



Some new species in the bee genus *Leioproctus* Smith (Hymenoptera: Colletidae: Neopasiphaeinae)

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Abstract

Twelve new species in the genus *Leioproctus* are described: *L. sicatus*, *L. gagateus*, *L. chaetosus*, *L. ammophilus*, *L. gelasinatus*, *L. nudiventris*, *L. castaneigaster*, *L. coracinus*, *L. platyceratus*, *L. tritus*, *L. autumnalis* and *L. exilicrinitus*. Five of the new species have males with the apex of the eighth metasomal sternum broad as in males of *L. (Exleycolletes)* and *L. (Goniocolletes)*. Two other species show evidence of possible floral preference for the nectarless flowers of *Isopogon*. The male of *L. fallax*, described here for the first time, has a seventh metasomal sternum that is the least elaborate in the subgenus *L. (Protomorpha)*.

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Introduction

Although there has been significant progress in clarifying relationships within the Australasian bee genus *Leioproctus* Smith, 1853 (Maynard, 2013; Almeida *et al.*, 2019), the nominate subgenus, *Leioproctus* s. str., remains a mixture of morphologically similar groups with intergrading and overlapping characters. In addition, there are species with distinctive features but no immediately apparent close relatives (Packer, 2006; Batley & Popic, 2016; Batley & Houston, 2023). One particular difficulty is that many species are morphologically similar apart from the male terminalia. For example, intraspecific variation or poor specimen condition can make identification difficult for species within the *spatulatus* group proposed by Maynard (2013) unless male terminalia can be examined. Molecular phylogenetics may provide valuable additional information, but

descriptions of the many unnamed species will also be required before we understand how best to classify the group.

Maynard (2013) proposed species groups within *L. (Leioproctus)* based largely on the nature of the propodeal triangle: whether or not it is almost vertical; whether it is carinate and whether the subhorizontal part is striate. Recognising that the addition of other characters was desirable a group of 25 species, many with an almost vertical propodeal triangle, were left as unplaced within the subgenus.

Several new *Leioproctus* from eastern and central Australia are described in order to illustrate the importance of male terminalia in identifying new species and to draw attention to possible new groupings within the genus.

Methods

The newly described species were selected from relatively recent acquisitions by the Australian Museum for which morphological or behavioural characteristics suggested new or expanded groupings within *Leioproctus* might emerge with the assistance of molecular evidence. Specimens of the new species were compared with all named species in *Leioproctus* using original descriptions, images in the data portals of the National History Museum, London and the Australian National Insect Collection and, when required, inspection of holotypes. Male terminalia can be particularly useful for identification and were extracted for examination.

No attempt has been made to produce an identification key for the new species because the range of divergent characters involved and the need for clarification the status of the subgenera *L. (Exleycolletes)* and *L. (Goniocolletes)* will require considerable additional work. The reference groups for diagnoses are the subgenera as defined by Maynard (2013) in which the new species is placed. *Leioproctus* are Australian short-tongued bees, usually hairy, the mandible of females is bidentate, the apex of the marginal cell of the forewing is bent away from wing margin, and the stigma is moderately wide. Females usually have conspicuous pre-pygidial fimbria and the scopae are on the hind tibiae and femora and often beneath the metasoma. *Leioproctus (Leioproctus)* females do not have impressed facial foveae, their scape reaches the median ocellus. Males have a long flagellum, and their facial hair is not appressed.

The morphological terminology used follows that of Michener & Fraser (1978), Michener (2007) and Harris (1979), including interchangeable use of the words hair and seta. The term reticulation is used to describe the microsculpture of the integument as described previously (Houston, 1975; Batley, 2025). The term propodeal triangle is synonymous the term metapostnotum (Brothers, 1976). Abbreviations used for measurements are as follows: CL length of clypeus; FL flagellar length; HL head length; HW head width; LFW lower face width; SL scape length; UFW upper face width (maximum width of face above antennae). Hair lengths are measured relative to the median ocellar diameter, MOD and density of punctures is indicated by the ratio of the interspaces, *i*, to the diameter of the puncture, *d*. The malar space is obsolete in all the newly described species. Metasomal terga are referred to as T1, T2 etc. and sterna as S1, S2 etc.

The following acronyms have been used in this paper: AM Australian Museum (Sydney, New South Wales), NSW New South Wales, NT Northern Territory, QLD Queensland. Unique identifiers for specimens, where given, refer to entries in the Australian Museum database.

Discussion

The three new species placed in *Exleycolletes* share many features in common with others in the subgenus. The basal area of the propodeal triangle is longer than the metanotum and is transversely striate, hair of the hind tibial scopa of females is mostly pectinate, males have apical hair fringes on S4 & S5 plus a tuft of erect hair on S6, and the male terminalia include S8 with a broad median process and a genital capsule with a sclerotised ridge on the penis valves (Maynard, 2013).

Seven of the eight new species placed in *Leioproctus s. str.* would key to Maynard's *spatulatus* species group, except that the male terminalia do not fit the final criterion and differ significantly between species. Further evidence for the relationship between them will be needed before further classification is attempted. It should be noted that females of four of the species have white metasomal hair bands of various degrees of completeness. Although Maynard's diagnosis for *Leioproctus (Leioproctus)* seeks to separate the subgenus from subgenera like *L. (Protomorpha)* and *L. (Zosterocolletes)* there are other named species with hair bands, such as *L. albovittatus* (Cockerell, 1929) and *L. alienus* (Smith, 1853) that would otherwise be placed in the nominated subgenus and hence Maynard's (2013) diagnosis for *Leioproctus (Leioproctus)* should be modified to allow for this possibility.

The three species *L. castaneigaster*, *L. coracinus* and *L. platyceratus* have different unusual characteristics. In *L. castaneigaster* the male S8 is without a posterior projection, in *L. coracinus* the female inner hind tibial spur has numerous teeth of variable length, but most are very short and in the male *L. platyceratus* the basal segment of the labial palpus is broad and flattened. There is no immediately obvious explanation for the origin of these features.

The final three species are not morphologically unusual, but differ from most *Leioproctus* in their active period or floral preference. On present evidence, *L. autumnalis* is active only in autumn, while most *Leioproctus* species appear earlier in the year. Bees with similar activity periods are those in the subgenus *L. (Cladocerapis)* that visit *Persoonia* flowers blooming in late summer/autumn in eastern Australia (Maynard, 1992, Weston, 1995). The male terminalia of *L. autumnalis* closely resemble those of some *L. (Cladocerapis)* species and the possibility that there is a close relationship warrants further investigation.

Females of *L. exilicrinus*, *L. tritus* and *L. (Protomorpha) fallax* all show a degree of preference for visiting nectarless flowers. Numerous females of the first two were observed visiting *Isopogon anemonifolia* but males of neither species were seen on that plant. This may indicate that the sexes interact at other, nectariferous, flowers. Male and female *L. tritus* were found together at *Boronia* and *Grevillea*, but *L. exilicrinus* males were

found in numbers at nectiferous flowers (*Mitrasacme*, *Poranthera*) with females appearing only rarely at those flowers.

From preliminary observations it appears that the sexes of *L. fallax* interact at the nectarless flowers (Tucker & Bernhardt, 2000) of *Hibbertia* species. Females were observed collecting pollen and males were seen both attempting to mate with the females and patrolling any flowering *Hibbertia* in the vicinity.

Taxonomy

Leioproctus (Exleycolletes) sicatus sp. nov.

Fig. 1

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Holotype: ♂, Ledknapper NR, NSW, 29.2852°S 146.3103°E, 26 Aug 2019, ex *Seringia nephrosperma* F.Muell., M. Batley, AM K.581038.

Paratypes: ♂ ♀, Ledknapper NR, 29.2852°S 146.3103°E, 26 Aug 2019, ex *Seringia nephrosperma* F.Muell. (♂) & *Calytrix longiflora* (F.Muell.) Benth. (♀), M. Batley, AM K.581037, 39.

Diagnosis. Black with with strong punctures and polished interspaces on the head and mesosoma, jugal lobe of hind wing reaching cu-v, propodeal triangle with a transversely rugose, sloping basal area, hair of hind tibial scopa of female pectinate, thus meeting the criteria for *L. (Exleycolletes)*. Both sexes without dense, pale hair on scutellum or anterior corners of scutum. Female with incomplete white hair bands on T2–T4 hence keying (Batley, 2023) to *L. pusillus* (Cockerell, 1929) but ca 11 mm long (ca 8 mm in *pusillus*) and with opaque apical margins of metasomal terga (translucent in *pusillus*). Male with an erect tuft of curly, yellow brown hair unlike any species in the Batley key and the only other species with the posterior lobes of S7 extended strongly towards the front of the body are *L. gagateus* sp. nov. and *L. chaetosus* sp. nov. Both sexes differ from *L. chaetosus* in which the tergal margins are translucent with a brown tint.

Description of male (holotype). Body length 9.7 mm, head width 3.0 mm. Relative head dimensions: HW 100; HL 80; UID 62; LID 49; SL 24; FL 70; CL 28.

Structure. Clypeus prominent, transversely convex, longitudinally weakly convex; frontal carina almost reaches medial ocellus; facial fovea not impressed; ocelloccipital area weakly depressed; flagellomeres other than the first three longer than wide; mandible with long apical tooth (length of pollex 70% of length of rutellum); length metanotum 0.4 times length scutellum; metanotum with weak, rounded medial tubercle; claws cleft; fore wing with three submarginal cells, second cell receiving first recurrent vein well before middle; stigma broad, $\frac{2}{3}$ as long as costal margin of marginal cell; apex of margin-

al cell well removed from costa; jugal lobe of hind wing, reaching slightly beyond cu-v, marginal areas of metasomal terga wide, depressed laterally, male S7 as in Fig. 1H.

Colouration. Black except inner face of fore tibia orange-brown medially; claws and mandible preapically amber; mandible dark red apically; tegula dark brown.

Pubescence. Hair on clypeus, paraocular areas and lower frons, dense, white plumose, 2×MOD, adpressed on clypeus and in paraocular areas, semi-erect on frons; gena with open, erect, similar hair; scutum and scutellum with sparse, fine, pale, weakly-branched hair mostly in peripheral areas, extreme margins of scutellum and metanotum with white, finely-branched hair 2×MOD; mesepisternum and venter with sparse similar hair; fore trochanter and fore femur with close plumose minutely-branched white hair 3–4×MOD with shorter hair on other trochanters; hind femur and hind basitibia with long white fringes of minutely-branched hair 2–3×MOD along anterior edges; metasomal terga with open cover of erect, simple, white hair 0.2–0.5×MOD with weak, but distinct bands of adpressed, minutely-branched, white hair, 0.5×MOD, bands complete on T3, T4, interrupted medially on T1, T2; T5 & T6 with open, brown hair bands; hair on metasomal sterna sparse apart from apical fringes, white, open to close interrupted medially on S2 & S3, dense, yellow-brown on S4; S6 with dense, yellow-brown tuft of erect, curly hair.

Sculpture. Integument polished apart from weak reticulation on metasomal sterna and weak reticulation and irregular transverse rugae basally on propodeal triangle. Punctures on clypeus, supraclypeal area and frons strong, small i<d; scutum and scutellum with similar punctures i=1–2d medially, i<d peripherally; metasomal terga with strong, small punctures i≈d on disc, i<d in marginal areas.

Description of female (K.581037). Body length 11.5 mm, head width 3.5 mm. Relative head dimensions: HW 100; HL 81; UID 64; LID 54; SL 28; FL 62; CL 32.

Structure. As for male except flagellum shorter, inner hind tibial spur with 6 strong, widely spaced teeth slightly more than twice as long as width of spur, pygidial plate flat, truncate, finely rugulose.

Colouration. As for male except flagellum ventrally dark brown, pygidial plate dull red-brown.

Pubescence. As for male except hair on clypeus sparse, fine, almost simple, scutum with open, tightly-branched, white hair 0.5×MOD, hair of apical tergal bands ca 1×MOD, prepygidial fimbria dark brown; hair of hind tibial scopa close, anterior half white, bipectinate, posterior half brown, pectinate; hind femoral scopa white, plumose; metasomal S2–S5 with subapical rows of semi-erect, white hair 1.5–2×MOD, mostly simple but laterally with some branching, S5 with dense apical fringe of pale

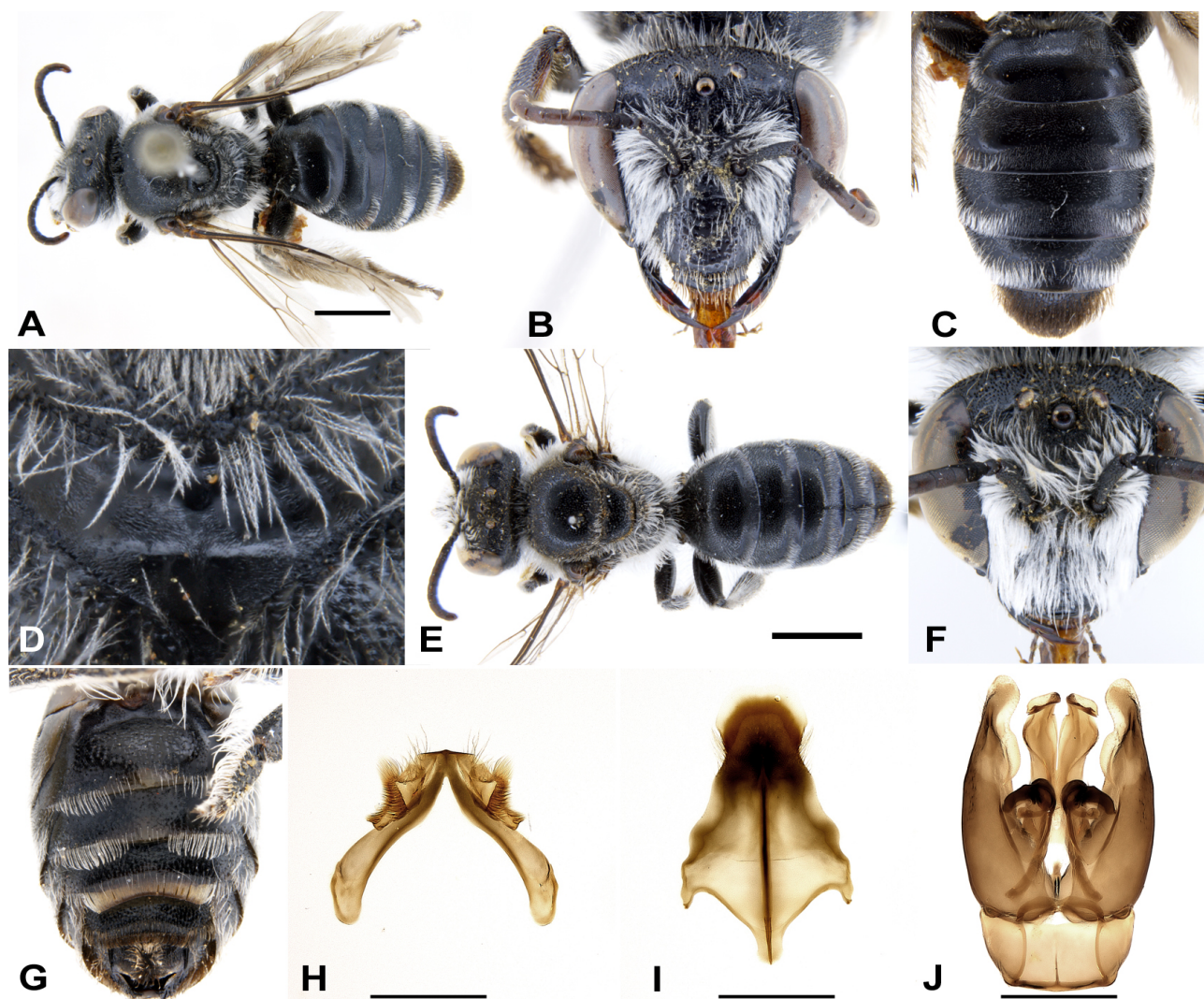


Figure 1. *Leioproctus (Exleycolletes) sicatus*, ♀: A, dorsal view; B, face; C, metasoma; D, propodeal triangle. ♂: E, dorsal view; F, face; G, fringes on metasomal sterna; H, metasomal S7 ventral view; I, S8 ventral view; J, genitalia ventral view. Scale bars: A, E 2 mm; H–J 500 μ m.

brown, plumose hair, 1 $\times$ MOD, S6 with similar adpressed hair either side of bare medial line.

Sculpture. As for male except clypeal punctures less dense, i=1–2d, punctures on metasomal terga pre-marginally less dense.

Etymology. The specific name is a Latin adjective meaning with a dagger, referring to the long apical tooth of the mandible.

Leioproctus (Exleycolletes) gagateus sp. nov.

Fig. 2

urn:lsid:zoobank.org:act:F7C9F70D-84CE-4544-AF80-735B7BD112E9

Holotype: ♀ 41 Mile Bore, Barkly Highway, NT, 19.320°S 134.851°E, 10 Jul 1989, N.W. Rodd, AM K.291014.

Paratype: ♂ Kunnamuka Swamp, Simpson Desert, 23.3548°S 138.2298°E, 11 Nov 2007, ex *Crotalaria cunninghamia* R.BR., T.J. Popic, AM K.396047.

