



A revision of the Australian leafcutter bees, previously placed in *Megachile* (*Eutricharaea*) (Hymenoptera: Megachilidae), with descriptions of seven new species

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Abstract

The species in the subgenus *Eutricharaea* Thompson, 1872 (genus *Megachile*) construct brood cells from pieces of leaves or petals cut from a diverse array of plants. Commonly bees in this group are called 'leafcutter bees'. The Australian species, as previously placed in *Eutricharaea*, are revised and redescribed, and seven additional species are described. New combinations are proposed for two species: *Chalicodoma* (*Hackeriapis*) *atrella* Cockerell 1906, *comb. nov.* = *Megachile* (unplaced) *atrella* Cockerell 1906; *Megachile* (*Eutricharaea*) *hampsoni* Cockerell 1906, *comb. nov.* = *Megachile* (unplaced) *hampsoni* Cockerell 1906. Based on examination of type specimens the following 12 names were synonymized: *Megachile adalaidae* Cockerell 1910a, *syn. nov.* = *Megachile* (unplaced) *atrella* Cockerell 1906; *Megachile phenacopyga* Cockerell 1910a, *syn. nov.* = *Megachile* (*Notochile*) *chrysopyga* Smith 1853; *Megachile australasiae* Dalla Torre 1896, *syn. nov.*, and *Megachile cygnorum* Cockerell 1906, *syn. nov.* = *Megachile* (*Notochile*) *macularis* Dalla Torre 1896; *Megachile austeni* Cockerell 1906, *syn. nov.*, and *Megachile rowlandi* Cockerell 1930a, *syn. nov.* = *Megachile* (unplaced) *pictiventris* Smith 1879; *Megachile ignescens* Cockerell 1929, *syn. nov.* = *Megachile* (*Aethomegachile*) *rhodogastra* Cockerell 1910; *Megachile cetera* Cockerell 1912, *syn. nov.*, and *Megachile subsericea* Rayment 1939, *syn. nov.* = *Megachile* (*Eutricharaea* s. l.) *sericea* Cockerell 1910c; *Megachile ciliatipes* Cockerell 1921, *syn. nov.*, *Megachile detera* Cockerell 1910b, *syn. nov.*, and *Megachile quinquelineata* Cockerell 1906 = *Megachile* (*Anodonteutricharaea*) *simplex* Smith 1853.

Phylogenetic analyses of DNA barcode data indicate that the Australian leafcutter bees, as previously placed in subgenus *Eutricharaea*, are not monophyletic and some are associated with other *Megachile* subgenera that also occur in South-East Asia. A description of a new subgenus *Megachile* (*Notochile*) that contains a clade of Australian endemic species is provided, and most species have been transferred to other subgenera. All descriptions in this paper are accompanied by high resolution diagnostic images and distribution maps. Data on flower visitation and phenology are given. Dichotomous keys to both sexes of the species are provided.

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Introduction

The subgenus *Megachile (Eutricharaea)* is a large group of species, with nine species in North America, and 203 species known from in Africa, West and East Palearctic, South-East Asia, Australia, and South Pacific (Ascher & Pickering, 2024). The name *Eutricharaea*, meaning well-endowed with hair, first appeared in a paper by Thomson, 1872, in association with *Apis argentata*. Michener (1965) in 'A classification of the bees of the Australian and South Pacific regions' uses the name *Eutricharaea* as a subgenus of *Megachile* for species where females have mandibles with a complete cutting edge in the third interval and an incomplete cutting edge in the second interval (Fig. 19I, Figs. 4JK). Members of the subgenus are commonly referred to as leafcutter bees, because the solitarily nesting females use pieces of leaves or petals to line brood cells in existing hollows, such as hollow plant stems, borer holes in wood, rock crevasses, or occasionally burrows dug in soil.

The evolution of the Megachilidae, and the systematics of leafcutter bees was first studied using phylogenetic analyses of multigene data by Litman *et al.* (2011), and later by Trunz *et al.* (2016), and, using a combined genetic and morphological dataset, by Gonzalez *et al.* (2019). These studies resulted in the subdivision and recognition of many new subgenera and species groups (Praz, 2017). Unfortunately, in these papers, Australian taxa are highly under-represented, which does not allow inferences about relationships of these taxa with others in the region.

Australian Megachilidae currently comprise 239 named species (Australian Faunal Directory, 2025). In the genus *Megachile* 159 species have been placed in 13 subgenera, and 62 species are unplaced to subgenus. Australia counts 38 named species of *M. (Eutricharaea)* including one species, *M. rotundata*, that was introduced for pollination of *Medicago sativa*, lucerne (Pitts-Singer & Cane, 2011).

Here, we provide a taxonomic revision of the Australian leafcutter bees associated with *M. (Eutricharaea)*, combined with DNA barcode data to shed some light on the systematics and evolutionary history of the group.

Methods

Specimens examined

This study is based on examination of specimens from the following institutions. Their acronyms are used in the database of the examined specimens, which is available as supplementary information associated with this paper: **AM** Australian Museum, Sydney; **ANIC** Australian National Insect Collection, Canberra; **BMNH** The Natural

History Museum, London, United Kingdom; **HU** Institute für Spezielle Zoology und Zoologisches Museum der Humboldt Universität, Berlin, Germany; **BPBM** Bernice Pauahi Bishop Museum, Honolulu, USA; **OUM** Hope department of Entomology, Oxford University, United Kingdom; **MV** Museum of Victoria Entomology, Melbourne; **QM** Queensland Museum, Brisbane; **SAMA** South Australian Museum, Adelaide; **UQIC** University of Queensland Insect Collection, Brisbane, at QM; **WADA** Department of Primary Industries, Perth, Western Australia; **WAM** Western Australia Museum, Perth; **WINC** Waite Insect Collection, Adelaide.

Additional fresh specimens were collected throughout Australia by RL, KH, and a number of other collectors. Field collected specimens were killed and preserved in absolute ethanol, to allow for molecular work at a later stage, or killed by freezing and then pinned. A single leg from specimens collected during Bush Blitz surveys (<https://bushblitz.org.au>) in the past 16 years were submitted to the Barcode of Life Database (BOLD; Ratnasingham and Hebert, 2007) for DNA barcoding using the cytochrome c oxidase subunit 1 gene (hereafter CO1). Specimen details, including DNA sequence, collecting dates and locality information are open access and available in BOLD under the project code AUSBS (Hogendoorn *et al.*, 2015; <https://www.boldsystems.org/>). BOLD-BIN (Barcode Index Number) codes and BOLD access codes, when available, are given with the species descriptions.

Vouchers for these specimens are kept in the AUSBS barcode reference collection at the South Australian Museum. With the species descriptions only the data of the type specimens are given, the full data of all examined specimens can be found in the supplementary information (<https://doi.org/10.5061/dryad.69p8cz9k6>). Distribution maps were created using the Spatial Portal in ALA (<https://spatial.ala.org.au/>) using the location data of the examined specimens. Information on host plant data were copied from specimen labels and the names of plant genera/species may not be following the current systematics.

Taxonomic methods

For species descriptions the terminology used by Michener (2007) was followed, but for punctuation, we followed definitions by Houston, illustrated in Figures 10–27 in Houston (1975). Type specimens in museum collections abroad and in Australia were examined by JK. The hidden sterna of male specimens were exposed after relaxing in a 70–80°C steam chamber for 1–2 hours (modified from Plant & Dubitzky, 2008). Character state matrices, species descriptions and construction of dichotomous and interactive keys were completed with

Lucid4 Builder. The interactive keys associated with this paper will be available at the Lucid website (<https://lucidcentral.org/>).

Measurements were taken using an ocular micrometre. Body length (L) and wing length (W) were recorded as absolute measurements. Body length was measured in lateral view, from the ventral margin of the clypeus to the petiole, and from the petiole to the tip of the metasoma. Wing length was measured from the tegula to the apex of the forewing. For the lower part of the clypeus, we use the term 'ventral margin', which is equivalent to 'apical margin' as used by other bee-workers. Other head characters are measured relative to head width, where head width was set to 100 units. A Leica stereomicroscope with auto-montage imaging stacking software and Zerene Stacker (<https://www.zereneystems.com>) was used to obtain high-resolution diagnostic images for all species.

The following abbreviations are used in the identification key and species descriptions: **L** body length in mm (measured as explained above); **W** wing length in mm (measured as explained above); **T1**, **T2** etc. for first, second metasomal tergite etc.; **S1**, **S2** etc. for first, second metasomal sternite etc.; **F1**, **F2** etc. for first, second flagellar segment etc.; **Ta1**, **Ta2** etc. for first, second tarsomere etc.; **Te1**, **Te2** etc. for first, second tooth on mandible etc.; **CL** clypeal length; **CW** clypeal width; **OCL** ocelloclypeal distance; **RHM** relative head measurements; **OOD** ocellocular distance; **OOC** vertex width (ocelloccipital distance).

Phylogenetic analyses

Phylogenetic analyses of aligned CO1 sequences of Australian *M. (Eutricharaea)* taxa obtained from the BOLD AUSBS project, and CO1 sequences from Genbank of leafcutter bees generated by Trunz *et al.* (2016) were carried out using the program PAUP* version 4.0b8 (Swofford 2001) and MRBAYES v.3.2.7 (Huelsenbeck & Ronquist 2001). PAUP* was used for generating and editing data matrices as well as error proofing using neighbour joining runs of uncorrected genetic distance. Bayesian analyses were performed using MRBAYES with a GTR + I + G model. The analyses were performed applying unlinked data partitions for each of the codons for the CO1 gene, with four simultaneous chains and ten million generations per chain, sampling trees every 1000 generations, until all parameters had reached their ESS, and the potential scale reduction parameter was approximately one for all parameters, indicating that the Bayesian runs had converged and that a sufficient sample of the posterior distribution had been obtained. Parameter estimation and calculations of the >50% posterior probability consensus tree were done after discarding the first 25% of the saved trees.

Phylogenetic analyses were done primarily to test whether the Australian *M. (Eutricharaea)* species are monophyletic relative to other leaf cutting *Megachile*

species, especially from the South-East Asian region. Additionally, results of phylogenetic analyses were used to investigate morphological character evolution and biogeographical history of the species studied here.

Results

Based on examination of type specimens, of specimens from all major Australian museum collections, as well as newly collected material during Bush Blitz surveys and other collecting trips, we now recognise 33 species in the group of bees formerly classified as *M. (Eutricharaea)*. Several of the 35 species of *M. (Eutricharaea)*, as previously classified by Michener 1965 (AFD, 2025), were synonymised, leaving 25 valid species. In addition, we describe seven new species, transfer one species from *Megachile (Hackeriapis)* into the leafcutter bee group, recognise one recently introduced species, and transfer one species out of the leafcutter group.

The type specimens of the Australian species listed under *M. (Eutricharaea)* by Michener (1965), and the Australian Faunal Directory were examined by Judith King. *Chalicodoma (Hackeriapis) atrella* Cockerell 1906, *comb. nov.* was transferred to *M.* (unplaced), and *M. (Eutricharaea) hampsoni* Cockerell 1906, *comb. nov.* was transferred out of *M. (Eutricharaea)* to *Megachile* (unplaced). Based on the examination of the types, the following 12 names are synonymised: *Megachile adelaidae* Cockerell 1910a, *syn. nov.* = *Megachile* (unplaced) *atrella* Cockerell 1906; *Megachile phenacopyga* Cockerell 1910a, *syn. nov.* = *Megachile (Notochile) maculariformis* Cockerell 1907; *Megachile australasiae* Dalla Torre 1896, *syn. nov.*, and *Megachile cygnorum* Cockerell 1906, *syn. nov.* = *Megachile (Notochile) macularis* Dalla Torre, 1896; *Megachile austeni* Cockerell 1906, *syn. nov.*, and *Megachile rowlandi* Cockerell 1930a, *syn. nov.* = *Megachile* (unplaced) *pictiventris* Smith 1879; *Megachile ignescens* Cockerell 1929, *syn. nov.* = *Megachile (Aethomegachile) rhodogastra* Cockerell 1910b; *Megachile cetera* Cockerell 1912, *syn. nov.*, *Megachile subserricauda* Rayment 1939, *syn. nov.* = *Megachile (Eutricharaea s. l.) serricauda* Cockerell 1910c; *Megachile ciliatipes* Cockerell 1921, *syn. nov.*, *Megachile detersa* Cockerell 1910b, *syn. nov.*, and *Megachile quinquelineata* Cockerell 1906, *syn. nov.* = *Megachile (Anodonteutricharaea) simplex* Smith, 1853.

The types of two species (*M. rufopilosa* Friese 1911, and *M. wyndhamensis* Rayment 1935) could not be examined because their whereabouts were uncertain, and these have been therefore classified as unplaced.

Based on a combination of molecular data and data of genitalia morphology (see below) most of the species previously placed in *M. (Eutricharaea)* (AFD 2026, Michener 1965) were transferred to other subgenera, i.e. *M. (Anodonteutricharaea)*, *M. (Aethomegachile)*, *M. (Eutricharaea s. l.)*, and *M. (Notochile subg. nov.)*, a new subgenus created for a clade of Australian endemic species, as well as some unrelated species that could not be placed in any of the known subgenera (Table 1).

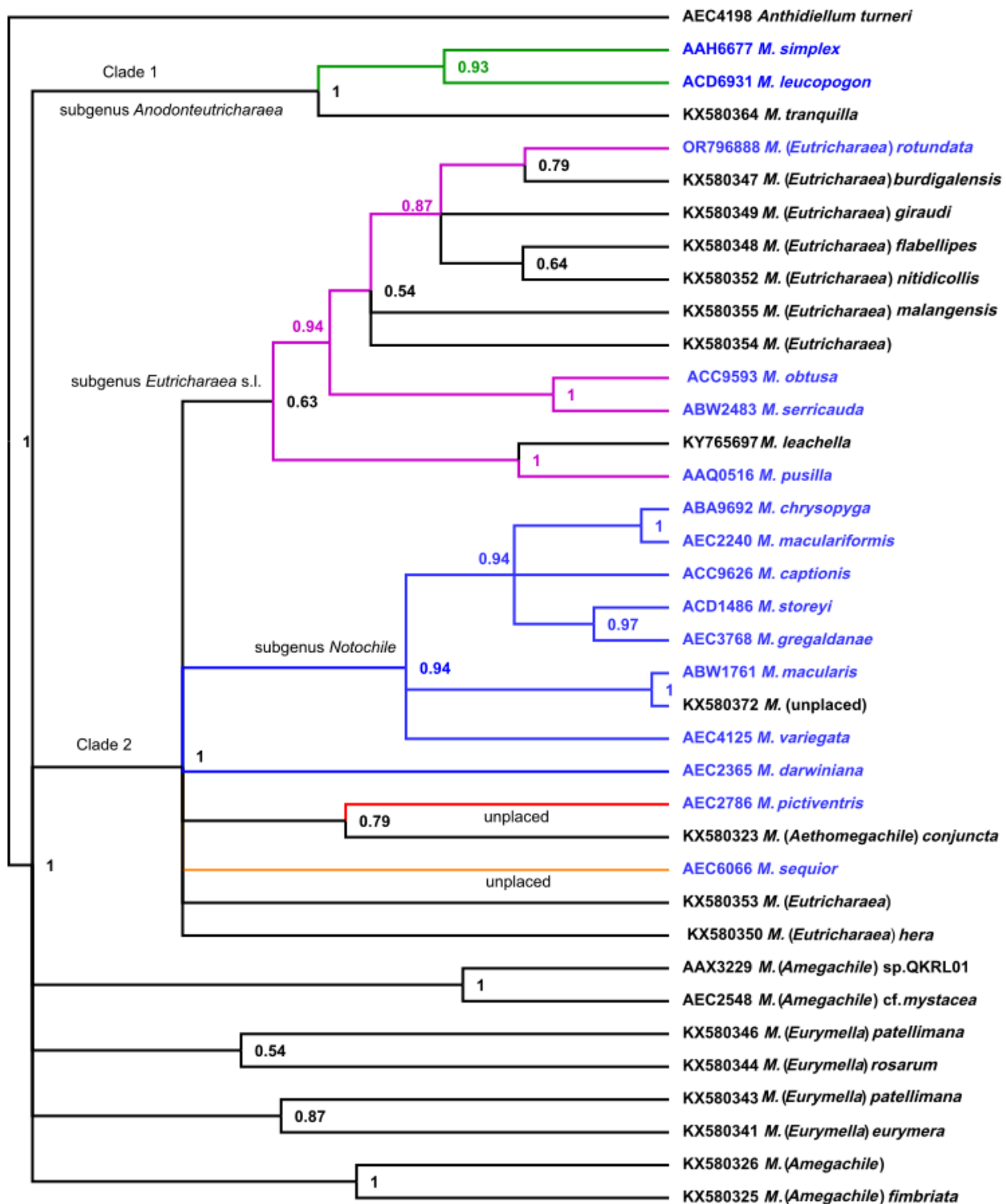


Figure 1. Bayesian phylogenetic analysis of Australian barcoded leafcutter bee species (blue text: BIN-codes and taxon names, see examined specimens file for BOLD Process IDs) in conjunction with SE-Asian species (black text: GenBank accession numbers and taxon names from data generated by Trunz et al., 2016) indicate that the Australian species formerly placed in *M. (Eutricharaea)* are not a monophyletic group. Coloured branches indicate the different Australian clades. Numbers at nodes indicate posterior probabilities.

Seven species are recognised as new. Four of the new species are known from both sexes, and three only from females.

Due to sexual dimorphism in this group, association of sexes was not straightforward. The association of the

sexes was established or confirmed for eight species using DNA barcode data, out of 15 species that have an associated DNA barcode. For the remaining species for which both sexes are known (n=14), the sexes were associated using combinations of locality, date and

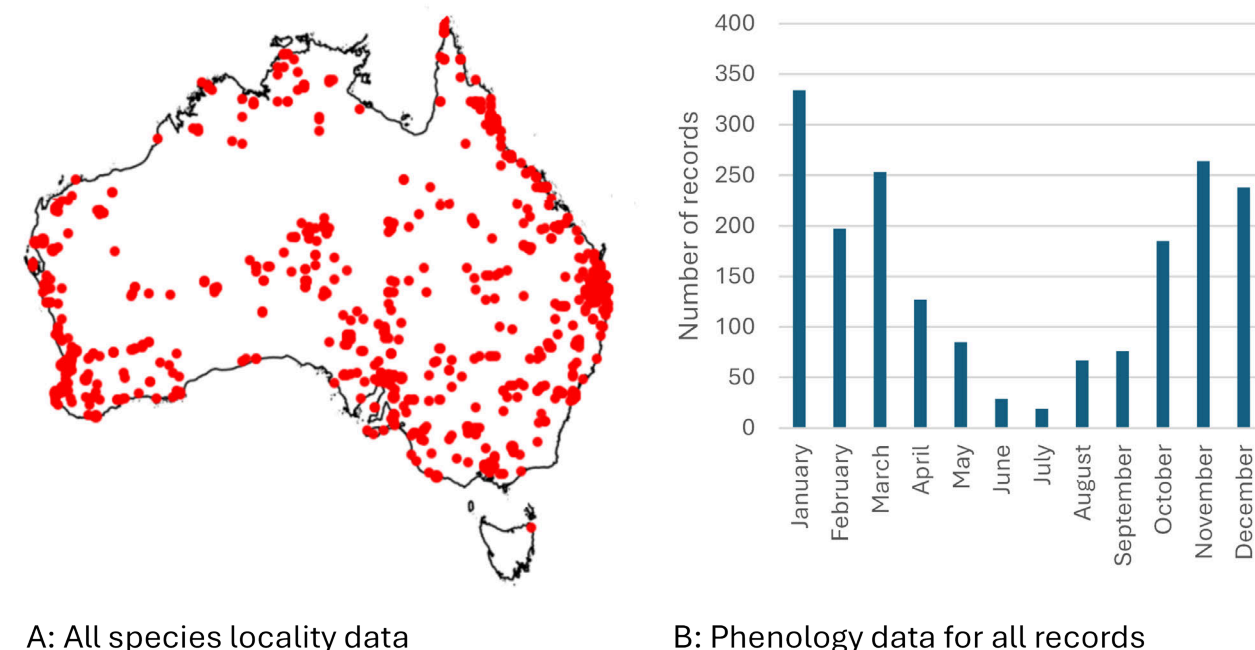


Figure 2. A: All species distribution data. B: All species phenology data

plant species on which the specimens were collected, which we refer to as 'collection data', and/or evidence from nest rearing, body size, and/or shared colouration.

Phylogenetic analyses and morphology

Sixteen of the Australian species have DNA barcodes which were used in phylogenetic analyses together with molecular data of South-East Asian leafcutter bee species generated by Trunz *et al.* (2016). The results indicate that the Australian species of *M. (Eutricharaea)* are not monophyletic (Fig. 1). The phylogenetic tree shows two well supported clades (posterior probabilities 1). Clade 1 contains the Australian species *M. simplex* and *M. leucopogon* Cockerell 1929 with the SE-Asian species *M. (Anodonteutricharaea) tranquilla* Cockerell 1911 as sister species. This clade is characterized by relatively simple gonostyli with short apical setae and forward pointing medio-inner lobes.

The clade is well separated from clade 2 which contains the remainder of the Australian species, as well as SE-Asian species. The backbone of clade 2 is unresolved, as is not surprising because the analyses were based on CO1 barcode data only, see also Trunz *et al.* (2016). However, clade 2 contains two reasonably supported subclades that show further evidence that the Australian species previously classified as belonging to *Eutricharaea* are not a monophyletic group. Subclade 1 (Fig. 1, purple branches) contains species that were classified in Trunz *et al.* (2016) as *M. (Eutricharaea)*, and includes the closely related Australian species *M. obtusa* Smith 1953 and *M. serricauda*, as well as the introduced *M. pusilla* Pérez 1884, with the SE Asian *M. leachella* Curtis 1828 as sister species. Subclade 2 *M. (Notochile) subg. nov.* (Fig. 1, blue branches) contains only Australian

species that do not seem to have a related SE-Asian species in this dataset. *Megachile darwiniana* Cockerell 1906, which appears outside of *M. (Notochile) subg. nov.*, most likely belongs to that group as well, based on the similarities in morphology of the male genitalia. Male genital morphology indicates that *M. bicingulata* sp. nov., *M. chrysopygopsis* Cockerell 1929, *M. gahani* Cockerell 1906, and *M. lineatipes* Cockerell 1910c, also belong to *M. (Notochile) subg. nov.*, but there are no molecular data for these species. The male genital morphology of this group is characterized by complex gonostyli with large hindward directed medio-inner lobes, patches of strong setae, and with apices divided in two lobes, the outer lobe with long setae. The shape of these lobes, and the length and direction of setae vary among species. Other characters that are shared among species in this group are the strongly modified forelegs of the males.

Further, although *M. pictiventris* groups with the SE-Asian *M. (Aethomegachile) conjuncta* Smith 1853, it probably does not belong with *M. (Aethomegachile)* because the shape of the gonocoxites (Fig. 23H) are unlike other species in that subgenus (see Fig. 9A-B in Ascher *et al.* 2016). The species *M. haematogaster* Cockerell 1921 and *M. rhodogastra* do have genitalia that show similarities to *M. (Aethomegachile)* species. Finally, *M. sequior* Cockerell 1910a, appears in clade 2 without close association with other species in the dataset.

Based on these results, we conclude that the Australian species revised here are not monophyletic but are associated with three existing *Megachile* subgenera, *M. (Aethomegachile)*, *M. (Eutricharaea)*, *M. (Anodonteutricharaea)*, a fourth clade, for which we proposed the new subgeneric name *Notochile*, and at least two

Table 1. List of new combinations of species transferred out of *Chalicodoma* (*Hackeriapis*) and *Megachile* (*Eutricharaea*). The unplaced species remain in the Group 1 subgenera of leafcutting species (as in Trunz *et al.* 2016). The letters A, B, C indicate species groups.

<i>Megachile</i> s.l. species	new combination
previously in <i>Chalicodoma</i> (<i>Hackeriapis</i>)	
<i>C. atrella</i> Cockerell 1906*	<i>M.</i> (unplaced A)
previously in <i>Megachile</i> (<i>Eutricharaea</i>)	
<i>M. haematogastra</i> Cockerell 1921	<i>M.</i> (<i>Aethomegachile</i>)
<i>M. rhodogastra</i> Cockerell 1910	<i>M.</i> (<i>Aethomegachile</i>)
<i>M. leucopogon</i> Cockerell 1929	<i>M.</i> (<i>Anodonteutricharaea</i>)
<i>M. simplex</i> Smith 1853	<i>M.</i> (<i>Anodonteutricharaea</i>)
<i>M. captionis</i> Cockerell 1914	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. chrysopyga</i> Smith 1853	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. chrysopygopsis</i> Cockerell 1929	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. darwiniana</i> Cockerell 1906	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. gahani</i> Cockerell 1906	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. lineatipes</i> Cockerell 1910	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. maculariformis</i> Cockerell 1907	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. macularis</i> Dalla Torre 1896	<i>M.</i> (<i>Notochile</i> subg. nov.)
<i>M. waterhousei</i> Cockerell 1906	<i>M.</i> (<i>Notochile</i> subg. nov.) ?
<i>M. kurandensis</i> Cockerell 1910	<i>M.</i> (unplaced)
<i>M. kuschei</i> Cockerell 1939	<i>M.</i> (unplaced)
<i>M. hamptoni</i> Cockerell 1906	<i>M.</i> (unplaced)**
<i>M. rufopilosa</i> Friese 1911	<i>M.</i> (unplaced)
<i>M. wyndhamensis</i> Rayment 1935	<i>M.</i> (unplaced)
<i>M. pictiventris</i> Smith 1879	<i>M.</i> (unplaced B)
<i>M. tenuicincta</i> Cockerell 1929	<i>M.</i> (unplaced B)
<i>M. sequior</i> Cockerell 1910	<i>M.</i> (unplaced C)

* was erroneously placed in the resin bee group

**most likely not a leafcutter bee

unnamed clades. These results also indicate that the Australian leafcutter bees have evolved from several independent colonisations in Australia, probably during the last 10My.

