The aulacid wasp fauna of Western Australia with descriptions of six new species

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Abstract – This study describes for the first time the Aulacidae from Western Australia, a fauna that comprises six geographically isolated species. Three new species of Aulacus; A. douglasi, A. houstoni, and A. mcmillani, and three new species of Pristaulacus; P. curryi, P. davisi, and P. mouldsi, are described. At the same time, a key to genera and species is presented, along with a diagnosis for Aulacus and Pristaulacus, and notes on their taxonomic history and species diversity.

Key words: Evanioidea, Aulacidae, Aulacus, Pristaulacus, taxonomy, parasitic wasps.

INTRODUCTION

The Aulacidae is a family of parasitic wasps that are endoparasitoids of wood-boring wasps (Xiphydriidae) and beetles (Cerambycidae and Buprestidae) (Carlson 1979; Gauld and Bolton 1996; Smith 2001; Jennings and Austin in press), although there are no records of aulacids parasitising xiphydriid wasps in Australia. At various times the Aulacidae have been treated as a subfamily or group of the Evanidae, or as a separate family, but all recent studies accord them family status (e.g. Naumann 1991; Mason 1993; Gauld 1995; Jennings and Austin 2000, in press; Smith 2001). They are included in the superfamily Evanioidea along with the Evanidae and Gasteruptiidae, and are most closely related to the latter family (Jennings and Austin in press).

Although all Evanioidea are characterised by the high insertion of the metasoma on the propodeum, aulacids are readily distinguished from evaniids and gasteruptiids by the presence of fore wing cross-vein 2m-cu (Gauld and Bolton 1996), and cross-vein 3r-m (Konishi 1990), and the presence of a metapostnotum.

Smith (2001) provided a catalogue of the world aulacid fauna, and included 48 species of Aulacus Jurine, 106 species of Pristaulacus Kieffer, and two species of Panaulix Benoit. Both Aulacus and Pristaulacus are worldwide in distribution, but Panaulix is confined to sub-Saharan Africa.

The Australian fauna comprises some 40 described species (24 for Aulacus and 16 for Pristaulacus) (Smith 2001; Jennings 2001; Jennings et al. in press), however, most descriptions are inadequate and date from the early part of the 20th Century. Even though modern collecting techniques such as malaise trapping have added significantly to the number of specimens held in museum and other collections, only one taxonomic study, that of Jennings et al. (in press), has been undertaken on the Australian fauna in the last 50 years.

This study is part of a project that aims to revise the Aulacidae of Australia, and for the first time treats the fauna of Western Australia which comprises three new Aulacus and three new Pristaulacus species.

METHODS, TERMINOLOGY AND ABBREVIATIONS

Specimens were observed under a Zeiss light microscope or using scanning electron microscopy (SEM). Specimens for SEM were first cleaned to remove obvious dirt and other debris and examined uncoated under a Phillips XL30 field emission SEM at 1kv and a spot size of three.

Terms for general morphology follow Jennings and Austin (1994), and that for wing venation follows the modified Comstock-Needham system after Sharkey (1988), but with some modifications, and using the nomenclature of van Achterberg (1979) for cells (Figures 1–2). Terms for surface sculpturing follow Harris (1979), and for male genitalia Crosskey (1951). Where morphometric
measurements are based on more than one specimen, data are presented as the mean followed by the range. The length of the ovipositor is measured from the tip of the metasoma, and the length of the hind femur includes the prefemur (trochantellus).

The abbreviations for the institutions that are the repository of the specimens referred to in this paper are: Western Australian Department of Agriculture (WADA) and Western Australian Museum (WAM).

SYSTEMATICS

Key to Western Australian species

Most of the described Australian species of aulacids are from the higher rainfall, forested areas of the east coast. A key to continental fauna is not presented here because there are many undescribed species known in collections. However, because the six species are known only from Western Australia, a key is presented to facilitate their identification.

1. Hind tarsal claw not pectinate .......... *Aulacus*. 2
   Hind tarsal claw pectinate ............. *Pristaulacus*. 4

2. Costal, basal, submarginal, and marginal cells of fore wing dark brown; large species, body length 16.5 mm, excluding ovipositor .......... 
   Fore wing cells largely hyaline; smaller species, <12.0 mm in body length, excluding ovipositor ..................................................... 3

3. Brown spot apically on marginal and submarginal cells of fore wing; lateral lobes of mesoscutum strigate; metasomal T1 and T2 broad when viewed dorsally. 
   Wings entirely hyaline, apical spot on fore wing absent; lateral lobes of mesoscutum rugose; metasomal T1 and T2 narrow when viewed dorsally. 
   ......................... *A. houstoni*, sp. nov.

