

An Unusual New *Leioproctus* Species (Hymenoptera: Colletidae)

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ABSTRACT. *Leioproctus glendae* Batley, n. sp., is described on the basis of two males and one female from western Queensland. The female has an unusually narrow fore basitarsus and mandibular structure not seen in other members of the genus, while the male terminalia do not closely resemble those of any other species group. The new species provides further demonstration of the variety of forms contained in the genus *Leioproctus*, and is described in order to assist future revision of this group.

KEYWORDS. Bee; Colletidae; *Leioproctus*; new species

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When rationalising the generic level taxonomy of Australian bees, Michener defined the genus *Leioproctus* Smith to mean a major group of bees that included both Australian and South American species (Michener, 1965). Even at that time, he acknowledged that South American mellitologists preferred to divide the genus more finely and that the genus he had defined was probably not a natural group (Moure *et al.*, 1999, 2012; Almeida, 2008; Almeida & Danforth, 2009). Over 40 years later he maintained this conservative approach (Michener, 2007, chapter 31; see also Maynard, 2013) because of difficulties in finding definitive characters that did not leave some species intermediate between groups, although an identification key was provided for all subgenera of *Leioproctus*.

Species with unusual characteristics (e.g., Packer, 2006; Houston & Maynard, 2012) will, therefore, be important in any future revision of the genus *Leioproctus* and this communication describes another such species.

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Terminology, methods and measurements

The morphological terminology follows that used by Michener (Michener & Fraser, 1978; Michener, 2007) including use of the word hair and the description of legs in their normal positions. Relative dimensions quoted in the descriptions were measured using an eye-piece graticule on a stereomicroscope with the zoom objective set to give a reading of 50 divisions for the head width. Abbreviations used for the measurements are *CL*, median vertical length of clypeus; *CW*, maximum width of clypeus; *FL*, length of flagellum; *HL*, head length; *HW*, head width; *LID*, lower interorbital distance; *SL*, length of scape; *UID*, upper interorbital distance. Metasomal terga are numbered *T1*, *T2* etc., sterna as *S1*, *S2* etc. The male terminalia were extracted for examination. Geospatial coordinates are GPS readings (map datum WGS84). The abbreviation *AM* is used for the collection in the Australian Museum, Sydney.

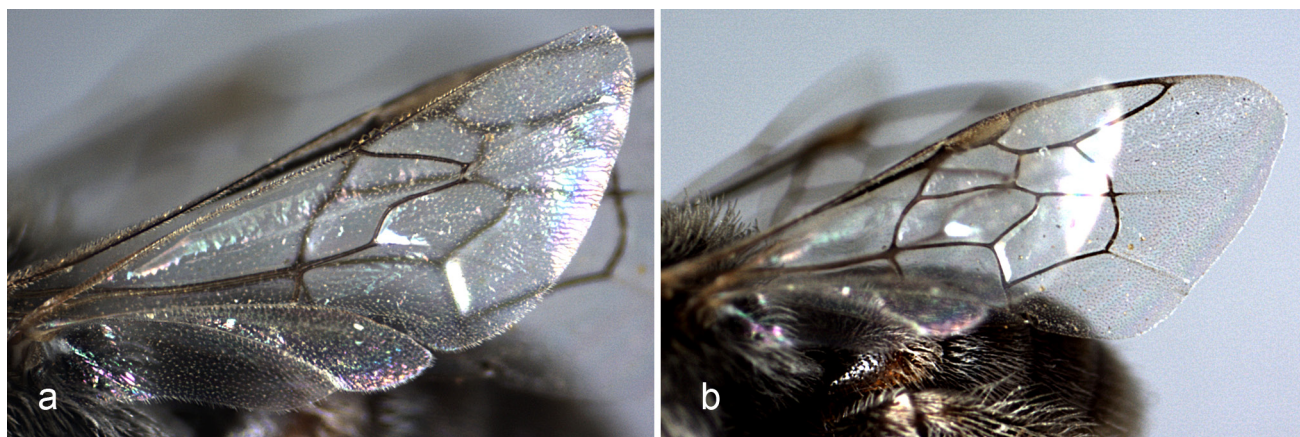


Figure 1. Wing venation of *Leioproctus glendae* Batley n. sp. male. (a) Hind wing in focus to show jugal lobe; (b) fore wing in focus.

