

## Descriptions of new paracolletine bees associated with flowers of *Eremophila* (Hymenoptera: Colletidae)

Terry F. Houston\*

### Abstract

Thirteen species of Paracolletini oligolectic (or probably oligolectic) on flowers of *Eremophila* (Myoporaceae) are described as new. They are as follows: eleven species of *Leioproctus sensu stricto* (*canutus*, *capito*, *concausus*, *eremites*, *eremitulus*, *kumarina*, *lanceolatus*, *longipalpus*, *lucanus* and *lucidicinctus*, collectively forming a monophyletic assemblage designated the *L. capito* species-group, and *nasutus*) and two closely related species of *Trichocolletes s. str.* (*eremophilae* and *multipectinatus*).

All are characterized by elongation of the proboscis, an adaptation to the constricted corolla tube of the forage plants. The *Leioproctus* species, especially members of the *capito* group, are further characterized by enlargement of the labial palpi.

Males of *L. capito* and *L. lucanus* are unusual in being much larger than the females and in having extraordinarily large heads and mandibles.

### Introduction

*Eremophila* (family Myoporaceae) is a large genus of shrubs and small trees mainly confined to the arid and semiarid regions (Eremaean Province) of Australia (Elliot & Jones 1984). The flower has a tubular corolla which is constricted near its base. The lumen of the corolla tube is occluded at the constriction by the style and four anther filaments; for this reason, typical broad-headed, short-tongued bees are excluded from the suite of bees which is able to obtain nectar from *Eremophila* flowers. The only bees which regularly take nectar from *Eremophila* are long-tongued species (anthophorids and megachilids), very tiny bees which presumably manage to squeeze through the corolla constriction and short-tongued bees with especially elongated proboscides and/or palpi (Houston 1983).

The present paper describes several species in the last category and makes names available for a proposed article on the bees of *Eremophila*.

The new species of *Trichocolletes* Cockerell are unusual in their floral preferences as most of their congeners are oligolectic on Fabaceae.

Both *Leioproctus* and *Trichocolletes* are large genera much in need of revision. However, after consulting the works of Cockerell (1934) and Michener (1965) I am confident that my new species have not been described previously.

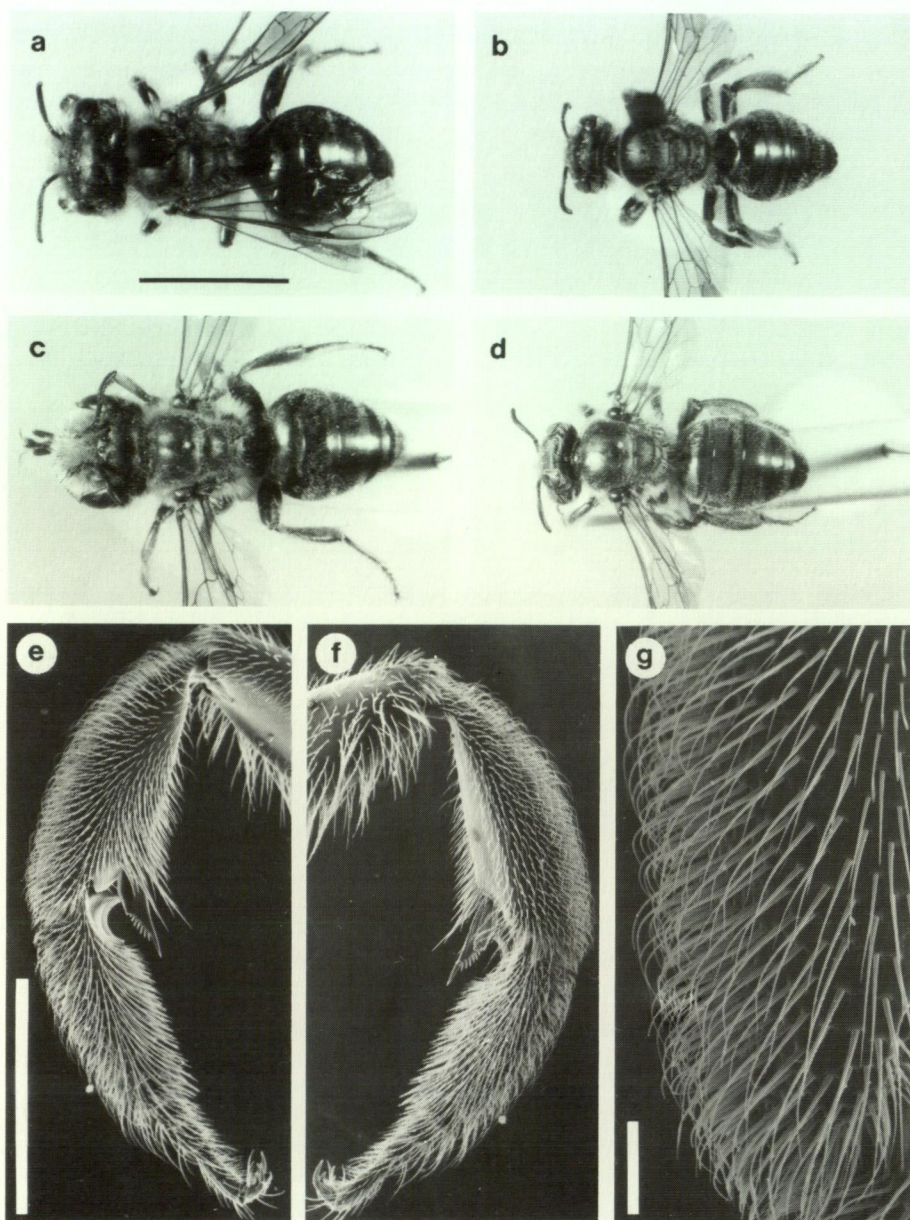
### Terminology and Abbreviations

The morphological terminology employed here follows that of Michener (1965).

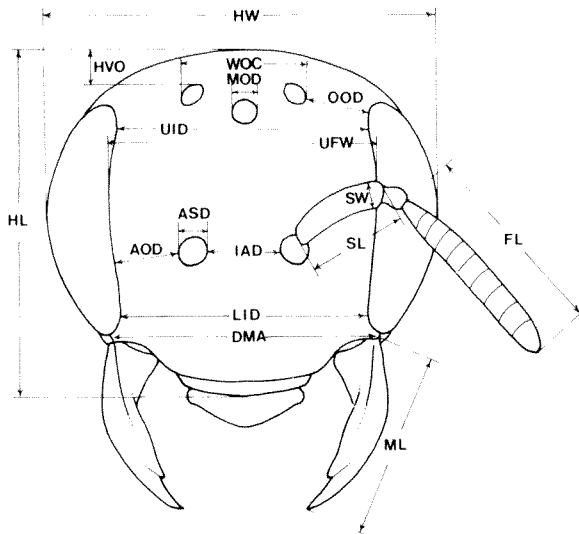
Relative dimensions quoted in the descriptions are directly comparable between sexes and species. All were measured using an eye-piece graticule on a stereomicroscope with

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\* Western Australian Museum, Francis Street, Perth, Western Australia 6000



**Figure 1** *Leioproctus capito* species-group: (a, b) male and female, respectively, of *L. capito*; (c, d) same of *L. lucanus*; (e, f) inner and outer views, respectively, of fore tibia and tarsus of *L. capito* female showing pollen brush extending over tibia; (g) detail (from e) showing brush hairs at apex of tibia. Scale lines (a-d) 5 mm, (e, f) 1 mm, (g) 0.1 mm.



**Figure 2** Head and left antenna of a *Leioproctus* showing some of the measurements used in this paper and their abbreviations (for explanation see Terminology and Abbreviations).

the zoom objective set to give a head width reading of 50 divisions. By doubling the figure for any given dimension, a percentage of head width is obtained. The methods of obtaining certain measurements are illustrated in Figures 2 and 3 i and abbreviations used for them are as follows:

- AOD Antennocular distance
- ASD Diameter of antennal socket
- BMW Basal width of mandible (viewed laterally)
- DMA Distance between anterior mandibular articulations
- FL Flagellum length
- HL Head length
- HVO Height of vertex above lateral ocelli
- HW Head width
- IAD Interantennal distance
- LID Lower interorbital distance
- LPL Labial palpus length
- LP4L Length of distal segment of labial palpus
- ML Mandible length
- MOD Diameter of median ocellus
- MPL Maxillary palpus length
- OOD Ocellocular distance
- PGL Length of post-palpal portion of galea
- PML Prementum length (from base to insertion of palpi)
- SL Scape length

SW Scape width  
UFW Upper width of face  
UID Upper interorbital distance  
WOC Width of ocellar cluster

LID, UFW and UID are not measurable in some instances when the inner orbits are strongly divergent ventrally or dorsally.

In the lists of specimens examined, collectors' names are abbreviated as follows: BPH, B.P. Hanich; CAH, C.A. Howard; JCC, J.C. Cardale; TFH, T.F. Houston. HS means homestead. The following abbreviations are used for collections in which specimens are lodged: ANIC, Australian National Insect Collection, Canberra; SAM, South Australian Museum; UQIC, University of Queensland Insect Collection, Brisbane; WAM, Western Australian Museum, Perth.

### Systematics

**Colletidae: Colletinae: Paracolletini**  
**Genus *Leioproctus* Smith**  
***Leioproctus capito* species-group**

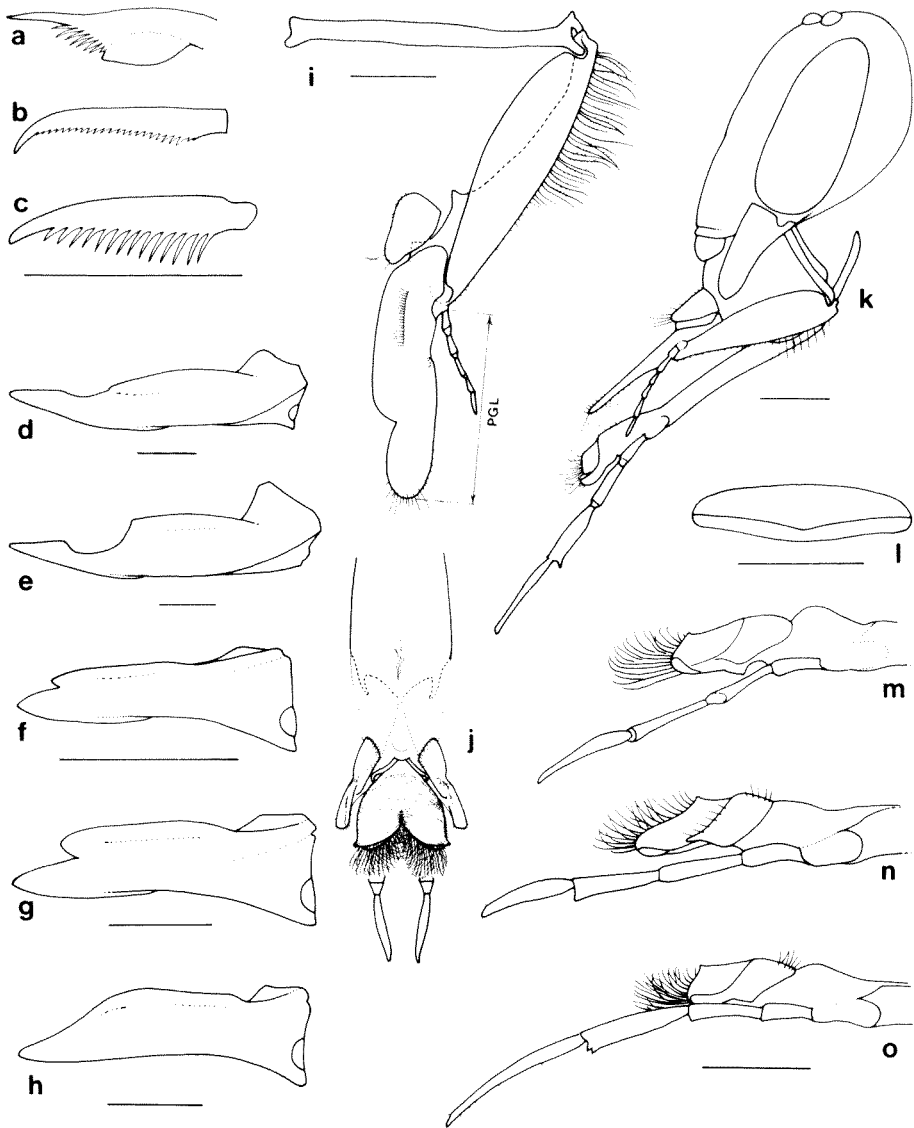
#### Diagnosis

Most readily distinguishable from other *Leioproctus* s. str. by the enlarged labial palpi: labial palpus 1.3-2.8 x as long as maxillary palpus, distal (fourth) segment 0.4-1.2 x as long as antennal scape, compressed and usually expanded, lanceolate (Figure 3 k, m-o).

#### Description

The following characteristics are additional to those noted in the diagnosis.

Frons and vertex uniformly convex (not sunken between lateral ocelli and compound eyes); vertex slightly to greatly developed above level of compound eyes and ocelli; genae moderately to strongly developed (0.6-1.4 x as wide as compound eyes viewed laterally); interantennal distance equal to or greater than antennocular distance; interantennal area transversely convex, more or less confluent with gently raised, somewhat triangular supraclypeal area; malar area extremely short or absent; antennae of both sexes relatively short, scape not or barely reaching mid ocellus, flagellum of male only 0.5-0.9 x as long as head width, cylindrical except at tapered ends; proboscis moderately to strongly elongated (Figure 3 k), glossa extended forward of sclerotized, pigmented apex of prementum on a more or less membranous stem by as much as its own length (Figure 3 j); glossal brush strongly developed, hairs about as long as or much longer than medial length of glossa; metanotum not tuberculate but prominent medially in some species; propodeal enclosure with steeply sloping basal surface rounding evenly onto vertical posterior surface with no separating carina; fore wing with 2nd submarginal cell about half as long as 3rd and one third as long as 1st; inner hind tibial spur of female pectinate with 8-16 long teeth (Figure 3 c); scopal setae of hind tibia of female dense, highly plumose.



**Figure 3** *Leioproctus capito* species-group: (a-c) fore, mid and inner hind tibial spurs, respectively, of *L. capito* female; (d-h) mandibles of males (outer apical or outer views, pubescence omitted) of (d) *L. capito*, (e) *L. lucanus*, (f) *L. eremitulus*, (g) *L. lanceolatus*, (h) *L. lucidicinctus*; (i) left maxilla (PGL = prepalpal portion of galea) and (j) apex of labium (anterior view) of *L. capito* female; (k) head (pubescence omitted) and proboscis of *L. longipalpus* female, left lateral view; (l) labrum of *L. lucidicinctus* female; (m-o) apex of labium (left lateral views) of females of (m) *L. kumarina*, (n) *L. capito* and (o) *L. eremitulus*. Scale lines 0.5 mm.

### Distribution

Arid and semiarid regions (Eremaean Province) of Australia.