Distribution patterns

Leafcutter bees are found throughout Australia and Tasmania (Fig. 2A). Species distributions seem, more or less, to reflect Australian terrestrial ecoregions as mapped by Olsen *et al.*, 2001. Species that are widely distributed in the deserts and xeric shrublands and adjacent ecoregions are *M. atrella*, *M. captionis*, *M. macularis*, *M. obtusa* and *M. serricauda*. The species *M. pictiventris*, *M. rhodogastra* and *M. tenuicincta* Cockerell 1929 are exclusively found along the east coast and are restricted to tropical and subtropical moist broadleaf forests. The same may be true, although the locality data are limited, for *M. gregaldanae* sp. nov., *M. haematogastra*, and *M. kuschei* Cockerell 1939. The species *M. (E.) chrysopyga* is restricted to the Mediter-

ranean forests, scrub- and woodlands of South-West WA, while its sister species *M. maculariformis* seems mainly to prefer the temperate broadleaf and mixed forest ecoregion. The main distribution of *M. darwiniana* and *M. sequior* is in the ecoregion of tropical and subtropical grasslands, savannas and shrublands, while *M. macrocephala* sp. nov. was found in the deserts and xeric shrubland and tropical and subtropical grasslands, savannas and shrublands along the North-West coast of WA.

Phenology

The activity patterns of Australian leafcutter bees seem to be determined by the climatic parameters of their distribution (Fig. 2B). Most of the records are from the period August-May, with a peak in January. Records in the lower scoring months June-July are represented by species with a wide distribution (e.g. *M. darwiniana*, *M. obtusa*, and *M. serricauda*) or species with restricted dis-

tributions at lower latitudes (e.g. *M. dissita* sp. nov., *M. rhodogastra*, and *M. tenuicincta*).

Floral Records

Australian leafcutter bees were collected on 154 plant species belonging to 35 families (623 records). Seventy-three percent of the records involve only seven plant families: Myrtaceae (27%) represented by 12 genera, with *Eucalyptus* and *Melaleuca* species the most prevalent; Fabaceae (22%) were represented by 14 genera of pea species, particularly *Crotalaria*, *Jacksonia*, and *Gom-*

pholobium; Lamiaceae (6%) with eight genera (e.g. *Dicrastylis*); Goodeniaceae (5%) four genera, with *Goodenia* and *Scaevola* most commonly visited; Asteraceae, Malvaceae, and Proteaceae together represented 13% of records.

Australian leafcutter bees were also collected on introduced plant species such as *Lantana* and *Medicago sativa* (lucerne). From those species with a multitude of flower records it may be concluded that the species are generally polylectic.

Key to the females and males of Australian species previously placed under *Megachile* (*Eutricharaea*)

The following key is based on our current knowledge about the species. Considering the low number of specimens of some species, the fact that for some species only a single sex is known, and that new species are still found in remote areas, one should be aware, when using the keys, of a likelihood of encountering undescribed sexes of species, or even additional species not treated in this paper. To ease identification, it may be necessary to make sure that the mandibles of both sexes are open, and that S4–S7 in males are exposed.

1()	Female	2
1()	Male	29
2(1)	Scopa orange	3
2(1)	Scopa white, straw-coloured, black or brown	6
3(2)	Mesepisternum below wing with patch of black hairs. Frons with straw-coloured or white hairs mixed with long black hairs	4
3(2)	Mesepisternum below wing without black hairs. Frons without black hairs	5
4(3)	Posterior hair bands on sterna only present laterally. Posterior hair bands on T3–T4 absent or very weak laterally	<i>M. (unplaced) pictiventris</i>
4(3)	Posterior hair bands on sterna absent. Posterior hair bands on T3–T4 present on entire width	<i>M. (Aethomegachile) rhodogastra</i>
5(3)	Frons with white hairs. General colour of tergal hair bands off-white or straw-coloured	<i>M. (Eutricharaea s.l.) dissita</i> sp. nov.
5(3)	Frons with orange or golden hairs. General colour of tergal hair bands orange	<i>M. (unplaced) macrocephala</i> sp. nov.
6(2)	Scopa black or brown	<i>M. (unplaced) kurandensis</i>
6(2)	Scopa white or straw-coloured	7
7(6)	Clypeus mostly (closely and) evenly punctate, when a small smooth upper medial patch present then mandibles red	8
7(6)	Clypeus with impunctate medio-longitudinal line	16
8(7)	T2 lateral fovea present, ovate (Fig. 26H)	<i>M. (Eutricharaea s. l.) rotundata</i>
8(7)	T2 lateral fovea absent	9
9(8)	Scutum: hair patches on notauli absent (e.g. Fig. 26A, Fig. 29A)	10
9(8)	Scutum: hair patches on notauli present (e.g. Fig. 11A), in some species reduced to a few small white hairs	12
10(9)	Mesepisternum below wing without black hairs. Posterior hair bands on sterna only present laterally	<i>M. (Notochile) chrysopyga</i>
10(9)	Mesepisternum below wing with patch of black hairs. Posterior hair bands on sterna complete	11
11(8)	Frons with white hairs. Scopa white or straw-coloured, black laterally	<i>M. (Anodonteutricharaea) simplex</i>
11(8)	Frons with white and black hairs. Scopa light straw-coloured, not black laterally	<i>M. (unplaced) tenuicincta</i>
12(9)	Posterior hair bands on sterna complete (Fig. 29D)	13
12(9)	Posterior hair bands on sterna only present laterally	14
13(11)	T6 tomentum on disc with narrow white hair band across posterior half of tergum (Figs 6C, 11C). General colour of tergal hair bands white	<i>M. (Notochile) captionis</i>
13(11)	T6 tomentum on disc with broad white hair band across anterior half of tergum. General colour of tergal hair bands off-white or straw-coloured	<i>M. (Notochile) gahani</i>
14(13)	Mesepisternum below wing with patch of black hairs	<i>M. (Notochile) chrysopygopsis</i>
14(13)	Mesepisternum below wing without patch of black hairs	15
15(14)	Mandibles predominantly orange red or brownish red, apical margin black (Fig. 4B). T6 tomentum on disc	

	white, and openly to sparsely placed among stiff erect brown hairs (Fig. 4C). Posterior hair bands on T3–T4 narrow, present laterally, weak medially	M. (unplaced) atrella
15(14)	Mandibles predominantly dark brown or black (Fig. 12B), T6 tomentum on disc predominantly orange or gold (Fig. 12C). Posterior hair bands on T3–T4 broad present on entire width	M. (Notochile) gregaldanae sp. nov.
16(7)	Posterior hair bands on sterna absent. Posterior hair bands on T3–T4 absent	M. (Notochile) bicingulata sp. nov.
16(7)	Posterior hair bands on sterna present laterally or across entire width. Posterior hair bands on T3–T4 present on entire width or present laterally, weak medially	17
17(16)	Mesepisternum below wing with patch of black hairs	18
17(16)	Mesepisternum below wing without black hairs	20
18(17)	Posterior hair bands on sterna only present laterally. Frons with orange or golden hairs	M. (Notochile) maculariformis
18(17)	Posterior hair bands on sterna complete (Fig. 29D). Frons with straw-coloured or yellowish hairs	19
19(18)	Metanotum immediately posterior to hind wing with black and white hairs. T6 tomentum on disc with narrow white hair band medially across width of tergum (Fig. 9C)	M. (Notochile) darwiniana
19(18)	Metanotum immediately posterior to hind wing with white or gold hairs. T6 tomentum on disc uniformly white or straw-coloured	M. (Notochile) macularis
20(17)	Scutum: hair patches on notauli absent (e.g. Fig. 26A, Fig. 29A)	21
20(17)	Scutum: hair patches on notauli present (e.g. Fig. 11A), in some species reduced to a handful of small white hairs	23
21(20)	Scopa white or light straw-coloured, with black hairs laterally	M. (Eutrigharaea s. l.) serricauda
21(20)	Scopa white or straw-coloured, without black hairs laterally	22
22(21)	Punctuation in ocellular area close to open	M. (Eutrigharaea s. l.) obtusa
22(21)	Punctuation in ocellular area dense to close	M. (Eutrigharaea s. l.) pusilla
23(20)	Posterior hair bands on sterna complete (Fig. 29D)	24
23(20)	Posterior hair bands on sterna only present laterally	25
24(23)	pubescence on vertex about twice as long as ocellus diameter	M. (Aethomegachile) haematogastra
24(23)	pubescence on vertex as long as ocellus diameter	M. (unplaced) sequior
25(24)	Frons with white hairs	26
25(24)	Frons lacking white hairs	28
26(25)	T6 tomentum on disc absent, only sparse erect hairs (Fig. 30C)	M. (Notochile) storeyi sp. nov.
26(25)	T6 tomentum on disc present across most of width (e.g. Fig. 21C)	27
27(24)	T6 tomentum on disc white, covering entire surface of tergum. Scopa white, some black hairs on S5 and S6	M. (unplaced) nivea sp. nov.
27(24)	T6 tomentum on disc with narrow white band across posterior half of tergum. Scopa light straw-coloured	M. (unplaced) waterhousei
28(25)	T6 tomentum on disc absent, only sparse erect hairs. Frons with orange or golden hairs. Posterior hair bands on T3–T4 present on across entire width	M. (Notochile) variegata sp. nov.
28(25)	T6 tomentum on disc broad white band across width at anterior half of tergum. Frons with straw-coloured or yellowish hairs. Posterior hair bands on T3–T4 present laterally, weak medially	M. (unplaced) acaciae sp. nov.
29(1)	Ventral margin of mandible without projection, not expanded	30
29(1)	Ventral margin of mandible with basal projection	39
30(29)	Vertex and scutum with predominantly black pubescence	31
30(29)	Vertex and scutum at most with some black pubescence	33
31(30)	Fore tarsus modified. Ta1 less than 2x as long as wide, Ta1 with smooth area and dark spot on ventral surface (Fig. 29J)	M. (Anodonteutrigharaea) simplex
31(30)	Fore tarsus not modified. Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface	32
32(31)	Posterior hair bands on T1–T4 white, anterior half of T5 with pale yellowish tomentum, posterior half black	M. (unplaced) kuschei
32(31)	Posterior hair bands on T1–T4 bright fulvus or orange, posterior two-thirds of T5 covered with fulvus or orange tomentum, black posteriorly	M. (unplaced) kurandensis
33(30)	Mandible with 3 teeth	33
33(30)	Mandible with 4 teeth	35
34(33)	T6 carina bidentate (Fig. 4G), tomentum orange-gold, fore tarsus Ta1–Ta3 brown or black	M. (unplaced) atrella
34(33)	T6 carina bilobed (Fig. 27F), T6 tomentum straw-coloured, fore tarsus Ta1–Ta3 brownish yellow	

		<i>M. (unplaced) sequior</i>	
35(32)	Fore tarsus slightly modified, Ta1 less than 2x as long as wide, flattened, with smooth area and dark spot on ventral surface	<i>M. (Anodonteutricharaea) leucopogon</i>	
35(32)	Fore tarsus not modified. Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface, basitarsus of hind leg more than twice as long as wide		36
36(35)	T6 tomentum orange-gold		37
36(35)	T6 tomentum lacking, only a few sparse erect hairs		38
37(36)	Mesepisternum below wing with gold hairs only. Posterior hair bands on T3–T4 present across entire width	<i>M. (Aethomegachile) haematogastra</i>	
37(36)	Mesepisternum below wing with white or gold, and black hairs. Posterior hair bands on T3–T4 present laterally, weak medially	<i>M. (Aethomegachile) rhodogastra</i>	
38(36)	General colour of hair bands on terga white. Mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus	<i>M. (unplaced) pictiventris</i>	
38(36)	General colour of hair bands on terga off-white or straw coloured. Hairs on posterior margin of mid-basitarsus much shorter than basitarsus length	<i>M. (unplaced) tenuicincta</i>	
39(29)	Fore tarsus not modified. Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface (e.g. Fig. 28G)		40
39(29)	Fore tarsus modified. Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, often with smooth areas or dark spots on ventral surface (e.g. Fig. 17D)		44
40(39)	Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered by a row of hairs or setae (e.g. Fig. 22H–I)		41
40(39)	Ta1 of fore tarsus without groove or shiny patch ventrally		43
41(40)	T6 tomentum orange-gold, general colour of hair bands on terga orange or gold	<i>M. (Eutricharaea s. l.) dissita sp. nov.</i>	
41(40)	T6 tomentum straw-coloured, general colour of hair bands on terga, when present, off-white or straw coloured		42
42(41)	Fore tarsus Ta1 overlaps the base of Ta2, fore tarsus Ta1–Ta3 pale yellow. Posterior margins of sterna with dense hair bands	<i>M. (Eutricharaea s. l.) obtusa</i>	
42(41)	Fore tarsus Ta1 does not overlap the base of Ta2, fore tarsus Ta1–Ta3 brownish yellow. Posterior margins of sterna with closely placed hairs (Fig. 28G)	<i>M. (Eutricharaea s. l.) serricauda</i>	
43(40)	T2 lateral fovea absent	<i>M. (Eutricharaea s. l.) pusilla</i>	
43(40)	T2 lateral fovea present, ovate	<i>M. (Eutricharaea s. l.) rotundata</i>	
44(39)	Mandible with 4 teeth, T3–T4 with anterior and posterior hair bands	<i>M. (unplaced) macrocephala sp. nov.</i>	
44(39)	Mandible with 3 teeth, T3–T4 without anterior hair bands		45
45(44)	Fore tarsus Ta2 with large bulbous swelling anteriorly and apically (e.g. Fig. 19G)		46
45(44)	Fore tarsus Ta2 without large bulbous swelling (e.g. Fig. 9G)		51
46(45)	Fore tarsus Ta2 overlapping the base of Ta3, and extending beyond middle of Ta3		47
46(45)	Fore tarsus Ta2 overlapping the base of Ta3, but not reaching middle of Ta3		48
47(46)	Hypostomal excavation without tooth on inner rim. T6 with some sparse, erect hairs, tomentum absent	<i>M. (Notochile) storeyi sp. nov.</i>	
47(46)	Hypostomal excavation with tooth on raised inner rim. T6 tomentum orange-gold	<i>M. (Notochile) maculariformis</i>	
48(46)	Posterior hair bands on T3–T4 absent (Fig. 5D)	<i>M. (Notochile) bicingulata sp. nov.</i>	
48(46)	Posterior hair bands on T3–T4 present (e.g. Fig. 8D, Fig. 20D)		49
49(48)	Hypostomal excavation without tooth or raised ridge on inner rim	<i>M. (Notochile) gregaldanae sp. nov.</i>	
49(48)	Hypostomal excavation with tooth and raised ridge on inner rim		50
50(49)	T6 tomentum orange-gold. Hair bands on posterior margins of sterna with openly placed hairs	<i>M. (Notochile) chrysopygopsis</i>	
50(49)	T6 tomentum white. Hair bands on posterior margins of sterna with closely placed hairs	<i>M. (Notochile) lineatipes</i>	
51(45)	Mesepisternum below wing with white or gold, and patch of black hairs		52
51(45)	Mesepisternum below wing without patch of black hairs		53
52(51)	T6 tomentum orange-gold. Hairs on posterior margin of mid basitarsus much shorter than basitarsus length	<i>M. (Notochile) chrysopyga</i>	
52(51)	T6 tomentum white or straw-coloured. Mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus	<i>M. (Notochile) darwiniana</i>	
53(52)	Inner hind tibial spur 2x as thick and 1.5x as long as outer spur	<i>M. (Notochile) macularis</i>	
53(52)	Inner hind tibial spur about as thick and less than 1.5x as long as outer spur		54

- 54(53)** Sterna with a patch of dense tomentum on S3 medially. Fore tarsus Ta1 overlapping the base of Ta2
M. (Notochile) gahani
- 54(53)** Sterna with a patch of dense yellowish tomentum on S2 and S3 medially. Fore tarsus Ta1 not overlapping the base of Ta2
M. (Notochile) captionis

Taxonomy

Megachile (Notochile) subgenus nov.

Type species *Megachile macularis* Dalla Torre 1896.

This new subgenus is erected for 12 (or more) species that, given the present data, form a monophyletic group which is endemic to Australia.

Diagnosis.

Males: Body length 9.9–11 mm; mandible with tree teeth; ventral margin of mandible with basal projection; hypostomal area modified with rounded excavation, in some species with tooth on inner rim; Fore tarsus modified; Ta1 short, less than 2x as long as wide, one or more tarsomeres flattened or expanded, often with smooth areas or dark spots on ventral surface (also in some other subgenera); Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered by a row of hairs or setae; fore coxa flat, with large tooth like lobe at inner posterior corner, posterior half with stiff orange setae (which is unique for this group), anterior half bare, outer area with long white pubescence; T6 carina bidentate; the genital morphology of this group is characterized by complex gonostyli with large hindward directed medio-inner lobes, patches of strong setae, and with apices divided in two lobes, the outer lobe with long setae. The shape of these lobes, and the length and direction of setae vary among species.

Females: Body length 9.8–12.5 mm. There are no autapomorphic or diagnostic characters for the females of the species in this group. There are a few robust species (11.5–12.5 mm) with a large patch of orange pubescence on T6 (i.e. *M. chrysopyga*, *M. maculariformis*, and *M. chrysopygopsis*), most other species in this group are smaller with variable extend and colour of pubescence on T6.

Etymology: The name *Notochile* is a combination of ‘*noto*’ meaning ‘south’ or ‘southern’ and ‘*chile*’ which is part of the genus name *Megachile* indicating the southern distribution, i.e. Australia, for the species in this clade.

Megachile (unplaced) acaciae King & Leijs *sp. nov.*

Figs 3A–D

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Examined specimens. Holotype, ♀, QM (T262684), WA, South Hedland (20.4049°S: 118.6069°E), 21/2/1973, E.M. Exley, on *Acacia* sp. Paratype, ♀, QM (T262685), same data as holotype.

Diagnosis. Female: scopa straw-coloured; posterior sternal hairbands mesially absent; no black hairs on mesepisternum behind wing; hair patches on notauli present; frons with orange hairs; dark hairs on the lower half of the mesopleuron.

Description

Female. Holotype, QM (T262684): L 11 mm; W 8 mm. RHM: HW 100; OOD 13; OOC 14; OCL 33; CL 17; CW 47.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line; mandible with Te1 about twice as large as Te2, Te2 slightly larger than Te3 or Te4; head, mesosoma and metasoma with fine to medium, dense punctures.

Pubescence. Clypeus, face and genae white-gold; frons with straw-coloured or yellowish hairs; vertex with white-gold tomentum posteriorly, short gold hairs between ocelli, anterolateral corners of pronotum with tuft of hairs; scutum with hair patches on notauli present, scutum anteriorly, dorsal to tegulae and at scutoscutellar suture white gold; axillae and scutellum with mainly short gold hairs; propodeum laterally with short dark hairs ventral to spiracle; mesopleuron with long white gold hairs on dorsal half, short dark brown hairs on ventral half; mesepisternum below wing without black hairs; mesepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present laterally, weak medially; general colour of tergal hair bands, off-white or straw-coloured; tomentum on disc of T6 a broad white band across width at anterior half of tergum; scopa light straw-coloured with few dark hairs laterally; legs with white gold hairs on outer surface, dark brown on inner surface.

Colouration. Antennae dark brown dorsally, red-brown ventrally; mandibles predominantly dark brown or black; legs mainly black, tibial spurs dark brown.

Association of sexes. Male unknown.

Flower visitation. *Acacia* sp.

Distribution. Known only from coastal Western Australia. Fig. 3D.

Phenology. February (2 records).

Etymology. The specific epithet ‘*acaciae*’ refers to the plant genus from which the specimens were collected.

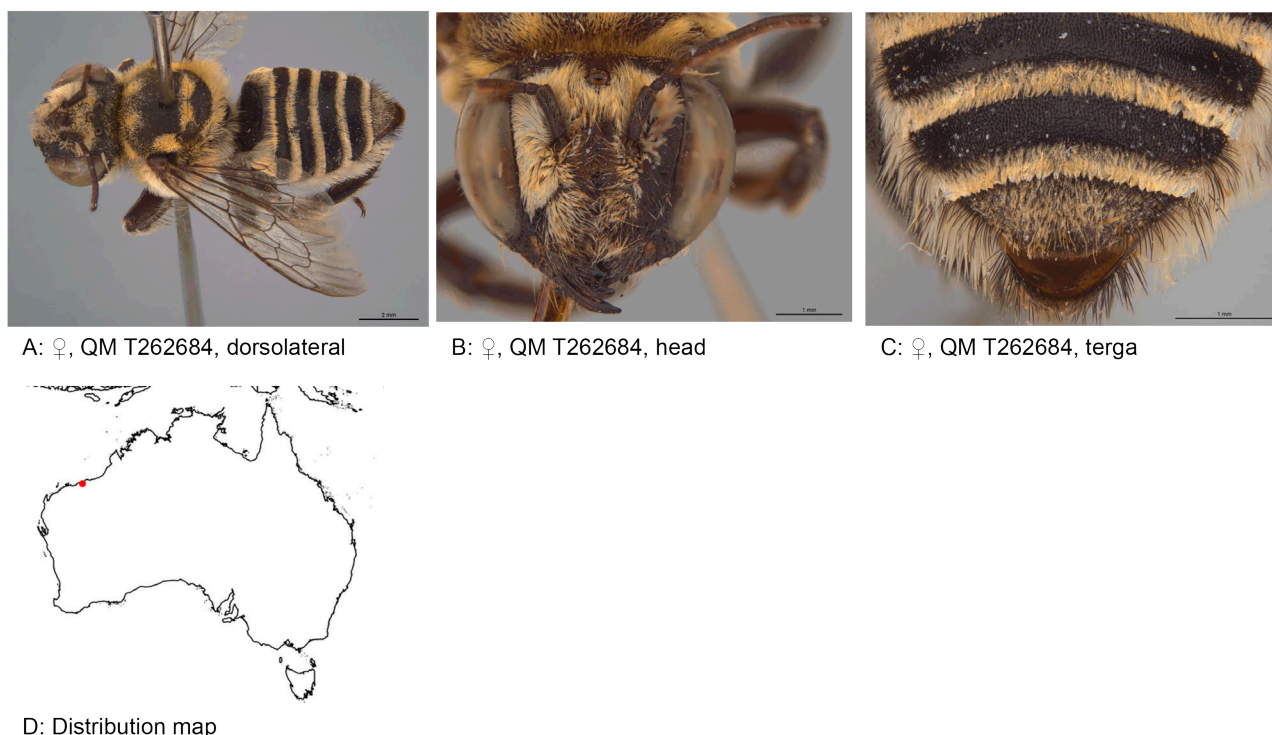


Figure 3A-D. *Megachile (unplaced) acaciae* King & Leijs *sp. nov.*

Megachile (unplaced) atrella* Cockerell 1906 *comb. nov.

Figs 4A–K

Megachile atrella Cockerell 1906, p.532

Chalicodoma (Hackeriapis) atrella Cockerell, Michener 1965, p.197. *comb. nov.*

Megachile adelaidae Cockerell 1910a, p. 111. *syn. nov.*

Notes on synonymy. Michener (1965) placed *atrella* in *Chalicodoma (Hackeriapis)*, however the presence of a reduced cutting edge in the second interspace and the association of the sexes identify *atrella* as a leafcutter. Cockerell (1906) in his detailed description notes the ‘mandibles with a 4-dentate cutting edge’. The holotype of *adelaidae* is not different from the holotype of *atrella* especially with respect to the colour of the mandibles.

Examined specimens. Holotype, ♀, *atrella*: BMNH, HYM 17a 2396, W. Australia. Holotype, ♀, *adelaidae*: HU 19410, Adelaide, Schomburgk S, condition very good; a little dirty. The specimen is teneral but the mandibles have cutting edges and distinct dark margins.

Allotype, ♂, SAMA (32-46083), WA, 20 mi E of Eucla (31.6548°S: 129.1541°E), T. F. Houston, resting in tunnel in dead branch. **Other specimens.** 80 males and 60 females.

Diagnosis Male: mandible with three teeth, ventral margin without basal projection; black pubescence on scutum, if present, not dense; fore tarsus: not modified, Ta1–Ta3 black. Female: the following combination of characters separate *atrella* from all other *M. (Eutricharaea)* species: mandible red with a reduced cut-

ting edge in the third interspace (Figs 4J–K), T6 distinctly narrowed pre-apically.

Description

Male. Allotype, SAMA (32-46083): L 8 mm; W 6.5 mm. RHM: HW 100; OOD 14; OOC 16; OCL 39; CL 20; CW 45.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 3 teeth, Te3 longer than Te1 or Te2; hypostomal area not modified; clypeus shallowly emarginate apically, small medial projection on apical margin; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate, deeply emarginate medially; body entirely with medium dense punctures; S6 as in Fig. 4G, genitalia with gonostyli rounded apically (Fig. 4G).

Pubescence. Face, clypeus and genae with long white pubescence; white-gold and sparse on vertex; spots of dense white tomentum posterior to tegulae and mesoscutum anteriorly; fore coxae with spine and tuft of gold hairs apically; fore tarsi, with fringe of long white hairs on posterior margin; outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; sterna without

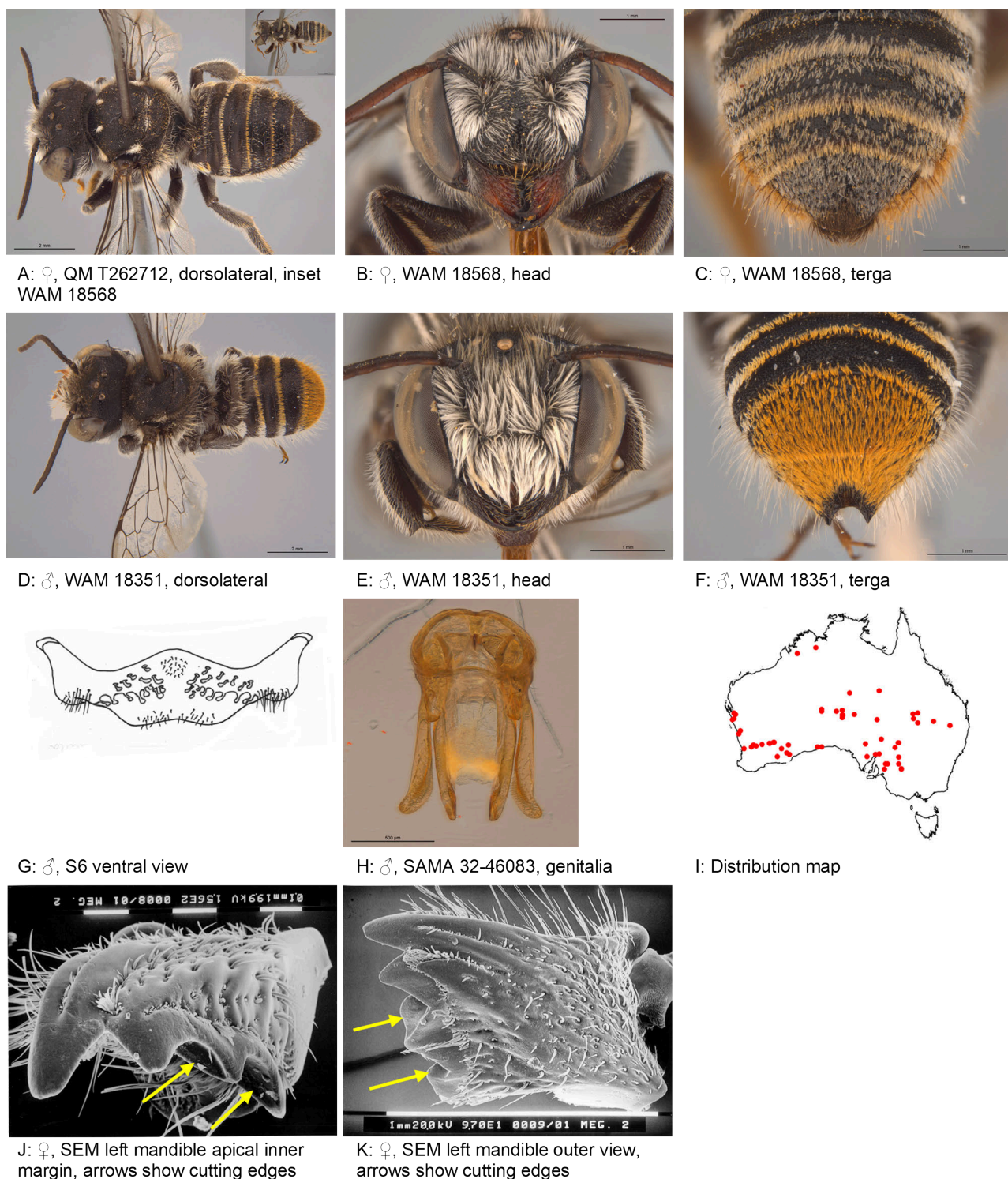


Figure 4A-K. *Megachile (unplaced) atrella* Cockerell 1906 *comb. nov.*

patches of dense tomentum; S1-S3 with dense apical fringe of white hairs, more than half length of sternum; S4 with fringe laterally, short gold hairs medially; T1-T4 with posterior hair bands complete, off-white or straw-coloured; tomentum on T5-T6 orange-gold.