4. Fore wing vein 2-Rs+M long and second discal cell elongate (see Figure 1); small species, 6.0 mm in body length, excluding ovipositor .......... 
   Fore wing vein 2-Rs+M short and second discal cell more or less quadrate (see Figure 2); larger species, >9.0 mm in body length, excluding ovipositor ................. 5

5. Metasoma clavate; hind wing venation reduced, veins R+Rs, M+Cu and Cu absent, r-m and 2-M largely spectral (Figure 2) .......... 
   Metasoma ovate; hind wing venation not reduced, R+Rs, M+Cu, Cu, r-2m and 2-M present (see Figure 1) .......... *P. mouldsi*, sp. nov.

Aulacus Jurine, 1807

[For a complete taxonomic history of *Aulacus* see Jennings et al. (in press)]

Diagnosis based on Australian species

Eyes small, circular or subcircular, remote from the mandibles; antenna 14-segmented in female, 13-segmented in male; antennal insertions low on face, near lower margin of eyes; scape usually deeply convex ventrally in lateral view, much thicker than pedicel and flagellomeres; sub-antennal groove or depression to accommodate scape (e.g. Figure 8); metapostnotum between propodeum and metanotum as a distinct sclerotisation (Figures 18–19); propodeum pyramidal, metasoma inserted high on the apex; metasomal T1 and T2 fused dorsally; hind coxa usually with groove or notch on inner lateral surface, the apposed grooves or notches forming an ovipositor guide; hind trochanter with a transverse trochanteral groove (Figure 16), prefemur (trochantellus) present (Figure 16); each tarsal claw with one basal tooth (sometimes difficult to see); fore wings not plicate at rest; fore wing vein 2m-cu present (Figure 1), vein 2r-m usually present, largely spectral, vein 3r-m present, often largely spectral (Figure 1); ovipositor exerted, protruding well beyond apex of metasoma.

Comments

*Aulacus* currently includes all aulacids with non-pectinate hind tarsal claws and includes 51 species worldwide, 21 of which are endemic to Australia (Smith 2001; Jennings 2001; Jennings et al. in press).

*Aulacus douglasi* sp. nov.

Figures 11, 16, 18, 29

Material Examined

Holotype


Female

Length. 16.5 mm, excluding ovipositor.

Colour. Body orange-red, with variable amounts of dark brown on mandibles, malar space, lateral mesoscutum, mesepisternum, mesepimeron, and metasomal T3 and T4; ovipositor brown; wings generally pale brown, costal, basal, submarginal and marginal cells darker brown.

Head. 1.24 x wider than long when viewed dorsally; face rugose, pubescence short; distinct sub-antennal groove; frons with weak lateral medial carina above toruli, rugose, with short
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pubescence; vertex imbricate, with scattered short setae; gena imbricate, slightly rugulose ventrally near eye margin, with scattered short setae; posterior margin of head not concave in dorsal view; occipital carina absent; malar space 0.2 x height eye; clypeus 4.0 x as wide as high, margin sinuate, medial process present; distance from lateral ocellus to eye margin 0.86 x distance between lateral ocelli; scape 2.1 x length pedicel; first flagellomere 0.8 x as long as scape, 1.0 x as long as second flagellomere.

Mesosoma. Propleuron rugulose, pubescence short, ventro-lateral carina weak; pronotum without angular process, rugulose-imbricate; mesoscutum in lateral view rounded antero-dorsally, medial and lateral lobes rugose (Figure 11), with scattered short setae, admedian lines present, weak; scutellum and axillae rugulose (Figure 18); metapostnotum rugose, posterior margin scrobiculate (Figure 18); meseipisternum rugose, with short pubescence; meseipimeron broad, carinate; metapleurone coarsely rugose, with short pubescence; propodeum coarsely rugose, posterior margin scrobiculate; hind coxa rugose dorsally, smooth laterally, pubescence short laterally, ovipositor guide on inner surface, medial; hind trochanter weakly imbricate, with scattered short setae; hind tibia imbricate, pubescence short, with scattered stout emergent setae; hind femur 0.75 x length hind tibia; hind tibia with ventro-apical pecten of short robust spines; hind tarsal segments 1-4 with ventro-apical pecten of short robust spines, segment 1, 2.6 x length segment 2; segment 2, 1.6 x length segment 3; segment 3, 1.5 x length segment 4; segment 4, 0.7 x length segment 5; hind tarsal claw 0.45 x length segment 5; fore wing vein 2-R+Rs-M long, second discal cell elongate, veins 2r-m and 3r-m largely spectral; hind wing venation complete, R+Rs, M+Cu, Cu, r-m and 2-M present, with 2 hamuli.