### Flower Preferences

By far the majority of specimens of the *capito* group (i.e. 102 of 110 males and 87 of 102 females) were collected at flowers of *Eremophila*. Blue or bluish flowered species are preferred and no records are known of the bees visiting the reddish-flowered and predominantly bird-pollinated species.

A few specimens were collected at flowers of other plant genera. The following species were collected at flowers of *Dipteracanthus* sp. (Acanthaceae): *capito* (2♂, 3♀), *eremitulus* (1♂, 1♀) and *lanceolatus* (1♂, 1♀). None of the females collected from *Dipteracanthus* carried pollen loads (although a few very large pollen grains occurred scattered on the hind tibiae, grains too large to be carried in bulk amongst the finely divided scopal setae). As the blue flowers of *Dipteracanthus* are similar to those of *Eremophila* in size and form, the bees may have mistaken them for those of their usual forage plants.

One of 16 males of *eremites* was collected at flowers of *Ptilotus obovatus* (Amaranthaceae) and one of four males of *lucanus* and the unique holotype female of *kumarina* on flowers of *Scaevola spinescens* (Goodeniaceae).

In summary, all or most specimens of each species (except *kumarina*) were collected at flowers of *Eremophila*. In view of this and their specialized mouthparts (described below), they are presumably oligolectic on *Eremophila*. Because *kumarina* has similar mouthparts, I expect it, too, will prove to be similarly oligolectic.

### Bionomics

Nesting sites of only one species, *L. eremites*, have been observed: about 20 burrows were found amongst small tussocks of grass on a flat road verge 21 km NW of Belele Homestead, W.A. All burrows were open and females were trafficking to and fro. The aggregation occupied about 2 m<sup>2</sup>. Three females were collected near Coppin Pool, W.A., while burrowing under separate pebbles on a dirt track.

Five species are active during the late winter-spring period (August-November) and the late summer-autumn period (February-May) as well. Three species (*canutus*, *concavus* and *kumarina*) are recorded only for the vernal period but on the basis of very few collections. Two species (*capito* and *longipalpus*) are recorded only for the autumnal period, again on the basis of few collections.

### Discussion

This group contains some very unusual species (such as *L. capito* and *L. lucanus*) which, by themselves, could warrant a separate subgenus. However, the characters of other members of the species-group grade back into those of *Leioproctus sensu stricto* as defined by Michener (1965).

Some morphological features of the group are as follows.

- (1). A trend towards increased cephalic development and reduction of the antennae. This is most evident in males and culminates in those of *capito* and *lucanus*. Least development occurs in *longipalpus*. Cephalic development includes elevation of

vertex well above level of compound eyes and ocelli, swelling of genae, broadening of lower face so that compound eyes diverge ventrally, and elongation of mandibles with loss of subapical tooth. These modifications may serve to make the mandibles more powerful and effective pincers for grasping other individuals, either females during copulation or males during intraspecific combat.

The relative size of the antennal flagellum shows a negative correlation with the degree of cephalic enlargement in males (cf Figures 4 a and 5 d).

- (2). Reversed sexual size dimorphism. Males of *capito* and *lucanus* are conspicuously larger than their females, especially in respect of their heads (Figure 1 a-d). For example, in a sample of 11 males and 10 females of *lucanus* collected together, head widths ranged from 3.8-4.3 mm ( $\bar{x}$  = 4.1 mm) in males and 2.8-3.1 mm ( $\bar{x}$  = 3.0 mm) in females. Thus, there is complete separation of the size ranges of the sexes.

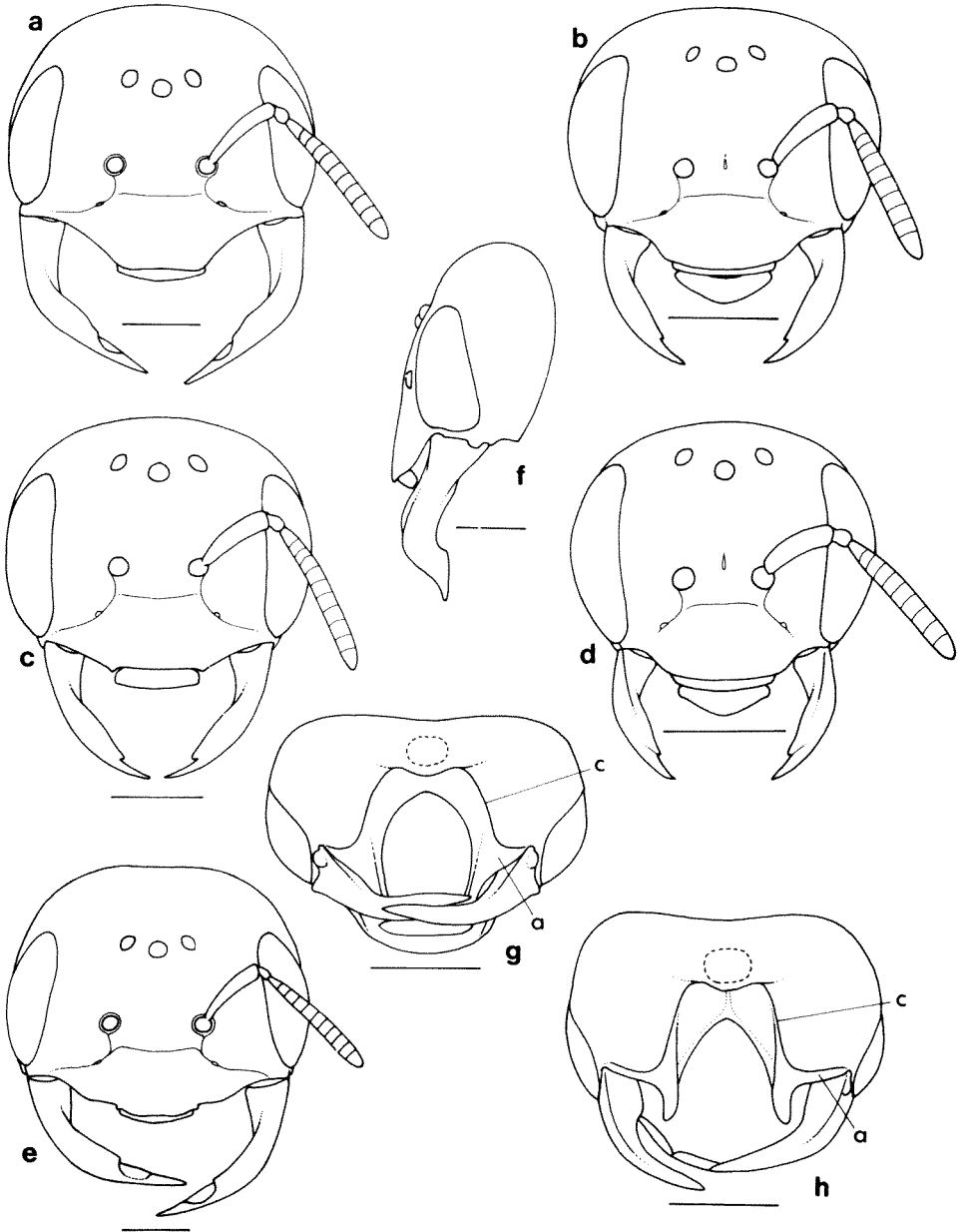
In *eremites* there is considerable overlap of the size ranges of the sexes with head widths of males averaging slightly more than those of females. In *eremitulus* there is also overlap of the size ranges but it is the females which average slightly larger.

Female bees are usually larger than their males and when males are the larger sex the species is usually one in which male combat is common and intense (Alcock & Houston 1987). Although I have observed males of *capito*, *lucanus* and other members of the *capito* group patrolling their forage plants, I have not observed any male-male or male-female interactions. Also, unlike many other bees where males are the larger sex, there is no pronounced size variation or allometry amongst males of *capito* and *lucanus*.

- (3). Development of a fore tibial pollen brush. A well-developed brush of specialized setae occurs on the anterior surface of the fore tibia of females of *capito*, *lanceolatus*, *lucanus* and *lucidicinctus*. The setae are fairly erect, simple, and bent distally towards the apex of the tibia (Figure 12 e-g). They are similar to setae on the anterior surface of the basitarsus and presumably serve a similar function of sweeping up pollen. A less distinct brush occurs in *eremites* and none is developed in the remaining species.
- (4). A trend towards reduction of the maxillary palpi. Most evident in *capito* and *lucanus*, least evident in *concaucus*, *kumarina* and *longipalpus*. Reduction of the palpi suggests a loss of function for these appendages.
- (5). Elongation of the proboscis as a whole. When related to the size of the head, the proboscis in all members of the *capito* group is distinctly longer than that of most *Leioproctus*. The cardines, stipites, prementum and glossa (especially basally) are all unusually long and slender (Figure 3 k). This elongation together with the unusually long labial palpi (Figure 3 k, m-o) presumably permits bees to reach nectar of *Eremophila* flowers through the largely occluded constriction of the corolla tube (Houston 1983).

#### Key to the species of the *Leioproctus capito* species-group

1. Inner orbits diverging downwards, strongly in males (Figure 4 a, e), slightly in females (Figure 4 b); maxillary palpus only



**Figure 4** *Leioproctus capito* species-group heads (pubescence omitted): (a-e) anterior views of (a, b) *L. capito* male and female, respectively, (c, d) *L. eremites* male and female, respectively, and (e) *L. lucanus* male; (f) *L. lucanus*, left lateral view; (g, h) posteroventral views of females of *L. lucanus* and *L. capito*, respectively (a, area of hypostoma bounded posteriorly by hypostomal carina, c). Scale lines 1 mm.

- about half as long as post-palpal portion of galea (Figure 3 i) ..... 2
- Inner orbits converging downwards (e.g. Figure 5 b-e) or more or less parallel (e.g. Figure 5 a); maxillary palpus at least 0.7 x as long as post-palpal portion of galea ..... 3
- 2. Male with lower gena excavated, angular (Figure 4 f), mandible excavated subapically on anterior margin, a prominent angle proximal to excavation (Figure 3 e); female with hypostomal carina defining a broad area near base of mandible (Figure 4 g) ..... *L. lucanus*
- Male with lower gena evenly convex, mandible weakly emarginate subapically on anterior margin, without a prominent angle proximal to excavation (Figure 3 d); female with hypostomal carina defining only a very narrow area near base of mandible (Figure 4 h)..... *L. capito*
- 3. Distal (4th) segment of labial palpus as long as or longer than antennal scape ..... 4
- Distal segment of labial palpus distinctly shorter than antennal scape ..... 6
- 4. Maxillary palpus distinctly exceeding apex of galea; propodeal enclosure and 1st metasomal tergum of male glossy, of female partly or moderately glossy ..... *L. longipalpus*
- Maxillary palpus not reaching apex of galea; propodeal enclosure and 1st metasomal tergum of both sexes dulled by fine sculpture ..... 5
- 5. Male with mandible bearing a distinct subapical tooth (Figure 4 f) and ventral margin of labrum slightly concave ..... *L. eremitulus*
- Male (female not recognized) with mandible lacking a distinct subapical tooth (Figure 5 c), ventral margin of labrum slightly convex ..... *L. canutus*
- 6. Inner orbits more or less parallel; maxillary palpus not attaining apex of galea; fore tibia of female with uniform set of brush hairs similar to those of basitarsus (Figure 1 e-g) ..... 7
- Inner orbits distinctly converging downwards (e.g. Figure 5 e); maxillary palpus attaining or exceeding apex of galea (if not, see Incertae sedis, 1); fore tibia of female (males unknown) without a uniform set of brush hairs ..... 9
- 7. Hind margins of metasomal terga 1-4 (♀) or 1-5 (♂) with bands of adpressed white pubescence (interrupted medially, often incomplete) ..... *L. lanceolatus*
- Hind margins of metasomal terga entirely without bands of white pubescence ..... 8
- 8. Hind margins of metasomal terga broadly hyaline; female with labrum transversely carinate (Figure 3 l), setae of hind

- tibiae wholly white ..... *L. lucidicinctus*  
 Hind margins of metasomal terga not hyaline; female with  
 labrum not transversely carinate, setae of hind tibiae largely  
 sooty ..... *L. eremites*
9. Clypeus of female (male unknown) sunken slightly medially;  
 metasomal terga dulled by fine sculpturing between  
 punctures ..... *L. concavus*  
 Clypeus of female (male unknown) evenly gently convex;  
 metasomal terga closely punctured but shining ..... *L. kumarina*

***Incertae Sedis***

Several specimens of the *capito* group which were available to me could not be placed with certainty in any of the recognized species. They are detailed below.

1. 5 ♀, in WAM (87/1449-50, 89/401-3), 18 km WSW of Mulline, 29°51'S, 120°20'E, Western Australia, 23 Sept. 1982, BPH & TFH, on flowers of *Eremophila pantonii*. These females are distinct from all others of the group. They are, perhaps, the females of *L. canutus* (known only from the unique male holotype) but there are no distinctive features permitting positive association.

In the key, the females run to couplet 6 and would run to couplet 9 and *L. concavus* were it not for the fact that the maxillary palpus does not attain the apex of the galea. They differ from *concavus* also in being larger and having the metasoma entirely black.

2. 1 ♂, 1 ♀, in WAM (89/399-400), 10 miles SW of Charleville, Queensland, 15 April 1969, TFH, on flowers of *Eremophila gilesii*.

Initially, I identified this pair as *lanceolatus* on the basis of external features and particularly the presence of partial apical bands of white tomentum on the metasomal terga. However, the terminalia of the male proved to be much more like those of *L. eremites*.