Colouration. Body brownish black, except preapical, apical tarsomeres red-brown; Ta1-Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Redescription, QM (T262712): L 9 mm; W 7 mm; RHM: HW 100; OOD 18; OOC 17; OCL 39; CL 20; CW 47.

Structure. Ventral margin of mandible about 1.5x medial length of clypeus; clypeus closely and evenly punctured, smooth basally; small and dense punctures elsewhere.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with white hairs; scutum with hair patches on notauli present, in some specimens only a few

white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with long white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T1–T5 complete, T3–T4 present laterally, weak medially; general colour of tergal hair bands, off-white or straw-coloured; tomentum on disc of T6 small, white, and openly to sparsely placed among stiff erect brown hairs; scopa white.

Colouration. Mandibles predominantly orange red or brownish red, apical margin black.

Association of sexes. The sexes were associated based on collecting data.

Flower visitation. *Adenanthos cygnorum*, *Angophora floribunda*, *Anthocercis*, *Callistemon linearis*, *Dicrastylis beveridgei*, *Eremophila scoparia*, *Eucalyptus*, *E. oleosa*, *E. populnea*, *E. salubris* *Eucaria*, *Hibiscus farragei*, *Melaleuca*, *M. corrugata*, *Prostanthera nudula*, *Ptilotus obovatus*, *Sarcostemma australe*, *Senecio*, *Verticordia densiflora*, *V. plumosa*, *Wahlenbergia*.

Distribution. Recorded from all states, from coastal and inland areas. Fig. 4I.

Phenology. January (46 records), February (3 records), March (2 records), May (3 records), October (28 records), November (45 records), December (13 records).

***Megachile (Notochile) bicingulata* King & Leijs sp. nov.**

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Examined specimens. Holotype, ♂, SAMA (32-51155), SA, Scorpion Springs CP by western border fence near corner in fence at junction with Ngarkat CP (35.5296°S: 140.9648°E), 16/12/1983, SA-Museum party. Allotype, ♀, SAMA (32-51153), SA, Scorpion Springs CP along NS track (35.5296°S: 140.9648°E), 15/12/1983, SA-Museum party. **Other specimens.** 5 males and 7 females.

Diagnosis. Both sexes: this is the only species with white pubescence on T1–T2 and black pubescence on the remaining terga.

Description

Male. Holotype, SAMA (32-51155): L 10.8 mm, W 7.4 mm. RHM: HW 100; OOD 15; OOC 16; OCL 34; CL 20; CW 42.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but not reaching middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate.

Pubescence. Mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 absent; general colour of tergal hair bands, where present, white; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs; tomentum on T6 lacking, only a few sparse erect hairs.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; outer surface of Ta1 of mid tarsus with white or white-gold hairs; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, SAMA (32-51153): L 11.9 mm, W 8.7 mm. RHM: HW 100; OOD 14; OOC 14; OCL 39; CL 23; CW 43.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with short black or brown hairs; axilla with white or pale gold hairs; posterior hair bands on sterna absent; posterior hair bands on T3–T4 absent; general colour of tergal hair bands, where present, white; tomentum on disc of T6 absent, only with sparse erect hairs; scopa white or straw-coloured, black laterally.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data, and on similarity in pubescence colour.

Flower visitation. *Calytrix strigosa*, *Dicrastylis exsuccosa*, *Eucalyptus*, *Keraudrenia*, *Melaleuca acerosa*.

Distribution. Fig 5L.

Phenology. January (4 records), April (1 record), September (3 records), October (1 record), November (1 record), December (4 records).

Etymology. The specific epithet '*bicingulata*' refers to the two white hair bands on T1–T2 in both sexes.

***Megachile (Notochile) captionis* Cockerell 1914 comb. nov.**

Figs 6A–J

Megachile captionis Cockerell 1914, p. 466

Megachile (Eutricharaea) captionis Cockerell, Michener 1965, p 209 comb. nov.

Examined specimens. Lectotype, ♂, BMNH, HYM 17a 2374, Brewarrina, NSW, 1914, W.W. Frogatt. Condition fair, left fore, mid tarsus and tibia missing, antennae missing. **Other spec-**

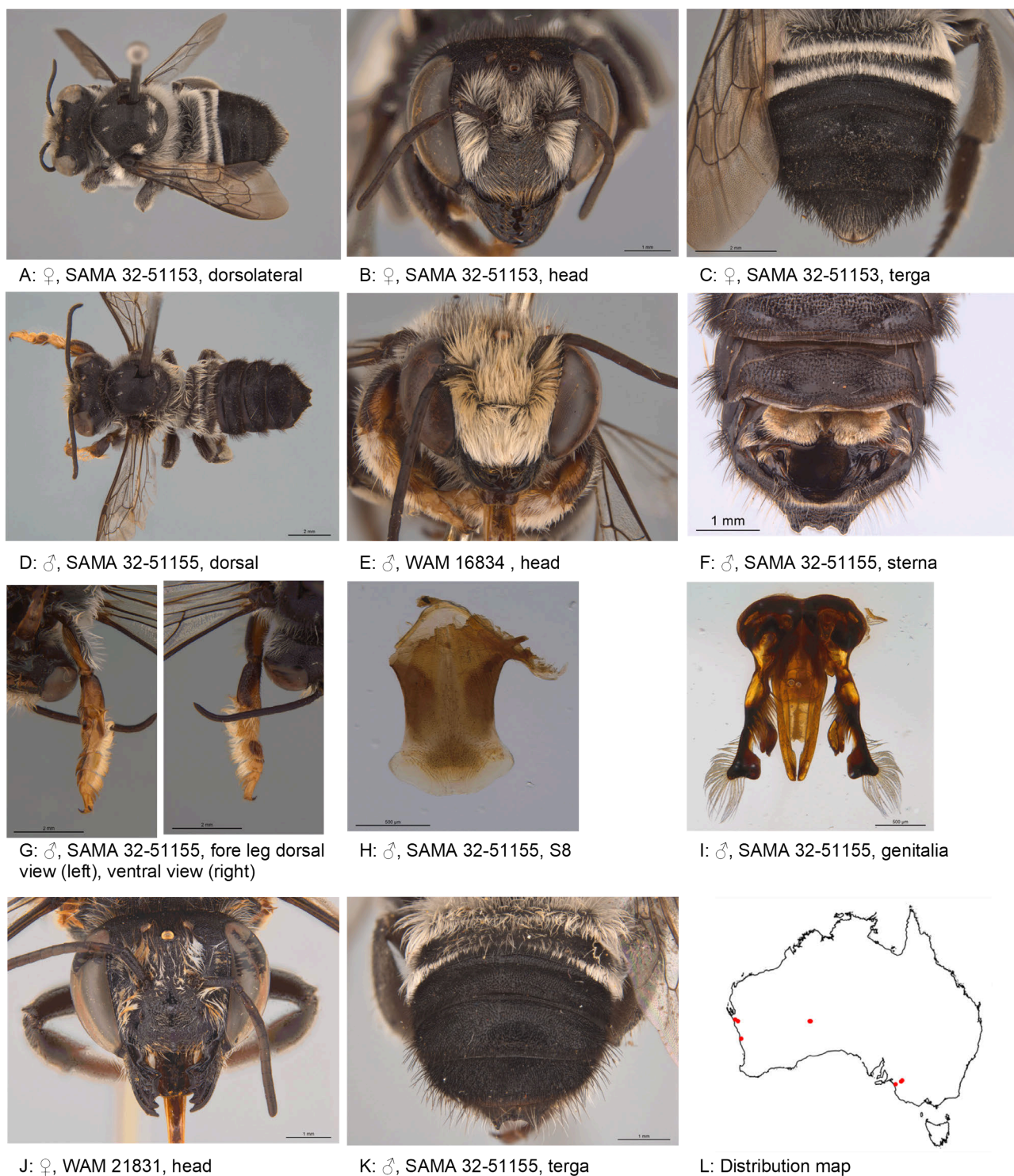


Figure 5A-L. *Megachile (Notochile) bicingulata* King & Leijs sp. nov.

imens. 137 males, 160 females, and 36 specimens sex not recorded.

Diagnosis. Male: mandible with three teeth and basal projection on the ventral margin; fore tarsus modified, Ta2 without bulbous swelling; mesepisternum without patch of black hairs; inner hind tibial spur about as thick as outer spur; S2 with medial patch of tomentum. Female: scopa light straw-coloured; posterior sternal hairbands complete; hair patches on notauli present;

clypeus medially without longitudinal impunctate line; tergal hairbands white.

Description

Male. Redescription, SAMA (32-37568): L 10.5 mm; W 6.4 mm. RHM: HW 100; OOD 12; OOC 15; OCL 42; CL 24; CW 42.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with raised

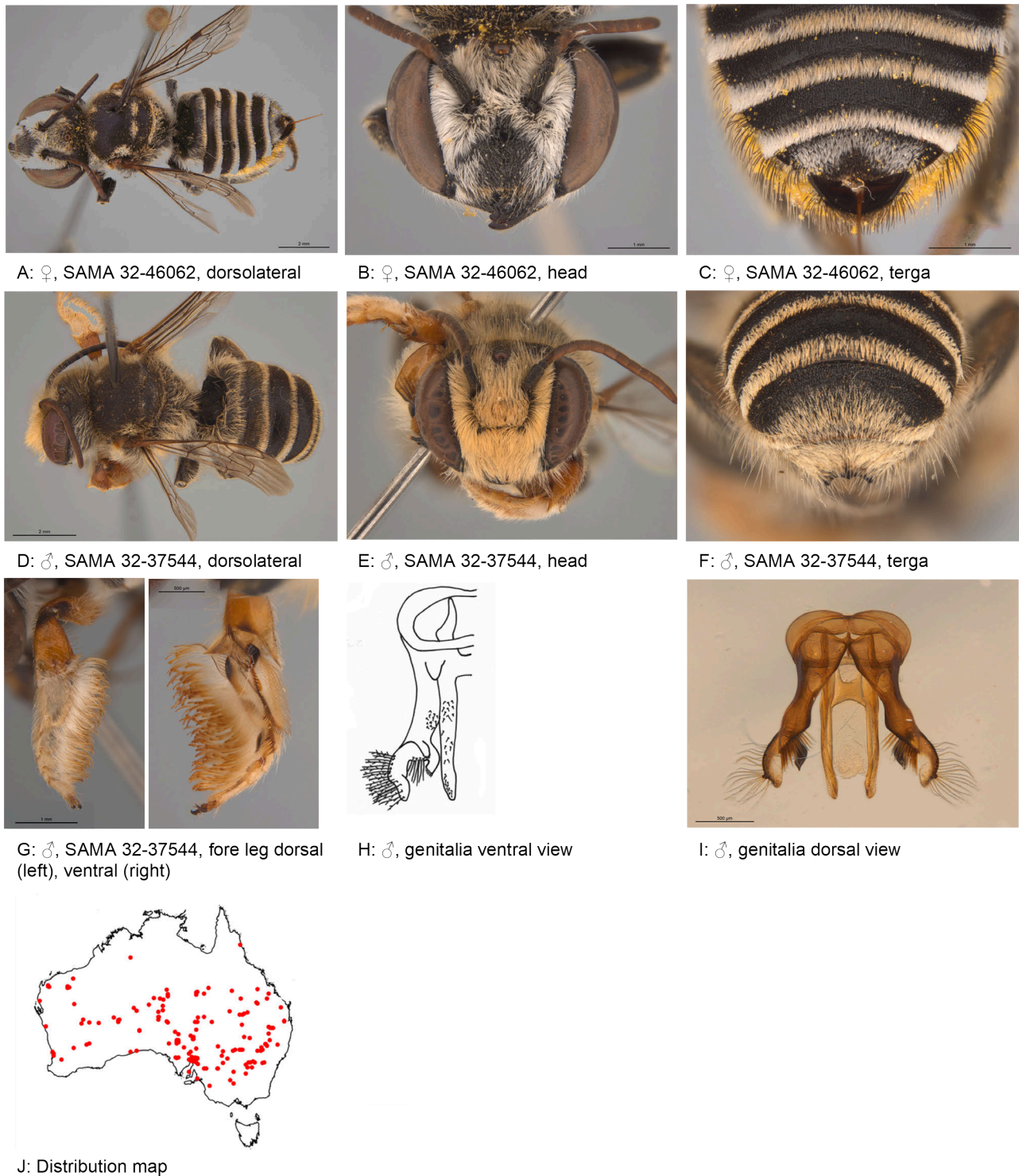


Figure 6A-J. *Megachile (Notochile) captionis* Cockerell 1914

inner rim; fore tarsus modified, with one or more tarsomeres flattened or expanded; Ta1 less than 2x as long as wide, with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; Ta2 with dark spot on ventral surface, lacking large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not over-

lapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3-T4 present on entire width; general colour of hair-

bands on terga off-white to straw coloured; sterna with a patch of dense yellowish tomentum on S2 and S3 medially, hair bands on posterior margins with dense hairs; tomentum on T6 white.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, SAMA (32-46062): L 10.8 mm; W 6.8 mm. RHM: HW 100; OOD 11; OOC 15; OCL 41; CL 22; CW 46.

Structure. Ventral margin of mandible less than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with white hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with long white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands, white; tomentum on disc of T6 a narrow white band across width at posterior half of tergum; scopa light straw-coloured.

Colouration. Integument black. Mandibles predominantly dark brown or black.

Association of sexes. The sexes were confirmed using DNA barcode data.

Flower visitation. *Anthocercis*, *Astartea fascicularis*, *Atalaya hemiglaucula*, *Crotalaria*, *Dicrastylis exsuccosa*, *Dicrastylis lewellinii*, *Eremophila* sp., *Eremophila* sp. (*freelingii*), *Eucalyptus*, *E. citriodora*, *E. largiflorens*, *Everlasting daisy*, *Hakea*, *Heterodendron oleifolium*, *Limonium*, *Melaleuca*, *M. linariifolia*, *Ptilotus*, *Ptilotus obovatus*, *Scaevola*, *Senecio*, *Trichodesma*.

Distribution. Fig. 6J.

Phenology. January (43 records), February (5 records), March (12 records), April (14 records), May (5 records), August (21 records), September (29 records), October (72 records), November (45 records), December (81 records).

***Megachile (Notochile) chrysopyga* Smith 1853 comb. nov.**

Figs 7A–J

Megachile chrysopyga Smith 1853, p.173

Megachile (Eutricharaea) chrysopyga Smith, Michener 1965, p.209 comb. nov.

Examined specimens. Lectotype, ♀, *M. chrysopyga*; BMNH, HYM 17a 2299, W. Australia. Syntype *Megachile (Eutricharaea) chrysopyga* ♀ Smith, C. O'Toole. det 1983. Condition poor; missing: both antennal flagella, fourth and fifth tarsomeres of left mid and hind legs, hind fourth and fifth tarsomeres, right

hind fifth tarsomere, very dirty. Allotype, ♂, QM (T262700), WA, Cape Le Grand National Park, (33.9666667°S, 122.11667°E), 10/01/1987, G. & A. Daniels. *Other specimens.* 108 males, 145 females, and 92 specimens sex not recorded.

Diagnosis. Male: mandible with three teeth and basal projection on the ventral margin; fore tarsus modified, Ta2 without bulbous swelling; mesepisternum with patch of black hairs; tomentum T6 orange-gold. Female: scopa straw-coloured; posterior sternal hairbands mesially absent; hair patches on notauli absent; clypeus medially without longitudinal impunctate line; tergal hairbands white.

Description

Male. Allotype, QM (T262700): L 11 mm; W 8 mm. RHM: HW 100; OOD 14; OOC 14; OCL 39; CL 17; CW 45.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation and raised at inner rim; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with dark spot on ventral surface of Ta2; Ta2 of fore tarsus with small bulbous swelling, which hardly overlap base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate with small median dent. Modified sterna and genitalia: S6 as in Fig. 7H; S8 as in Fig. 7H; genitalia as in Fig. 7I.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or gold, and black hairs; posterior hair bands on T3–T4 present laterally, weak medially; general colour of hair bands on terga white; sterna without patches of dense tomentum; hair bands on posterior margins with closely placed hairs; tomentum on T6 orange-gold.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, QM (T262701): L 12.5 mm; W 9.5 mm. RHM: HW 100; OOD 13; OOC 13; OCL 38; CL 17; CW 49.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with orange or golden hairs; scutum lacking hair patches on notauli, mesepisternum below wing with dense long white hairs, without black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present laterally,

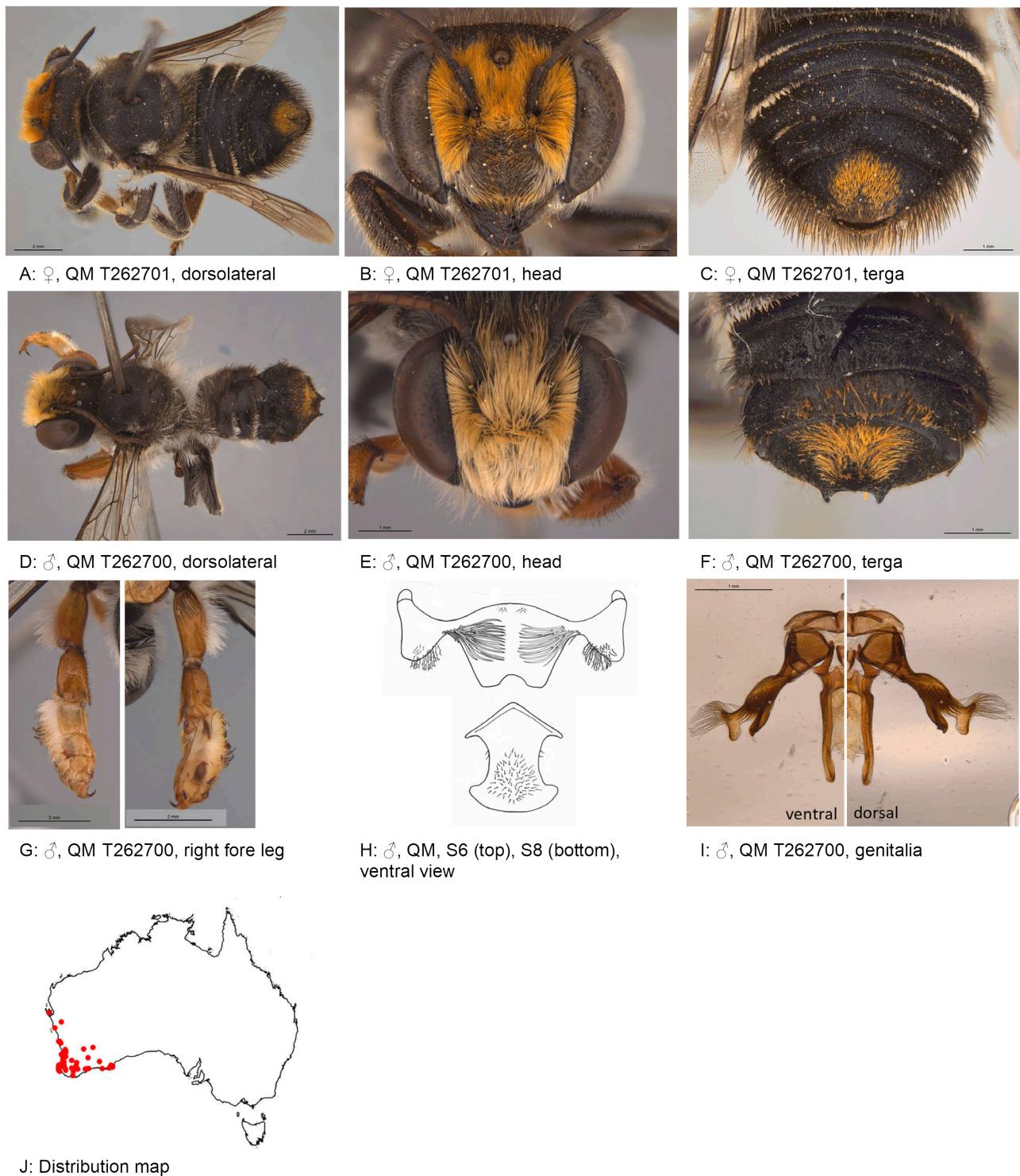


Figure 7A-J. *Megachile (Notochile) chrysopyga* Smith 1853

weak medially; general colour of tergal hair bands, where present, white; tomentum on disc of T6 orange or gold patch; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data.

Flower visitation. *Beaufortia squarrosa*, *Boronia*, *Calytrix*, *Daviesia*, *D. divaricata*, *Eriochilus dilatatus*, *Eucalyptus*, *E. calophylla*, *E. haematoxylon*, *Frankenia*, *Gastrolobium spinosum*, *Gompholobium tomentosum*, *Helianthus annuus*, *Hibbertia*, *Jacksonia*, *J. furcellata*, *J. lehmannii*, *J. near sternbergiana*, *J. sericea*, *J. sternbergiana*, *Kunzea*, *Melaleuca*, *M. huegelii*, *M. lanceolata*, *M. striata*, *M. subfalcata*, *Rosa*, *Scaevola*, *S. crassifolia*, *S. glandulifera*, *Thryptomene camphorosmae*, *Trachymene*, *Viminaria*.

Distribution. Fig. 7J.

Phenology. January (50 records), February (34 records), March (57 records), April (9 records), May (5 records), October (4 records), November (35 records), December (38 records).

Comments. Smith (1853) described the female and male, giving the collecting localities as Western Australia and Van Diemen's Land (Tasmania) respectively and indicating that the sexes had been collected separately. We have not examined the male, but its description fits the male of *Megachile maculariformis* Cockerell 1907, and it is apparent that Smith wrongly associated the sexes, which led to confusion about the real distribution of *chrysopyga*. (see also discussion concerning *maculariformis*). The male of *chrysopyga* therefore has not been described yet.

***Megachile (Notochile) chrysopygopsis* Cockerell 1929 comb. nov.**

Figs 8A–J

Megachile chrysopygopsis Cockerell 1929, p.302

Megachile (Eutricharaea) chrysopygopsis Cockerell, Michener 1965, p.209 comb. nov.

Examined specimens. Holotype, ♀, QM, Hy 4024, WA, Perth, G.H. Hardy. Condition perfect. Allotype, ♂, WAM (16804), WA, Boolathana, (24.6219°S: 113.6578°E), 27/08/1980, C.A. Howard & T.F. Houston, on *Asphodelus fistulosus*. *Other specimens.* 7 males and 7 females.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus Ta2 with large bulbous swelling not reaching middle of Ta3; mandible with 3 teeth; posterior hairbands T3–T4 present; rim of hypostomal excavation with tooth or raised ridge; tomentum T6 orange-gold. Female: facial hair white.

Description. **Male.** Allotype, WAM (16804): L 11 mm; W 8 mm. RHM: HW 100; OOD 15; OCL 34; CL 18; CW 49.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; Clypeus very shallowly emarginate apically; hypostomal area with rounded excavation and tooth at raised inner rim; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with dark spot on ventral surface of Ta2; Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but not reaching middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate; punctation on vertex, genae, and mesoscutum medium and dense, on metasoma fine and dense. Modified sterna and genitalia: S6 as in *M. chrysopyga* (Fig. 7H) except more shallowly emarginate apically; S8 as in Fig. 7H; genitalia Figs 8H–I.

Pubescence. Face white-gold; genae white; vertex pale gold, white-gold posteriorly; white-gold on mesosoma except few dark hairs on pleuron below wings, on axillae; outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; T1–T3 with apical hair bands white-gold; T4 apically, T5 medially, T6 with orange gold tomentum; S1–S3 with short apical hair bands, remainder with very sparse white hair. Mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga white; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs; tomentum on T6 orange-gold.

Colouration. Foreleg with inner surface of femur pale, few dark diagonal lines basally, tibia pale on inner surface, on outer surface dark basally, pale apically; Ta1–Ta3 of fore tarsus whitish, yellow or gold; Ta3 with dark spot on inner surface; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription.* WAM (11542): L 12 mm; W 9 mm. RHM: HW 100; OOD 16; OOC 16; OCL 38; CL 22; CW 52.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum with hair patches on notauli present but small; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with long white adjacent hairs; axilla with mixed black and white hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 predominantly orange or gold; scopa light straw-coloured.

Colouration. Integument black. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data and similarities in pubescence colour on the tergites.

Flower visitation. *Asphodelus fistulosus*, *Crotalaria*, *Eucalyptus*, *Trianthema pilosa*.

Distribution. Fig. 8J.

Phenology. January (3 records), March (1 record), August (5 records), October (2 records), December (1 record).

