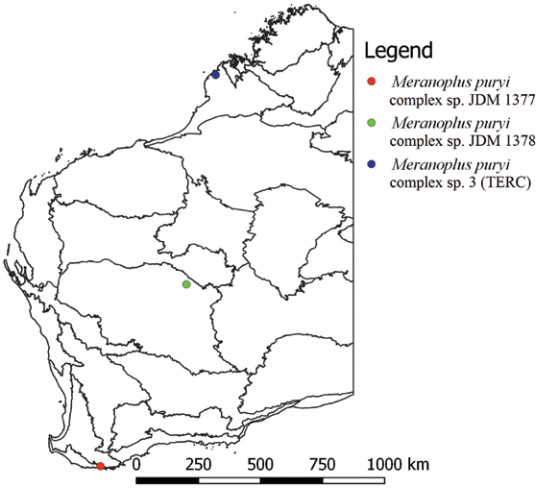

FIGURE 126 Distribution of *Meranoplus puryi* complex sp. JDM 1377 and JDM 1378, and *Meranoplus puryi* complex sp. 3 (TERC).

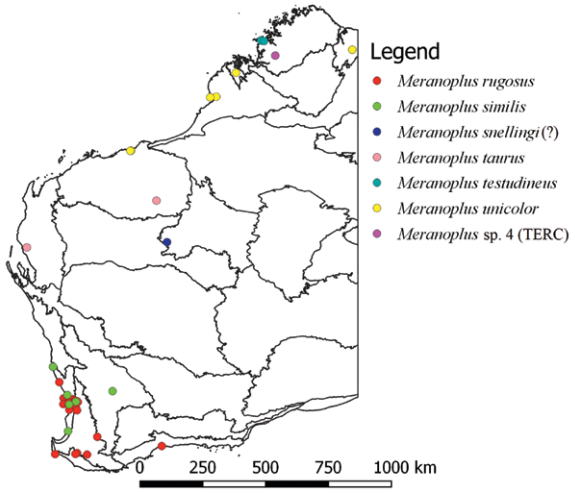

FIGURE 127 Distribution of *Meranoplus rugosus*, *M. similis*, *M. snellingi*(?), *M. taurus*, *M. testudineus*, *M. unicolor* and *Meranoplus* sp. 4 (TERC).

species. Ecotypes 1 and 3 have the anteromedial clypeal conformation mentioned by Schödl (2004), whereas ecotypes 2 and 4 seem to have an entire, laminate anteromedial clypeal margin; however, this minute feature is difficult to gauge. WAM and JDM material for *Meranoplus curvispina* in its various manifestations is mainly found within 200 km of the coast, and no specimens have been seen from the inland desert areas. The inland specimens mentioned by Schödl (2004) are held elsewhere. The range of *Meranoplus curvispina* extends throughout the Australian mainland and includes not only WA, but NSW, QLD, SA, and Vic based on the sources of the material Schödl examined. Similarly, based on the proximity of the data points shown on his map to the boundaries of the ACT and the NT, this species unquestionably also occurs in those states as well. Schödl was not able to cast any light on the biology of the species, but there is some information given in the labels of WA specimens in the JDM/WAM collections. Thus, vegetation associations include chenopod shrubland, *Allocasuarina*/samphire over grey sand and laterite, and *Allocasuarina* heathland (ant collected among twig litter on white sand). A worker taken at Minilya Station was also hand-collected in thick bark and twig litter at the base of a *Eucalyptus camaldulensis*.

Meranoplus sp. JDM 1133 is much less common than *M. curvispina* and has been found on Barrow Island and in the northern Pilbara. The occurrence of this species elsewhere is unknown. No specimens are held in the JDM/WAM Collections, and there is no biological information available for this ant.

Mesostruma (Figure 128)

These rather uncommon and specialised little ants in the tribe Attini are related to and similar in appearance to *Colobostruma* and *Epopostruma*. In profile, the antennal scape in the resting position passes below the eye or across its lower margin, and elongate depressions to receive the antennae (antennal scrobes), when present, run below the eye. The mandibles are triangular to elongate-triangular and, when fully closed, touch or nearly touch along their entire length, and the teeth in the mandible are confined to the base and tip of the mandible. A further character is that, when seen in dorsal view, wing-like lamellae (when present) are to be found only on the postpetiole, otherwise the sides of the petiole and postpetiole are rounded and bear a ridge only. These ants are predaceous and have commonly been collected on tree-trunks or at the base of trees, one hand-collection being made at night. Five species have been recorded from WA, but *Mesostruma spinosa* is known only from the holotype, collected over 40 years ago. The genus was revised by Shattuck (2000, 2007).

The anterior pronotum of *Mesostruma laevigata* and *M. eccentrica*, when viewed dorsally, is seen to be armed with distinct angles or short spines, the remaining *Mesostruma* having a rounded pronotum. The propodeal lamellae of *M. laevigata*, seen in dorsal view, are well-developed, and the lateral surfaces of the postpetiole likewise have well-developed wings. The propodeal lamellae in *M. eccentrica*, in the same view, are reduced to thin carinae, and the lateral surfaces of the postpetiole are rounded, lacking wings. *Mesostruma laevigata*,

one of the more common *Mesostruma*, has been collected on the eastern edges of the Jarrah Forest, the Esperance Plains and the Nullarbor. The range of this ant extends into NSW, eastern SA, and Vic. This species has frequently been captured on the trunks of mallees or in litter at their base and has also been collected from an intercept trap on a powderbark wandoo trunk. Other specimens have been taken on sandy soil and on a limestone ridge. These ants have occasionally been seen in small numbers on mallee trunks at night and are known to attend honey or sugar baits and, on at least two occasions, have turned up in berlesates. *Mesostruma eccentrica* is also a reasonably common species, with a number of records north and east of Perth and along the south coast. This ant has a similar range to the above species interstate and is also known from NSW, eastern SA, and Vic. *Mesostruma eccentrica* is also a mallee loving species, but in addition has been found on powderbark wandoo and wandoo (intercept traps), on sand in mallee and spinifex country, and in leaf litter, especially at the base of a tree. Like the foregoing, *M. eccentrica* also attends honey and sugar baits. This species has been picked up in berlesates no less than 13 times, attesting to its cryptic behaviour.

Mesostruma spinosa has elongate propodeal spines, a unique feature among WA *Mesostruma*, and the propodeal lamellae are reduced to thin bands which are only slightly raised above the underlying propodeal surface. This species, known only from the holotype, was collected by means of a pitfall trap near Manjimup in the Warren subregion in July 1977 by Professor Jonathan Majer of Curtin University. Since multiple collections, even of the more uncommon *Mesostruma* species (with the exception of *M. turneri* [Forel], which is known from several specimens) have been made, usually in more than one state, *Mesostruma spinosa* has to be considered as very rare and localised. Nothing else is known about the taxon. *Mesostruma inornata* is an ant of drier arid and semi-arid areas. Sculpturing patterns separate it from *M. loweryi*. Seen in dorsal view, the dorsum of the mesosoma in *M. inornata* has dense, shallow, foveolate punctures which are generally spaced less than their width apart, and the area between the punctures has weak but distinct sculpturing. By way of contrast, the dorsum of the mesosoma of *M. loweryi*, seen in dorsal view, has scattered, shallow, foveolate punctures which are spaced more than their width apart, the area between the punctures being smooth and lacking in sculpture. In WA, specimens of *M. inornata* have been collected in the eastern goldfields and the Nullarbor. The species was described from SA. The ant is nocturnally active and has been collected from a tree and heath, in a riparian zone and by pitfall trap in sandplain. Substrates include litter and soil. Mallee is the only vegetation association mentioned in label data. *Mesostruma loweryi* prefers more humid habitats, and in WA specimens have been taken from the jarrah woodlands in Dryandra State Forest and near Boddington, and also in (or near) Geraldton on the mid-western coast (an ergatoid). The species also occurs in SA, from whence it was described. The Dryandra captures were taken in intercept traps set on wandoo trunks. However, the ant has also been collected in *Eucalyptus/Callitris* woodland. Interestingly, a South Australian sample was taken from a midden of *Rhytidoponera metallica*, while the South Australian holotype and a paratype came from a nest made in moss-covered red soil. Two other collection habitats are simply described generically as 'dry sclerophyll low scrub'.

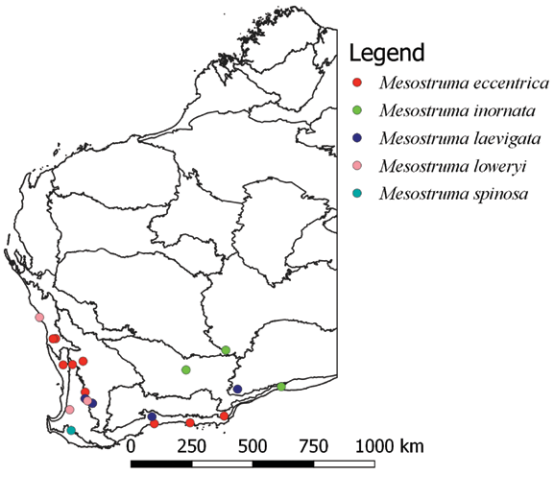

FIGURE 128 Distribution of *Mesostruma eccentrica*, *M. inornata*, *M. laevigata*, *M. loweryi*, and *M. spinosa*.

Monomorium (Figures 129–132)

Until recently the taxonomy of the genus *Monomorium* has been bedevilled by inadequate characterisation (the identification of the worker has been largely based on the presence of a bicarinate clypeus and a median clypeal seta), and only in recent years has the genus been shown to be paraphyletic. There has been general taxonomic acceptance for the peeling off of the genera *Trichomyrmex* and *Syllophopsis*, both of which include (largely introduced) Australian taxa, and Sparks et al. (2019) remove a number of other endemic taxa, all of which revert to *Chelaner*. *Monomorium* is a moderate-sized group of small, generalist myrmicine ants (24 putative species in this State, four undescribed), many of which are

very abundant in the habitats in which they occur, such that one or more species invariably constitute a major component of the terrestrial invertebrates collected by pitfall traps or other ground-based trapping methods. The group can be recognised by the following features: in profile, the antennal scape in the resting position passes above the eye (which is invariably present in this group); the antennae have 10–12 articles and the last three segments form a recognisable club; the postpetiole is attached to the front of the gaster; the clypeus below the antennal sockets is usually smooth and is never raised up into a sharp-edged ridge; the tip of the sting lacks a lamella; the femora and tibiae of the middle and hind legs are of normal dimensions; the petiole is nodiform and unarmed; the dorsum of the mesosoma is usually undulant and always has a weakly to strongly defined metanotal groove; in dorsal view, the petiole and postpetiole are usually narrower than the propodeum; the PF is 1,2 or 2,2, and workers are monomorphic. In addition, the propodeal angles are usually blunt or absent and never have denticles or spines in WA species and all these ants have three or four mandibular teeth. Perhaps the strongest evidence for the monophyly of this group seen in the broader context of the Australian ant fauna currently placed in *Monomorium* is the appearance of the wings in the sexual forms. In *Monomorium* the wing veins lack sclerotisation and both queens and males lack cross vein cu-a (the wing veins are tubular and cross vein cu-a is always present in the species that have recently reverted to *Chelaner*). The taxonomy of several nominate taxa is difficult, and hidden sibling species may be present in such cases.

Monomorium antipodum complex sp. JDM 103 is a tiny yellowish species with a glabrous mesosoma and nodes. The clypeal carinae protrude over the anterior margin of the clypeus as minute, sharp spinules or denticles. The 10-segmented antenna and the glabrous mesosoma and nodes readily identify most specimens. A few workers have 11-segmented antennae, and these are adequately identified by the clypeal denticles, glabrous mesosoma and nodes and yellowish colour. This species has only been collected in and around the Perth region, including Rottnest Island, and seems to be endemic to that part of the Swan Coastal Plain; no specimens are known from other Australian states. This ant is quite at home in suburban locations, and can often be found on lawns and paths, although it commonly escapes detection because of its minute size (TL ≤ 1.5 mm). This ant was included in *Monomorium sydneyense* by Heterick (2001) but is now excluded from that species. Workers from Guilderton were collected in coastal heath on white sand.

Monomorium eremophilum is the only taxon among 19 *Monomorium* in this clade that have 11-segmented antennae that also possesses a PF of 2,2. In profile, the eye of *M. eremophilum* is oriented diagonally to the vertical axis, is often large and may be folded around the curvature of the head capsule. The clypeal carinae are produced as sharp denticles, and the mesopleuron and propodeum are finely and evenly microreticulate (microreticulation may be superficial in some specimens). Other members of the group with a similar eye lack the clypeal denticles and have a PF of 1,2. In WA, *Monomorium eremophilum* has been collected in the Carnarvon, Murchison and Yalgoo subregions but also occurs in NSW, QLD, and SA. Nothing is known of the biology of the species. *Monomorium arenarium* is also distinctive, and its nearest relatives are unclear. In this instance, the worker mandible has three distinct teeth, and the propodeum, seen in profile, is almost roundly triangular with a strong carina along either side as it descends to its junction with the petiolar peduncle. This is a yellow or yellow-orange species. Other *Monomorium* in the clade have four mandibular teeth (although the basal denticle may occasionally be reduced to an angle), and the propodeal profile is not roundly triangular. This species is not common but has been found in biogeographically separated, mainly coastal areas, as far north as Barrow Island. Other records have come from SA and Tas. The only inland record is from Tammin in the Avon Wheatbelt. Workers have mainly been recovered on sand: specimens found at a nest in Swanbourne were on a coastal dune which had a mixture of native and exotic vegetation over white sand, and a worker from Eneabba, in the mid-west, was collected on a sandplain slope vegetated with *Melaleuca leuropoma* and *Banksia attenuata*.

The remaining *Monomorium* with 11-segmented antennae fall into two broad morphological groupings that are not easy to characterise in a morphological key. The first of these includes generally larger ants with a moderate to large propodeal spiracle, and a short, globose or long, weakly carinate, mainly smooth propodeum with distinct, small or vestigial propodeal lobes. This clade includes *M. anderseni*, *M. fieldi*, *M. laeve* and *M. silaceum*. The second grouping includes mainly smaller ants with a small to minute propodeal spiracle and a short, globose or cuboidal propodeum or longer carinate propodeum. If present and developed, the propodeal lobes are elongate flanges (highly sculptured species). Otherwise, they are represented by a longitudinal

carina on either side of the declivous propodeal face, or they are vestigial (in workers with a globose propodeum). This second group, in turn, can be separated into two sub-groups (this is the way the species are split in the species key in Part I). The genetics are not completely clear, but the second morphological grouping appears to consist of two very closely related species complexes; namely, the *M. sydneyense* complex which has a microreticulate mesopleuron and propodeum, developed propodeal lobes and, frequently, sculpture on the mesonotal sector of the promesonotum, and the *M. antipodum* complex, in which the mesosoma is mainly smooth and shining. The *M. sydneyense* species complex includes *Monomorium aithoderum*, *M. carinatum*, *M. micula*, *M. nanum*, *M. stictonotum*, *Monomorium sydneyens*e (as understood here, although the species status of certain populations is disputed by some researchers) and *M. sydneyense* complex sp. JDM 101. Rather regrettably from a researcher's angle, the difficult and broadly variable *M. sydneyense* taxon includes a few populations whose phenotype overlaps and intergrades with that of members of the *M. antipodum* species-complex, possibly due to hybridisation. In the vast bulk of the *M. sydneyense* species-complex the propodeum is rather flat and always laterally carinate, these lateral propodeal carinae often being produced as distinct lateral flanges that are divergent posteriad. In most species the propodeum is also matt or weakly shining with intense areolate or microreticulate sculpture that is uniform over the sclerite, but where this is reduced, the mesopleuron is uniformly microreticulate. The petiolar node and postpetiole often also have at least surface microsculpture.

The second sub-group is here called the *M. antipodum* species-complex and includes the described species *M. antipodum*, *M. disetigerum* and *M. orientale* as well as the undescribed *M. antipodum* complex sp. 103 (discussed above), *M. antipodum* complex sp. JDM 717, and *M. antipodum* complex sp. JDM 1369. In this suite of ants, the propodeum is rounded, weakly cuboidal or even globose, its appearance mainly smooth and glossy with a few metapleural striae or with weak, superficial microreticulation; the propodeal lobes are small to vestigial, and never present as well-developed lateral flanges and, if the propodeum is weakly cuboidal, then its dorsal and lateral surfaces are separated by a blunt edge only. The petiole and postpetiole in this aggregation of species is smooth and shining or almost so (note: there is some support for the two major groupings and the two sub-groupings having a genetic basis — see Fig. 1 [3-gene analysis] in Sparks et al. [2019]).

Perhaps the most spectacular species in the *M. sydneyense* species complex is *Monomorium carinatum*. The propodeum of this ant is unmistakeable. This anatomical structure is strongly carinate and impressed at its junction with the metapleuron so that it splays out and overhangs the metapleuron in an even curve onto its declivous face. The declivous propodeal face is shining and possesses superficial imbricate sculpture. The propodeum is not strongly carinate and splayed posteriorly in related species. This is a northern taxon that in WA occurs from the Pilbara northwards into the Kimberley. The species is also found in the NT. Nocturnal ground foragers have been seen by the author in the vicinity of Newman; however, there is no other biological information.

Within the *M. sydneyense* species complex *M. micula* is the only large-eyed species (EL 0.35–0.40 × length of side of head capsule) that is both glabrous and a bright to dirty yellow, other large-eyed, glabrous workers being various shades of brown or yellowish-brown. A further useful character is the broadly U-shaped metanotal groove. (*Monomorium sydneyense* complex sp. JDM 101 also has a moderately large eye, but in this case the eye length is 0.30 ≤ × length of head capsule, and the metanotal groove, seen in profile, is narrow.) *Monomorium micula* is found in drier western areas of southern WA, from eastwards of the eastern edge of the Darling Scarp and taking in the eastern and northern goldfields. The species has also been recorded from NSW, QLD, and SA. *Monomorium micula* is apparently adapted to sandy habitats. At Brookton, east of Perth, this species has been found in small nests on a sandy track in degraded woodland. Other nests have been found in dunes. The only vegetation association mentioned is *Casuarina*.

The clypeal carinae are produced as two acute denticles in *M. aithoderum*, *M. nanum* and *M. stictonotum*, and the clypeus between the two denticles is excavate. The metanotal groove in *Monomorium aithoderum*, viewed in profile, is narrowly impressed to form a shallow slit and, seen in dorsal view, the promesonotum and propodeum are laterally compressed towards their junction with the metanotal groove. The eye is of moderate size and elliptical. In *M. nanum* and *M. stictonotum* the metanotal groove, seen in profile, is broadly impressed to form a U- or weakly V-shaped groove, and the promesonotum and propodeum are not laterally compressed towards their junction with the metanotal groove. The eye is also generally large and reniform to varying degrees. *Monomorium aithoderum* is relatively uniform throughout its range, the major

(clinal) differences being that populations in forested mesic areas are lighter in colour and have erect setae on the mesosoma, while populations in drier wheatbelt or goldfields locations are darker and have a glabrous mesosoma. Populations of *M. aithoderum* in WA are virtually restricted to the SWP, being particularly common in the wheatbelt and less common in the Jarrah Forest, Swan Coastal Plain and on the south coast. The species has also been recorded in SA. Most vegetation associations on labels mention mallee as the habitat from which the specimens were collected, but the ant has also been found within Salmon Gum cover, in *Eucalyptus accedens/E. wandoo* woodland and on sandplain heath. Foragers have been collected on light sandy soil over lateritic inclusions and on light soil/clay.

Monomorium stictonotum is most probably the sister taxon to *M. nanum*, rather than *M. aithoderum*, as suggested by Heterick (2001) and, whereas specimens of *M. stictonotum* and *M. aithoderum* can easily be separated on a global scale based on the features of the mesonotum mentioned above, this is not the case with *M. stictonotum* and *M. nanum*. Here, the only usable character is the appearance of the eye, which is particularly large and reniform, obliquely orientated and positioned close to the mandibular insertion in *M. nanum*, and is generally smaller, less obliquely orientated and positioned at about its length or more away from the mandibular insertion in *M. stictonotum*. However, the eye size and orientation, pilosity and sculpture are quite variable in *M. stictonotum*, and this makes it possible — although not likely — that *M. nanum* only represents a morphological extreme in optics. Variation centres around three basic forms in *M. stictonotum*. Hairy workers with small elliptical eyes are common in the Avon Wheatbelt and Mallee subregions of the SWP. Similarly, hairy workers but with larger, more reniform eyes are found in the same area, while glabrous workers with the largest eyes come from remote, arid and semi-arid regions outside of the SWP. Erect setae (where present) can vary from plentiful, long and flexuous in samples from wet areas to sparse, short and more bristly in appearance in samples from drier areas; however, the basic morphology remains the same on a global basis, apart from the appearance of the eye. Some workers from remote interstate localities have long, curved setae on the venter of the head capsule. This feature has not been seen in WA workers but, nonetheless, some local populations do have long flexuous setae on the underside of the head; this seems to be a variable pattern, in keeping with the appearance of these setae elsewhere on the body. In WA, *M. stictonotum* appears to have quite a wide distribution. Most collections have come from the eastern wheatbelt, with isolated records from Carnarvon, the eastern goldfields and the Gibson Desert. Interstate records come from NSW, QLD, and SA. The terms 'sandplain' and 'heathland' are found several times in the label data, and the ant has also been collected on coastal dunes. There is one record of workers from disturbed wandoo woodland, another from mallee, and a recent hand-collection (not on AntWeb) has come from *E. accedens/E. wandoo* woodland. *Monomorium stictonotum* is diurnally active, with some hand collections taking place in the early morning. The only nest mentioned was found under a house brick in disturbed wandoo woodland.

The ant spoken of as '*Monomorium nanum*' in Heterick (2001) is actually a polyphyletic species-aggregate, as the author suggested could be the case. *Monomorium antipodum* sp. JDM 1369 (which lacks clypeal denticles) has consequently been peeled off from the species. Another specimen has been transferred to *Monomorium antipodum* complex sp. JDM 717. The remaining material includes workers with clypeal denticles and a very large eye that is reniform, oblique and closely aligned to the mandibular insertion (see above). Specimens in the JDM Collection definitely assigned to this species have come from drier areas of the wheatbelt and the eastern goldfields. The species also nominally occurs in NSW, the NT, and SA, but due to the taxonomic lumping mentioned above, there is unquestionably more than one taxon that is currently listed under the name '*nanum*'. Workers held in WA have been collected as ground foragers in open woodland (Lake Hillman) or have been pitfall-trapped in tall open shrubland in red sandplain. Red soil also appears to be found around Lake Hillman and may represent a preferred soil type for the species.

Workers of *Monomorium sydneyense* lack the clypeal denticles found in the above three species, and the anterior margin of the clypeus between the clypeal carinal ridges is straight or weakly and evenly concave. Seen in profile the metanotal groove is weakly impressed and, seen in dorsal view, the promesonotum and the propodeum are not laterally compressed. The morphological differences and resulting taxonomic difficulties seen in *M. nanum* are exacerbated in *Monomorium sydneyense*, which, in its various morphological incarnations, is ubiquitous throughout Australia and has now invaded New Zealand, where it seems to be impacting other species (Stringer & Lester 2008). Since Heterick's (2001) revision

of *Monomorium*, that author has peeled off two taxa from *M. sydneyense*, which he had included as part of the variation found within this taxon. These two newly identified species are here called *Monomorium antipodum* species complex sp. JDM 103 (see discussion above) and *Monomorium sydneyense* complex sp. JDM 101, mentioned in the original monograph as a bright yellow ant that frequently occurs in sympatry with brown workers of *M. sydneyense*. Further careful analysis using a variety of molecular and morphological techniques may result in the identification of further cryptic species within the currently recognised taxon. In general, several ecotypes of *M. sydneyense* can be identified among Australian material, most of which occur in WA. However, unlike the above two newly recognised taxa, the morphology of these ecotypes seems to merge without discrete taxonomic characters being preserved, and thus far different forms have not been found existing in sympatry. The major ecotypes are:

1. A small northern morph. The workers are among the smallest myrmicines (TL > 1 mm). They are coal-black to chocolate brown in colour and have impressed microreticulate sculpture throughout. The petiolar node is low and both the node and the postpetiole are also sculptured. The propodeal lobes are particularly large and prominent in this morph, which has a more angulate appearance compared with its southern counterparts. This form is common in the Kimberley and occurs as far south as Barrow Island.

2. Also found in parts of the Kimberley is a lighter-coloured form with matt, shagreenate, orange foreparts and a dark gaster. One specimen was collected from a tree-trunk in Broome.

3. The most common eastern states morph, and the one represented by the syntype material, is a medium-brown ant with smooth, shining head and dorsal promesonotum and with microreticulation largely restricted to the mesopleuron and propodeum. This ant is particularly common in the Sydney area and occurs elsewhere. (JDM holdings include specimens from Monarto, SA). However, this form is not common in WA, being replaced by (4) in most southern localities.

4. By far the most frequently encountered morph in southern WA is a honey-coloured ant with a greyish orange to dirty-yellow gaster. This small ant can easily be mistaken for *M. antipodum* species complex sp. JDM 103 but can be distinguished by the 11-segmented antenna, the lack of clypeal spinules and the longer propodeum, which always has some sculpture (the propodeum is shorter and cuboidal and always smooth in the latter). The propodeal lobes are reduced compared with darker morphs. Occasionally, workers may have a few, short, fine, erect setae on the promesonotum.

Unlike *M. nanum*, the structural morphology, apart from sculpture, colour and development of the propodeal lobes, is invariable in *M. sydneyense*, and the exoskeleton seems to be of a thicker composition in the darker, northern forms, perhaps explaining their more intensely sculptured and 'squared-off' appearance. It may be tendentious to suggest a situation similar to human 'races' — where more melanic populations occur in harsher, hotter conditions nearer the equator, and fair-skinned individuals are found in higher latitudes — but pale-coloured workers of *M. sydneyense* reared in colonies in cooler, wetter environments that tend to have a thinner, shinier and less sculptured cuticle may simply be displaying phenotypes suited to their physical environment. For the present, these morphospecies do not seem divisible. A large-eyed form from NSW, seen by the author when he was doing the revision of the group, may represent a different species; however, no specimens of that morphospecies have been seen among the WA material. *Monomorium sydneyense* is ubiquitous in WA and has been found in a wide variety of habitats; indeed, it is probably the most common of all the *Monomorium* species in this country. The ant is also catholic in its nest requirements; a nest has been found under moss at the base of a tree. This species has been recorded from all Australian states but appears to be more common in the humid coastal areas. The species may occur in peridomestic situations, particularly in cities and towns in the tropics, but does not normally constitute a pest in Australia.