***Leioproctus (Leioproctus) canutus* sp. nov.**

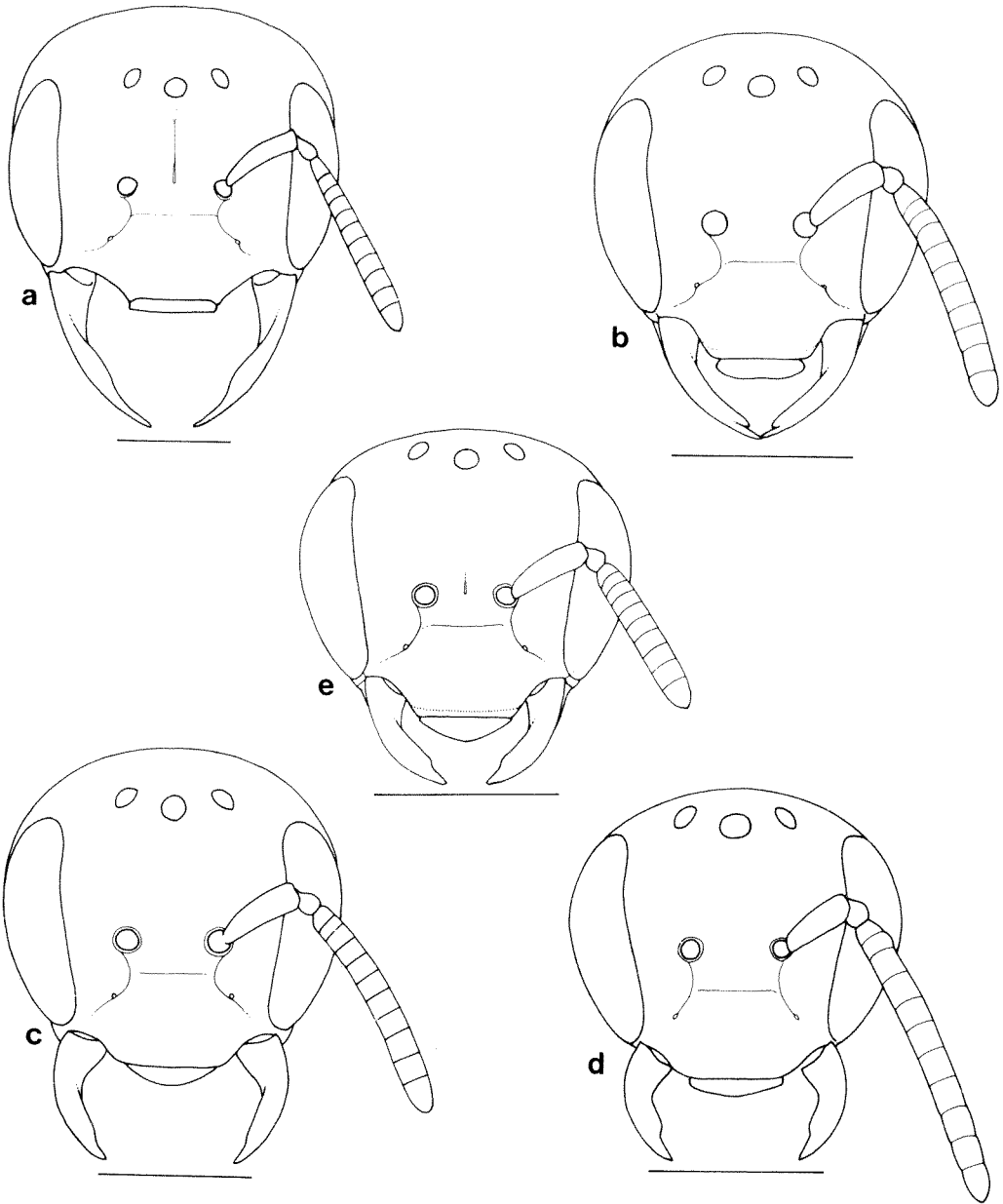
Figures 5 c; 6 a-c

**Holotype**

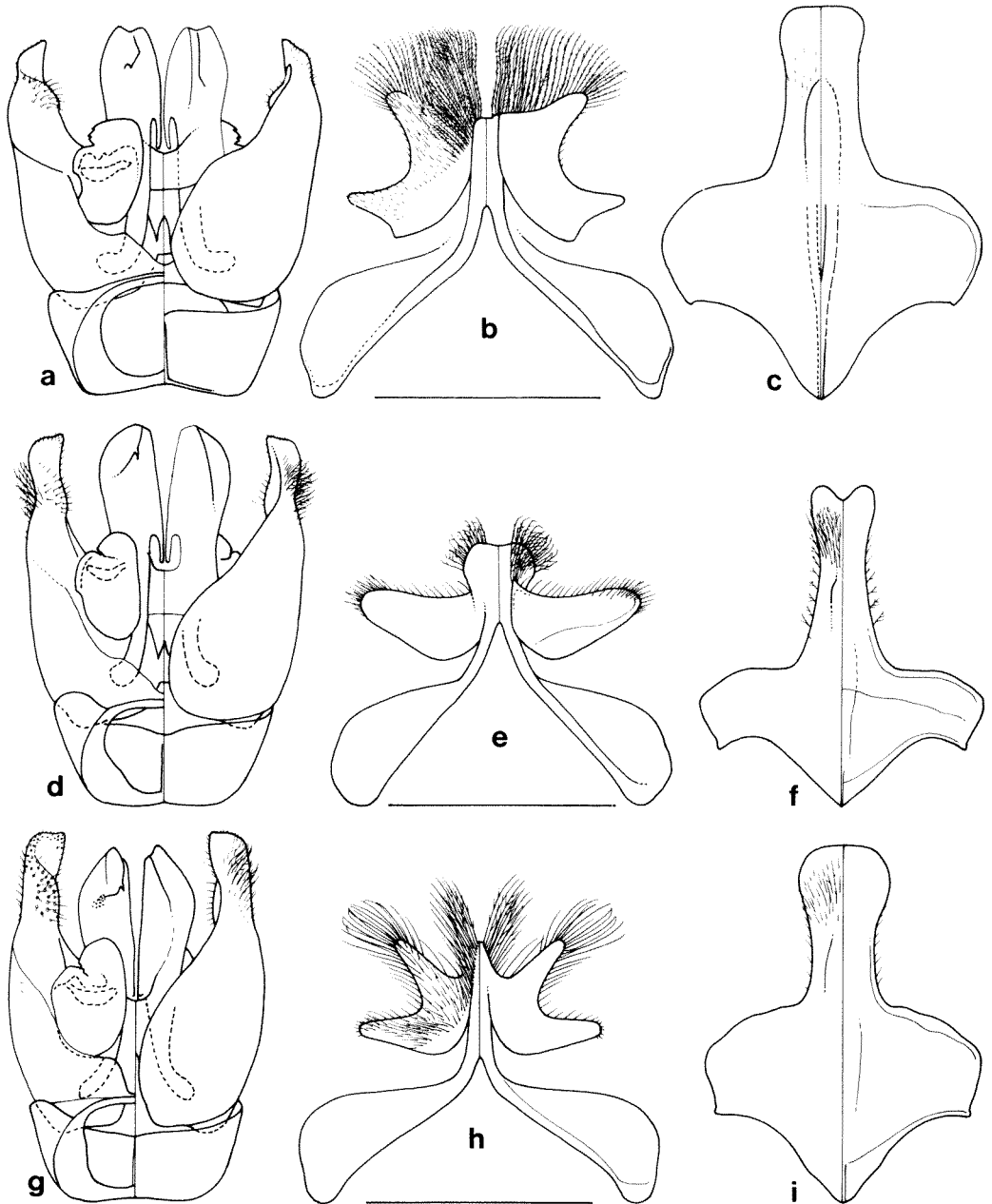
In WAM (89/385), ♂, 10 km ESE of Meedo HS (25°40'S, 114°37'E), Western Australia, 23-26 Aug. 1980, C.A. Howard & T.F. Houston 336-9, on flowers of *Eremophila maitlandii*.

**Diagnosis**

Male (female unknown) most like *L. eremitulus* and *L. longipalpus* in having inner orbits slightly converging ventrally (Figure 5 c), lower face relatively narrow (DMA/HW *ca.* 0.6), distal segment of labial palpus about as long as antennal scape. Differs from *longipalpus* in having relatively shorter palpi and dull propodeal enclosure. Differs from *eremitulus* in having subapical tooth of mandible obtuse, indistinct, and metasomal terga 2-5 with numerous long erect white plumose setae.



**Figure 5** *Leioproctus capito* species-group heads (anterior views, pubescence omitted): (a-d) males of (a) *L. lucidicinctus*, (b) *L. eremitulus*, (c) *L. canutus*, (d) *L. longipalpus*; (e) female of *L. concavus*. Scale lines 1 mm.



**Figure 6** *Leioproctus capito* species-group male terminalia (left to right - genital capsule, 7th and 8th metasomal sternae; dorsal views on right halves, ventral on left): (a-c) *L. canutus*, (d-f) *L. eremitulus*, (g-i) *L. longipalpus*. Scale lines 0.5 mm.

*Male* (holotype)

Head width 2.07 mm; body length *ca.* 7 mm.

Relative dimensions: HW 50; HL 47; UID 33; UFW 34; LID 29; DMA 30; HVO 4; WOC 18; MOD 5; OOD 8.5; IAD 9; ASD 5; AOD 7; SL 13; SW 4.5; FL 37; ML 20; BMW 7.5; PML 35; LPL *ca.* 32; LP4L 12.5; MPL *ca.* 15; PGL 18.5.

Head fairly rounded in anterior view with vertex moderately strongly elevated above level of ocelli; compound eyes converging ventrally (Figure 5 c); gena about 0.7 x as wide as compound eye viewed laterally; mandible virtually without a subapical anterior tooth (tooth not excised); labrum 0.38 x as long as wide, smooth, convex, ventral margin straight; flagellum 0.74 x as long as head width, fairly cylindrical; maxillary palpus *ca.* 0.8 x as long as post-palpal portion of galea; labial palpus *ca.* 0.93 x as long as prementum, distal segment 0.96 x as long as antennal scape.

Integument wholly black to black-brown except for reddish apices of mandibles and some orange-brown at apices of tarsi and metasoma; generally dull, coriarius, except as follows: clypeus and supra-clypeal area glossy with close to sparse medium puncturing; scutum and scutellum weakly shining with close small puncturing; metasomal terga very dull, strongly coriarius with sparse indistinct puncturing.

Pubescence entirely white, nowhere very dense but long, erect and plumose over most of head, body and appendages, that of scutum up to 2.5 ocellar diameters long; metasomal terga with setae shorter, evenly sparsely distributed but absent from hind margins.

Terminalia: Figure 6 a-c.

**Remarks**

One of the smaller members of the *capito* group known only from the unique male holotype. However, five unidentified females from near Mulline, W.A. (see *Incertae Sedis*), may prove to be conspecific.

**Etymology**

The specific epithet is Latin for 'white-haired'.

***Leioproctus (Leioproctus) capito* sp. nov.**

Figures 1 a, b, e-g; 3 a-d, i, j, n; 4 a, b, h; 8 a-d

**Holotype**

In WAM (82.474), ♂, 9.5 km SE of Banjiwarn HS (27°42'S, 121°37'E), Western Australia, 22-28 February 1980, T.F. Houston *et al.* 316-4, on flowers of *Eremophila margarethae*.

**Paratypes**

10♂, 9♀ in WAM; 5♂, 9♀ in SAM. See Specimens Examined.

**Diagnosis**

Most like *L. lucanus* and unlike other species in having inner orbits diverging ventrally (Figure 4 a, b), maxillary palpus only about half as long as post-palpal portion of galea; mandible of male very large, sinuously curved, with anterior margin excavated subapically (Figure 3 d). Differs from *lucanus* in having 5-segmented maxillary palpi,

mandible of male with smaller excavation in anterior margin and more obtuse angle proximal to excavation (cf d and e Figure 3), gena of male not excavated and angular, hypostomal carina of female defining only a very narrow area near insertion of mandible (Figure 4 h) and metasoma of female black-brown (not orange-brown).

### Description

#### *Male* (holotype)

Head width 3.85 mm; body length *ca.* 11 mm.

Relative dimensions: HW 50; HL 43; UID 31; UFW -; LID -; DMA 46; HVO 10; WOC 11.5; MOD 3; OOD 10; IAD 11; ASD 3.5; AOD 10; SL 14; SW 3; FL 24; ML 34; BMW 9; PML 31; LPL *ca.* 20; LP4L 5.5; MPL *ca.* 7; PGL 14.

Compound eyes strongly diverging ventrally (Figure 4 a); vertex greatly developed; ocelli closer to antennal sockets than to posterior margin of head; labrum emarginate mid-ventrally (medial length only 0.28 x width); mandible very long, sinuate in outer view (as in *lucanus*, Figure 4 f), anterior margin emarginate subapically, without a tooth; gena slightly wider than compound eye viewed laterally, profile even; maxillary palpus *ca.* 0.5 x as long as post-palpal portion of galea; labial palpus *ca.* 0.67 x as long as prementum; distal segment 0.39 x as long as antennal scape; flagellum 0.48 x as long as head width.

Integument black to black-brown except as follows. Yellow-brown: scape, pedicel, proximal portion of flagellum, mid-ventral margin of clypeus, labrum, mandibles (except dark red apices), inner surfaces of fore and mid femora and tibiae, distal segments of tarsi, distal portion of proboscis. Tegulae and wing veins mostly mid-brown. Hind margins of metasomal terga hyaline.

Lower face and metasomal terga weakly shining, integument otherwise rather dull, strongly minutely coriaceous; clypeus with open to close small punctures; areas below antennal sockets impunctate; frons, vertex and scutum with open fine puncturing; metasomal terga coriaceous with sparse minute punctures.

Pubescence almost wholly white (sooty setae occur at apex of metasoma); moderately long, more or less erect plunose setae occur on head, thorax, propodeum, first metasomal tergum anteriorly and legs (setae dense, obscuring most of integument on paraocular areas and lateral angles of clypeus; elsewhere rather sparse); metasomal terga with sparse covering of short, simple, more or less adpressed setae, most conspicuous in oblique illumination.

Terminalia: see Figure 8 a-d; 'brush' on apex of seventh metasomal sternum longer and less dense than that of *lucanus*.

#### *Female* (paratype WAM 89/367)

Head width 2.75 mm; body length *ca.* 10 mm.

Relative dimensions: HW 50; HL 44; UID 31; UFW -; LID -; DMA 38; HVO 5; WOC 13; MOD 3.5; OOD 8.5; IAD 9; ASD 4; AOD 8; SL 14; SW 3.2; FL *ca.* 24; ML 26; BMW 9; PML 34; LPL *ca.* 24; LP4L 7; MPL 9; PGL 17.

Compound eyes diverging ventrally, vertex strongly developed above ocelli (Figure 4 b); labrum 2.6 x as wide as long, smoothly convex without carinae; mandibles bidentate,

anterior tooth weak; maxillary palpus 0.53 x as long as post-palpal portion of galea, 5-segmented; labial palpus 0.7 x as long as prementum, distal segment 0.5 x as long as antennal scape; fore tibial calcar with long, tapering, apical spine bearing several fine teeth (Figure 3 a); mid tibial spur strongly curved at apex (Figure 3 b).

Integument of head, thorax and propodeum black; labrum, antennae (partly), legs, wing veins and metasoma dark brown to black-brown. The following are yellow-brown: mandibles basally (grading to red-brown distally), proboscis distally, flagella ventrally, inner surfaces of fore tibiae.

Clypeus and supraclpeal area shining with close to sparse punctures; metasomal terga feebly shining, coriarius with open minute puncturing; remainder of integument dull, coriarius with (except propodeal enclosure) close to open small puncturing.

Pubescence predominantly white, buff on vertex and dorsum of thorax, dusky brown on dorsal edges of mid and hind tibiae, dark brown on 5th and 6th metasomal terga; setae moderately long, more or less erect, plumose on head, thorax (except scutum), propodeum, metasomal tergum 1 anteriorly, 2-5 laterally and hind margins of sterna; scutum (except margins) with sparse, simple, erect setae and short adpressed setae; metasomal terga 2-4 with sparse cover of short simple silvery setae; fore tibia with brush-like set of erect, simple setae, curved at the end and much like those of basitarsus (Figure 1 e-g).

#### Variation

Slight. Head widths of males vary from 3.35-4.15 mm, of females from 2.6-3.15 mm.

#### Remarks

This species is morphologically very similar to *L. lucanus*. Males of both species are remarkable for their relatively large broad heads and long mandibles and for exceeding the females in size (see species-group discussion). The two species are sympatric and have even been collected together at the same flowers. While they could be interpreted as morphs of one species, I have treated them as distinct species in view of their morphological constancy and lack of intergrades.