***Megachile (Notochile) darwiniana* Cockerell 1906 comb. nov.**

BOLD:AEC2365

Figs 9A–J

Megachile darwiniana Cockerell 1906, p.535

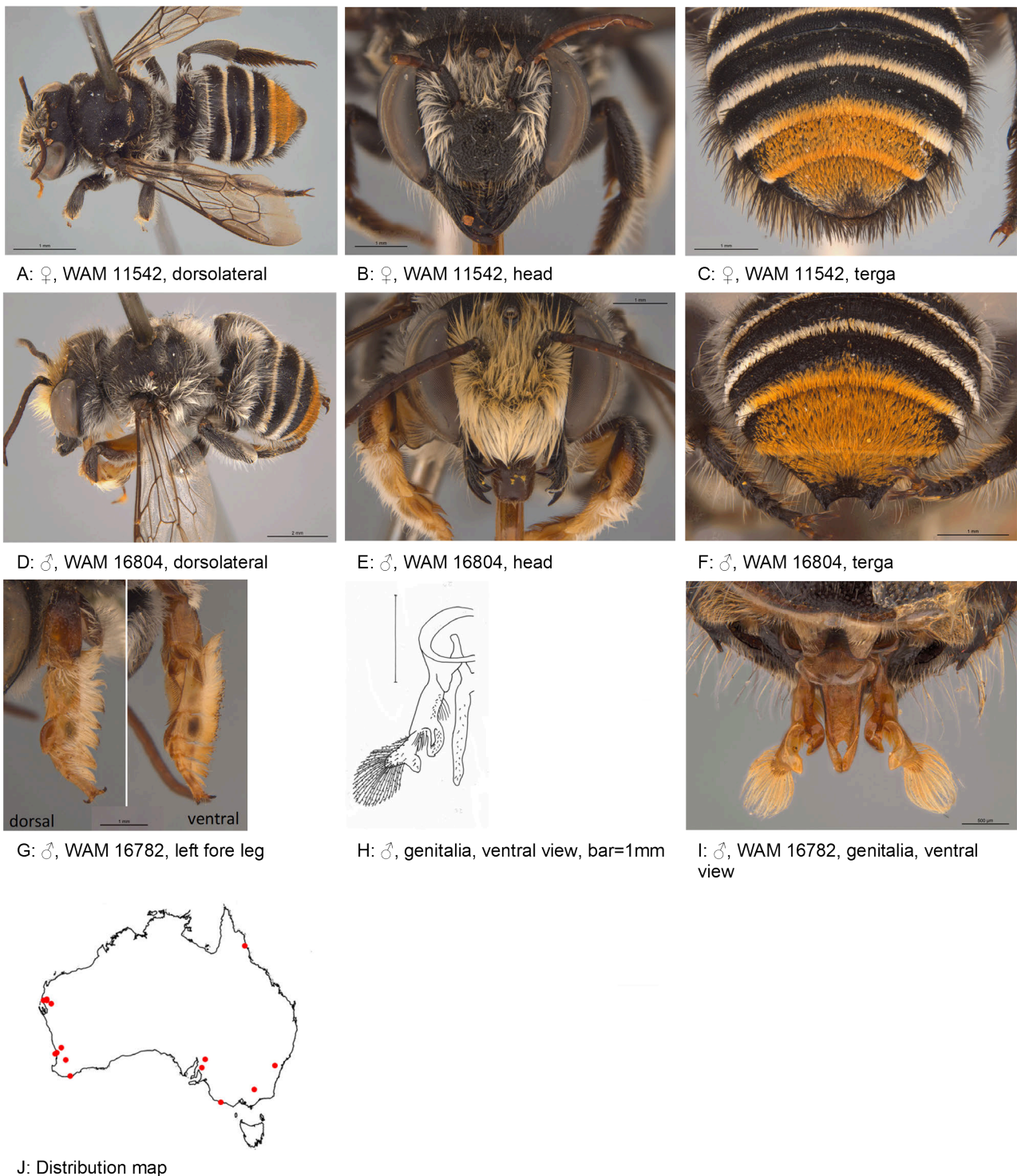


Figure 8A-J. *Megachile (Notochile) chrysopygopsis* Cockerell 1929

Megachile (Eutricharaea) darwiniana Cockerell, Michener 1965, p.209 *comb. nov.*

Examined specimens. Holotype, ♂, BMNH Hym.17.a.2326, NT, Port Darwin. Allotype, ♀, QM (T262718), QLD, Samford, (27.3701°S: 152.8901°E), 17/3/1979, P Kirsch. *Other specimens.* 24 males, 56 females, and 35 specimens sex not recorded.

Diagnosis. Male: mandible with three teeth and basal projection on the ventral margin; fore tarsus modified,

Ta2 without bulbous swelling; mesepisternum with patch of black hairs; tomentum T6 straw-coloured. Female: scopa straw-coloured; posterior sternal hair-bands complete; mesepisternum with black hairs; T6 with narrow white band.

Description

Male. *Redescription*, QM (T262719): L 10 mm; W 7.2 mm. RHM: HW 100; OOD 12; OOC 15; OCL 39; CL 25; CW 45.



A: ♀, QM T262718, dorsolateral



B: ♀, QM T262718, head



C: ♀, QM T262718, terga



D: ♂, QM T262719, dorsolateral



E: ♂, QM T262719, head



F: ♂, QM T262719, terga



G: ♂, SAMA 32-46038, left fore leg



H: ♂, SAMA 32-46038 genitalia, dorsal view (right); ventral view (left)



I: ♂, genitalia, ventral view



J: Distribution map

Figs 9A–J. *Megachile (Notochile) darwiniana* Cockerell 1906

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation and raised inner rim; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with dark spots on ventral surface of Ta1–Ta2; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of

hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate. Genitalia as in Fig. 9H–I.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or gold, and black hairs; posterior hair bands on

T3–T4 present on entire width; general colour of hair bands on terga straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with dense hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, QM (T262718): L 11.8 mm; W 7.8 mm. RHM: HW 100; OOD 11; OOC 12; OCL 35; CL 20; CW 48.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured or yellowish hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 a narrow white band across width at posterior half of tergum; scopa light straw-coloured.

Colouration. Integument black. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data.

Flower visitation. *Atalaya hemiglaucua*, *Canthium*, *Crotalaria*, *Lantana*.

Distribution. Fig. 9j.

Phenology. January (5 records), February (31 records), March (18 records), April (24 records), May (2 records), June (2 records), July (3 records), August (5 records), October (5 records), November (13 records), December (6 records).

***Megachile (Eutricharaea s. l.) dissita* King & Leijs sp. nov.**

Figs 10A–I

urn:lsid:zoobank.org:act:9AB1E5A5-C4DC-4223-8F9C-4928A5077CEC

Examined specimens. Holotype, ♂, WAM (22447), WA, Christmas Island South Point (10.5596°S: 105.6460°E), 01/07/1961, G.F. Mees. Allotype, ♀, WAM (22446) same locality data as holotype. **Other specimens.** 2 males and 6 females.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus not modified, Ta1 anterior margin extended, forming groove or shiny patch ventrally; T6 tomentum orange-gold. Female: scopa orange; frons with white hairs.

Description. Male. Holotype, WAM (22447): L 11.6 mm; W 7.8 mm. RHM: HW 100; OOD 12; OOC 18; OCL 37; CL 25; CW 43.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 multi-dentate. S5 as in Fig. 10G; genitalia as in Fig. 10H.

Pubescence. Outer surface of Ta1 of mid tarsus with orange or gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with gold hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga orange or gold; sterna with a small patch of dense yellowish tomentum on S3 and S4 medially, hair bands on posterior margins with dense hairs; tomentum on T6 orange-gold.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; or brownish red; integument of T6 black or brown.

Female. Allotype, WAM (22446): L 12.3 mm; W 8 mm. RHM: HW 100; OOD 10; OOC 14; OCL 37; CL 25; CW 44.

Structure. Ventral margin of mandible about 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Eyes with minute setae, anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum lacking hair patches on notauli, mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands off-white or straw-coloured; tomentum on disc of T6 straw-coloured or light brown; scopa orange.

Colouration. Integument black. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated using collecting data.

Related species. Based on similarities in genitalia morphology *M. dissita* is probably in the same *M. (Eutricharaea s.l.)* clade as *M. obtusa* and *M. serricauda*.

Flower visitation. Not recorded.

Distribution. Only known from Christmas Island. Fig. 10I.

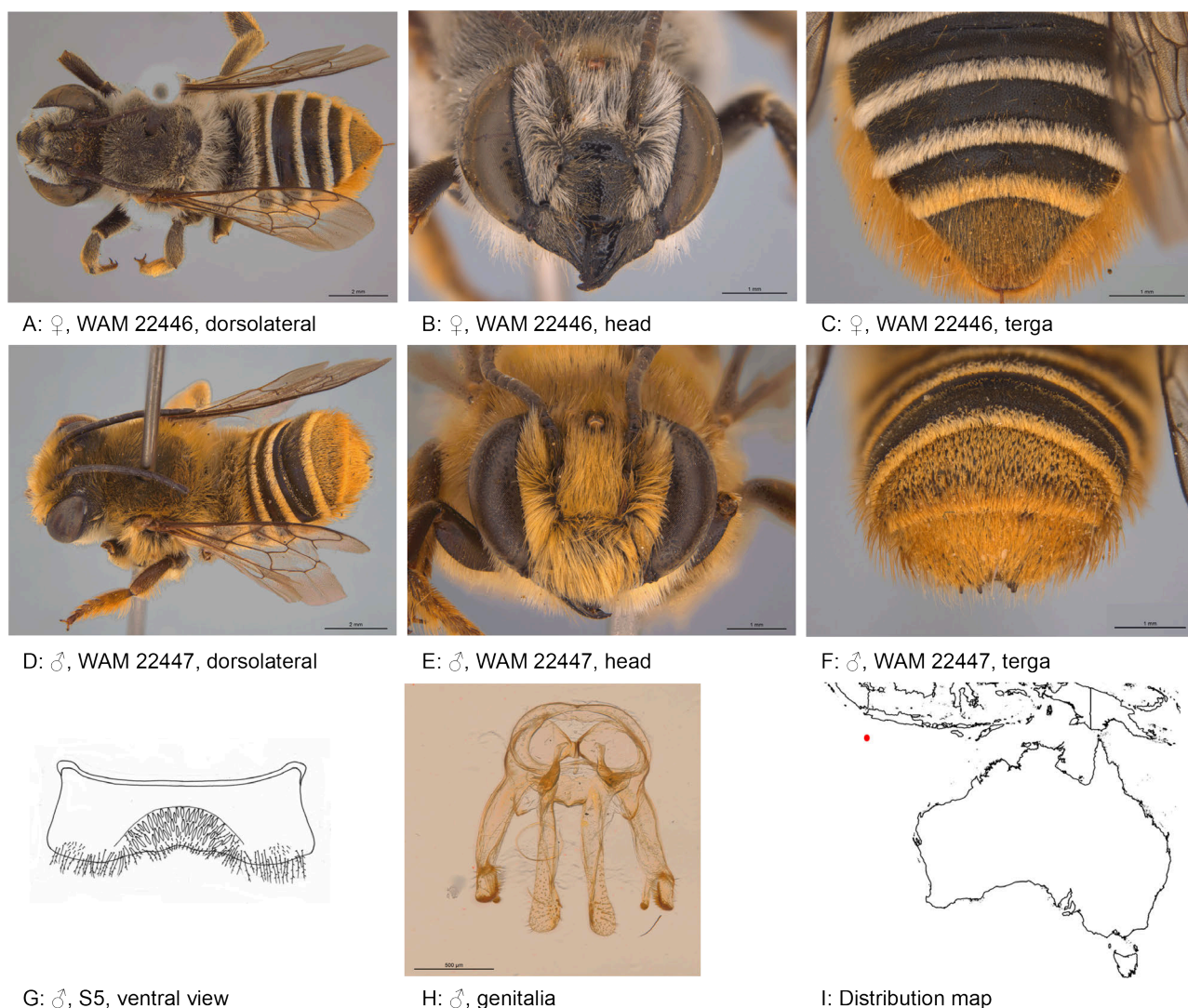


Figure 10A-I. ***Megachile (Eutricharaea s. l.) dissita*** King & Leijs *sp. nov.*

Phenology. July (5 records), August (5 records).

Etymology. The specific epithet '*dissita*' refers to the remote distribution of the species.

Megachile (Notochile) gahani* Cockerell 1906 *comb. nov.

Figs 11A–K

Megachile gahani Cockerell 1906, p.537

Megachile (Eutricharaea) gahani Cockerell, Michener 1965, p.209 *comb. nov.*

Examined specimens. Holotype, ♂, BMNH Hym.17.a.2282, New Holland. Condition fair, broken: left antenna, left hind leg, specimen very dirty, looks like it has been soaked in liquid. Allotype, ♀, QM (T262722), NT, 9 mi S of Katherine (14.5836°S: 132.2873°E), 14/03/1973, E. M. Exley. *Other specimens.* 1 male and 13 females.

Diagnosis. Male: mandible with three teeth and basal projection on the ventral margin; fore tarsus modified, Ta2 without bulbous swelling; mesepisternum without

patch of black hairs; inner hind tibial spur about as thick as outer spur; S2 without medial patch of tomentum. Female: scopa straw-coloured; posterior sternal hair bands mesially absent; hair patches on notauli absent; clypeus medially without longitudinal impunctate line; tergal hair bands straw-coloured.

Description.

Male. Redescription, QM (T262723): L 9.9 mm; W 7.4 mm. RHM: HW 100; OOD 13; OOC 14; OCL 35; CL 22; CW 40.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with smooth areas and dark spots on ventral surface of Ta1–Ta2; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur;

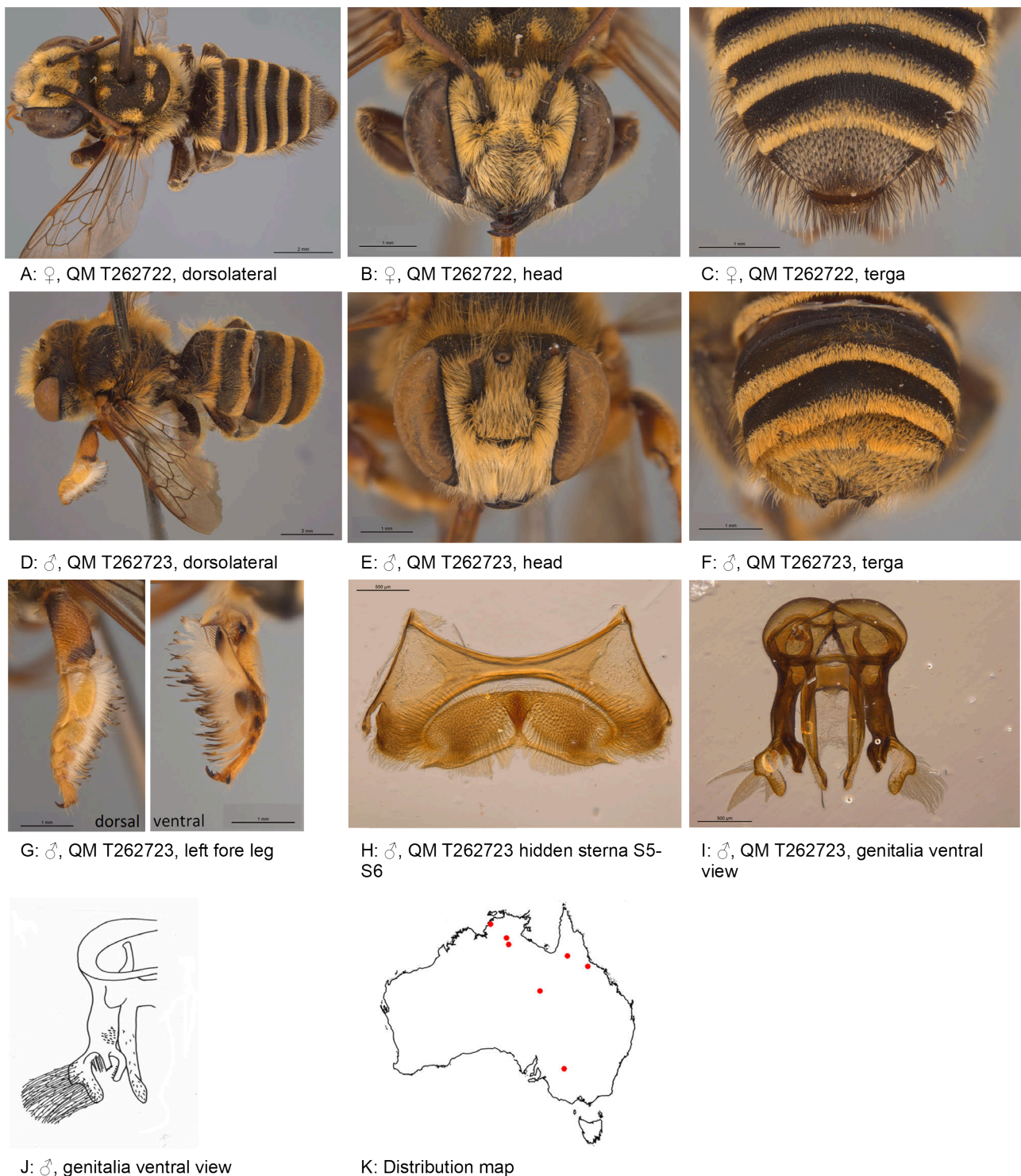


Figure 11A-K. **Megachile (Notochile) gahani** Cockerell 1906

carina on T6 bidentate. Hidden sterna as in Fig. 11H; genitalia as in Figs. 11I-J.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with gold hairs only; posterior hair bands on T3-T4 present on entire width; general colour of hair bands on terga straw-coloured; sterna with a patch of dense tomentum

on S3 medially, hair bands on posterior margins with dense hairs; tomentum on T6 straw-coloured.

Colouration. Ta1-Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, QM (T262722): L 9.8 mm; W 6.5 mm. RHM: HW 100; OOD 12; OOC 16; OCL 37; CL 19; CW 39.

Structure. Ventral margin of mandible about 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured or yellowish hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands off-white or straw-coloured; tomentum on disc of T6 a broad white band across width at anterior half of tergum; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data.

Flower visitation. Not recorded.

Distribution. Fig. 11K.

Phenology. January (1 record), March (3 records), April (1 record), May (10 records).

***Megachile (Notochile) gregaldanae* King & Leijs sp. nov.**

BOLD:AEC3768

Figs 12A–J

urn:lsid:zoobank.org:act:227A5E74-988A-4DBE-8BD0-E2D8F698DD22

Examined specimens. Holotype, ♂, QM (T262686), QLD, Bald Hills Stn, 7.6 km N. Isabella Falls (15.2500°S: 145.0170°E), 31/12/1984, G. and A. Daniels. Allotype, ♀, SAMA (32-37427), QLD, 25 km SW of Laura (15.7462°S: 144.3201°E), 8/3/2017, R. Leijs. Paratype, same data as holotype, in UQ. *Other specimens.* 2 males.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus Ta2 with large bulbous swelling not reaching middle of Ta3; mandible with 3 teeth; posterior hairbands T3–T4 present; hypostomal area with rounded excavation with small tooth below mandibular articulation. Female: scopa straw-coloured; posterior hair bands T1–T4 complete; posterior sternal hair bands incomplete; hair patches on notauli present; clypeus medially without longitudinal impunctate line.

Description.

Male. Holotype, QM (T262686): L 11 mm; W 8.5 mm. RHM: HW 100; OOD 15; OOC 15; OCL 38; CL 18; CW 45.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation with small tooth below mandibular articulation; clypeus very shallowly emarginate apically; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with

dark spots on ventral surface of Ta1–Ta2; Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but not reaching middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate with small median dent; punctation on head medium and dense, on mesosoma and metasoma fine and dense; genitalia as in Fig. 12H–I.

Pubescence. Head pale gold on face, sparse and gold on vertex; white on genae, transverse parallel bands of white hairs posterior to ventral hypostomal excavation, tuft of pale gold hairs on inner anterior angle of excavation; outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesosoma short, gold, dorsally, long, pale gold laterally and ventrally; mesepisternum below wing with white or whitish hairs only; mid tarsus with short pale gold hairs on outer surface, posterior margin with fringe long hairs, hind leg with gold hairs on inner surface; T1–T4 with posterior hair bands complete, pale gold, T5 covered with gold tomentum, T6 without tomentum, only very sparse erect gold hairs; S1–S4 with sparse white-gold hairs; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs.

Colouration. Antennae with scape, pedicel black, flagellum brown dorsally, red-brown ventrally; forelegs with femur, tibia, tarsus mainly gold, tibia brown on inner surface; mid and hind legs dark brown; tegulae brown; Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, SAMA (32-37427): L 12.1 mm; W 7.9 mm. RHM: HW 100; OOD 14; OOC 15; OCL 36; CL 20; CW 45.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with straw-coloured or yellowish hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands straw-coloured; tomentum on disc of T6 predominantly orange or gold; scopa light straw-coloured.

Colouration. Integument black. Mandibles predominantly dark brown or black.

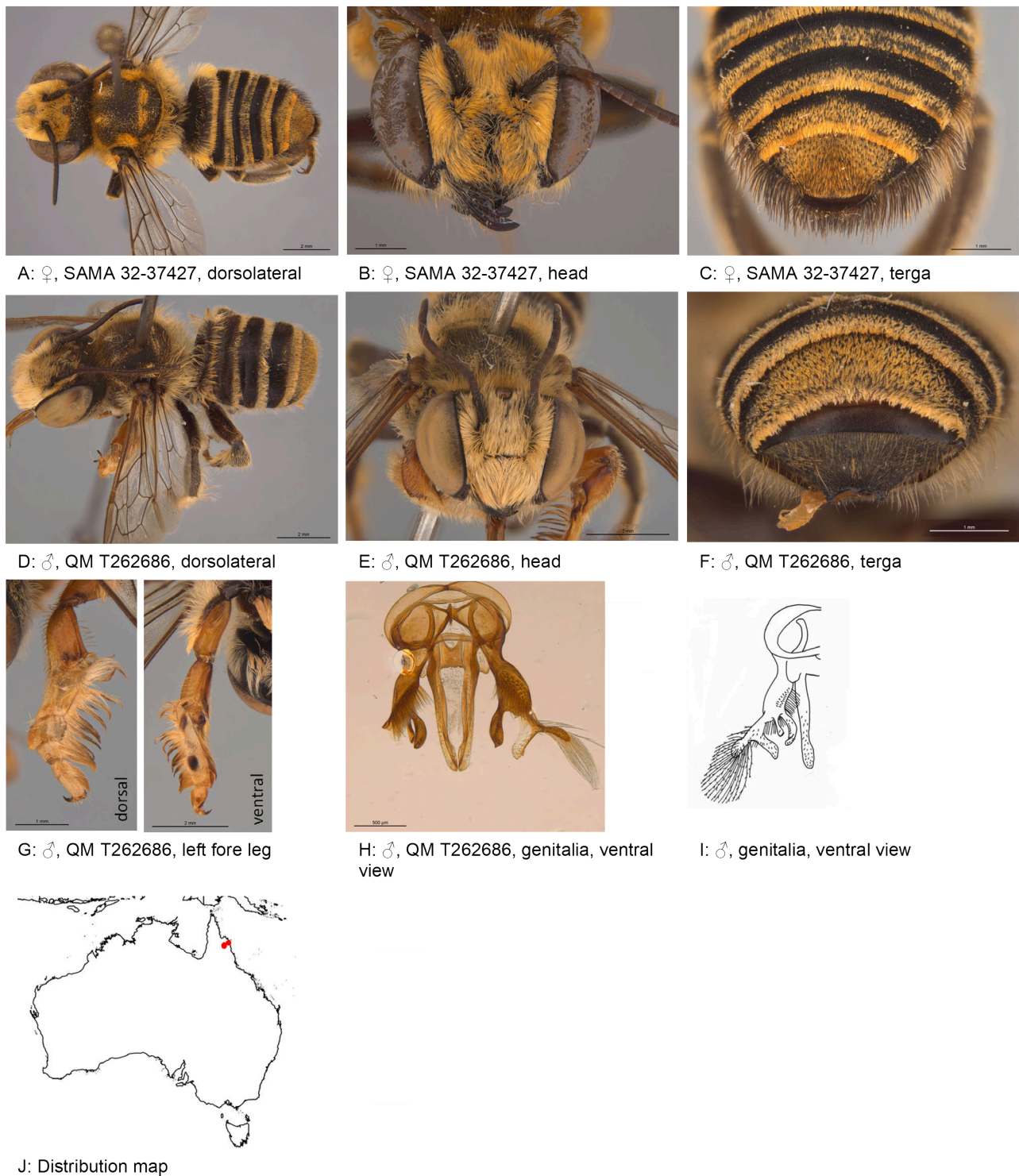


Figure 12A-J. *Megachile (Notochile) gregaldanae* King & Leijs *sp. nov.*

Association of sexes. The sexes were associated using DNA barcode data.

Flower visitation. Not recorded.

Distribution. Fig. 12J.

Phenology. March (3 records), December (2 records).

Etymology. The specific name refers to the collectors Greg and Alice Daniels who have collected widely in Aus-

tralia and donated many bees to the UQ and QM collections.

Megachile (Aethomegachile) haematogastra* Cockerell 1921 *comb. nov.