Leioproctus glendae Batley n. sp.

Type specimens. Holotype ♀, Ethabuka Station, Queensland (23.738°S 138.467°E), 21 Apr 2012, M. Batley, *ex Scaevola depauperata* in AM (K363485). Paratypes 2 ♂♂ Ethabuka Station, Queensland (23.714°S 138.453°E), 30 Apr and 9 May 2014, M. Batley, *ex Scaevola depauperata* in AM (K470078–079).

Diagnosis

Small, moderately hairy bees with black head and mesosoma and orange-brown metasoma. Forewing with two submarginal cells, jugal lobe of the hind wing extending well beyond cu-v (Fig. 1a). Females possess a narrow, flattened fore basitarsus (Fig. 4) and mandibles unlike any other *Leioproctus* species (Fig. 3). Males have similar mandibles and a unique eighth metasomal sternum (Fig. 8a) whose apex is visible externally.

Description

Female—Head width 1.83 mm, body length 5.8 mm. Relative measurements: HW 50, HL 47, UID 33, LID 25, SL 16, CW 26, CL 16, FL 27. *Head*: black, except antenna, labrum, mandible and ventral margin of clypeus orange brown. Clypeus extends well below mandibular articulations giving face an elongate appearance, anterior surface projected in front of eyes, lateral edges strongly convex, epistomal suture indistinct; face with broad, shallow depression from anterior ocellus to ventral margin of clypeus. Mandible with condylar ridge and outer ridge very narrow and strongly projected from outer surface leaving a large, flat outer interspace, below each ridge is a line of long, weakly-branched setae; cap of rutellum

thick and greatly elongated into a dagger-like tooth (Fig. 3). Head densely punctate except in medial depression and small areas of vertex adjacent to posterior ocelli. Paraocular areas and frons, except medially, densely covered with long, white, finely-branched hair. Scape short reaching a bit over ½ way to anterior ocellus. Labrum approximately triangular, width *ca* 2.5× length, gently convex, polished, with horizontal carina and stiff setae on the inflexed surface below the carina. Malar space obsolete. Maxillary palpus short (*ca* 0.25× head width), labial palpus elongate and flattened, exceeding end of glossa (*ca* 0.5× head with, ratio of segments 17:13:12:10 starting from base). *Mesosoma*: black with legs orange-brown. Fore basitarsus greatly flattened and elongated (*ca* ¾ as long as tibia and twice as long as remainder of tarsus, excluding claws), bearing widely spaced long hairs (Fig. 4a, b); fore tibial spur modified (Fig. 4c); inner hind tibial spur finely serrate (Fig. 5a); claws cleft with inner tooth slightly smaller than outer; hind basitibial plate carinate, well-defined with open cover of minutely-branched hair; scopae formed from combination of long, plumose hair on hind trochanter and basal half of hind femur, openly spaced, weakly-branched hair on outer face of hind tibia and open, erect hair on sterna, widely-branched on S2, 3, simple on S4, 5. Pronotal collar thin, much lower than scutum; metanotum with small tubercle; subhorizontal surface of propodeum about as long as metanotum, rounding smoothly onto vertical surface. Surface polished with close, strong punctures except in propodeal triangle which is weakly transversely striate with large areolae lateromarginally. Most of mesosoma other than propodeum closely covered with moderately long, strongly-branched, white hair; scutellum and posterior half of scutum mostly bare, possibly as a result of wear. *Wing venation*: fore wing with two submarginal cells,