#### Etymology

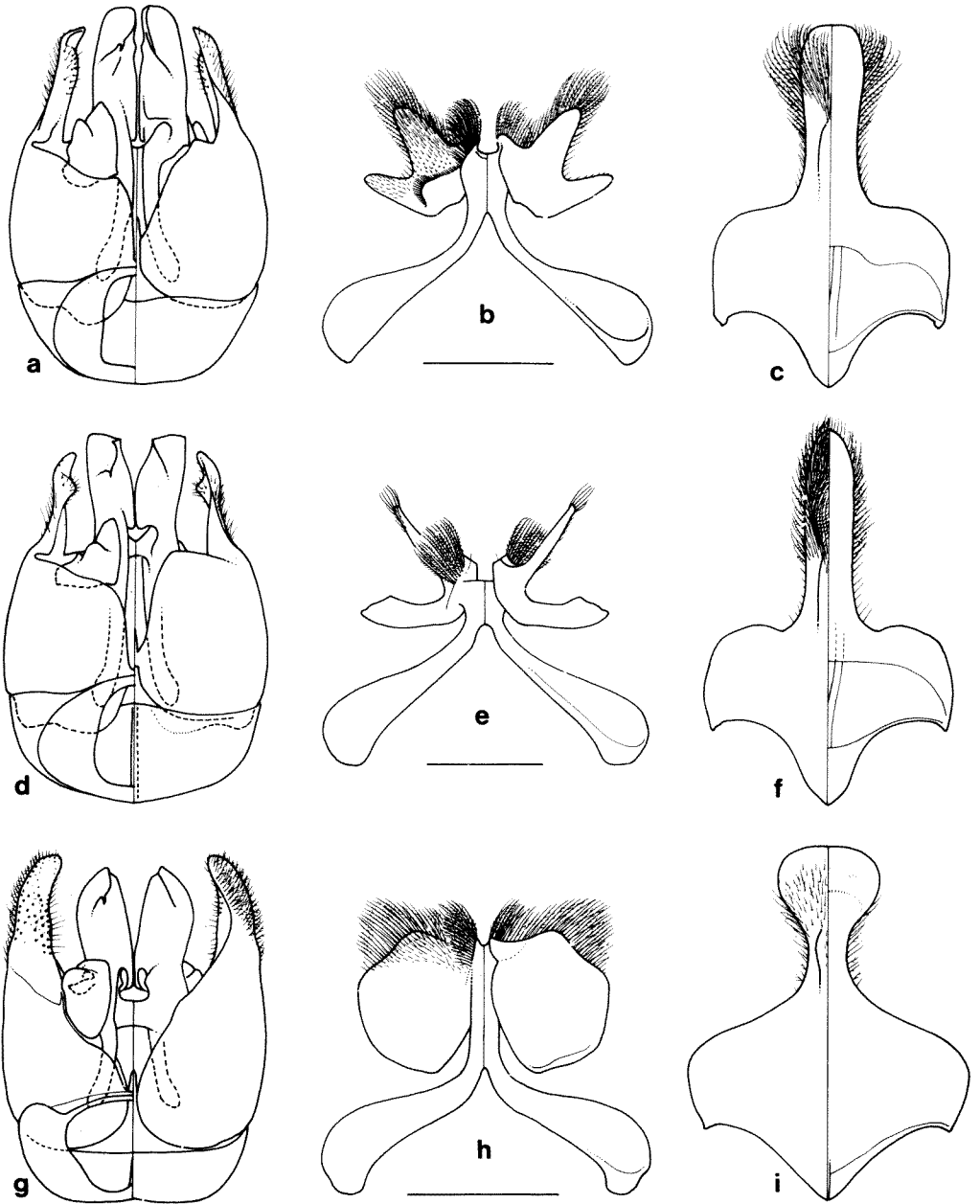
The specific epithet, *capito*, is Latin for 'large-headed'.

#### Distribution

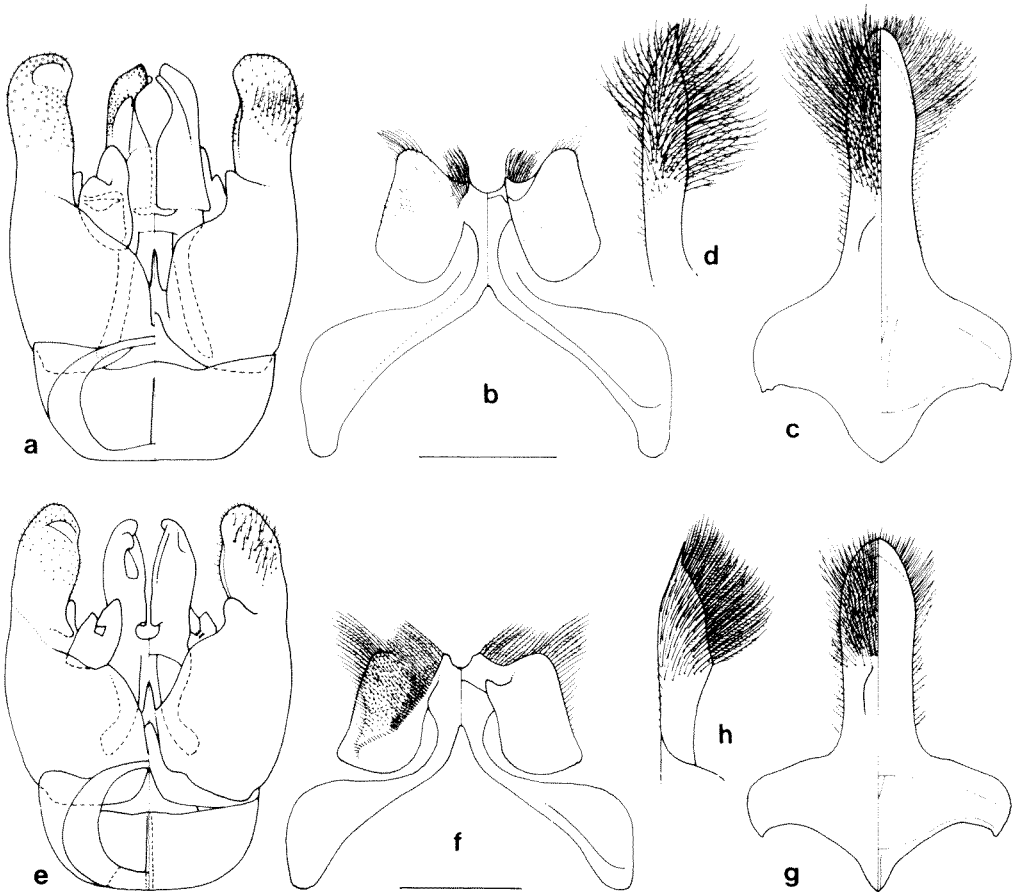
'Goldfields Region' of Western Australia (between Mt Magnet and Laverton) and far northern South Australia.

#### Specimens Examined

The holotype and the following paratypes. **Western Australia:** 6♂, same data as holotype, WAM (82/469, 471-2, 475-6, 478); 2♀, same data as holotype but 10.5 km SE of homestead, WAM (82/465-6); 4♂, 6♀ (2 on flowers of *Eremophila spathulata*, same data as holotype but 12.5 km SSE of homestead, WAM (82/457, 461-4; 89/365-9); 1♀, 26 km NE of Youanmi, 28°27'S, 119°03'E, 15 March 1982, TFH & BPH, on blue flowers of *Eremophila*, WAM (89/370). **South Australia:** 2♂, 3♀, 45 km ENE of Dalhousie HS, 26°24'S, 135°54'E, 24 April 1977, TFH, on flowers of *Dipteracanthus*, SAM; 3♂, 6♀, 6 km NE of Nilpinna HS, 5 March 1975, TFH, on blue flowers of *Eremophila*, SAM.



**Figure 7** *Leioproctus capito* species-group male terminalia (left to right - genital capsule, 7th and 8th metasomal sterna; dorsal views on right halves, ventral on left): (a-c) *L. eremites*, (d-f) *L. lanceolatus*, (g-i) *L. lucidicinctus*. Scale lines 0.5 mm.



**Figure 8** *Leioproctus capito* species-group male terminalia (left to right - genital capsule, 7th and 8th metasomal sterna; (d, h) right lateral views of apices of 8th metasomal sterna; dorsal views on right halves, ventral on left): (a-d) *L. capito*, (e-h) *L. lucanus*. Scale lines 0.5 mm.

***Leioproctus (Leioproctus) concavus* sp. nov.**

Figure 5 e

**Holotype**

In WAM (87/1448), ♀, 70-75 km ENE of Norseman, Western Australia, 10-16 Nov. 1978, T.F. Houston *et al.* 220-20, on flowers of *Eremophila scoparia*.

**Paratypes**

1♀ in ANIC; 3♀ in WAM. See Specimens Examined.

**Diagnosis**

Female (male unknown) distinguished by the following combination of characters: relatively small (body length *ca.* 6 mm), inner orbits converging ventrally, vertex only

slightly elevated above ocelli (Figure 5 e), clypeus slightly depressed medially (unique in species-group), labial palpi only about 0.75 x as long as prementum and maxillary palpi as long as post-palpal portion of galea.

*Female* (holotype)

Head width 1.85 mm; body length *ca.* 6 mm.

Relative dimensions: HW 50; HL 43; UID 34; UFW 34; LID 29; DMA 30; HVO 2; WOC 18; MOD 4; OOD 9; IAD 8; ASD 4.5; AOD 7; SL 14; SW 4; FL 25; ML 20; BMW 8; PML 31; LPL *ca.* 23; LP4L 8; MPL 16; PGL 16.

Vertex only weakly elevated above level of ocelli (Figure 5 e); inner orbits moderately convergent ventrally; clypeus slightly sunken medially; labrum 0.36 x as long as wide, smooth; mandible with very obtuse anterior tooth and short apical (posterior) tooth (possibly worn); maxillary palpus as long as post-palpal portion of galea; labial palpus *ca.* 0.74 x as long as prementum, 4th segment 0.59 x as long as scape, 3rd segment expanded and compressed distally, tapering proximally; mid tibial spur only slightly curved distally.

Integument black to dark brown; metasoma infused with orange-brown dorsally (mostly on terga 2 and 3 and adjacent parts of 1 and 4), hind margins of terga with broad transparent bands.

Clypeus and supraclypeal area shiny with sparse moderately large punctures; frons, vertex, scutum and scutellum with close to dense small punctures, weakly shining; propodeal enclosure mostly smooth and glossy, coriarius only near anterior margin; metasomal terga largely dull, strongly finely coriarius with open fine puncturing, broad hind margins shiny, impunctate, obscurely coriarius.

Pubescence mostly fairly sparse, erect, plumose and white; scutum, scutellum and metanotum with fairly dense, short, buff, plumose setae; metasomal terga with sparse, very short simple setae; preanal fimbria and scopal setae on outer (dorsal) edge of hind tibia dusky brown; fore tibia without a brush-like set of specialized setae.

**Variation**

One paratype has the metasoma uniformly black-brown.

**Etymology**

The specific epithet is Latin for 'concave' and alludes to the form of the clypeus.

**Distribution**

South-western Australia near Norseman and Kalgoorlie.

**Specimens Examined**

The holotype and the following paratypes. **Western Australia:** 2♀ (WAM 87/1447, 89/388), same data as holotype, ANIC, WAM; 1♀ (WAM 89/387), same data as holotype but on flowers of *Eremophila caerulea*, WAM; 1♀, 24 km SW of Kalgoorlie (30°44'S, 121°28'E), 10 Oct. 1988, R.P. McMillan, on flowers of *Eremophila*, WAM (89/389).

*Leioproctus (Leioproctus) eremites* sp. nov.

Figures 4 c, d; 7 a-c

**Holotype**

In WAM (88/1047), ♂, Coppin Pool area, 30 km S of Mt Bruce, NW Division of Western Australia, 10-13 May 1980, T.F. Houston *et al.* 324-2, on flowers of *Eremophila*.

**Paratypes**

1♂, 1♀ in ANIC; 1♂, 1♀, in UQIC; 12♂, 21♀ in WAM. See Specimens Examined.

**Diagnosis**

Most like *L. lanceolatus* and *L. lucidicinctus* in having inner orbits more or less parallel (Figure 4 c, d), distal segment of labial palpus distinctly shorter than antennal scape, lower face of male relatively broad (DMA/HW 0.72-0.78), and fore tibia of female with regular, brush-like set of specialized setae similar to those of *L. capito* (Figure 1 e-g). Differs from both *lanceolatus* and *lucidicinctus* in having hind margins of metasomal terga neither hyaline nor with bands of dense white pubescence. Differs also from *lucidicinctus* in mandible of male being bidentate.

*Male* (holotype)

Head width 3.2 mm; body length *ca.* 11 mm.

Relative dimensions: HW 50; HL 43; UID 33; UFW 35; LID 34; DMA 39; HVO 7.5; WOC 15.5; MOD 4; OOD 9.5; IAD 9; ASD 4; AOD 9; SL 13; SW 3.5; FL 26; ML 28; BMW 9; PML 31; LPL 17.5; LP4L 9.5; MPL *ca.* 13; PGL 15.

Compound eyes parallel; vertex strongly elevated (Figure 4 c); gena 1.1 x as wide as compound eye viewed laterally; width of labrum 3.3 x medial length; ventral margin of labrum concave; mandible slender with acute subapical tooth (like *lanceolatus*, Figure 3 g); maxillary palpus 0.87 x as long as post-palpal portion of galea; labial palpus 0.56 x as long as prementum, distal segment 0.73 x as long as antennal scape; flagellum 0.52 x as long as head width.

Integument black generally, grading to dark brown on appendages and apical margins of metasomal terga; dull generally, coriarius with fine puncturing; punctures small and dense on lower face, sparse on vertex, moderately close on scutum and metasomal terga.

Head, thorax, propodeum (except enclosure), legs proximally and 1st metasomal tergum with moderately long, dense, plumose setae; setae white generally but brown on vertex, scutum and scutellum; metasomal terga 2-4 and apical margin of 1 with short, simple, more or less adpressed, white setae, appearing silvery in oblique light; similar brown setae on terga 5 and 6.

Terminalia: Figure 7 a-c.

*Female* (paratype WAM 88/1052)

Head width 2.7 mm; body length *ca.* 8.5 mm.

Relative dimensions: HW 50; HL 41; UID 32; UFW 34; LFW 31; DMA 33; HVO 4; WOC 15; MOD 3.5; OOD 8; IAD 8.5; ASD 3.5; AOD 8; SL 12; SW 4; FL 25; ML 22; BMW 8; PML 32; LPL 27; LP4L 10; MPL *ca.* 13; PGL 16.

Compound eyes more or less parallel, inner orbits converging only slightly ventrally (Figure 4 d); vertex moderately elevated above ocelli; labrum 0.4 x as long as broad, uniformly convex; mandibles bidentate; maxillary palpus 0.8 x as long as post-palpal portion of galea; labial palpus 0.84 x as long as prementum, distal segment 0.83 x as long as antennal scape; fore and mid tibial spurs as in *L. capito* (Figure 3 a, b).