Figs 13A–H

Megachile haematogastra Cockerell 1921, p.90

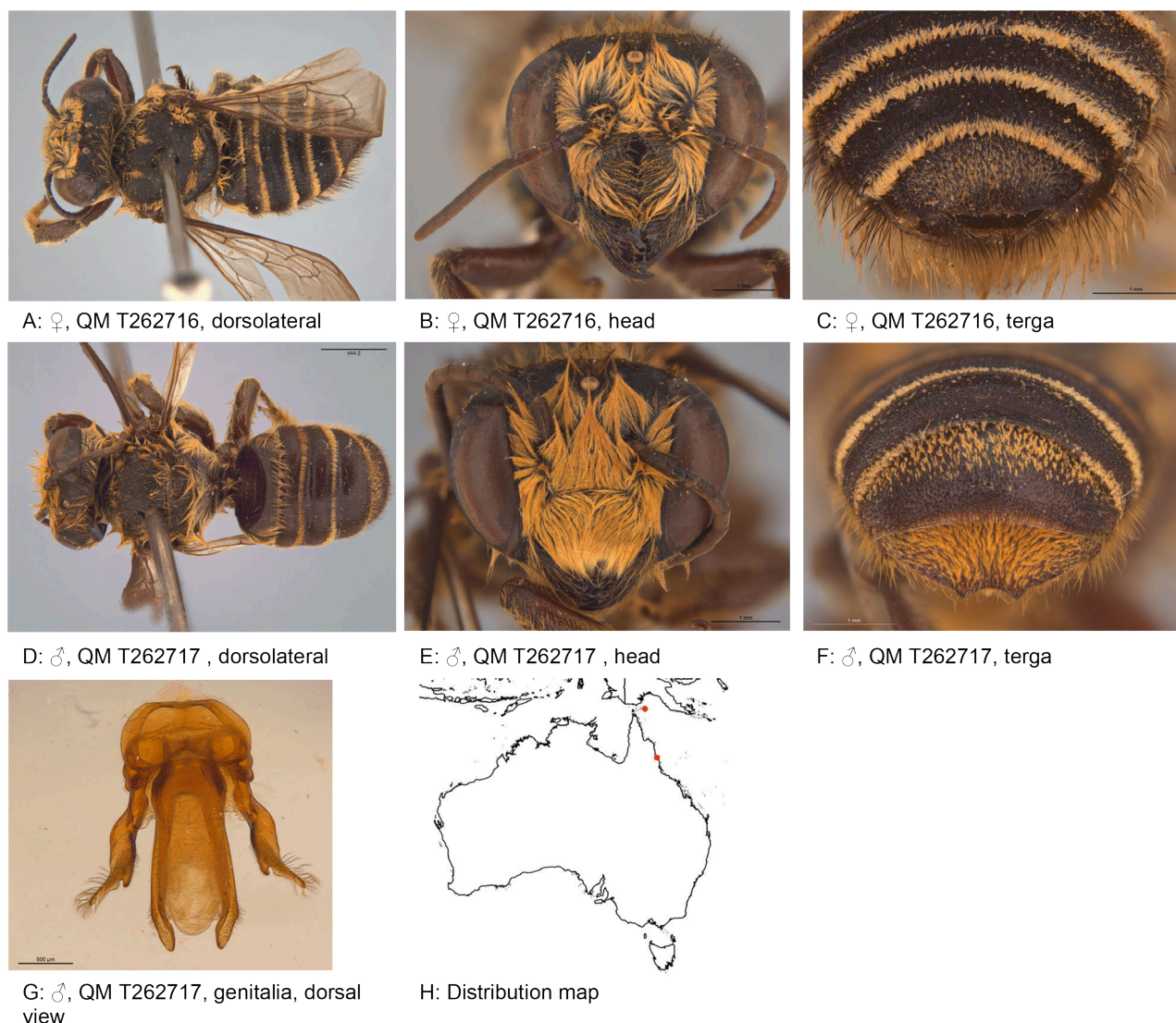


Figure 13A-H. *Megachile (Aethomegachile) haematogastra* Cockerell 1921

Megachile (Eutricharaea) haematogastra Cockerell, Michener 1965, p. 209 *comb. nov.*

Examined specimens. Holotype, ♀, QM T2505, QLD, Cairns. Allotype ♂, QM (T262717) K28362, QLD, Murray Isl, Torres Strait, no date, id. by H. Hacker. Redescription, ♀, QM (T262716), same label data as allotype.

Diagnosis. Male: T6 integument orange or red; T3–T4 posterior hair bands present on entire width. Female: T6 Integument orange or red.

Description.

Male. Allotype, QM (T262717): L 10.1 mm; W 7.9 mm. RHM: HW 100; OOD 12; OOC 14; OCL 37; CL 24; CW 46.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without

groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate; genitalia as in Fig. 13G.

Pubescence. Mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with gold hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs; tomentum on T6 orange-gold.

Colouration. Ta1–Ta3 of fore tarsus brown or black; outer surface of Ta1 of mid tarsus with orange or gold hairs; integument of sterna brownish red; integument of T6 orange or red.

Female. Redescription, QM (T262716): L 10.4 mm; W 7.7 mm. RHM: HW 100; OOD 11; OOC 14; OCL 37; CL 21; CW 45.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured or yellowish hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands off-white or straw-coloured; tomentum on disc of T6 straw-coloured or light brown; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data.

Related species. Based on close similarities in genitalia morphology with South East Asian species such as *M. (Aethomegachile) conjuncta* Smith and *M. (Aethomegachile) laticeps* (Ascher *et al.* 2016, Fig. 9AB) *M. haemato-gastra* Cockerell is placed in *M. (Aethomegachile)*.

Flower visitation. Not recorded

Distribution. Fig. 13H.

Phenology. No data.

***Megachile* (unplaced) *kurandensis* Cockerell 1910 comb. nov.**

Figs 14A–F

Megachile kurandensis Cockerell 1910, p.359

Megachile (Eutricharaea) kurandensis Cockerell, Michener 1965, p.209. *comb. nov.*

Examined specimens. Holotype, ♂, *M. kurandensis* BMNH Hym 17a 2382, Kur 1.02, Turner Coll. 1910–7. Condition fair; missing are apical segments of right antenna, preapical and apical segments of left mid tarsus. **Other specimens:** ♂, AMNH, QLD, Cairns.

Only the type and one other male were examined. The latter was already broken, and it was decided not to attempt to remove the genitalia.

Diagnosis. Male: ventral margin of mandible without basal projection; scutum with dense black pubescence; posterior hair bands on T1–T4 bright fulvus or orange.

Description.

Male. Redescription. Holotype, BMNH Hym 17a 2382: L 8 mm; W 6 mm. RHM: HW 100; OOD 14; OOC 16; OCL 39; CL 22; CW 45.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 3 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least

2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; coxal spines on foreleg absent; Carina on T6 binodulose.

Pubescence. Face densely covered with golden fulvous hair; vertex with black hairs; fore tarsus with long pale fulvous hairs on outer surface; outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesoscutum with brown and black hairs; mesepisternum below wing mainly with black hairs; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on tergabright golden-fulvus or golden orange; sterna without patches of dense tomentum; hair bands on posterior margins with dense to closely placed hairs; tomentum on T5–T6 golden orange.

Colouration. Overall body integument black or brownish black.

Association of sexes. Female unknown (but see note).

Flower visitation. Not recorded

Distribution. Known only from the Cairns area, Queensland.

Phenology. January (1 record).

Note. An unlabelled specimen in QM may be the female of this species, as it has a dark scopa not seen in any other species.

***Megachile* (unplaced) *kuschei* Cockerell 1939 comb. nov.**

Figs 15A–G

Megachile kuschei Cockerell 1939, p.134

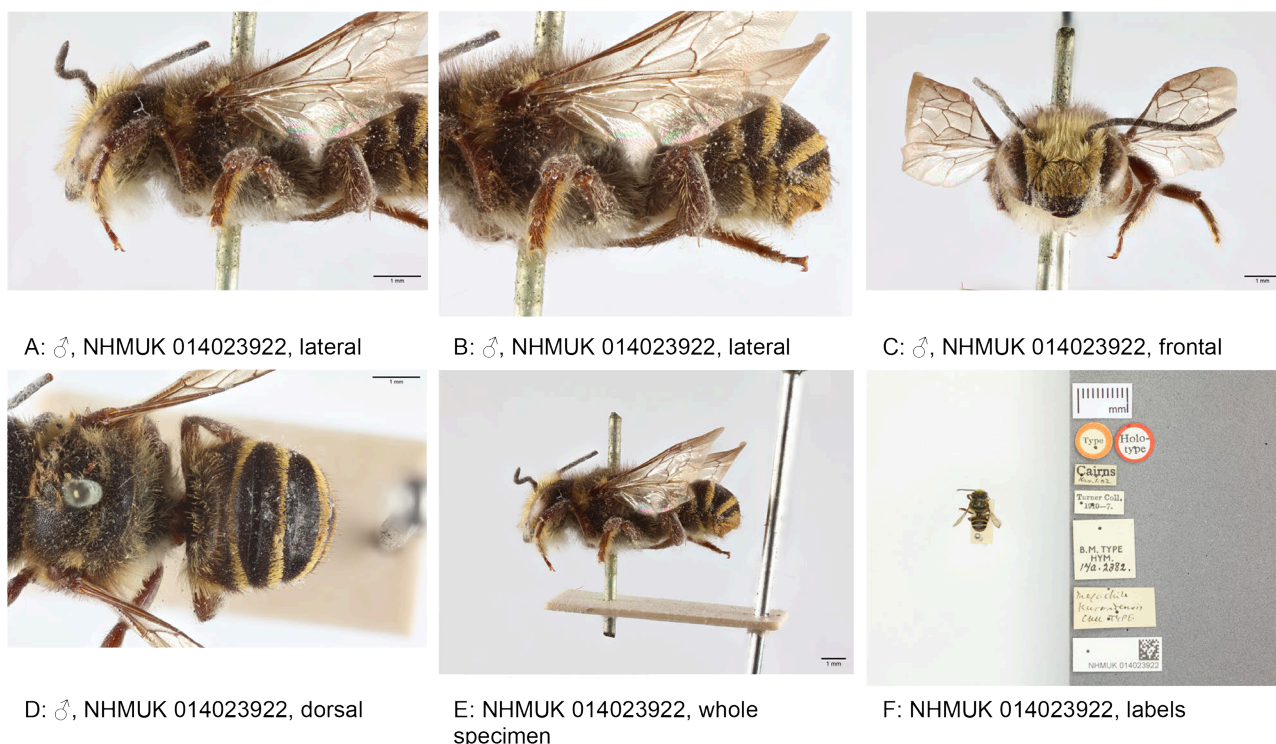
Megachile (Eutricharaea) kuschei Cockerell 1939, Michener 1965, p.209. *comb. nov.*

Examined images. Holotype, ♂, BPBM ENT 000 000 1229, QLD, Prince of Wales I. (10.66°S: 142.18°S), August 1920, coll. J. A. Kusche, from collection of W. M. Giffard.

Diagnosis. Male: ventral margin of mandible without basal projection; scutum with dense black pubescence; posterior hair bands on T1–T4 white.

Male. Redescription: Holotype, BPBM ENT 000 000 1229: Measurements not available.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bilobed.

Figure 14A-F. *Megachile (unplaced) kurandensis* Cockerell 1910

Pubescence. Vertex and mesoscutum with black hair; mesepisternum below wing with mainly black hairs; outer surface of Ta1 of mid tarsus with orange or gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga, when present, white; sterna without patches of dense tomentum; hair bands on posterior margins with closely placed hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna brownish red; integument of T6 black or brown.

Association of sexes. Female unknown.

Flower visitation. Not recorded

Distribution. Fig. 15F.

Phenology. August (1 record).

Megachile (Anodonteutricharaea) leucopogon Cockerell 1929 *comb. nov.*

BOLD:ACD6931

Figs 16A–E

Megachile leucopogon Cockerell, 1929, p. 6

Megachile (Eutricharaea) leucopogon Cockerell, Michener 1965, p.209. *comb. nov.*

Examined specimens. Holotype, ♂, AMNH, ac 24727, NT, Darwin, G.F. Hill. Condition good: apical segment missing from left antenna. **Other specimens.** 14 males.

Diagnosis. Male: mandible with four teeth, and ventral margin without basal projection; fore tarsus slightly modified with dark smooth mark ventrally on first tarsomere.

Description.

Male. Redescription, SAMA (32-37421): L 8 mm; W 5.5 mm. RHM: HW 100; OOD 18; OOC 16; OCL 33; CL 17; CW 47.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth; hypostomal area not modified; fore tarsus not modified. Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus extended posteriorly with shiny black patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bilobed; S5 similar to *tenuicincta* (Fig. 31G) but lacking the small patch of thick modified hairs just mesad of apico-lateral branched hairs; S6 similar to Fig. 31H but apical hairs are simple; S8 similar to Fig. 31H but wider and slightly shorter; genitalia as in Fig. 16D.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with

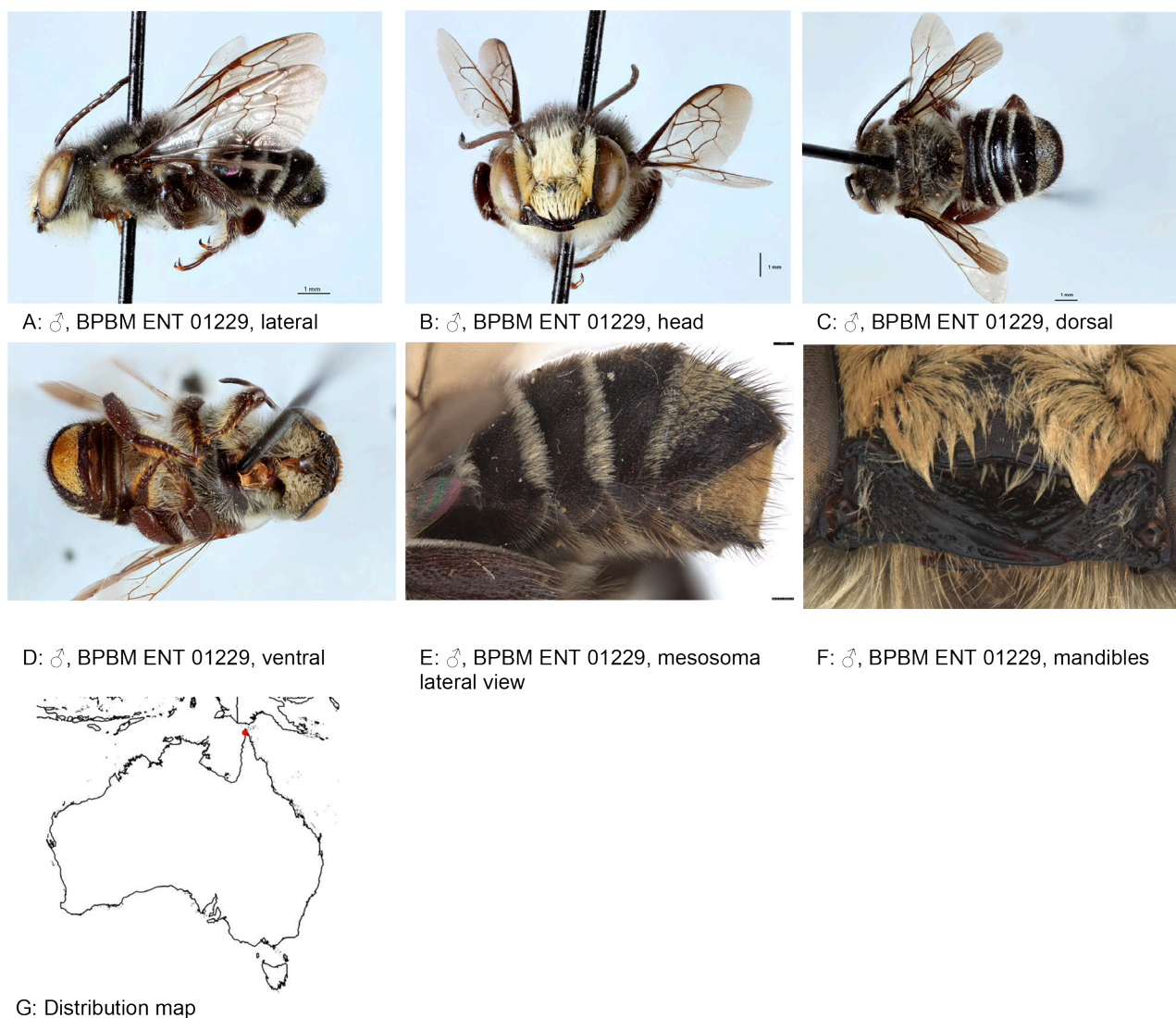


Figure 15A-G. ***Megachile (unplaced) kuschei*** Cockerell 1939

white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with dense hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Association of sexes. Female unknown.

Subgeneric placement. Based on molecular evidence (Fig. 1) *M. leucopogon* is placed in *M. (Anodonteutricharaea)*.

Flower visitation. *Antigonon leptopus*, *Grewia cf. mesomischia*, *Melaleuca lanceolata*, *Waltheria indica*.

Distribution. Fig 16E. Central Queensland and the Northern Territory.

Phenology. January (1 record), March (3 records), April (1 record), May (1 record), June (1 record), September (1 record), October (1 record), December (1 record).

***Megachile (Notochile) lineatipes* Cockerell 1910 comb. nov.**

Figs 17A–H

Megachile lineatipes Cockerell 1910c, p.364

Megachile (Eutricharaea) lineatipes Cockerell, Michener 1965, p.209 comb. nov.

Examined specimens. Holotype, ♂, BMNH, HYM 17a 2401, QLD, Cairns, E. Kur. 1.02, Turner Coll. 1910–7, Swan R. Australia. **Other specimens.** 20 males.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus Ta2 with large bulbous swelling not reaching middle of Ta3; mandible with 3 teeth; posterior hairbands T3–T4 present; rim of hypostomal exca-

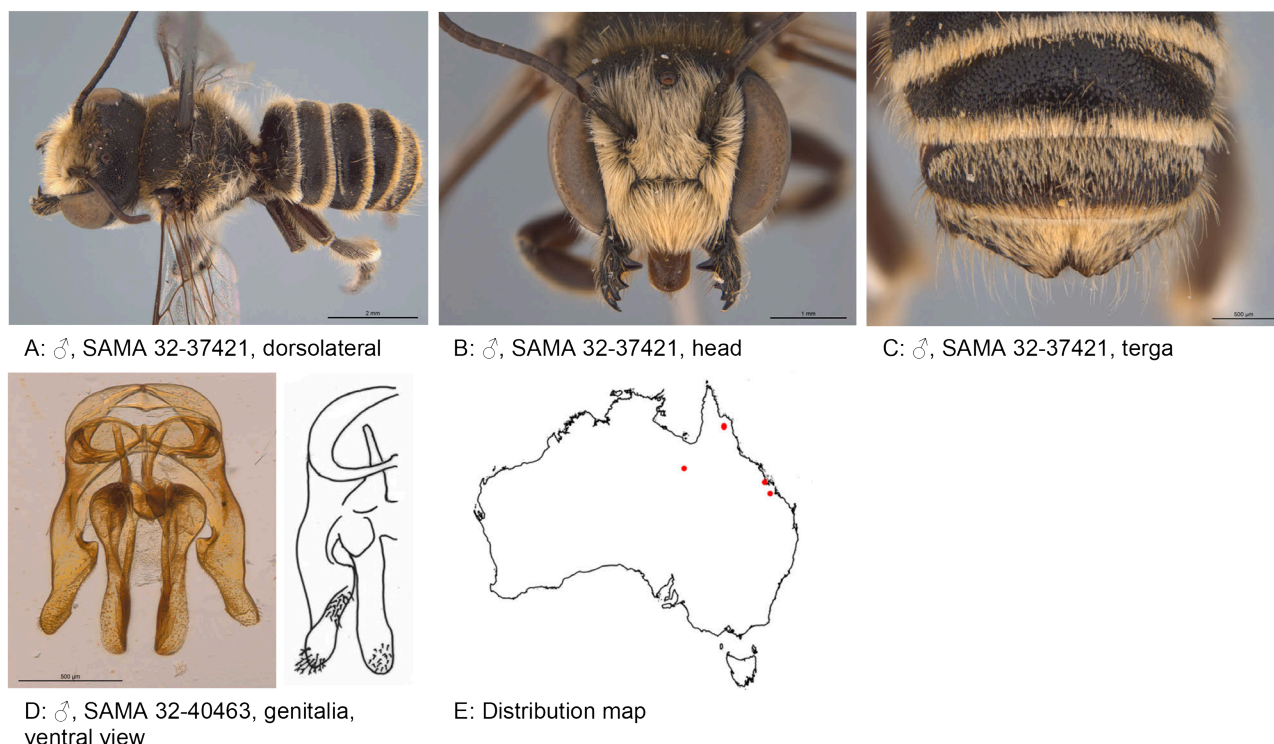


Figure 16A-E. *Megachile (Anodonteutricharaea) leucopogon* Cockerell 1929

vation without tooth or raised ridge; tomentum on T6 white.

Description.

Male. *Redescription*, QM (T262739): L 10.5 mm; W 7.5 mm. RHM: HW 100; OOD 16; OOC 16; OCL 38; CL 20; CW 39.

Structure. Ventral margin of mandible with large basal projection; mandible with 3 teeth; hypostomal area deeply excavated, excavation margined anteriorly by polished ridge extending to a sharp tooth ventral to acetabular condyle 2; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with grey spot on ventral surface of Ta2; Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but not reaching middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate; S5 with medio-longitudinal ridge and modified hairs in basal two-thirds, Fig.17F; genitalia Fig.17E.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or gold, and black hairs; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga white or straw-coloured; sterna without patches of dense

tomentum; hair bands on posterior margins with dense hairs; tomentum on T6 white.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Association of sexes. Female unknown.

Flower visitation. *Melaleuca bracteata*.

Distribution. Fig 17G.

Phenology. February (1 record), July (1 record), September (1 record), October (1 record), November (10 records), December (2 records).

Comments. The type is in excellent condition, but bears 2 labels, one giving Cairns QLD as the collecting locality, the other Swan River WA. Cockerell (1910c) records Cairns as the type locality, and as all other specimens are from the eastern half of Australia it is assumed that the other label is a mistake.

Megachile (unplaced) macrocephala Leijs sp. nov.

Figs. 18A–K

urn:lsid:zoobank.org:act:23F6F714-71FB-464C-BAE3-80DD27707B9B

Examined specimens. Holotype, ♂, WAM (17412), WA, Hidden Valley near Kununurra (15.768°S: 128.7508°E), 05/01/1989, T.F. Houston, on *Scaevola*, Allotype, ♀, WAM (16817), WA, NE of foot of Mount Bruce (22.608°S: 118.1394°E), 06/05/1980, T.F. Houston. **Other specimens.** 1 male and 2 females.

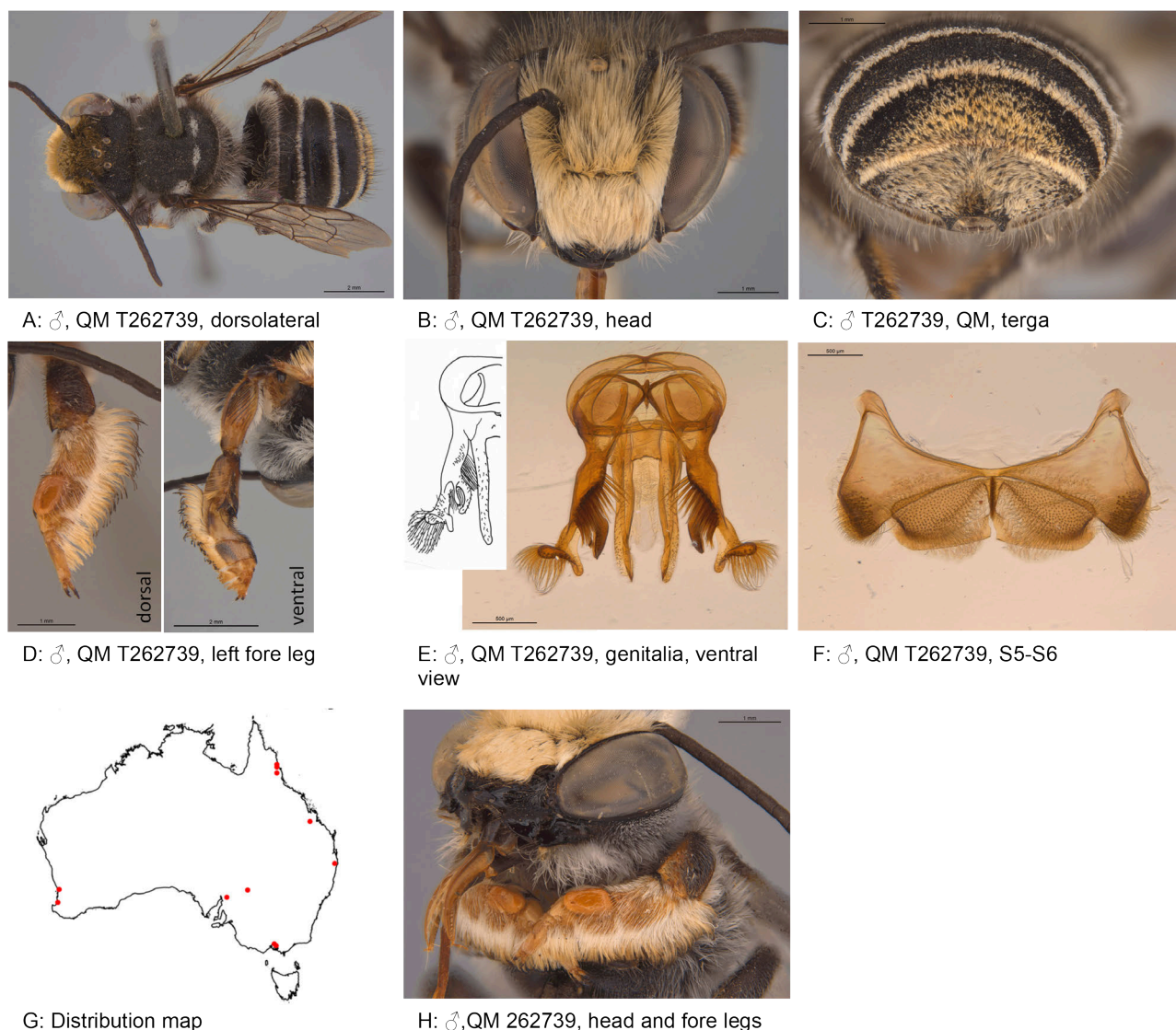


Figure 17A-H. *Megachile (Notochile) lineatipes* Cockerell 1910

Diagnosis. Both sexes: this is the only species with extensive orange-brown pubescence, and wide orange-brown posterior tergal hair bands in both sexes. Males head width is larger than scutum width.

Description.

Male. Holotype, WAM (17412): L 13.1 mm; W 9.7 mm. RHM: HW 100; OOD 14; OOC 13; OCL 34; CL 25; CW 39.

Structure. Head wider than scutum; ventral margin of mandible with basal projection; mandible with 4 teeth, hypostomal area with rounded excavation and tooth or raised at inner rim; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with smooth dark spot on ventral surface of Ta2; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, overlapping base of Ta2; inner hind tibial spur about as thick

and less than 1.5x as long as outer spur; carina on T6 bilobed.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3-T4 present on entire width; general colour of hair bands on terga orange or gold; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs; tomentum on T6 orange-gold.