Diagnosis. Black with with strong punctures and polished interspaces on the head and mesosoma, jugal lobe of hind wing reaching cu-v, propodeal triangle with a transversely rugose, sloping basal area, hair of hind tibial scopa of female pectinate, thus meeting the criteria for inclusion in *L. (Exleycolletes)*. Female keys to *L. tuberculatus* (Cockerell, 1913) in Batley, 2023 but differs in the absence of any white hair in the hind tibial scopa. Male keys to *L. leai* (Cockerell, 1913) but lacks any yellow or dark orange hair on the anterior corners of the scutum. The absence of pale hair from the mesosoma or metasoma is unlike any other known *L. (Exleycolletes)* species.

Description of male (holotype). Head width 2.7 mm; body length 9.0 mm. Relative head dimensions: HW 100; HL 82; UFW 62; LFW 49; SL 28; FL 65; CL 28.

Structure. Clypeus and supraclypeal area prominent, transversely convex; frontal carina extends 0.7 of distance to median ocellus, ocellular area flat; metanotum with a barely discernable broad tubercle; basal

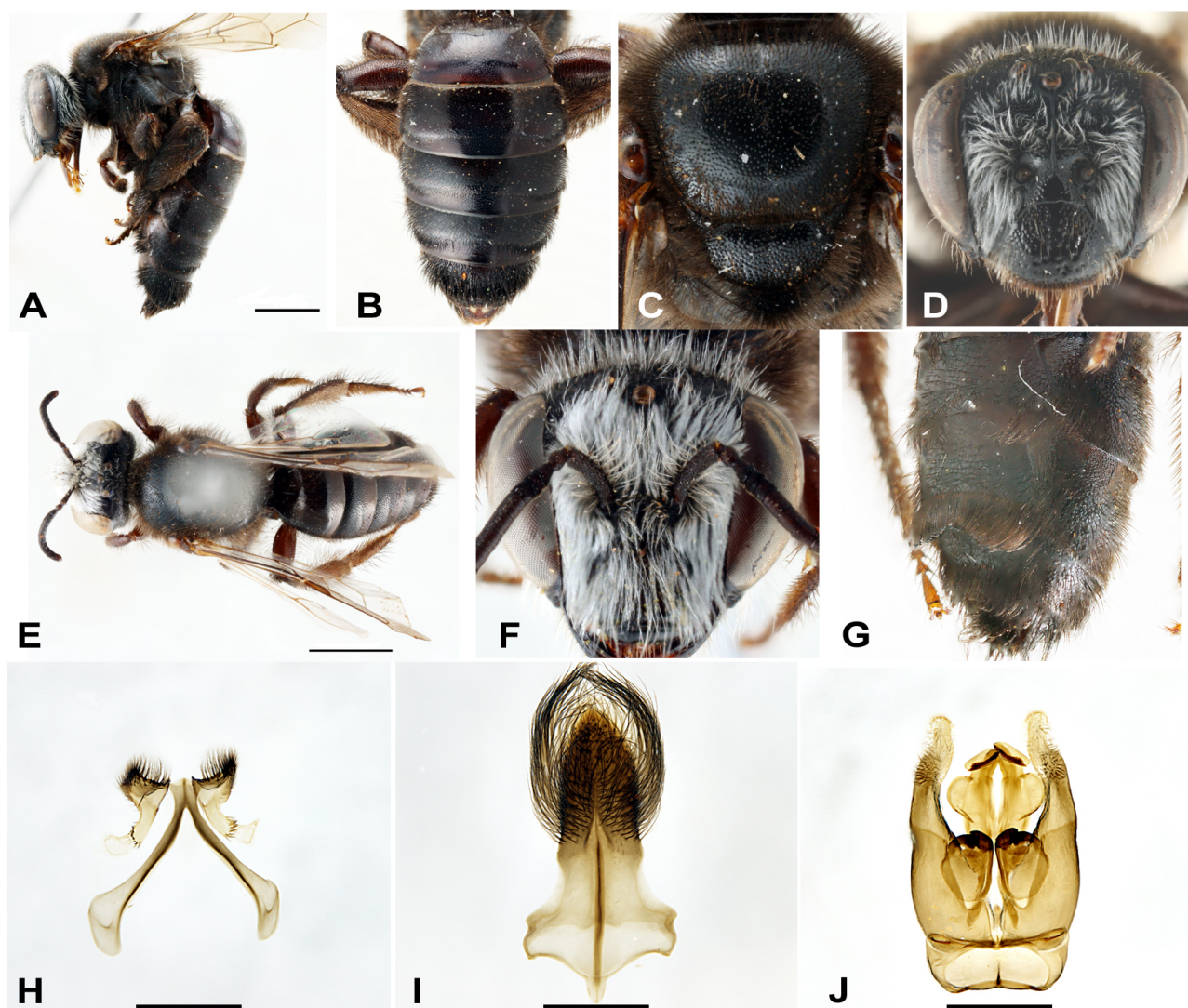


Figure 2. *Leioproctus* (*Exleycolletes*) *gagateus*, ♀: A, lateral view; B, metasoma; C, scutum; D, face. ♂: E, dorsal view; F, face; G, metasomal stern S3–S6; H, metasomal S7 ventral view; I, S8 ventral view; J, genitalia ventral view. Scale bars: A, E 2 mm; H–J 500 μ m.

half of propodeal triangle sloping gently then curving smoothly to the vertical half, both halves with fine transverse rugae, the marginal sulcus scrobiculate for most of its length; claws cleft; second submarginal cell of forewing receiving first recurrent slightly before middle, jugal lobe of hind wing extending well beyond cu-v.

Colouration. Integument black except legs dark brown, tegula transparent with brown tint and metasomal tergal margin areas dark brown, claws yellow-brown.

Pubescence. Hair on head white, elsewhere black or dark brown. Hair on clypeus, paraocular areas and frons dense, white, plumose $3\times\text{MOD}$, weakly branched, open, white hair on lateral faces of supraclypeal area, scape, vertex and gena $3\times\text{MOD}$, longer on lower gena; scutum and scutellum with weakly branched, open, erect black to dark brown hair, $2\times\text{MOD}$, metanotum with similar, but longer hair, $4\times\text{MOD}$, mesosoma laterally and ventrally with plumose dark brown to black hair $3\times\text{MOD}$; metasomal terga with open to sparse, erect to semi-

adpressed, simple, dark hair, $0.5\text{--}1\times\text{MOD}$, metasomal sterna with black, open, weakly branched, apical fringes, interrupted medially, on S2, S3, a dense, black, apical fringe on S4, $4\times\text{MOD}$ laterally, shorter medially, a similar apical fringe, $3\times\text{MOD}$, on S5 and S6 with a dense tuft of erect, curly hair medially.

Sculpture. Integument polished, punctures strong, well-defined, small except on clypeus where punctures small basally becoming medium ventrally, $i < d$: elsewhere on head punctures small, $i < d$ except sparse in a small areas adjacent to the lateral ocelli; punctures of scutum and scutellum small, $i = 1\text{--}2d$; on metasomal terga $i \approx d$.

Description of female (paratype). Head width 3.4 mm; body length 11.9 mm. Relative head dimensions: HW 100; HL 87; UFW 65; LFW 56, CL 32.

Specimen shows signs of significant wear, with both antennae missing, wing tips frayed and end of pygidial plate very worn.

Structure. Clypeus transversely gently convex, with supraclypeal area raised above adjacent areas; frontal carina extends 0.65 of distance to median ocellus, ocellocular area flat; metanotum with broad rounded tubercle; basal half of propodeal triangle sloping gently, curving sharply but smoothly to the vertical half, both halves with strong transverse rugae; anterior half of marginal sulcus scrobiculate; claws cleft; second submarginal cell of forewing receiving first recurrent towards proximal end, jugal lobe of hind wing extends well beyond cu-v; inner hind tibial spur not visible.

Colouration. Integument mostly black with legs, tegulae and metasoma ventrally dark brown (flagellum missing). Pygidial plate dark brown with a pair of cream spots near the base.

Pubescence. Mostly black or dark brown except on face, where hair in paraocular areas and apicolateral corners of clypeus dense, white plumose, 1–2×MOD, sparse, simple on remainder of clypeus, on frons open, white, plumose, 0.5–2×MOD, on gena pale brown to white, weakly branched, ca 2×MOD; hair on scutum and scutellum brown, on metanotum medially erect, black, plumose, ca 1×MOD; mesosoma laterally and ventrally with dark brown, plumose hair, ca 3×MOD; hind tibial scopa dense, black, plumose on anterior margin, remainder pectinate with some dark brown on posterior margin; hind femoral scopa black, plumose; hair on metasomal terga sparse (worn?), but with remnants of black hair bands posteriolaterally on T2–T4; prepygidial fimbria black, metasomal sterna S3, S4 with apical rows of erect, simple, black hair, 2×MOD (S2 not visible), S5 with dense, plumose, black apical fringe, 2×MOD.

Sculpture. Integument polished, punctures strong, small except on clypeus, which has medium punctures, i<d, on basal half becoming small laterally, on apical half, i=1–3d; supraclypeal area almost impunctate medially; frons, paraocular areas, vertex and lateral faces of supraclypeal area with small punctures, i=0.5d; scutum and scutellum with small punctures, i=1–2d medially, i<d peripherally; metasomal terga with small punctures, i≈d, sparser in marginal areas.

Note. While the two collection sites are 560 km apart the size, colour and diagnostic features of both sexes are similar and the combination is unlike any other known species.

Etymology. The specific name is a Latin noun based on the Greek word for jet (lignite) and refers to the black colour of both sexes.

Leioproctus (Exleycolletes) chaetosus sp. nov.

Fig. 3

urn:lsid:zoobank.org:act:463D02C2-C567-4769-A39C-34EA6AF45A03

Holotype: ♂, 22 km S of Charleville, QLD, 26.5989°S 146.1900°E, 29 Aug 2009, ex *Calotis erinacea* Steetz, M. Batley, AM K.273345

Paratypes: 3♂ ♀, same data as holotype, K.273344, 46–48; 2♀ 33 km S of Charleville, 26.6861°S 146.1603°E, ex Asteraceae Bercht. & J.Presl, M. Batley, AM K.273376,77.

Diagnosis. Black with with strong punctures and polished interspaces on the head and mesosoma, jugal lobe of hind wing reaching cu-v, propodeal triangle with a transversely rugose, sloping basal area, hair of hind tibial scopa of female pectinate, thus meeting the criteria for inclusion in *L. (Exleycolletes)*. Both sexes without dense, pale hair on scutellum or anterior corners of scutum. Female with white metasomal hair bands so keys to *L. pusillus* in Batley, 2023, but has a polished, impunctate line down the middle of the clypeus (which is uniformly punctate in *pusillus*). Male keys to *L. leai* (Cockerell, 1913) in Batley, 2023 but, unlike males of that species, or any other species in *L. (Exleycolletes)*, has conspicuous tufts of hair protruding from S8 that are visible externally.

Description of male (holotype). Head width 2.8 mm; body length 9.3 mm. Relative head dimensions: HW 100; HL 78; UFW 67; LFW 50; SL 29; FL 86; CL 30.

Structure. Clypeus and supraclypeal area prominent, transversely convex, frontal carina extending 0.65 of distance to median ocellus, ocellocular area flat, flagellum crenulate; metanotum almost ½ as long as scutellum, basal half of propodeal triangle with weak transverse rugae, sloping gently before curving sharply but smoothly to the vertical half, peripheral sulcus narrow, scrobiculate for nearly all its length; claws cleft; second submarginal cell of forewing receiving first recurrent vein towards proximal end, jugal lobe of hind wing reaching well beyond cu-v; apical margins of metasomal terga somewhat depressed.

Colouration. Integument black except mandible apically dark red; flagellum, legs and sometimes parts of metasoma dark brown; marginal areas of metasomal terga translucent, brown on anterior half.

Pubescence. Facial hair dense, white, minutely branched, 2×MOD, adpressed in paraocular areas, close and adpressed on clypeus, open, erect on lower frons, scape and gena; similar erect, open hair is found on the margins of the scutum and scutellum, on lateral surfaces of mesosoma and on femora and hind tibia; metasomal T1 with open, erect, minutely-branched, white hair, 1×MOD, T2–T5 with similar open hair beneath the transparent margins of the preceding tergum, all terga with sparse, erect, almost simple setae, 1×MOD, metasomal sterna S2, S3 apically with weak, interrupted, pale fringes, S4, S5 with dense, black or dark brown fringes, 1.0–1.5×MOD, S6 with a dense, erect tuft of black hair medioapically.

Sculpture. Integument polished. Punctures strong, small, i<d on clypeus, supraclypeal and paraocular areas and vertex, i≈d on frons, i≈4d in ocellocular area, i=3–4d on scutum, i=1–2d on scutellum and i=0.5–1d on metasomal terga.

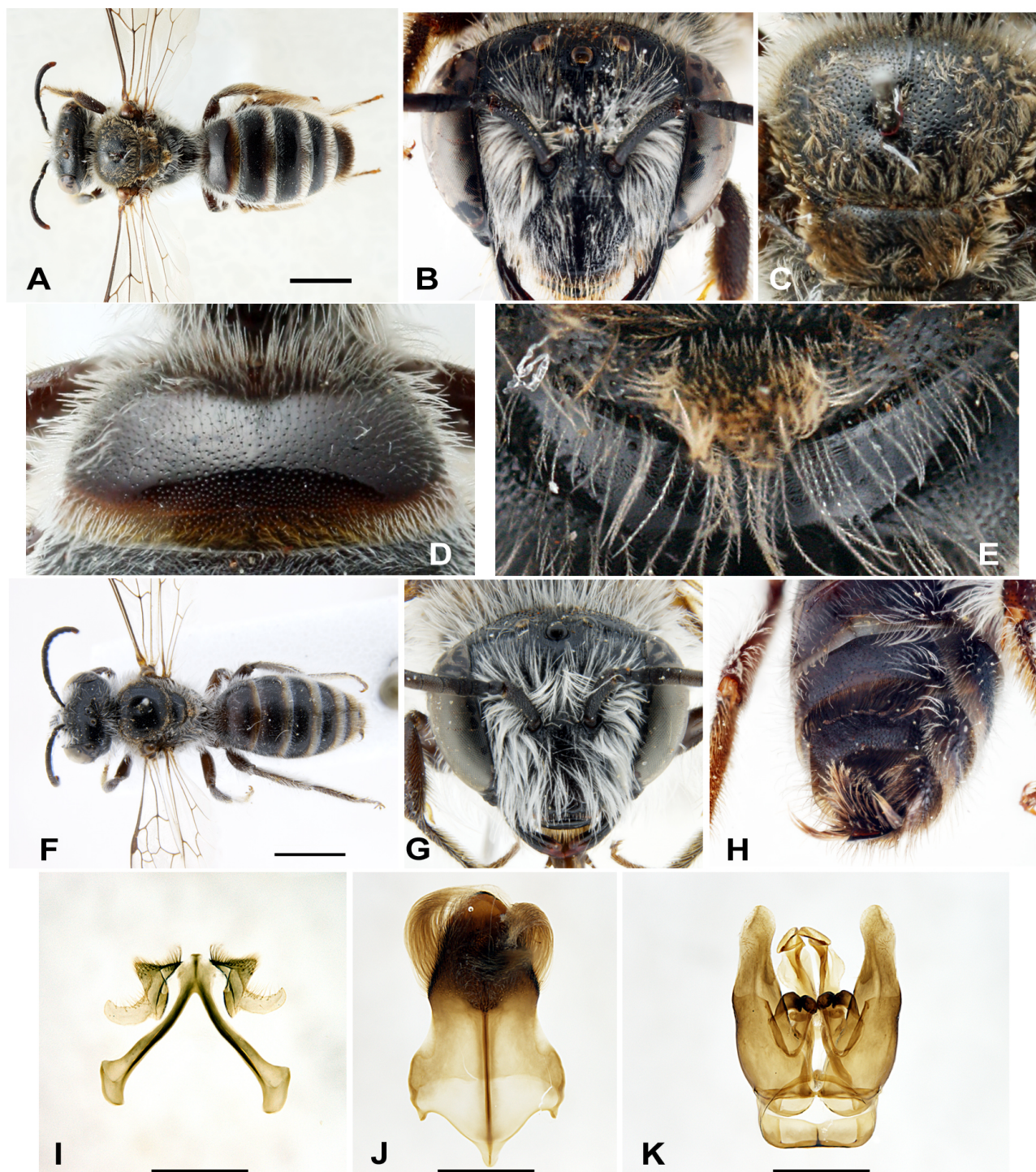


Figure 3. *Leioproctus (Exleycolletes) chaetosus*, ♀: A, dorsal view; B, face; C, scutum; D, metasomal T1; E, propodeal triangle. ♂: F, dorsal view; G, face; H, metasomal sterna S3–S6; I, metasomal S7 ventral view; J, S8 ventral view; K, genitalia ventral view. Scale bars: A, F 2 mm; I–K 500 μ m.

Description of female (K.273344). Head width 3.2 mm; body length 10.0 mm. Relative head dimensions: HW 100; HL 80; UFW 68; LFW 57; SL 30; FL 57; CL 30.

Colouration. As for male except apical half of mandible dark amber.