Integument black generally except as follows: scapes ventrally, proboscis, tegulae, wing veins, distal segments of tarsi and hind margins of metasomal terga brown.

Clypeus densely punctate, shining between punctures; supraclypeal area glossy, impunctate medially; otherwise sculpture much as in male.

Fore tibia anteriorly and laterally with an even brush-like cover of setae (similar to that of *capito*, Figure 1 e-g, but setae finer and less bent); hind tibia with scopal setae grading from white ventrally to dusky brown dorsally; metasomal terga 5 and 6 with long brown plumose setae; pubescence otherwise as in male.

### Variation

Head widths range from 2.7-3.25 mm in males and 2.6-3.1 mm in females.

### Remarks

This species is morphologically closest to *L. lanceolatus*, differing chiefly in features of metasomal pubescence and male terminalia. It appears to be allopatric (or perhaps parapatric) with *lanceolatus* in Western Australia. In view of a male from near Charleville, Qd (see *Incertae Sedis*), with the pubescence of *lanceolatus* but terminalia much more like those of *eremites*, these two forms may prove to be no more than subspecies.

The sexes were associated on the basis of coincident collection records and morphological similarity.

### Etymology

The specific epithet is Latin meaning 'of the desert'.

### Distribution

North-western Australia between Newman, Cue and Carnarvon.

### Specimens Examined

The holotype and the following paratypes. **Western Australia:** 2♀, 21 km NW of Belele HS (26°22'S, 118°01'E), 4 Sept. 1980, CAH & TFH, ex burrow in road verge, WAM (89/382-3); 1♂, 121 miles NNE of Carnarvon, 22 Aug. 1971, TFH, on blue *Eremophila*, WAM (89/372); 2♂, 6♀, Coppin Pool area, 30 km S of Mt Bruce, NW Division, 10-13 May 1980, TFH *et al.*, on flowers of *Eremophila* or (3♀) burrowing under stones on track, (WAM 88/1046, 1048, 1052-7), ANIC, UQIC, WAM; 9♂, 2♀, 8 km S of Lyons River HS (24°38'S, 115°20'E), 30 Aug. 1980, CAH & TFH, on flowers of *Eremophila platycalyx* var. *lancifolia*, (WAM 88/1034-44), ANIC, UQIC, WAM; 2♂, same as preceding but 16 km WSW of HS, 30 Aug.-1 Sept., 1♂ on flowers of 'flannel leaf' *Eremophila*, 1♂ on flowers of *Ptilotus obovatus*, WAM (82/551, 89/371); 1♀, 26 km ESE of Minnie Creek HS (24°02'S, 115°42'E), 2 Sept. 1980, CAH & TFH, on flowers of *Eremophila cuneifolia*, WAM (89/384); 5♀, Mt Augustus (24°20'S, 116°50'E), 3 Sept. 1980, CAH & TFH, on flowers of *Eremophila* affin. *freelingii*, WAM (82/548-50, 89/373-4); 7♀, 14 miles NE of Newman, 28 Aug. 1971, TFH, on blue flowers of *Eremophila*, WAM (89/375-81).

*Leioproctus (Leioproctus) eremitulus* sp. nov.

Figures 3 f, o; 5 b; 6 d-f

**Holotype**

In SAM, ♂, 45 km ENE of Dalhousie HS, South Australia, 26°24'S, 135°54'E, 24 April 1977, copulating in *Dipteracanthus* flower, T.F. Houston.

**Paratypes**

38♂, 19♀ in ANIC; 1♀ in SAM; 2♂, 2♀ in WAM.

**Diagnosis**

Most like *L. canutus* (vide) and *L. longipalpus*, differing from both in having mandible of male with distinct, acute, subapical tooth (Figure 3 f). Differs from *canutus* also in having off-white to buff (rather than pure white) pubescence in male, metasomal terga of male with mostly short, simple setae, dorsum of thorax of female fairly densely pubescent and distal segment of labial palpus of female relatively longer, as long as antennal scape. Differs from *longipalpus* also in having propodeal enclosure wholly coriarious and dull, maxillary palpus (at least in female) relatively shorter (not reaching apex of galea), vertex of male more strongly elevated (Figure 5 b) and flagellum of male relatively shorter.

*Male* (holotype)

Head width 1.85 mm; body length 6.5 mm.

Relative dimensions: HW 50; HL 48; UID 34; UFW 35; LID 30; DMA 30; HVO 5; WOC 18; MOD 5; OOD 9; IAD 9; ASD 5; AOD 7; SL 13; SW 4.5; FL *ca.* 35; ML 22; BMW 9; PML 40; LPL 42; LP4L 15; MPL ? (obscured; = 16 in paratype); PGL 20.

Vertex strongly elevated above level of ocelli (Figure 5 b); inner orbits converging slightly ventrally; gena 0.9 x as wide as compound eye viewed laterally; mandibles slender, distinctly bidentate with acute subapical tooth (Figure 3 f); flagellum fairly cylindrical, 0.7 x as long as head width; labrum 5 x wider than long, ventral margin gently concave; labial palpus relatively very long, 1.05 x as long as prementum, 2nd segment attaining apex of glossa (Figure 3 o), 4th segment 1.15 x as long as antennal scape.

Integument black to dark brown generally with hind margins of metasomal terga light brown, transparent; dull generally except clypeus and supra-clypeal area which are glossy with open to sparse medium puncturing; labrum and mandibles distally glossy; frons finely vertically striate; vertex, scutum and scutellum finely coriarious with open puncturing; propodeal enclosure dull, coriarious; metasomal terga dull, shagreened (except apical margins), without distinct punctures.

Pubescence mostly white to off-white (buff on dorsum of thorax), erect, plumose, rather sparse; metasomal terga 2-5 with sparse vestiture of short, erect, simple setae.

Terminalia: Figure 6 d-f.

*Female* (paratype in SAM)

Head width 2.25 mm; body length *ca.* 8 mm.

Relative dimensions: HW 50; HL 47; UID 32; UFW 35; LID 31; DMA 32; HVO 3.5;

WOC 18; MOD 4; OOD 8; IAD 9; ASD 4; AOD 8; SL 15; SW 4; FL 27; ML 25; BMW 8.5; PML 38; LPL 40; LP4L 15; MPL 16; PGL 19.

Head generally similar to that of male; mandibles bidentate, both teeth acute; labrum smooth, convex, with convex ventral margin; maxillary palpus 0.84 x as long as post-palpal portion of galea; labial palpus 1.05 x as long as prementum, 4th segment as long as antennal scape; fore and mid tibial spurs much as in *L. capito* but latter not as strongly curved distally.

Coloration, sculpturing and pubescence as in male except as follows. Metasomal terga sparsely indistinctly punctured; fore tibia fairly densely setose but setae not specialized nor forming a brush as in *capito*; scutum, scutellum and metanotum with fairly dense, moderately short, buff, plumose setae; outer (dorsal) scopal setae of hind tibia dusky; preanal fimbria brown.

#### Variation

Head widths vary from 1.95-2.20 mm in males and 2.15-2.35 mm in females.

#### Remarks

The sexes were associated on the basis of a pair taken *in copula* and numerous coincident collection records.

#### Etymology

The specific epithet is the diminutive form of the Latin word *eremites* meaning 'of the desert'.

#### Distribution

Central Australia and far northern South Australia.

#### Specimens Examined

The holotype and the following paratypes. **South Australia:** 1♀, same data as holotype, SAM; 1♂, 1♀, 17 km E of Granite Downs, 26°57'S, 133°40'E, 21 Sept. 1978, JCC, ANIC; 9♂, 5♀, Indulkana Ck, 7 km E by S of Granite Downs, 26°57'S, 133°34'E, 21 Sept. 1978, JCC, on flowers of *Eremophila freelingii* F. Muell., ANIC. **Northern Territory:** (near) Alice Springs (24♂, 3♀, 39 km E of, 23°41'S, 134°15'E, 26 Sept., on flowers of *Eremophila* sp., 3♂, 11♀, 53 km E by N of, 23°35'S, 134°22'E, 6 Oct., on flowers of *Eremophila* sp.: 1♂, 41 km S by E of, 24°03'S, 133°59'E, 4 Oct.; 1♀, 56 km S by E of, 24°11'S, 134°01'E, 3 Oct.), 1978, JCC, ANIC, WAM; 2♂, 8 km N of Kulgera, 25°46'S, 133°17'E, 21 Sept. 1978, JCC, on flowers of *Eremophila freelingii* F. Muell., ANIC.

### *Leioproctus (Leioproctus) kumarina* sp. nov.

Figure 3 m

#### Holotype

In WAM (89/386), ♀, 83 miles S of Newman, Western Australia, 29 Aug. 1971, T.F. Houston, on (flowers of) *Scaevola spinescens*.

#### Diagnosis

Female (male unknown) distinguished by the following combination of characters: inner orbits converging ventrally; fore tibia without a brush-like vestiture of regular specialized setae; maxillary palpus exceeding apex of galea; labial palpus only 0.88 x as

long as prementum, 3rd segment not compressed, circular in section (Figure 3 m); metasomal terga closely punctured, shining between punctures.

*Female* (holotype)

Head width 2.45 mm; body length *ca.* 8.5 mm.

Relative dimensions: HW 50; HL 44; UID 31; UFW 33; LID 29; DMA 30; HVO 3; WOC 17; MOD 4; OOD 7.5; IAD 8; ASD 4; AOD 7.5; SL 14; SW 3.5; FL *ca.* 26; ML 22; BMW 8; PML 34; LPL *ca.* 30; LP4L 10; MPL 17; PGL 15.

Inner orbits converging slightly ventrally; gena 0.8 x as wide as compound eye viewed laterally; mandible bidentate, subapical tooth small but acute; labrum smooth, convex, 2.8 x wider than long; maxillary palpus 1.13 x as long as post-palpal portion of galea; labial palpus 0.88 x as long as prementum, 2nd segment not attaining apex of glossa, 3rd slender and round in section, 4th 0.7 x as long as antennal scape, strongly compressed and widened proximally (Figure 3 m); fore and mid tibial spurs much as in *L. capito* but latter not as strongly curved distally.

Integument black to dark brown; supraclypeal area and clypeus glossy with sparse, large punctures; frons and vertex weakly shining with close small punctures; scutum and scutellum dulled by dense small punctures; propodeal enclosure coriarius and dull dorsally, smooth and glossy posteriorly; metasomal terga shining with distinct, close to open small puncturing except on hind margins, not coriarius.

Pubescence mostly white, sparse and erect but scutum, scutellum and metanotum with fairly dense, short, buff tomentum; metasomal terga 2-4 with very short simple setae dorsally; preanal fimbria brownish; scopal setae on outer (dorsal) margin of hind tibia dusky brown.

**Remarks**

Known only from the unique holotype female.

**Etymology**

The specific epithet is a noun in apposition. Kumarina is the nearest settlement to the type locality.

***Leioproctus (Leioproctus) lanceolatus* sp. nov.**

Figures 3 g; 7 d-f

**Holotype**

In WAM (82.479), ♂, 11 km W of Banjiwarn HS (27°42'S, 121°37'E), Western Australia, 21 Feb. 1980, T.F. Houston *et al.* 315-1, on blue flowers of *Eremophila*.

**Paratypes**

7♂, 4♀ in ANIC; 1♂, 1♀ in SAM; 8♂, 7♀ in WAM. See Specimens Examined.

**Diagnosis**

Most like *L. eremites* (vide) and *L. lucidicinctus*. Differs from these and other members of the group in having at least partial bands of adpressed white pubescence on hind margins of metasomal terga 1-4 or 5. Differs from *lucidicinctus* also in mandible of male being bidentate (Figure 3 g).

*Male* (holotype)

Head width 2.8 mm; body length *ca.* 8.5 mm.

Relative dimensions: HW 50; HL 44; UID 32; UFW -; LID -; DMA 38; HVO 6.5; WOC 15.2; MOD 4; OOD 8.5; IAD 9; ASD 3.5; AOD 8.5; SL 12.5; SW 3.5; FL *ca.* 26; ML 27; BMW 10; PML 31; LPL 26; LP4L 8; MPL *ca.* 10; PGL 15.

Similar to male of *eremites* except as noted in Diagnosis and with the following additional differences: maxillary palpus 0.75 x as long as post-palpal portion of galea; labial palpus 0.84 x as long as prementum, distal segment 0.64 x as long as antennal scape; integument generally weakly shining; dorsal margin of clypeus and supraclypeal area medially impunctate; punctures of metasomal terga minute, sparse, indistinct; setae of vertex, scutum and scutellum buff; metasomal terga 2-5 (except apical margins) with short, simple, more or less adpressed brown setae, not appearing silvery in oblique light.

Bands of adpressed white plumose setae on apical margins of metasomal terga 1-5 are interrupted medially, widely on tergum 1, less so on subsequent terga.

Terminalia: Figure 7 d-f.

*Female* (paratype WAM 89/396)

Head width 2.5 mm; body length *ca.* 8.2 mm.

Relative dimensions: HW 50; HL 42; UID 30; UFW 34; LID 32; DMA 34; HVO 4; WOC 15; MOD 3.5; OOD 8; IAD 9; ASD 4; AOD 8; SL 13; SW 3.5; FL *ca.* 24; ML 21+ (worn); BMW 9; PML 35; LPL *ca.* 26; LP4L 8; MPL *ca.* 12; PGL 16.

Similar to female of *eremites* except as noted in Diagnosis and with the following additional differences: maxillary palpus 0.75 x as long as post-palpal portion of galea; labial palpus 0.74 x as long as prementum, distal segment 0.6 x as long as antennal scape; mandibles orange-brown proximally; legs dark brown generally; lower face sparsely hairy, especially medially; metasomal terga 2-4 with short brown simple setae (except apically) not appearing silvery in oblique light.

Bands of adpressed white plumose setae on apical margins of metasomal terga 1-4 are interrupted medially, widely on tergum 1, less so on subsequent terga.

**Variation**

Head widths vary from 2.4-3.0 mm in males and 2.45-2.8 mm in females.

Bands of white pubescence on metasoma worn and sparse or almost absent in older specimens.

**Remarks**

See remarks under *eremites*.

The sexes were associated on the basis of morphological similarity (especially the presence of metasomal hair bands) and coincident collection records.

**Etymology**

The specific epithet is Latin meaning 'with a little lance' and alludes to the lance-like apex of the 8th metasomal sternum.

**Distribution**

Western Australia (east of Mt Magnet and north of Kalgoorlie) to Central Australia and far northern South Australia.