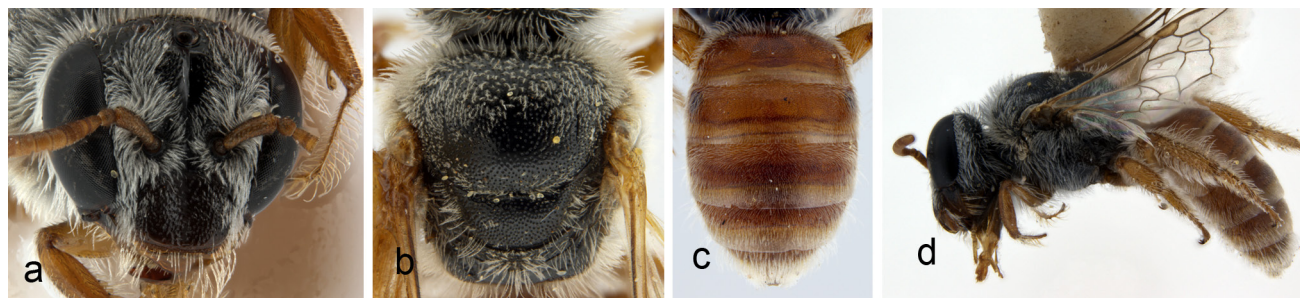


Figure 2. Habitus images of *Leioproctus glendae* Batley n. sp. female.



Figure 3. Mandible of *Leioproctus glendae* Batley n. sp. female.

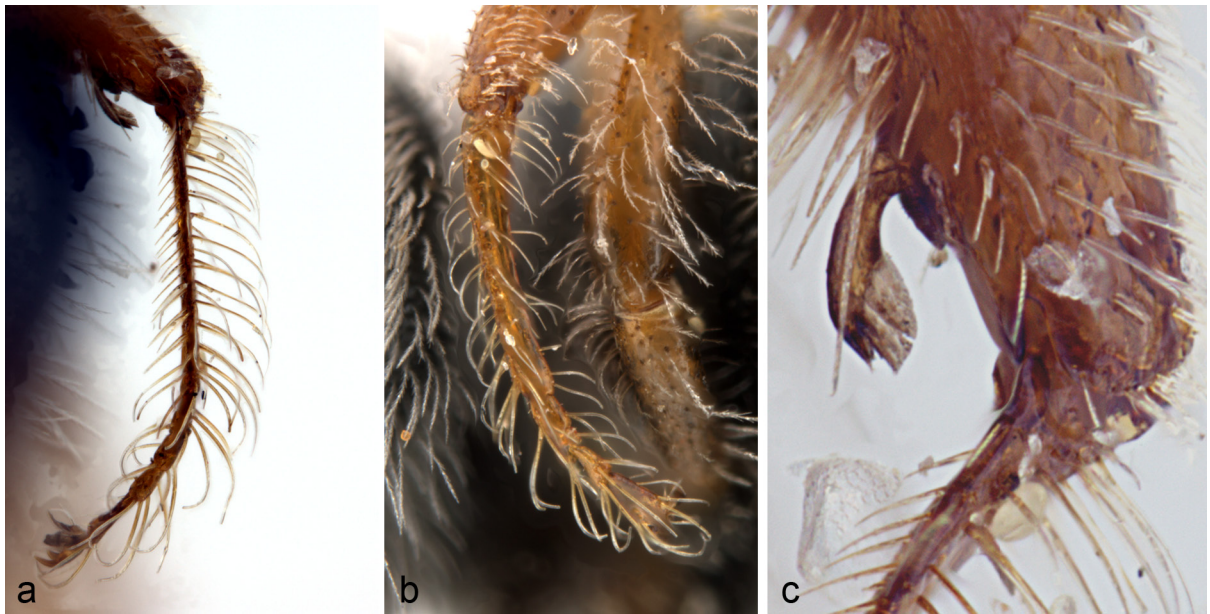


Figure 4. Female *Leioproctus glendae* Batley n. sp. (a) fore tarsus lateral view; (b) front view; and (c) fore tibial spur.