The remaining species within the *M. sydneyense* species complex is *M. sydneyense* complex sp. JDM 101. This ant was included under *M. sydneyense* (with some reluctance) by Heterick (2001) but is here treated as a separate species. The combination of a glabrous mesosoma and nodes, uniformly bright, pale yellow coloration, largish eye (EL 0.35–0.40 × length of side of head capsule), and, when seen in profile, the narrowly impressed metanotal groove are sufficient to characterise this species. *Monomorium sydneyense* complex sp. JDM 101 has been recorded at scattered locations throughout the entire State but is probably ubiquitous in WA. This ant also occurs in NSW, the NT, and SA (Heterick 2001). The species occurs in a wide variety of habitats and can be found foraging in litter and

on tree-trunks. Vegetation associations mentioned on labels include chenopod shrubland and mallee woodland.

Among the smoother *Monomorium* with much reduced sculpture and small or vestigial propodeal lobes that belong to the *M. antipodum* species complex, two species have an elongate, reniform eye that is always oriented diagonally to the vertical axis. The eye in *M. antipodum* complex sp. JDM 717, and often also in *M. antipodum* complex sp. JDM 1369, may be folded around the curvature of the head capsule. *Monomorium antipodum* complex sp. JDM 717 is the larger of the two species (HW ~0.45 mm, compared with HW < 0.40 mm in *M. antipodum* complex sp. JDM 1369). Only two collection sites for the former are known — one on Barrow Island and one from 30 km south of the Overlander Roadhouse near Shark Bay — but morphological and colour differences between the material from both sites could indicate they belong to different although undoubtedly closely related species. The single worker from the mainland (wrongly included under *M. nanum* in Heterick's (2001) revision) is yellowish-orange and lacks sculpture on the mesopleuron. A series of workers from Barrow Island housed in the JDM Collection is brown and the mesopleuron is sculptured. The eye in the JDM series of workers is also longer than that of the mainland form. These particular ants were collected from a disturbed site but capture method and environmental details are lacking on the labels. Images of a separate Barrow Island worker, collected on an earlier occasion, appear on PaDIL identified (incorrectly) as '*Monomorium eremophilum*' (https://www.padil.gov.au/barrow-island/pest/main/136767/10168 [accessed 30 July 2019]). More mainland material is needed for comparison.

Monomorium antipodum complex sp. JDM 1369 is a minute species (TL ~1–1.2 mm). The large eye whose width is ≥ 2 × greatest width of antennal scape and, in profile, often oriented diagonally to the vertical axis, is definitive; this eye is usually no more than 0.5 × its length from the mandibular insertions and may almost abut them. Three pins contain specimens that have an obliquely oriented eye closely aligned to the posterior margin of the clypeus, a glabrous mesosoma and short, well-spaced appressed setae on the gaster (although these do vary in length among the workers) but a specimen on a fourth pin has a less enlarged eye that is oriented along the vertical axis of the head capsule and is not closely aligned with the posterior margin of the clypeus, and has erect setae on the mesosoma, gaster and nodes. Other morphological features are virtually identical with what is found in *M. antipodum* (which is of similar size), and, given that the eye is variable in size and orientation, it is conceivable the large-eyed forms are simply a part of the infraspecific variation found in *M. antipodum*. This species was included among *M. nanum* by Heterick (2001), but the ants have a quite different clypeus and propodeum and are possibly not that closely related. *Monomorium antipodum* complex sp. JDM 1369 has been found in dry inland areas in the eastern goldfields, the Nullarbor and the Pilbara. This form of '*M. nanum*' is mentioned in Heterick (2001) as having been seen in specimens from NSW, and it certainly also occurs in SA. The occurrence of the species in at least some of the other Australian mainland states is likely. The only ecological note is that a specimen from Madura (the smaller-eyed ant mentioned above) was collected on a limestone path in Chenopod shrubland.

Monomorium antipodum is identical with the above species except for the eye, which is of moderate size and elliptical, although even here there is variation in eye length. This species is variable in colour, but yellow specimens (found in the northern Kimberley) can be distinguished from *M. disetigerum* by the regular erect setae on the mesosoma, the smaller eye, and the preferred habitat, from yellow *M. orientale* by the short, generally more cuboidal propodeum, the longer antennal scape (SI 81–85) compared with SI ≤ 76) and from very small *M. laeve* by the short propodeum, the shorter antennal scape (SI 81–85 compared with 86–100) and the small propodeal spiracle (the spiracle is moderate to large in size in *M. laeve*). Darker brown or greyish-yellow forms may be distinguished from darker *M. orientale* by the features mentioned above and from *M. fieldi* by the much smaller propodeal spiracle, the smaller size (HW 0.30-0.33 mm compared with HW > 0.40 mm), the narrower head capsule and the lower nodes. *Monomorium antipodum* always has erect setae on the mesosoma and nodes, and this also helps to set it apart from smoother populations of *M. sydneyense*. The type workers of *M. antipodum* are chocolate brown with conspicuously paler legs and rather a rounded propodeum. The petiolar node is a bluntly rounded, equilateral triangle. This species equates extremely closely with the type material for the Australian *Monomorium laeve nigrius* Forel and *M. fraterculus* Santschi. In fact, this form of the ant is very common in south-eastern QLD (supporting Sparks et al.'s [2019] contention that the ant was introduced to New Zealand from Australia), but is not the usual morph seen in WA. Members of the species in this State range from greyish-brown in the south to honey-coloured or greyish-yellow in the Pilbara and on Barrow Island to the bright yellow form mentioned above found in the Kimberley. *Monomorium 'fieldi'* specimens that can definitely be assigned to *Monomorium*

antipodum are also known from NSW, SA, and Norfolk Island (see 'Remarks' under *Monomorium fieldi* in Heterick [2001]), but the species very likely can also be found in the NT, based on its known range in the Kimberley region in WA. The propodeum in northern WA specimens tends to be more cuboidal compared with that of the named types, the transverse costate ribs on the metanotal groove are reduced in specimens from all areas, and the petiolar node is generally more of an isosceles triangle, but the differences are very small and can be put down to biogeographical variation. *Monomorium antipodum* has been taken from all corners of the state, but collections are relatively few, although it is likely the ant has often been overlooked in collections because of its tiny size and unremarkable appearance. Nevertheless, this species occurs in abundance in some localities on Barrow Island and in the Pilbara. The ant caused confusion for this author, when he was revising *Monomorium* because of clear dissimilarities between this ant and *M. fieldi* in terms of size, head shape, appearance of the mesosoma and appearance of the propodeal carinae, and it was with quite some reluctance that he provisionally synonymised *M. laeve nigrius* and *M. laeve fraterculus* under *M. fieldi*. He was not aware that the species also occurred in New Zealand since he regarded *M. antipodum* as an extralimital taxon (this being in the days before AntWeb and online photographs). Heterick's incorrect identification was supported by Shattuck and Gunawardana (2005). An attempt is therefore being made here to rectify this situation by removing the two junior synonyms from under *M. fieldi* and placing them under *M. antipodum*. Label data are surprisingly sparse, and most information comes from New Zealand, where this ant is a minor household pest whose scavenging behaviour is in keeping with an introduction rather than an endemic species (https://www.landcareresearch.co.nz/discover-our-research/biodiversity/plants-invertebrates-fungi-and-bacteria/invertebrate-systematics/ants-wasps-and-bees/ants-of-new-zealand/monomorium-antipodum [accessed 10 January 2021]). In this country it has been collected from under a rock and foraging on polypore fungus in rainforest (both QLD records). Workers from Middle Lagoon in the north-western Kimberley were pitfall-trapped in pindan/savannah. Other WA material has been hand-collected or pitfall-trapped but without ecological notes.

Monomorium orientale is excruciatingly similar to *monomorium antipodum* in terms of its morphology, especially the northern yellow form of the latter. Both species have regularly spaced erect setae on the mesosoma and nodes. Perhaps the best ways to determine which taxon one is looking at are to examine the antennal scape, which is extremely short in *M. orientale* (SI ≤ 76), the petiolar node, which is a low, bluntly rounded equilateral triangle and barely higher than the globose postpetiole in that ant, and the coloration of the first gastral tergite, which is pale centrally but with dusky infuscation on the sides. In similar specimens of *M. antipodum*, the antennal scape is longer (SI 81–85), the petiolar node is either narrower (most Australian workers) or, if a low, bluntly rounded triangle, is noticeably higher than the postpetiole, and the first gastral tergite, whether light or dark, is uniformly coloured. *Monomorium disetigerum* has a longer scape (SI 84–95), is always uniformly light to tawny yellow, has a petiolar node: postpetiole height ratio of 4:3 and a different pilosity pattern. Small workers of *Monomorium laeve* may also be confused with this species, but the antennal scape is longer (SI 86–100), the propodeal spiracle is often larger and the eye is also larger. *Monomorium orientale* has undoubtedly been introduced to this country, and its occurrence has not been recognised previously because of the difficulty in distinguishing between this and very similar, small native *Monomorium*, especially *M. antipodum*. Of the WA *Monomorium* material, only one damaged worker from Argyle Diamond Mine in the eastern Kimberley appears to belong to this species, but the ant may occur patchily elsewhere in far northern Australia. *Monomorium orientale* is Indomalay in origin and also occurs in India but has been introduced to American Samoa and intercepted in Hawaii. This species may be conspecific with *M. banksi* Forel, described from the Philippines.

Monomorium disetigerum is yet another small, yellow *Monomorium*. In the typical form, long paired setae are to be found on the humeri, but these may be absent. In some populations, short erect or subdecumbent setae (much shorter than the erect setae found in *M. laeve*) occur profusely on the dorsum of the mesosoma, or the ant has a glabrous mesosoma. In the latter case, this species may be mistaken for *M. sydneyense* complex sp. JDM 101, but in *M. disetigerum* the petiolar node and postpetiole always have a pair of erect setae directed posteriad, while the nodes are devoid of erect setae in *M. sydneyense* complex sp. JDM 101. The eye in *M. disetigerum* is moderately large (EL ~0.32–0.34 × length of side of head capsule) and the propodeum is shining and virtually free of sculpture, unlike the case in *M. sydneyense* complex sp. JDM 101. This ant is found from the northern Murchison and Gascoyne subregions (including Barrow Island) northwards into the Kimberley. Where it occurs, this species can be very abundant. Workers have been collected in pitfall and gidgee traps, and also 'in *Daistidia*' [sic], but there is very little else recorded on this species.

Monomorium anderseni, *Monomorium fieldi*, *M. laeve* and *M. silaceum* appear to form a tight grouping. Sparks et al. (2019) did not include *M. anderseni* in their analysis, but that species appears to be a sister species of *M. laeve* on morphological grounds, and most samples of *M. fieldi* and *M. laeve* cluster together in the figures published by Sparks et al. Now that *M. antipodum* is removed from *M. fieldi*, the remaining specimens form an acceptably homogenous morphological unit. *Monomorium fieldi* can be characterised as a glossy light chocolate to brownish-black ant with a prominent propodeal spiracle. The propodeum is always short and usually globose but it may be cuboidal and weakly carinate in some populations. By way of contrast, *M. anderseni* is always concolorous yellow to gamboge, while *M. laeve* is nearly always concolorous yellow but occasionally the gaster is darker. One series of brown specimens of *M. laeve* from QLD has been seen by the author, but these had an elongate propodeum (hence, could not be confused with *M. fieldi*) and this colour form has not been seen among WA specimens. *Monomorium fieldi* workers are also appreciably larger than those of *M. antipodum* and *M. orientale*. All collections of *M. fieldi* in WA are from the western parts of the State, and there are no records from the Nullarbor, goldfields or eastern deserts. Whether this reflects the genuine distribution of the taxon or is merely an artefact of collecting is not known. However, this species appears to be quite common in the NP and in the SWP. The exact distribution of this species in other states is not completely clear due to its confusion with *M. antipodum* but, based on Heterick (2009) and AntWeb data, *M. fieldi* definitely occurs in the NT, QLD, and SA, and probably occurs in other mainland states and possibly also Tas. This species nests in sandy soil and can be found in suitable habitats in built-up areas in suburban Perth, as it is not deterred by highly modified environments that include sand patches on verges and in yards. Native habitats recorded for *M. fieldi* take in low shrubland, *Banksia* woodland, mallee, and sand dunes vegetated with *Acacia* and spinifex. Foragers have been found on the ground.

The bright yellow or orange-yellow *Monomorium anderseni* is very similar to *M. laeve* but is restricted to northern Australia. This species is most easily recognised by the laterally expanded nodes, but the very large propodeal spiracle and the shallow but distinct broadly V-shaped notch in the anteromedial margin of the clypeus also set it apart from otherwise similar workers of *M. laeve*. Most workers also have fine, superficial microreticulation on the metapleuron and katepisternum that is generally lacking in *M. laeve*. Within WA, *Monomorium anderseni* does not occur outside the NP but is widespread within that province. The range of the ant extends into the NT, but there appear to be no biological data whatever for this species. *Monomorium laeve* is a size variable, yellow or predominantly yellow species that has been found throughout western parts of the entire State. As with *M. fieldi*, its absence from drier areas of the interior is probably merely an artefact of collecting. This species may be separated from other, similar species on a formal basis as follows: the clypeus is either straight or very weakly indented between the clypeal carinae or the clypeal carinae are indistinct; seen in full-face view, the petiolar node and postpetiole are not expanded, and the nodes are distinctly higher than wide; the width of the propodeal spiracle is approximately the same as or slightly larger than the diameter of one eye facet; erect setae are always present on body surfaces; and workers are generally yellow but may be bicoloured yellow with a darker gaster. A large, gracile morph with a dorsoventrally compressed head capsule and moderately large eye is the form predominating in the southern half of the state, but further north in the Pilbara, and especially on Barrow Island, a much smaller, more compact morph with a moderate-sized elliptical eye is the more common. Despite the considerable size difference between workers at either end of the scale, however, workers of intermediate size occur along an allometric cline, and the overall morphology of all workers is identical. As well as occurring in WA, this ant is found in all Australian mainland states. The species frequents a variety of habitats that include dry sclerophyll woodland, riparian woodland, *Eucalyptus* savannah, open woody savanna, and sand dunes. In some localities, such as Canberra, this ant will enter houses and become a minor pest. Mostly *M. laeve* nests are directly into soil or under cover such as a stone, but in Cairns, QLD, a colony was found nesting under the bark of a mangrove.

Monomorium silaceum is one of several small, yellow *Monomorium* that often appear in numbers in pitfall traps set in the north and north-west of WA. *Monomorium silaceum* is generally the least common of these species, but all are very similar in appearance and require careful examination by researchers to determine their species-specific *bona fides*. *Monomorium silaceum* can only be distinguished from its near relatives by the following combination of characters: the eye is very large, (length of eye 0.25–0.30 × length of side of head capsule); the mesosoma always has 5–10 erect setae; the propodeum is cuboidal with

varying degrees of microreticulate sculpture varying from complete coverage of the sclerite to almost absent, but mesopleural microreticulation is always present; the propodeal lobes are very small; northern populations are uniformly yellow; and southern populations are dirty yellow with a light brown head and gaster. Other yellow species with a large eye (e.g. *Monomorium disetigerum*, *M. micula* and *M. sydneyense* species complex sp. JDM 101) either have a smooth and shining and mostly unsculptured mesopleuron or the mesosoma is glabrous. There is a small difference in colour and general stature between populations, some ants being quite gracile with reduced sculpture and darkening of the head and gaster, while pure yellow morphs tend to have a uniformly microreticulate propodeum and are more compact in general body form. However, there is no sharp distinction between the two morphs. *Monomorium silaceum* has a very broad distribution in the state, ranging from just north of Kellerberrin in the Avon Wheatbelt to as far north as Argyle Diamond Mine in the eastern Kimberley. Eastwards, the species has been found on the eastern fringes of the Gibson Desert. Most records have come from the eastern Pilbara and western Little Sandy Desert, possibly due to environmental studies associated with mining activities. *Monomorium silaceum* has also been recorded from QLD and unquestionably also occurs in the NT. Most specimens have been collected by pitfall trapping and one nest was located on the open ground and was not surrounded by vegetation, but there are no other data for the ant.

Only five WA *Monomorium* species have a 12-segmented antenna, and two of these have been introduced to this country. The introduced exotic *Monomorium pharaonis* can readily be distinguished from the other four taxa by its having the frons of the head capsule and the entire mesosoma finely densely reticulate-punctate, and other cephalic sculpture is also present; the mandibles are longitudinally rugulose and shagreenate. This species is believed to have originated in tropical Asia but has now been documented for 225 geographic areas including very many countries (Wetterer 2010c). On a global scale, this is probably the most pestiferous *Monomorium* species, and it has thus attracted a voluminous literature. Western Australian records are mainly from settlements between Bunbury in the south and Wittenoom in the north, but there is one record from Walyunga National Park north-east of Perth. This species is also known from NSW, the NT, QLD, and Vic. *Monomorium pharaonis* appears to have penetrated native forest or other natural environments on the mainland and on offshore islands in north-east QLD, and the author has seen several samples from these areas — WAM holdings include material from QLD's Magdelaine Cays, South West Coringa Cay, and South West Herald Island. As well as causing annoyance by scavenging foodstuffs in houses, this species can be a (mechanical) vector of disease (Wetterer 2010c). The other *Monomorium* introduction to Australia, namely, *M. floricola*, is built along the same morphological lines as *M. antipodum* and *M. orientale*, and shares the same low, bluntly triangular petiolar node. However, it may be distinguished from all the native *Monomorium* by its 12-segmented antenna and its strongly bicoloured body (head, gaster and often the propodeum brown to blackish, promesonotum, propodeum [some workers] and nodes orange or yellowish). The anterior margin of the clypeus is weakly but uniformly emarginate. *Monomorium floricola* is not seen in WA very often and records are mostly of intercepts, although occasional colonies have been uncovered in the Perth metropolitan area (e.g. see Heterick [2009]). This species is more common in tropical areas, and the other WA record shown on Figure 130 comes from Adele Island Nature Reserve, off the north-west Kimberley Coast. This species also occurs in the NT and QLD, where it is much more abundant. This ant is almost as widespread as *M. pharaonis*, having been recorded from 119 geographic areas, but its origin is still unclear although this is most likely to be Asia. This species does not engage in nuptial flights, since queens are wingless, but disseminates by budding. Extralimital dispersal can be by rafting or transport in containers, etc. (Wetterer 2010a). Where it occurs in numbers the ant may be a house pest, but it is less significant in this regard than *M. pharaonis*. However, like *M. pharaonis*, *M. floricola* can vector disease in hospitals, and it tends noxious plant pests like pineapple mealybugs (Wetterer 2010a). This species is primarily arboreal, but most collections have been taken from leaf mold and litter, rotten wood, grass stems and hollow twigs, the usual methods of capture being MiniWinkler sacks, Malaise traps, hand aspirators, beating of low vegetation and baiting. Rainforest and urban gardens are the most common habitats; much less frequently ants have been collected in dry forest.

The remaining *Monomorium* with a 12-segmented antenna, i.e. *M. megalops*, *M. rothsteini* and *M. sordidum*, are all Australian natives. In these three species the head is smooth and shining; the petiolar node is cuneate and conspicuously higher than the postpetiole, and the propodeum

and mesopleuron always bear some sculpture, and are sometimes densely microreticulate-areolate. *Monomorium rothsteini* and *M. sordidum* are clearly related and cluster together on all cladograms, whether these are based on morphological characters (e.g. Heterick [2001]) or molecular characters (e.g. Sparks et al. [2014, 2019]). *Monomorium rothsteini* is easily distinguished by its three-toothed mandible, the other two species having four mandibular teeth (although the basal tooth may be reduced to a tiny denticle or angle in some workers). Morphologically, the granivorous *M. rothsteini* is convergent on *M. whitei* and its allies, with its broad head, although the two groups of ants are not related. This well-known species has been subject to recent revisionary activity. Sparks et al. (2014, 2015) recovered no less than 18 species in their revision of the group, of which 11 can be found in WA; they concluded additional taxa were likely but could not be identified with certainty. Their work seems to this author to be a case of over-splitting (see Excursus 2 in Part I), and the clade is actually more compact, consisting of either one polymorphic species or a much smaller complex of species. Here, *M. rothsteini* is treated as a single unit. *Monomorium rothsteini* (*sensu lato*) has been found throughout WA but is less common in the wetter forested areas of the south-west. Availability of suitable seeds may be a limiting factor in its distribution, since 90% of its diet is made up of

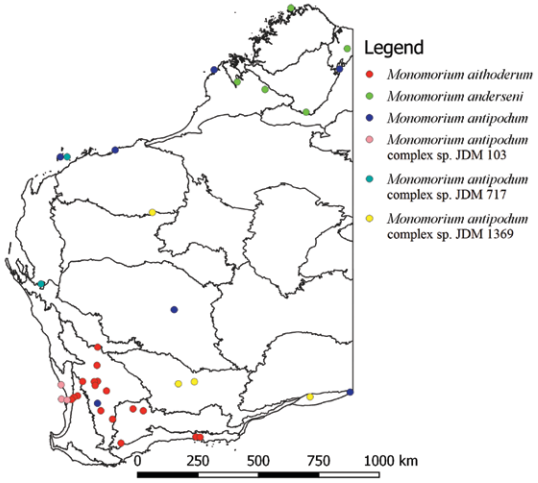

FIGURE 129 Distribution of *Monomorium aithoderum*, *M. anderseni*, *M. antipodum* and *Monomorium antipodum* complex sp. JDM 103, JDM 717 and JDM 1369.

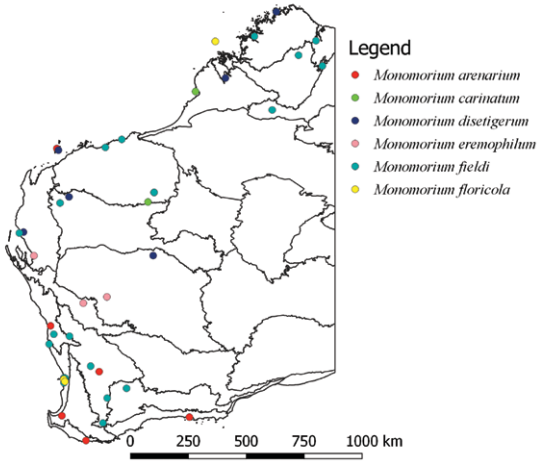

FIGURE 130 Distribution of *Monomorium arenarium*, *M. carinatum*, *M. disetigerum*, *M. eremophilum*, *M. fieldi* and *M. floricola*.

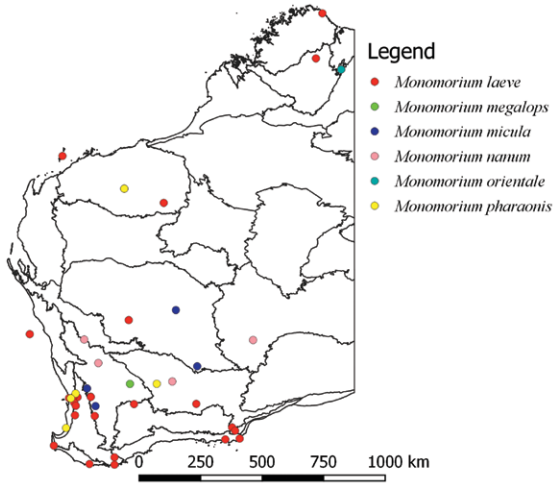

FIGURE 131 Distribution of *Monomorium laeve*, *M. megalops*, *M. micula*, *M. nanum*, *M. orientale* and *M. pharaonis*.

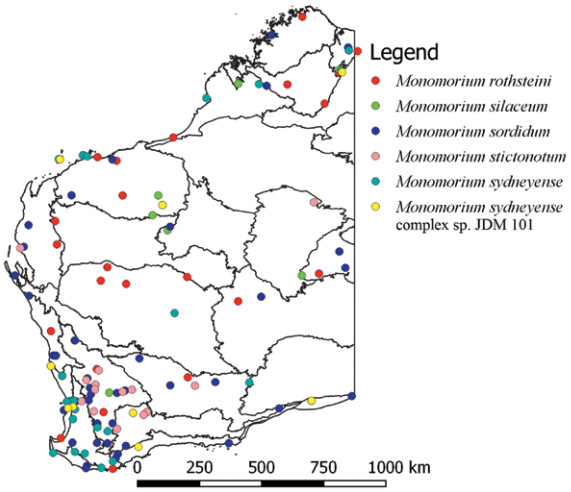

FIGURE 132 Distribution of *Monomorium rothsteini*, *M. silaceum*, *M. sordidum*, *M. stictonotum*, *M. sydneyense* and *Monomorium sydneyense* complex sp. JDM 101.

seeds (Sparks et al. 2014). Elsewhere, this clade occurs throughout mainland Australia. As well as the references in Sparks et al. (2014, 2015), detailed information on the habits of this organism can be found in a number of earlier articles (e.g. Briese & Macauley [1977, 1980], and Davison [1982]).

Monomorium sordidum is a very similar species but has four mandibular teeth (albeit the basal tooth may be much reduced and difficult to see) and the anterior clypeal margin, which is variably crenulate in *M. rothsteini*, is planar or evenly convex between the clypeal carinae. Coverage of morphological variation in *M. sordidum* is to be found in Heterick (2001). The eye in *M. sordidum* is moderate in size and elliptical, contrasting with the large, reniform, obliquely oriented eye seen in *M. megalops*. Like *M. rothsteini*, *M. sordidum* is a very abundant small *Monomorium* that is probably found throughout most of regional WA, although collecting effort has mainly been concentrated on the SWP and areas around mining activities in the north. Like the preceding species, *M. sordidum* has been recorded from all Australian mainland states. This ant is a generalist species that is attracted to elaiosome-bearing seeds, but it is not an effective dispersal agent since small *Monomorium* (including this species, to which Palfi [2017] refers as '*sordidum* group' in her monograph) tend to consume the elaiosome in situ rather than removing the seed to a place suitable for germination (Palfi 2017). This species also seems to play an opportunist role in native ecosystems and has been found in very large numbers in WA forest sites that have been logged, burned or otherwise thinned (Heterick et al. 2015). *Monomorium sordidum* occurs in very many environments, including built-up suburbia. Environmental notes for WA material include the following vegetation associations: open low *Eucalyptus* (now *Corymbia*) *chippendalei* woodland, low shrubland, remnant native vegetation on roadside verge, sandplain/laterite heathland, mallee woodland and heathland. On several occasions foragers have been collected from tree-trunks. Nests in native environments are often made under stones or logs. There is also one old record from Boddington of this ant as a 'pest' (WAM). *Monomorium megalops* is an uncommon species that appears to be the sister species to *M. sordidum*, differing only in its very large, oblique eye. This species may also be confused with *M. stictonotum* but can be recognised by its 12-segmented antenna and lack of clypeal denticles. *Monomorium megalops* has only been recorded once from this State, from the goldfields town of Westonia. Other records come from NSW, QLD, and SA. The WA worker was pitfall-trapped in a mining dump in clay soil. The only vegetation association is *Casuarina* (in SA).