**Specimens Examined**

The holotype and the following paratypes. **Western Australia:** (near) Banjiwari HS (27°42'S, 121°37'E) (4♂, 9.5 km SE of, WAM 82/468, 470, 473, 477; 1♂, 10.5 km SE of, WAM 82/467; 1♂, 1♀, 12.5 km SSE, WAM 87/1446, 89/396), 22-28 Feb. 1980, TFH *et al.*, on flowers of *Eremophila margarethae* (except ♀ on *E. spathulata*), WAM; 2♂, 1♀, 3.75 km NE of Comet Vale Siding (29°57'S, 121°07'E), 7-15 Mar. 1979, TFH *et al.*, on flowers of *Eremophila granitica*, WAM (89/390-2); 3♀, same as preceding but 7 km NE of siding, WAM (89/393-5); 1♀, Lake Cohen and vicinity, 24°26'S, 125°05'E, 1 Aug. 1983, TFH & R.P. McMillan, on flowers of *Eremophila battii*, WAM (89/398); 1♀, 26 km NE of Youanmi, 28°27'S, 119°03'E, 15 Mar. 1982, TFH & BPH, on flowers of *Eremophila ?clarkei*, WAM (89/397). **South Australia:** 1♂, 1♀, ca. 45 km ENE of Dalhousie HS, 26°24'S, 135°54'E, 24 April 1977, TFH, on flowers of *Dipteracanthus*, SAM. **Northern Territory:** (near) Alice Springs (2♀, 32 km S by E of, 23°59'S, 133°56'E, 23 Sept., on flowers of *Eremophila willsii*; 1♂, 56 km S by E of, 24°11'S, 134°01'E, 24 Sept.; 1♂, 39 km E of, 23°41'S, 134°15'E, 25 Sept., on flowers of *Eremophila freelingii*; 4♂, 53 km E by N of, 23°35'S, 134°22'E, 6 Oct., on flowers of *Eremophila* sp.; 1♀, 30 km NW by N of, 23°32'S, 133°38'E, 7 Oct., in malaise trap), 1978, JCC, ANIC; 1♂, Henbury Meteorite Craters, 24°34'S, 133°08'E, 22 Sept. 1978, JCC, ANIC.

***Leioproctus (Leioproctus) longipalpus* sp. nov.**

Figures 3 k; 5 d; 6 g-i

**Holotype**

In WAM (88/1058). ♂, 12 km E of Marandoo Camp (22°38'S, 118°06'E), Western Australia, 5-19 May 1980, TFH *et al.* 321-2, on flowers of *Eremophila leucophylla*.

**Paratypes**

1♂, 3♀, in WAM. See Specimens Examined.

**Diagnosis**

Most like *L. canutus* (vide) and *L. eremitulus*. Female agrees with that of *eremitulus* in having face narrowest in lower part, fore tibia lacking brush-like vestiture of specialized setae, and distal segment of labial palpus at least as long as antennal scape. Differs from both *canutus* and *eremitulus* in having relatively longer palpi and glossy (or, in female, partially glossy) propodeal enclosure.

**Male (holotype)**

Head width 1.85 mm; body length 6.5 mm.

Relative dimensions: HW 50; HL 42; UID 32; UFW 33; LID 28; DMA 29; HVO 2.5; WOC 18; MOD 5; OOD 8; IAD 8; ASD 4.5; AOD 6.5; SL 11; SW 4.2; FL ca. 45; ML 18; BMW 8; PML 28; LPL 40; LP4L 13; MPL 23; PGL 14.

Head fairly rounded viewed anteriorly (Figure 5 d); vertex only weakly elevated behind ocelli; compound eyes distinctly converging ventrally; gena only about 0.6 x as wide as compound eye viewed laterally; mandibles relatively short, strongly curved, with an obtuse subapical tooth; labrum 3.6 x wider than long, ventral margin straight; flagellum 0.9 x as long as head width, each segment slightly swollen; maxillary palpus 1.64 x as long as post-palpal portion of galea; labial palpus ca. 1.43 x as long as prementum, distal segment 1.18 x as long as antennal scape, fairly straight-sided.

Integument black generally grading to black-brown on metasoma and legs distally; proboscis, flagella ventrally and wing veins mid brown.

Integument mostly shining, glossy on vertex, scutum and propodeal enclosure; not coriarius except on more apical metasomal terga; puncturing close, small to medium

on face, sparser and less distinct on vertex, sparse but distinct on scutum, distinct, small and close to sparse on metasomal terga 1-3 (except hind margins), indistinct on more apical terga.

Pubescence wholly white; head, thorax, propodeum and legs generally with long, erect, plumose setae, nowhere dense enough to obscure integument; metasomal terga with short, simple, more or less erect setae, appearing silvery in oblique light; 5th sternum with dense apical fringe.

Terminalia: Figure 6 g-i.

*Female* (paratype WAM 88/1050)

Head width 2.35 mm; body length *ca.* 8.4 mm.

Relative dimensions: HW 50; HL 43; UID 30; UFW 32; LID 28; DMA 30; HVO 2.5; WOC 16; MOD 4; OOD 7; IAD 8; ASD 4; SL 14; SW 3.5; FL 27; ML 21; BMW 8.5; PML 33; LPL 42; LP4L 16; MPL 20; PGL 17.

Head fairly rounded viewed anteriorly, vertex moderately elevated above ocelli; inner orbits converging slightly ventrally; clypeus moderately convex transversely; gena little more than half as wide as compound eye viewed laterally (Figure 3 k); labrum 3.1 x wider than long, smooth, evenly convex; mandibles slender with obtuse subapical tooth; maxillary palpus 1.2 x as long as post-palpal portion of galea; labial palpus 1.2 x as long as prementum, distal segment 1.14 x as long as antennal scape, 3rd segment about 1.5 x as wide as 4th, terminating in a spine (Figure 3 k).

Integument black generally grading to dark-brown on metasoma and legs; mandibles partly orange-brown; palpi, tegulae and wing veins proximally light brown.

Integument faintly to moderately shining generally; clypeus and supraclypeal area glossy with open puncturing of variable size; frons and vertex with close, small puncturing, sparse near ocelli; scutum and scutellum dulled by close fine puncturing; propodeal enclosure rather glossy centrally, coriarious and dull peripherally; 1st metasomal tergum almost glossy, obscurely coriarious with open, small to minute puncturing; subsequent terga progressively duller, more strongly coriarious with less distinct punctures.

Pubescence fairly sparse generally except on scutum and scutellum which have dense cover of short buff tomentum and scattered longer erect setae; dorsum of metasoma with short simple setae appearing silvery in oblique light; 5th and 6th terga with dark brown plumose setae; fore tibia without a brush-like cover of specialized setae; hind tibia with scopal setae grading from white ventrally to dark brown dorsally.

### Etymology

The specific epithet is a noun in apposition and alludes to the labial palpi which, proportionately, are the longest in the species group.

### Distribution

Hamersley Ranges, north-western Australia.

### Specimens Examined

The holotype and the following paratypes. **Western Australia:** 1♂, same data as holotype, WAM (88/1059); 3♀, Coppin Pool area, 30 km S of Mt Bruce, NW Division, 10-13 May 1980, TFH *et al.*, on flowers of *Eremophila*, WAM (88/1049-51).

***Leioproctus (Leioproctus) lucanus* sp. nov.**

Figures 1 c, d; 3 e; 4 e-g; 8 e-h

**Holotype**

In SAM, ♂, 2 km S of Hamilton HS (26°43'S, 135°04'E), South Australia, 26 April 1977. T.F. Houston, on flowers of *Eremophila willsii*.

**Paratypes**

11♂, 10♀ in ANIC; 1♂ in SAM; 2♂, 1♀ in WAM. See Specimens Examined.

**Diagnosis**

Most like *L. capito* (vide). Differs from *capito* in having 6-segmented maxillary palpi, mandible of male with larger excavation in anterior margin and angle proximal to excavation more prominent (cf. d and e Figure 3), gena of male excavated and angular near insertion of mandible (Figure 4 f), hypostomal carina of female defining a broad area near insertion of mandible (Figure 4 g) and metasomal terga of female frequently infused with orange-brown.

**Male (holotype)**

Head width 4.25 mm; body length *ca.* 11 mm.

Relative dimensions: HW 50; HL 40; UID 34; UFW -; LID -; DMA 44; HVO 10; WOC 12; MOD 3; OOD 11; IAD 11; ASD 3.5; AOD 10; SL 12.5; SW 2.5; FL *ca.* 22; ML 32; BMW 9.5; PML 28; LPL 20; LP4L 6; MPL *ca.* 10; PGL 13.5.

Similar to male of *L. capito* except as noted in the Diagnosis and with the following additional differences: clypeus less produced mid-ventrally, not uniformly concave lateroventrally (Fig. 4 e); lower gena with distinct angle running from near posterior articulation of mandible towards posterior end of proboscival fossa, marking off a large, rather triangular area mediad of mandible; maxillary palpus *ca.* 0.74 x as long as post-palpal portion of galea; labial palpus 0.71 x as long as prementum, distal segment 0.48 x as long as antennal scape; flagellum *ca.* 0.44 x as long as head width; hind margins of metasomal terga (especially 2-6) broadly hyaline; lower face with close small punctures, areas below antennal sockets more sparsely punctured but not impunctate; propodeal enclosure finely transversely striate dorsally; antennae, ventral margin of clypeus and labrum dark brown (not yellow-brown).

Terminalia: Figure 8 e-h; setae on apex of 8th metasomal sternum forming a shorter, denser 'brush' than in *capito*.

**Female (paratype WAM 82/459)**

Head width 2.6 mm; body length *ca.* 8.5 mm.

Relative dimensions: HW 50; HL 44; UID 30; UFW -; LID -; DMA 36; HVO 5; WOC 14; MOD 3.2; OOD 8; IAD 10; ASD 3.5; AOD 8; SL 13; SW 3.2; FL *ca.* 25; ML 25; BMW 9; PML 35; LPL *ca.* 22; LP4L 5.5; MPL *ca.* 8; PGL 17.

Similar to female of *capito* except as noted in the Diagnosis and with the following additional differences: inner orbits diverging only slightly ventrally; epistomal carina diverging from proboscival fossa anteriorly and enclosing a broad area posterior to mandible (Figure 4 g); metasomal terga with small, distinct puncturing, setae of vertex white.

**Variation**

Head width varies from 3.3-4.3 mm in males and 2.65-3.15 mm in females; the extent of orange-brown on the metasoma of females varies from nil to almost total coverage of terga 1-4.

**Remarks**

See Remarks under *L. capito*.

The sexes were associated on the basis of morphological similarities and coincident collection records.

**Etymology**

The specific epithet is a noun in apposition and was chosen because the large pincer-like mandibles of males are suggestive of those of some *Lucanus* beetles.

**Distribution**

Western Australia (east of Leinster), Central Australia and far northern South Australia.

**Specimens Examined**

The holotype and the following paratypes. **Western Australia:** 2♂, 1♀, 12.5 km SSE of Banjiwarn HS (27°42'S, 121°37'E), 22-28 Feb. 1980, TFH *et al.*, on flowers of *Eremophila spathulata* (1♂, 1♀, 82/458-9), on flowers of *Scaevola spinescens* (1♂, 82/460), WAM. **South Australia:** 1♂, same data as holotype, SAM. Northern Territory: (near) Alice Springs (9♂, 9♀, 32 km S by E of, 23°59'S, 133°56'E, 23 Sept., on flowers of *Eremophila willsii*; 1♂, 46 km SW by S of, 24°03'S, 133°37'E, 23 Sept.; 1♂, 1♀, 41 km S by E of, 24°03'S, 133°59'E, 4 Oct.), 1978, JCC, ANIC.

***Leioproctus (Leioproctus) lucidicinctus* sp. nov.**

Figures 3 h, l; 5 a; 7 g-i

**Holotype**

In WAM (88/1045), ♂, 57 km ENE of Carnarvon, Western Australia, 29 Aug. 1980, C.A. Howard & T.F. Houston 339-1, on flowers of *Eremophila* sp. "*crenulata*" of R.J. Chinnock.

**Paratypes**

1♂ in ANIC; 5♂, 2♀, in SAM. See Specimens Examined.

**Diagnosis**

Most like *L. eremites* (vide) and *L. lanceolatus*. Differs from both in having hind margins of metasomal terga broadly hyaline (without bands of white pubescence), distal segment of labial palpus more slender, hardly compressed, mandible of male simple, lacking subapical tooth (Figure 3 h), labrum of female transversely carinate (Figure 3 l), metasomal terga of female orange-brown.

**Male (holotype)**

Head width 3.0 mm; body length *ca.* 11 mm.

Relative dimensions: HW 50; HL 44; UID 33; UFW -; LID -; DMA 36; HVO 9; WOC 16; MOD 3.5; OOD 9; IAD 10; ASD 3.5; AOD 9; SL 13; SW 3; FL *ca.* 27; ML 28; BMW 9.5; PML 35; LPL 31; LP4L 9.5; MPL 12; PGL 17.

Similar to male of *L. eremites* except as noted in the Diagnosis and with the following additional differences: vertex more developed (Figure 5 a); width of labrum 4.0 x medial length; maxillary palpus 0.7 x as long as post-palpal portion of galea; labial palpus 0.88 x as long as prementum, distal segment 0.73 x as long as antennal scape; mandibles orange-brown except for dark red apices; integument generally with a sheen, especially on metasomal terga; vertex and scutum with close, fine puncturing; metasomal terga with sparse, small to minute, indistinct puncturing; hyaline margins of metasomal terga 3 and 4 about as long medially as metanotum; setae of vertex and scutum very pale buff; metasomal terga 2-4 with short, simple, brownish setae (absent on hind margins).

Terminalia: Figure 7 g-i.

#### *Female* (paratype SAM)

Head width 2.8 mm; body length *ca.* 9 mm.

Relative dimensions: HW 50; HL 44; UID 31; UFW 34; LID 32; HVO 6; WOC 16; MOD 3.5; OOD 8; IAD 9.5; ASD 3.5; AOD 8; SL 13; SW 3.5; FL *ca.* 23; ML 21+ (worn); BMW 9; PML 34; LPL *ca.* 28; LP4L 7.5; MPL 13; PGL 17.

Similar to female of *L. eremites* except as noted in the Diagnosis and with the following additional differences: vertex more strongly elevated; labrum 0.28 x as long as wide, angled but not especially convex; maxillary palpus 0.76 x as long as post-palpal portion of galea; labial palpus *ca.* 0.82 x as long as prementum, terminal segment 0.58 x as long as scape; mid tibial spur only slightly curved distally.

Ventral margin of clypeus, labrum, mandibles except dark red apices orange-brown; metasoma largely dark orange; legs black-brown to yellow-brown.

Face below ocelli fairly shiny; clypeus with small, close to open puncturing; frons with close, fine punctures; vertex and scutum duller with dense, fine puncturing; metasomal terga with a sheen and indistinct, sparse, fine punctures.

Pubescence almost wholly white including scopal setae; hair of 5th and 6th metasomal terga buff.

#### **Variation**

Head widths range from 3.0-3.35 mm in males and the second female paratype has a HW of 2.75 mm.

#### **Remarks**

The sexes were associated on the basis of morphological similarity (especially the hyaline tergal margins) and coincident collection records.

#### **Etymology**

The specific epithet is Latin for 'clear banded' and alludes to the tergal margins.

#### **Distribution**

Western Australia (near Carnarvon), Central Australia and far northern South Australia.