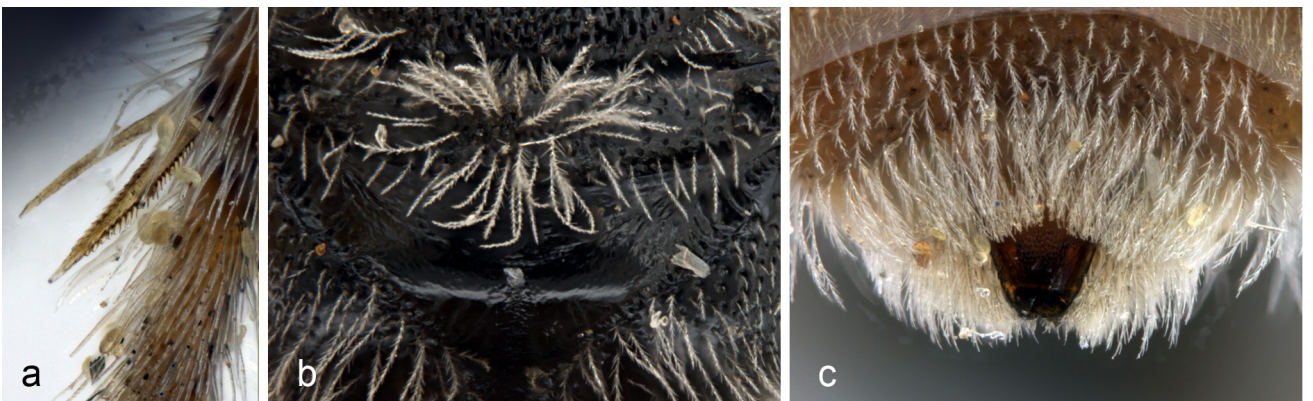


Figure 5. Female *Leioproctus glendae* Batley n. sp. (a) inner hind tibial spur; (b) propodeum; and (c) pygidial plate.

first recurrent vein entering second submarginal cell; stigma broad, *ca* ½ as long as costal margin of marginal cell; apex of marginal cell well away from costa; jugal lobe of hind wing reaches well beyond cu-v (similar to that of male, Fig. 1a). *Metasoma* orange-brown, slightly darker ventrally, terga translucent apically, strongly and densely punctate with a fine covering of long, adpressed, white, minutely-branched hair; T5,6 with dense, pale prepygidial and pygidial fimbria; pygidial plate weakly emarginate, carinate with medial area acinose (Fig. 5c).

Male—Head width 1.74, 1.84 mm, body length 5.5, 5.8 mm. Relative measurements: HW 50, HL 45, UID 32, LID 24, SL 11, CW 24, CL 18, FL 30 (± 1 for both specimens). *Head*: as for female except for following: facial hair somewhat longer and extending onto clypeus and scapes; width labrum *ca* 4× length, apical ½ sharply deflexed, bearing stiff setae; mandible broad basally, tapering evenly to a single tooth, cap of rutellum not thick and extended; labial palpus *ca* 0.6× head with, ratio of segments 18:16:15:11 starting from base. *Mesosoma* as for female except hair a bit longer

and very pale brown. *Wing venation*: as described for female (Fig. 1). *Legs*: dark brown basally, mostly orange-brown distally from apices of femora, outer face of tibiae with dark brown suffusions; claws cleft, teeth of equal size; inner hind tibial spur finely serrate. Lengths of basitarsi ½ length corresponding femora; hind basitibial area small, defined by a fine carina, more easily observed with transmitted light. *Metasoma* orange-brown, slightly darker ventrally, terga translucent apically, strongly and densely punctate with a fine covering of long, adpressed, pale brown, minutely-branched hair. Posterior margin S6 with small medial emargination (Fig. 8b). Vestiture as in female except somewhat longer and denser. *Terminalia*: as shown in Figs 7, 8; S7 with simple, greatly reduced posterior lobes and a few simple setae; S8 has a short, bifid apical process, which is exposed externally; genital capsule has strongly hairy gonoforceps and penis valves with broad transparent wings at the apex.

Etymology. The species is named after Prof. Glenda Wardle in recognition of her contributions to desert ecology.