Orectognathus (Figure 133)

Orectognathus species can be easily recognised. In this genus of ants, when seen in profile, the antennal scape in the resting position passes above the eye, and the antennal scrobes, when present, also run above the eye. The antenna, including the scape, consists of five segments, with the third segment (measuring from the apical segment) much longer than the other segments of the funiculus. The PF is 5,3. No other WA myrmicine genus has this combination of characters. These snap-jawed ants are stealth predators and are believed to prey on a variety of arthropods (Carlin 1981; Shattuck 1999), although their predatory behaviour has not been studied in detail in the wild. Only *Orectognathus clarki* occurs in WA. This species is known in this State from just three records, two in or near the Stirling Range and a third from the vicinity of the alumina refinery at Worsley, in the Jarrah Forest. However, this ant has an extensive range, and has been recovered in all Australian states except the NT. This species is versatile in terms of preferred habitat, and has been recorded from rainforest, dry and wet sclerophyll and *Casuarina* scrub. Foragers have been collected from tree trunks and low foliage by pyrethrum knockdown and vacuuming, but most specimens have been found under or between rocks, presumably in their nests. Apart from rock, stony ground and red clay soil are the two substrates mentioned.

Pheidole (Figures 133–137)

In WA this is a moderately large genus with mainly dimorphic workers, with 27 taxa covered here (16 regarded as described, 11 as undescribed). Because of the similarity of *Pheidole* workers to a number of other WA myrmicines, a large number of characters have to be assessed in order to determine a major or minor worker ant as belonging to *Pheidole*. Thus: in profile, the antennal scape in the resting position passes above the eye; the antennal scrobes, when present, also run above the eye; the antenna has 12 segments including the scape and possesses a three-segmented club; the postpetiole is attached to the front of the gaster and, in dorsal view, the gaster is not distinctly heart-shaped; the petiole possesses a developed node; the clypeus below the antennal sockets is never raised up into a sharp-edged ridge, and the anterior clypeal margin has numerous unpaired setae or paired setae around the midpoint but never a single median seta; the tip of the sting lacks a lamella; the eye is always present and developed with multiple ommatidia; seen in profile, the propodeum is on a lower plane than the promesonotum (except for *P.*

dispar and *P. antipodum*), with the posterior sector of the promesonotum forming a steep, sloping bridge between anterior and posterior mesosoma, only interrupted by a shallow metanotal groove; and workers are dimorphic. The two exceptions to the usual run of *Pheidole* can be differentiated from other WA myrmicines as follows: *Pheidole antipodum* is a polymorphic species within the genus, in which the promesonotum and propodeum are on the same plane and are only interrupted by a shallow metanotal groove. This species has a small eye with at most four ommatidia at the eye's greatest width, and a PF of 3,2. *Pheidole dispar* is a dimorphic species in which (like *P. antipodum*) the promesonotum and propodeum are on the same plane and are only interrupted by a shallow metanotal groove. Unlike other WA *Pheidole*, this species has an 11-segmented antennae, the femora and tarsi are of normal dimensions, a nodiform, unarmed petiole is present, paired setae straddle the anteromedial clypeal sector and the ant has a PF of 2,2.

Australian members of this genus have never been monographed, and the taxonomy of species related to *P. ampla*, *P. bos* and *P. variabilis* poses a formidable challenge (see Excursus 3 in Part I). In this work *P. variabilis latigena* Forel is synonymised under *P. ampla* Forel (with a degree of hesitation), *P. ampla perthensi*s Crawley and *P. pyriformis* Clark are synonymised under *P. bos* Forel, *P. proxima bombalensis* Forel is synonymised under *P. rugosula* Forel, and *P. variabilis rugocciput* is synonymised under *P. variabilis* Mayr. All WA taxa have known minor workers, but in five cases the major is unknown.

Pheidole antipodum, formerly placed in its own genus *Anisopheidole*, is quite common in south-west WA, with many records from the Perth region and its surrounds. In WA, the range of this species extends to the eastern goldfields. *Pheidole antipodum* is also not uncommon in other parts of Australia and has been recorded from all mainland states except the ACT and QLD, but is likely to occur in the latter jurisdictions as well. This species builds a shallow nest in open soil but can also be found under rocks or logs. Western Australian habitats known for the species include closed low shrubland, jarrah-marri woodland, degraded tuart (*Eucalyptus gomphocephala*) woodland with a ground cover of exotic weeds, open woodland, and an outer suburban lawn. Both lateritic and sandy soils are mentioned on labels. Nothing is known of its biology. Greenslade (1979) thought *Pheidole antipodum* could be a specialist predator of termites, and the notion is echoed by Shattuck (1999), but this seems unlikely given the ant's mandibular morphology and the fact that this species probably does not have a piercing sting (lacking in many *Pheidole*) (Kugler 1979). *Pheidole dispar*, like *P. antipodum*, formerly occupied its own genus, *Machomyrma*. This species shares a similar mesosoma to the preceding species but has one fewer antennal segments and a different PF (2,2, compared with 3,2). In WA, *Pheidole dispar* has only been recorded a couple of times in the northern Kimberley, and the JDM/WAM pinned holdings currently lack specimens of WA workers. The species has also been recorded from NSW, the NT, and QLD and may penetrate as far south as northern Vic. *Pheidole dispar* occurs in mallee and rainforest and is a ground nester in soil or under rocks (Shattuck 1999). Alate queens in WAM have been collected in a malaise trap. Otherwise, nothing is known about the ant.

Pheidole indica and *P. megacephala* are two *Pheidole* introduced to WA that, in the minor worker, possess a large and rather elongate postpetiole that is broader and larger than the petiolar node; seen in profile, the postpetiolar ventrite may be conspicuously swollen. In the minor workers of other WA *Pheidole*, seen in dorsal view, the postpetiole is small and compact, not larger than the petiolar node, and, seen in profile, the postpetiolar ventrite is not conspicuous or swollen. In profile, the promesonotum of the minor worker of *P. indica* has two convexities including a small hump in the mesonotal sector as well as the even curve of the pronotal sector; also, seen in profile, the postpetiolar ventrite does not bulge conspicuously. By way of comparison, seen in profile, the promesonotum of the minor worker of *P. megacephala* has a single convexity (the curve of the pronotal sector), and the postpetiolar ventrite is well-developed so as to bulge conspicuously. In the major worker of *P. megacephala* the junction of the petiole with the postpetiole is broad, but it is narrow in *P. indica* and other WA *Pheidole*. The *Pheidole indica* major worker can be distinguished from similar native *Pheidole* by the lack of denticles on the occipital lobes, frontal carinae that, in full-face view, are well-developed and extend beyond the last quarter of the head with the antennal scapes fitting into a distinct scrobe, a frons with coarse striae that extend longitudinally almost to the vertex without curving or ramifying distally, and a vertex that, in full-face view, is broadly and shallowly emarginate, expressing a weak U-shaped concavity.

In WA, *P. indica* is known from several collections in or close to the Perth metropolitan area, and the occasional intercept. *Pheidole indica* has not been recorded from any other Australian state to date, probably because it hasn't been looked for. The species does not infest dwellings and is

not generally regarded as a pest to agriculture or in native ecosystems. The biology and impact of the ant in overseas settings are covered in Sarnat et al. (2015). This species is easily mistaken for *P. megacephala* in the field, but is active in the middle of the day, an uncommon behaviour for *P. megacephala*. The latter is particularly common in and around Perth, where it often constitutes a domestic nuisance, but the very built-up areas of WA's larger regional centres probably all support populations of this pest. The species also occurs in much of the rest of Australia (although records for the ACT are lacking), with most reports coming from NSW, QLD, and WA. A comprehensive description of the taxonomy, distribution, biology, and impact on human and native ecosystems for this ant can be found in Sarnat et al. (2015).

The minor worker in four species of *Pheidole* (*Pheidole vigilans*, *Pheidole* sp. JDM 280, *Pheidole* sp. JDM 933 and *Pheidole* sp. JDM 1332) has the propodeal angles either unarmed or armed with a minute angle or denticle. These four minor workers are mainly smooth, shining species with sculpture lacking on most of the promesonotum. Other minor workers have their propodeal angles armed with a distinct tooth or a sharp, well-formed denticle (these ants often being highly sculptured, matt species). *Pheidole* sp. JDM 1332 is an aberrant *Pheidole* known from a solitary specimen, a minor worker, from the north-western Kimberley. Uniquely among the WA *Pheidole* fauna this species completely lacks propodeal angles, the propodeum dorsum folding smoothly over on to its declivous face. The sides of the propodeum are longitudinally striate. The eye is also unusually small (≤ 10 ommatidia), the remaining WA *Pheidole* having more than 15 ommatidia in the eye. The single specimen was collected in a malaise trap, but there are no other details concerning its capture. *Pheidole* sp. JDM 933 is a tiny, bright yellow species. The antennal scape of the minor worker is short, barely attaining the vertex of the head and, seen in profile, the entire promesonotum is hemispherical (in the minor workers of other, similar WA *Pheidole* the scape in longer, surpassing the vertex by ≥ 1.5 × its greatest width, and only the anterior sector of the promesonotum is hemispherical, its posterior sector being weakly curved or almost straight as it descends to the metanotal groove). The major worker is even more conspicuous, since the occipital lobes are narrowed and bent anteriad as tiny denticles, the whole of the head thus resembling that of some *Carebara* major workers. This character is not seen in other WA *Pheidole* majors. This species occurs throughout the north-west Kimberley but its occurrence in other states in uncertain, though Andersen (2000) mentions this and/or similar species as occurring in litter in the Australian tropics. Specimens held in the JDM Collection were captured by pitfall trapping in rainforest, but nothing more is mentioned of their habitat or biology.

Pheidole vigilans is a common eastern states ant that has been introduced to southern WA. The general appearance is not dissimilar to *Pheidole* sp. JDM 280, but the minor workers can be distinguished as follows: seen in full-face view, the head is broader with the vertex weakly concave; also in full-face view, the erect setae on the antennal scape are predominantly sub-erect, numerous and generally shorter than the greatest width of the scape. In *Pheidole* sp. JDM 280, seen in full-face view, the head is narrower with the vertex convex or tending to planar; also seen in full-face view, the erect setae on the antennal scape are predominantly erect and sparser than the above, the length of the longest setae greater than the greatest width of the antennal scape. The major worker of *P. vigilans* has lobate occipital lobes that are smooth, glossy and unsculptured, short frontal carinae that do not reach the posterior half of the head, and a promesonotum that completely lacks sculpture (thus distinguishing this species from very similar major workers like those of *P. ampla* that have a sculptured promesonotum). The major worker of *Pheidole* sp. JDM 280 is unknown. In the south, *P. vigilans* is restricted to parts of Perth, especially parks and other well-watered locations. A couple of northern collections from the Pilbara and the eastern Kimberley are here placed in this taxon but exhibit several small but possibly significant differences; notably, the katepisternum is completely microreticulate (mostly smooth in typical *P. vigilans*, with reticulation mainly restricted to the sutures), the node is higher, and the propodeal dorsum is quite flat (slightly convex in typical *P. vigilans*). Interstate, the ant can be found in NSW, QLD, SA, Vic, and Tas, and extralimital populations (doubtless introduced) occur on Norfolk Island and in New Zealand. In southern WA, specimens have been collected in damp urban locations such as lawn and moss near lakes. In Woodville, SA, workers were found ring-barking young cabbage plants growing in compost. In Victoria one nest was found under a stone in pasture. *Pheidole* sp. JDM 280 is found in the western Kimberley, and also occurs in the NT, at least. At Millagoon, in Dampierland in the west Kimberley, this species was pitfall-trapped in pindan and savanna woodland. Workers from Mary River in the NT were also found on the ground.

Pheidole hospes may by a senior synonym of *P. impressiceps* Mayr, but the supposed type minor and major workers of the latter illustrated on AntWeb do not come from the type locality and appear to be of a completely different species, based on Mayr's description. The Rockhampton type material is not illustrated, but the description matches that of *P. hospes*. *Pheidole hospes* belongs to an Indomalay *Pheidole* species-group in which the occipital carina in the minor worker is produced to form a nuchal collar. This feature is unique among WA *Pheidole*, and immediately distinguishes this species. The major worker, on the other hand, is not as spectacular, apart from its size, and keys out next to *P. indica* (see discussion above). The *P. hospes* major worker can, however, be separated from *P. indica* by the appearance of the vertex in full-face view. In the case of *P. hospes* the vertex is narrowly emarginate medially, expressing a distinct V-shaped concavity (broadly and shallowly emarginate, expressing a weak U-shaped concavity in *P. indica*). In WA, the only JDM/WAM record comes from the west Kimberley coast, and *P. hospes* is seen more commonly in the NT and QLD. The extralimital range of this tropical ant extends to Irian Jaya/Papua New Guinea. This rainforest species is largely arboreal, and often nests in dead or living branches, in epiphytes and under bark, although it may also nest in leaf litter on the forest floor. The ant can be attracted to fish bait and, while collection method is mostly given as 'by hand', Winkler sacs have also been successful.

While WA does not have the spectacular tropical *Pheidole* species with well-developed pronotal spines, the minor workers and the known major worker of two taxa bear small humeral denticles (lacking in other WA *Pheidole*). In *Pheidole longiceps* complex near *doddi* Forel (TERC) the promesonotum, seen in profile, is raised as a distinct ledge above the level of the propodeum and the propodeal spines are directed vertically. In *Pheidole* sp. JDM 684 the promesonotum, seen in profile, descends over a small protuberance to the propodeum, but is not raised as a shelf above the level of the propodeum. Only the minor worker of *P. longiceps* complex near *doddi* was seen in TERC, but the major worker is likely to be identical with *P. longiceps doddi* or very close. The major worker of *Pheidole* sp. JDM 684 is not known. *Pheidole longiceps* complex near *doddi* is found in scattered populations in the Kimberley, most records coming from the northern Kimberley subregion. The ant also occurs in the NT and QLD. Andersen (2000) mentions that this species and its close relatives prefer shaded rainforest habitats; however, there are no ecological or other data for this species on Web-based sources. *Pheidole* sp. JDM 684 has been collected rarely in the Pilbara and also on Barrow Island in pitfall traps, but essentially nothing is known about this species.

Pheidole proxima has a bright yellow minor worker. The head and most of the promesonotal dorsum are smooth, shining and unsculptured. This does not agree with Mayr's (1976) description of the minor worker, and it is possible that the syntype major workers and minor workers used for the description belong to two different species, the minor worker possibly being *P. variabilis* or a close relative. This is a real possibility, as the major worker of *P. variabilis* is very much like the major worker of this ant and keys out in the same couplet. Unlike the minor worker, the major worker takes some getting to in the taxonomic key as it is a nondescript *Pheidole*, but it does have the following characters: the species is on the small side (HW ≤ 1.45 mm); the head is narrowly spherical in shape; the occipital lobes are lobate; seen in full-face view, the frontal carinae do not reach past the posterior half of the head; the frons is finely striate and the striae peter out well before the vertex, which has fine, transverse rugae; viewed in profile, the promesonotum is more-or-less symmetrical, has transverse rugulae and descends steeply towards the metanotal groove; the length of the propodeal spines is approximately 2 × their width across their base; and, seen in profile, the sides of the mesosoma are mainly shining with reduced microreticulation. *Pheidole proxima* is largely tropical with several records from the Pilbara and Kimberley, but there is one possible record from Cadoux in the Avon Wheatbelt (although that small minor worker differs in terms of promesonotal outline and sculpture and may belong to a separate species). This ant has also been recorded from NSW and QLD and its range likely extends into Vic in the south and the NT in the north. *Pheidole proxima* supposedly has been introduced to New Zealand. However, the major worker of the NZ specimens illustrated on AntWeb, along with major workers in ANIC identified as this species, do not exactly agree with either the description or the appearance of the imaged syntype major workers (two of these). No syntype minor worker has been imaged. The syntype major workers have well-defined transverse striae on the dorsum of the promesonotum (lacking in the illustrated NZ major worker, which is completely smooth). On the other hand, the WA major workers strongly agree with the syntype workers. Australian specimens have been pitfall-trapped but nothing is known of their biology.

Pheidole hartmeyeri is a rather large *Pheidole*, whose nests in southern regions are easily identified by the discarded bracts and other floral parts

of smokebush, bluebush and other shrubs. This species has a finely microreticulate minor worker with small but sharply pointed propodeal denticles that are directed vertically, but the minor worker lacks humeral denticles. This subcaste is large (HW ≥ 0.85 mm), brown and, in full-face view, the occipital carina is seen to be developed and clearly visible as a narrow strip above the vertex; seen in profile the head is gently curved as it descends from the vertex. This combination of characters serves to identify the minor worker. Longitudinal striae on the frons in the major worker, seen in full-face view, peter out at the base of the smooth occipital lobes (which are smooth and glossy). Seen in profile, the promesonotum is more-or-less symmetrical and always has transverse striae or rugulae. In full-face view, the head of the major worker is square and gently widened posteriad, the occipital lobes are not closely approximated, and the cephalic sulcus between the lobes is shallowly impressed. This is a common ant throughout its range, which largely takes in the drier western and central parts of the SWP, the eastern goldfields, and mid-western WA to about Carnarvon. The range of this species extends eastwards to SA. *Pheidole hartmeyeri* has been recorded in yellow sand, light sand over laterite, yellow, loamy soil and light soil/clay. Vegetation associations include chenopod shrubland, degraded mulga shrubland, mallee woodland, York-salmon gum woodland and mixed *Banksia/Xylomelum* heath. This species appears to be largely or exclusively granivorous. The crater nests of *Pheidole hartmeyeri*, decorated as described above, can be very numerous in suitable locations.

The remaining minor workers are small to moderate in size (HW < 0.70 mm), in full-face view, the occipital carina is generally less developed and is either invisible or appears only as a sharp edge above the vertex. The larger species, seen in profile, have a head that is often flattened near the vertex.

The WA *Pheidole incurvata* complex representatives (at least three species in the state) have a minor worker with a distinctive reniform or inverted lachrymiform eye that is positioned obliquely across a vertical axis less than its own length from the mandibular articulation. This eye form is also seen in other small myrmicines (e.g. *Mayriella* and some *Monomorium*) and there may be some as yet unknown adaptive significance in such an eye shape in these tiny ants. *Pheidole incurvata* Viehmeyer itself was described from material collected at Liverpool, NSW. The minor worker does not have the characteristic elongate eyes seen in the WA species, and the placement in this species complex of the following three taxa is based on the appearance of the frons of the major worker, which is quite distinctive. The very short erect setae in the minor worker (modified in *P. incurvata*) are probably also diagnostic. The differences between *Pheidole* sp. JDM 164 and *Pheidole* sp. JDM 429 are very subtle and may be debated but appear to be consistent throughout the material seen. All minor workers in this complex are small (HW < 0.50 mm), and the erect setae on both head and body are short (shorter than the length of the eye) and may be modified (clavate or spatulate). The known major workers for the complex, seen in full-face view, have longitudinal striae on the frons which curve strongly inward in a concentric pattern, and often meet at the midline of the frons. Seen in dorsal view, the dorsum of the occipital lobes has coarsely reticulate and areolate or rugose sculpture. Viewed in profile the promesonotum is more-or-less symmetrical. The most common of this small grouping is *Pheidole incurvata* complex sp. JDM 164. The minor worker of this species is dark brown or blackish, with a distinctly convex promesonotum when viewed in profile; in full-face view, the antennal scape is nearly always short and fails to attain the vertex by about its own width when in an upright position (rarely the antennal scape may barely reach the vertex). In the minor worker of the very similar *Pheidole* complex sp. JDM 429 the promesonotum is planar for most of its length when viewed in profile, and, in full-face view, the antennal scape is longer and attains or surpasses the vertex when in an upright position. The dorsum of the occipital lobes in the *Pheidole incurvata* complex sp. JDM 164 major worker is densely areolate-rugose, the lobes broadly rounded above. The dorsum of the occipital lobes in the *Pheidole* complex sp. JDM 429 major worker has mainly transverse rugae, with areolate sculpture reduced to a few patches, and the lobes are narrowly rounded above. *Pheidole incurvata* complex sp. JDM 164 has a wide distribution in WA that stretches to the SA/WA border in the east and to the Pilbara in the north. Most records are from the SWP, probably because of concentration of collecting effort as the ant seems to be common in many places. This species can also be found in SA, and probably occurs in other states. Known habitats include heathland, wooded sandplain, York-salmon gum woodland, and jarrah-marri woodland. Most label references are to a sandy soil structure (including white sand), but this ant has also been found on yellow, loamy soil. Around Perth, particularly in remnant bushland, this is one of the most commonly seen *Pheidole* species. *Pheidole* complex sp. JDM 429 has a similar range, but thus far populations have not been found much further east than Norseman. In some cases, these two species appear to be sympatric. The occurrence of this taxon interstate is unknown. Based on label data from a more limited number of specimens,

Pheidole complex sp. JDM 429 occurs in much the same habitats with the same soil types as *Pheidole incurvata* complex sp. JDM 164. The minor worker of *Pheidole incurvata* complex sp. JDM 306 differs from the minor worker of the preceding two species in being yellow or yellowish, and in having more obviously thickened or clavate setae. The major worker is not yet known, and the species appears to be restricted to the NP, most records coming from the northern and western Kimberley. In all likelihood *Pheidole incurvata* complex sp. JDM 306 also occurs in the NT. The only label data available mentions workers from Millagoon were pitfall-trapped in pindan/savannah woodland.

The other WA *Pheidole* minor workers have an ovate eye that is positioned along a vertical axis at least its own length from the mandibular articulation. In four of these species (*Pheidole ampla*, *P. bos* [both the typical and the '*pyriformis*' morph], *P. turneri* and *Pheidole* sp. JDM 934) the frons of the worker is shining and mainly smooth apart from longitudinal striae, other sculpture being absent or very much reduced (e.g. a few reticulate patches may be present near the vertex, and some, mostly obscure microreticulation may be present on the sides of the head). In *P. bos* complex sp. JDM 871, *P. deserticola foveifrons*, *P. mjobergi*, *P. mjobergi* complex sp. JDM 1176, *P. rugosula*, *P. rugosula* complex sp. JDM 337, and *P. variabilis*, on the other hand, the frons of the minor worker always displays other prominent sculpture, this being chiefly reticulate and microreticulate sculpture, and the appearance is mainly matt.

Viewed in profile, the propodeal angles of the *Pheidole* sp. JDM 934 minor worker are developed as gently curved, long spines that do not arise from a broadly triangular base, the spines being 5 × as long as their width across their base (this is a tawny yellow species with a largely unsculptured, smooth promesonotum). Viewed in profile, the propodeal angles of the other smooth-headed minor workers are developed as teeth or short spines that arise from a broadly triangular base, the teeth or short spines ≤ 3 × as long as their width across their base. What appear to be at least two size classes of major and a variable morphology occur for this species, although it is possible two species of *Pheidole* may actually be represented. The differences, however, may be clinal for this possible relative of *P. variabilis*. In full-face view, the large major has occipital lobes that possess very fine, almost indistinct striolae; seen in profile, the head is narrow and evenly oblong in shape, and is slab-like; also seen in profile, the promesonotum only weakly descends to the metanotal groove. The head of the small major worker viewed in profile is narrower at the vertex than it is anteriad. Seen in dorsal view, this morph has the transverse rugae on the occipital lobes limited to two or three faint ridges on their dorsum, these being only barely visible in full-face view; seen in profile, the propodeum is armed with slightly curved spines, these being long and acuminate, their length ~4 × their width at the base. *Pheidole* sp. JDM 934 is found throughout the central and northern Kimberley. This species has been collected in both rainforest and woodland, and yellow pan traps have been successful in capturing several series.

The minor worker of *P. turneri* that can now be associated with that species is a small, bright yellow ant (HW ≤ 0.45 mm), the *P. ampla* and *P. bos* minor workers being larger (HW ~0.50 mm) and darker coloured. *Pheidole turneri* includes two separate species among the syntype material illustrated on AntWeb. The major worker represents a unique type species, but a minor worker is clearly identical with the earlier named *P. variabilis*. The major and (correct) minor worker can now be associated. The minor worker should be described and the wrongly associated minor worker removed from the series by being made a paralectotype, a current syntype major worker being made the lectotype for the name. The major worker is more distinctive than the minor worker. Viewed in profile, the frons of the head in the major worker is noticeably flattened and feebly depressed near the vertex, the occipital lobe nearest the viewer being slightly curved anteriad; in full-face view, one or two transverse rugae near the vertex are particularly prominent. The major worker is also very small (HW ~0.80 mm) compared with the much larger major workers of *P. ampla* and *P. bos* (HW ≥ 1.65 mm). *Pheidole turneri* is very common on Barrow Island, the Pilbara and the Kimberley, and it extends southwards to the Cape Range, near Exmouth. Most specimens have been pitfall-trapped, but there are no other details.

Pheidole bos and *P. ampla* are two of the more common *Pheidole* in the south-west of WA and also pose considerable taxonomic problems (see Excursus 3 in Part I). The minor workers are easier to separate than the major workers, but both exhibit considerable variation in sculpture, with some morphs being highly striated (although still shining) while other minor workers exhibit an almost completely smooth frons and promesonotum. This variation is not discrete but occurs along a gradient, even within a nest. The best method of separating the taxa is to view the promesonotum in profile; in *P. ampla* the promesonotum is not strongly humped but exhibits a more-or-less smooth anterior convexity that descends gradually towards the metanotal groove over what is only a slight undulation posteriad. The eyes are slightly larger than its sister taxon (EW ≥ 0.25 × length of

side of head). In the *P. bos* minor worker, seen in profile, the promesonotum is strongly humped and often terminates in a relatively steep declivity immediately before the metanotal groove. The eye is slightly smaller (EW ≤ 0.22 × length of side of head) (note: the taxonomic key in Part I also enables the reader to separate the extremely smooth morphs [*'P. pyriformis'*] from those with typical sculpture [*P. bos*]). The appearance of the major worker raises the greatest taxonomic issues: previous publications (e.g. Heterick [2009]) or original descriptions have separated *P. ampla* and *P. bos* on the basis of the horizontal rugae on the upper frons usually seen in the latter but absent from the former. Heterick (2009) also uses the anteromedial teeth on the underside of the head to distinguish the two taxa. However, the former character is not an invariable guide as this feature is lacking in some *P. bos* major workers, and the latter character is also dubious and has the added disadvantage of not always being visible (without dissection), and the teeth may be abraded. In fact, the most useful character is the postpetiole. In *P. ampla* this part seen in full-face view or from above is rounded and lacks distinct acute angles, or small denticular wings, whereas distinct acute angles or small, denticular wings are present on this sclerite in *P. bos*. Most major workers of the latter also have reticulate sculpture on the promesonotum, while the promesonotum has transverse rugulae in *P. ampla*. In a few series from localities in the Avon Wheatbelt and Mallee subregions, the major worker has distinct incurved striae or rugulae on the frons (but is otherwise quite distinct from major workers in the *P. incurvata* complex), although the postpetiole is of the *P. ampla* conformation. The appearance of the frons corresponds closely to the major worker of *P. bos baucis*. The minor workers, however, look to be different with somewhat larger eyes, the local minor workers agreeing closely with those of unequivocal *P. ampla*. Since the type locality of *P. bos baucis* major and minor workers is given only as 'NSW', it is altogether possible that separate species have become associated within the type series. The syntype worker of *P. ampla perthensis* illustrated on AntWeb, moreover, also departs from the standard appearance of the nominal taxon by having some curved striae on the frons but these are confined to the lower half of the head and do not continue to the occipital lobes. This will require further research. For the moment, this author thinks it best to leave the two morphs under the umbrella of *P. ampla*, although this is not a comfortable fit.