Structure. As for male except sculpture of propodeal triangle very weak and peripheral sulcus is scrobiculate only on anterior $\frac{1}{4}$, marginal areas of metasomal terga

only weakly depressed; pygidial plate apically truncate with irregular longitudinal striae; inner hind tibial spur with *ca* 8 strong teeth ~ 1.5 times as long as width of spur, claws with sharp medial tooth.

Pubescence. As for male except hair on head and mesosoma with longer branches, that on clypeus, lower frons and scape sparse, on scutum and scutellum pale brown rather than white, metasomal terga with dense, white, apical hair bands, widely interrupted medially on T1, T2,

briefly interrupted on T3 and complete on T4; prepygidial fimbria black, sternal hair sparse apart from open, white, apical fringes on S2–S3 and a dense golden-brown fringe on S5; hair of hind tibial scopa dense, plumose but stiffly branched, pale brown with a darker brown area extending from the basitibial plate, hind femoral scopa white, plumose.

Sculpture. As for male except clypeus with an impunctate medial line.

Other specimens examined. 2♀ 40km S of Charleville, 26.7500°S 146.1194°E, ex *Eremophila gilesi* F.Muell., M. Batley, K.273389,90; ♀, Hattah-Kulkyne NP, 34.7048°S 142.3356°E, 8 Nov 2015, ex *Eucalyptus* sp., M. Batley, AM K.516593; ♀, Hattah-Kulkyne NP, 34.7048°S 142.3356°E, 3 Oct 2019, ex *Calotis erinacea* F.Muell., M. Batley, AM K.581132.

Etymology. The specific name is a Latin adjective formed from a Greek word for long hair, and refers, to the tufts on S8 of the male, which are visible externally.

Leioproctus (Leioproctus) ammophilus sp. nov.

Figure 4.

urn:lsid:zoobank.org:act:77769022-A81C-454A-BBEB-E25B19E3C01D

Holotype: ♂, Hattah-Kulkyne NP, VIC, 34.7622°S 142.3100°E, 18 Sep 2011, ex *Aotus subspinescens* (Benth.) Crisp, M. Batley, AM K.361337.

Paratypes: 2♂, 2♀, 35 km SW of Pinnaroo, 35.5539°S 140.7614°E, 7 Oct 2003, ex *Dillwynia* sp., M. Batley, AM K.360946–9; ♂, Lake Hattah NP, 34.7620°S 142.3528°E, 18 Sep 2011, ex *Hibbertia* sp., M. Batley, AM K.361343.

Diagnosis. Medium sized, hairy, without impressed facial fovea, scapes reach median ocellus, subhorizontal basal area of propodeal triangle longer than metanotum, reticulate not striate, metasoma black with translucent brown tergal margins, terga sparsely punctate medially. Together these characters place the species in *Leioproctus* s. str. and exclude it from *L. (Exleycolletes)* as currently defined. In *L. (Leioproctus)* it keys to the *spatulatus* species group (Maynard, 2013) but the male genital capsule does not have a large tooth subapically on the inner lateral margin of the gonostylus, which is a defining characteristic of that group. The species, therefore, joins the 27 other species in *L. (Leioproctus)* that are unplaced (Maynard, 2013) and for which there is no useful key so that the new species must be compared individually with holotypes of the 27 species, aided by original descriptions. (The key included in Cockerell, 1934 predates Michener's 1965 overhaul of Australian bee genera and consequently can be confusing as well as outdated.) In both sexes of this species, the vertex extends only slightly above top of eyes, metasomal terga have open to sparse weak punctures and weakly shiny interspaces, apical margins are gently

depressed, the metanotum has a small, broad tubercle, the female has weak metasomal hair bands. Many of the 27 named species remaining unplaced can be eliminated on the basis of size, colour or hair pattern and the closest possibilities for this species are *L. cinereus* (Smith, 1853), which has a transversely striate basal area of the propodeal triangle and *L. sigillatus* (Cockerell, 1914) which has a more elevated vertex and does not have depressed tergal margins on T3 & T4.

Description of male (holotype). Head width 3.0 mm; body length 9.2 mm. Relative dimensions: HW 100; HL 78; UFW 62; LFW 61; SL 26; FL 70; CL 31.

Structure. Clypeus elevated, transversely strongly convex; frontal carina extends $\frac{2}{3}$ of distance to median ocellus; ocellocular area flat; facial fovea absent; first flagellar segment longer than next two; metanotum without a tubercle; basal half of propodeal triangle sloping gently before rounding smoothly onto apical half, peripheral sulcus scrobiculate; claws cleft; jugal lobe of hind wing reaching well beyond cu-v, second submarginal cell of forewing receives first recurrent vein near proximal end; marginal areas of metasomal terga slightly depressed.

Colouration. Head and mesosoma black except nine apical segments of flagellum dark brown ventrally, legs dark brown; metasomal terga black with marginal areas translucent brown, sterna dark brown.

Pubescence. Hair of lower paraocular areas and apicolateral corners of clypeus dense, adpressed, plumose, white 2×MOD, scape with similar hair open and erect, hair of vertex brown, erect, weakly branched and sparse; hair of scutum open to sparse, white, plumose <1×MOD; on gena and sides of mesosoma white, weakly plumose 2×MOD; on metasoma sparse except for dense white apical fringe, 1×MOD, on S4.

Sculpture. Integument polished with strong punctures except propodeal triangle shiny but reticulate with scattered irregular rugae. Punctures of clypeus large i<d; those of frons and paraocular areas strong, small to medium i<d, almost contiguous. Punctures on scutum and scutellum small i=1–4d, those on metasomal terga small i=2–4d.

Description of female (K.360949). Head width 3.1 mm; body length 9.8 mm. Relative dimensions: HW 100; HL 80; UFW 65; LFW 57; SL 30; FL 60; CL 30.

Structure. As for male except fovea very weakly impressed; metanotum with a weak, broad tubercle; claws with sharp basal inner tooth; inner hind tibial spur translucent brown with 5 strong teeth about twice as long as width of shaft; pygidial plate entire, apically rounded, colliculate except near edges.

Colouration. As for male with apical segment of flagellum dull brown and pygidial plate often reddish.

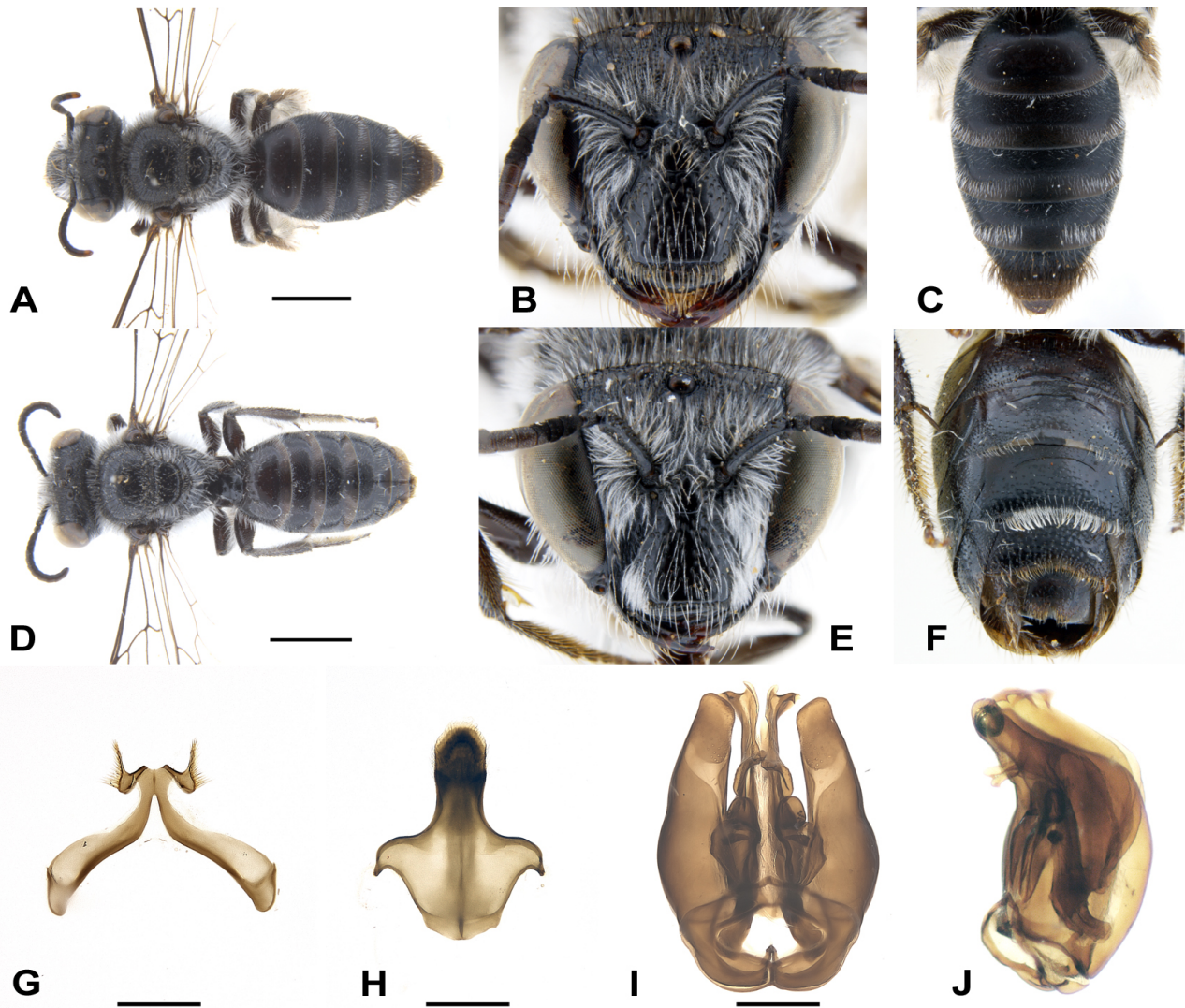


Figure 4. *Leioproctus (Leioproctus) ammophilus*, ♀: A, dorsal view; B, face; C, metasoma. ♂: D, dorsal view; E, face; F, fringes on metasomal sternum; G, metasomal S7 ventral view; H, S8 ventral view; I, genitalia ventral view; J genitalia lateral view. Scale bars: A, D 2 mm; G–J 500 µm.

Pubescence. Clypeal hair open, white, minutely-branched $2\times\text{MOD}$, on paraocular areas, lower frons and gena close, plumose, and dark brown, erect, weakly-branched $3\times\text{MOD}$; on scutum and scutellum medially hair is erect, plumose, dark brown $1.5\times\text{MOD}$, peripherally white $1-2\times\text{MOD}$; lateral surfaces of mesosoma with white, plumose hair $\text{ca } 3\times\text{MOD}$; hind tibial scopa open, white to mid-brown, pectinate with a few plumose setae on the anterior edge, hind femoral scopa white, plumose. Metasomal terga with sparse hair except for very weak white, medially interrupted apical hair bands on T2–4 and the dense black prepygidial fimbria; metasomal sterna S2–S5 with apical fringes of white, simple or weakly plumose hair $1\times\text{MOD}$, slightly denser on S5.

Sculpture. As for male except facial fovea indicated by a broad area near top of compound eye where punctures are weak or absent; punctures on metasomal terga small $\approx$ d basally, absent approaching marginal area and weak within marginal area.

Etymology. The specific name is from the Greek for sand lover referring to both the sandy soils of the collection sites and the presence of Dune Aotus flowers which were present at both locations.

Leioproctus (Leioproctus) gelasinatus sp. nov.

Fig. 5

urn:lsid:zoobank.org:act:45E4132E-6B62-4312-BB4D-E0C864E8A14B

Holotype: ♂, 24 km W of St George, QLD, 27.9838°S 148.3420°E, 7 Sep 2016, ex *Acacia burbridgeae* Pedley, M. Batley, AM K.516806.

Paratypes: ♂ ♀, same data as holotype, AM K.516805,07; ♂ ♀, 18 km SW of Ledknapper NR, 29.6787°S 146.0283°E, 11 Sep 2016, ex *Eremophila sturtii* R.Br., M. Batley, AM K.516935,6.

Diagnosis. Medium sized, body length 7–8 mm, hairy, subhorizontal basal area of propodeal triangle longer

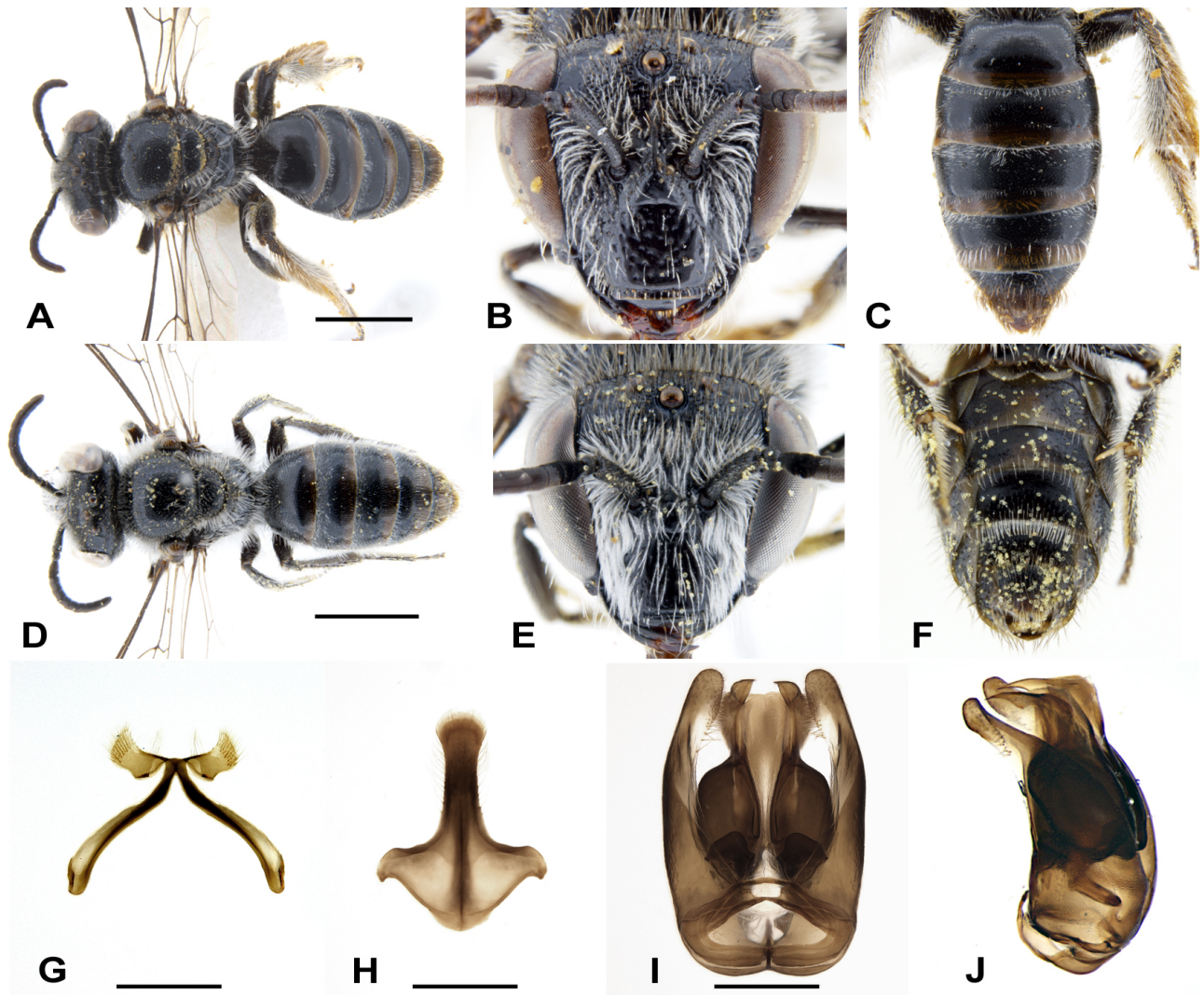


Figure 5. *Leioproctus (Leioproctus) gelasinatus*, ♀: A, dorsal view; B, face; C, metasoma dorsal view. ♂: D, dorsal view; E, face; F, metasomal ventral view; G, metasomal S7 ventral view; H, S8 ventral view; I, genitalia ventral view; J genitalia lateral view. Scale bars: A, D 2 mm; G–I 500 μ m.

than metanotum, reticulate not striate. The species keys to the *spatulatus* group of *L. (Leioproctus)* but is excluded from that group by the male terminalia. Vertex only slightly above top of eyes, metanotum with a small, broad tubercle, metasoma black, with translucent brown tergal margins, T1–T3 with some white hair basally but no significant apical hair bands, terga with small, open punctures and polished interspaces, apical tergal margins gently depressed. Similar to *ammophilus* sp. nov. but clypeus flattened medially not smoothly convex transversely.

Description of male (holotype). Head width 2.4 mm; body length 7.8 mm. Relative dimensions: HW 100; HL 86; UFW 66; LFW 51; SL 27; FL 84; CL 29.

Structure. Clypeus strongly convex transversely, almost flat longitudinally; frontal carina extends about halfway to median ocellus; ocellular area flat; facial fovea absent; metanotum without a noticeable tubercle; basal part of propodeal triangle moderately long, sloping before rounding smoothly onto the shorter vertical part,

basal part with fine irregular transverse rugae and some reticulation, usually with an imprecisely defined basomedial depression, whole of peripheral suture scrobiculate; hind basitibial plate with acute apex and strong marginal carina; claws cleft; jugal lobe of hind wing extends well beyond cu-v; marginal areas of metasomal terga weakly depressed.