Metasoma. Clavate, 1.75 x length of mesosoma; T1 and T2 narrow, smooth; ovipositor 18.8 mm.

Male
Unknown.

Remarks
Aulacus douglasi has a distinctive fore wing colouration in that the costal, basal, submarginal and marginal cells are dark brown, and this distinguishes it from the other Western Australian species. Although A. douglasi is similar to the fore wing colouration of A. festivus (Kieffer) from Queensland, the latter species differs in many ways including having more extensive black colouration on the head, body, and metasoma, and a smooth vertex. Aulacus douglasi is known only from the holotype locality, Wubin, Western Australia (Figure 29), and is named after the collector, Athol Douglas. Nothing is known of its biology.

Aulacus houstoni sp. nov.
Figures 1, 3, 9, 12, 19, 29

Material Examined

Holotype

Female
Length. 11.0 mm, excluding ovipositor.

Colour. Body orange-brown except flagellomeres and ovipositor sheaths dark brown; mesoscutum, scutellum, axillae, metanotum, meseipisternum, metapleurone, propodeum, and metasomal T1 with variable amounts of dark brown; wings pale brown, fore wing with darker spot apically on the marginal and submarginal cells.

Head. 1.5 x wider than long when viewed dorsally (Figure 3); face, frons and gena punctate-imbricate, with scattered short setae; shallow sub-antennal groove; frons with slight lateral protrusion above toruli; posterior margin of head slightly concave in dorsal view; occipital carina absent; malar space 0.33 x height eye; clypeus 4.6 x as wide as high, margin sinuate, distinct medial process (Figure 9); distance from lateral ocellus to eye margin 0.9 x distance between lateral ocelli; scape 1.3 x length pedicel; first flagellomere 1.06 x as long as scape, 0.65 x as long as second flagellomere.

Mesosoma. Propleuron rugulose medially, imbricate and with scattered short setae laterally, ventro-lateral carina weak; pronotum without angular process, rugulose and with scattered punctures; mesoscutum in lateral view rounded antero-dorsally, medial and lateral lobes strigate, with underlying punctate-imbricate sculpturing, with scattered short setae, admedian lines present (Figure 12); scutellum and axillae weakly strigate (Figure 19), with underlying punctate-imbricate sculpturing; with scattered short setae, admedian lines present (Figure 12); scutellum and axillae weakly strigate (Figure 19), with underlying punctate-imbricate sculpturing; metapostnotum scrobiculate, posterior margin distinctly convex (Figure 19); meseipisternum rugulose dorsally, smooth medially, rugose-punctate ventrally, with short setae, denser ventrally; meseipimeron broad, carinate; metapleuron rugulose dorsally, smooth medially, rugose-punctate ventrally with short setae; propodeum coarsely rugose, smooth medially and with a median dorso-ventral carina, posterior margin scrobiculate; hind coxa rugose dorsally, imbricate laterally, pubescence short, ovipositor guide on inner side, somewhat distal, pronounced ventral lobe on outer side; hind trochanter imbricate, pubescence short; prefemur on hind leg
Figures 1–2  Wings of (1) *A. houstoni* sp. nov., holotype female; (2) *P. davisi* sp. nov., holotype female; cells are: 1 = marginal, 2 = submarginal, 3 = discal, 4 = subdiscal, 5 = costal, 6 = basal, 7 = subbasal, 8 = plical. Scale bars = 1 mm.

Remarks

This species is readily separated from the other Western Australian species by a number of character states. *Aulacus houstoni* (length 11.0 mm) is intermediate in size between *A. douglasi* (16.5 mm) and *A. mcmillani* (7.1 mm). The medial and lateral lobes of the mesoscutum are strigate in *A. houstoni*, whereas the mesoscutal lobes of the other two species are rugose. Along with *A. mcmillani*, this species lacks the dark brown colouration on the costal, basal, submarginal, and marginal cells of the fore wing that is found in *A. douglasi*. It also differs in having a dark spot apically on the marginal and submarginal cells of the fore wing that is absent in the other two species. A number of eastern Australian species also have this apical spot on the fore wing.