Figure 6. Habitus images of *Leioproctus glendae* Batley n. sp. male.

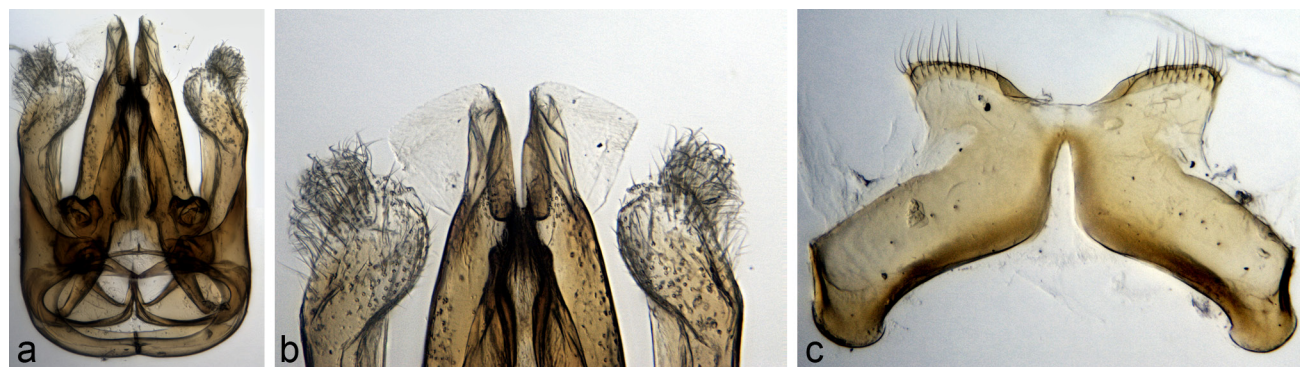


Figure 7. Terminalia of *Leioproctus glendae* Batley n. sp. male (a) genital capsule; (b) apex of penis valves; and (c) S7.

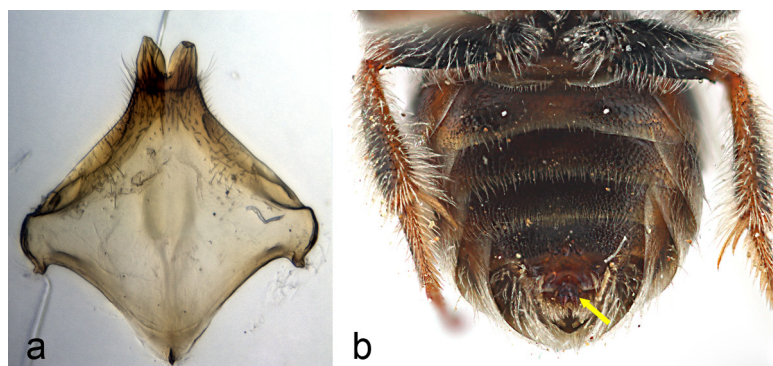


Figure 8. Male *Leioproctus glendae* Batley n. sp. (a) S8; and (b) ventral view of metasoma; apex S8 arrowed.

Remarks

Although the sexes were collected 2 years apart, both were found on the same flower at sites separated by about 3 km, each time when the areas were recovering from recent fire. Given the many morphological similarities, but especially the similar mandibles there can be little doubt that they belong to the same species. During the second collection event, flowers were examined for evidence of bud damage, but none was observed.

Discussion

This species keys out to the subgenus *Leioproctus* (*Colletellus*) using Michener's scheme (Michener, 2007). The male terminalia, however, were completely unlike those of three *L. (Colletellus)* species examined (*vide infra*). It may ultimately be placed in a genus or subgenus of its own, but until more is known about its biology it would seem prudent to leave it as unplaced within *Leioproctus*. The most obvious characteristics of the female, the fore tarsus and mandible, are absent or less pronounced in the male, suggesting that they are related to pollen collection or nest construction. Changes in male terminalia, however, are more likely to show relationships between species though they sometimes change more rapidly than other morphological features (Eberhard, 2010; Simmons, 2014).