Colouration. Ta1-Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, WAM (16817): L 10.6 mm; W 8.0 mm. RHM: HW 100; OOD 11; OOC 14; OCL 34; CL 19; CW 42.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

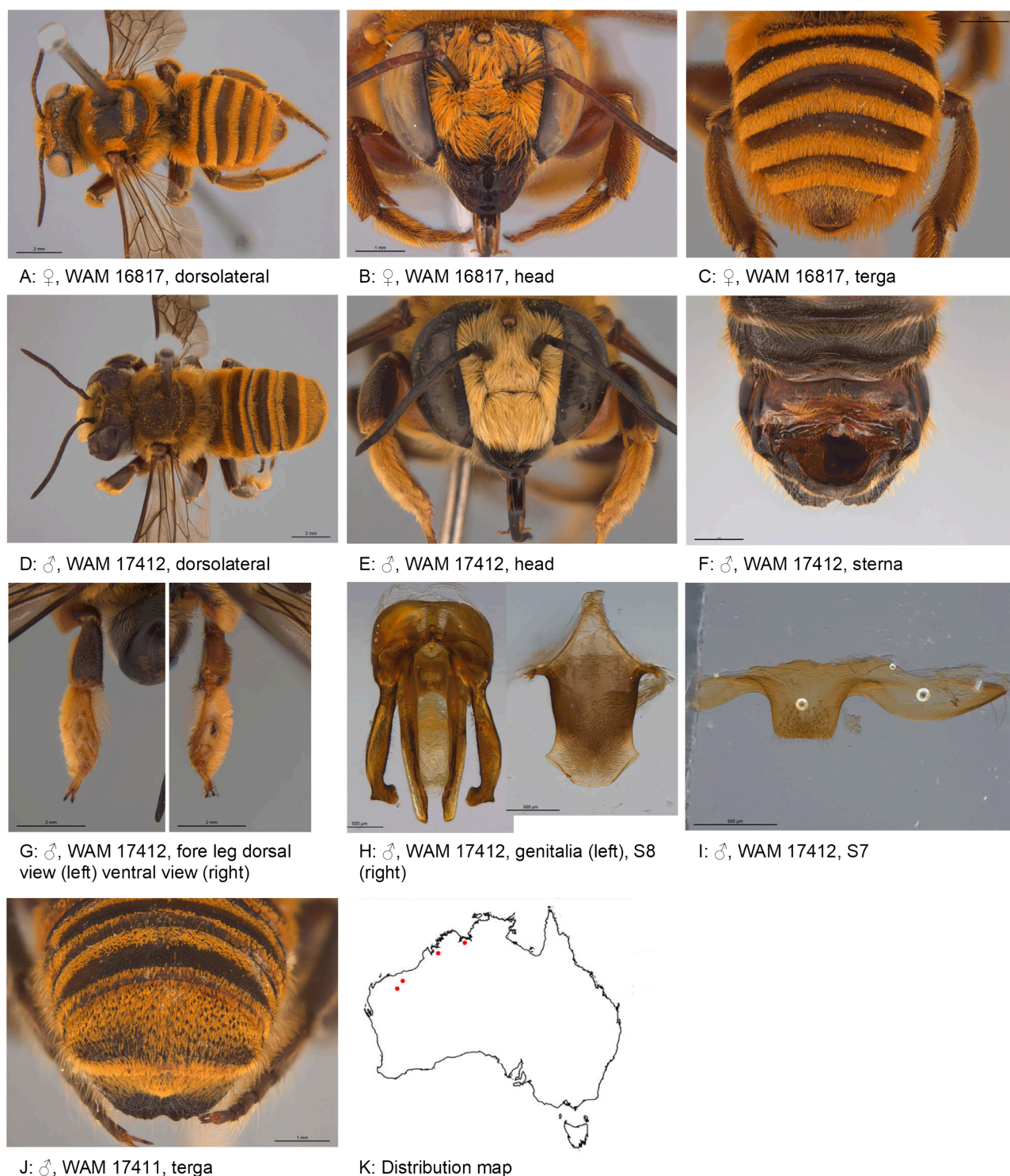


Figure 18A-K. ***Megachile (unplaced) macrocephala*** Leijs sp. nov.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with orange or golden hairs; scutum lacking hair patches on notauli, mesepisternum below wing without black hairs; metepisternum below spiracle with short black or brown hairs; or almost without hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands orange; tomentum on disc of T6 straw-coloured or light brown; scopa orange.

Colouration. Integument black. Mandibles predominantly orange red or brownish red, apical margin black.

Association of sexes. Sexes were associated by similarity in pubescence colour which is unique within the Australian species.

Flower visitation. *Scaevola*.

Distribution. Fig. 18K.

Phenology. January (2 records), May (2 records), September (1 record).

Etymology. The specific epithet refers to the enlarged head of the males of this species.

***Megachile (Notochile) maculariformis*
Cockerell 1907 comb. nov.**

BOLD:AEC2240

Figs 19A–J

Megachile maculariformis Cockerell 1907, p.223

Megachile (Eutricharaea) maculariformis Cockerell, Michener 1965, p.209. comb. nov.

Megachile phenacopyga Cockerell 1910a. p.109. syn. nov.

Megachile (Eutricharaea) phenacopyga Cockerell, Michener 1965, p.209. comb. nov.

Notes on synonymy. There has been confusion about the identity of *M. chrysopyga* and *M. maculariformis*, which started with Smith's (1953) description of a female *M. chrysopyga* from WA and a male from Van Diemen's Land (TAS). Apparently, sexes were wrongly associated, which led to the belief that *M. chrysopyga* had a wide distribution. When Cockerell described the female of *M. maculariformis* in 1907, he did not compare it with Smith's female of *M. chrysopyga*. Cockerell described *M. phenacopyga* from a male from Eastern Australia and compared it with a male (not the type specimen) from Ararat, Victoria, which he considered the real male of *M. chrysopyga* as described by Smith (Cockerell, 1910a). There has also been confusion about the type locality in WA or VIC of the male of *M. phenacopyga* (Cockerell, 1930b, p.229). This may have been the reason why Cockerell synonymized *M. maculariformis* with *M. chrysopyga* (Cockerell, 1930b, p.219). We now consider *M. maculariformis* and *M. chrysopyga* as proper, although closely related, species that could be reliably separated using several morphological characters, which also correlate with their distribution. *M. chrysopyga* is restricted to SW WA and *M. maculariformis* to Eastern Australia. The original description of *M. phenacopyga*, especially with respect to the morphology of the front leg, and the type locality of Broad Meadows, VIC, indicates that it is a synonym of *M. maculariformis*.

Examined specimens. Holotype, ♀, *M. maculariformis*, AMNH Dept. Invert. Zool. 21135 303, N.S.Wales. Condition: right antennal flagellum missing. Holotype, ♂ *M. phenacopyga*, HU, 1004, New Holland, Orient, Preiss S. Condition: right antenna missing. **Other specimens.** 44 males, 59 females, and 54 specimens with sex not recorded.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus Ta2 with large bulbous swelling extending beyond middle of Ta3; mandible with 3 teeth; tomentum T6 orange-gold. Female: scopa white or straw-coloured; clypeus medially with impunctate line; hairbands T3–T4 complete; mesepisternum with black hairs; frons with orange/golden hairs.

Description.

Male. Redescription, SAMA (37583): L 10.5 mm; W 7.5 mm. RHM: HW 100; OOD 15; OOC 15; OCL 39; CL 19; CW 44.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with dark spots on ventral surface of Ta1–Ta2; Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but extending beyond middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate with small median dent; genitalia as in Fig. 19H.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or gold, and distinct patch of black hairs; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga white; sterna without patches of dense tomentum; hair bands on posterior margins with closely placed hairs; tomentum on T6 orange-gold.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Redescription, SAMA (38915): L 11.5 mm; W 9 mm. RHM: HW 100; OOD 13; OOC 15; OCL 37; CL 19; CW 51.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with orange or golden hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present laterally, weak medially; general colour of tergal hair bands, where present, white; tomentum on disc of T6 predominantly orange or gold; scopa white or light straw-coloured.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated using DNA barcode data.

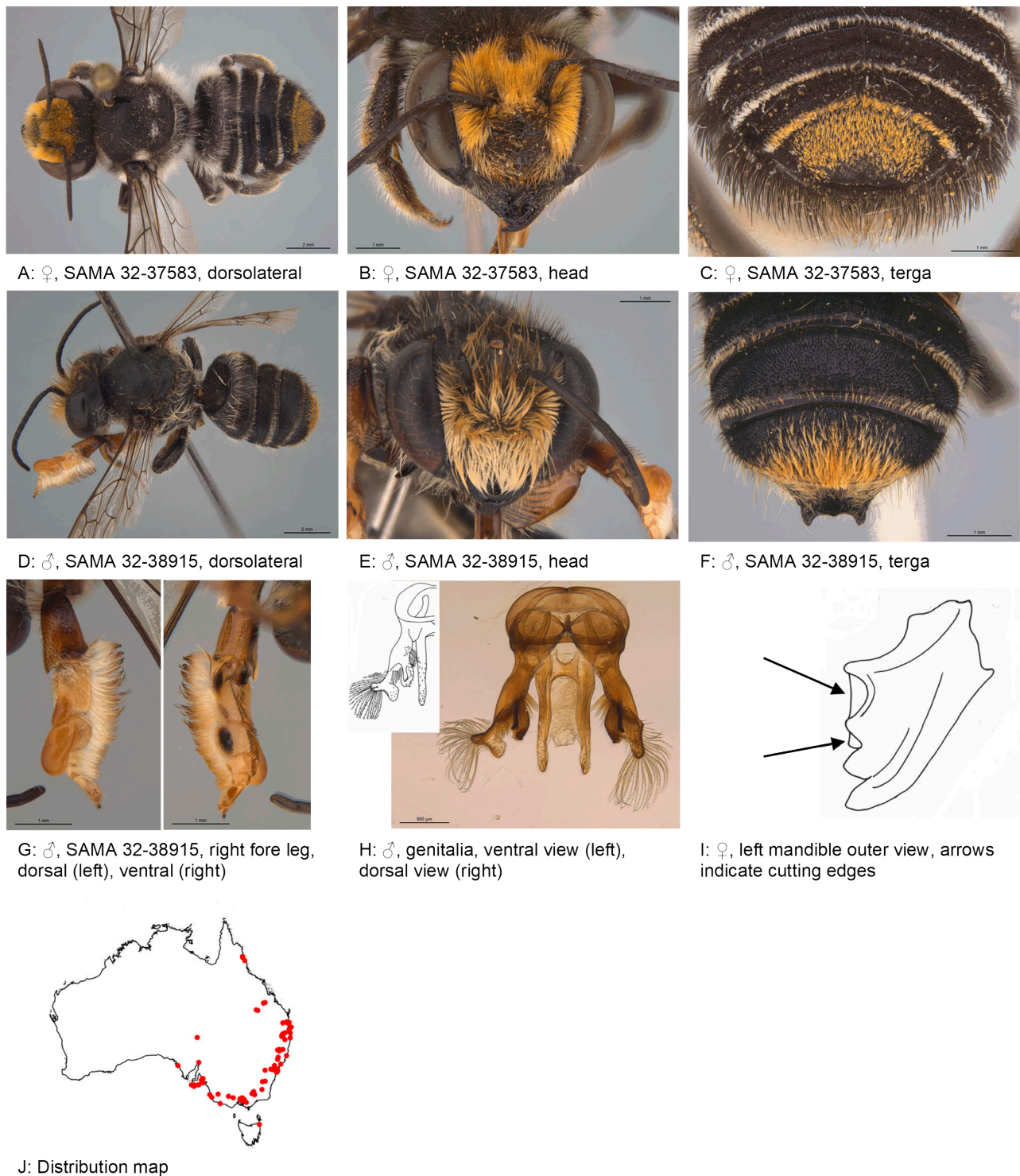


Figure 19A-J. *Megachile (Notochile) maculariformis* Cockerell 1907

Flower visitation. *Cakile maritima*, *Daviesia*, *Dillwynia retorta*, *Eucalyptus*, *Goodenia*, *Melaleuca*, *M. lanceolata*, *M. pubescens*, *Persoonia*, *Pultenaea*, *Rubus*, *Xanthorrhoea*.

Distribution. Fig. 19J. Eastern Australia. This is one of the few megachilid species recorded from Tasmania.

***Megachile (Notochile) macularis* Dalla Torre 1896 comb. nov.**

BOLD:ABW1761

Figs 20A-N

Megachile maculata Smith 1853, p.170

Megachile macularis Dalla Torre 1896, p. 437

Megachile australasiae Dalla Torre 1896, p. 421. syn. nov.

Megachile cygnorum Cockerell 1906, p. 533. syn. nov.

Megachile (Eutricharaea) macularis Dalla Torre 1896. Michener 1965, p. 209 comb. nov.

Notes on synonymy. Dalla Torre (1896), changed the name because the name *maculata* was preoccupied. *M. australasiae* and *M. cygnorum* are considered new synonyms of *M. macularis* because of their morphological similarities, including the distinctive robust inner hind tibial spur.

Examined specimens. Syntypes, ♀ ♂, *M. maculata*, BMNH, ♀ specimen has type label. Hym 17a.2440, *Megachile maculata* Sm, W. Australia, 47 109. Condition: fair, missing are right foreleg, left hind leg, apical segments from right hind tarsus, apical segments of left antenna. Holotype ♀ *M. australasiae*, BMNH, Hym 17a.2355, WA, Champion Bay, Geraldton. Condition: right antenna broken, left mid and hind leg, apical and preapical tarsal segments on foreleg missing, mesosoma broken. Holotype ♂ *M. cygnorum*, BMNH, Hym 17a.2377, WA, Swan R., 69 50. Condition: fair, right antenna broken, very dirty. **Other specimens.** 90 males, 88 females, 64 specimens where sex was not recorded.

Diagnosis. Male: mandible with three teeth and basal projection on the ventral margin; fore tarsus modified, Ta2 without bulbous swelling; mesepisternum without patch of black hairs; inner hind tibial spur 2x as thick as outer spur. Female: scopa white or straw-coloured; posterior sternal hairbands complete; mesepisternum without black hairs; T6 with dense white tomentum.

Description.

Male. *Redescription*, SAMA (32-40453): L 10 mm; W 7.5 mm. RHM: HW 100; OOD 14; OOC 16; OCL 37; CL 18; CW 46.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with smooth areas and dark spots on ventral surface of Ta1–Ta2; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur 2x as thick and 1.5x as long as outer spur; carina on T6 bidentate with small median dent; hidden sterna as in Figs 20J–K, N; genitalia as in Fig. 20I, M.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with dense hairs; tomentum on T6 white.

Colouration. Ta1–Ta3 of fore tarsus whitish, yellow or gold; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, SAMA (32-37683): L 11 mm; W 8 mm. RHM: HW 100; OOD 12; OOC 14; OCL 35; CL 21; CW 45.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured or yellowish hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands off-white or straw-coloured; tomentum on disc of T6 a broad white band across width at anterior half of tergum; scopa light straw-coloured.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. The sexes were associated using DNA barcode data.

Flower visitation. *Calytrix*, *Crotalaria*, *C. cunninghamii*, *Daviesia*, *Dicrastylis exsuccosa*, *Eremophila gilesii*, *Eucalyptus*, *E. campaspe*, *Fabacea*, *Frankenia*, *Hakea*, *Indigofera monophylla*, *Jacksonia*, *J. affin grevilleoides*, *J. densiflora*, *J. scoparia*, *J. sericea*, *Lepidosperma gladiatum?*, *Limonium*, *Melaleuca*, *M. lanceolata*, *M. nematophylla*, *M. styphelioides*, on mint, *Persoonia*, *Pityrodia glutinosa*, *Ptilotus*, *Santalum*, *Stemodia florulenta*, *Swainsona*, *Trichodesma zeylanicum*.

Distribution. Fig. 20L.

Phenology. January (23 records), February (6 records), March (10 records), April (21 records), May (16 records), August (14 records), September (13 records), October (29 records), November (15 records), December (13 records).

Megachile (unplaced) *nivea* Leijs sp. nov.

Figs 21A–D

urn:lsid:zoobank.org:act:82C54F55-A741-452C-AE1E-D2D795BF24DA

Examined specimens. Holotype ♀ SAMA (32-46092), SA, Bon Bon St. South Mungillio, (30.875077°S: 135.446052), 4/01/2023, R. Leijs & K. Hogendoorn, on *Frankenia*. **Other specimens.** 6 females.

Diagnosis. Female: scopa white; posterior sternal hairbands mesially absent; no black hairs on mesepisternum behind wing; hair patches on notauli present; frons

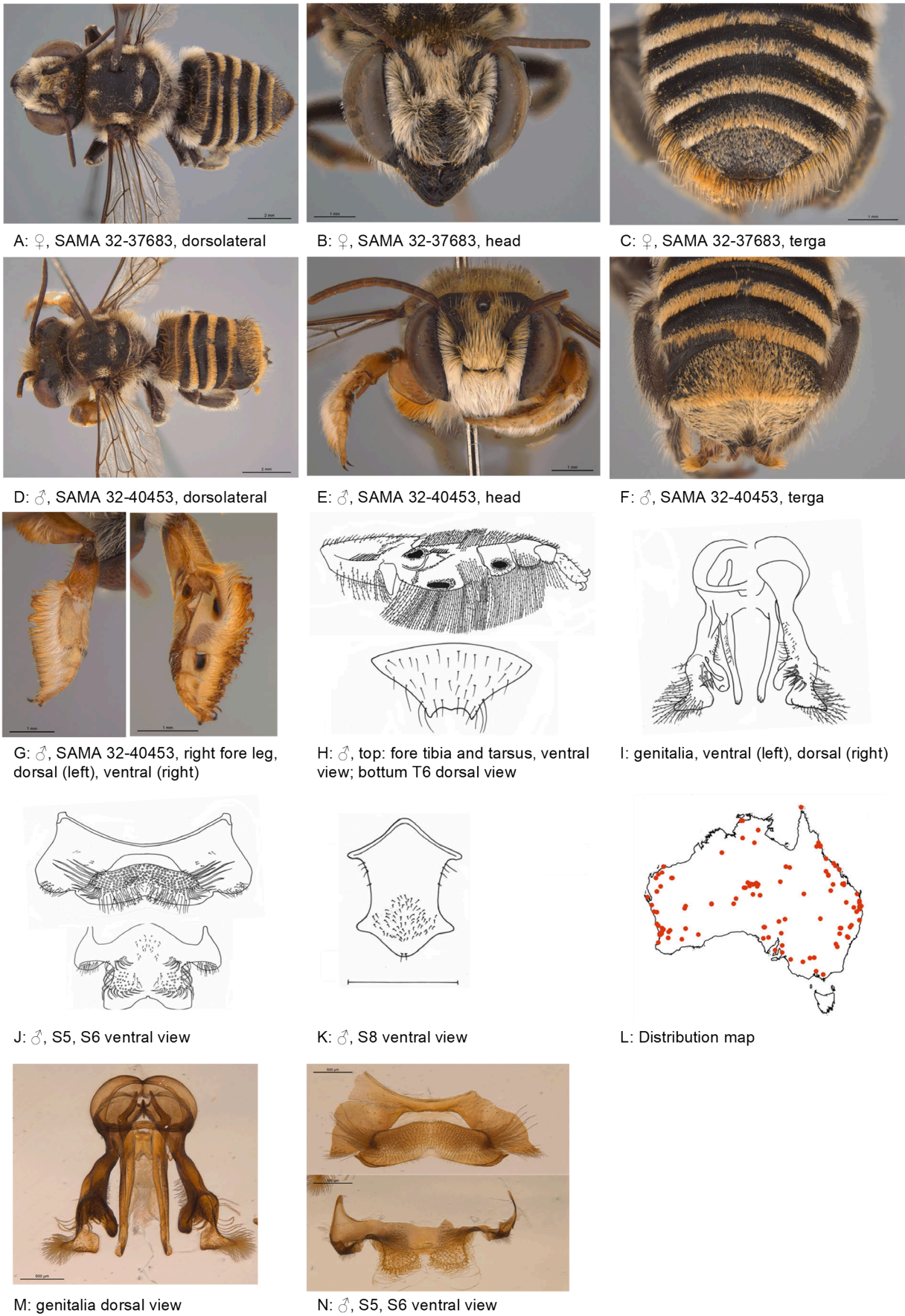


Figure 20A-N. *Megachile (Notochile) macularis* Dalla Torre 1896



A: ♀, SAMA 32-46092, dorsolateral

B: ♀, SAMA 32-46092, head

C: ♀, SAMA 32-46092, terga



D: ♂, Distribution map.

Figure 21A-D. **Megachile (unplaced) nivea** Leijs sp. nov.

with white hairs; T6 covered with dense white tomentum.

Description.

Female. Holotype, SAMA (32-46092): L 12.3 mm; W 8.1 mm. RHM: HW 100; OOD 15; OOC 14; OCL 39; CL 23; CW 43.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with white hairs; scutum with hair patches on notauli present, in some specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 a broad white band across width at anterior half of tergum; scopa white or straw-coloured, black laterally.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Male unknown.

Flower visitation. *Frankenia serpyllifolia*.

Distribution. Fig. 21D.

Phenology. January (2 records), October (2 records), December (3 records).

Etymology. The specific epithet 'nivea' refers to the snow-white pubescence on head, mesosoma, and metasoma.

Megachile (Eutricharaea s. l.) obtusa Smith 1853 comb. nov.

BOLD:ACC9593

Figs 22A–J

Megachile obtusa Smith 1853, p.170

Megachile (Eutricharaea) obtusa Smith, Michener 1965, p.209 comb. nov.

Examined specimens. Holotype ♂, OUM, W. Australia. W.W. Saunders coll. Condition good, tarsal claw missing from left foreleg, apical and preapical tarsomeres missing from left hind leg. Allotype, ♀. SAMA (32-37685), SA, Witchelina, Bala-wopina Creek (30.0651°S:138.1160°E), SA, 27/9/2014, R.Leijs. **Other specimens.** 70 males and 79 females, 55 specimens sex not recorded.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus: Ta1 anterior margin extended, forming groove or shiny patch ventrally; T6 tomentum straw-coloured; fore tarsus Ta1–Ta3 pale yellow. Female: scopa straw-coloured; clypeus medially with impunctate line; posterior hairbands on sterna complete; mesepisternum without black hairs; hair patches on notauli absent.

Description.

Male. Redescription, SAMA (32-39929): Holotype: L 8.5 mm; W 6 mm. RHM: HW 100; OOD 15; OOC 15; OCL 35; CL 19; CW 46.

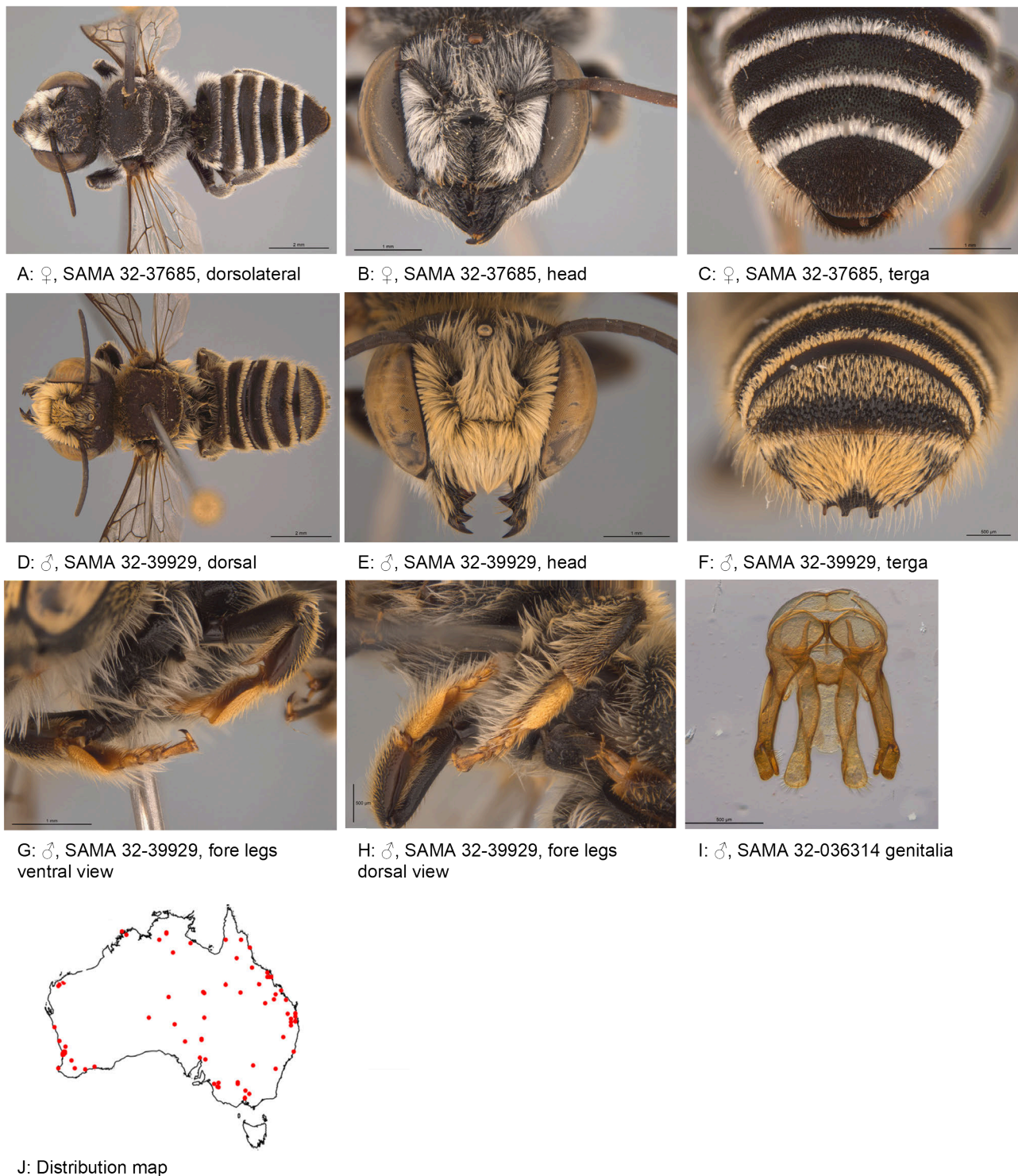


Figure 22A-J. *Megachile (Eutricharaea s. l.) obtusa* Smith 1853

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area not modified; fore tarsus: Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, overlapping base of Ta2; inner

hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 multi-dentate.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3-T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna with

a small patch of dense yellowish tomentum on S3 and S4 medially, hair bands on posterior margins with dense hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Allotype, SAMA (32-37685): L 9.5 mm; W 5.9 mm. RHM: HW 100; OOD 13; OOC 16; OCL 39; CL 25.