#### **Specimens Examined**

The holotype and the following paratypes. **South Australia:** 5♂, 2♀, 2 km S of Hamilton HS (26°43'S, 135°04'E), 26 April 1977, TFH, on flowers of *Eremophila willsii*, SAM. **Northern Territory:** 1♂, Plenty River, 245 km ENE of Alice Springs, 23°00'S, 136°08'E, 14 Oct. 1978, JCC, ANIC.

*Leioproctus (Leioproctus) nasutus* sp. nov.

Figure 9 a-k

**Holotype**

In WAM (89/345), ♂, Meleya Well (28°58'S, 117°12'E), Thundelarra Station, 28 Aug.-2 Sept. 1981, T.F. Houston 388c-6, on foliage of *Eremophila pantonii*.

**Paratypes**

1♂, 1♀ in ANIC; 1♂, 1♀ in UQIC; 12♂, 3♀ in WAM. See Specimens Examined.

**Diagnosis**

Distinguished from other black, non-metallic species of *Leioproctus s. str.* by the strongly protruding clypeus (especially that of male, Figure 9 c), smooth, relatively long and rather oblong labrum (Figure 9 d) and flattened, expanded fore tarsi of male (Figure 9 h).

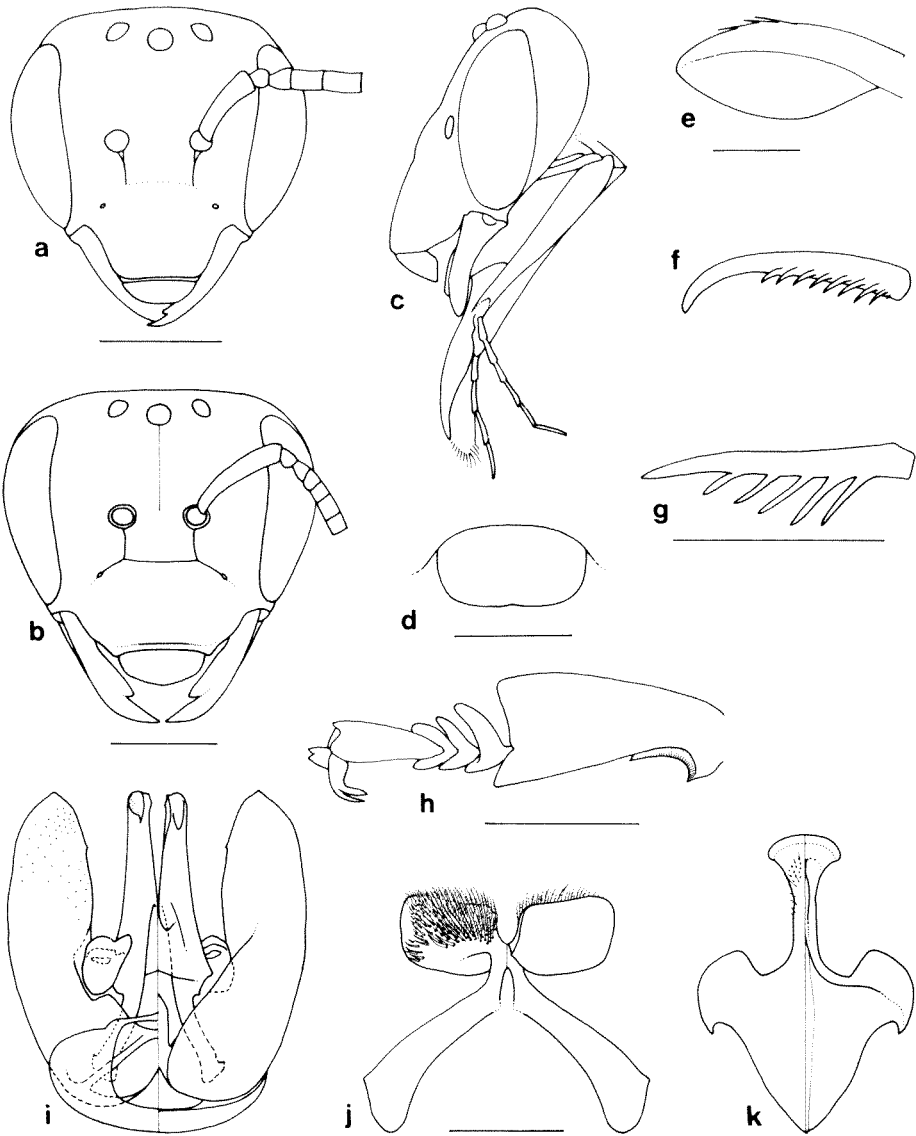
*Male* (holotype)

Head width 2.65 mm; body length *ca.* 10 mm.

Relative dimensions: HW 50; HL 55; UFW 33; LID 29; HVO 2; WOC 17; MOD 4.2; OOD 8; DMA 30; IAD 10; ASD 4; AOD 7; ML 22; SL 14; SW 4; FL 65; PML 34; PGL 20; MPL 25; LPL 23.

Head slightly longer than broad; compound eyes more or less parallel (Figure 9 a); vertex elevated a little above level of compound eyes and ocelli, rather level viewed anteriorly; frons and vertex depressed slightly between compound eyes and ocelli but facial foveae not at all defined; clypeus strongly protuberant (Figure 9 a, c), lateral portions bent back almost parallel to long axis of body; interantennal area strongly convex transversely; gena narrower than compound eye viewed laterally, undeveloped in lower part; malar area very short; labrum smooth, almost rectangular, half as long as broad (Figure 9 d); mandible slender, fairly straight, bidentate, apical tooth much exceeding subapical tooth; maxillary palpus slender, exceeding apex of galea (relative lengths of segments 1-6 are 3.5, 4.0, 4.5, 4.0, 4.0 and 5.0); labial palpus almost as long as maxillary palpus (Figure 9 c), distal segment slender, not expanded (relative lengths of segments 1-4 are 5, 6, 6 and 6); antennae relatively long, flagellum 1.3 x as long as head width, middle segments 1.6 x as long as wide, terminal segment 2.4 x as long as wide, first segment slightly shorter than wide; metanotum ordinary (not swollen or tuberculate); propodeum with sloping dorsal area as long as metanotum, rounding onto vertical posterior surface with no separating edge or carina; metasoma moderately slender, terga 2-5 slightly depressed across posterior margins; fore wing with three submarginal cells, first as long as second and third together, second receiving first recurrent vein three quarters of its posterior length from first transverse cubital vein; fore tarsi highly modified, flattened and expanded (Fig. 9 h); fore and mid tibiae with prominent outer apical spines, hind tibia with an obtuse outer apical projection; hind basitarsus very long, straight and slender, 7 x as long as greatest height, almost 2 x as long as segments 2-5 together (excluding claws); legs otherwise fairly ordinary.

Integument almost wholly black and nonmetallic; flagellum ventrally and fore tibia anteriorly yellow-brown; compound eyes and wing veins dark brown.



**Figure 9** *Leioproctus nasutus*: (a, b) heads of male and female, respectively (pubescence omitted); (c) left lateral view of head (pubescence omitted) and proboscis of male; (d) labrum of male (fringing setae omitted); (e) fore tibial spur of male; (f, g) mid tibial and inner hind tibial spurs of female; (h) fore tarsus of male (inner view; pubescence omitted); (i-k) genital capsule, 7th and 8th metasomal sternite of male (dorsal views on right halves, ventral on left). Scale lines (a, b) 1 mm, (e) 0.1 mm, others 0.5 mm.

Clypeus and supraclypeal area shining with close medium puncturing; hind margins of metasomal terga shining; integument otherwise minutely roughened, indistinctly punctate and dull; frons and vertex finely longitudinally striate except laterally.

Clypeus with moderately long silvery-white setae directed ventrally; paraocular areas and lower frons with dense long white pubescence directed laterally and dorsally; remainder of head (except eyes), thorax, propodeum (except enclosure), metasomal terga 1 and 2, fore femora and anterior margins of fore basitarsi with abundant erect, long, white pubescence; remainder of legs, hind margins of metasomal sterna and lateral edges of terga with sparse, erect, white setae (4th and 5th sterna with no apical fringes); tergum 2 posteriorly and 3-7 generally with very short to moderately long, simple, brown setae.

Terminalia: Fig. 9 i-k.

*Female* (paratype WAM 89/363)

Head width 2.9 mm; body length *ca.* 10 mm.

Relative dimensions: HW 50; HL 43; UID 32; UFW 35; LID 32; DMA 32; HVO 1.5; WOC 16; MOD 4; OOD 8; IAD 8; ASD 4; AOD 9; ML 23; SL 16; SW 3; FL *ca.* 28; PML 37; LPL 21; MPL 23; PGL 18.

Head a little wider than long; vertex only slightly elevated above level of compound eyes and ocelli (Figure 9 b), fairly level; compound eyes more or less parallel; clypeus and supraclypeal area strongly protuberant as in male; malar area very short; gena about as wide as compound eye viewed laterally, more developed in lower part than in male; labrum smooth, convex, slightly more than half as long as broad; mandibles bidentate, apical tooth much exceeding subapical tooth; palpi as in male; thorax and propodeum as in male but dorsal area of latter defined posteriorly by a few transverse striae; metasoma ordinary, terga fairly even; venation as in male; legs ordinary, tibiae without outer apical spines and projections; fore tibial calcar with a short stout apical spine bearing only two teeth; mid tibial spur strongly curved and lacking teeth on distal half (Figure 9 f); inner hind tibial spur coarsely pectinate with 5-6 long teeth (Figure 9 g); hind basitarsus 3.4 x as long as high.

Integument almost wholly black, nonmetallic; flagella ventrally, compound eyes, proboscis distally, wing veins and distitarsi dark brown; anterior patch near base of fore tibia yellow-brown.

Clypeus and supraclypeal area glossy, sparsely punctured; hind margins of metasomal terga finely coriaceous and shiny; integument otherwise finely roughened and dull (metasomal terga with a sheen); propodeal enclosure sparsely rugose dorsally.

Pubescence much as in male; prepygidial fimbria of dense, dark brown, plumose setae; hind tibial scopa moderately dense, consisting of long highly plumose setae, white ventrally, dusky brown dorsally.

#### **Variation**

Head widths of males vary from 2.4-2.7 mm.

#### **Remarks**

The sexes were associated on the basis of morphological similarity and have been collected together at the same flowers.

### Etymology

The specific epithet is Latin meaning 'with a snout'.

### Distribution

Known only from the type locality in southern Western Australia.

### Specimens Examined

The holotype and the following paratypes. **Western Australia:** 14♂, 5♀, same data as holotype, on flowers and foliage of *Eremophila pantonii* (10♂, 4♀), *E. longifolia* (1♂, 1♀) and *Scaevola spinescens* (3♂). (WAM 89 346-64). ANIC, UQIC, WAM.

### Genus *Trichocolletes* Cockerell

By far the majority of species in this moderately large genus are oligoleges of Fabaceae. A few appear to specialize in flowers of other families but the two species described here are the only ones known to utilize flowers of Myoporaceae (*Eremophila* in particular).

The two species are closely related and may be distinguished from their congeners as follows: females with mid tibial spur stout, strongly curved and serrate or pectinate only along the middle section (Figure 10 e, f); proboscis relatively elongate, prementum length (PML) at least 3.5 x eye length (Figure 10 a).

### *Trichocolletes (Trichocolletes) eremophilae* sp. nov.

Figures 10 c, e, g; 11 a-c

#### Holotype

In WAM (89 328), ♂, East Yuna Reserve, 34 km WNW of Mullewa, Western Australia, 28-29 August 1984, T.F. Houston 601-9 & B.P. Hanich, on flowers of *Eremophila*.

#### Paratypes

3♀ in SAM; 1♂, 8♀ in WAM. See Specimens Examined.

#### Diagnosis

Readily distinguishable from *T. multipectinatus* as follows: male with fore basitarsus slender, unmodified; female with lower clypeus sparsely punctate and shining, metasomal segments 3-6 and preanal fimbria wholly black.

#### Male (holotype)

Head width 3.6 mm; body length *ca.* 13 mm.

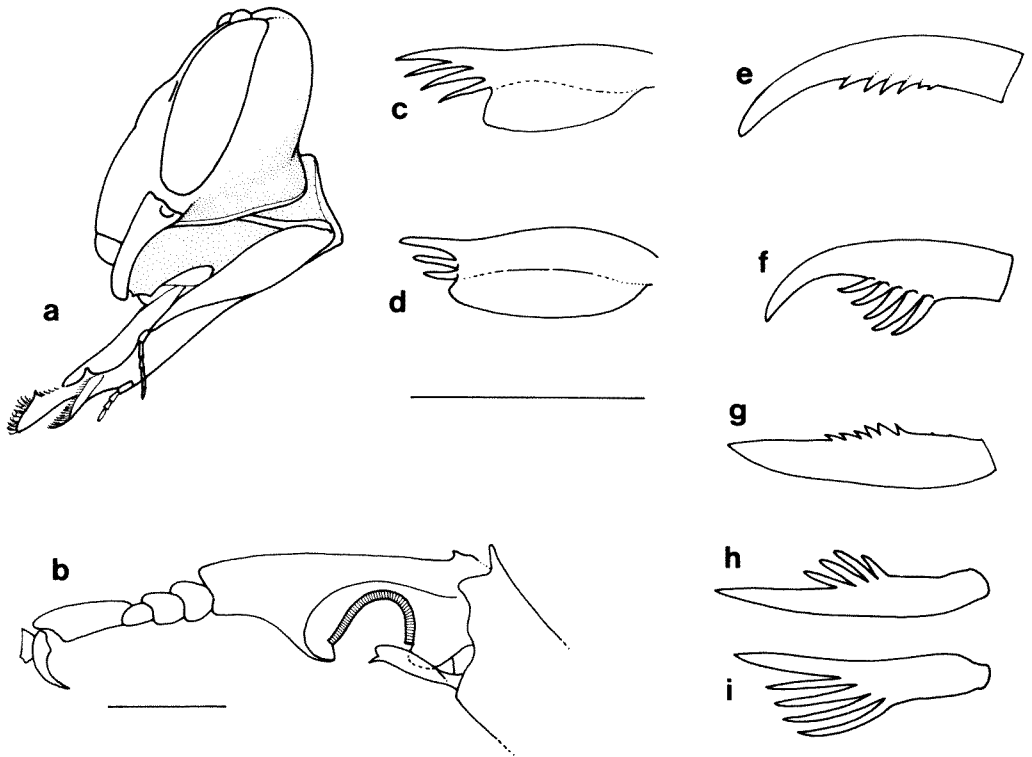
Relative dimensions: HW 50; HL 41; UID 33; UFW 36; LID 35; DMA 32; HVO 2; WOC 15; MOD 4; OOD 9; ML 21; BMW 5.5; MSL 1.5; SL 13; SW 4; FL *ca.* 64; PML 36; LPL 11; MPL 13; PGL 16.