*Aulacus houstoni* is known only from the holotype locality, Fitzgerald River National Park, Western Australia (Figure 29), and is named after the collector, Dr Terry Houston, Western Australian Museum. Nothing is known of its biology.
Figures 3–8  3–4. Dorsal view of head of (3) A. houstonii sp. nov., holotype female; (4) A. mcmillani sp. nov., holotype male. 5–7. Postero-lateral view of head of (5) P. curryi sp. nov., holotype female; (6) P. mouldsi sp. nov., holotype female; (7) P. davisi sp. nov., holotype female. 8. Lateral view of lower head showing sub-antennal groove of P. davisi sp. nov., holotype female. Scale bars = 3, 5, 7, 500 μm; 4, 8, 200 μm; 6, 1 mm

Aulacus mcmillani sp. nov.  
Figures 4, 27, 29

Material Examined

Holotype  


Paratype  
Western Australia: 1 δ, same data as holotype (WAM).
Figures 9–10 Clypeal region and mandibles of (9) *A. houstoni* sp. nov., holotype female; (10) *P. mouldsi* sp. nov., holotype female. Scale bars = 9, 200 µm; 10, 500 µm.

Other specimens examined

**Western Australia**: 1 ♀, same data as holotype (WAM); 2 pupae, Kings Park, 17.xi.1957, R.P. McMillan (WAM).

**Male**

*Length*. 7.1 mm.

*Colour*. Body and head dark brown, legs and metasoma yellow brown. Wings hyaline.

*Head*. Width:length 1.5 when viewed dorsally (Figure 4); distinct sub-antennal groove; face rugose, with scattered short setae; frons without lateral carina above toruli, punctate-imbricate, with scattered short setae; vertex punctate-imbricate, with scattered short setae; gena weakly rugulose, with scattered short setae; posterior margin of head not concave in dorsal view; occipital carina absent; malar space 0.3 x height eye; clypeus 3.3 x as wide as high, margin sinuate with small medial process; distance from lateral ocellus to eye margin 0.8 x distance between lateral ocelli; scape 1.7 x length pedicel; first flagellomere 0.7 x as long as scape, 0.9 x as long as second flagellomere.

*Mesosoma*. Propleuron punctulate-imbricate, pubescence long, ventro-lateral carina present; pronotum without angular process, rugulose, with a few scattered punctures; mesoscutum in lateral view rounded antero-dorsally, medial and lateral lobes rugose, with a few scattered short setae, admedial lines present; scutellum and axillae rugose; metapostnotum rugose, posterior margin scrobiculate; mesepisternum rugose, with short pubescence; mesepimeron broad, scrobiculate; metapleuron rugose, with short pubescence; propodeum rugose dorsally, areolate laterally and medially, posterior margin weakly scrobiculate laterally; hind coxa striigate dorsally, rugose laterally, pubescence long laterally; hind trochanter imbricate, with scattered long setae; hind prefemur present; hind femur imbricate, with short pubescence; hind tibia imbricate, pubescence short, with scattered emergent stout setae; hind femur 0.67 x length hind tibia; hind tibia with ventro-apical pecten of short robust spines; hind tarsal segments 1–4 with ventro-apical pecten of short robust spines, segment 1, 2.8 x length segment 2; segment 2, 1.5 x length segment 3; segment 3, 1.3 x length segment 4; segment 4, 0.75 x length segment 5; hind tarsal claw 0.6 x length segment 5; fore wing vein 2-Rs+M long, second discal cell elongate, 2r-m absent, 3r-m spectral medially; hind wing venation reduced, M+Cu and Cu absent, with 3 hamuli.

*Metasoma*. Clavate, 1.65 x length of mesosoma; T1 and T2, narrow, smooth dorsally; basiparameres broad, imbricate (Figure 27); digitus broad, slightly longer than basiparameres (Figure 27).

**Female**

Note: The specimen has not fully emerged from the cocoon. Similar to male except: length 8.0 mm; ovipositor at least 10.0 mm long; ovipositor guide on hind coxae present.

*Pupa*

5.3 mm in length, exarate, covered with a pale brown testaceous cocoon.

**Remarks**

This species is the smallest of the Western Australian *Aulacus* species, and can be readily separated from the other species by its size and the characters in the key.

All known specimens were bred from cerambycid larvae (unknown species) collected in Kings Park, Perth, Western Australia (Figure 29). The species is named after the collector, R.P. McMillan.