Structure. Ventral margin of mandible about 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum lacking hair patches on notauli, mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 black; scopa white or straw-coloured, black laterally.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Confirmed using DNA barcode data.

Related species. Based on similarities in genitalia morphology *M. obtusa* is probably in the same *M. (Eutricharaea* s.l.) clade as *M. dissita* and *M. serricauda*.

Flower visitation. *Calytrix*, *Crotalaria*, *Dasypogon bromeli-aefolius*, *Eucalyptus*, *Gompholobium inconspicuum*, *Goodenia* sp., *Jacksonia*, *J. furcellata*, *J. nr. sternbergiana*, *J. sericea*, *Marubium*, *Medicago sativa*, *Melaleuca leiocarpa*, *Persoonia*, *Salvia*, *Santalum*, *Trichodesma*, *Westringia*.

Distribution. Fig. 22j.

Phenology. January (34 records), February (24 records), March (26 records), April (11 records), May (13 records), June (2 records), July (1 record), August (8 records), September (4 records), October (12 records), November (10 records), December (11 records).

Comments. Cockerell (1930b, p.228) reported that Meade-Waldo recorded that Turner took nine females and seven males at Yallingup (WA). However, the female was never formally described.

***Megachile* (unplaced) *pictiventris* Smith 1879 comb. nov.**

BOLD:AEC2786

Figs 23A–I

Megachile pictiventris Smith 1879, p.65

Megachile (Eutricharaea) pictiventris Smith, Michener 1965 p.209 comb. nov.

Megachile (Eutricharaea) secunda Dalla Torre 1896, p. 437 = *senex* Smith 1862, p.61, in Michener 1965, p.209 comb. nov.

Megachile austeni Cockerell 1906, p.539. syn. nov.

Megachile (Eutricharaea) austeni Cockerell, Michener 1965, p.539 comb. nov.

Megachile rowlandi Cockerell 1930a, p.143. syn. nov.

Megachile (Eutricharaea) rowlandi Cockerell, Michener 1965, p.209 comb. nov.

Notes on synonymy. Cockerell (1930a) described *M. rowlandi* from a female he thought to be larger and a slightly different in colour from *M. pictiventris*. In fact, the two female types are approximately the same size. However, males and females examined vary in overall, length by up to 2mm. Cockerell (1906) described *M. austeni* from a male, its description and comparing this specimen with the holotype of *M. pictiventris* indicated that it was conspecific.

Examined specimens. Holotype ♀ *M. pictiventris*: BMNH HYM 17a 2399, Austr., Richmond R. Condition: head distorted posteriorly, mesosoma broken. Holotype, ♂, *M. austeni*: BMNH HYM 17a 2313, Mackay, Austr. Holotype ♀ *M. rowlandi*: USNM Type 54906, Mackay. Condition: good: right flagellum missing. *Other specimens.* 7 males, 24 females, 30 specimens with sexes not recorded.

Diagnosis. Male: ventral margin of mandible without basal projection; T6 tomentum lacking; hairs on posterior margin of mid basitarsus shorter than length of basitarsus. Female: scopa orange; frons with long black hairs; sternites with posterior hairbands.

Description.

Male. Redescription, WAM (11643): L 10 mm, W 7.5 mm. RHM: HW 100; OOD 15; OOC 15; OCL 39; CL 20; CW 46.

Structure. Ventral margin of mandible without basal projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bilobed. Modified sterna and genitalia Figs 23G–H.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or gold, and patch of black hairs; posterior hair bands on T3–T4 present laterally, weak medially; general colour of hair bands on terga, where present, white; sterna without patches of dense tomentum; hair bands on posterior margins complete with closely placed hairs; S5 with sparse white tomentum basally; tomentum on T6 lacking, only a few sparse erect hairs.

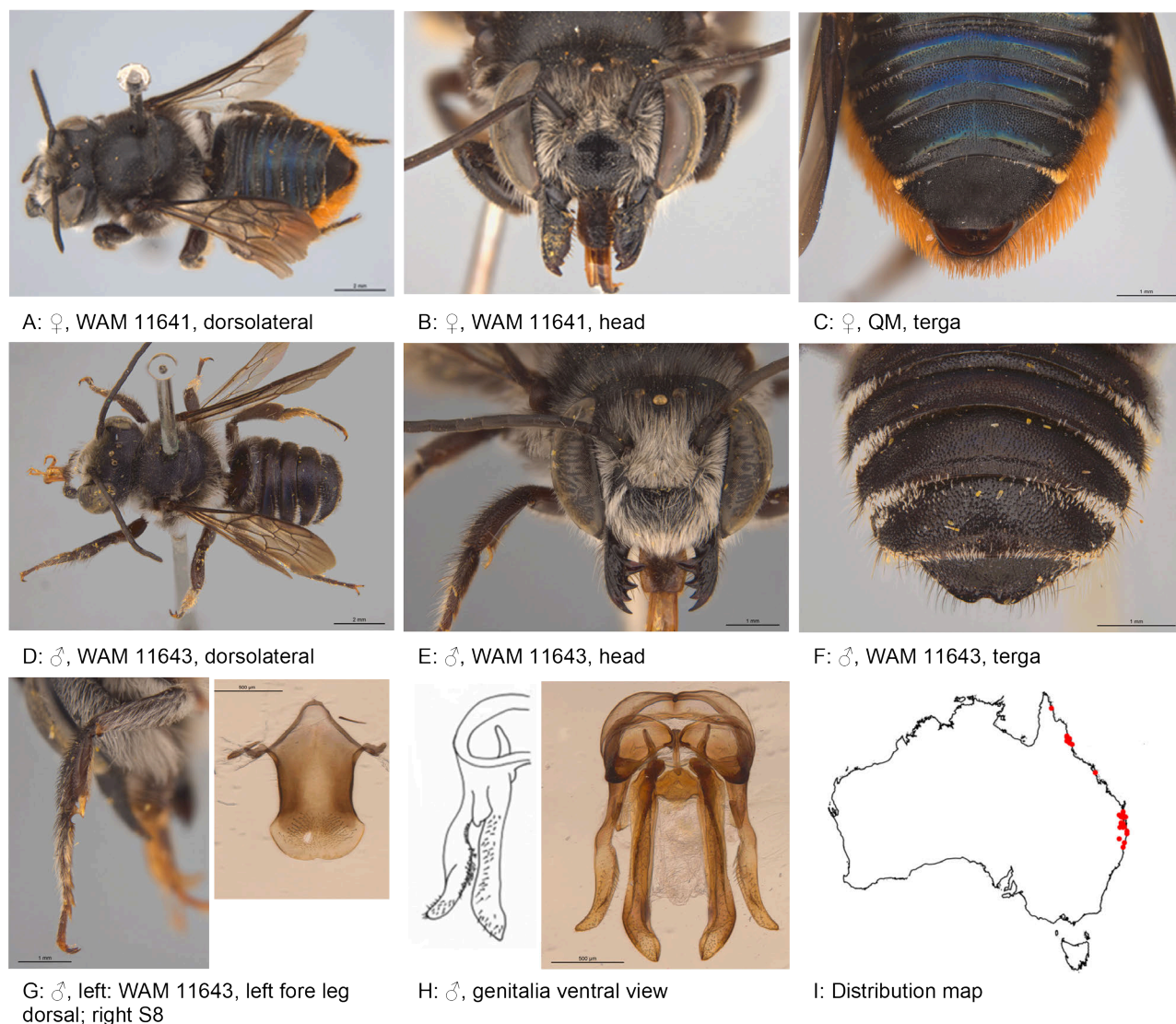


Figure 23A-I. ***Megachile (unplaced) pictiventris*** Smith 1879

Colouration. Ta1-Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, WAM (11641): L 13 mm; W 9 mm. RHM: HW 100; OOD 14; OOC 11; OCL 35; CL 16; CW 41.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus, mandibles quadridentate, Te1, Te2 pointed, Te3 large, square; upper interspace with complete cutting edge, about 4x as wide as middle interspace; middle interspace without cutting edge; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with white and black hairs; scutum lacking hair patches on notauli, mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with mixed black and white hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T1-T5, S1-S5 with very short apical hair bands, broken

medially; tomentum on disc of T6 absent, only with sparse erect hairs; scopa orange.

Colouration. Integument black, terga with blue shine; mandibles predominantly dark brown or black.

Association of sexes. Confirmed using DNA barcoding data.

Related species. Based on similarities in genitalia morphology *M. pictiventris* is related to *M. tenuicincta*.

Flower visitation. *Lantana*.

Distribution. Fig. 23I.

Phenology. January (7 records), February (19 records), March (13 records), April (1 records), November (6 records), December (6 records).

***Megachile (Eutricharaea) pusilla* Pérez 1884**

BOLD:AAQ0516

Figs 24A-H

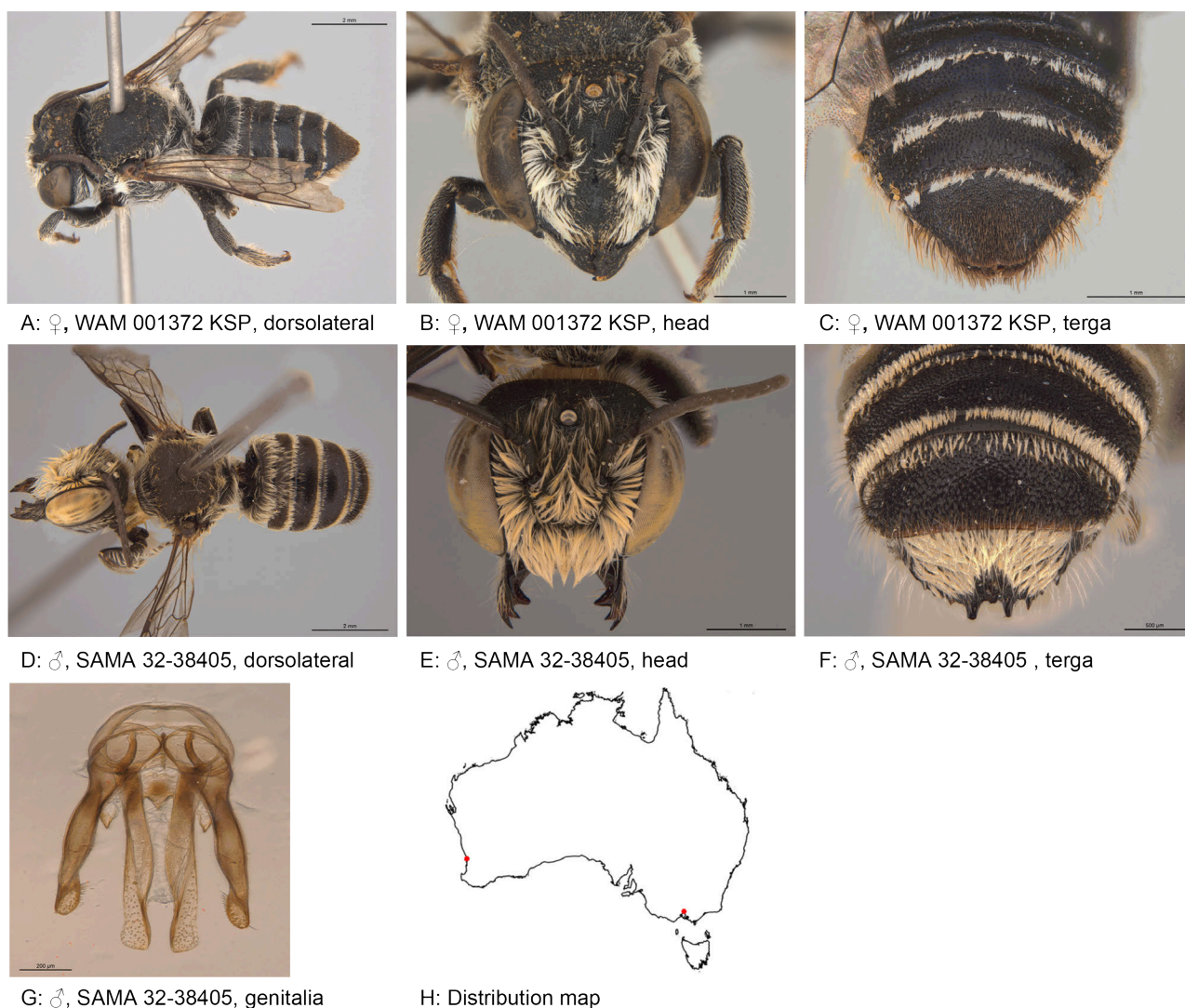


Figure 24A-H. *Megachile (Eutricharaea) pusilla* Pérez 1884

Examined specimens. ♂, SAMA (32-38405), VIC, Brunswick, (37.7742°S: 144.965°E), 18/11/2018, J. B. Dorey, on *Brachyscome*. ♀, WAM (KPS001372), WA, 96 Wheatley Street, Gosnells (32.0755°S: 116.0050°E), 14/2/ 2017, K.S. Prendergast. **Other specimens.** 1 male.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus: not modified, Ta1 without groove or shiny patch ventrally; T2 lateral fovea absent. Female: scopa straw-coloured; clypeus medially with impunctate line; posterior hairbands on sterna complete; mesepisternum without black hairs; hair patches on notauli absent; vertex narrow and coarsely punctate, frons pit-reticulate.

Description.

Male. *Redescription*, SAMA (32-38405): L 9 mm; W 5.2 mm. RHM: HW 100; OOD 12; OOC 17; OCL 41; CL 28; CW 41.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long

as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 multi-dentate; genitalia as in Fig. 24G.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga white; sterna with a small patch of dense tomentum only on S4 medially, hair bands on posterior margins with closely placed hairs; tomentum on T6 white. or straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, WAM (KPS001372): L 8.6 mm; W 5.8 mm. RHM: HW 100; OOD 9; OOC 13; OCL 42; CL 26; CW 46.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum lacking hair patches on notauli; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 brown; scopa white.

Colouration. Integument black; mandibles predominantly dark brown or black.

Note: The three specimens studied here were all DNA-barcoded and appeared to be closely matching (sequence identity 99.85–100%) specimens identified as *Megachile pusilla* Pérez, 1884. There are DNA-barcode records of this species from France, Corsica, Spain, Portugal, Hawaii, and Japan. The original distribution of this species is Western Mediterranean (Mitchell 1962; Ascher and Pickering 2014) and it has been introduced to other localities in the world (<https://www.discoverlife.org/mp/20m?kind=Megachile+concinna>). These are the first records of its occurrence in Australia.

Association of sexes. The sexes were associated using DNA barcode data.

Flower visitation. *Brachyscome*.

Distribution. Fig 24H.

Phenology. February (2 records), November (1 record).

***Megachile (Aethomegachile) rhodogastra* Cockerell 1910**

Figs 25A–I

Megachile rhodogastra Cockerell 1910b, p.283 (♂), 1922, p.267 (♀)

Megachile (Eutricharaea) rhodogastra Cockerell, Michener 1965, p.209

Megachile ignescens Cockerell 1929, p.6. *syn.nov.*

Megachile (Eutricharaea) ignescens Cockerell, Michener 1965, p.209

Notes on synonymy. The type of *M. ignescens*, female, matched females of *M. rhodogastra* in series of specimens where both sexes were reared out from nests (Cockerell, 1930b).

Examined specimens. Types: Holotype ♂ *M. rhodogastra*: BMNH HYM 17a 2398, Mackay, Queensland, G. Turner, 1892–16. Condition good, except right front leg broken glued to type label. Holotype ♀ *M. ignescens*: AMNH ac 24727, NT, Darwin, Melville Isl. G.F. Hill. Condition good, Ta4, Ta5 missing

from right hind tarsus. **Other specimens.** 25 males, 36 females, and 75 specimens sex not recorded.

Diagnosis. Male: T6 integument orange or red; T3–T4 posterior hair bands present laterally, weak medially. Female. Scopa orange; frons with long black hairs; no posterior hairbands on sternites.

Description.

Male. *Redescription*, WAM (11648): L 11 mm; W 6.5 mm. RHM: HW 100; OOD 13; OOC 14; OCL 44; CL 21; CW 56.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate; hidden sterna as in Fig. 24G; genitalia as in Fig. 24G–H.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or gold, and black hairs; posterior hair bands on T3–T4 present laterally, weak medially; general colour of hair bands on terga straw-coloured laterally, white medially; sterna without patches of dense tomentum; hair bands on posterior margins with closely placed hairs; tomentum on T6 orange-gold.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna brownish red; integument of T6 orange or red.

Female. *Redescription*, QM (T262711): L 11 mm; W 8 mm. RHM: HW 100; OOD 13; OOC 12; OCL 39; CL 23; CW 44.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured hairs mixed with long black hairs; scutum lacking hair patches on notauli, mesepisternum below wing with patch of black hairs; metepisternum below spiracle almost without hairs; axilla with mixed black and white hairs; posterior hair bands on sterna absent; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 black; scopa orange.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on specimens reared from the same nest. Cockerell (1930b) reported that H. Hacker reared both sexes from a nest,

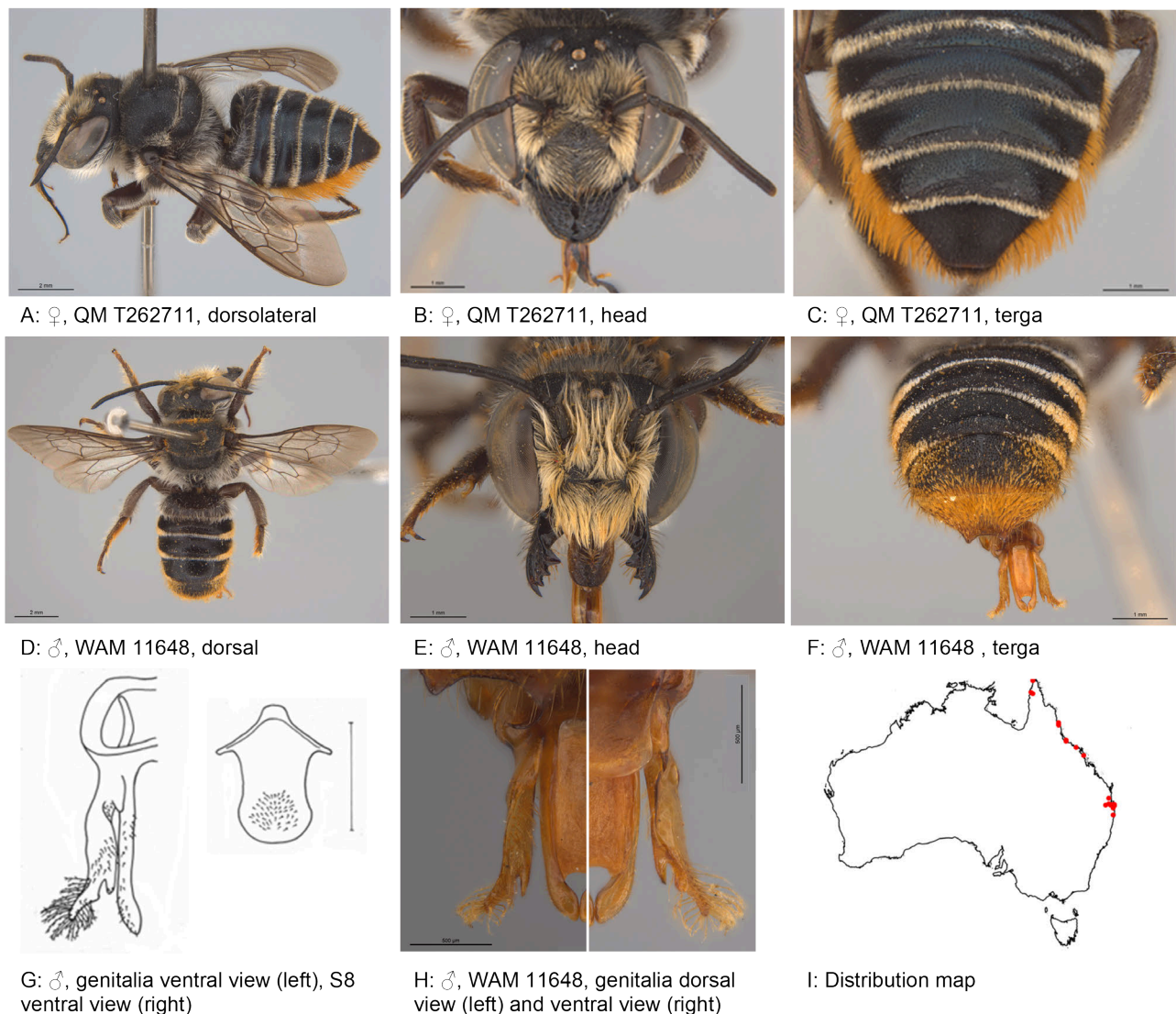


Figure 25A-I. ***Megachile (Aethomegachile) rhodogastra*** Cockerell 1910

and Cockerell (1922) subsequently described the female.

Related species. Based on close similarities in genitalia morphology with South East Asian species such as *M. (Aethomegachile) conjuncta* Smith and *M. (Aethomegachile) laticeps* (Ascher et al. 2016, Fig. 9AB) *M. rhodogastra* Cockerell is placed in *M. (Aethomegachile)*.

Flower visitation. Not recorded.

Distribution. Fig. 24I. This species is one of the most common leafcutters in southeast Queensland.

Biology. JK has reared specimens from nests in her garden, the females had used pieces of Honeysuckle leaves (*Lonicera* sp.) for nest construction.

Phenology. January (10 records), February (3 records), March (30 records), April (2 records), October (1 records), November (23 records), December (5 records).

***Megachile (Eutricharaea) rotundata* (Fabricius 1787)**

Figs 26A–J

BOLD:AAA3797

Apis rotundata Fabricius 1787, p.303

Megachile (Eutricharaea) rotundata (Fabricius 1787)

Examined specimens. ♂, SAMA (32-46081), Eden Hills (35.0221°S: 138.5975°E), SA, 30/11/2024, R. Leijs, near nest. ♀, SAMA (32-46079), same locality data as male.

Diagnosis. This species is unique, compared to other Australian species of *M. (Eutricharaea)* species in that both sexes have ovate fovea on T2 laterally (Fig. 26H).

Description.

Male. **Redescription.** SAMA (32-46081): L 9 mm; W 5.2 mm. RHM: HW 100; OOD 16; OOC 17; OCL 42; CL 26; CW 46.

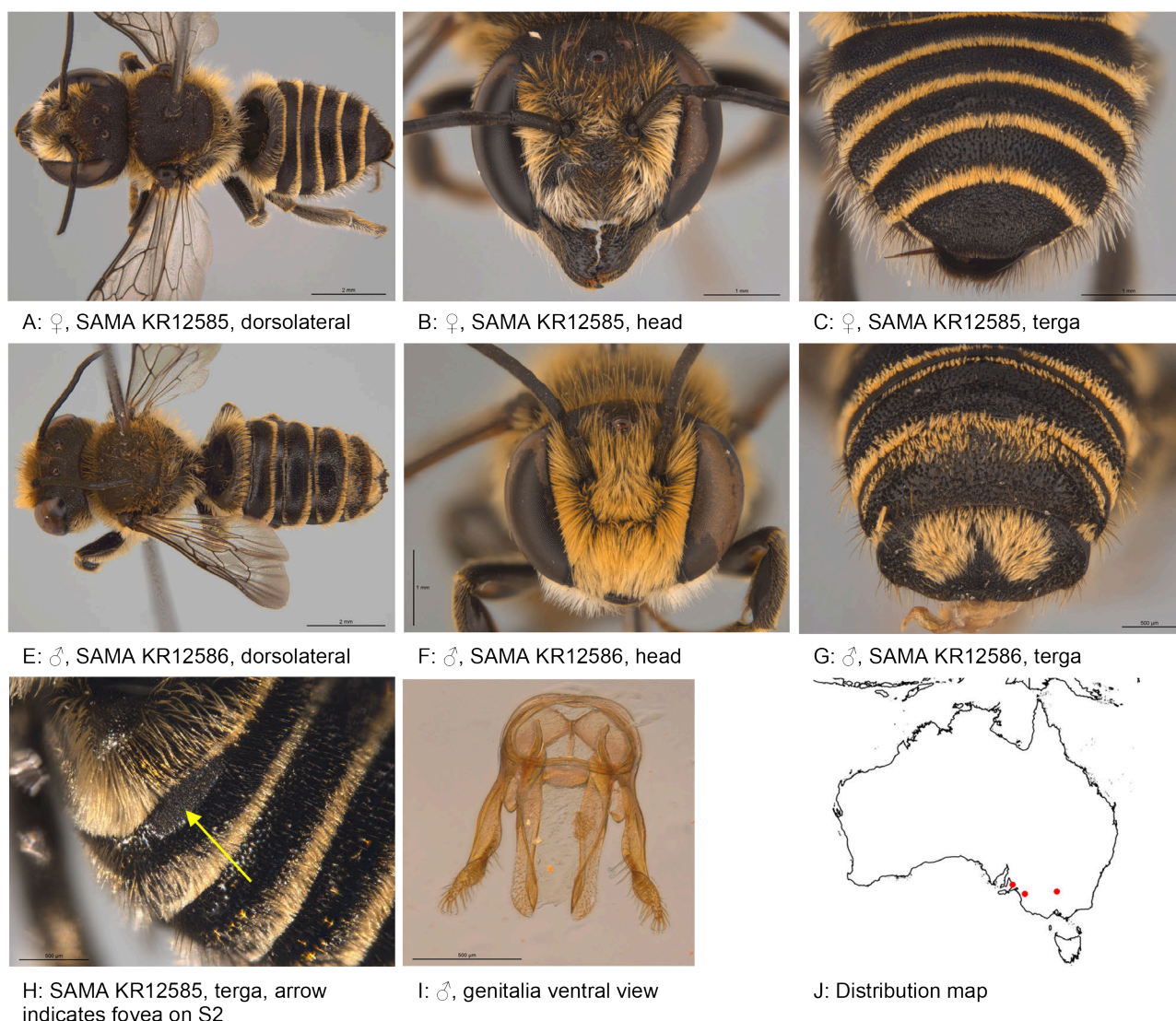


Figure 26A-J. *Megachile (Eutricharaea) rotundata* (Fabricius 1787)

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 multi-dentate; lateral ovate fovea on T2 present (Fig. 26H); genitalia as in Fig. 25I.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present laterally, weak medially; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on pos-

terior margins with closely placed hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. Redescription, SAMA (32-46079): L 9.2 mm; W 6.1 mm. RHM: HW 100; OOD 15; OOC 15; OCL 43; CL 23; CW 44.