The overall appearance of both sexes suggests that the closest groups are *L. (Colletellus)* and *L. (Minycolletes)*. Species in these groups are small, have short scapes and flagella, no impressed facial fovea, a jugal lobe of the hind wing that exceeds cu-v and distinctly punctate sculpture. Although species in the subgenus *L. (Minycolletes)* mostly have three submarginal cells in the fore wing, individual males with only two cells are found in *L. abnormis* (Maynard, 2013) and *L. eruditus* (MB, pers. obs.). The inner hind tibial spur of *L. glendae* is neither ciliate like *L. (Colletellus)* nor pectinate like *L. (Minycolletes)* and the metanotum is tuberculate only in *L. (Minycolletes)*. The male terminalia of three undescribed *L. (Colletellus)* species were examined (two specimens in AM, one set of images provided by Dr Houston, Western Australian Museum, results not shown). The terminalia of all three were similar (and unlike those of *L. glendae*) with a pair of moderately large apical lobes on S7, a normal medial posterior projection on S8 and unmodified penis valves on the genitalia.

While a bifid form of S8 and reduced apical lobes of S7 are also found in *Glossurocolletes*, in that genus the projections from S8 are much larger and more delicate and the rest of S8 is rather different. Both *Glossurocolletes* species are somewhat larger, have males with modified antennae and both sexes have somewhat coarser surface sculpture. It is relatively common for *Leioproctus* males to have the tip of S8 visible externally so the emargination of S6 may have arisen as a consequence of the short neck on S8. While the bifid apex of S8 might suggest a change in copulatory configuration from that illustrated for *Perdita albipennis* to that shown for *Nomia triangulifera* (Roig-Alsina, 1993), it is unlikely that such a change would occur suddenly within a group of otherwise similar species. It does mean that details of the mating behaviour of *L. glendae* would be of great interest.

The modified fore tarsus of the female suggests that it is an adaptation for collecting pollen from narrow tubular flowers similar to those visited by *L. macmillani* (Houston,

1991). There is no elongation of the malar area but the labial palpi are long and flattened. Such modifications would not be required for foraging from the *Scaevola* flowers on which the specimens were found, but the recent fire events may have reduced the types of flowers available. The hair on the hind tibia of *L. glendae* is relatively sparse, more like that of *L. (Protomorpha) gurneyi* than the denser, more highly branched hair of *L. (Protomorpha) gibber*. The sparser scopal hair of the former species was ascribed to preferential collection of pollen tetrads from *Lechenaultia divaricata* rather than from *Scaevola* species (Batley & Popic, 2013). No *Lechenaultia* flowers were found when the *L. glendae* specimens were collected.

The mandibles of other female Australian *Leioproctus*, like those of most non-megachilid bees, have a distinct preapical tooth at the end of the pollex (Michener & Fraser, 1978; Michener, 1965). The one exception is *L. nigrofulvus*, which nests in termite mounds (Maynard, 2013). In this case, all the normal features of the mandible are elongate and the pollex can be seen to merge smoothly with the rutellum. In *L. glendae*, the mandibular pollex is hidden behind the large carinate outer ridge and the point where it merges with the rutellum is less obvious. The unusual feature of the *L. glendae* mandible is that there is no elongation of the mandible basal to the point where the outer and condylar ridges merge, but the cap of the rutellum is elongated and thickened.

The function of the mandibular tooth is unclear. It is much stronger than would be required for opening flower buds, and species like *Hylaeus bicolorellus* and *Hylaeus hypoleucus* that are known to do so have female mandibles with a pre-apical tooth. Australian bee species having mandibles with strong ridges and a large flat outer interspace, like *Amphylaeus morosus* and *Hylaeus perplexus*, nest in wood (Spessa *et al.*, 2000; Ellingsen, 2015). Where the nests of *Leioproctus* species have been found, they were in the ground, so it would be surprising if the adaptation were found to be for nesting in wood. It may be interesting to examine plants with woody buds like *Eucalyptus*.

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