Colouration. Integument black except tips of mandibles dark red, tegulae and marginal areas of metasomal terga translucent brown and claws amber.

Pubescence. Silvery-white and plumose 1×MOD, close and erect on lower frons, dense and adpressed in lower paraocular areas and apicolateral corners of clypeus; sparse, minutely-branched 2×MOD on remainder of clypeus; open, erect, brown, finely-branched 2×MOD on vertex; white, finely-branched 2×MOD on gena. Scutum and scutellum openly to sparsely covered with erect, openly plumose hair <1×MOD, white in all marginal areas becoming brownish medially, longer around scutellum; mesopleura with open, white plumose hair

2×MOD; metasomal tergum T1 openly covered with erect, white, finely-branched hair <1×MOD and T2 & T3 with similar open cover of even shorter white hair (ca 0.3×MOD) on basal half, remaining terga with sparse, but noticeable almost simple semi-erect setae becoming brown on T6; metasomal sternum S4 with dense white apical fringe 1×MOD, remaining sterna with sparse almost simple setae.

Sculpture. Integument polished with strong well-defined punctures. Punctures of clypeus and anterior face of supraclypeal area large, i<d occasionally coalescing; on frons, lower paraocular areas punctures and lateral surfaces of supraclypeal area punctures are small to medium, almost contiguous. Punctures on scutum and scutellum are small i≈d medially, i<d near margins; metasomal terga with small, strong punctures mostly i<d.

Description of female (K.447445). Head width 2.7 mm; body length 8.8 mm. Relative dimensions: HW 100; HL 81; UFW 65; LFW 55; SL 31; FL 58; CL 33.

Structure. As for male except frontal carina extends ¾ of distance to median ocellus; inner hind tibial spur with 5 teeth about twice as long as width of shaft.

Colouration. Black except eight apical segments of flagellum ventrally orange-brown, marginal areas of metasomal terga translucent brown.

Pubescence. Hair of lower paraocular areas open, white, plumose, 2×MOD. Hair of scutum and scutellum open, brown, closely-branched 1×MOD; on sides of mesosoma open, white, plumose 3×MOD; hind tibial scopa white becoming brown near basitibial plate, mostly pectinate often with long basal shafts, hind femoral scopa white, openly plumose; metasoma with sparse hair except prepygidial fimbria which are chocolate brown and apical fringes of mostly simple white hair on sterna S2–S5.

Sculpture. As for male except punctures a bit less dense, i=1–2d on scutum, i≈d on metasomal terga.

Other specimens examined. ♀, 70 km N of Bourke, 29.4736°S 145.8047°E, 6 Sep 2007, ex *Micromyrtus hexamera* (Maiden & Bettle) Maiden & Bettle, M. Batley, AM K.362681; 2♀, 12 km SW of Ledknapper NR, 29.6338°S 146.0645°E, 11 Sep 2016, ex *Eremophila gilesi* F.Muell., M. Batley, AM K.516928,9; 3♀,2♂, 75 km E of St. George, 27.9836°S 149.3889°E, 8 Sep 2013, ex *Calytrix longiflora*, (F.Muell.) Benth., M. Batley, AM K.447450–54; 2♂,4♀, 63 km E of St. George, 27.9978°S 149.2725°E, 8 Sep 2013, ex *Dianella longifolia* R.Br. & *Newcastelia interrupta* Munir, M. Batley, AM K.447444–49.

Etymology. The specific name is a Latin adjective meaning "with a dimple" and refers a depression frequently but not always seen in the propodeal triangle.

Leioproctus (Leioproctus) nudiventris sp. nov.

Fig. 6

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Holotype: ♂, NSW, Ledknapper NR, 29.4102°S 146.1671°E, 26 Aug 2019, ex *Acacia triptera* Benth., M. Batley, AM K.581036.

Paratypes: ♂ 67 km N of Bourke, 29.4870°S 145.8050°E, 5 Sep 2007, ex *Calotis* sp., M. Batley, AM K.362662; 2♂, 70 km N of Bourke, 29.4736°S 145.8047°E, 6 Sep 2007, ex *Micromyrtus hexamera* (Maiden & Bettle) Maiden & Bettle & *Solanum* sp., M. Batley, AM K.362677, 78.

Diagnosis. Medium sized, 7–8 mm long, hairy, without impressed facial fovea, scapes reach median ocellus, metanotum without a tubercle, subhorizontal basal area of propodeal triangle longer than metanotum, finely striate. Although the propodeal triangle has striae they are finer than in known *L. (Exleycolletes)* species, additionally there is no tuft of erect hair on S6 and the penis valves of the genital capsule do not have the sclerotised ridge that are characteristic of *Exleycolletes* (Maynard, 2013). The species keys out to the *spatulatus* species group of *L. (Leioproctus)* but does not have the toothed gonostyli of males in that group and is therefore treated as an unplaced species within *Leioproctus* s. str. The highly polished, impunctate, posterior half of S6 curving ventrally (Fig. 6E) is unknown in any other species.

Female unknown.

Description of male (holotype). ♂ Head width 2.4 mm; body length 7.6 mm. Relative dimensions: HW 100; HL 82; UFW 65; LFW 47; SL 28; FL 80; CL 28.

Structure. Clypeus elevated and convex; the frontal carina reaches halfway to median ocellus where it is replaced by a thick polished sulcus; ocellocular area gently depressed; facial fovea absent; metanotum without a discernable tubercle; basal ½ of propodeal triangle sloping gently before rounding smoothly onto apical half; claws cleft; jugal lobe of hind wing extends well beyond cu-v and second submarginal cell of forewing receives the first recurrent vein near its proximal end; marginal areas of metasomal terga slightly depressed.

Colouration. Black except the flagellum ventrally dark brown and claws brown; mandibles dark red apically.

Pubescence. Hair of lower face long (2–4×MOD), silvery white and plumose, dense in paraocular areas becoming close to open on lower frons, interantennal area and clypeus and on gena. On scutum and scutellum hair is open to sparse, white, erect, plumose, 1–2×MOD slightly longer on scutellum, on sides of mesosoma open and slightly longer. Metasomal T1 has open, erect, tightly-branched hair on anterior half, T2 has similar but shorter hair in the postgradular groove, elsewhere on the metasoma dorsally hair is sparse and ca 0.5×MOD; metasomal sternum S4 has a close white fringe 1×MOD and the other sterna have only sparse hair.

Sculpture. Integument is polished with strong, distinct punctures. Punctures of the clypeus, frons and paraocular areas are moderately large, i<d, though the last are

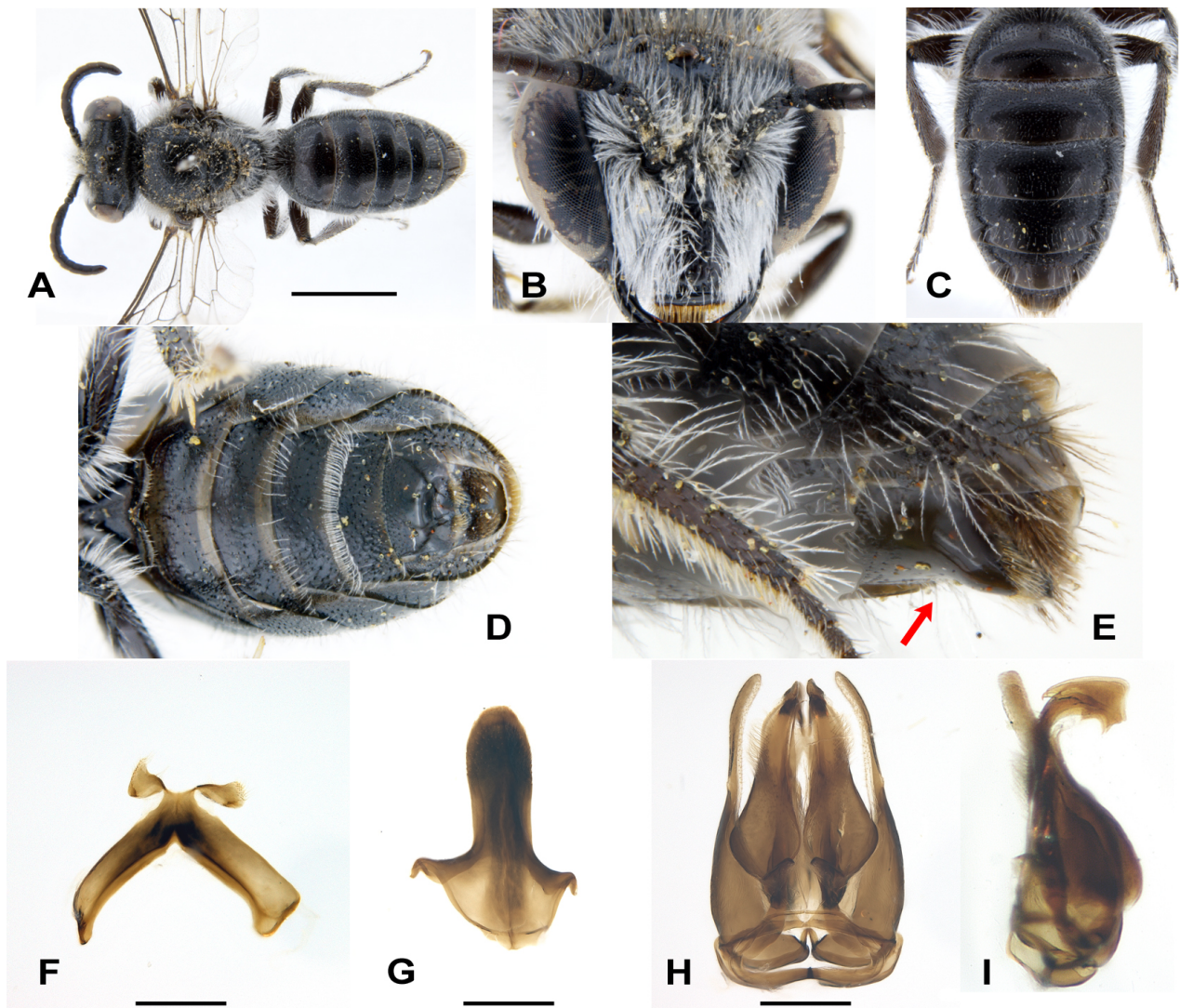


Figure 6. *Leioproctus (Leioproctus) nudiventris*, ♂: A, dorsal view; B, face; C, metasoma dorsal view; D, metasoma ventral view; E, metasomal S6 (arrowed); F, metasomal S7 ventral view; G, S8 ventral view; H, genitalia ventral view; I genitalia lateral view. Scale bars: A 2 mm; F–H 500 µm.

usually hidden by pubescence; anterior face of supra-clypeal area is impunctate; Punctures on scutum and scutellum are small $\approx$ d, as are those on metasomal terga where $i=1-3d$. The propodeal triangle has moderately fine irregular transverse rugae.

Female. Unknown.

Etymology. The specific name is a Latin adjective meaning bare-bellied referring to the polished surface of metasomal S6 of the male.

Leioproctus (Leioproctus) castaneigaster sp. nov.

Fig. 7

urn:lsid:zoobank.org:act:E1778259-4399-417D-BC1F-0355715B5266

Holotype: ♂ Cunawarra NP, NSW, 30.5290°S 152.3182°E, 5 Oct 2015, ex *Coronidium elatum* (A.Cunn. ex DC.) Paul G. Wilson, M. Batley, AM K.516462.

Paratypes: ♂ Cunawarra NP, 30.5698°S 152.2700°E, 6 Oct 2015, ex *Leucopogon lanceolatus* (Sm.) R.Br., M. Batley, AM K.516464; ♀ Clarence, 33.4683°S 150.2267°E, 29 Oct 2002, ex *Boronia microphylla* Sieber ex Rchb., M. Batley, AM 593272; 2♂, 4♀ Dorrigo NP, 17 Nov 1990, N.W. Rodd, AM K.593257–62.

Diagnosis. Medium sized (length 8–10 mm) with long hair, metanotum without a tubercle, subhorizontal basal area of propodeal triangle longer than metanotum, reticulate not striate, jugal lobe of hind wing extending well beyond cu-v. Keys to *spatulatus* group of *Leioproctus* s. str. but male genital capsule excludes it from that group. Metasoma of females usually suffused with red, of males usually black occasionally with reddish areas; terga reticulate with sparse, indistinct punctures, wings infuscated, hair on head and thorax dorsally dark and moderately long. The combination in the female of a reddish metasoma, a propodeal triangle without a carina and infuscated wings make the species unlike anything other than *L. apicalis* (Cockerell, 1921).

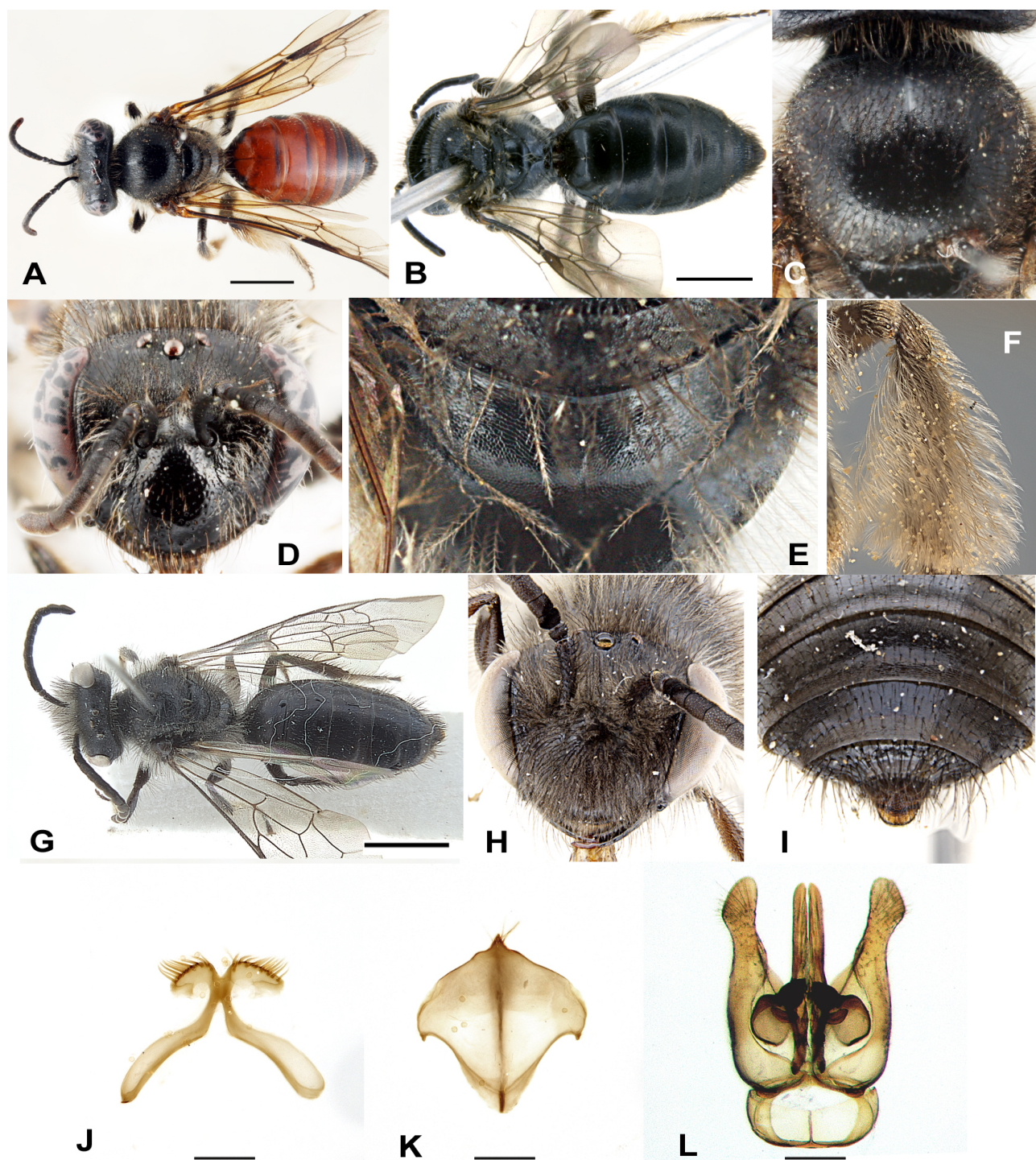


Figure 7. *Leioproctus (Leioproctus) castaneigaster*, ♀: A, red form dorsal view; B, black form dorsal view; C, scutum; D, face; E, propodeal triangle; F, hind tibial scopa (anterior margin to left). ♂: G, dorsal view; H, face; I, metasomal T7; J, metasomal S7 ventral view; K, S8 ventral view; L, genitalia ventral view. Scale bars: A, B, G 2 mm; J–L 200 µm.

from which it differs by the curved mandibles (straight in *apicalis*), open scutal punctures (dense in *apicalis*), and longer, more numerous teeth (7 versus 4–5 in *apicalis*) on inner hind tibial spur. The form of the male S8, without a posterior shaft, is unlike that known for any other species and the long hair on the male face and scutum is longer and darker than in most species other than *L. metallescens* (Cockerell, 1914) (synonymised with *atronitens* by Maynard, 2013), but hair on

the ventral half of the mesosoma is not white as in *metallescens*.