Head rather quadrate in anterior view, inner orbits parallel; malar area about 1/3 as long as basal width of mandible; mandible straight, slender, bidentate; labrum 3/4 as long as wide, smooth and gently convex, fringe of bristles at least 1/2 as long as labrum; glossa extended well beyond prementum, deeply bifid; maxillary palpus slender, almost reaching apex of galea; labial palpus slender, slightly shorter than maxillary palpus; scape slender; flagellum longer than head width, first segment shortest, 1.4 x as long as wide, middle segments 1.5 x as long as wide, each bowed ventrally, terminal segment 2.5

x as long as wide with rounded-compressed apex; legs fairly ordinary, slender; hind tarsus (excluding claws) 1.26 x as long as hind tibia, basitarsus 5.5 x as long as maximum height, slightly curved; fore tibial calcar with a short apical spine with 2-3 teeth and a rounded velum.

Head and body mainly black; mandibles and labrum whitish basally grading into rusty brown distally (apices of mandibles dark red); hind margins of metasomal terga 1-5 silvery white. The following are yellow-brown: scapes wholly, flagella ventrally, legs (except coxae and blackish patches on dorsal edges of mid and hind tibiae) and 7th metasomal tergum.

Integument of head and body minutely reticulated, dull, with a slight satiny sheen (most pronounced on hind margins of metasomal terga); puncturing weak or absent on head and thorax, on metasoma weak and sparse anteriorly becoming more distinct posteriorly (absent on tergal margins).



**Figure 10** *Trichocolletes* spp.: (a) head and proboscis (pubescence omitted) of female of *T. multipectinatus*, left lateral view; (b) fore tarsus of *T. multipectinatus* male, inner view (pubescence omitted); (c, d) fore tibial, (e, f) mid tibial and (g, h) outer hind tibial spurs of *T. eremophilae* and *T. multipectinatus* females, respectively; (i) inner hind tibial spur of *T. multipectinatus* female. Figures c-i to same scale. Scale lines 0.5 mm.

Head, thorax, propodeum and base of metasoma with abundant, long pubescence, that of face very dense, obscuring integument, silvery-buff tinged with rufous; pubescence of clypeus very erect, of even length, appearing cropped; pubescence of genae and thorax paler, that of propodeum and base of metasoma white, sparser, not obscuring integument; legs only sparsely white-haired; metasomal terga 3-7 with sparse, short, simple, brownish setae; metasomal sterna without conspicuous hair fringes.

*Female* (paratype WAM 89/333)

Head width 3.85 mm; body length *ca.* 12 mm.

Relative dimensions: HW 50; HL 41; UID 30; UFW 35; LID 34; DMA 31; HVO 2; WOC 14; MOD 4; OOD 8; IAD 7.5; ASD 4; AOD 9.5; ML 22; BMW 7; MSL 1.5; SL 15; SW 3; PML 33; PGL 15; MPL 12; LPL *ca.* 10.

Inner orbits more or less parallel; face narrowest at level of ocelli; interantennal-supraclypeal area convex; clypeus transversely convex in lower part, slightly depressed medially in upper part; clypeo-antennal distance 1.3 as long as maximum length of clypeus; malar space about 1/5 as long as basal width of mandible; mandible gently curved, bidentate; labrum smoothly convex, length about 0.7 x width, fringing bristles almost as long as labrum; gena less than half as wide as compound eye viewed laterally but sweeping backwards medially to encompass enlarged proboscoidal fossa (as in *multipectinatus*, Figure 10 a); first segment of flagellum 1.2 x as long as wide, tapering proximally; glossa deeply bifid; fore tibial calcar with stout apical spine bearing three long, slender teeth (Figure 10 c); mid tibial spur short, stout, strongly curved, bearing about four serrations at mid length (Figure 10 e); inner hind tibial spur very thick proximally, with six long teeth at mid length; outer hind tibial spur almost simple, a few short serrations along one edge (Figure 10 g); hind basitarsus 3 x as long as high. Integument predominantly black; narrow hind margins of metasomal terga 1 and 2 silvery white, of 3 and 4 translucent but not silvery white; mandibles cream proximally, grading through orange-brown to dark red distally; labrum dark brown, paler basally; flagellum yellow-brown ventrally.

Face, vertex and upper genae with sparse, long, sooty-brown, simple to slightly plumose setae; ventral margin of clypeus fringed with gold-brown setae; genae, entire thorax, propodeum, first two metasomal segments and legs proximal to tibiae with abundant white plumose setae, long on ventral and lateral areas and first tergum of metasoma, moderately short on dorsum of thorax and very short on second tergum and lateral margins of third, obscuring underlying integument only around pronotal tubercles and tegulae; third and fourth terga with adpressed, simple, short, dark brown setae; fifth and sixth terga with dense, dark brown, plumose setae; setae of mid and hind tibiae and tarsi mostly white but sooty brown on outer edges of tibiae; metasomal sterna with mostly white simple setae, fringed on hind margins with longer plumose setae.

Lower face weakly shining with uneven, dense to open puncturing; clypeus glossy between punctures; frons and vertex dull, finely punctured; facial foveae undefined but evident as broad matt areas between compound eyes and ocelli; thorax coriarius, with small punctures, close to dense on anterior and lateral areas of scutum, open on

mesopleura, very sparse on posteromedial area of scutum; metasomal terga dull, finely punctured, puncturing open on terga 1 and 2, gradually becoming denser on 3 and 4.

#### Variation

Number of teeth or serrations on tibial spurs of females varies from 3-5 (fore), 4-8 (mid) and 5-8 (inner hind). Head widths of females vary from 3.6-3.9 mm.

#### Remarks

The sexes were associated on the basis of coincident collection records.

#### Etymology

The specific epithet is derived from the generic name of the forage plants.

#### Distribution

Southern Western Australia between Geraldton, Meekatharra and Kalgoorlie.

#### Specimens Examined

The holotype and the following paratypes. **Western Australia:** 1♂, same data as holotype, WAM (89/329); 1♀, 8 miles NNE of Meekatharra, 30 Aug. 1971, TFH, on white *Eremophila*, (1♀, same data but 6 miles E, 31 Aug., 1♀, 13 miles E, 31 Aug., on blue *Eremophila*), SAM; 1♀, 18 km WSW of Mulline, 29°51'S, 120°20'E, 23 Sept. 1982, BPH & TFH, on flowers of *Eremophila granitica*, WAM (89/334); 6♀, 7 km W of Nalbarra HS (28°39'S, 117°36'E), 29-30 Aug. 1981, TFH, on flowers of *Eremophila* affin. *georgei*, WAM (87/1463-4, 89/330-3).

### *Trichocolletes (Trichocolletes) multiplectinatus* sp. nov.

Figures 10 a, b, d, f, h, i; 11 d-f

#### Holotype

In WAM (87/1459), ♂, Meleya Well (28°58'S, 117°12'E), Thundelarra Station, Western Australia, 28 Aug.-2 Sept. 1981, T.F. Houston 388c-9, on flowers of *Eremophila pantonii*.

#### Paratypes

7♂, 5♀ in WAM; 2♂, 5♀ in SAM. See Specimens Examined.

#### Diagnosis

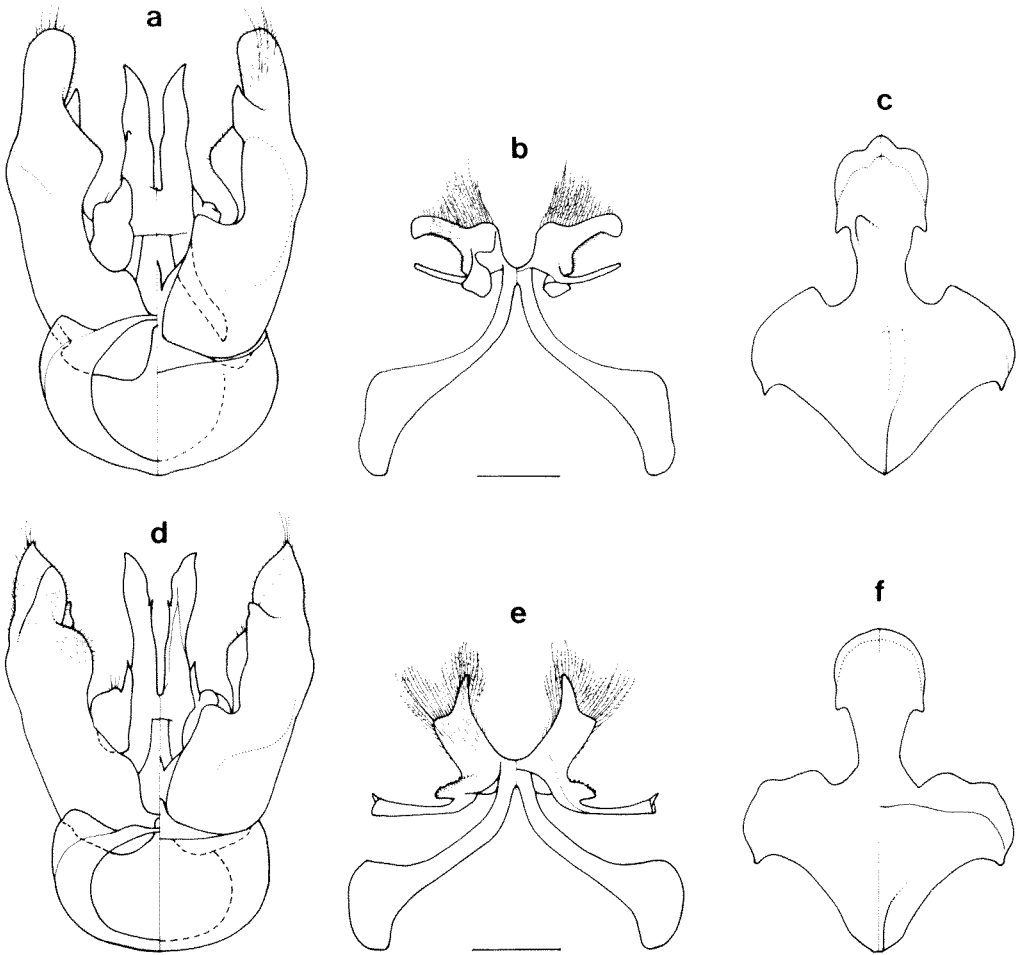
Readily distinguishable from *T. eremophilae* as follows: male with fore basitarsus expanded ventrally, notch of strigilis much enlarged (Figure 10 b); female with whole clypeus finely, densely punctate and dull, and preanal fimbria orange or mostly so.

#### Male (holotype)

Head width 3.45 mm; body length ca. 12 mm.

Relative dimensions: HW 50; HL 44; UID 32; UFW 37; LID 36; DMA 34; HVO 2.5; WOC 9; MOD 4; OOD 9; ML 22; BMW 5.5; SL 13; SW 4; FL ca. 62; PML 38; LPL ca. 10; MPL 10; PGL 17.

Form much as in male of *eremophilae* except as noted in Diagnosis and with the following additional differences: inner orbits very slightly diverging downwards, face narrowest at level of ocelli; maxillary palpus somewhat reduced, no longer than labial palpus and only about 0.6 x as long as post-palpal portion of galea; fore tibial calcar with minute, erect apical spine without any teeth (Figure 10 b).



**Figure 11** *Trichocolletes* spp. male terminalia (left to right - genital capsule, 7th and 8th metasomal sterna; dorsal views on right halves, ventral on left): (a-c) *T. eremophilae*, (d-f) *T. multipectinatus*. Scale lines 0.5 mm.

Coloration as in male of *eremophilae* except as follows: areas of yellow-brown less extensive, scapes partly black suffused, legs predominantly black, with yellow-brown areas confined to anterior surfaces of femora and tibiae, 7th metasomal tergum with only a median yellow-brown spot.

Integumental sculpture much as in male of *eremophilae* but vertex faintly shiny.

Pubescence as in male of *eremophilae* except as follows: pubescence of head and thorax pale buff without a rufous tint; sparse, long, erect setae occur on all metasomal terga except 7th, setae white grading to brown on more apical terga.

Terminalia: see Figure 11 d-f.

*Female* (paratype WAM 87/1461)

Head width 3.75 mm; body length *ca.* 12 mm.

Relative dimensions: HW 50; HL 44; UID 30; UFW -; LID -; DMA 32; MOD 3.5; WOC 14; OOD 8; HVO 2.5; IAD 8; ASD 3.5; AOD 10; ML 24; BMW 6.5; SL 16; SW 3; FL *ca.* 34; PML 35; LPL 8; MPL 8.75; PGL 15.

Similar to female of *T. eremophilae* except as follows.

Inner orbits slightly diverging downwards; upper clypeus fairly flat; malar space about  $\frac{1}{4}$  as long as basal width of mandible; gena in upper part about  $\frac{3}{4}$  as wide as compound eye viewed laterally; first segment of flagellum *ca.* 1.5 x as long as wide; glossa appearing bilobed because of extended glossal lobes but ventral margin of annulate surface only gently concave; maxillary palpus reduced, *ca.* 0.6 x as long as post-palpal portion of galea; labial palpus reduced, not reaching annulate area of glossa; fore tibial calcar with apical spine little larger than two auxillary teeth (Figure 10 d); mid tibial spur with short, comb-like set of stout teeth (Figure 10 f); inner hind tibial spur with four or five long prongs, outer spur with similar but shorter set of prongs (Figure 10 h).

Lower face dull; clypeus evenly, densely, finely punctate, coriarius between punctures; scutum centrally virtually impunctate, coriarius.

Sooty brown setae of face erect, up to 0.6 x as long as scape; ventral margin of clypeus without golden setae; scutum with diffuse patch of sooty-tipped setae centrally; 5th metasomal tergum with dense, orange, plumose setae except laterally and basally where setae are black-brown.

**Variation**

Head width varies from 3.15-3.65 mm in males and 3.25-3.75 mm in females. Number of teeth on tibial spurs of females varies a little, inner hind tibial spur having 3-5. Mid tibial spur of some females quite swollen opposite teeth. Females from South Australia differ from typical form in having hind margins of metasomal terga 3 and 4 silvery white (like 1 and 2) with mostly pale adpressed setae and preanal fimbria wholly orange.

**Remarks**

The sexes were associated on the basis of coincident collection records.

**Etymology**

The specific epithet is Latin meaning 'many combs' and alludes to the pectinate tibial spurs of females.

**Distribution**

Southern Western Australia (Mt Magnet - Kalgoorlie region) and northern Eyre Peninsula, South Australia.

**Specimens Examined**

The holotype and the following paratypes. **Western Australia:** 5♂, 1♀, same data as holotype, WAM (87/1460-1; 89/336-9); 2♂, 1♀, 4.5 km NNE of Mt Jackson (30°59'S, 119°07'E), 5-11 Sept. 1979, TFH *et al.*, on flowers of *Eremophila scoparia*, WAM (87/1462, 89/340-1); 3♀, 18 km WSW of Mulline, 29°51'S, 120°20'E, 23 Sept. 1982, BPH & TFH, on flowers of *Eremophila pantonii*, WAM (89/342-4). **South Australia:** 1♀, Lake Gilles National Park, 27 Oct. 1974, C.A. & TFH, on flowers of *Eremophila scoparia*, SAM; 2♂, 5♀, North Middleback Range, 33°03'S, 137°09'E, 7-8 Oct. 1973, C.A. & TFH, on *Eremophila scoparia*, SAM.

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