Several names become junior synonyms in this work: *P. pyriformis*, from Port Lincoln, SA, appears to meld into the general appearance of *P. bos*. Also conforming closely to *P. bos* is *P. ampla perthensis*, the major workers of both ants being described from material from the Perth metropolitan area, although a supposed syntype minor worker of *P. bos*, illustrated on AntWeb, that was collected from Ballarat in Vic. is probably not this species (and is also not a syntype, as Ballarat is not mentioned as a type locality by Forel [1893]). Major and minor syntype workers of *Pheidole variabilis latigena* (clearly nowhere near *P. variabilis*) also appear to fit within the mainstream of *P. ampla* morphs, and *P. variabilis latigena* here becomes a junior synonym under that name.

Within WA, *Pheidole ampla* is mainly concentrated in eastern and northern parts of the SWP, but occurs as far north as the Pilbara, and is found occasionally in the Perth region. The species may occur interstate but records require verification in view of the difficulty in identifying *Pheidole* workers. Series have been collected in saltbush/mallee remnant near paddocks, in *Melaleuca lanceolata* shrubland, in a largely cleared road verge and in a rehabilitated limestone quarry. The '*P. bos baucis*' morph has been collected in *Acacia/Hakea* shrubland with *Plectrachne* ground cover. *Pheidole bos* is the more common of the two species and is perhaps the native *Pheidole* most commonly found in the Perth region and in the Jarrah Forest. Within WA, this species has been taken as far north as the Little Sandy Desert and as far east as Mundrabilla. This species certainly occurs in SA, but records from Vic require verification. *Pheidole bos* is very tolerant in terms of its environment and is found in a wide variety of habitats — *Banksia/Allocasuarina*, *Eucalyptus camaldulensis* with *Acacia* and vines, York-salmon gum woodland, on white sand coastal dunes, coastal scrubland, on karri trunks and on lawn and verges in built-up areas to name just a few habitats. Sandy soil seems to be preferred and this includes white or grey-over-yellow sand, although the ant has also been taken on red clay soil near Carnarvon. Nests can be numerous in suitable sites. Both this and the foregoing species may be found in yards, grassy verges and weedy edges of playing fields, etc. within WA's larger cities and townsites, but their numbers have probably been curtailed compared with their historical incidence with the spread of the highly competitive Big-headed ant, *Pheidole megacephala*, in recent decades.

Pheidole deserticola foveifrons is a large species that almost rivals *P. hartmeyeri* in size. The minor worker can be distinguished from *P. bos* complex sp. JDM 871, *P. mjobergi*, *P. mjobergi* complex sp. JDM 1176, *P. rugosula*, *P. rugosula* complex sp. JDM 337, and *P. variabilis* by the netted pattern of large reticulations on the upper frons and on the anterior and lateral sectors of the promesonotum.

Minor workers from the Pilbara are ferruginous and duller in appearance, whereas those from the eastern goldfields, the Avon Wheatbelt, the Mallee, and the southern fringe of the Yalgoo subregion are chocolate brown and have a less sculptured and more shining cuticle (and correspond to images of types of minor workers appearing on AntWeb). While these two forms may represent different although very similar sibling species, the major worker of the southern morph (based on AntWeb images) is identical with the syntype major worker, which has the cuticle and coloration of the northern, ferruginous morph. The position taken here is that populations located between the two forms (as yet unsampled because of the remoteness of this part of WA) will likely reveal a clinal pattern. The major worker is nearly always recognisable because of its size (HW ≥ 2.5 mm) and glossy, unsculptured occipital lobes. This major worker also differs from the major worker of *P. hartmeyeri*, the only other WA species with which it could be confused, by its head shape, which in full-face view tends to longitudinally rectangular, with the sides parallel, the occipital lobes closely approximated, and the cephalic sulcus between them distinctly impressed (in *P. hartmeyeri*, seen in full-face view, the head is square and gently widened posteriad, the occipital lobes are not closely approximated, and the cephalic sulcus between the lobes is rather shallowly impressed). The two WA populations mentioned above are well separated geographically. This ant is much less common than *P. hartmeyeri* in WA, and was described from SA, the only other Australian state from whence it has been recorded. Ecological information is lacking on the northern form, but foragers of the southern form have been collected nocturnally on the ground in sandplain laterite heathland. The species has also been taken in closed shrubland, this time foraging diurnally. *Pheidole deserticola foveifrons* is known to nest directly in soil.

Pheidole variabilis is another ant in which the minor worker is easily recognised. Based on AntWeb images of types, this ant has been described many times under different guises, mostly as various subspecies of *P. variabilis*. The earliest synonym that matches the ant's morphology is '*variabilis*', hence that name has been assumed here. The minor worker of this very common northern species has sculpture that consists almost exclusively of fine microreticulation without distinct striae, reticulate areas or smooth, shining sectors, the ant being completely matt in appearance. Workers are yellow to tawny orange. The remaining five *Pheidole* do not share this combination of characters. The major worker is much less distinctive, but can be distinguished from the known major workers of the other five species by a combination of the following characters: seen in full-face view, the longitudinal striae on the frons are straight and peter out at the base of the smooth occipital lobes and, seen in profile, the promesonotum is more-or-less symmetrical and its rugae are mainly transverse (the rugae on the promesonotum mostly meet its midpoint at an oblique angle and are rarely transverse in the rather similar *P. rugosula* and *P. rugosula* complex sp. JDM 337 major workers). *Pheidole variabilis rugocciput* appears to be the same ant, and so that subspecies becomes a junior synonym in this work. In WA, *P. variabilis* has been collected from the Pilbara and Barrow Island northwards, and is one of the most common small myrmicines collected in pitfall traps in inventory work for mining companies, etc. *Pheidole variabilis* also occurs in the NT and QLD, at least, but not all the nominal subspecies belong to this taxon, and so the records purporting to be of *P. variabilis* must be treated with caution. Despite the very many times this ant has been collected, the existing pinned material in the JDM/WAM Collections is rather old and label data are lacking. Doubtless this is a small generalist that can be found in a variety of habitats, but the only available label data mention it being collected in forest on Boongaree Island in the north-western Kimberley and by pitfall trap in red sand on Enderby Island.

The morphology of the minor worker *Pheidole bos* complex sp. JDM 871 (the major worker of this species is unknown) generally conforms to that of the *P. ampla/P. bos* genetic cluster, but this ant has a stronger microsculpture including a microreticulate/striolate frons (except for a smooth, shining, medial sector) and a uniformly microreticulate promesonotum. This species is larger than *P. rugosula* and *P. rugosula* complex sp. JDM 337 (HW ≥ 0.52 mm compared with HW ≤ 0.48 mm), and has a shorter antennal scape (scape barely reaching the vertex if at all compared with antennal scape longer, surpassing vertex by at least 1.5 × its greatest width), a smaller eye (EL ≤ 0.18 × length of side of head compared with EL ≥ 0.20 × length of side of head) and dark chocolate colour (ochraceous or tawny orange-brown in the *P. mjobergi* complex) compared with *P. mjobergi* and *P. mjobergi* complex sp. JDM 1176. This species is known in WA from two collections, one from Ethel Creek Station and one from Kadji Lake Road, Pintharuka, in the mid-west of the state. The latter

specimens were hand-collected from a nest or nests near a salt lake. Nothing more is known of the habits or ecology of this species and its occurrence in other states is equally unclear.

Pheidole rugosula and *P. rugosula* complex sp. JDM 337 are two very small species (minor worker HW ≤ 0.48 mm). In the minor worker, the smaller size separates them from *P. mjobergi* and *P. mjobergi* complex sp. JDM 1176 (HW ≥ 0.52 mm). The major worker can immediately be separated from that of *P. mjobergi* and *P. mjobergi* complex sp. JDM 1176 by the appearance of the longitudinal striae on the frons seen in full-face view. In the former these striae curve strongly outward, often becoming transverse as they pass across the occipital lobes. In the latter the longitudinal striae on the frons continue to the vertex without diminution or transformation into other sculpture, these striae curving only slightly as they traverse the occipital lobes. The promesonotum seen in profile in these two species is also strongly asymmetrical and humped and directed posteriad, with a long, sloping pronotal sector and an almost abruptly declivous mesonotal sector, whereas in *P. rugosula* and *P. rugosula* complex sp. JDM 337 the promesonotum, seen in profile, is more-or-less symmetrical and not directed posteriad. Only the minor workers of *P. rugosula* and *P. rugosula* complex sp. JDM 337 can be separated, based on details of the frons: In *P. rugosula*, seen in full-face view, the frons is shining and largely smooth or with only feeble or indistinct sculpture between paired longitudinal striae that extend almost to the vertex and, seen in dorsal view, the median sector of promesonotum is mainly smooth and shining. In *P. rugosula* complex sp. JDM 337, seen in full-face view, the frons is matt, finely striolate and microreticulate between paired longitudinal striae that extend almost to the vertex; seen in dorsal view, the promesonotum is matt with uniform microreticulation and a few incomplete longitudinal striae. *Pheidole rugosula* complex sp. JDM 337 also tends to be more distinctly orange in colour, compared with light fawn or brown in *P. rugosula*. The major workers of these two species have no obvious visible morphology by which they may be separated. Within WA, *P. rugosula* appears to be largely confined to the SWP, where it is particularly common on the Swan Coastal Plain and in the Jarrah Forest. In bushland areas this species is often found in conjunction with one or more of the *P. ampla* complex species and *P. incurvata* complex sp. JDM 164 but is not very often seen in built-up areas. Interstate the ant is known to occur in NSW and southern QLD, but probably has a wide range in southern Australia, and it has been introduced to NZ (Berry et al. 1997). Within WA this species has been collected in a variety of natural habitats, mostly involving white sand. These include sandplain laterite heathland, mallee woodland, white sand coastal dune, *Banksia/Nuytsia* woodland, *Banksia* woodland, disturbed wandoo woodland, coastal scrub with white sand and woody debris, relictual woodland with scattered jarrah and marri over white sand, and low coastal scrub. The species typically makes a small nest directly into soil. *Pheidole rugosula* complex sp. JDM 337 prefers more arid situations to its close relative (although there is some overlap) and has been collected from Merredin in the central wheatbelt to as far east as Mt Crawford, on the edge of the Great Victoria Desert. The occurrence of this species in other states is not known. Workers have been taken from soil nests, but there are no additional label data.

The minor worker of *Pheidole mjobergi* is not dissimilar to a larger version of *P. rugosula*, but the major workers are very different in appearance. Seen in dorsal view, the promesonotum of the *P. mjobergi* minor worker has irregular longitudinal striolae in addition to uniform microreticulation (the latter lacking in two workers from Ophthalmia Dam that have a mainly smooth, shining promesonotum); also seen in dorsal view, the dorsum of the head is reticulate, with descending longitudinal striae, but microreticulate sculpture is not or is only barely visible. Seen in dorsal view, the promesonotum of the closely related *P. mjobergi* complex sp. JDM 1176 is exclusively microreticulate without striolae; also seen in dorsal view, the dorsum of the head carries little or no

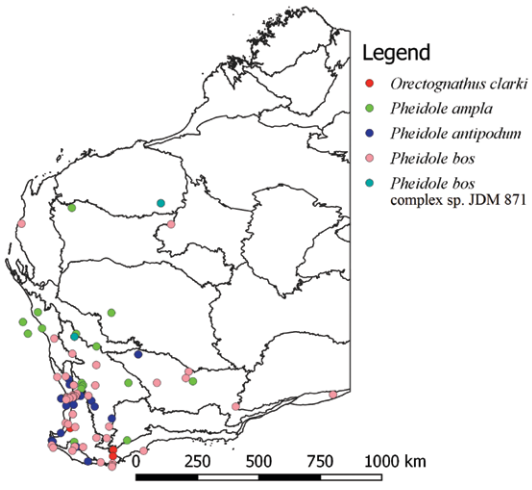

FIGURE 133 Distribution of *Orectognathus clarki*, *Pheidole ampla*, *P. antipodum*, *P. bos* and *Pheidole bos* complex sp. JDM 871.

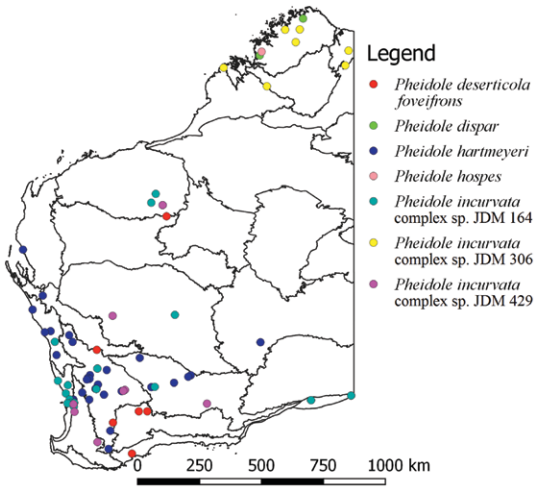

FIGURE 134 Distribution of *Pheidole deserticola foveifrons*, *P. dispar*, *P. hartmeyeri*, *P. hospes*, and *Pheidole incurvata* complex sp. JDM 164, JDM 306 and JDM 429.

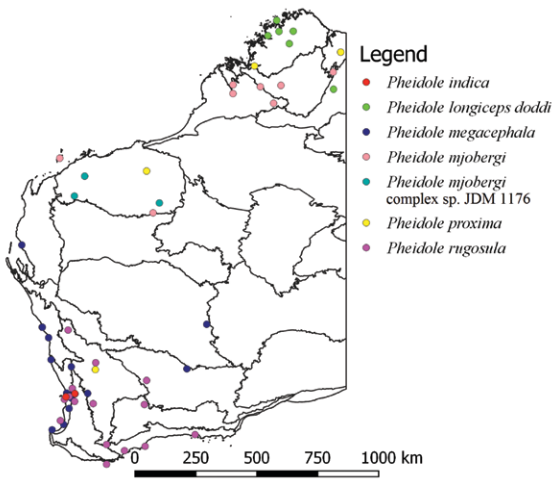

FIGURE 135 Distribution of *Pheidole indica*, *P. longiceps doddi*, *P. megacephala*, *P. mjobergi*, *Pheidole mjobergi* complex sp. JDM 1176, *P. proxima* and *P. rugosula*.

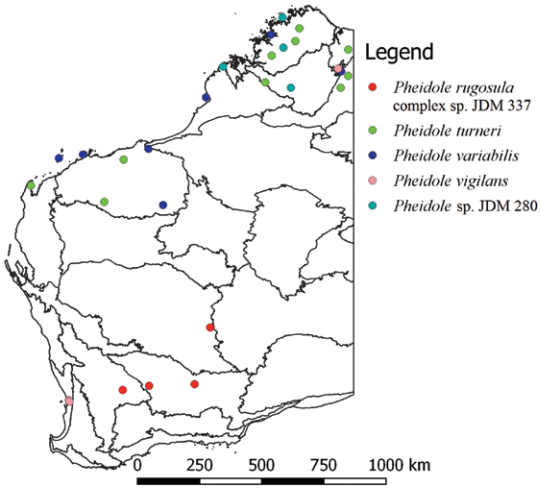

FIGURE 136 Distribution of *Pheidole rugosula* complex sp. JDM 337, *P. turneri*, *P. variabilis*, *P. vigilans* and *Pheidole* sp. JDM 280.

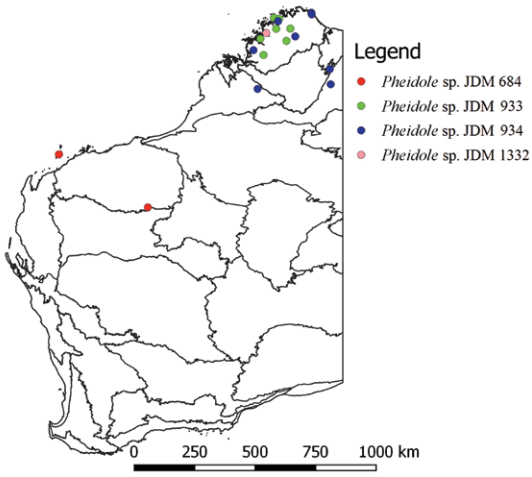

FIGURE 137 Distribution of *Pheidole* sp. JDM 684, JDM 933, JDM 934 and JDM 1332.

reticulate sculpture but microreticulate sculpture is plainly visible. In the *P. mjobergi* major worker, seen in dorsal view, the humeral angles of the promesonotum are produced laterally as small, anteriorly directed cuticular horns or processes, but in the major of *P. mjobergi* complex sp. JDM 1176 the humeral angles of promesonotum form convex lobes. The minor worker of this species is very similar to that of *P. platypus* Crawley, a third member of this complex, but the promesonotum of the major worker of *P. platypus* is much bulkier. *Pheidole mjobergi* is quite common in the Kimberley but its range extends south to the Pilbara and to Barrow Island. On the other hand, all JDM/WAM records of *P. mjobergi* complex sp. JDM 1176 are confined to the Pilbara. The range of *P. mjobergi* unquestionably extends into the NT, and it is not improbable that, as with many tropical ants, it can also be found in northern QLD. However, the range of *P. mjobergi* sp. JDM 1176 is likely to be more circumscribed although its occurrence in other states is unknown. Workers of *Pheidole mjobergi* have been collected from litter at Willare Bridge, south of Derby and members of this group are said to be largely granivorous (Andersen 2000), but crucial label data are lacking. Major and minor workers of *P. mjobergi* complex sp. JDM 1176 have been captured in ethylene glycol pitfall traps, but nothing else is recorded for this species.

Podomyrma (Figures 138–139)

Podomyrma is a moderate sized genus with 13 species (two undescribed) recorded from WA. This is also the only myrmicine genus found in the state that is almost exclusively arboreal. In appearance these are sometimes colourful but morphologically unremarkable ants. To arrive at the genus the following characters have to be ticked off in the taxonomic key: seen in profile, the antennal scape in the resting position passes above the eye; antennal scrobes, when present, also run above the eye; the antenna is 11-segmented, including the scape, and has a weak 3-segmented club; the postpetiole is attached to the front of the gaster, and, seen in dorsal view, the gaster is not distinctly heart-shaped; the petiole in this genus is often barrel-shaped with or without spines but is not flattened; the clypeus below the antennal sockets is usually smooth and never raised up into a sharp-edged ridge; the tip of the sting lacks a lamella and is thin and pointed; and the femora and often the tibiae of the middle and hind legs are conspicuously swollen. Despite this group of ants' overwhelming preference for arboreal nests in solid wood, Shattuck (1999) records occasional ground nesting along with terrestrial foraging, and *Podomyrma* in the JDM/WAM Collections have sometimes been collected from the soil surface or while crawling on grass. As far as is known, *Podomyrma* species are generalist scavengers and, based on images of live foragers posted on the Web, also tend various Hemiptera.

A clade of five *Podomyrma* (*P. adelaidae*, *P. basalis*, *P. chasei*, *P. gastralis* and *Podomyrma* sp. JDM 512) are united by the longitudinally striate frons, the angulate or dentate humeral angles, the striate or striate-reticulate mesosoma and the shape of the nodes By far the most commonly seen species in this state is *Podomyrma adelaidae*. The paired but well separated white anterior maculae on the first gastral segment are peculiar to this ant, although faint, conjoined maculae may be seen on some workers from other species in the genus. *Podomyrma adelaidae* is most common in southern WA but can be found in the remote eastern desert areas and as far north as the Pilbara, and has been recorded from all mainland Australian states except the ACT (although it most likely also occurs there). While not particularly tolerant of urbanisation, *Podomyrma adelaidae* is occasionally seen on street trees in the Perth metropolitan area. Most records come from mallee but other eucalypts recorded on labels include jarrah and wandoo. Additional vegetation associations are sandalwood and *Acacia veronica*. This species has been collected by pyrethrum knockdown, vacuum sampling and by hand from nest holes in branches. One South Australian series was taken from a soil nest, but this should be regarded as atypical for this species. *Podomyrma chasei* is very similar in appearance to *P. adelaidae* but lacks the paired white maculae on the first gastral tergite, which in this species is usually uniformly dark but may be lighter towards its base. This ant may also be distinguished by its striate-reticulate mesosoma, its angulate humeri and the many close, parallel striae on the head. Local populations of *Podomyrma chasei* appear to be confined to the Swan Coastal Plain and the western portion of the Darling Range, and several collections have been made in relict woodland in the Perth metropolitan area. The Atlas of Living Australia also has one interstate record for this species, from Batlow, NSW. Workers have been taken on the trunks of jarrah and *Banksia attenuata*, and a large series from Karragullen was obtained by pyrethrum knockdown.

Podomyrma gastralis (mentioned under its junior synonym '*Podomyrma tricosa*' in Andersen [2000]) is a handsome red-black-and-yellow species with distinctly denticulate humeral angles. This ant has been recorded in the state on one occasion in the central Kimberley (TERC). Within Australia this species also occurs in the NT and QLD, and its range extends to Papua New Guinea. *Podomyrma gastralis* is to be found in both Eucalypt woodland and rainforest and has been taken on *Melaleuca*. Workers may forage on the ground and have been taken on a track around a billabong. One worker was found being dragged along a log by *Amopholopis* sp. [spelling?]. *Podomyrma* sp. JDM 512 is represented in JDM/WAM by a solitary worker. In full-face view, the frons in this species is longitudinally striate medially, with the genae and the area around the vertex striate-reticulate. Seen in dorsal view, the promesonotal angles are very small and inconspicuous, and the gaster is evenly dark with a faint suggestion of paired maculae near the base of the first gastral tergite. The legs are very hairy for this group of *Podomyrma*, and the femora have very many sub-erect setae. The worker that represents all we know of this species was collected at Marandoo in the Pilbara in 1980, but there are no biological details. *Podomyrma basalis* is another Torresian species known in local collections from a single worker collected in a malaise trap on Mt Connor in the far northern Kimberley. The pale base of the first gastral tergite and the bicoloured legs immediately identify this species. *Podomyrma basalis* is also known

from the NT and QLD, and the range of the ant along with a number of nominal subspecies extends northwards into the island of Papua (both Papua and Papua New Guinea) and the islands around Papua. Labels on material taken in other Australian states or overseas indicate the ant can be found in rainforest, savanna and dry sclerophyll and even in a tropical garden. Apart from the generic mention of *Eucalyptus*, the only vegetation association is *Ficus*. Workers have been collected from tree boles, tree trunks and treetops.

Podomyrma clarki with its punctate head and mesosoma appears to stand somewhat apart from the other *Podomyrma*. The propodeum is smoothly rounded, and erect setae are very sparse on the mesosoma and entirely lacking on the gaster (but abundant and well-distributed on the gaster and other body surfaces in the other species that lack propodeal teeth or spines). In WA, *Podomyrma clarki* is restricted to a narrow stretch of coastal sandplain between Perth and Eneabba and this appears to be the global range for this taxon. Even within this limited range the ant is rarely seen. What appears to be the holotype worker (the worker length is specific in Crawley's [1925] description) was collected from a very small colony that had made its nest in the hollow root of an *Acacia*. Other specimens taken in relictual woodland in the Perth metropolitan area have been netted in *Banksia/Casuarina* woodland, hand-collected from the ground in *Banksia* woodland and pitfall-trapped (Bold Park). Another specimen was pitfall-trapped on a sandplain slope in the Eneabba region.

Podomyrma elongata and *P. macrophthalma* are two brown, narrow-headed species that appear to be closely related. The propodeum in *P. elongata* is unarmed, the mesosoma is longitudinally striate or striate-reticulate, erect setae are abundant and well distributed on the body surfaces, including the gaster, in full-face view, the frons of the head has many close, parallel striae, at least, medially and, in dorsal view, the humeri are smoothly rounded. *Podomyrma elongata* is found in WA in areas of high rainfall in the western Darling Range and on or near the western south coast. This species, however, has an extensive range across other Australian mainland states and has been recorded from NSW, QLD, SA, and Vic. Workers have been found on jarrah, scribbly gum, on 'low vegetation' and in karri litter, and have been collected by pyrethrum knockdown and in pitfall traps. While workers of *P. elongata* are relatively uniform, this is not the case with *P. macrophthalma*. Workers of the latter can mostly be identified by the presence of propodeal spines, denticles or blunt angles and a frons which, in full-face view, has an area around the vertex that is mainly smooth and shining with a few longitudinal striae; in dorsal view, the promesonotum has similar sculpture to the vertex. However, a worker collected in the Nuyts Wilderness area near Walpole has an unarmed propodeum and the petiolar node bears small lateral teeth (specimen held by the Department of Biodiversity, Conservation and Attractions) (see Heterick [2009]). The appearance of the propodeum is quite variable in this species, with the posterior propodeum bearing mere blunt angles through denticles of various lengths to pronounced spines in specimens seen, although an armed petiolar node has not been encountered in other workers. Whether the aberrant worker simply represents part of the variation inherent in the taxon or is a distinct species is conjectural; more material is needed. Western Australian populations of *P. macrophthalma* are only known from the Perth region, the Darling Range and just north of the Stirling Range. This species also occurs in NSW. This ant is seen occasionally on wooden fence lines or on trees in yards within the Perth metropolitan area and also occurs in relictual woodland near Perth's western coastal suburbs. Further inland the species has been captured on wandoo. Pitfall and intercept traps and hand-collection have been the collection methods used. In addition to workers, a dealate queen was found in a gall on *Amyema* (quandong) that was using a *Casuarina* tree as a host.