Description of male (holotype). Head width 2.5 mm; body length 7.8 mm. Relative dimensions: HW 100; HL 80; UFW 70; LFW 62; SL 31; FL 117; CL 33.

Structure. Clypeus elevated and convex; frontal carina reaches halfway to median ocellus; ocellocular area strongly depressed; flagellum weakly crenulate; basal

half of propodeal triangle sloping at about 45° to horizontal rounding smoothly onto vertical apical half, anterior half peripheral suture with a narrow scrobicular sulcus; hind basitibial plate with acute apex and strong marginal carina, 0.2× as long as tibia; claws cleft; jugal lobe of hind wing extends well beyond cu-v; marginal areas of metasomal terga not depressed;

Colouration. Black except flagellum ventrally, legs and marginal areas of metasomal terga dark brown. Rarely, metasoma partly chestnut brown.

Pubescence. Hair of clypeus, lower paraocular and inter-antennal areas and vertex close, plumose, dark brown to black 3×MOD. Hair of scutum and scutellum similar but shorter 2×MOD; on sides of mesosoma pale brown, plumose 2×MOD; metasoma with sparse hair.

Sculpture. Integument imbricate but mostly moderately shiny, punctures of clypeus and supraclypeal area and lower paraocular areas strong, medium $i < d$, similar punctures on frons obscured by strong vertical rugae. Punctures on scutum and scutellum are medium $i = 3-4d$, those on metasomal terga small, shallow $i = 3-4d$.

Description of female (K.593272). Head width 3.0 mm; body length 9.7 mm. Relative dimensions: HW 100; HL 80; UFW 68; LFW 60; SL 29; FL 67; CL 31.

Structure. Clypeus elevated and convex; mandible smoothly curved, frontal carina reaches halfway to median ocellus; ocellular area flat; facial fovea indicated only by change of microsculpture; metanotum with a very broad, barely discernable tubercle; basal ½ of propodeal triangle sloping at about 45° to horizontal rounding smoothly onto vertical apical half, anterior half of peripheral suture with a narrow scrobicular sulcus; hind basitibial plate with acute apex and strong marginal carina, 0.2× as long as tibia; claws cleft; jugal lobe of hind wing extends well beyond cu-v; marginal areas of metasomal terga not depressed; inner hind tibial spur translucent brown with *ca* 7 strong teeth about twice as long as width of shaft.

Colouration. Head and mesosoma black except the two apical segments of flagellum dark brown ventrally, distitarsi and claws brown; metasomal T1–T3 and anterior half of T4 chestnut brown with variable dark infuscation, T5 and posterior half of T4 black, T2 with large oval black mark laterally; sterna similar but a bit darker.

Pubescence. Clypeus and lower paraocular area with sparse, simple or very weakly branched brown setae 2×MOD, interspersed in paraocular area with open white or pale brown, plumose hair 1×MOD; similar plumose hair covers the lower frons. On scutum and scutellum hair is erect, plumose, brown 1×MOD, slightly longer on scutellum, on sides of mesosoma off-white, plumose 2×MOD; hind tibial scopa open, plumose on anterior margin, pectinate elsewhere, pale brown laterally, dark brown medially, hind femoral scopa white, plumose. Hair on metasomal terga sparse apart from

the open, black prepygidial fimbria; metasomal sterna S2–S4 with apical fringes of open, off-white, plumose hair 1.5×MOD, S5 with black apical fringe 1.5×MOD.

Sculpture. Integument is imbricate, moderately strong and dull except weak on metasoma and propodeal triangle and very weak on clypeus, a broad area adjacent to top ½ of inner orbit and small medial areas of scutum and scutellum, leaving those areas shiny. Punctures of clypeus and supraclypeal area are medium becoming larger ventrally $i = 1-3d$, in lower paraocular areas punctures are small $i \approx d$, and on frons punctures are small and obscured by strong reticulation and fine vertical rugae. Punctures on scutum and scutellum are medium $i = 3-4d$, those on metasomal terga small, shallow $i = 3-4d$.

Other specimens examined. 5♂ Mount Tomah, 33.550°S 150.417°E, 7–10 Oct 1977, N.W. Rodd, AM K.593263–66, K.291006; ♂ 5 km E Bilpin, 33.511°S 150.570°E, 12 Sep 1978, N.W. Rodd, AM K.593267; ♂ Mount Tomah, 1 Oct 1978, N.W. Rodd, AM K.593271; 2♂ Mount Tomah, 33.550°S 150.417°E, 22, 28 Oct 1992, N.W. Rodd, AM K.593269, 70; ♂ 3 km S of Mount Wilson, 33.530°S 150.354°E, 12 Sep 1978, N.W. Rodd, AM K.593268; ♀ Clarence, 4 Oct 1988, N.W. Rodd, AM K.593271; ♀ Nar-row Neck, 33.7403°S 150.2808°E, 17 Oct 1998, *ex Podolobium ilicifolium* (Andrews) Crisp & P.H. Weston, M. Batley, AM K.593273; ♀ 1 km N Clarence, 33.4683°S 150.2242°E, 16 Nov 2007, *ex Boronia microphylla* Sieber *ex* Rchb., M. Batley, AM K.593274.

Etymology. The specific epithet is a Latin noun in apposition meaning chestnut coloured abdomen.

Leioproctus (Leioproctus) coracinus sp. nov.

Fig. 8

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Holotype: ♀, Clarence, NSW, 33.4683°S 150.2267°E, 20 Oct 2002, *ex Boronia microphylla* Sieber *ex* Rchb., M. Batley, AM K.593355.

Paratypes: 2♀, same data as holotype, AM K.593355, 56; ♀ 6♂, 3 km S of Mount Wilson, 33.530°S 150.354°E, 26 Aug, 1979, N.W. Rodd, AM K.593322–28.

Diagnosis. Large, female *ca* 12 mm long, male *ca* 11 mm, black, without impressed facial fovea, scapes reach median ocellus, propodeal triangle almost vertical, weakly reticulate, shiny, jugal lobe of the hind wing not reaching cu-v, hence keying to unplaced species in *Leioproctus* s. str. (Maynard, 2013). Hair of head and mesosoma mostly long, dark grey or black, tergal apical margins brown, female inner hind tibial spur with 10–12 teeth variable in length but usually about half as long as width of shaft, and female metanotum with large, blunt tubercle, male flagellum crenulate. Several species of similar colour differ in having the jugal lobe of the hind wing reaching cu-v or in having transverse striae on the propodeal triangle. Of the two species where images of the holotype do not show the hind wing clearly, *L. sig-*

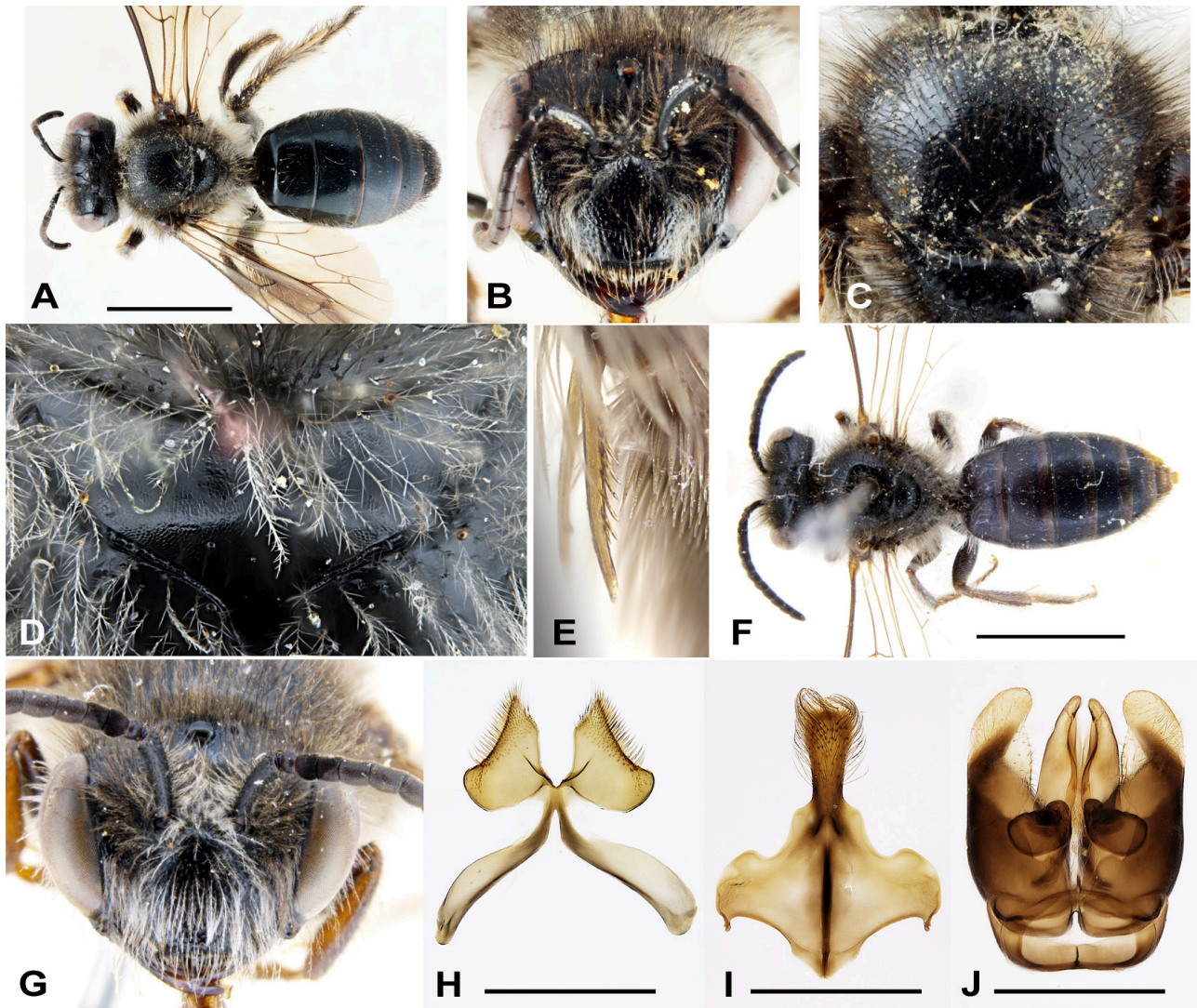


Figure 8. *Leioproctus (Leioproctus) coracinus*, ♀: A, dorsal view; B, face; C, scutum; D, propodeal triangle; E, inner hind tibial spur. ♂: F, dorsal view; G, face; H, metasomal S7 ventral view; I, S8 ventral view; J, genitalia ventral view. Scale bars: A, F 4 mm; H–J 500 μ m.

illatus (Cockerell, 1914) has translucent tergal margins, which *L. coracinus* does not, and the scutum of *L. rudis* (Cockerell, 1906) is described as dull, not shiny as in *L. coracinus*.

Description of female (holotype). Head width 3.7 mm; body length 12.2 mm. Relative dimensions: HW 100; HL 75; UFW 70; LFW 60; SL 32; FL 63; CL 30.

Structure. Clypeus elevated but flat medially; supra-clypeal area with sharp apical projection at the start of the frontal carina which extends 0.6 of distance to median ocellus; ocellocular area flat; facial fovea indicated by broad areas of reticulation near the top of the eye; metanotum with a large, blunt tubercle medially; propodeal triangle steeply sloping rounding smoothly onto vertical half; hind basitibial plate with acute apex, 0.3 $\times$ as long as tibia, with strong marginal carina and several stiff setae; claws cleft; fore wing with three sub-marginal cells, second cell moderately narrow receiving first recurrent vein near middle; stigma moderately nar-

row, 0.8 times as long as costal margin of marginal cell; apex of marginal cell well removed from costa; jugal lobe of hind wing almost reaches cu-v; marginal areas of metasomal terga weakly depressed; inner hind tibial spur translucent brown with 8–12 short teeth about $\frac{1}{2}$ as long as width of shaft, not only is the total number variable between specimens, the length of the teeth can vary randomly along the spur.

Colouration. Integument black (metasoma with a hint of metallic blue) except mandible pre-apically, flagellum, tegula and legs dark brown.

Pubescence. Sub-erect, plumose, off-white on clypeus and interantennal area 2 $\times$ MOD, more openly branched in paraocular areas, on frons, vertex, scutum, scutellum and metanotum mostly dark brown, 2 $\times$ MOD, somewhat longer on edges of scutellum, hair on gena white, finely-branched 2 $\times$ MOD, white, openly plumose 3 $\times$ MOD on sides of mesosoma, all trochanters and on fore femur; hind tibial scopa open, anterior half white plumose, pos-

terior half dark brown, pectinate. Hair on metasomal terga sparse apart from the dark brown to black prepygidial fimbria, that of apical half of metasomal sterna S2–S4 pale, semi-erect, weakly branched 2×MOD, S5 with dark brown to black apical fringe 1.5×MOD.

Sculpture. Integument appears highly polished but metasomal terga are weakly imbricate apart from disc of T1, scutellum, mesepisternum and propodeal triangle are also weakly imbricate as are areas of the frons near the top of the compound eye. Punctures of clypeus are large i=d, on paraocular areas, gena and frons punctures are mid-sized, strong i≈d, on vertex punctures are small and weaker i≈d, scutum and scutellum have strong, medium punctures i=1–2d, discs of metasomal terga with an open to sparse mixture of medium and tiny distinct punctures, sparser on T1 than on subsequent terga.

Description of male. Head width 3.2 mm; body length 11.0 mm. Relative dimensions: HW 100; HL 76; UFW 70; LFW 60; SL 30; FL 102; CL 28.

Structure. Flagellum subcrenulate; eye prominent and gena viewed from above narrowing posteriorly; second submarginal cell of forewing receiving first recurrent vein well before middle; jugal lobe of hind wing does not reach cu-v; marginal areas of metasomal terga very weakly depressed; hind tibial spurs simple, inner one smaller than outer.

Colouration. Integument black except apical half of mandible amber; flagellum, tegula and legs dark brown with tibiae and tarsi slightly more orange, metasomal tergal marginal areas dull orange-brown.

Pubescence. Similar to female except hair on scutum and scutellum somewhat longer, scopal hair absent and terminal fimbria largely absent; metasomal sterna S4 & S5 with apical fringes 1×MOD medially, 2×MOD laterally, fringe on S4 white, on S5 brown.

Sculpture. Punctures of clypeus are small i<d; on paraocular areas, gena and frons punctures are similar but weaker; scutum and scutellum have strong, medium punctures i=1–2d, less dense medially; metasomal punctures as for female.

Variation. Metasomal T1 of female sometimes suffused with brown. Males vary in size.

Other specimens examined. ♀, Clarence, 33.48°S 150.22°E, 18 Apr 1977, N.W. Rodd, AM K.593316; ♀, Mount Tomah, 33.543°S 150.414°S, 29 Aug 1977, N.W. Rodd, AM K.593317; 2♂, Blackheath, 33.63°S 150.28°E, 4 Oct 1977, N.W. Rodd, AM K.593318, 19; ♀, Clarence, 33.48°S 150.22°E, 21 Nov 1977, N.W. Rodd, AM K.593320; ♂, Mount Tomah, 33.543°S 150.414°S, 1 Oct 1978, N.W. Rodd, AM K.593321; 4♀, Clarence, 33.48°S 150.22°E, 26 Oct 1979 & 14 Oct 1980, N.W. Rodd, AM K.593332–35; 2♂, 6 km NE Bilpin, 33.47°S 150.57°E, 2 Nov 1980 & 23 Sep 1992, N.W. Rodd, AM K.593336,

53; ♀, 20 km W of Mount Tomah, 33.51°S 150.29°E, 20 Dec 1980, G.A. Holloway, AM K.593337; 7♀ ♂, Clarence, 33.48°S 150.22°E, 3 & 12 Nov 1982, 28 Mar 1983, 1 Oct 1985, 6 Dec 1986, N.W. Rodd, AM K.593338–45; 7♂, Clarence, 33.48°S 150.22°E, 4 Oct 1988, ex *Boronia* sp., N.W. Rodd, AM K.593346–52.

Etymology. The specific name is derived from the Latin word for crow and refers to the predominant colour.

Leioproctus (Leioproctus) platyceratus sp. nov.

Fig. 9

urn:lsid:zoobank.org:act:EE719B4B-3260-4B49-96F5-0A2F0037EBE1

Holotype: ♂, Commodore Heights, NSW, 33.6134°S 151.2888°E 18 Aug 2019, ex *Boronia ledifolia* (Vent.) DC., M. Batley, AM K.580999.

Paratypes: 4♂ ♀, as for holotype, AM K.580998, K.581000–02.

Diagnosis. Small, 6.5–7.5 mm long, without impressed facial fovea, scapes reach median ocellus, jugal lobe of hind wing approaching but not reaching cu-v, subhorizontal basal area of propodeal triangle longer than metanotum, relatively coarsely reticulate with a few striae in anterolateral corners, face and scutum moderately hairy. If scored as sparsely hairy, the species would key to Maynard's *irroratus* species group in *Leioproctus* s.str. but is left as unplaced in that subgenus. The metasoma of both sexes has a weak greenish sheen, clypeus and scutum have long dark hair, interspersed on male clypeus with plumose golden-brown hair, metanotum without a tubercle, metasoma reticulate with open to sparse, indistinct punctures, proximal segment of male labial palpus flattened and expanded (Fig. 9I). The two unplaced species of roughly similar size, *L. nanus* (Smith, 1879) and *L. nicholsoni* (Cockerell, 1929), both have a convex clypeus not flattened medially.