**Pristaulacus Kieffer, 1900**

*Aulacostethus* Philippi 1873: 302. Type species: *Aulacostethus rubiventer* Philippi, by monotypy.
(preoccupied by Waterhouse 1869 (Coleoptera), Uhler 1871 (Hemiptera—see Smith 2001).—Townes 1950: 88; Townes 1951: 657; Crosskey 1953: 759.

*Aulacostethus* Schletterer 1889: 523. Misspelling of *Aulacostetlllls*.


*Aulacostetlllls* Dalla Torre 1902: 1062. Misspelling of *Aulacostetlllls*.

*Anaulacus* Semenow 1903: 173. Type species: *Aulacus sibiricus* Semenow, by subsequent designation of Bradley 1908: 120. Preoccupied by MacLeay 1825 (Coleoptera) (see Smith 2001).


*Aulacostethus* Kieffer 1912: 370. Misspelling of *Aulacostethus*.

*Aulacomastus* Muesebeck and Walkley 1956: 333. Unnecessary new name for *Aulacostethus* Philippi.


**Diagnosis based on Australian species**

As for *Aulacus* except: each tarsal claw pectinate, with one basal tooth (sometimes difficult to see) and one or more medial teeth.

**Comments**

The genus *Aulacostethus* was erected by Philippi (1873), but *Aulacostethus* was preoccupied by a beetle and a hemipteran. In 1900, Kieffer erected *Pristaulacus* to include all taxa previously included in *Aulacostethus*. However, a degree of confusion continued for many years as a number of authors, notably Townes (1950) and Crosskey (1953), continued to use *Aulacostethus*.

As with *Aulacus*, early authors had not established the generic limits of *Pristaulacus*, so that a number of genera were erected to include specific variation. These included *Anaulacus* Semenow from Siberia, *Deraiodontus* Bradley, *Oleioprister* Bradley, and *Tropaulacus* Bradley from North America, *Odontaulacus* Kieffer from South and North America, and Australia, *Interaulacus* Bradley from South America, *Psilaulacus* Kieffer from Mexico, and *Tetrulacinus* Kieffer from India. By 1912, Kieffer had included some 84 species in his world catalogue and synonymised *Semenovia* with *Odontaulacus* and *Psilaulacus* with *Pristaulacus*. Townes (1950) provided a degree of generic stability by placing *Odontaulacus*, *Tropaulacus*, and *Tetrulacinus* into synonymy with *Aulacostethus*, although he failed to recognise that *Aulacostethus* had been synonymised with *Pristaulacus*. Townes also erroneously synonymised *Disaulacinus* with *Aulacostethus*; *Disaulacinus* is now considered a synonym of *Aulacus*. Oehlke (1983) and others recognised only the genus *Pristaulacus* to define those aulacids with pectinate hind tarsal claws. In his recent catalogue, Smith (2001) included 106 species in *Pristaulacus*, including 16 from Australia.
Figures 11–15  11–14. Dorsal view of mesoscutum of (11) *A. douglasi* sp. nov., holotype female; (12) *A. houstoni* sp. nov., holotype female; (13) *P. curryi* sp. nov., holotype female; al = admedial line; (14) *P. mouldsi* sp. nov., holotype female.  15. Lateral view of head and mesoscutum of *P. mouldsi* sp. nov., holotype female; vlc = ventro lateral carina. Scale bars = 11–13, 500 μm; 14–15, 1 mm.

**Pristaulacus curryi** sp. nov.
Figures 13, 20, 23, 26, 28–29

Material Examined

**Holotype**


**Paratypes**

Western Australia: 1 ♂, N Yanchep, 6.ii.1968, S.J. Curry (WADA); 1 ♂, Ludlow, 20.iii.1968, S.J. Curry (WADA); 2 ♀♀, Dwellingup, 24.ii.1970, S.J. Curry
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Female

Length. 6.0 (5.7–6.5) mm, excluding ovipositor.

Colour. Body black. Scape, clypeus, legs and metasomal T1 and T2 light brown; wings hyaline except for a small fuscous spot at tip of fore wing.

Head. Width:length 1.2 when viewed dorsally; face rugose, pubescence short; sub-antennal groove smooth; frons rugose-punctate near toruli to clypeus 4.4 (4.2–4.8) x as wide as high, margin concave in dorsal view; occipital carina complete between lateral ocelli; scape 1.7 (1.6–1.8) x as long as second flagellomere.