Podomyrma christae, *P. ferruginea*, *P. libra* and *P. nitida* were originally placed in the genus *Dacryon* because of the presence of spines or denticles on the petiolar node. All are very uncommon to rare in collections. These four species form two natural clades: namely, *P. christae* plus *P. libra* and *P. ferruginea* plus *P. nitida*. *Podomyrma* sp. JDM 1395, known from a single specimen, also appears to belong to this clade, but has a unique, subsessile petiole that is unarmed. *Podomyrma christae* and *P. libra* are obviously very closely related species that share the same rugose or areolate-rugose sculpture on the vertex and mesosoma, but can also be distinguished from the other pair of named taxa by the presence of numerous erect setae on the first gastral tergite (the first gastral tergite being glabrous or almost so in *P. ferruginea* and *P. nitida*) and the elevation and orientation of the paired denticles on the node (directed obliquely upward at an angle of > 45° in *P. christae* and *P. libra*, and directed laterally at an angle of < 30° in *P. ferruginea* and *P. nitida*). Very rarely, individual workers of *P. christae* may

lack spines on the petiolar node (see Heterick [2009]), and here the presence of robust surface sculpture on the vertex and promesonotum easily separates such individuals from workers of *P. macrophthalma*, which are mainly smooth in these areas. The presence of a small, vertically directed tooth on either side of the promesonotum just posteriad of the promesonotal suture separates *P. libra* from *P. christae*, which lacks such a tooth. *Podomyrma christae* is widely distributed in the State but, like its close cousin, is rarely seen. Workers have been found as far north as Ethel Creek, in the Pilbara, south to Dryandra State Forest on the eastern edge of the Darling Range 140 km south-east of Perth. This species is also recorded from NSW and Victoria and may be expected to also occur in SA. Specimens have been collected in various forms of tree-based traps (bark, intercept, and tree-traps) as well as pitfall traps, but the only host tree mentioned is wandoo. *Podomyrma libra* is even rarer and has been collected just a few times in semi-arid habitats at the northern and eastern edges of the SWP. To date, this ant is only known from WA. One worker was excavated from woody debris at the base of a eucalypt and the species may nest in such an environment. Another pair of workers was recovered in an ungrazed site with salmon gum cover.

Podomyrma ferruginea and *P. nitida* also share obvious similarities, particularly in terms of the shape of the nodes and the appearance of the propodeum. Seen in full-face view, the head of *P. ferruginea* is longitudinally striate while, seen in dorsal view; the dorsum of the promesonotum of this species is matt and dull. Seen in full-face view, the head of *P. nitida* has transverse striae interconnecting with longitudinal striae to form a semireticulate pattern while, seen in dorsal view, the dorsum of the promesonotum is shining and almost smooth. *Podomyrma ferruginea* is another very uncommon species, and the only WA records are from John Forrest National Park and Dryandra State Forest. Otherwise, this ant is known from the syntypes collected in Bombala, NSW. The Dryandra worker was captured in an intercept trap on a powderbark wandoo, and the Kings Park worker was also collected from a tree-trunk. Within WA, *Podomyrma nitida* is restricted to high rainfall areas, with two of the three collection sites located on or near the western south coast. The species was originally described from Reevesby Island, SA, the only other state known to harbor populations of this species. A worker from Lesley State Forest was captured in a bark trap set on a marri tree, while a worker from Mt Barker was taken in a pitfall trap. Workers from

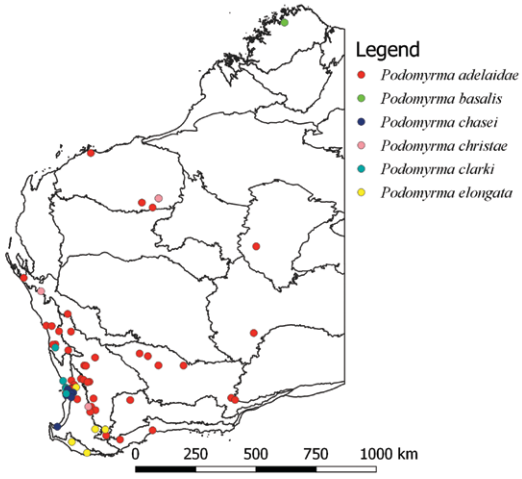

FIGURE 138 Distribution of *Podomyrma adelaidae*, *P. basalis*, *P. chasei*, *P. christae*, *P. clarki* and *P. elongata*.

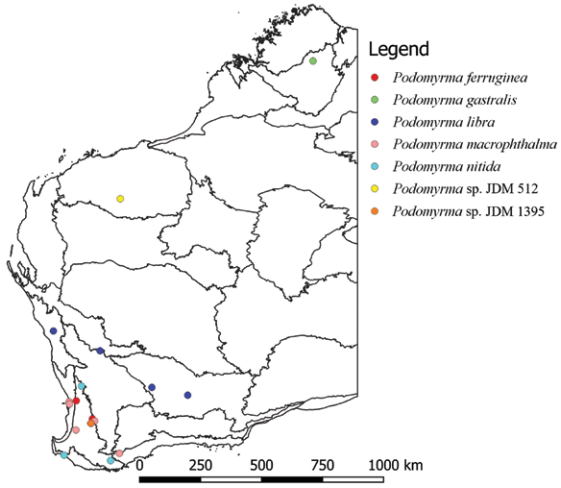

FIGURE 139 Distribution of *Podomyrma ferruginea*, *P. gastralis*, *P. libra*, *P. macrophthalma*, *P. nitida*, and *Podomyrma* sp. JDM 512 and JDM 1395.

Woodarburrup Road, near the western south coast, were collected while foraging on the ground (M. Widmer, Department of Primary Industries and Regional Development, pers. comm.). *Podomyrma* sp. JDM 1395, with its distinctive yellowish coloration and subsessile petiole, is presumed collected by Professor Jonathan Majer and his Curtin University students in Dryandra State Forest in the 1980s, but there are no other data whatever. Even the collection locality is slightly doubtful as the specimen cannot be equated with any record appearing in publications based on student collections in Dryandra. That this medium-sized species does not appear in any other WA holdings or in electronic images on the Web remains a mystery.

Solenopsis (Figure 140)

Just two morphologically distinct species of *Solenopsis* — *S. belisarius* and *S. clarki* — have been identified as native to WA, although it is possible that the conservative morphology of *S. clarki* masks a small species complex. In addition, colonies of the red imported fire ant (*Solenopsis invicta*) have very recently been found in Fremantle Port and eradication of this major pest is continuing. Western Australian *Solenopsis* species can be distinguished by the following suite of characters: seen in profile, the antennal scape in the resting position passes above the eye (or where the eye would be in *S. belisarius*) but antennal scrobes are not found in the local species; the antenna are 10-segmented and have a two-segmented antennal club; the postpetiole is attached to the front of the gaster and, seen in dorsal view, the gaster is not distinctly heart-shaped; the petiole has a developed, squamiform node; the propodeum has its dorsal face rounded smoothly over into its declivous face and lacks teeth, spines or thin flanges; and the clypeus is medially notched with a single anteromedian seta, this often being surrounded by paired setae. In *Solenopsis belisarius* the eye is absent or represented by a minute, pigmented speck, while in *S. clarki* the eye is small but distinct and multi-faceted. These ants are cryptic and soil nesting and are often exposed when nests of termites or other ant species are excavated. In these situations, they act as kleptoparasites, robbing the termite or other ant species of food and brood. The WA endemic *Solenopsis belisarius* occurs in mid-western WA from about Mingenew to Barrow Island. Workers have been captured in wet or dry pitfall traps, but there are no other data. *Solenopsis clarki* is by far the more common species and probably occurs throughout the entire state, although most records are from the south-west corner. This species has only been officially recorded from WA, but undoubtedly its range extends to the NT, and it is likely the species (more than one species?) mentioned by Andersen (2000). Nests of this ant yield workers that display a certain amount of allometry, and a small major worker with a distinctly wider and darker head is occasionally seen. In natural environments this taxon occurs in a wide range of habitats, including jarrah/marri woodland, disturbed wandoo woodland, *Banksia/Allocasuarina* sandplain and vine thicket. Soil types vary from grey over yellow sand to lateritic soil. *Solenopsis clarki* is very tolerant of urbanisation and will persist even in yards overrun by exotic ant species such as the Big-headed ant *Pheidole megacephala* and the Argentine ant *Linepithema humile.* Colonies have been found under stones, house-bricks, and in twig litter and rotting wood. Occasionally this ant has also been collected while foraging on tree-trunks.

Stereomyrmex (Figure 140)

this is a monotypic species in Australia and only *Stereomyrmex anderseni* (Taylor) occurs here. In the taxonomic key the species will come out just after *Podomyrma*, as it lacks the swollen middle and hind legs and the petiole and postpetiole are thin and the node is broad and fractionally wider than the propodeum, as is the postpetiole. The dorsum of the mesosoma is evenly convex and lacks any trace of a metanotal groove, the antenna has 11 segments including the scape and the PF is 5,3. This suite of features will distinguish this little ant from those that come after it in the taxonomic key. The species is not uncommon in biomonitoring and DBCA collections in parts of the Pilbara and also occurs in the Kimberley region. All known specimens have come from locations in WA, but *Stereomyrmex anderseni* possibly also occurs in western regions of the NT near the NT/WA border. Little is known about the ant, but workers from Middle Lagoon in the north-western Kimberley were pitfall-trapped in pindan/savanna woodland, and specimens from Whim Creek in the Pilbara were also pitfall-trapped. The holotype worker was pitfall-trapped in sclerophyll woodland on brown sand.

Strumigenys (Figure 140)

Australian species of the trap-jawed genus *Strumigenys* have traditionally been placed in tribe Dacetini, along with other Australian ants such as *Colobostruma*, *Epopostruma*, *Mesostruma* and *Orectognathus*. The paper on myrmicine phylogeny by Ward et al. (2015), however, locates these ants and many others not traditionally regarded as related in the Attini, and *Strumigenys* has been shown to be only a distant relative to the other former Australian Dacetini within this clade. Like *Orectognathus*, but unlike the other former dacetines just mentioned, the *Strumigenys* antennal scape seen in profile in a resting position passes above the eye, and the antennal scrobes also run above the eye. *Strumigenys* has four to six antennal segments but can be distinguished from *Orectognathus* (which has five) by having a third antennal segment that is about the same length or shorter than the remaining segments of the funiculus (the third segment in *Orectognathus* [measuring from the apical segment] is much longer than the other segments of the funiculus). *Strumigenys* also has a PF of 1,1 compared with a PF of 5,3 in *Orectognathus*.

All of the four species currently known for Western Australia are soil nesting, cryptic predators of Collembola and possibly other small arthropods (see Shattuck [1999]). The genus has been revised by Bolton (2000).

Strumigenys radix and *S. emmae* have a four-segmented antenna, compared with a six-segmented antenna in *S. perplexa* and *S. quinquedentata*. They also have short mandibles, contrasting with the elongate mandibles seen in *S. perplexa* and *S. quinquedentata*. In *S. emmae* the inner margin of the mandible has no conical intercalary tooth between the prominent, spiniform, preapical tooth and the spiniform apical tooth although a low welt or minute denticle may be present. This feature is present in *S. radix* but, apart from this feature, which varies in size in the specimens of *S. radix* seen, there are no other obvious structural differences between this species and *S. emmae*. Molecular testing of this group would be interesting. Although *Strumigenys emmae* is a tropical and sub-tropical tramp species, Bolton (2000) suggests this ant and its relatives are Australian natives. *Strumigenys emmae* was formerly believed to be present on Barrow Island, but records from that locality appear to relate to *S. radix*, and the only indisputable WA record of the former species that this author can find comes from Boongaree Island in the north-western Kimberley. Elsewhere in this country, the species has been recorded from NSW, the NT, and QLD. Overseas, *S. emmae* now populates several African states and Indian Ocean islands, the Americas, parts of the Middle East, south-western Asia and many Pacific islands. In these parts, *S. emmae* can often be found in disturbed habitats such as beaches and agricultural areas. The sole WA worker was collected in a berlesate. *Strumigenys radix* has been collected on Barrow Island and in the Mitchell Plateau, and also occurs in the NT and QLD. This species has been found in open forest and has been collected by hand and also in a berlesate. At the time of writing, Júlio Chaul (Universidade Federal de Viçosa, Brazil) is doing taxonomic research on this and other *Strumigenys* species.

The setae of the promesonotum in *Strumigenys perplexa* are normal, erect and thin, and unlike the thickened, short, curved setae on the frons. This is a useful distinguishing character for the species compared with *S. quinquedentata*, in which the setae of the promesonotum are thickened and inwardly curved, like those on the frons. In WA, *S. perplexa* has been found in the western SWP from Perth southwards, but has a very wide distribution in eastern Australia (ACT, NSW, QLD, Tas, and Vic) including Lord Howe Island and Norfolk Island, and it has apparently been introduced to the Philippines. This ant is not uncommon in moist, well-littered spots in yards and gardens in the Perth metropolitan area, and a colony or colonies was/were located in a lush garden outside the Environmental Biology building at Curtin University, Bentley for several years. *Strumigenys perplexa* is always found in cryptic situations, e.g. under rocks, in leaf mould or rotting wood, in logs or occasionally in galleries in the nests of other ants (*Amblyopone australis* is mentioned). The site habitats are equally varied — dry sclerophyll, wet sclerophyll, a *Pinus radiata* plantation, a kiwifruit orchard and a creek being some of the habitats mentioned on labels. Berlesates, intercept traps, pitfall traps and Winkler sacks are all mentioned on labels as collection methods used to capture this species. *Strumigenys quinquedentata* seems to be restricted to south-western WA, from between the Capes northwards to about Dongara and in the Darling Range south to Manjimup. There are no interstate records for this species. *Strumigenys quinquedentata* has also been found in the Perth Metropolitan Area but seems to be confined to relictual woodland and has not been recovered from yards and gardens. This species has been collected in coastal heath, *Banksia/Agonis* woodland and in a vegetated coastal dune. Grey or white sand is the substrate. Nests seen have mostly been made directly into soil rather than beneath moist litter or in other cryptic situations, although one nest was found under a log.

Syllophopsis (Figure 140)

Syllophopsis is one of several genera peeled off from *Monomorium* by Ward et al. (2015). This genus, as it stands, can be distinguished by the following apomorphies: in profile, the antennal scape in the resting position passes above where the eye would be in the one (eyeless) species found in WA; the antenna possesses 12 segments and terminates in a distinct three-segmented club; the postpetiole is attached to the front of the gaster and, seen in dorsal view, the gaster is not distinctly heart-shaped; the petiole has a developed node; and the eye is absent or vestigial and represented by a fleck of pigment. This species, as with *Monomorium*, also has an anteromedial clypeal seta. *Syllophopsis* sp. JDM 438 is the only member of the genus found in WA. There is some doubt that the ant here referred to as *Syllophopsis* actually belongs to that genus, or that the genus itself is monophyletic. Sparks et al. (2019) indicate that monophyly within *Syllophopsis* has not been established and two small, blind cryptobiotic species assigned to this genus

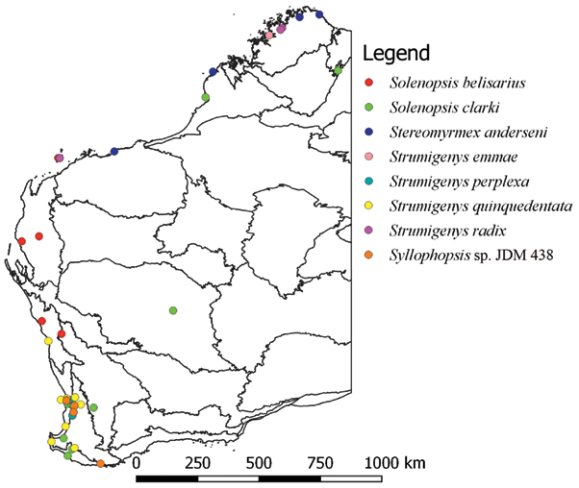

FIGURE 140 Distribution of *Solenopsis belisarius*, *Solenopsis clarki*, *Stereomyrmex anderseni*, *Strumigenys emmae*, *Strumigenys perplexa*, *Strumigenys quinquedentata*, *Strumigenys radix* and *Syllophopsis* sp. JDM 438.

do not link up in a molecular tree with either *Syllophopsis fisheri* (Madagascar) or *S. sechellense* (a cosmopolitan tramp species also found in Australia). The two species referred to by Sparks et al. (2019), although not illustrated or described in the text, may include the WA species; hence this enigmatic little ant may not have yet ceased its taxonomic pilgrimage, and may require further placement or description as an entirely new genus. In WA, *Syllophopsis* sp. JDM 438, as far as is known, is restricted to the SWP, but very similar workers have been seen among material from NSW, the NT, and QLD. This species, like the extralimital *Anillomyrma*, has a very well-developed sting. The ant is also tolerant of urban settings. *Syllophopsis* sp. JDM 438 has been found in small galleries in moist sand under a concrete birdbath in a suburban yard in East Fremantle, while other specimens have been pitfall-trapped in lawn in the same yard. The occurrence of *Syllophopsis* sp. JDM 438 in an older, built-up suburb is interesting. This eyeless species appears to be cryptobiotic and the strong development of the sting may point to carnivorous habits, but its life-history is unknown.

Tetramorium (Figures 141–143)

Tetramorium is a moderate-sized genus in WA with twenty species (nine described). The exact dimensions of the genus in WA, however, remain slightly problematic because of the taxonomically intractable nature of the taxa closely related to *T. striolatum*. Thus, while there are several names within the broader *T striolatum* species-group available for species in the smaller clade that includes *T. striolatum*, they cannot be extracted in a key based on morphological characters (see Excursus 4 in Part I). The genus itself can be defined as follows: seen in profile, the antennal scape in the resting position passes above the eye, and antennal scrobes, when present, run above the eye; the antenna consists of 11 or 12 segments with a three-segmented club; the postpetiole is attached to the front of the gaster which, seen in dorsal view, is not distinctly heart-shaped; the petiole has a developed node; the clypeus below the antennal sockets is raised up into a sharp-edged ridge; and the tip of the sting has a very small triangular to elongate lamella that can be seen when the sting is protruded. Bolton (1977) carried out a general revision of the group in the Oriental, South-East Asian and Australasian regions, but only included a limited amount of Australian material in his analysis. *Tetramorium* appear to be generalist scavengers and predators and some species take seeds (Shattuck 1999).

Most WA *Tetramorium* — and all native *Tetramorium* — have 11-segmented antennae. Three introduced species, however, have a complement of 12 segments. These are *T. bicarinatum*, *T. caldarium* and *T. simillimum*. *Tetramorium bicarinatum* (in the *T. bicarinatum* species-group) can very easily be distinguished by its larger size (HW ≥ 0.90 mm compared with HW ≤ 0.50 mm in the other two species, which both belong to the *T. simillimum* species-group) and its notched clypeus (versus an entire clypeus). This species has been recorded from the Perth metropolitan area, Culham, Eneabba, Morawa, and Tammin. Nearly all sites reporting this ant have been highly disturbed if not completely modified. Elsewhere in Australia, this species has been officially recorded from NSW, QLD, Vic, and Norfolk Island, but the author has also seen it in Port Augusta, SA. This very successful tramp ant, whose origins may lie in Southeast Asia (Bolton 1977), has now colonised all the world's continents, many islands (including most Pacific islands) and is only absent from much of the Afrotropical region and the far northern latitudes (except for its occurrence indoors in some of these northern countries). While this species may be seen on paths and lawns in WA, this author is not aware of its constituting a nuisance in the state. In the USA, however, it may enter houses to feed on grease, meat, sugary foods and plant-based products (M.R. Smith 1965). *Tetramorium caldarium* is very similar in appearance to *T. simillimum*, and for many years was mistaken for that species in WA. However, their environmental requirements are

quite different, *T. caldarium* being temperate in its distribution, and *T. simillimum* being tropical. Seen in full-face view, the antennal scrobe in *T. caldarium* is undeveloped, the sculpture below the frontal carina being flat and not indented, and the cuticle between the frontal carina and the eye containing a mix of microreticulate and reticulate sculpture. Seen in full-face view, the antennal scrobe in *T. simillimum* is well-developed and indented below the frontal carina, while the sculpture between the frontal carina and the eye is almost exclusively microreticulate. *Tetramorium caldarium* has been recorded from WA, but not from other states, possibly because it has been confused with *T. simillimum*. This species is native to Africa, but, like *T. bicarinatum*, has been spread by human commerce throughout the Neotropics, the Mediterranean, parts of northern Europe and some Pacific and Atlantic islands. *Tetramorium caldarium* is a common inhabitant of lawns and gardens in Perth, but the only specimens in the JDM Collection come from the Melville area. The species has been observed to build small nests in sand, and these can be numerous in suitable locations. The species behaves submissively and freezes when approached by other ants, and it does not appear to constitute any environmental threat here. *Tetramorium simillimum* is rarely seen in WA, and the only record uncovered by this author is from Koolan Island, in the north-western Kimberley (ANIC). Nor is there any material held in DPIRD. However, this species is very common in QLD and has also been recorded from NSW. Outside of Australia, this pantropical ant has a range similar to that of *T. bicarinatum*, with very many island records. Like its close relative, this ant does not seem to have pest status in this country, or to have any significant environmental impact.

Perhaps the most spectacular of the native *Tetramorium* found in WA, apart, possibly, from *T. spininode*, is an undescribed species in the *T. laticephalum* complex within the *T. striolatum* species-group, *T. laticephalum* complex sp. JDM 1117. In full-face view, the clypeus of this broad-headed species has a distinct anteromedian notch, and the mandible is smooth and shining, its inner and outer margins subparallel; seen in profile, the mesosoma is mostly planar with a faint indentation that indicates the obsolete metanotal groove. Other WA *Tetramorium* with a similar mesosoma have a narrower head and striated mandibles. This species is known from one collection taken in the Kambalda district. The two workers were pitfall-trapped in low open woodland. Nothing more is known about this ant.

Tetramorium lanuginosum, the sole WA representative of the largely extralimital *T. obesum* species-group, has a vestiture of many fine, downy erect setae, some of which are bifid or trifid in nature. This downy appearance is not shared by other WA *Tetramorium*, which all have simple erect setae. Within WA, the range of this ant is mainly in the western Kimberley, and the species can also be found in the NT and QLD. The origin of *Tetramorium lanuginosum* is probably tropical Asia (Wetterer 2010b) but its natural range may extend to northern Australia. The ant now occurs in islands off the African mainland and in Morocco, in the USA and much of South America, throughout South-East Asia and the Middle East, Spain and some Pacific islands. Western Australian samples have been taken by berlesate or pitfall trap, a specimen from Chile Creek in the north-western Kimberley being collected at the edge of a vine thicket. Ants seen by the author are slow moving foragers. They generally forage terrestrially, often in litter or rotten wood, but can climb trees. The species does not constitute an environmental threat of any significance nor, despite its abundance over an extensive range, is it a pest except perhaps in particularly fragile environments.

Four uncommon to rare species of *Tetramorium* form a distinct unit, here called *Tetramorium* species-group A, compared with the remainder of WA's *Tetramorium* fauna, all of which belong to the *T. striolatum* species-group (and, probably, within a single complex; the *T. striolatum* species complex). These ants correspond to the 'Group A' of Andersen (2000). Viewed as a group, this clade has the following distinguishing characteristics: seen in profile, the mesosoma is distinctly arcuate without a faint indentation that indicates the obsolete metanotal groove; seen in full-face view, the anteromedial margin of the clypeus is a rectangular projection that is clearly set off from the lateral clypeal sectors; also, seen in full-face view, the eyes are placed below the midpoint of the head and the mandible is narrow, its inner and outer margins sub-parallel. In members of the *T. striolatum* species-group the mesosoma, seen in profile, is not arcuate and displays a dip that indicates the obsolete metanotal groove; in full-face view, the anteromedial margin of the clypeus is rounded on to the lateral clypeal sectors; also seen in full-face view, the eyes are placed at or even slightly above the midpoint of the head and the mandible is triangular. The known range of these four ants is WA only (see Andersen 2000), although the range of *Tetramorium* sp. JDM 886, at least, may well extend into the NT (note: the JDM/WAM material discussed here is limited to one or a handful of workers; additional specimens are held at TERC).

Tetramorium sp. JDM 707 is easily identified within the more inclusive clade because of its large (EL ≥ 0.30 × length of side of head), reniform eye (the eye being of medium size or even rather small in the other group members). The eye is positioned obliquely to the vertical axis in a manner reminiscent of some *Monomorium* and *Pheidole* minor workers. The species is known in local collections from one worker collected from Ethel Creek Station (a veritable 'ant zoo', with more ants recorded by P. Varris in her project than have been recorded from any other WA regional locality). The specimen was pitfall-trapped but nothing more is known about it. Also currently known from one specimen only is *Tetramorium* sp. JDM 886. In this ant, the mesosoma, seen in dorsal view, is strongly impressed anteriad with longitudinal porcate sculpture and the metanotal groove is identifiable by a small cuticular ridge facing anteriad. In the other two ants the mesosoma, seen in dorsal view, has rugose-alveolate sculpture, and is uninterrupted by any prominence or other cuticular feature. As with the former species, virtually nothing is known about the sole worker, which was collected in woodland at Cape Bernier in the northern Kimberley. In *Tetramorium* sp. JDM 1177 the postpetiolar ventrite, seen in profile, is massively developed as a lobe directed obliquely anteriad; and, seen in full-face view, the scrobal furrow is distinctly though weakly impressed below the frontal carinae, and extends to the weakly developed occipital lobes. In the very closely related *Tetramorium* sp. JDM 1007, the postpetiolar ventrite, seen in profile, is prominent but is not developed as a massive lobe directed obliquely anteriad; and, seen in full-face view, a scrobal furrow is not present, the sculpture below the frontal carinae being striate-reticulate and the same as the rest of the frons. *Tetramorium* sp. JDM 1177 has the more northerly distribution of the two species and has been collected on the Dampier Peninsula in pindan/savanna woodland and by pitfall trap at the edge of the Great Sandy Desert. *Tetramorium* sp. JDM 1007 has been collected in mid-western WA, once by hand beside the Great Northern Highway near Eurardy Station and once in a wet pitfall trap on Nerren Nerren Station.

Tetramorium spininode is one of the more distinctive WA *Tetramorium*, and the most readily recognisable within its species-group, because of the petiolar node which, seen in profile, projects posteriad as a blunt spur. In this species the margins of the first gastral tergite are flattened so as to form flanges. In other WA *Tetramorium*, seen in profile, the petiolar node is cuboidal and not produced as a spur directed posteriad, and, seen in dorsal view, the lateral margins of the first gastral tergite are rounded towards their junction with the first sternite of the gaster. Local records for this ant range from the Pilbara to the Kimberley, and the ant also occurs in Barrow Island. This species is also found in inland NT, and in 'the Gulf Country' (Andersen 2000) which takes in the north-eastern NT and north-western QLD. Specimens turn up quite regularly in biomonitoring collections from the Pilbara, but despite its frequent occurrence at suitable sites, biological data for this species are lacking. Most workers have been pitfall-trapped or hand-collected but the JDM Collection includes a worker taken by suction.