Description of male (holotype). Head width 2.0 mm; body length 6.5 mm. Relative dimensions: HW 100; HL 75; UFW 68; LFW 54; SL 30; FL 90; CL 26.

Structure. Clypeus flat medially; supraclypeal area coplanar with clypeus; frons with frontal carina reaching half way to median ocellus; ocellar cluster elevated above surrounding area; fovea broad, slightly raised with weakened sculpture; ocelloccipital area flat; scape reaching median ocellus; flagellomeres longer than wide except first two which are shorter and third which is as long as wide; mandible smoothly curved, bidentate; first segment of labial palpus flattened and much broader than subsequent segments. Pronotal collar thin, much lower than scutum; metanotum without a tubercle; subhorizontal surface of propodeal triangle approximately as long as metanotum, rounding smoothly onto vertical surface, area surrounded by a narrow sulcus; hind basitibial plate 0.25× as long as tibia, acute with strong marginal carina, with open gold setae; inner hind tibial spur ciliate; claws cleft; forewing with three sub-

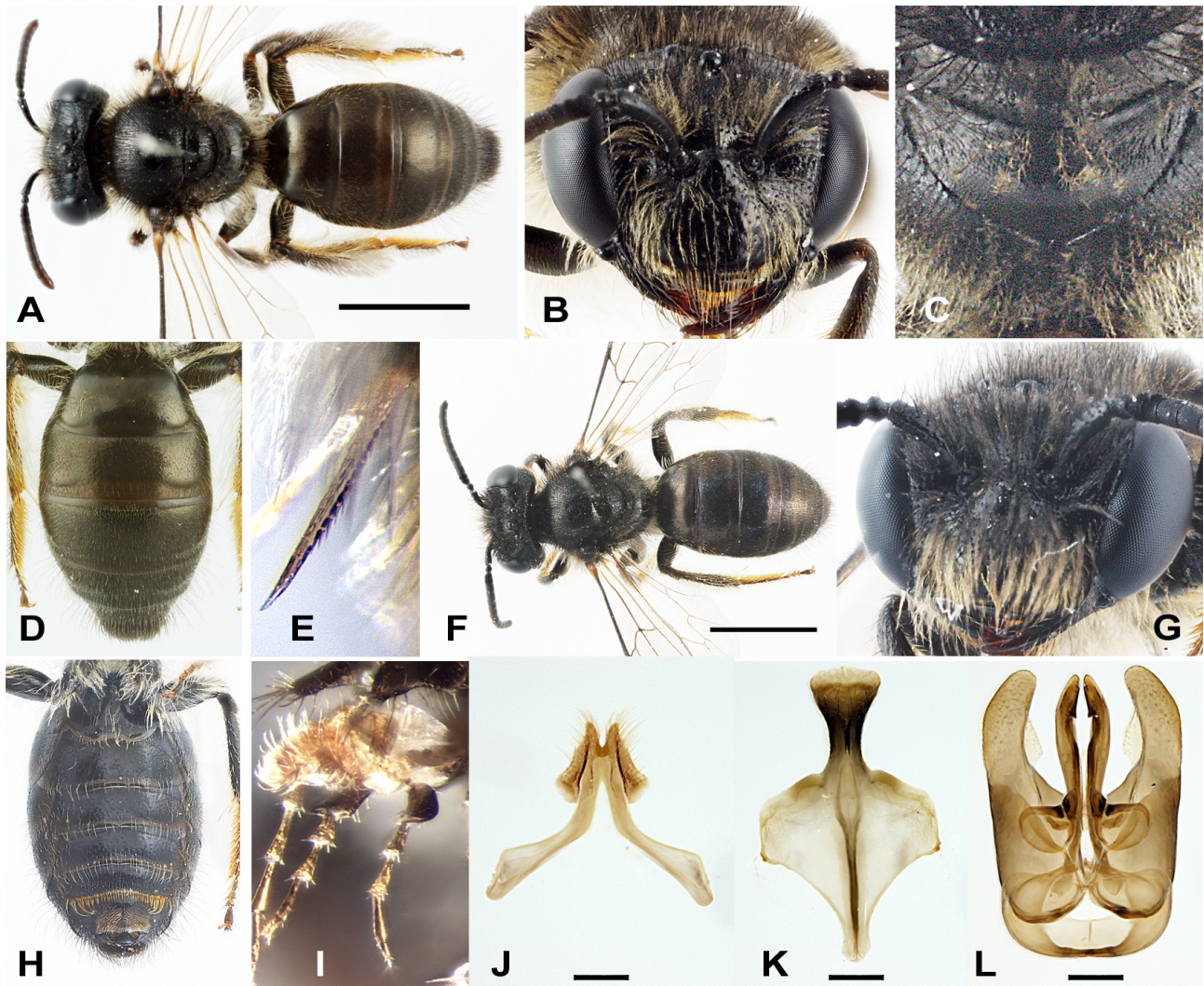


Figure 9. *Leioproctus* (*Leioproctus*) *platyceratus*, ♀: A, dorsal view; B, face; C, propodeal triangle; D, metasoma; E, inner hind tibial spur. ♂: F, dorsal view; G, face; H, metasoma ventral view; I, labial palpus; J, metasomal S7 ventral view; K, S8 ventral view; L, genitalia ventral view. Scale bars: A, F 2 mm; J–L 200 μ m.

marginal cells, second cell narrow receiving first recurrent vein near middle, first submarginal crossvein curved parallel to second; stigma broad, 0.74 times as long as costal margin of marginal cell; apex of marginal cell well removed from costa; length of jugal lobe of hind wing about 0.8 $\times$ distance from base of wing to cu-v. Metasomal terga convex with apical margins weakly depressed.

Colouration. Integument black except as follows: metasoma vaguely metallic; mandible, flagellum, mid and hind tarsus and hind tibia dark brown; wings hyaline but darkened by dense hairs in most cells, veins and stigma dark brown.

Pubescence. Head and thorax with long, open, plumose hair, semi-adpressed, pale gold 4 $\times$ MOD on clypeus, dark brown, erect 2 $\times$ MOD on frons and supraclypeal area, pale gold 2 $\times$ MOD on gena, pale gold 4 $\times$ MOD on fore femur and trochanter, shorter on other femora and trochanters, dark brown, erect 1–3 $\times$ MOD on vertex, scutum and scutellum, inner face of fore basitarsus with a

brush of stiff gold setae, metasomal hair sparse except S5 with open fringe $\approx$ MOD medially, 2 $\times$ MOD laterally and S6 with apicolaterally directed, semi-adpressed, gold setae $\approx$ MOD.

Sculpture. Integument reticulate except medially on scutum and scutellum. Clypeal punctures medium apically becoming smaller basally, $i=1-2d$; frons, paraocular areas, vertex, gena and scape with strong medium punctures, $i=d$, closer near ocelli; scutum with small piliferous punctures $i=2-3d$ peripherally, $i=4d$ medially, metasomal terga and sterna with weak, minute piliferous punctures, $i=3-5d$.

Description of female (K.581308). Head width 2.4 mm; body length 7.6 mm. Relative dimensions: HW 100; HL 72; UFW 68; LFW 58; SL 33; FL 60; CL 24.

Structure. As for male except: fovea not raised; length of first four flagellomeres less than or equal to width; first segment of labial palpus only slightly broadened; basitibial plate 0.30 $\times$ as long as hind tibia; inner hind tib-

ial spur almost ciliate with *ca* 8 fine teeth shorter than width of spur at an acute angle to axis of spur; pygidial plate subtruncate with weak medial elevation.

Colouration. As for male except: metasomal terga apically brown with bronze sheen.

Pubescence. As for male except: clypeal hair open to sparse; setae on outer face of fore basitarsus denser; metasomal sterna S2–S6 apically with erect rows of long, pale gold, plumose hair; hind tibial scopa dense, hair plumose except immediately adjacent to basitibial plate, mostly brown but pale gold on anterior margin.

Sculpture. As for male except some clypeal punctures large; punctures on head and scutum more open.

Variation. Males vary in size, average length 6.6 mm (s.d. 0.4, *n*=10), but are otherwise similar.

Other specimens examined. ♂ Commodore Heights, 33.6114°S 151.2739°E, 23 Aug 2006, *ex Grevillea sericea* (Sm.) R.Br., AM K.359893; 5♂, Commodore Heights, 33.6134°S 151.2888°E, 6 & 13 Aug 2019, *ex Boronia ledifolia* (Vent.) DC., M. Batley, AM K.580990, 92–94, 96; 4♂, Commodore Heights, 33.613°S 151.288°E, 13 & 27 Aug 2020, *ex Boronia ledifolia* (Vent.) DC. & nest, M. Batley, AM K.581293, 94, 98, 99; 3♀, 33.613°S 151.233°E, 3 Sep 2020, *ex nest*, M. Batley, AM K.581306–08; ♂ 2♀, 33.610°S 151.278°E, 3 Sep 2020, *ex nest*, M. Batley, AM K.581309–11; ♀, 33.612°S 151.284°E, 20 Aug 2023, *ex nest*, M. Batley, AM K.593307.

Etymology. The specific part of the name comes from the Greek words *platys*, meaning broad or flat and *keras*, a horn or feeler, referring to the labial palpus of the male which has a broad, flat proximal segment.

Leioproctus (Leioproctus) tritus sp. nov.

Fig. 10

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Holotype: ♂, Commodore Heights, NSW, 33.5936°S 151.2978°E, 28 Aug 2002, *ex Boronia ledifolia* (Vent.) DC., M. Batley, AM K.593280.

Paratypes: 4♀, Mellong Swamp, 33.0744°S 150.7195°E, 30 Oct 2018, *ex Isopogon anemonifolius*, M. Batley, AM K.540404–07; ♂ ♀, Colo Heights, 33.3657°S 150.7581°E, 16 Sep 2023, *ex Isopogon anemonifolius* (Salisb.) Knight (♀) & *Grevillea buxifolia* (Sm.) R.Br. (♂), M. Batley, AM K.593290, 91.

Diagnosis. Medium sized, 7.5–8.5 mm long, hairy, without impressed facial fovea, scapes reach median ocellus, subhorizontal basal area of propodeal triangle longer than metanotum, shiny with weak reticulation. Keys to the *spatulatus* species group (Maynard, 2013) but the male genital capsule does not meet the criterion for that group so it is unplaced within *Leioproctus* s. str. Metanotum without a tubercle, metasoma black, terga with translucent brown apical margins, and weak apical hair bands, particularly in female; male with geniculate flagellum, like *L. ibex* (Cockerell, 1929) but malar

space obsolete. After eliminating species with a transversely striate propodeal triangle the closest possibility for this species is *L. sigillatus* (Cockerell, 1914), which has pale, not dark, hair on the scutum. *L. tritus* is also superficially like *L. thornleighensis* (Cockerell, 1906), but has a longer subhorizontal part of the propodeal triangle and the inner hind tibial spur of the female has *ca* 6 teeth (3 in *thornleighensis*). Males of both *L. tritus* and *L. thornleighensis* have a geniculate flagellum, but differ in punctuation of the metasomal terga which is weak and open in *tritus* and strong and close in *thornleighensis*. The sternal hair of male *L. thornleighensis* is sparse apart from a tight fringe on S5, but males of *L. tritus* have noticeable plumose white hair on sterna other than S5, including a weak apical fringe on S4.

Description of male (holotype). Head width 2.4 mm; body length 7.5 mm. Relative dimensions: HW 100; HL 86; UFW 65; LFW 58; SL 25; FL 112; CL 32.

Structure. Clypeus transversely gently convex, longitudinally apical half more strongly convex than the basal half; frontal carina reaches $\frac{2}{3}$ of way to median ocellus; malar space obsolete; fovea indicated by weaker microsculpture; ocellocipital area flat; flagellomeres longer than wide except first two which are shorter than wide, viewed from front they are geniculate and overlap above as in *Leioproctus ibex*; metanotum without a tubercle; subhorizontal surface of propodeal triangle rounding smoothly onto vertical half; claws cleft; pterostigma broad, $\frac{2}{3}$ as long as costal margin of marginal cell; apex of marginal cell well removed from costa; jugal lobe of hind wing broad, reaching slightly beyond cu-v, metasomal terga with marginal areas weakly depressed laterally.

Colouration. Integument black except ventral surface of flagellum brown on apical half, tegula and apical margin of metasomal terga brown.

Pubescence. Hair of clypeus, paraocular areas, lower frons and gena open, semi-erect, white with some pale brown, plumose 2×MOD; dark brown, erect, weakly-branched 1–2×MOD on frons and vertex; erect, dark brown, plumose 2–3×MOD on scutum, scutellum and mesonotum; white, plumose, erect 3×MOD on mesepisternum, propodeum and fore femur; metasoma with sparse, mostly simple, short hair except S4 with pale, open, apical fringe 2×MOD and S5 with denser, pale fringe 3×MOD laterally, 1×MOD medially.

Sculpture. Surface mostly reticulate but shiny, on propodeal triangle and medial area of scutum reticulation very weak. Clypeal punctures medium to large *i*≤*d*, those in paraocular areas medium *i*<*d*, those on frons small, shallow *i*≈*d*, scutum with medium piliferous punctures *i*≈*d* except *i*>3*d* medially, metasomal terga with tiny indistinct punctures *i*≈2*d* and sterna with small, strong, punctures, *i*=2–4*d*.

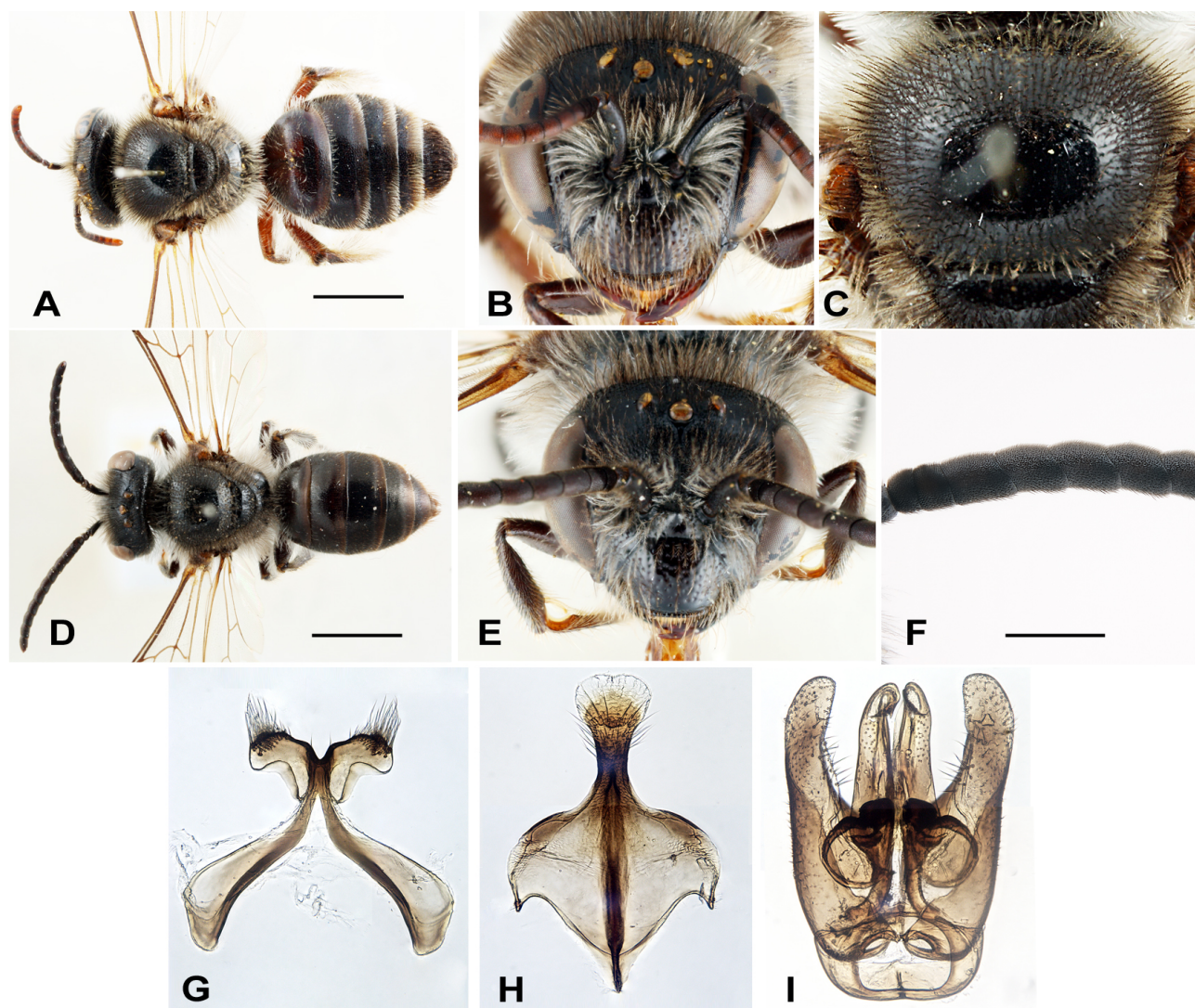


Figure 10. *Leioproctus (Leioproctus) tritus*, ♀: A, dorsal view; B, face; C, scutum. ♂: D, dorsal view; E, face; F, proximal end of flagellum, fl1–fl6; G, metasomal S7 ventral view; H, S8 ventral view; I, genitalia ventral view. Scale bars: A, D 2 mm; G–I 200 µm.