Mesosoma. Propleuron rugose, pubescence short, ventro-lateral carina present; pronotum without angular process, rugose; mesoscutum in lateral view angular antero-dorsally, medial and lateral lobes carinate with scattered short setae, admedian lines slightly curved (Figure 13); scutellum and axillae carinate (Figure 20); metaprosternum rugose, with long pubescence; mesepimeron broad, scrobiculate; metapleuron rugose, with long pubescence; propodeum coarsely rugose, posterior margin coarsely scrobiculate; hind coxa rugulose, distinct flange-like ovipositor guide on inner side, distal tarsal segments 1–4 with ventro-apical pecten of short robust spines; hind tarsal segments 1–4 with ventro-apical pecten of short robust spines, segment 1, 2.8 (2.2–3.2) x length segment 2; segment 2, 1.4 (1.35–1.60) x length segment 3; segment 3, 1.4 (1.3–1.6) x length segment 4; segment 4, 0.7 (0.6–0.8) x length segment 5; hind tarsal claw pectinate, with one large medial and one small basal tooth (difficult to see), 0.5 x length segment 5; fore wing vein 2-Rs+M long, second discal cell elongate, vein 2r-m largely spectral, 3r-m tubular in anterior third and posterior tenth, remainder spectral; hind wing venation complete, R+Rs, M+Cu, Cu, r-m and 2-M present, with 2 hamuli.

Metasoma. Clavate, 1.07 (1.05–1.10) x length of mesosoma; T1 and T2, narrow, smooth (Figure 25); ovipositor 4.7 (3.4–5.2) mm.

Male

Similar to female except: length 6.7 (6.5–6.8) mm; wings entirely hyaline; metasoma narrower; digitus about same length as basiparameres (Figure 28); basiparameres narrow and smooth, except shallow punctures, each associated with a somewhat stout seta (Figure 28).

Remarks

The male of this species is slightly larger than the female and can be distinguished from the female by the absence of the fuscous tip on the fore wings, as well as by having 13 antennal segments, typical of maleaulacids.

Pristaulacus curyi can be readily distinguished from the other two Western Australian species by its small size. Both P. davisi and P. mouldsi have a body length of more than 10.0 mm compared with 6.0 (5.7–6.5) mm for P. curyi. Also, the fore wing vein 2-Rs+M is short and the second discal cell is more or less quadrate in P. davisi (Figure 2) and P. mouldsi, whereas in P. curyi, vein 2-Rs+M is long and the second discal cell is elongate (see Figure 1).

All specimens of P. curyi emerged from timber of various Eucalyptus species, jarrah (E. marginata), tallowwood (E. microcorys) and tuart (E. gomphocephala), although the beetle host is unknown. This species has been collected from a number of localities in south-western Western Australia (Figure 29), and has been named after the collector, Stephen Curry.

Pristaulacus davisi sp. nov.

Material Examined

Holotype

♀. “Sawyer[s] Valley, W.A., Dec.” (WADA). Left flagellomeres 7 to tip and right 8 to tip, front right femur and tarsi, mid tarsi, and hind tibiae and tarsi missing.

Female

Length. 10.0 mm, excluding ovipositor.

Colour. Body brown, head, antennae, pronotum, and hind trochanters and femora black, last few metasomal segments darker brown, wings hyaline, pale brown, fore wing costal cell darker.

Head. Width:length 1.25 when viewed dorsally; face rugulose, pubescence short; sub-antennal groove smooth, shiny (Figure 8); frons without lateral carina above toruli, shiny, punctate, with scattered short setae, denser and longer near toruli; vertex and gena smooth, shiny except for a few scattered shallow punctures, each associated with a short seta; posterior margin of head slightly concave in dorsal view; occipital carina complete (Figure 5); malar space 0.3 (0.26–0.33) x height eye; clypeus 4.4 (4.2–4.8) x as wide as high, margin sinuate, with small medial process; distance from lateral ocellus to eye margin 0.46 (0.4–0.5) x distance between lateral ocelli; scape, 1.24 (1.09–1.36) x as long as second flagellomere.