Despite being another conspicuous *Tetramorium* through its lack of propodeal spines, *Tetramorium* sp. JDM 515 in all other respects is identical with *Tetramorium striolatum* and may eventually prove to be no more than a variant of that more widespread species. Two of the three known workers have a completely unarmed, rounded propodeum, but the third has tiny nubs at the propodeal angles. This ant appears occasionally in coastal areas between Eneabba and Shark Bay, where it has been collected by pitfall trap in a sand mine rehabilitation project at Eneabba, and separately at Nanga Station, near Shark Bay. *Tetramorium* sp. JDM 522 is yet another unmistakeable species because of its black or blackish-brown coloration. The dorsum of the petiolar node and postpetiole in this species are completely smooth and shining. This taxon is closest to *T. turneri* Forel, whose range includes NSW and QLD, and shares with that species the smooth dorsum of the petiole and postpetiole, but the local taxon is darker, the eye is larger and the antennal scrobe is shallower and has microreticulate sculpture, whereas the scrobe in *T. turneri* is more deeply impressed and mainly smooth. This species has been collected by pitfall trap in the Eneabba sand mine rehabilitation project mentioned for the preceding species, and also from relictual *Adenanthos* and *Banksia* bushland in Kensington, Perth Metropolitan Area. In Eneabba this ant was only found in the control sites and was absent from rehabilitated areas, suggesting it may have physiological requirement that were not met by altered sites.

Tetramorium megalops and *T. viehmeyeri* are two large-eyed species occasionally found in WA's arid and semi-arid regions. The large eye (EL ≥ 0.35 × length of side of head) and, seen in profile, the long, low petiolar node that is distinctly wider than high characterise *T. megalops*. In other species the eye is smaller (EL ≤ 0.30 × length of side of head) and, seen in profile, the petiolar node is usually

higher and narrower, being higher than wide or as high as wide. Colour variation may be seen in this latter ant, with most workers concolorous orange while others have black infuscation of the head and parts of the mesosoma. This rather uncommon taxon has been collected in the Coolgardie subregion and also from the western fringe of the Little Sandy Desert, but probably also occurs infrequently in the vast region between these sites (there is approximately 650 km between the northern record and the nearest recorded site to the south). To date, *T. megalops* has not been recorded from any other Australian state. Three workers from 102.8 km south-east of Newman were collected in temporary inverted pitfall traps in mulga woodland, while two workers from Argo Gold mine in the Kambalda district were also collected by means of pitfall trap. Other data are lacking. *Tetramorium viehmeyeri* was characterised by Bolton (1977) as distinctive due to its abruptly descending clypeus, which is transversely concave anteriorly, with the medial clypeal carina more-or-less erased on the anterior sector. This feature is not accentuated on all specimens, but the clypeus is gently notched or at least concave across its anteromedial margin. Probably of more assistance to a researcher is the long antennal scape which almost reaches the vertex or actually attains it (the scape is much shorter in the remaining *Tetramorium* species). The eye is rather large (EW > 0.30 × length of side of head) and the antennal scrobe is reasonably well developed throughout much of its length. *Tetramorium viehmeyeri* is quite rare and has only been collected three times in the Murchison subregion. This species appears to be localised and would not be found interstate. Three workers were pitfall-trapped at the Black Swan Mine, but there are no habitat or ecological data. *Tetramorium viehmeyeri venustus* is here made a junior synonym of *T. impressum* (see notes, Part I).

Tetramorium sp. JDM 141 is similar in colour and general appearance to larger morphs of *T. striolatum*, but the antennal scrobes are more deeply impressed and the petiolar node is narrow in profile (higher than wide) compared with a petiolar node that is as high as it is wide or wider than high in *T. striolatum* and *Tetramorium* sp. JDM 884. (*Tetramorium impressum*, *T. sjostedti* and *Tetramorium* sp. JDM 347 either do not have a discernible antennal scrobe, or this feature is short, does not extend beyond the frontal carinae and is only weakly developed.) *Tetramorium* sp. JDM 141 is found in arid and semi-arid environments, and has been recorded from the Pilbara, the Great Victoria Desert and Argyle Diamond Mine in the eastern Kimberley. The extensive range of this species in WA suggests it is probably also to be found in the NT and in SA, at least. There are almost no label data, but the worker from Tropicana minesite in the Great Victoria Desert was collected from a salt lake area. *Tetramorium sjostedti* is a large (HW ≥ 1.10 mm), handsome species than can be readily identified by a combination of its basally striate gaster, the massively developed, blocky petiolar node and postpetiole and the heavily striated mesosoma. The other species still to be discussed are smaller (HW ≤ 0.95 mm) and otherwise lack the above combination of characters. Two colour forms are recognised for WA, one being a rich red to crimson morph with orange gaster and appendages, this being the most widespread, the other, from the northern Kimberley, being blackish with yellow gaster and appendages. The two morphs are identical in all respects except colour and are here treated as conspecific. This ant has been recorded in WA from the Pilbara northwards (including Barrow Island), and also occurs in the NT and QLD (Andersen 2000). The strongly bicoloured morph has been collected in woodland, and the red morph has been pitfall-trapped but there are no other data. *Tetramorium* sp. JDM 347 is a markedly bicoloured ant with blackish foreparts and bright yellow gaster; in full-face and in dorsal views, the frons and mesosoma are seen to have strong, longitudinal costate sculpture tending to porcate in some individuals. The lack of a discernible antennal scrobe easily separates this species from *T. striolatum*, which is usually concolorous orange or brownish-orange or, if bicoloured, only the head is blackish, the gaster being the same colour as the mesosoma. *Tetramorium impressum* differs in having much finer, striolate sculpture on the frons and mesosoma. *Tetramorium* sp. JDM 347 appears to have two populations, one from Dwellingup north to about Wongan Hills, the other on the Nullarbor, where it has been collected from near Mundrabilla Roadhouse and just west of the Eucla Pass. The latter population is almost on the SA/WA border and can be expected to extend into SA. Workers from Dwellingup have been collected at their nest, and foragers near Eucla were hand-collected in steppe, but other data are lacking, although it is obvious this ant can colonise several different habitats.

Tetramorium impressum is distinguished from *T. striolatum* and *Tetramorium* sp. JDM 884 by the following combination of characters: seen in semi-profile, the frontal carina is not developed and is indistinguishable from other longitudinal striations; the frons lacks a strip on either side of the carinae that is largely free of sculpture apart from microreticulate sculpture; also, seen in

profile, the propodeal spines are tilted at > 135° to the slope of the propodeum, while, in full-face view, the antennal scapes are shorter, failing to reach the vertex by ≥ 2.5 × their greatest width. In the other two species, the frontal carina, viewed in semi-profile, constitutes a weakly developed but distinct ridge, and the frons often has a strip on either side of the carinae that is largely free of sculpture apart from microreticulate sculpture (especially in small, northern workers); also, viewed in profile, the propodeal spines are usually tilted at > 110° to the slope of the propodeum, while, seen in full-face view, the antennal scapes are longer, failing to reach the vertex by > 1.5 × their greatest width. *Tetramorium impressum* is colour and size variable, even within nest series, and can be uniformly reddish, reddish with a dark gaster, variegated red-and-black or entirely dark reddish-black with lighter patches. Occasionally the gaster is yellow, contrasting with dark foreparts. Even in paler workers the fore coxae are often black. *Tetramorium impressum* tends to be a very common ant where it occurs in WA, and, while most collections have been made in the SWP, this species has also been collected in the eastern goldfields and occurs as far north as the southern Pilbara. This ant is also known from NSW and QLD and, having been collected next to the SA/WA border, can also be assumed to occur in SA. This is a pioneer species and, in such environments as mined areas, it is one of the first ants to populate young rehabilitated sites (pers. obs.). Label data record a large range of habitats — heathland, gum forest, jarrah/marri woodland and *Acacia rostellifera* scrub. This species is quite often seen on Perth metropolitan lawns or verges, indicating its adaptability. There is also a record from a salt lake. The nest is a simple mound with a small entrance hole. *Tetramorium* sp. JDM 884 is a small, undescribed species that resembles *T. fuscipes* but is more diminutive than the eastern states taxon. The dark coloration, especially of the gaster, is sufficient to identify this ant when compared with southern *T. striolatum* (which always have an orange or reddish gaster). The frons besides the frontal carinae is depressed, matt and finely microreticulate, as in some northern *T. striolatum* (*sensu lato*), but the dark gaster immediately identifies the ant. This species has been collected only three times, twice in Eneabba and once near the Yalgorup National Park, south of Perth, and its occurrence interstate is unknown. The species has been collected in Eneabba in a *Banksia/Xylomelum* control site by means of a pitfall trap, but there are no other data.

Tetramorium striolatum (*sensu lato*) can be distinguished from *T. impressum* by the characters mentioned above, and from *Tetramorium* sp. JDM 884 by its colour pattern (also see above). The southern population of *T. striolatum* reveals some variation in degree of sculpture, but the node is consistently square in form and longer than wide when seen in dorsal view (agreeing with the descriptions in Viehmeyer [1914] and Bolton [1977]), and the base of the gaster is matt and shagreenate and, in the case of larger workers particularly, may include fine striolae among the dense microreticulation. The exception to this is a worker from Mt Gibson which has a smooth shining petiole and postpetiole, and the gaster is also smooth and shining. In all other respects, however, the morphology and the remaining sculpture of this worker conform to the typical *T. striolatum* pattern, and the Mt Gibson specimen is regarded as simply representing an interesting variant — although more material is desirable to see if other workers from this area also reveal these morphological traits. The real difficulty is in interpreting morphological patterns in workers from the coastal Pilbara and the Kimberley. These ants tend to have infuscated or completely dark heads — never seen in southern material — and the postpetiole in most specimens is more-or-less smooth, but not invariably so. In specimens from around Mt Goldsworthy and Whim Creek, the petiolar node is thick and, seen dorsal view, is about as wide as long. In other workers of much the same appearance the node in dorsal view is narrow, as in southern workers. In most of these ants, the frons at either side of the frontal carinae is depressed, matt and densely microreticulate, so that the striated portion of the frons between the carinae stands out in relief. This pattern is seen in pale-headed as well as dark-headed and infuscated individuals making the differences hard to interpret. However, some dark-headed workers have the frons more-or-less uniformly striolate, as in southern workers, without the recessed, matt, microreticulate patch just beside the antennal carinae mentioned above. Workers from Ethel Creek and Marillana in the inland Pilbara are identical with the southern form, except that the base of the gaster has reduced microsculpture. One final feature of note is the slight depression of the metanotal groove seen in a pair of workers from Cape Bernier that gives the propodeum more definition than is usually the case with this clade. Overall, the northern workers (with the exception of the Ethel Creek and Marillana workers) conform pretty closely

to Bolton's *T. thalidum* — except that the erect mesosomal setae tend to be slightly longer and merely blunted distally rather than strongly modified. The overall impression of this author is that *T. striolatum* populations in the south are conspecific, but northern populations, especially those from the coast, may represent one or possibly a couple of sibling species very closely allied with *T. striolatum*, perhaps including *T. thalidum*. On the other hand, they may simply represent biogeographical variation, as the differences (apart from the head coloration) are quite subtle. Molecular genetics would be very helpful in unravelling the taxonomy of this nominal taxon. *Tetramorium striolatum* (*sensu lato*) occurs in two clusters on the map with more than 500 km separating the southern population from the more contentious northern populations that extend from the Pilbara to the northern Kimberley; material from between Kalbarri and Exmouth, especially from coastal populations, is highly desirable. This species also occurs in SA, from whence it was described. The species, like *T. impressum*, occupies a variety of habitats — York gum woodland, relictual urban woodland and sandplain heath being mentioned on labels — but is not seen in urban parks, lawns or gardens or other highly modified urban environments. Most specimens, particularly from the north, have been captured in pitfall traps.

Trichomyrmex (Figure 143)

This genus is represented in WA by one species; the pestiferous *Trichomyrmex destructor*. This ant superficially resembles small species of *Monomorium*, and until recently was placed in that genus. *Trichomyrmex destructor* comes out in the taxonomic key in Part I next to *Monomorium*, as it has much the same body plan, but can be distinguished by the following characters: seen in full-face view, the head has a band of fine, transverse striolae that are confined to the margin of the vertex (rarely absent in very small workers), and the worker exhibits monophasic allometric size variation. The PF is 2,2, and the four-toothed mandible has 3 distinct teeth with the basal tooth a minute offset denticle. Similar-looking *Monomorium* (e.g. *M. rothsteini*) or *Chelaner* with a PF of 2,2 have a completely smooth head or the head has more uniformly distributed sculpture, and the mandible has two to seven mandibular teeth, but never four teeth of which the basal tooth is a minute, offset denticle. A related species, *Trichomyrmex mayri* (Forel), has supposedly been recorded from Western Australia (Cross et al. 2016; Borowiec & Salata 2019), but the WA record may be a misidentification and needs verification (the record does not appear in AntWeb or the Atlas of Living Australia, and the occurrence of a single specimen in a remote part of the Kimberley seems unlikely when most records of this species are from the Middle East). *Trichomyrmex destructor* is occasionally recorded from Perth, but most records are from the more northern parts of the state. The ant also occurs in the NT and QLD. Overseas, this species occurs widely throughout the tropics, and can be found in several African nations and Africa's major offshore islands, in the central Americas, in the Middle East, South and South-East Asia, Oceania, and indoors in parts of Europe

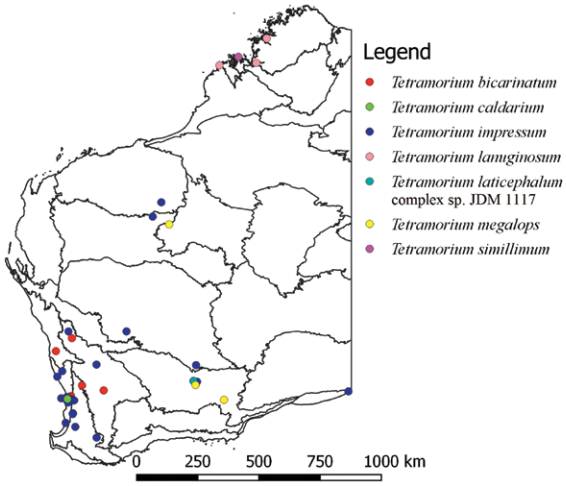

FIGURE 141 Distribution of *Tetramorium bicarinatum*, *T. caldarium*, *T. impressum*, *T. lanuginosum*, *Tetramorium laticephalum* complex sp. JDM 1117, *T. megalops* and *T. simillimum*.

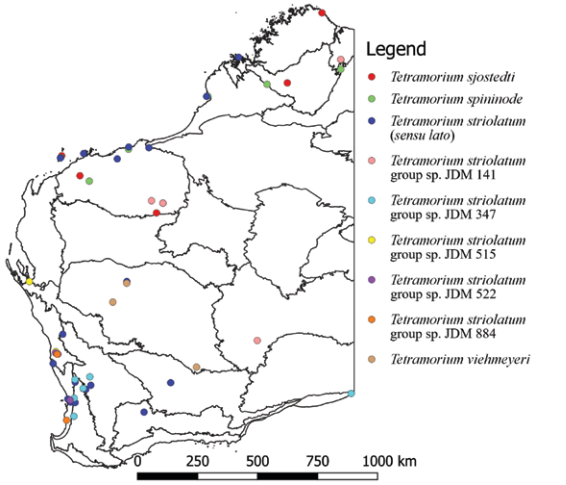

FIGURE 142 Distribution of *Tetramorium sjostedti*, *T. spininode*, *T. striolatum (sensu lato)*, *Tetramorium striolatum* group sp. JDM 141, JDM 347, JDM 515, JDM 522 and JDM 884, and *T. viehmeyeri*.

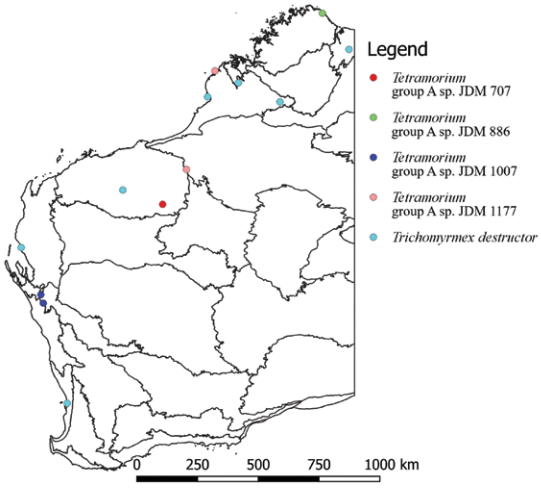

FIGURE 143 Distribution of *Tetramorium* group A sp. JDM 707, JDM 886, JDM 1007 and JDM 1177, and *Trichomyrmex destructor*.

and the USA. Refer to AntWiki for a sometimes graphic description of the damage caused by this ant on a global basis (https://www.antwiki.org/wiki/Trichomyrmex_destructor [accessed 23 August, 2019]). In WA, the species is most closely associated with dwellings and built-up sites and is rarely found outside them. In Carnarvon, the author has found this ant to be a minor nuisance in a caravan park, where it enters vans and cabins in swarming trails, attracted by soiled fishing bags, food and the like. This species appears to be confined to reticulated areas within the park, but probably also occurs more widely in the Carnarvon townsite. Within this restricted area other ant species are not seen. However, adjacent to the main street outside the park, *T. destructor* is absent, and native ants (predominantly species of *Camponotus*, *Iridomyrmex*, *Polyrhachis* and *Rhytidoponera*) are abundant and can be seen crawling on paths, tree-trunks and verges.

PONERINAE

Ponerine ants have many similarities with other subfamilies of stinging ants, and a fairly comprehensive suite of characters must be checked to determine whether a given specimen is a ponerine, thus: the mesosoma (i.e. thorax and fused portion of the abdomen) is attached to the gaster by a single distinct segment (the petiole) that is separated from the gaster by a marked constriction; the upper surface of the pygidium is not flattened and lacks peg-like teeth; a sting, usually visible, is present at the tip of the gaster; in *Odontomachus* the gaster lacks a slight but distinct constriction between the first and second gastral segments (this ponerine genus can be recognised by having the mandibles situated close together, elongate and linear, armed with teeth only at tip and capable of a gape of almost 180°, and by a high petiolar node that terminates in a spine) but such a constriction is present in all other WA ponerines; when viewed full-face, the head lacks an uninterrupted median longitudinal ridge (although a partial median impression may be present [e.g. *Pseudoneoponera*]); the hind tarsal claws may be toothed or comb-like (pectinate); the metapleural gland orifice is elliptical or circular, and opens laterally or posteriad and is not bounded by a strip of cuticle; and, finally, the angle of the pronotum is not armed in Western Australian species.

The Ponerinae are generically biodiverse in WA (10 genera) but species poor, with the greatest number of species being found in *Leptogenys* (8 species), followed by *Platythyrea* (6 species) and then *Anochetus* and *Pseudoneoponera* (each with 5 species). In total there are just 34 ponerine species in WA. This is a huge reduction over older inventories, largely brought about by the recent peeling off of several subfamilies (Amblyoponinae, Ectatomminae [including the Heteroponerini] and Proceratiinae) based on morphological and genetic findings (Bolton [2003]; Ouellette et al. [2006] and Feitosa et al. [2019]). The taxonomy of the local Ponerinae is well known, with just five species awaiting description. This is despite most species rarely being seen by members of the public, partly due to the cryptic habits of many of them, partly due to the localised range of some taxa and partly because most species are not tolerant of urbanisation. *Brachyponera lutea* is a rare exception and is ubiquitous, even in built-up areas where it occasionally poses a minor stinging nuisance for gardeners. As far as is understood, all WA Ponerinae are predaceous and, based on overseas and interstate research, species belonging to some of our genera are known specialist predators of prey such as termites. However, the habits of most of our taxa are quite unstudied.

Anochetus (Figure 144)

Anochetus is one of two trap-jawed ponerines in which the mandibles are armed with two or three large teeth at their ends, and snap shut when prey is encountered. This genus is superficially similar to the larger *Odontomachus* but, unlike the latter, its members have a distinct constriction between the first and second segments of the gaster. The occipital region of the head also lacks the suture lines that enclose a V-shaped sector

in *Odontomachus*, and the petiolar node does not terminate in a spine as it does in *Odontomachus* but is rounded above or bears a pair of small teeth. These ants form small nests, usually with fewer than 100 workers, such nests being located in soil, under logs or other surface cover or in rotten wood. Workers use their trap-jaws to capture prey, which is then subdued by the ant's sting. While a variety of small arthropods are preyed on, some species specialise in termites (Shattuck 1999; Shattuck & Slipinska 2012). There is some evidence that one of the WA species, *A. renatae*, may also take seeds, as husks and other plant refuse have been found around its nests (Heterick 2009). The Australian members of the genus were revised by Shattuck & Slipinska in 2012. Five species have been recorded from WA, but only *A. rectangularis* and *A. renatae* are common enough to be seen occasionally by members of the public.

Anochetus veronicae is the only WA species of *Anochetus* in which the propodeal angles are developed as spines. However, this ant is so similar to *A. renatae* (from which it is biogeographically separated) that Shattuck & Slipinska (2012) concede additional material from the region in which neither ant has yet been collected may reveal a morphological cline involving a single species. No material is held in the WAM/JDM Collections for *A. veronicae*, which is only known in WA from a couple of records from the vicinity of Kalumburu Mission in the Kimberley and one record from near Roy Hill in the Pilbara (all ANIC records). The range of this ant extends into the NT. This species has been collected in open woody savanna, but no other biological data appear to be available. *Anochetus graeffei* is another northern taxon, which in this case has its main area of distribution in land masses to the north of Australia. This species is immediately recognisable: seen in full-face view, the sculpture on the front of the head extends well above the eyes and reaches (or nearly reaches) the posterior margin of the head. In other *Anochetus* species the sculpture on the front of the head, seen in full-face view, extends only slightly beyond the eyes and ends well before the posterior margin of the head. The only WA record comes from South West Osborn Island adjacent to the far north coast of the Kimberley. This ant has a much more extensive range in the top end of the NT and along the east coast of the Australian continent, from the tip of Cape York, QLD, to northern NSW. Outside of Australia *A. graeffei* occurs in India, China, South-East Asia, South Africa and Seychelles, Brazil, and a number of Melanesian and Pacific islands. This is the only member of the genus found in WA that appears to have been widely disseminated beyond its original boundaries by human commerce. As would be expected for such a widespread species, this ant is catholic in its habitat requirements and has been found in a variety of forested environments, ranging from rainforest and secondary forest to dry sclerophyll woodland. Nests may be made directly into soil, within termite nests or in rotting wood or, as is more frequently the case, under rocks or other objects lying on the ground (Shattuck & Slipinska 2012). The most frequent collection methods include litter sifting, berlesates and Winkler sacks, but the ant has occasionally been hand-collected or has been captured in traps baited with peanut butter.

Anochetus rectangularis is a small species in which the pronotum, seen in profile, is partially to completely sculptured, and the sides of the propodeum have coarse striations. Seen in dorsal view, the dorsal propodeal surface is coarsely sculptured with a combination of irregular rugosity and striations; also seen in dorsal view, the setae on the dorsal surface of the propodeum are longer, and erect or semi-erect. In *A. avius* and *A. renatae* the entire pronotum and the sides of the propodeum, seen in profile, are smooth and shining, while, seen in dorsal view, the dorsal surface of the propodeum possesses weak transverse striations (nearly absent in some specimens). Also, seen in dorsal view, the setae on the dorsal surface of the propodeum are very short, scattered, and appressed. Within WA, *A. rectangularis* has only been encountered in the north-west of the state, i.e. in the Pilbara, the

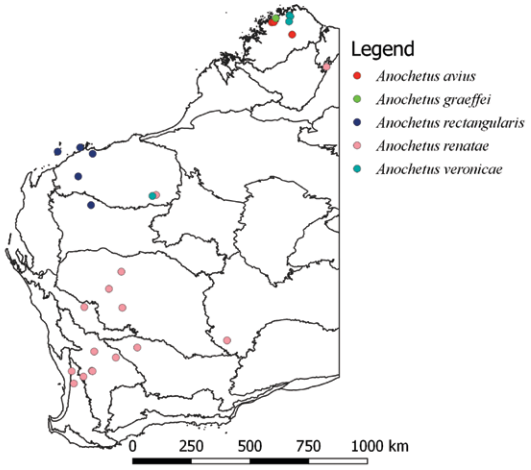

FIGURE 144 Distribution of *Anochetus avius*, *A. graeffei*, *A. rectangularis*, *A. renatae* and *A. veronicae*.

adjoining Barrow Island and in the northern Gascoyne. Elsewhere, the species occurs in northern NSW, the NT, and QLD. This species mainly inhabits dry sclerophyll and savanna woodland and is rarely found in rainforest. Nests are generally made in rocks or logs, but the taxon may also use termite mounds or the unoccupied nests of *I. purpureus* (Shattuck & Slipinska 2012). The species is nocturnally active. *Anochetus avius* is known from only a handful of collections in the northern Kimberley and has not been reported from elsewhere in Australia. This is a small-eyed (EL < 0.25mm), small antennal-scaped (SL < 1.00mm) species compared with *A. renatae*, in which the eyes are larger (EL > 0.30mm), as are the antennal scapes (SL > 1.05mm). Otherwise, the latter is morphologically a larger version of the former. Essentially nothing is known about this species, which is unrepresented in the WAM/JDM Collections, apart from the fact that it occurs in dry sclerophyll woodlands (Shattuck & Slipinska 2012).

Anochetus renatae is the only species within the genus that is found in southern WA. However, it eschews the wetter, heavily forested areas of the south-western tip of the state and is found in the drier semi-arid woodlands. Most records are from the eastern SWP and the surrounding Eremaean woodlands in the Coolgardie, Murchison and Yalgoo subregions, but there is one record from much further east, in the Great Victoria Desert. However, this species is restricted to WA. *Anochetus renatae* is associated with a variety of vegetation types — mulga, mallee, heath, York-salmon gum, and *Eucalyptus accedens/E. wandoo* woodland are all mentioned on labels. Yellow loamy soil and limestone laterite are soil types mentioned. Nests are usually made under objects (Shattuck & Slipinska 2012), but where made directly into soil, there may be multiple entrance holes in a line (label data). The presence of seed husks and other plant material around nests indicating a possible vegetarian component to the diet for this species has been mentioned above.