Description of female (K.593283). Head width 2.9 mm; body length 8.5 mm. Relative dimensions: HW 100; HL 82; UFW 67; LFW 57; SL 32; FL 59; CL 26.

Structure. As for male except flagellum short, flagellomeres other than fl1 & fl2 *ca* as long as wide, hind basitibial plate 0.25× as long as hind tibia, inner hind tibial spur with 6 strong teeth almost twice as long as width of spur, pygidial plate entire, carinate, gently elevated medially.

Colouration. As for male except legs mostly dark brown, marginal areas of metasomal terga more bronze than brown and with partial white hair bands on T2–T4.

Pubescence. As for male except all hair somewhat shorter, hair on scutum and scutellum medially almost black, metasomal terga T2 & T3 with open, white apical fringes laterally only, T4 with fringe open but entire, prepygidial fimbria black, metasomal sterna S2–S4 with erect, pale simple hair on apical half, fringe on S4 brown, fringe on S5 black, of uniform length. Hind tibial scopa close, plumose, pale brown but darkening to almost black

adjacent to basitibial plate, femur and trochanter with long, openly feathery white hair.

Sculpture. As for male except reticulation on face absent other than on frons, clypeal punctures medium i=1–2d; punctures on head and scutum more open.

Variation. There are small variations in the shape of posterior lobes of S7 of the male.

Other specimens examined. ♂, Pennant Hills, 33.7494°S 151.0878°E, 3 Sep 1999, *ex Phyllota phyllicoides* (Sieber ex DC.) Benth., M. Batley, AM K.593275; 4♂ ♀, Marramara NP, 33.5639°S 151.0700°E, 24 Aug 2001, *ex Boronia ledifolia* (Vent.) DC. & *Grevillea sericea* (Sm.) R.Br., M. Batley, AM K.593276–79, 83; ♂ ♀, Mount Wilson, 33.5417°S 150.3414°E, 20 Oct 2002, *ex Boronia microphylla* Sieber ex Rchb. & *Isopogon anethifolius*, M. Batley, AM K.593281, 82; 2♂, Mount Colah, 33.6761°S 151.1347°E, 27 Aug 2004, *ex Gaudium parvifolium* & *Grevillea sericea* (Sm.) R.Br., M. Batley, AM K.361079, 85; ♀, 4 km N of Clarence, 33.4483°S 150.2306°E, 22 Dec 2004, *ex Isopogon anemonifolius*, M. Batley, AM K.360743; 4♂, Turra-

murra, 33.6864°S 151.1600°E, 26 Aug 2005, ex *Grevillea sericea* (Sm.) R.Br., M. Batley, AM K.224653–6; 2♀, 1 km N of Clarence, 33.4683°S 150.2242°E, 16 Nov 2007, ex *Boronia microphylla* Sieber ex Rchb., M. Batley, AM K.362375, 76; ♀, Bilpin, 33.4714°S 150.5790°E, 15 Oct 2022, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.593284; 3♂ ♀, Mount Wilson, 33.5413°S 150.3433°E, 26 Oct 2022, ex *Boronia microphylla* Sieber ex Rchb., M. Batley, AM K.593285–88; ♂, 1 km E of Hawkesbury Heights, 33.6637°S 150.6565°E, 18 Nov 2022, M. Batley, AM K.593289; ♂, Marramarra NP, 33.5699°S 151.1117°E, 29 Aug 2023, ex *Grevillea buxifolia* (Sm.) R.Br., M. Batley, AM K.593308; ♂, Springwood, 33.7195°S 150.5579°E, 25 Sep 2023, ex *Grevillea buxifolia* (Sm.) R.Br., M. Batley, AM K.593292.

Note. Females found in numbers on *Isopogon* sp. but males were absent. Both sexes were also found on nectariferous flowers so it is possible that females use *Isopogon* pollen to feed their larvae and visit other flowers for nectar.

Etymology. The specific epithet is a Latin adjective used in the sense of “commonplace” or “familiar” and refers to the absence of particularly distinctive features.

Leioproctus (Leioproctus) autumnalis sp. nov.

Fig. 11

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Holotype: ♂, Mellong Swamp, NSW, 33.0858°S 150.7058°E, 31 Mar 2000, M. Batley, AM K. 593293.

Paratypes: ♂, as for holotype, AM K.593294; 2♂, 3♀, Mellong Swamp, 33.086°S 150.706°E, 30 Apr 2000 & 3 Apr 2001, ex *Monotoca scoparia* (Sm.) R.Br., M. Batley, AM K.593295–98, K.182560.

Diagnosis. Medium sized, 7–8.5 mm long, with long grey-brown hair dorsally, without impressed facial fovea, scapes reach median ocellus, subhorizontal basal area of propodeal triangle longer than metanotum, reticulate not striate, and hence keys to the *spatulatus* group of *L. (Leioproctus)* but is excluded from it by male terminalia. The iridescent blue colour of the metasoma in fresh specimens in combination with the reticulate propodeal triangle is found only in this species and a few members of the *spatulatus* species group of *Leioproctus* s. str. Female resembles *L. incomptus* (Cockerell, 1921), but mandible almost straight (not strongly curved as in *incomptus*) and the inner hind tibial spur has numerous short teeth *ca* as long as width of shaft (twice as long as shaft in *L. incomptus*); flagellum of male is subcrenulate. Also resembles *L. thornleighensis* (Cockerell, 1906) but has a more sharply curved propodeal triangle and a longer malus of the fore strigilis with *ca* 8 fine teeth (*ca* 5 in *thornleighensis*).

Description of male (holotype). Head width 2.3 mm; body length 7.0 mm. Relative dimensions: HW 100; HL 82; UFW 67; LFW 56; SL 25; FL 113; CL 28.

Structure. Clypeus transversely convex, coplanar with supraclypeal area; ocellocular area depressed, frons bigibbous, median carina extending halfway to ocellus; scape reaching median ocellus; facial fovea not evident; flagellum subgeniculate, flagellomeres longer than wide except for first two; mandible almost straight, with acute subapical tooth; labrum *ca* 0.4× as long as wide with a polished triangular elevation basally. Pronotal collar thin, much lower than scutum; scutellum large almost half as long as scutum; deep sulcus between scutellum and metanotum; metanotum with a barely noticeable tubercle; subhorizontal surface of propodeal triangle approximately as long as metanotum, rounding smoothly onto vertical surface, area surrounded by a narrow sulcus; hind basitibial plate 0.2× as long as tibia, with strong marginal carina, and two or three setae; claws cleft; fore wing with three submarginal cells, second cell narrow receiving first recurrent vein near middle; stigma moderately broad, 0.6 times as long as costal margin of marginal cell; apex of marginal cell well removed from costa; jugal lobe of hind wing extends beyond cu-v. Terga transversely convex, apical margins of T3–T5 weakly depressed.

Colouration. Integument of head and mesosoma black except mandibles apically, tarsi, tegulae, wing veins and pterostigma brown; metasoma metallic blue but with time pinned specimens lose the metallic colour and the terga become brown.

Pubescence. Suberect, plumose, white to pale brown, 2–3×MOD on all areas of head and thorax except propodeal triangle, sparse and simple on metasomal terga with some plumose brown hair <2×MOD on T6 & T7, sparse to open, erect, plumose, pale brown 1.5×MOD on metasomal sterna plus finely-branched, pale apical fringes on S4 & S5 and apicomedia on S3.

Sculpture. All surfaces imbricate, most strongly on the frons, gena and metasoma. Punctures of clypeus and paraocular areas mid-sized, strong *i*<*d*, those on frons smaller and weak *i*=1–2*d*, scutum and scutellum with strong medium punctures *i*=3–4*d*, somewhat denser in peripheral areas, metasomal terga with sparse, small, very weak punctures, sterna S4–6 with strong medium punctures, *i*≈2*d* on apical half of S4 & S5, *i*<*d* on S6.

Description of female (030402-04). Head width 2.7 mm; body length 8.6 mm. Relative dimensions: HW 100; HL 80; UFW 69; LFW 60; SL 34; FL 73; CL 25.

As for male except: mandible almost straight; flagellum not geniculate; inner hind tibial spur with *ca* 11 sharp small teeth about as long as width of spur; hind basitibial plate 0.3×length of tibia, with several stiff dark setae; colour of metasomal terga less prone to fading; clypeal punctures larger and closer than for males and clypeal pubescence less dense; hind tibial scopa golden brown, moderately dense, composed entirely of plumose hairs; metasomal sterna S2–S4 with broad rows of erect, plumose, pale brown hair 2×MOD and S5 with a dense

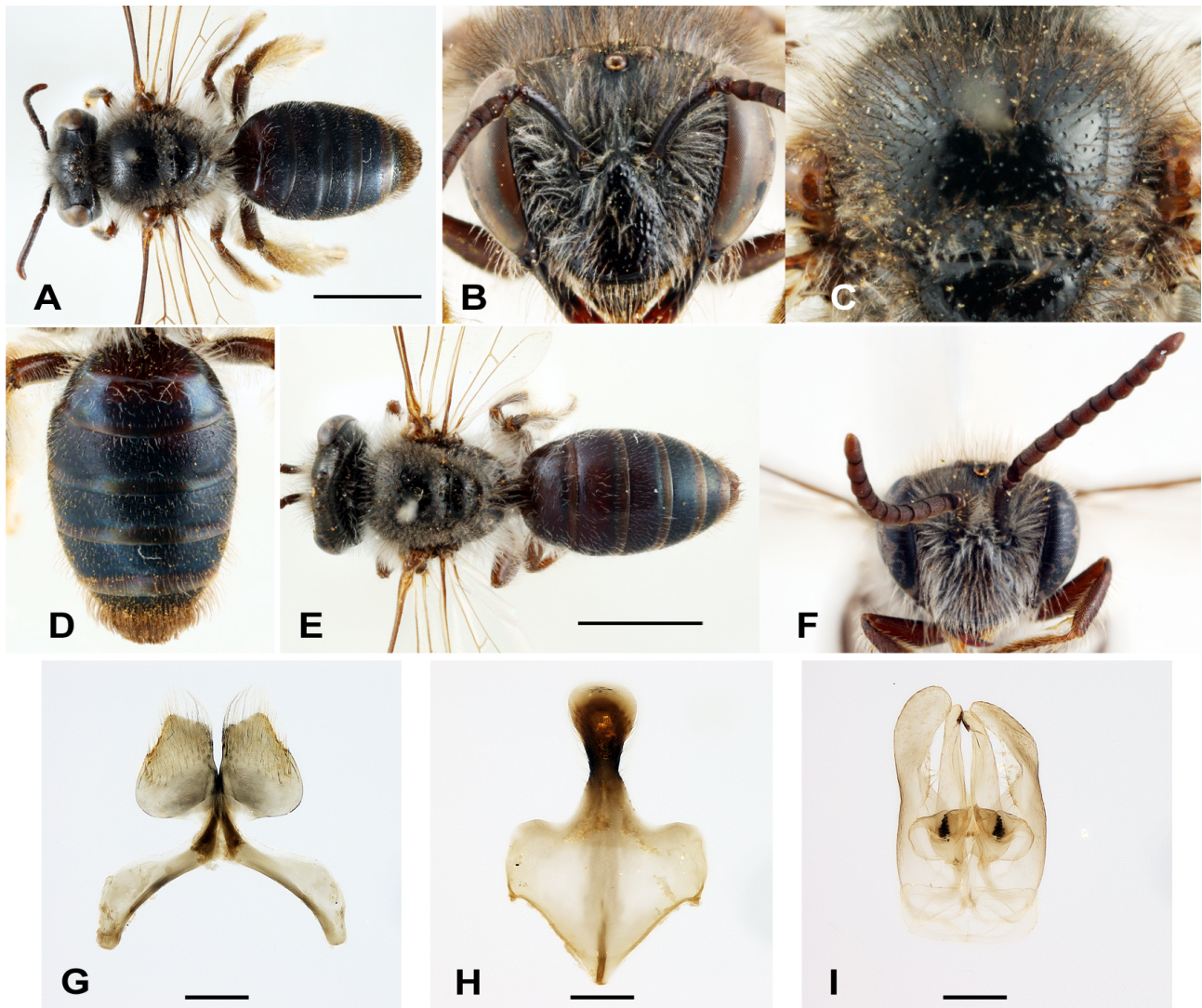


Figure 11. *Leioproctus (Leioproctus) autumnalis*, ♀: A, dorsal view; B, face; C, scutum; D, metasoma. ♂: E, dorsal view; F, face; G, metasomal S7 ventral view; H, S8 ventral view; I, genitalia ventral view. Scale bars: A, E 2 mm; G–I 200 µm.

apical fringe of darker brown hair $<2 \times \text{MOD}$; pygidial plate tapered, truncate with a longitudinal medial elevation.

Variation. Male lengths: 7.2, 7.0, 7.0 mm; female lengths: 8.4, 8.8, 8.5, 8.3 mm.

Other specimens examined. ♀, Clarence, 33.4764°S 150.2233°E, 3 Apr 2002, ex *Monotoca scoparia* (Sm.) R.Br., M. Batley, AM K.593299; 8♂, 7♀, Mellong Swamp, 33.086°S 150.706°E, 9 Apr 2002, 31 Mar 2008 & 8 Apr 2009, ex *Monotoca scoparia* (Sm.) R.Br., M. Batley, AM K.182561, K.362461–69, K.225023–7; 3♀, Mellong Swamp, 33.078°S 150.708°E, 16 Apr 2015, ex *Monotoca scoparia* (Sm.) R.Br., M. Batley, AM K.516305–07; ♂, Mellong Swamp, 33.0986°S 150.706°E, 4 Apr 2021, ex *Monotoca scoparia* (Sm.) R.Br., M. Batley, AM K.396146.

Note. The male terminalia resemble those of *L. (Cladocerapis) bipectinatus* (Smith, 1857), *L. (C.) carinatifrons* (Cockerell, 1929), *L. (C.) ignicolor* Maynard, 1992 and *L. (C.) incanescens* (Cockerell, 1913).

Etymology. The specific name refers to the apparent activity period for the species.

Leioproctus (Minycolletes) exilicrinitus sp. nov.

Fig. 12

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Holotype: ♀, Mellong Swamp, NSW, 33.086°S 150.706°E, 11 Nov 2020, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.581376.

Paratypes: ♂ 2♀, Mellong Swamp, NSW, 33.09°S 150.71°E, 27 Oct 2021, ex *Isopogon anemonifolius* (Salisb.) Knight (♀), *Poranthera ericifolia* Rudge (♂, ♀), M. Batley, AM K.396211–3; 3♂, Mellong Swamp, NSW, 33.0784°S 150.7084°E, 24 Oct 2014, ex *Mitrasacme polymorpha* R.Br., M. Batley, AM K.515777–79; 4♀, Mellong Swamp, NSW, 33.08°S 150.71°E, 17 Oct 2021, ex *Isopogon anemonifolius* (Salisb.) Knight & *Mitrasacme polymorpha*, M. Batley, AM K.396148, 49, 55, 56.