Mesosoma. Propleuron rugose, pubescence short, ventro-lateral carina present; pronotum without angular process, rugose; mesoscutum in lateral view angular antero-dorsally, medial and lateral lobes carinate with scattered short setae, admedian lines slightly curved (Figure 13); scutellum and axillae carinate (Figure 20); metaprosternum rugose, with long pubescence; mesepisternum rugose, with long pubescence; propodeum coarsely rugose, posterior margin coarsely scrobiculate; hind coxa rugulose, distinct flange-like ovipositor guide on inner side, distal tarsal segments 1–4 with ventro-apical pecten of short robust spines; hind tarsal segments 1–4 with ventro-apical pecten of short robust spines, segment 1, 2.8 (2.2–3.2) x length segment 2; segment 2, 1.4 (1.35–1.60) x length segment 3; segment 3, 1.4 (1.3–1.6) x length segment 4; segment 4, 0.7 (0.6–0.8) x length segment 5; hind tarsal claw pectinate, with one large medial and one small basal tooth (difficult to see), 0.5 x length segment 5; fore wing vein 2-Rs+M long, second discal cell elongate, vein 2r-m largely spectral, 3r-m tubular in anterior third and posterior tenth, remainder spectral; hind wing venation complete, R+Rs, M+Cu, Cu, r-m and 2-M present, with 2 hamuli.

Material Examined

Holotype

♀. “Sawyer[s] Valley, W.A., Dec.” (WADA). Left flagellomeres 7 to tip and right 8 to tip, front right femur and tarsi, mid tarsi, and hind tibiae and tarsi missing.
Figures 16–24  (16) Lateral view of hind trochanter, prefemur, and femur of *A. douglasi* sp. nov., holotype female; tg = trochanteral groove, pf = prefemur (trochantellus), f = femur. (17) Lateral view of hind trochanter and prefemur of *P. davisi* sp. nov., holotype female. Scale bars = 200 μm. Dorsal view of scutellum of (18) *A. douglasi* sp. nov., holotype female; sc = scutellum, ax = axilla, mpn = metapostnotum; (19) *A. houstoni* sp. nov., holotype female; (20) *P. curryi* sp. nov., holotype female; (21) *A. davisi* sp. nov., holotype female; (22) *P. mouldsi* sp. nov., holotype female. Dorsal view of T1 and T2 of (23) *P. curryi* sp. nov., holotype female; (24) *P. mouldsi* sp. nov., holotype female. Scale bars = 16–17, 200 μm. 18–19, 21–22, 24, 1 mm; 20, 23, 500 μm.
Aulacid wasps of Western Australia

vertex and gena shiny, punctate, with scattered short setae; posterior margin of head not concave in dorsal view; occipital carina present laterally, absent medially (Figure 7); malar space 0.25 x height eye; clypeus 5.0 x as wide as high, with sinuate margin, small medial process present; distance from lateral ocellus to eye margin 0.65 x distance between lateral ocelli; scape 1.6 x length pedicel; first flagellomere 2.0 x as long as scape, 0.75 x as long as second flagellomere.

**Mesosoma.** Propleuron smooth, shiny, with scattered shallow punctures, each associated with a long seta, ventro-lateral carina present; pronotum without angular process, rugose-punctate in dorsal part to punctate in ventral part; mesoscutum in lateral view rounded antero-dorsally, medial and lateral lobes coarsely strigate, with scattered short setae, admedial lines not visible; scutellum and axillae strigate (Figure 21); posterior margin of metapostnotum scrobiculate, weakly convex (Figure 21); mesepisternum and metapleuron rugose, with long pubescence; mesepimeron broad, scrobiculate; propodeum rugose, almost areolate medially, posterior margin scrobiculate; hind coxa rugose with lateral striations dorsally, pubescence long laterally, ovipositor guide on inner side, distal, indicated by bulge on ventral surface (Figure 25); hind trochanter with broad groove (Figure 17), imbricate, pubescence long; prefemur indistinct (Figure 17); hind femur imbricate, with short pubescence; hind tibiae and tarsi missing; fore wing vein 2-Rs+M short, second discal cell more or less quadrate, vein 2r-m almost absent except for slight node on medial vein (Figure 2); 3r-m tubular in anterior quarter, remainder spectral (Figure 2); hind wing venation reduced, veins r-m and 2-M spectral except for distal 2-M (Figure 2), with 3 hamuli.

**Metasoma.** Clavate, 1.5x length of mesosoma; T1 and T2, narrow, smooth dorsally; ovipositor 8.0 mm.

**Male**

Unknown.

**Remarks**

*Pristaulacus davisi* can be separated from *P. curryi* by its larger size, and from *P. mouldsi* by the hind wing venation, which is reduced (Figure 2). This species also has the metasomal T1 and T2 narrow whereas these are broad in *P. mouldsi*. Several eastern Australian species have a similar dark costal cell on the fore wing to that of *P. davisi*, but these species are quite different, particularly in size and colouration. They include *P. cingulatus* (Westwood) that is 9-12 mm in length and largely red-brown, *P. lateritius* (Shuckard) that is 12-20 mm in length and red-brown and black, and a number of undescribed taxa.