Austroponera (Figure 145)

The sole WA species belonging to this genus, namely, *Austroponera rufonigra*, was formerly placed in the genus *Trachymesopus* (Brown 1963), and then *Pachycondyla* (Bolton 1995). Along with two other ponerine genera found in WA, namely, *Brachyponera* and *Pseudoneoponera*, Schmidt & Shattuck (2014) removed it from *Pachycondyla* in their publication. However, unlike the former genera which reverted to a genus level name in the existing synonymy, *Austroponer*a is a new genus level name erected by Schmidt & Shattuck. The genus and species can be determined by the following characters: the clypeus, seen in full-face view, is narrowly inserted between the frontal lobes and the antennal sockets are closely approximated; the mandibles are triangular and inserted towards the sides of the front of the head; the clypeus lacks a blunt anteromedian clypeal projection; the eyes are not set on prominences; the ventral apex of the hind tibia carries a large pectinate spur and a smaller simple spur; the tarsal claws are simple; the propodeal spiracle is round or ovoid; the mandible lack a basal pit or groove, and a prora (anterior cuticular ridge) is present on the first gastral sternite. Within WA, *A. rufonigra* is confined to the Darling Range, the Swan Coastal Plain and the Warren subregion. One record is also known from Victoria. Schmidt and Shattuck (2014) include two New Zealand species in the genus (with important reservations). *Austroponera rufonigra* is generally found in cryptic situations, such as rotting wood, leaf litter and under rocks, and nests are small. Vegetation associations from local labels include *Melaleuca lanceolata* woodland and dry sclerophyll forest. Specimens in the WAM/JDM Collections have been taken in hand-collections, in pitfall-traps and in sifted leaf litter put through a Tullgren funnel, while one worker was captured in an intercept trap on a marri trunk, indicating this species will occasionally climb trees.

Brachyponera (Figure 145)

This genus, represented in WA only by *Brachyponera lutea*, is the only ponerine with which many Western Australians will be familiar, as it is common in suburban parks, gardens, and lawns. As with *Austroponera*, *Brachyponera lutea* can be determined by the following characters: the clypeus, seen in full-face view, is narrowly inserted between the frontal lobes and the antennal sockets are closely approximated; the mandibles are triangular and inserted towards the sides of the front of the head; the clypeus lacks a blunt anteromedian clypeal projection; the eyes are not set on prominences; the ventral apex of the hind tibia carries a large pectinate spur and a smaller simple spur; the tarsal claws are simple; and the propodeal spiracle is round or ovoid. However, unlike *Austroponera*, *Brachyponera* possesses a basal pit or groove on the mandible (evident on the outer surface when a specimen is viewed under a stereomicroscope), and the first ventral gastral sternite lacks a prora. *Brachyponera lutea* is common in the SWP, particularly in

highly disturbed areas, but occurs as far north as the southern Pilbara and Barrow Island and has been taken as far east as Cape Arid National Park. *Brachyponera lutea* has also been recorded from NSW, the NT, SA, and QLD, but probably occurs in all Australian mainland states. This species has been found in all sorts of habitats, including highly modified habitats like suburban lawns, but has not been recorded from rainforest. In drier areas, this is a species commonly seen in association with decaying wood; possibly because of the presence of termites (the author has seen a row of apparently paralysed termite workers in a gallery within a nest of this ant — see also Wheeler [1933]). In lawns, it is not uncommon to see multiple nests of this species aggregated together. Anecdotal reports and comments addressed to the author indicate it has an unpleasant sting, and it is perhaps pertinent to note that two other members of the same genus can cause medically significant discomfort and even anaphylaxis (Fukuzawa et al. [2002]: Al-Khalifa et al. [2015]).

Hypoponera (Figure 145)

Hypoponera is possibly the most poorly understood of Australia's smaller ant genera. While there are almost a dozen names available for Australian taxa, these very uniform little ants have few useful characters for the morphological taxonomist, and it is not surprising the Australian members of the genus have not been monographed. With revision, the taxonomy and nomenclature of the WA species may well change. The genus itself can be determined by the following characters: seen in full-face view, the clypeus is narrowly inserted between the frontal lobes, and the antennal sockets are closely approximated; the hind tibiae bears a single pectinate spur; the mandibles are elongate-triangular, and inserted towards the sides of the front of the head; the eyes are not set on prominences; and the subpetiolar process lacks an anterior fenestra or paired teeth posteriad. As far as the author can tell, there are three probable taxa in WA (two named, including an introduced species), although there is a small amount of doubt attached to *H. congrua*. The genus is cryptic and predaceous and moderately common in suitable habitats; some species specialise in Collembola (Shattuck 1999), but nothing is known of the biology of the two WA natives.

Hypoponera sp. JDM 1376 is a shining, bright gamboge-yellow species that can be separated from *H. congrua* and *H. eduardi* by the inconspicuous, small appressed setae on the mesosoma (the appressed setae are longer, of a downy appearance and partially obscure the mesosoma in the other

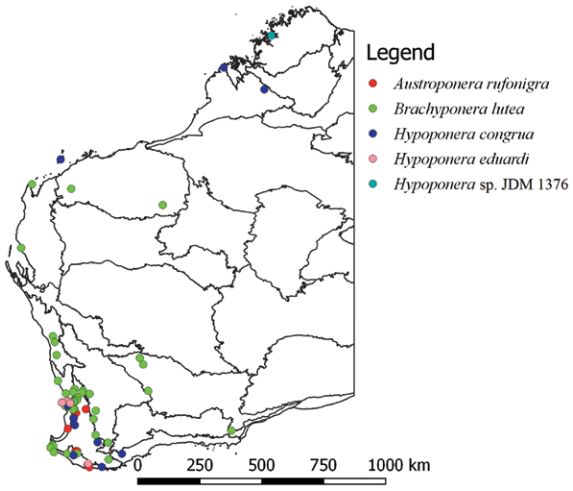

FIGURE 145 Distribution of *Austroponera rufonigra*, *Brachyponera lutea*, *Hypoponera congrua*, *H. eduardi* and *Hypoponera* sp. JDM 1376.

two ants, which are orange or brownish). This species is known in local collections only from a single pin of two workers collected in 'forest' on Boongaree Island in the Kimberley. There are no other ecological details, and nothing is known of the range of the ant. Seen in lateral view, the sides of the propodeum in *H. congrua* are shining with longitudinal striolae mainly confined to the metapleuron, while, seen in dorsal view, the metanotal groove is present or absent, but where present as a dorsal sulcus the sulcal impression is indistinct laterally. In this species the legs are concolorous with the mesosoma or only slightly lighter in colour. At present, *H. congrua* is known from two very disjunct populations, one mainly based on the Swan Coastal Plain and the Jarrah Forest, the other found on Barrow Island and several sites in the Kimberley. The wide biogeographical separation might suggest that two species are involved, but although northern specimens are fractionally deeper in hue on average than the southern workers, they are identical in morphology and pilosity pattern. *Hypoponera congrua* is probably restricted to WA and, apart from Barrow Island, to areas of high rainfall. In the north, specimens have been gathered in litter and pitfall-trapped in pindan/savanna woodland at the edge of a thicket. In the south, a worker from Henderson, near Fremantle, was hand-collected in sandy soil, while a worker and dealate queen were taken from rotting wood in Denmark, and another worker from just east of Stirling Dam was found in deep litter in a jarrah stump. The eastern-most series comes from the Stirling Range; these five workers were hand-collected, but there are no other details.

Seen in lateral view, the sides of the propodeum in *H. eduardi* are rather matt with many fine, parallel longitudinal striolae and other microreticulate or punctate sculpture, while, seen in dorsal view, the metanotal groove is impressed, this impression continued along the anterior junction of propodeum and mesopleuron. The legs are yellowish and much lighter in colour than the orange-brown mesosoma. In WA, *H. eduardi* has been found in the Perth metropolitan area, where it is an inconspicuous inhabitant within litter and under stones, e.g. in suburban gardens, but it has also been found in pristine wet sclerophyll forest in the Frankland National Park and in dry sclerophyll woodland at an Alcoa site near Jarrahdale, suggesting the species has been naturalised in WA for a long time. This ant probably also occurs in other Australian states but has not yet been recognised. *Hypoponera eduardi* is of Mediterranean origin but is now found not only in Mediterranean mainland locations and on Mediterranean islands, but also in the Middle East, South Africa, offshore African island such as Mauritius, Reunion and the Seychelles, Chile, and New Zealand. Most often the species is taken by means of Winkler sacks or pitfall traps, and the usual substrate is rootmats, rotten wood, litter or leaf-mold or under cover such as a stone, wood, or a coconut.

Leptogenys (Figure 146)

Leptogenys (eight species, one undescribed) is the largest WA ponerine genus, and the eight species found here are well-distributed throughout the state, although none has adapted to urbanisation. In full-face view, the clypeus in *Leptogenys* is narrowly inserted between the frontal lobes (which may be raised) and the antennal sockets are closely approximated, the hind tibiae has a large pectinate spur and a smaller simple spur, the mandibles are elongate-triangular or narrow and falcate, the eyes are not set on prominences, and the tarsal claws are pectinate (usually) or armed with one or two preapical teeth. Various *Leptogenys* workers are known to specialise on termites or isopods. Army ant behaviour is also recorded for this genus but has not been seen in Australia. Most or all species have ergatoid queens (Shattuck 1999). (In recent years the term 'gamergates' has been preferred by a number of researchers, as these are actually mated workers, e.g. see Hölldobler & Wilson 1990.) The biology of some WA species has been studied by Wheeler (1933). The eight taxa recorded here fit into three morphological clades: namely, small, compact, reddish or orange species (*L. fallax* and *L. tricosa*), two large, heavily-sculptured dark species with narrowly falcate or linear mandibles (*L. clarki* and *Leptogenys* sp. JDM 1128) and four dark, mainly smooth and shining species with elongate-triangular mandibles (*L. centralis*, *L. darlingtoni*, *L. exigua* and *L. neutralis*).

Leptogenys fallax and *L. tricosa* are immediately identifiable by their colour, the other ants being black. *Leptogenys fallax* is much the larger of the two species (HW > 1.60 mm compared with HW ≤ 0.67 mm) and, seen in full-face view, the masticatory margin of the mandible is strongly oblique with three to five distinct teeth and a variable number of tiny denticles. The eye in this species, although very small, is clearly visible and multifaceted. *Leptogenys tricosa* is not only much smaller but, seen in full-face view, the masticatory margin of the mandible is weakly oblique and three-toothed with, perhaps, one tiny basal denticle and another vestigial denticle, and the eye is minute and consists of only one ommatidium. A couple of long, flexuous setae that may have a specialised sensory function are present on the tibia in both species. In WA, *L. fallax* has only been recorded a couple of times in the Pilbara subregion. This species also occurs in the NT and QLD. This ant has been collected in both *Eucalyptus* woodland and rainforest, with two workers being extracted from a rotten log. Northern Territory workers have been collected as ground foragers, while WA material has been pitfall-trapped. *Leptogenys tricosa* has a wider range in the state than *L. fallax*, and has been collected on Barrow Island, 102 km SE. of Newman at the edge of the Great Sandy Desert, and at Millagoon, in Dampierland in the Kimberley. The species also occurs in QLD, from whence it was described. The worker from the edge of the Great Sandy Desert was collected in a permanent invertebrate trap in mulga woodland, while the four Kimberley workers (2 pins) were pitfall-trapped in pindan/savanna woodland at the edge of a thicket.

Leptogenys clarki is the most spectacular of the WA *Leptogenys*, being a large ant with long, curved, edentate mandibles. This renders it unmistakeable, the other dark-coloured ants having elongate-triangular mandibles, except for (the probably closely related) *Leptogenys* sp. JDM 1128, whose strap-like mandibles are shorter and linear and whose mesosomal and petiolar sculpture is foveate. The sculpture of the side of the mesosoma and the petiolar node is striate or striate-reticulate in *L. clarki*. The type material for this taxon was collected in the vicinity of the port of Geraldton, but more recent material has been

collected around Carnarvon and near Newman in the Pilbara. *Leptogenys clarki* is confined to mid-western WA. In his publication, W.M. Wheeler (1933), the author of the species name, describes four colonies of the ant as being in sandy soil, sparsely covered with low wattles, eucalypts and other shrubs. These were located at the back of the beach near the Geraldton lighthouse. The nests were built around the stems of sedges and were marked with a high crater 8–10 inches tall, with the entrance hole half-an-inch in diameter and extended into the soil to a depth of about one foot. The workers were timid and slow-moving. Metamorphosing larvae were enclosed in brown cocoons. No obvious females were seen. *Leptogenys* sp. JDM 1128 is found further north than its relative and has been collected at Barrow Island and the adjoining Pilbara coast, but only the Barrow Island sites were available for mapping. This undescribed species is not known from any other state, and there are no biological data associated with it.

Leptogenys centralis, *L. darlingtoni*, *L. exigua* and *L. neutralis* are clearly closely related and much of a muchness in appearance, differing chiefly in overall size, the width of the petiolar node seen in profile, eye size and the presence or absence of a prora on the first gastral sternite. *Leptogenys exigua* and *L. neutralis* share the presence of a prora (absent in the other two ants) and a petiolar node as high as wide with a steeply declivous anterior face, but differ in the dimensions of the head seen in full-face view (broad in *L. exigua* [CI ≥ 78] and narrow in *L. neutralis* [CI ≤ 70]) and the size of the eye when seen in profile (eye larger in *L. exigua* [eye length ≥ 0.30 × length of side of head], and shorter in *L. neutralis* [eye length ≤ 0.27 × length of side of head]). *Leptogenys exigua* is found in the monsoonal north of Australia, with WA specimens coming from the Argyle Diamond Mine near Kununurra. This species can also be found in the NT and northern QLD. Workers have been collected at night while foraging on the ground in *Eucalyptus* woodland and have also been pitfall-trapped. *Leptogenys neutralis* is restricted to wetter parts of the south-west corner of the state, mostly in thick forest in and around the Darling Range, but there is one record from Rottnest. This species is most common in the karri, jarrah and tuart forests of the deep south of the state (Wheeler 1933). *Leptogenys neutralis* is confined to WA. This species is known to capture and store in its galleries dealate male and female termites, but dealated queens of a number of ant species, small beetles and the occasional wasp are also taken (Wheeler 1933). Nests of the ant are typically found under rotting logs or lateritic rocks; one was found under the bark of a fallen tree in *Eucalyptus diversicolor* forest. The appearance of the node can be variable; workers from Pemberton, near the south coast, have a petiolar node whose dorsum descends at a distinct angle anteriad and in this respect tends towards that of *L. darlingtoni* (although there is still a steeply declivous anterior face), while workers from Mt Cooke, in the Darling Range have a more-or-less square node.

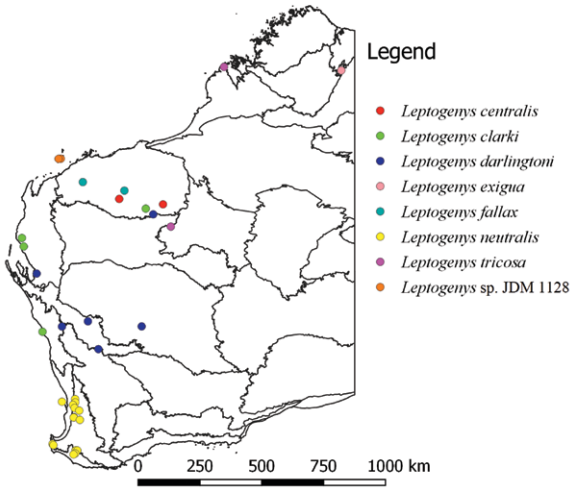

FIGURE 146 Distribution of *Leptogenys centralis*, *L. clarki*, *L. darlingtoni*, *L. exigua*, *L. fallax*, *L. neutralis*, *L. tricosa* and *Leptogenys* sp. JDM 1128.

Leptogenys centralis and *L. darlingtoni* lack a prora and have a petiolar node that is longer than high. Seen in profile, the node in *L. centralis* is quite attenuated (≥ 1.3 × as long as high, often approaching 1.5 × as long as high), but it is less so in *L. darlingtoni* (node ≤ 1.2 × as long as high). Within WA, *L. centralis* has been recorded from several sites in the Pilbara, and its range extends to the NT and SA. Workers from Marandoo minesite in the Pilbara have been pitfall-trapped in a mine dump, but there are no ecological or biological data for this species. *Leptogenys darlingtoni* is mainly an ant of mid-western WA and the northern goldfields, although it has been collected as far north as the southern boundary of the Pilbara subregion. Like *L. neutralis*, this taxon is confined to WA. North of the Overlander Roadhouse a worker of this species was hand-collected early am on light red soil in degraded scrub, and another worker was taken in a wet pitfall trap at Mt Gibson iron-ore mine. Wheeler (1933) found a small colony (less than 40 workers) under a stone in the shade of jam wattle trees near Mullewa, but there are no other data.

Myopias (Figure 147)

Superficially, *Myopias* might be mistaken for *Brachyponera*, but the mandibles are very different. In this genus, the clypeus, seen in full-face view, is narrowly inserted between the frontal lobes and the antennal sockets are closely approximated; the hind tibiae have two spurs (a large, pectinate spur, and a smaller, simple spur); the mandibles are narrow and toothed and inserted towards the sides at the front of the head; the eyes are not set on prominences; the tarsal claws are simple; the propodeal spiracle is round or ovoid, and the clypeus has a blunt, median projection. Like most Australian ponerines, these ants predate on other arthropods, including Collembola (Shattuck 1999). Only *Myopias tasmaniensis* has been recorded in WA on three occasions, all collections being made in the vicinity of Manjimup in the Warren subregion many years ago. This is a cool rainforest species that is much more common on Australia's east coast, where it has been recorded from NSW, south-western QLD, Vic, and Tas. There are no data on the three workers collected in WA (one of which was pitfall-trapped in an arboretum), but, in the eastern states, nests of this species are found under rocks or stones, and vegetation associations include rainforest (*Ceratopetalum*, *Doryphora*), snow gum woodland, dry sclerophyll and wet sclerophyll.

Odontomachus (Figure 147)

Odontomachus ants (two WA species, both described) are highly distinctive, and could only be mistaken for *Anochetus*. *Odontomachus* have a single waist segment that is strongly constricted at the front and back, frontal lobes that wholly or partially obscure the antennal insertions, a pygidium that lacks teeth, a sting at the tip of the gaster, a gaster that lacks any constriction between the first and second segments (unlike *Anochetus*), and elongate, linear mandibles that are situated close together, armed with developed teeth only at the tip and are capable of a gape of almost 180°. The petiolar node is high and terminates in a spine. These are generalist predators that capture prey by a sudden snap of their trap jaws. The snapping movement may be extremely fast (Gronenberg et al. 1993). The genus, including the biology, is covered on a global scale by Brown (1976). The two species are generally separated by differences in sculpture, although the variability on display in both species can make this difficult. In the case of *O. ruficeps*, the formal diagnosis is that the first gastral tergite, seen in dorsal view, is smooth and glossy apart from a finely punctate strip near the posterior margin; also seen in full-face view, the head is mostly smooth and glossy without distinct sculpture. In *O. turneri*, seen in dorsal view, the first gastral tergite is matt and completely striolate; also seen in full-face view,

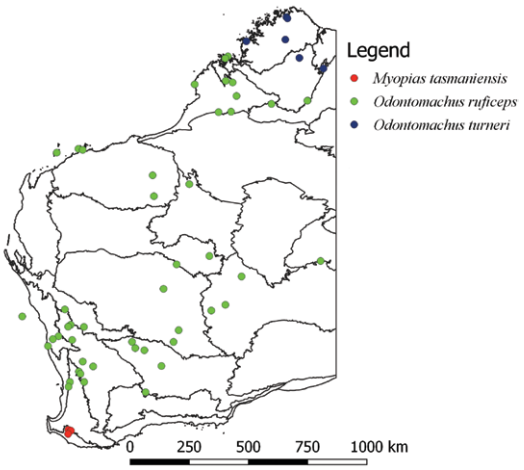

FIGURE 147 Distribution of *Myopias tasmaniensis*, *Odontomachus ruficeps* and *O. turneri*.

the head is rather matt and uniformly finely and longitudinally striolate. The characters given in the key, however, are provisional; the gastral striolae in *O. turneri* are not uniform, even in specimens from the same location: one worker from Horse Creek (NT?) has a uniformly striolate, matt first gastral tergite, but another worker from the same location and otherwise identical has the striolae reduced to the apical quarter and the gaster is reasonably shiny. There are clearly two species among the WA material, but possibly other features such as the shorter mandibles in *O. turneri* compared with *O. ruficeps*, and the presence of erect, flexuous pronotal setae in the former (absent in the latter) might be better characters by which to separate them (see comments in Andersen [2000]). *Odontomachus ruficeps* is also variable in colour and fine pronotal sculpture throughout its range in this state; southern specimens from Perth to about Wongan Hills being blackish, with samples from mid-western WA being dark reddish or reddish-black with lighter heads, and workers from the Pilbara northwards having red heads and mesosoma and sometimes being entirely reddish. In addition, southern material has transverse striolae across the pronotum, but various forms of partially or fully concentric patterning are usually found in ants from the north of the state. This genus would benefit from a modern integrated morphological/molecular revision.

Odontomachus ruficeps is found throughout WA except for the wetter south-west corner and southern coastline. This species is found in all the mainland Australian states except the ACT but is rare in Victoria. Records have come from all sorts of habitats, ranging from rainforest to heath, savanna, saltbush and mallee. Nests are made

either directly into soil or under an object such as a stone or log. Specimens have most often been collected in berlesates, less frequently by hand or in pitfall traps. In WA, *Odontomachus turneri*, as it is interpreted here, is confined to the Kimberley, but is more common in the NT and northern QLD. The habitats recorded for this species are much the same as those recorded for *O. ruficeps*, but do not include mallee or saltbush. Nests have been found made directly in soil, as well as under logs or stones. Sieved litter, berlesates and stick brushing are methods of capture mentioned on labels.

Platythyrea (Figure 148)

Platythyrea retains ancestral characteristics compared with other ponerines and is currently regarded as the sister group to all the other ponerines (Schmidt & Shattuck 2014). Six taxa (five described, one undescribed) occur in WA, but all are very uncommon and localised in the state and are rarely seen. This genus is readily separated from other WA Ponerinae by the broad separation of the clypeus between the frontal lobes, the antennal sockets also being widely separated. The hind tibiae have two pectinate spurs, and the tarsal claws are usually furnished with a solitary preapical tooth, but in rare cases the claws may be simple. The biology of Australian *Platythyrea* is poorly known, but WA species have mostly been taken on the ground in pitfall traps, although *Platythyrea* is said to have arboreal habits (Brown 1975; Shattuck 1999). Western Australian species are predaceous, presumably on a variety of arthropods including termites (see Shattuck [1999]) but concrete details of their preferred prey are mostly lacking. The existing keys that include the local fauna are outdated and a revised key to the WA *Platythyrea* taxa in supplied in Part I.

The *P. parallela* group of *Platythyrea* stands apart from the other taxa, which were included originally in genus *Eubothroponera*. In the former clade, the petiolar node, seen in dorsal view, is longer than broad or, rarely, about as broad as, or even slightly broader than long, but is always much narrower than the pronotum; in addition, the maxillary palps are short, not extending much beyond the buccal cavity. In '*Eubothroponera*' the petiolar node, seen in dorsal view, is much broader than long and nearly, or quite as broad as the pronotum, and the maxillary palps are very long, extending almost to the foramen magnum. Two species in the former group are found in WA. *Platythyrea parallela*, itself, has the widest distribution of the WA *Platythyrea* and isolated collections have been in the Jarrah Forest, the northern Avon Wheatbelt, and the southern Pilbara. This ant also has a broad range within Australia, being found in the ACT, NSW, the NT, and QLD. Overseas, *P. parallela* occurs in India, Indonesia, Madagascar, Malaysia, the Seychelles, Sri Lanka, and Vietnam. Local records of workers have all come from pitfall traps, but records from other countries list a variety of habitats and collection methods. Most commonly this ant has been collected in rainforest, but other vegetation associations include *Pandanus* and *Casuarina* forest, sandstone scrub, dry sclerophyll, wet sclerophyll, and degraded coastal hill forest on granite. Nests have been found under bark, while other workers have been taken from logs and log litter, tree trunks and from the ground. In Micronesia, one worker fell on a person's arm from a village restaurant roof. Collection methods include malaise trap, berlesate, pyrethrum knockdown, peanut-butter-and-maple-syrup bait trap, aspirator, sifting, pitfall trap and hand collection. An undescribed species, *P. parallela* group sp. JDM 1171, is distinguished from its cousin by the larger eye (EL ~0.30 × length of side of head vs EL ≤ 0.20 × length of side of head) and the appearance of the posterior margin of the petiolar node when seen in dorsal view. In *P. parallela*, the posterior margin is broad, undulant and describes a bow, while in *P. parallela* sp. JDM 1171 the posterior margin is a simple, narrow convexity. There are two mapped records of the latter species from the Pilbara, based on extant pinned material, but other samples have also been seen. Both sets of workers were collected in ethylene glycol pitfall traps, but there are no other data.

Colour is helpful in separating the workers of the other four species. In *P. turneri* the petiolar node is brownish-red, contrasting with the dark brown gaster. In *P. brunnipes*, *P. dentinodis*, and (usually) *P. micans* the head and body are concolorous brown, yellowish-brown or ferruginous. Within WA, *Platythyrea turneri* is known from sporadic collections on the Swan Coastal Plain, the jarrah forests of the western Darling Range and the western south coast. However, the species has a more extensive range interstate, where it has been recorded from all Australian states including Tas. Label data include the following vegetation associations and ecological notes: sandstone scrub, mulga pine box scrub [sic], box/*Callitris*, 'low granite outcrop in karri forest', beach scrub, 'foraging in leaf litter', and coastal heath. Soil types include sand and red soil, and nests have been recorded under stones or rocks on at least three occasions. Pitfall traps are common means of capture. *Platythyrea micans* is generally a concolorous dark brown but, while some workers have a reddish-brown mesosoma, the petiolar node and gaster are always of the same hue and the head is dark (the head is lighter in *P. brunnipes* and *P. dentinodis*); seen in profile, most erect setae on the dorsal body surfaces are < 0.08 mm long; seen in dorsal view,

the posterodorsal margin of the petiolar node is unarmed anterodorsally. *Platythyrea micans* occurs in the Perth Hills, where it is localised in the area bounded by Mundaring in the north and Jarrahdale in the south, but it has also been recorded near the south coast in Porongorup National Park and Chingarrup, north-west of Bremer Bay. One very old WAM record comes from Cannington, which is now part of Perth suburbia. This species is restricted to WA. Clark (1930b) found two small colonies of the species, one nesting in an old burrow of a trap-door spider, the other under a piece of old bark lying on the ground. No reproductives or brood were present. This species appears to prefer granitic environments. The only vegetation mentioned is Jarrah/marri woodland. Nests have been found in soil or under stones or rocks, and one worker was collected while crawling on a log.

Both *P. brunnipes* and *P. 'dentinodis'* have a small, medial, anterodorsal spur on the petiolar node that is variably developed but usually observable. The foreparts (in contract to most *P. micans*) are ferruginous-brown or ferruginous and the length of most erect setae on the body surfaces is greater than 0.10 mm (less than 0.08 mm in *P. micans*). The taxonomy of these two species is confused because of a mix-up in the type material. This is because the workers imaged for AntWeb as *'dentinodis'* represent two distinct species:

1. A Museums Victoria syntype worker is only represented by profile and dorsal shots, but this is enough to distinguish it from one of the 'co-type' specimens figured. This syntype has erect setae on the antennal scape.