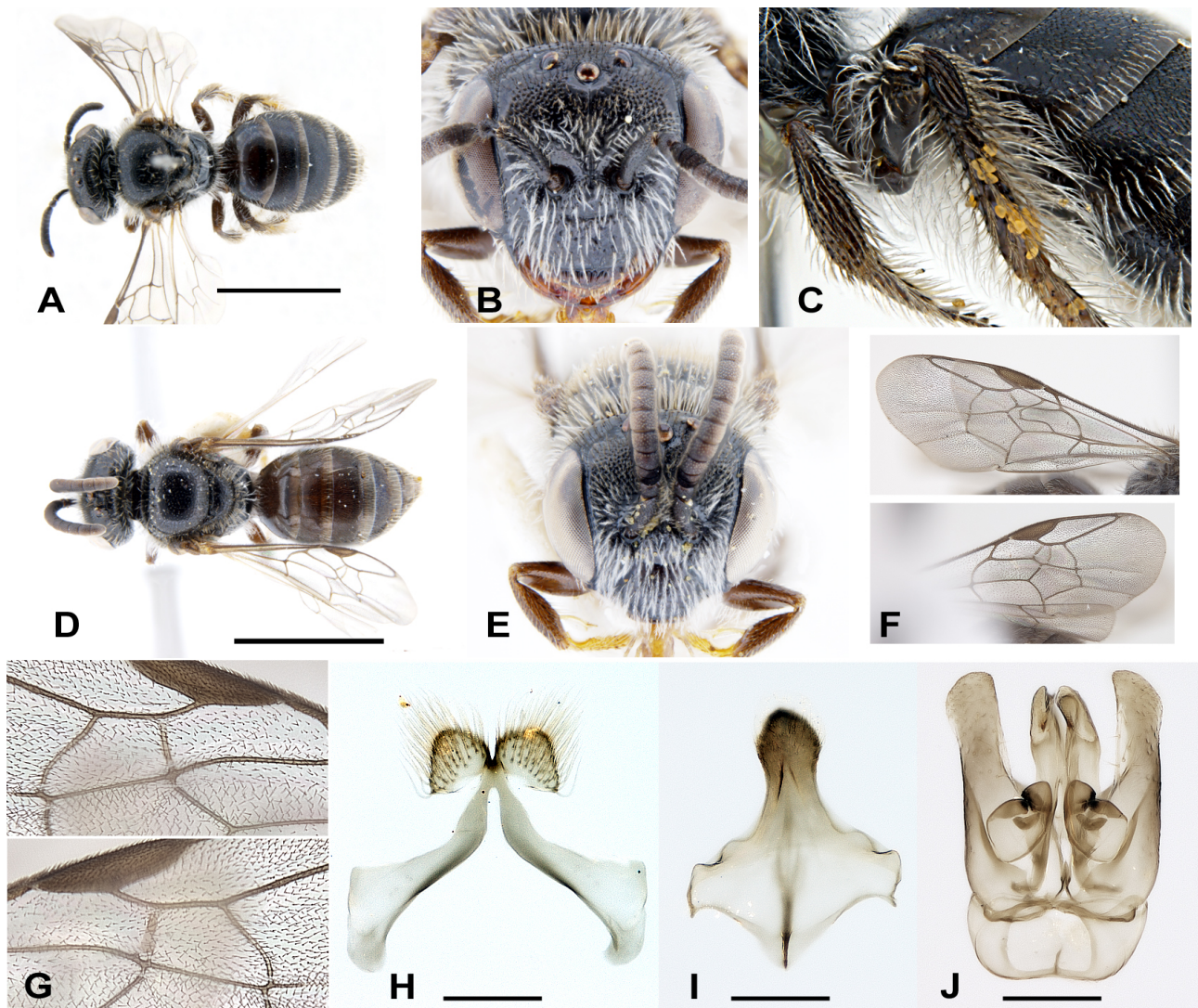


Figure 12. *Leioproctus (Minycolletes) exilicrinatus*, ♀: A, dorsal view; B, face; C, hind tibial scopa. ♂: D, dorsal view; E, face; F, specimen a, right wing above, left wing below; G, specimen b, right wing above, left wing below; H, metasomal S7 ventral view; I, S8 ventral view; J, genitalia ventral view. Scale bars: A, D 2 mm; H–J 200 μ m.

Diagnosis. Small (body length 4–5 mm), non-metallic with scape not reaching median ocellus, facial fovea absent, propodeal triangle strongly curved without defined basal area, metasoma with translucent apical tergal margins hence meeting the criteria (Maynard, 2013) for inclusion in *L. (Minycolletes)*. Mostly black, male with dark brown metasoma; hair on frons sparse; female with sparse hair in hind tibial scopa and inner hind tibial spur with >10 short teeth; male with basitibia noticeably paler than remainder of legs. Female keys to *L. insitus* in Maynard's key but is smaller (and the first segment of the labial palpus is 2.0 $\times$ as long as the second (subequal in *insitus*). The male keys to *L. finkei* but is ca 4.5 mm long (*finkei* ca 6 mm) and has different terminalia with the posterior lobes of S7 rounded, without large emarginations around the periphery.

Description of female (holotype). Head width 1.7 mm; body length 5.2 mm. Relative dimensions: HW 100; HL 84; UFW 72; LFW 62; SL 25; FL 56; CL 24.

Structure. Inner orbits convergent ventrally, clypeus smoothly convex; frontal carina extending $\frac{1}{2}$ way to median ocellus, fovea possibly indicated by absence of punctures, ocellocipital area flat, flagellum short, all flagellomeres wider than long, metanotum without a tubercle, subhorizontal surface of propodeal triangle slightly shorter than vertical part, claws cleft, forewing with strongly curved basal vein, second submarginal cell with narrow anterior margin, receiving first recurrent vein past middle; stigma broad, 0.8 times as long as costal margin of marginal cell, jugal lobe of hind wing exceeds cu-v, hind basitibial plate 0.3 $\times$ as long as tibia, inner hind tibial spur with 11 fine teeth about $\frac{1}{2}$ as long as width of spur, pygidial plate entire, elevated medially.

Colouration. Black except flagellum ventrally, tegula, tarsi and apical margins of metasomal terga dark brown, apical half of mandible amber with dark red apex.

Pubescence. Hair of clypeus, lower paraocular areas, and gena open to sparse, semi-erect, white plumose

1×MOD; similar brown hair on vertex; scutum and most of scutellum with open to sparse, brown, plumose hair 0.5×MOD; mesepisternum with sparse, white plumose hair 1–1.5×MOD; metasomal terga T2–T4 with weak, white apical hair bands 1.5×MOD, on lateral margins only on T2 & T3, prepygidial fimbria dense, pale brown; metasomal sternum S5 with dense, pale brown, apical fringe 1×MOD, S6 with adpressed pale brown hair, remaining sterna with sparse, erect, simple hair <2×MOD; hind tibial scopa sparse, white, weakly plumose, anterior half, brown, weakly pectinate on posterior half, hind femoral scopa sparse.

Sculpture. Head and scutum polished, mesepisternum, propodeal triangle and metasomal T1 very weakly imbricate, remainder of metasoma imbricate but shiny. Punctures on clypeus mostly large $i < d$ with smaller punctures basally; supraclypeal area with very small punctures $i = 2\text{--}4d$, those in paraocular areas and on frons medium $i < d$; scutum and scutellum with strong, small punctures $i = 1\text{--}2d$, metasoma with small indistinct punctures.

Description of male (K.593300). Head width 1.6 mm; body length 4.4 mm. Relative dimensions: HW 100; HL 79; UFW 64; LFW 49; SL 22; FL 92; CL 25.

Structure. As for female except flagellum longer, hind basitibial plate 0.2× as long as tibia and inner hind tibial spur ciliate.

Colouration. As for female except metasoma dark brown, all basitibiae yellow-brown.

Pubescence. As for female except without scopa and hair on mesosoma a bit longer, metasomal terga without noticeable hair bands, sterna S3–S5 with apical hair bands, open 1×MOD on S3, close 1.5×MOD on S4 and close on S5, 2×MOD laterally, 1.5×MOD medially.

Sculpture. As for female except clypeal punctures medium $i = 0.5\text{--}2d$.

Variation. A number of males have only two submarginal cells in one or both forewings, as found in *L. abnormis* (Cockerell, 1916), but in the present case the loss may occur in one of two ways. The first is simple loss of one vein as shown in Fig 12F for specimen a (K.515780) where one crossvein is absent from the right wing but not the left. Considerable variation was also observed in the width of the second submarginal cell of males and in specimen b (K.515773), shown in Fig. 12G, the width appears to have decreased to zero, leaving a single vein where the middle of the cell would normally appear.

Other specimens examined. ♂, Mellong Swamp, 33.0858°S 150.7058°E, 3 Nov 2000, ex *Mitrasacme polymorpha* R.Br., M. Batley, AM K.362533; ♂, Dargan, 33.4858°S 150.2550°E, 20 Oct 2002, ex *Boronia microphylla* Sieber ex Rchb., M. Batley, AM K.593300; ♀, Mellong Swamp, 33.0858°S 150.7058°E, 11 Oct 2014, ex *Leucopogon virgatus* (Labill.) R.Br., M. Batley, AM K.515773; 10♂, Mellong Swamp, NSW, 33.0784°S

150.7084°E, 24 Oct 2014, ex *Mitrasacme polymorpha* R.Br., M. Batley, AM K.515773, 80–88; 4♂, Mellong Swamp, 33.077°S 150.709°E, 24 Oct 2015, ex *Mitrasacme polymorpha* R.Br., M. Batley, AM K.516496–99; 3♀, Mellong Swamp, 33.07440°S 150.7195°E, 30 Oct 2018, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.540408–10; 5♀, Mellong Swamp, 33.0792°S 150.7208°E, 11 Nov 2020, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.581373–77; ♂, Mellong Swamp, 33.0803°S 150.7207°E, 22 Oct 2022, ex *Hibbertia obtusifolia* DC., M. Batley, AM K.593301; ♀, Mellong Swamp, 33.0773°S 150.7084°E, 22 Oct 2022, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.593302; 2♀, Mellong Swamp, 33.077°S 150.708°E, 8 Nov 2022, M. Batley, AM K.593303, 04; ♀, Mellong Swamp, 33.0715°S 150.7162°E, 9 Oct 2023, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.593305; ♀, Marramarra NP, 33.5630°S 151.0695°E, 24 Oct 2023, ex *Isopogon anemonifolius* (Salisb.) Knight, M. Batley, AM K.593306.

Note. Most females were collected from *Isopogon* sp. while most males were found on *Mitrasacme polymorpha* in the same vicinity. This pattern is consistent with the hypothesis that the females are monolectic from *Isopogon* which is not nectiferous (Harden, 2002; Bernhardt et al., 2019).

Etymology. The specific name, from the Greek words for weak and hair, refers to the sparse hind tibial scopa of the female.

Leioproctus (Protomorpha) fallax (Cockerell, 1921)

Fig. 13

Holotype: ♀, Bribie Is., QLD, 2 Nov 1913, H. Hacker, QM T2396.

Diagnosis for male. Small (*ca* 7 mm long), dark, strongly and densely punctate, propodeal triangle mostly vertical with a short, coarsely areolate subhorizontal region shorter than the metanotum, jugal lobe of hind wing extending beyond cu-v, length of stigma more than half length of the costal margin of the marginal cell of forewing, malar space obsolete. These characters meet most of the criteria for inclusion in the subgenus *L. (Protomorpha)* (Maynard, 1991; Michener, 2007). The male of *L. fallax* can be distinguished from males of all other known *L. (Protomorpha)* species by the unmodified hind tibia and basitarsus (elaborately expanded in most other species) and hind tibial spurs of equal length (Batley & Popic, 2013).

Description of male (K.581396). Head width 2.5 mm; body length 7.1 mm. Relative dimensions: HW 100; HL 78; UFW 63; LFW 43; SL 22; FL 68; CL 24.

Structure. Clypeus flat, weakly elevated; frontal carina short extending only 0.3 of way to median ocellus; fovea impressed, narrow curving towards lateral ocellus; ocell-occipital area flat; flagellomeres longer than wide

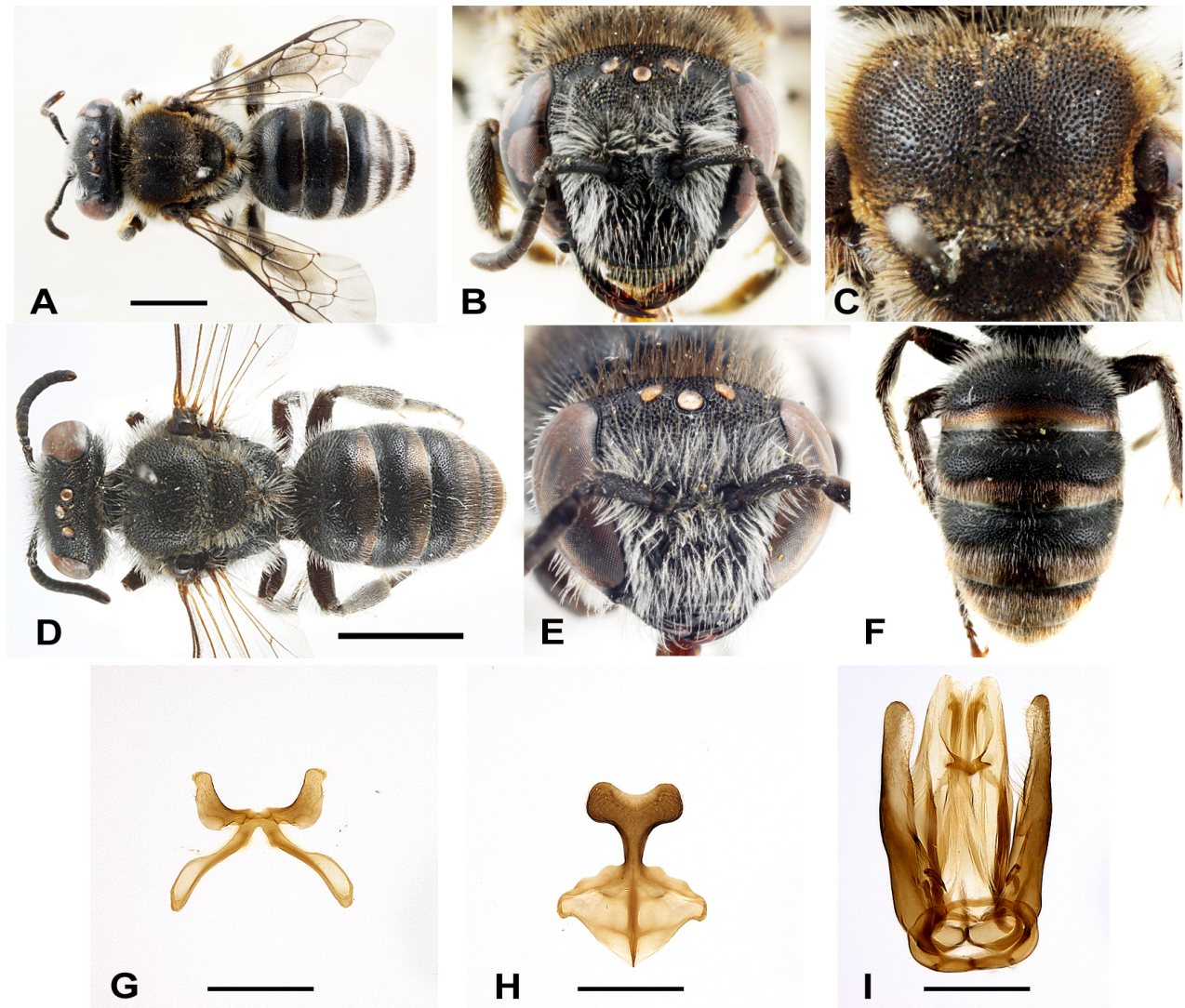


Figure 13. *Leioproctus (Protomorpha) fallax*, ♀: A, dorsal view; B, face; C, scutum. ♂: D, dorsal view; E, face; F, metasoma; G, metasomal S7 ventral view; H, S8 ventral view; I, genitalia ventral view. Scale bars: A, D 2 mm; G–I 500 µm.

except first three shorter than wide; metanotum with distinct, blunt tubercle; claws cleft; fore wing with three submarginal cells, second cell receiving first recurrent vein medially; stigma broad, 0.6 times as long as costal margin of marginal cell; apex of marginal cell well removed from costa; jugal lobe of hind wing, reaches well beyond cu-v, marginal areas of metasomal terga wide, depressed.

Colouration. Black except metasomal marginal areas translucent brown, claws amber and mandible dark red apically.

Pubescence. Hair in paraocular and interantennal areas, and on scape open, white plumose 1×MOD, sparse on clypeus; gena with white, erect, plumose hair 1–1.5×MOD; scutum and scutellum with open, erect, pale brown, plumose hair 0.5–1×MOD, extreme margins of scutellum and metanotum with longer plumose hair; mesepisternum, venter and all trochanters with plumose white hair *ca* 1×MOD; metasomal terga with open, erect, minutely-branched white hair 0.5×MOD on

disc and open, adpressed, simple pale brown hair in marginal areas; sternal hair sparse apart from open apical fringes on S2–S5.

Sculpture. Integument polished between punctures. Punctures on face large, mostly contiguous, merging on lateral parts of clypeus, $i \approx 0.5d$ basally on clypeus and on supraclypeal area; punctures on scutum, scutellum, mesepisternum and discs of metasomal terga, small $i \leq 0.5d$ on marginal areas; propodeal triangle coarsely areolate.

Other specimens examined. ♂, Marramarra NP, 33.5639°S 151.0700°E, 21 Nov 1998, ex *Gaudium trinervum* (J.White) Peter G.Wilson, M. Batley, AM K.593309; ♀, 22 km S of Charleville, 26.599°S 146.190°E, 29 Aug 2009, ex *Calotis erinacea* Steetz, M. Batley, AM K.273350; 2♂,♀, Mellong Swamp, 33.0792°S 150.7208°E, 18 Nov 2020, ex *Hibbertia obtusifolia* DC. (♀) & *Dampiera stricta* (Sm.) R.Br. (♂), M. Batley, AM K.581388–90; 2♂, Mellong Swamp, 33.08°S 150.72°E, 28 Nov 2020, ex *Hibbertia acicularis* (Labill.) F.Muell., *Platysace ericoides*

(Sieber ex Spreng.) C. Norman, M. Batley, AM K.581396, 97; 2♂ 3♀, Mellong Swamp, 33.07°S 150.72°E, 15 Nov 2021, ex *Hibbertia obtusifolia* DC. (2♂, 3♀), *Dampiera stricta* (Sm.) R.Br. (♀), M. Batley, AM K.593310–14; ♂, Goonoo SCA, 32.013°S, 148.918°E, 11 Nov 1984, N.W. Rodd, K.291011.

Note. Most, though not all, females were collected while gathering pollen from *Hibbertia*, and most males when searching around *Hibbertia* flowers which do not produce nectar. From the limited data available, it would appear that female *L. fallax* may be monolectic (*sensu* Cane 2021), requiring visits to flowers other than *Hibbertia* to obtain nectar.

Disclosures

None

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