**Figures 25-28**

25. Lateral view of hind coxa showing position of ovipositor guide of *P. davisi* sp. nov., holotype female; og = ovipositor guide. 26. Dorsal view of ovipositor guide on inner hind coxal surface of *P. curryi* sp. nov., holotype female; og = ovipositor guide. 27-28. Adeagus of (27) *A. mcmillani* sp. nov., holotype male; bp = basiparamere, d = digitus; (28) *P. curryi* sp. nov., paratype male. Scale bars = 25, 500 μm; 26, 100 μm; 27, 200 μm; 28, 50 μm.
This species is named after Peter Davis, entomologist, Department of Agriculture, Western Australia. It is known only from the holotype locality, Sawyers Valley, Western Australia (Figure 29), and nothing is known of its biology.

**Pristaulacus mouldsi sp. nov.**

Figures 6, 10, 14–15, 22, 24, 29

**Material Examined**

**Holotype**


**Paratype**

Western Australia: 1 female, Norseman, [19]37. No other data. (WAM). Left hind leg missing except for coxa, right hind leg missing except for coxa and trochanter.

**Female**

Length. 10.8 (10.3–11.4) mm, excluding ovipositor.

Colour. Body dark brown to black, clypeus, legs, metasoma and ovipositor brown. Wings hyaline, pale brown.

Head. Width:length 1.75 when viewed dorsally; face rugose, pubescence long; sub-antennal groove present; frons without lateral carina above toruli, punctate-rugose, with short pubescence; vertex and gena punctate-imbricate with scattered short setae; posterior margin of head concave in dorsal view; occipital carina absent medially, weak laterally (Figure 6); malar space 0.3 x height eye; clypeus 6.75 x as wide as high, margin sinuate, with small medial process (Figure 10); distance from lateral ocellus to eye margin 0.7 x distance between lateral ocelli; scape 1.05 (1.0–1.1) x length pedicel; first flagellomere 1.1 (1.0–1.2) x as long as scape, 0.65 (0.6–0.7) x as long as second flagellomere.

Mesosoma. Propleuron punctate, pubescence long laterally, ventro-lateral carina flange-like (Figure 15); pronotum without angular process, rugose; mesoscutum in lateral view angular antero-dorsally (Figure 15), medial and lateral lobes carinate with scattered short setae, admedial area depressed (Figures 14–15); scutellum and axillae carinate (Figure 22); metapostnotum narrow, scrobiculate, posterior margin straight (Figure 22); mesepisternum rugose with long pubescence; mesepimeron broad, scrobiculate; metapleuron rugose, with long pubescence; propodeum rugose, a few striations dorsally, posterior margin scrobiculate, hind coxa punctate with a few lateral striations dorsally, rugose laterally, pubescence long laterally, ovipositor guide on inner side, distal, almost at apex; hind trochanter imbricate, with distinct groove, with scattered short setae; hind femur imbricate, pubescence short; hind tibia imbricate, pubescence short, with scattered emergent stout setae; prefemur on hind leg present; hind femur 0.8 x length hind tibia; hind tibia with ventro-apical pecten of very short robust spines; hind tarsal segments 1-4 with ventro-apical pecten of short robust spines, segment 1, 3.2x length segment 2; segment 2, 1.3 x length segment 3; segment 3, 1.8 x length segment 4; segment 4, 0.6 x length segment 5; hind tarsal claw with two medial and one basal teeth (this difficult to see), 0.6 x length segment 5; fore wing vein 2-Rs+M short, second discal cell more or less quadrate, vein 2-r-m absent, 3r-m tubular in anterior third, remainder spectral; hind wing venation reduced, veins r-m and 2-M spectral, with 2 hamuli.

Metasoma. Clavate, 1.0 (0.9–1.1) x length of mesosoma; T1 and T2, broad, smooth except for a few shallow punctures laterally (Figure 24); ovipositor 8.0 (7.5–8.5) mm.

**Male**

Unknown.

**Remarks**

Pristaulacus mouldsi is the only Western Australian species with the metasomal T1 and T2 broad. It has been collected from two localities in the central, south-west of Western Australia (Figure 29), and is named after Max Moulds, formerly Collection Manager, Entomology at the Australian Museum. Nothing is known of the biology of this species.

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**Figure 29** Distribution map of Western Australian Aulacidae.
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REFERENCES