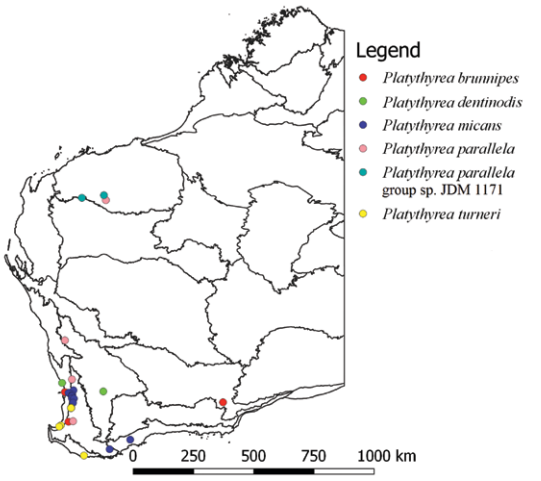

FIGURE 148 Distribution of *Platythyrea brunnipes*, *P. dentinodis*, *P. micans*, *P. parallela*, *Platythyrea parallela* group sp. JDM 1171 and *P. turneri*.

2. 'Co-type' CASENT0900577 and 'co-type' CASENT0900578 (head only imaged) do not have this feature. Neither does a solitary worker from Yanchep National Park (JDM Collection). The holotype for *P. 'brunnipes'* has a hairy scape and a relatively feeble posterior median tooth on the petiolar node, but a paratype is in all respects identical with *P. dentinodis*. I regard the nodal tooth as variable and thus taxonomically unhelpful in both species, although it is generally more prominent in *P. dentinodis*. It appears from the descriptions that Clark (1930c) intended *P. dentinodis* to be understood to have a glabrous antennal scape and *P. brunnipes* to have a hairy antennal scape. Unfortunately, he chose a specimen with a hairy scape as a name-bearing type for *P. dentinodis*! Equally unfortunately, the scape is not mentioned in Brown's (1975) key, which pulls out these two species as well as *P. turneri* in an awkward triplet. Shattuck & Schmidt's (2014) Figure 3 depicts a *P. dentinodis/brunnipes* specimen identical with the holotype. AntWiki leaves the separation between the latter two species unresolved. Perhaps the best solution would be to synonymise the two taxa under the earlier name of *dentinodis* and select ant CASENT0900578 that represents the distinct species — presuming it otherwise agrees with the Yanchep worker — and rename it. In summary, what can best be made of the present situation is that in *P. brunnipes* the antennal scape, seen in full-face view, has short, erect setae that are mostly on its outer margin. Viewed in profile, erect setae are also numerous on the mesosoma. In *P. 'dentinodis'*, seen in full-face view, the antennal scape is devoid of erect setae and, seen in profile, erect setae are more sparsely distributed on the mesosoma. In WA, *P. brunnipes* has been collected in relict bushland in one of Perth's western suburbs, at Worsley Alumina Mine in the lower Jarrah Forest and south-west of Balladonia in the Coolgardie subregion. Most of the other WA non-type records on AntWeb under *P. brunnipes* and *P. 'dentinodis'* that have not been imaged are probably also of this species, which seems to be the more common of the two. The ant was described from material collected from Reevesby Island, SA, but it has not been recorded from any other state to date. The Worsley worker was collected from vacuuming of vegetation, and the worker from Perth suburban Allen Park was captured in a pitfall trap in coastal sandplain containing remnant woodland. *Platythyrea 'dentinodis'* is definitely known only from Tammin ('Cotype' CASENT0900578) and from Yanchep National

Park, north of Perth. Other records ostensibly of this species are problematic. The only data that can reliably be assigned to *P. 'dentinodis'* relates to the Yanchep worker. This ant was hand-collected in *Banksia* woodland. The species may also occur in SA, but individual specimens would need to be examined to confirm this.

Ponera (Figure 149)

The genus *Ponera* (two species, one undescribed) is rarely seen in WA. In *Ponera* the clypeus, seen in full-face view, is narrowly inserted between the frontal lobes and the antennal sockets are closely approximated, the hind tibia has a single pectinate spur; the tarsal claws are usually simple but may be pectinate or armed with a single tooth, the mandibles are triangular and are inserted towards the sides of the front of the head, the eyes are not set on prominences, and the subpetiolar process has an anterior fenestra (this process has paired teeth posteriad in *P. leae*, but this is lacking in *Ponera* sp. JDM 1122). Superficially, workers in this genus resemble those of the much commoner *Hypoponera*, although the two genera are not closely related (based on the work of Schmidt & Shattuck 2014). Members of this genus are cryptic foragers that form small colonies (under 100 workers) in situations such as under rocks in moss on rotting wood, under bark or in the soil (Shattuck 1999). They are presumably predaceous, but their prey is unknown (Taylor 1967), although in the case of the tiny local species it might include small Diplura, spiders, and Collembola.

The two species found in WA are separated both morphologically and biogeographically. The northern taxon, *Ponera leae*, has a four-segmented antennal club and the subpetiolar process has a toothed posterior face. The southern taxon, *Ponera* sp. JDM 1122, has a distinctly five-segmented antennal club, and the subpetiolar process lacks a posterior face, the process merging with the petiolar ventrite posteriad (the lack of a distinct posterior face to the subpetiolar process is unusual and perhaps unique within the genus). Within WA, *Ponera leae* is known only from one record from Mt Trafalgar on the north-western Kimberley coast. This species is much more common in eastern Australia and is formally recognised from all the Australian states including Tas, excepting the NT. (However, Andersen [2000] mentions the presence of one *Ponera* species in the NT, and it could well be this one.) The ant is also found in New Caledonia and New Zealand. Taylor (1967) opines that the widespread occurrence of *Ponera leae* is probably due to involuntary transport by human agency. Rainforest and wet sclerophyll habitats have produced most databased specimens, while volcanic soil seems a favoured substrate for colonies of the ant. Collection of *Ponera leae* has usually been undertaken by means such as berlesates, Winkler sacks, pyrethrum knockdown, suction, stick brushing, and pitfall trapping, these being used to extract specimens from leaf mould, rotten wood, sieved litter, and sifted leaf litter. Other collections have been made from under stones. *Ponera* sp. JDM 1122 is an uncommon species that has been collected by JDM/WAM researchers only from Denmark, on the western south coast, and from Huntly Forest, near Dwellingup in the Jarrah Forest. The ant appears to be confined to this state but one specimen was regarded as a *Cryptopone* by Shattuck (1999) and appears on a map for that genus (p. 183) as a WA record under '*Cryptopone*'. However, the specimen, seen by the author, is a worker of *Ponera* sp. JDM 1122. (*Cryptopone* spp. have spinules or peg-like setae on the outer surfaces of the middle tibiae, lacking in *Ponera* sp. JDM 1122, and all other *Cryptopone* records come from Australia's east coast. That genus is unlikely to occur in WA). The Huntly Forest worker (JDM) was pitfall-trapped in jarrah forest, but there are no other details. The Denmark worker (WAM) has a secondary label 'Inquilines', suggesting that this worker may have been found within the nest of another ant species. This particular specimen came from a drawer, one of several containing various ant species and their inquilines that had been collected by R. P. McMillan, an amateur collector of ants and other insects.

Pseudoneoponera (Figure 149)

Pseudoneoponera species include some of the largest Australian ponerines that rival the larger *Myrmecia* in bulk, if not in length. These ants were placed in genus *Bothroponera* for many years, then in *Pachycondyla*, following Brown (1973). Finally, they reverted to *Pseudoneoponera* (Schmidt & Shattuck 2014), the genus in which they had originally been placed by Donisthorpe (1943). Five species (four described, one undescribed) are found in WA, nearly all in arid or semi-arid areas. The genus can be identified through a combination of the following features: seen in full-face view, the clypeus is narrowly inserted between the frontal lobes (which may be raised) and the antennal sockets are closely approximated; the ventral apex of the hind tibia bears two spurs, a large pectinate spur and a smaller, simple spur; the tarsal claws are simple; and the propodeal spiracle is slit-shaped. These ants have a powerful sting, which is accompanied by a foamy defensive secretion. The queen caste is lacking in Australian species (Schmidt & Shattuck 2014), and reproduction is probably carried out by ergatoid workers (gamergates). These large ants may be generalist predators and scavengers of arthropods and other

invertebrates (Schmidt & Shattuck 2014). However, Andersen (2000) states the genus primarily feeds on termites.

Pseudoneoponera sp. JDM 984 is a huge and formidable ant, and it is astonishing that this species remains undescribed, even though it is found only in the remote interior of WA and mostly well away from roads and settlement. This species is unmistakeable, not only because of its large size — it is the largest of the WA species, and probably the largest Australian *Pseudoneoponera* — but because the dorsum of the petiolar node is armed with a thin, horizontal tooth on either side, these teeth directed posteriad (the dorsum of the petiolar node is unarmed in other *Pseudoneoponera*). The species is known from WA's inland deserts, and its range probably extends to the NT (although not mentioned by Andersen [2000]) and SA. These ants appear to be quite common within their remote range, and WAM has a representative collection of specimens from a variety of localities. *Pseudoneoponera* sp. JDM 984 seems always to be found on sandy soil, especially red sand, and is associated with sandplain dunes covered with spinifex, mulga and mallee. Marble gum woodland is also mentioned. Workers are active both during the day and during the night. *Pseudoneoponera sublaevis* is also distinctive. Seen in dorsal view, the first and second gastral tergites in this species has microreticulate sculpture only, this sculpture largely obscured by dense, thick, yellow pubescence. In *P. denticulata*, *P. piliventris regularis* and *P. porcata* the first and second gastral tergites, seen in dorsal view, have parallel, longitudinal rugae that are usually very distinct (although they may be reduced on the second gastral tergite). Within WA, *Pseudoneoponera sublaevis* is restricted to the central and eastern Kimberley. This species is otherwise known from the NT and QLD. There are very little data: workers have been collected in sclerophyll woodland, and two specimens (Cairns, QLD) were collected from under a stone.

In *P. piliventris regularis* the pits on the mandible, seen in full-face view, are elongate and frequently confluent, their edges often constituting an irregular, finely striolate pattern. In *P. denticulata* and *P. porcata* the pits on the mandible, seen in full-face view, are largely circular or oval and are mostly separated from one another by many times their own diameter. *Pseudoneoponera piliventris regularis* is a relatively common species that has a wide range throughout WA, only being absent from the wetter south-western corner and the northern part of the Great Sandy Desert and the Kimberley. WAM material from Alice Springs also places the species in the NT. The number and spread of records in WA suggests that it is likely this ant also occurs in SA, but currently only the record for two WA syntypes is shown on databases. Interestingly, label data reveal this ant occurs in sympatry with *Pseudoneoponera* sp. JDM 984 in the same habitats, and how the two species partition their resources without direct competition would make for an interesting study. This ant has also been recorded from stony, alluvial plains covered by halophyte shrubland, mulga and short grasses. A similar environment (limestone and chenopod shrubland) is also recorded for two workers collected near Madura Roadhouse.

Pseudoneoponera porcata is a smaller species (HW ≤ 2.50 mm): seen in profile the eye is also smaller (EL ≤ 0.16 × length of side of head), the ant is moderately shining and is clothed with a coarse, off-white or yellowish pilosity that does not hide the underlying cuticular sculpture. In comparison, *P. denticulata* is a larger species (HW ≥ 2.60 mm). Seen in profile the eye is larger (EL ≥ 0.29 × length of side of head), the ant is matt and is clothed in fine, yellow pubescence (along with yellow erect setae) that hides the underlying cuticular sculpture when seen in certain lights. The WA record for *P. porcata* is limited to one worker collected on South West Osborn Island in the north-western Kimberley. The existing databases show this ant also occurs in NSW and Vic, but, given its presence in the Kimberley, it would be surprising if this species did not have a much broader range that also took in the NT and QLD. There are little data for *P. porcata*; the species occurs in *Eucalyptus* open forest, and one worker mentioned in AntWeb was found under a stone. Five workers (WAM material) captured on Mt Warning, NSW, by indefatigable ant collector the

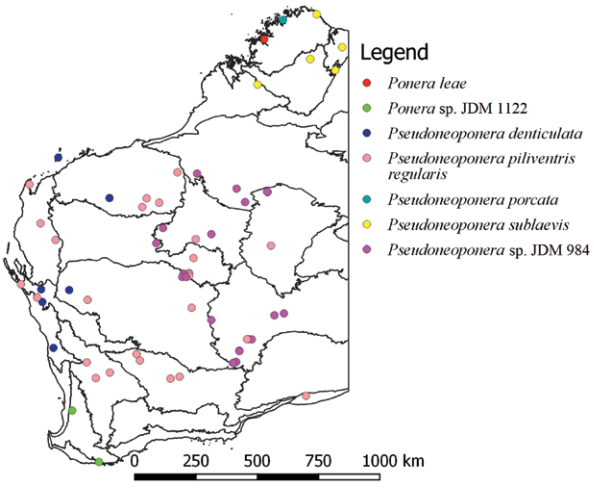

FIGURE 149 Distribution of *Ponera leae*, *Ponera* sp. JDM 1122, *Pseudoneoponera denticulata*, *P. piliventris regularis*, *P. porcata*, *P. sublaevis* and *Pseudoneoponera* sp. JDM 984.

Rev. Bede Lowery, were also found under rocks. Within WA, *Pseudoneoponera denticulata* is mainly restricted to the mid-west of the state, but it also occurs in the Pilbara and on Barrow Island. The holotype for this species, however, was collected by the Horn Expedition in 'Central Australia' (actual locality Blood Creek in northern SA), so the taxon is obviously not restricted to WA; its wider occurrence within this nation, however, is unclear in the absence of records. (Clark, [1930b], who redescribed some of the Horn Expedition types, including the holotype of *P. denticulata*, mentions the ant as 'being widespread throughout the interior'.) Within Western Australia these ants have been collected diurnally over bare sand, but there is no other information on the species.

PROCERATIINAE

This subfamily, along with the Amblyoponinae and Ectatomminae, was formerly part of a now much-reduced Ponerinae. In this subfamily the mesosoma is attached to the gaster by a single distinct segment (the petiole). In the genus *Discothyrea* the petiole has visible anterior and dorsal faces but is broadly attached to the gaster posteriorly, the separation of the petiole and gaster indicated by a shallow impression or slit. The second gastral tergite is strongly arched so that it is the last gastral segment visible in a dorsal view, the remaining gastral segments being much reduced, directed anteriad and located ventrally. In the genus *Probolomyrmex* the petiole has visible anterior, dorsal and posterior faces, the rear portion of the petiole being separated from the gaster by a marked constriction. The frontal lobes of both genera are reduced to a thin, sharp lamella between the antennal sockets, which are clearly visible in full-face view and located anteriorly on a shelf-like frontoclypeal prominence that overhangs the mandibles. In other subfamilies and genera with a single waist segment the frontal lobes are not produced as thin, sharp lamellae or located on a shelf-like frontoclypeal prominence that overhangs the mandibles, and the frontal lobes usually partially or completely obscure the antennal sockets. Five species in two genera are found in WA. Proceratiines are very small and highly cryptic, have tiny colonies (20 or fewer workers), are mostly confined to largely undisturbed environments and so are virtually never encountered by members of the Western Australian public. Both of the known genera are foragers in leaf litter, under rocks and logs and in similar cryptic situations. Based on overseas observations, *Discothyrea* species may be specialist predators on arthropod eggs (Shattuck 1999), particularly spider eggs (Katayama 2013), and one *Probolomyrmex* species predates on polyxeniid millipedes (Ito 1998) but the local proceratiine fauna is utterly unstudied.

Discothyrea (Figure 150)

These dainty little ants are not uncommon in WA, and there are four described species present in this state. The genus is separated from the other proceratiine genus found in WA; namely, *Probolomyrmex*, by the characters mentioned in the paragraph above. Three species are restricted to the wetter south-western corner of the state and to the south coast, but *Discothyrea clavicornis* is found in the tropical north.

Discothyrea bidens, seen in profile, has the propodeal angles produced as broad, flat teeth projected vertically. In the other three species the propodeal angles are unnamed. The species is known in WA from a single record (in ANIC) from thick forest in Boranup near the south-western tip. The main stronghold of this species is eastern Australia, from Victoria through NSW to south-eastern QLD. All records are coastal or from near the coast. Most specimens have been obtained from leaf mould, litter, under logs, and in grass tussocks. A number of workers were also found in a snail shell. Rainforest and *Nothofagus* forest are the main vegetation associations, although a few samples have been obtained from dry sclerophyll, tree fern or moss. Berlesates are by far the most common collection method. Stick brushing and sieved litter have also been successful. *Discothyrea clavicornis* is the sole tropical species found in WA. In this ant, seen in profile, the postpetiolar node is thin and squamiform without a distinct dorsal surface, and is closely aligned with the gaster so that the gastral presclerite is not visible. In the other species, seen in profile, the postpetiolar node is thick and broad with a distinct dorsal surface and is less closely aligned to the gaster so that the gastral presclerite is often visible. *Discothyrea clavicornis* has been collected several times in the state from Barrow Island, the Pilbara and in the north-western Kimberley. Other records come from the NT and Cape York, QLD, and overseas from China, Indonesia, Malaysia, Papua New Guinea, and the Solomon Islands. This extensive range suggests the ant may have been transported from its original habitat to exotic locations by human agency. Many records throughout its present range come from various types of rainforest, but there are several records from rubber plantations. A nest was located in a pocket of heavy clay (New Guinea), but individual captures have been made from wood, litter, moss and leaf mould. Winkler sacks and berlesates have been the favoured extraction methods.

In *D. crassicornis* the one-segmented antennal club is elongate, being approximately 3 times as long as its greatest width; in dorsal view, the dorsal face of the propodeum is distinguished from its declivous face by a distinct emarginate separation that may be carinate in some workers. The one-segmented club in *D. turtoni* is ovate, being ≤ 2 × as long as its greatest width; in dorsal view, the dorsal face of the propodeum passes more-or-less smoothly over to its declivous face without a distinct transverse carina or ridge. Most records of *D. crassicornis* are restricted to the Jarrah Forest and the Warren subregions, with a single collection from Cape Arid National Park. This ant also occurs in Vic. The type specimens (Manjimup) were found under a rotten log. Another worker was located in deep litter in a jarrah stump (WAM), and yet others under wood or rock. Mallee (in Mt Ragged, Cape Arid National Park) is the only named vegetation association. *Discothyrea turtoni* has also been found in jarrah forest and on the western south coast. Like *D. crassicornis*, this species is similarly found in Vic., but has a more extensive range than its relative and also occurs in NSW, SA, Tas, and the Bass Strait islands. Various forest types and climax vegetation are mentioned on labels, e.g. rainforest (this being cool temperate rainforest), wet sclerophyll, dry sclerophyll, *Nothofagus cunninghamii* forest with tree ferns, logged jarrah forest and *Eucalyptus obliqua* forest. Typical microhabitats recorded include under rock, in a rotten log and in leaf litter, but, in a more interesting note, one worker was collected under a granite rock from the mud cell of a wasp (Tas). Berlesates and pitfall traps have accounted for most collections.

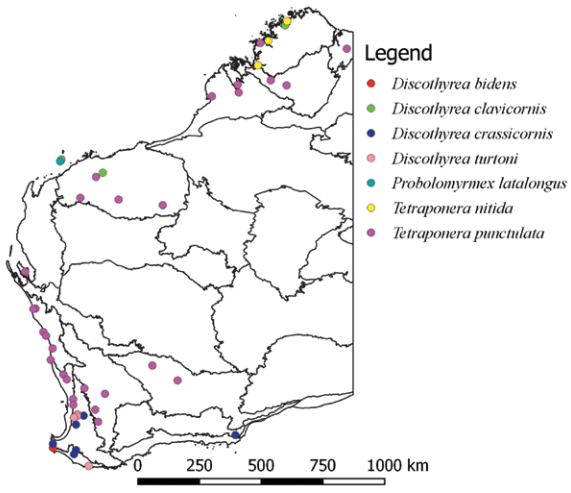

FIGURE 150 Distribution of *Discothyrea bidens*, *D. clavicornis*, *D. crassicornis*, *D. turtoni*, *Probolomyrmex latalongus*, *Tetraponera nitida* and *T. punctulata*.

Probolomyrmex (Figure 150)

The Australasian members of this genus were revised by Shattuck, et al. (2012). Only *P. latalongus* (Shattuck et al. 2012) occurs in this state, and thus far no workers have been collected in WA, the two records involving a queen from Barrow Island and three males from Langi Crossing south of Derby, in the Dampierland subregion in the central Kimberley. Other collections have been made in the NT (which provided the workers for the type series) and QLD. Known habitats include rainforest, *Eucalyptus* woodland and grassland. Most collections have been from leaf litter, but one specimen was caught in a pitfall trap and a queen was captured in a flight intercept trap (Shattuck et al. 2012).

PSEUDOMYRMECINAE

Pseudomyrmecinae in WA are restricted to two species of *Tetraponera* (both described), both of them thin, black, shiny ants that are unlikely to be mistaken for any other WA genus. The Oriental and Australian members of the genus have been revised by Ward (2001).

Tetraponera (Figure 150)

In *Tetraponera* the mesosoma is attached to the gaster by two distinct segments (the petiole and the postpetiole), each segment clearly constricted anteriorly and posteriorly, the mandibles are short and triangular and eyes are present and located above the mandibular attachment, the pronotum and mesonotum are not fused, and the join between them is flexible, the tarsal claws are toothed, and the ants are of medium size and arboreal. *Tetraponera punctulata* is more of a generalist and inhabits galleries and cavities in branches excavated by coleopteran and lepidopteran larvae, while *T. nitida* is an inhabitant of dead twigs and plant stems (Ward 2001).

Careful examination is needed to separate the two species: The petiole of *T. nitida*, seen in profile, has a pair of acute, posteroventral teeth, formed from the ventrolateral extensions of the petiolar sternite; in dorsal view, the pronotum is seen to have dense punctate sculpture on its anterior quarter which contrasts with the shiny (and less densely sculptured) posterior half of the head and with the more sparsely punctate posterior regions of the pronotum; in full-face view, the scapes are shorter than the eye length. In profile, the petiole of *T. punctulata* lacks a pair of posteroventral teeth; in dorsal view, the pronotal sculpture is variable but the punctures are more evenly distributed, and not concentrated solely on the anterior quarter (although they may be sparse medially), and they usually do not occur in a density that contrasts strongly with that of the posterior half of the head;

in full-face view, the scapes are longer than the eye length. In WA, *Tetraponera nitida* appears to be restricted to the north-western Kimberley coast. This ant also occurs in the NT and QLD, and has an extensive distribution in the Indomalay Peninsula and elsewhere in Asia, occurring in Cambodia, China, India, Indonesia, Papua New Guinea, the Philippines, Singapore, Sri Lanka, and Thailand. Despite its preference for twigs and stems, this species is catholic in the plants it chooses to nest in, having been recorded from *Eucalyptus*, *Premna serratifolia*, *Avicennia alba*, *Terminalia catappa*, and *Rhizophora* sp. Malaise traps, pan traps and fogging are responsible for most specimens collected. However, there seems to be no mention in the literature of the diet of this taxon. *Tetraponera punctulata* has a broad but apparently discontinuous range in WA, with collections being taken from Perth northwards to Shark Bay and eastwards to Norseman, another set of records coming from the Pilbara (including Barrow Island) and a third set of records from the Kimberley. The species also occurs in NSW, the NT, QLD, SA, and overseas in Papua New Guinea. Ward (2001) mentions morphological variability in this species (eye size, elongation of the head, and robustness of the petiolar node) but puts these down to allometry. Nesting most often occurs in *Eucalyptus* (5 species) in woodland or open forest. Other host plants include *Avicennia eucalyptifolia*, *Calophyllum inophyllum*, and *Rhizophora* sp. Local specimens have been found on mallee and *Eucalyptus wandoo*. Workers from Geraldton are said to have an association with the bird-dropping weevil *Metyrus albicollis* (label data). Other workers have been observed to tend scale insects (? *Coccus* sp.) in the nest (Ward 2001).

ADDITIONAL ANT SPECIES

The total of 832 species of ants discussed in Parts I and II will undoubtedly be subject to alteration as subsequent revisionary work on Australian ants, using ever more sophisticated morphological and molecular techniques, is undertaken. A list of taxa treated here as a species unit but possibly consisting of a complex of morphologically very similar species is supplied in Part I. Other names will very likely pass into synonymy, resulting in an incremental net gain with time (this assumption based on the results of monographic work done over the last twenty years). On the other hand, the addition of novel, morphologically distinct taxa will probably constitute a much smaller component for the SWP fauna (which is very well known) but a larger one for the EP, where a number of new *Meranoplus*, in particular, may well come to light. The greatest increase, however, will be for ants from the much less well known NP, where there are very many cryptic rainforest and vine thicket species that occur in small colonies in remote and difficult to access parts of the Kimberley. Some of these ants are present in the TERC Collection.

The following taxa, some probably undescribed, are mentioned in publications by Dr. Alan Andersen and his colleagues but cannot be matched with material held in the ANIC or WAM/JDM Collections or with WA-collected specimens imaged on databases such as AntWeb or AntWiki. Since Part I was published online, *Crematogaster scita* Emery has been identified among Curtin University material collected in the north-western Kimberley in 1988 (see https://www.antweb.org/specimenImages.do?name=casent0908383&countryName=Australia).

Andersen (2008):

DORYLINAE

Lioponera turneri Forel p. 34

FORMICINAE

Polyrhachis (Hedomyrma) cupreata Emery

Polyrhachis (*Campomyrma*)
'Group A' (pp. 86, 88)

MYRMICINAE

Crematogaster '*queenslandica* group'
(hairy species) p. 41

Andersen and Majer (1991)
Parvaponera darwinii (Forel) (as *Trachymesopus darwinii*) p. 339

ACKNOWLEDGMENTS

The provision of a working space, computer and bookshelves by the Western Australian Museum has made it possible to carry out this work in close proximity to the WAM Insect Collection. The WAM also permitted me to use their state-of-the-art Digital Imaging System. Ms Paige Maroni was very helpful in training me up on the use of the Visionary Digital Imaging System camera and associated computer. Ms Robyn Meier (CSIRO) and Dr Ben Hoffman (TERC) kindly permitted me to inspect specimens in their respective Ant Collections. Ms Michele Esposito (California Academy of Sciences) was most helpful and patient in setting up my Digital Imaging System images on AntWeb, so that they could be linked to couplets in Part I, and I also express gratitude to AntWeb for permission to use their images. I thank two anonymous referees for their helpful comments on the submitted manuscript. I would also like to thank other WAM and Curtin University staff who assisted in various ways throughout the compilation of this volume.

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