Structure. Ventral margin of mandible less than 1.5x medial length of clypeus; clypeus closely and evenly punctured; lateral ovate fovea on T2 present.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with straw-coloured or yellowish hairs; scutum lacking hair patches on notauli, mesepisternum below wing without black hairs; metepisternum below spiracle with short black or brown hairs; or almost without hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire

width; general colour of tergal hair bands off-white or straw-coloured; tomentum on disc of T6 black; scopa white.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated using DNA barcoding and rearing.

Flower visitation. *Medicago sativa* (lucerne)

Distribution. Fig. 25J. The original distribution of this species is middle Europe. The species has been introduced in Australia in 1987 from Canada for the pollination of lucerne. Unsuitability of the climate and high mortality due to parasitism and quarantine requirements resulted in discontinuation of the breeding program (Anderson 2006).

Phenology. In Adelaide, the species has two generations between December and April (Leijs and Hogendoorn, pers. obs.).

***Megachile* (unplaced) *sequior* Cockerell 1910 comb. nov.**

BOLD:AEC6066

Figs 27A–I

Megachile sequior Cockerell 1910a, p.108

Megachile (*Eutricharaea*) *sequior* Cockerell, Michener 1965, p.209 comb. nov.

Examined specimens. Holotype, ♂ *M. sequior*, HU 20640, Adelaide, Schomburgk. S. Strand det. Condition good, left antenna broken. **Other specimens.** 8 males, 29 females, and 4 specimens for which the sex was not recorded.

Diagnosis. Male: mandible with three teeth, and ventral margin without basal projection; black pubescence on scutum, if present, not dense; fore tarsus not modified; T6 covered in light brown tomentum. Female: scopa straw-coloured; clypeus medially with impunctate line; mesepisternum without black hairs; hair patches on notauli present; posterior hairbands on sterna complete.

Description.

Male. **Redescription**, QM (T262692): L 9.5mm, W 7mm. RHM: HW 100; OOD 15; OOC 15; OCL 37; CL 17; CW 44.

Structure. Ventral margin of mandible without projection, not expanded; mandibles tridentate, deeply emarginate between Te2 and Te3, Te2 small, Te3 large, recurved; hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; S4 with

apical margin hyaline, projecting medially; carina on T6 bilobed; punctation entirely fine and dense; genitalia as in Fig. 27H.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga, orange to straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with dense hairs, or with closely placed hairs; S1–S3 with dense, apical fringe; S4 with fringe laterally, continuing medially at base of hyaline area; tomentum on T6 orange to straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brownish yellow; integument of sterna black or brownish black; integument of T6 black or brown.

Female. **Redescription**, QM (T262693): L 11mm; W 8.5mm. RHM: HW 100; OOD 16; OOC 14; OCL 32; CL 16; CW 50.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; mandible large with 4 teeth, Te1 largest; complete cutting edge in upper interspace, incomplete cutting edge in middle interspace; clypeus with impunctate medio-longitudinal line, apical margin shallowly emarginate medially. Punctation entirely fine and dense, except frons smooth and shining medially above fronto clypeal suture.

Pubescence. Clypeus with sparse pale gold hair, more dense at apico-lateral angles; dense, pale gold on face, sparse, short, gold on vertex; anterolateral corners of pronotum with fringe of white tomentum; scutum with hair patches on notauli present, in worn specimens only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; mesosoma laterally with long white hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands orange to straw-coloured; tomentum on disc of T6 a broad white or straw coloured band across width at anterior half of tergum; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black; tibial spurs dark brown.

Association of sexes. Sexes were associated using collecting data.

Flower visitation. *Cleome*, *Corymbia foelscheana*, *Eucalyptus argillacea*.

Distribution. Fig. 27I.

Phenology. January (9 records), February (4 records), March (15 records), April (6 records), May (1 records),

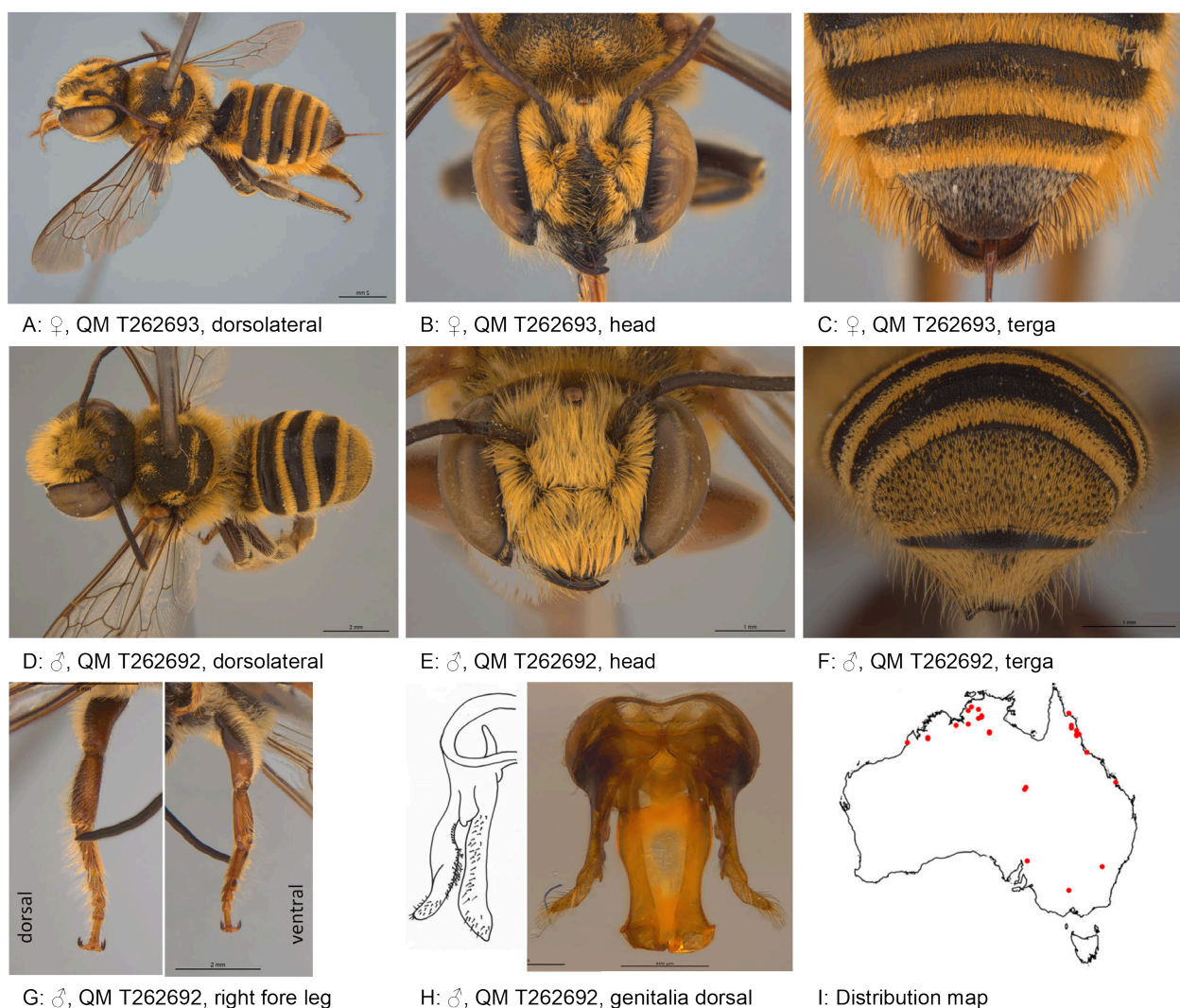


Figure 27A-I. ***Megachile (unplaced) sequior*** Cockerell 1910

June (3 records), November (3 records), December (8 records).

Comments. Cockerell (1930b) briefly described the female, and noted that the type location is labelled 'Adelaide', but that he believed the specimen was collected by Turner at Port Darwin. This would agree with the distribution data.

Megachile (Eutricharaea s. l.) serricauda **Cockerell 1910**

BOLD:ABW2483

Figs 28A-J

Megachile serricauda Cockerell 1910c, p.361

Megachile (Eutricharaea) serricauda Cockerell, Michener 1965, p.209

Megachile cetera Cockerell 1912, p.220. *syn. nov.*

Megachile subserricauda Rayment 1939, p.287. *syn. nov.*

Notes on synonymy. The holotype of *M. subserricauda*, male, is not different from the holotype of *M. serricauda*, male,

especially with respect to the of dense yellowish patches of tomentum on S3 and S4 medially. The holotype of *M. cetera*, female, does not differ from females collected with males of *M. serricauda*, specifically with the absence of hair patch on the notaulus.

Examined specimens. Holotype ♂ *M. serricauda* BMNH HYM 17a 2322, QLD, Mackay, 1910, Turner coll. Condition excellent. Holotype ♀ *M. cetera*, ANIC 53, VIC, Nagambe. Condition: two apical segments of right hind tarsus missing, rather dirty, no wear on wings or mandibles. Holotype ♂ *M. subserricauda*, ANIC 28e, NSW, Sydney, 6/1/1933. Condition: fair, right anterior tarsus and tibia, left hind tarsus and tibia missing. **Other specimens.** 29 males, 82 females, and 89 specimens sex not recorded.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus: not modified, Ta1 anterior margin extended, forming groove or shiny patch ventrally; T6 tomentum straw-coloured; fore tarsus Ta1-Ta3 brownish yellow. Female: scopa straw-coloured with black hairs laterally; clypeus medially with impunctate line; mesepisternum with black hairs; no hair patches on notauli.

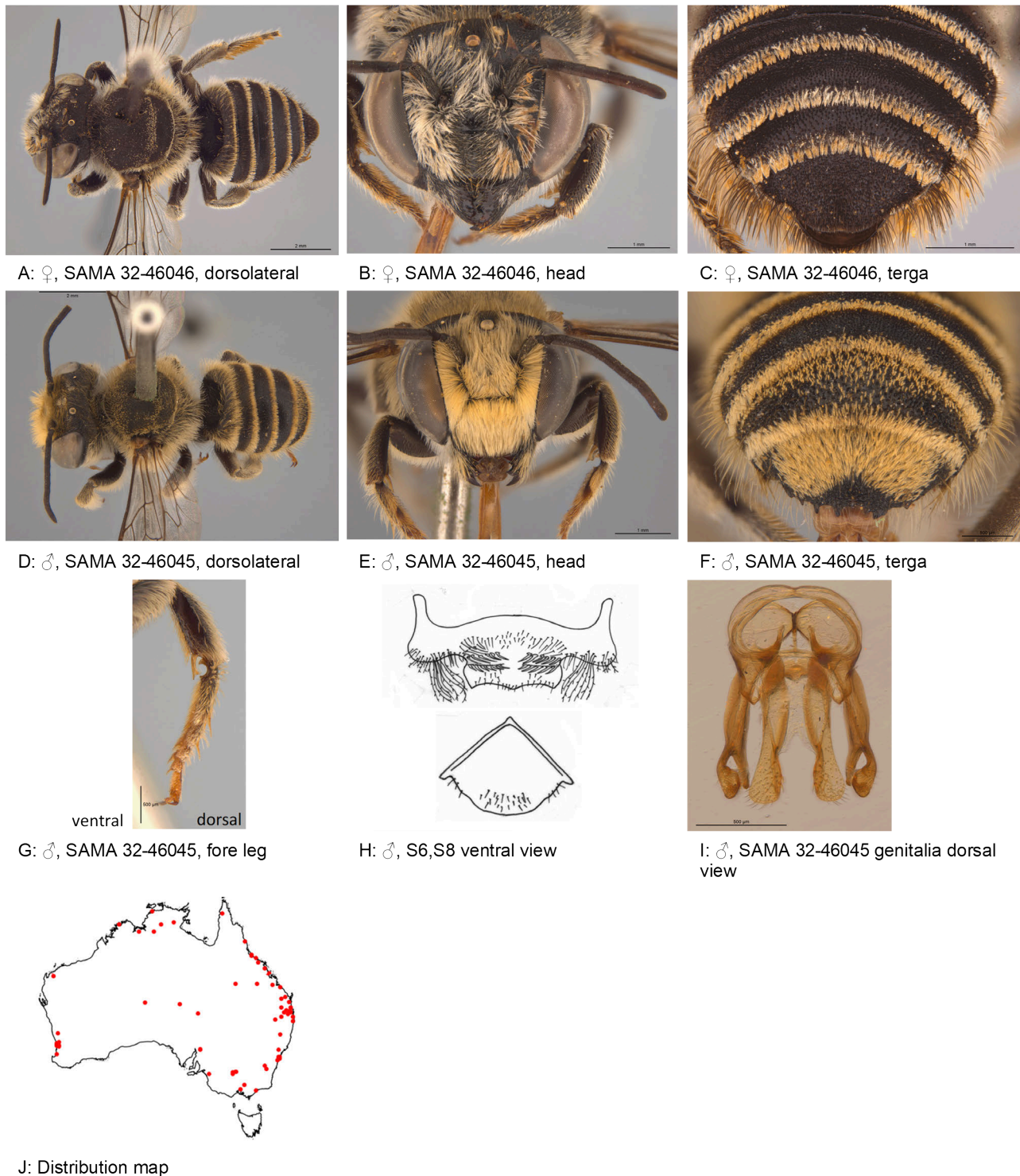


Figure 28A-J. *Megachile (Eutricharaea s. l.) serricauda* Cockerell 1910

Description.

Male. *Redescription*, SAMA (32-46045): L 7.5 mm; W 5.5 mm. RHM: HW 100; OOD 16; OOC 14; OCL 39; CL 23; CW 43.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of

fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 multi-dentate; hidden sterna Fig. 28H; genitalia as in Fig. 28I.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of

long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna with a small patch of dense yellowish tomentum on S3 and S4 medially, hair bands on posterior margins with closely placed hairs; tomentum on T6 straw-coloured.

Colouration. Ta1–Ta3 of fore tarsus brownish yellow; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, SAMA (32-46046): L 9.6 mm; W 6.6 mm. RHM: HW 100; OOD 15; OOC 15; OCL 42; CL 15; CW 48.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; or straw-coloured or yellowish hairs; scutum hair patches on notauli absent, mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands off-white or white; tomentum on disc of T6 brown; scopa white or light straw-coloured.

Colouration. Integument black. Mandibles predominantly dark brown or black.

Note on gynandromorphism. One specimen that was bar-coded appeared to be a gynandromorph where male and female characters were distributed over the body in an almost mosaic-like pattern. Female characters included the number of antennal segments, the mandibles, the number of metasomal segments, and the shape of T6. Male characters were the length of the antennal segments, the shape of the face and pubescence, the front legs and front coxa. The specimen did not have a scopa nor any male like pubescence on the sterna. Gynandromorphs regularly occur in megachilids (Sommaggio et al., 2021) and have tricked earlier researchers (see under *M. (E.) simplex*). The distribution of the male/female characters often appear in recurrent patterns, mostly with male characters in the front half of the body, with exception of the mandibles which were female in 6 out of 10 recognised patterns.

Association of sexes. The sexes were associated based on collecting data.

Related species. Based on similarities in morphology of male genitalia *M. serricauda* is probably in the same *M. (Eutricharaea)* clade as *M. obtusa* and *M. dissita*.

Flower visitation. *Bursaria*, *Corymbia foelscheana*, *Crotalaria*, *C. dissitiflora* subsp. *dissitiflora*, *Helianthus annuus*, *Jacksonia furcellata*, *J. scoparia*, *Lucerne*, *Melaleuca*, *M.*

linariifolia, *Psoralea*, *Salvia*, *Sida subspicata*, *Swainsona*, *Trichodesma*, *Wedelia*.

Distribution. Fig. 28J.

Phenology. January (24 records), February (18 records), March (34 records), April (8 records), May (13 records), June (3 records), July (1 record), August (2 records), September (15 records), October (10 records), November (20 records), December (12 records).

***Megachile (Anodonteutricharaea) simplex* Smith1953 comb. nov.**

BOLD:AAH6677

Figs 29A–L

Megachile simplex Smith 1853 p.169

Megachile (Eutricharaea) simplex Smith, Michener 1965 p.209 comb. nov.

Megachile quinquelineata Cockerell 1906 p.534. syn. nov.

Megachile (Eutricharaea) quinquelineata Cockerell, Michener 1965, p.209 comb. nov.

Megachile ciliatipes Cockerell 1921, p.89. syn. nov.

Megachile (Eutricharaea) ciliatipes Cockerell, Michener 1965, p.209. comb. nov.

Megachile detersa Cockerell 1910b. p.283. syn. nov.

Megachile (Androgynella) detersa Cockerell 1911, p.313 comb. nov.

Megachile (Eutricharaea) detersa Cockerell, Michener 1965, p.209. syn. nov.; comb. nov.

Notes on synonymy. The holotype ♀ of *M. quinquelineata* perfectly matches the holotype ♀ of *M. simplex*. The holotype ♂ of *M. ciliatipes* matches exactly males of *M. simplex*. The holotype of *M. detersa* was originally described as a female, but in fact is a gynandromorph with female characters on the mesosoma, but lacking a scopa, and antenna and all legs bearing male characters. The small and short hind basitarsus of the specimen is also a characteristic for males of *M. simplex*. Related species such as *M. obtusa* and *M. serricauda* have hind leg basitarsi which are much longer.

Examined specimens. Holotype, ♀, *M. simplex*: BMNH HYM 17a 2386. Cockerell (1930b) recorded the type in the BMNH as from 'New Holland'. This may be the illegible label attached to the type. Condition is poor, both antennae broken; missing are apical and subapical tarsomeres from right fore and hind legs, four tarsomeres from left hind tarsus, two tarsomeres from left mid tarsus; metasoma broken off and glued back into place. Holotype, ♀, *M. quinquelineata*: BMNH HYM 17a 2360, Mackay. Holotype, ♂, *M. ciliatipes*: BMNH HYM 17a 2380, Brisbane, 9/4/1918, H. Hacker. Condition: head and prothorax broken off, in gelatine capsule with specimen. Holotype, ♂, *M. detersa*: BMNH HYM 17a 2474, QLD, Mackay. **Other specimens.** 24 males, 50 females, and 45 specimens sex not recorded.

Diagnosis. Male: mandible with four teeth, and ventral margin without basal projection; black pubescence on scutum, if present, not dense. Fore tarsus modified.

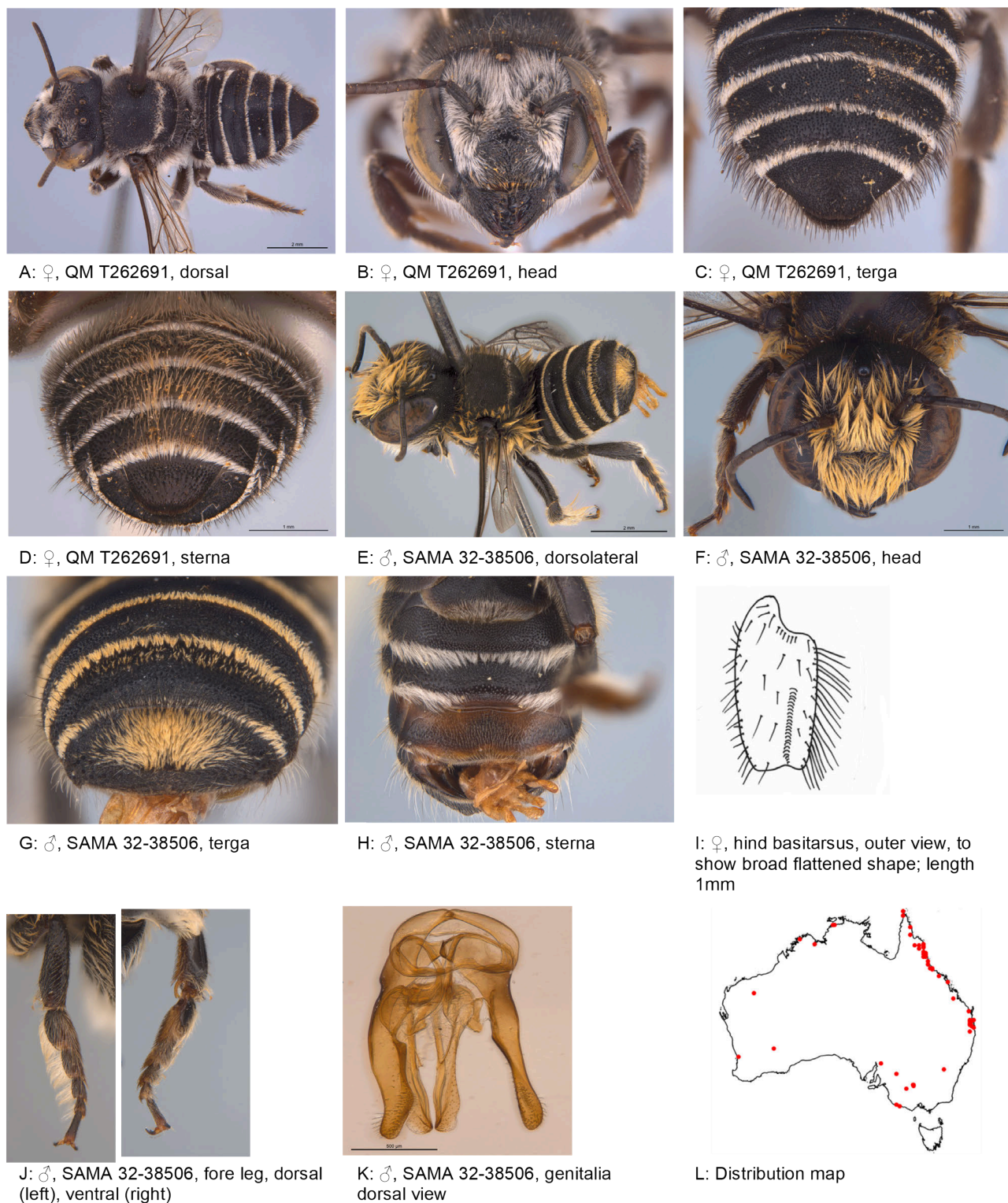


Figure 29A-L. *Megachile (Anodonteutricharaea) simplex* Smith1953

Female: scopa white or straw-coloured, black laterally; clypeus evenly punctate; no hair patches on notauli; posterior hairbands on sterna complete.

Description.

Male. *Redescription*, SAMA (32-38506): L 8.5 mm; W 6 mm. RHM: HW 100; OOD 17; OOC 17; OCL 35; CL 21; CW 42.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus little modified, Ta1 less than 2x as long as wide, a smooth dark spot on ventral surface of Ta1; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus extended posteriorly with shiny black patch ventrally, not overlapping base of Ta2; inner hind tibial spur about

as thick and less than 1.5x as long as outer spur; carina on T6 almost smooth; or bilobed; genitalia as in Fig. 29K.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with fringe of long hairs on posterior margin, hairs as long or longer than mid basitarsus; mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with dense hairs; tomentum on T6 straw-coloured.

Colouration. Fore basitarsus with shiny dark spot baso-ventrally (Fig. 29J), Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, QM (T262691): L 9 mm; W 7 mm. RHM: HW 100; OOD 16; OOC 16; OCL 16; CL 22; CW 48.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Face with mainly pale hairs and a few long black hairs, anterolateral corners of pronotum with tuft of hairs; frons with white hairs; scutum lacking hair patches on notauli; mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete (Fig. 29D); few long black bristles laterally on S3–S5; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands, white; tomentum on disc of T6 black; scopa white or straw-coloured, black laterally.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collection data.

Subgeneric placement. Based on molecular evidence (Fig. 1), *M. simplex* is placed in *M. (Anodonteutricharaea)*.

Flower visitation. *Grevillea*, *Stenocarpus sinuatus*, *Sida platycalyx*, *Crotalaria*, daisy, *Persoonia*.

Distribution. Fig. 29L.

Phenology. January (14 records), February (13 records), March (8 records), April (13 records), May (11 records), June (2 records), July (1 record), August (8 records), September (2 records), October (5 records), November (7 records), December (2 records).

***Megachile (Notochile) storeyi* King & Leijs sp. nov.**

BOLD:ACD1486

Figs 30A–K

Examined specimens. Holotype ♂, QM (T262683), 30 km S. Alice Springs, N.T., 3/11/1974, E.M. Exley & R.I. Storey, on *Scaveola parvifolia* in QM. Allotype ♀, SAMA (32-51194), DNA barcode voucher AUSBS104-12, Witchelina Stn (30.4230°S: 138.0770°E), SA, 21/10/2010, R.Leijs *Other specimens*. 5 males and 10 females.

Diagnosis. Male: ventral margin of mandible with basal projection; fore tarsus Ta2 with large bulbous swelling extending beyond middle of Ta3; mandible with 3 teeth; tomentum T6 absent. Female: scopa white or straw-coloured; clypeus medially with impunctate line; mesepisternum without black hairs; hair patches on notauli present; posterior hairbands on sterna incomplete; pubescence on frons white; tomentum T6 absent.

Description.

Male. Holotype, QM (T262683): L 10.5 mm W 8 mm. RHM: HW 100; OOD 15; OOC 15; OCL 33; CL 17; CW 48.

Structure. Ventral margin of mandible with basal projection; mandible with 3 teeth; hypostomal area with rounded excavation and large tooth below mandibular articulation; fore tarsus modified, Ta1 less than 2x as long as wide, one or more tarsomeres flattened or expanded, with brown spot on ventral surface of Ta2 and smooth area on ventral surface of Ta5; Ta2 of fore tarsus with large bulbous swelling anteriorly and apically, overlapping base of Ta3, but extending beyond middle of Ta3; Ta1 of fore tarsus with anterior margin extended forming a longitudinal groove or flat area bordered with row of hairs or setae, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bidentate with small median dent; Punctuation of head and mesosoma medium dense, metasoma fine and dense; modified sterna as in Fig. 30H; genitalia as in Figs 30I–J.

Pubescence. Face and genae dense and white-gold; vertex pale gold; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; outer surface of Ta1 of mid tarsus with white or white-gold hairs; mesosoma entirely white; fore tarsus with posterior marginal fringe of long white hairs; mid tarsus with dense white hairs on outer surface, hind basitarsus with dark brown hairs on inner surface. Mesepisternum below wing with white or whitish hairs only; posterior hair bands on T3–T4 present on entire width; general colour of hair bands on terga, white; sterna without patches of dense tomentum; hair bands on posterior margins with openly placed hairs; tomentum on T6 lacking, only a few sparse erect hairs. S2, S3 with short white apical hair bands, remainder with short sparse white hairs.

Colouration. Antennae with scape and pedicel black, flagellum gold-brown; foreleg femur, tibia, and tarsus gold-brown; Ta2 with pale brown spot on inner surface; integument of sterna black or brownish black; integument of T6 black or brown.

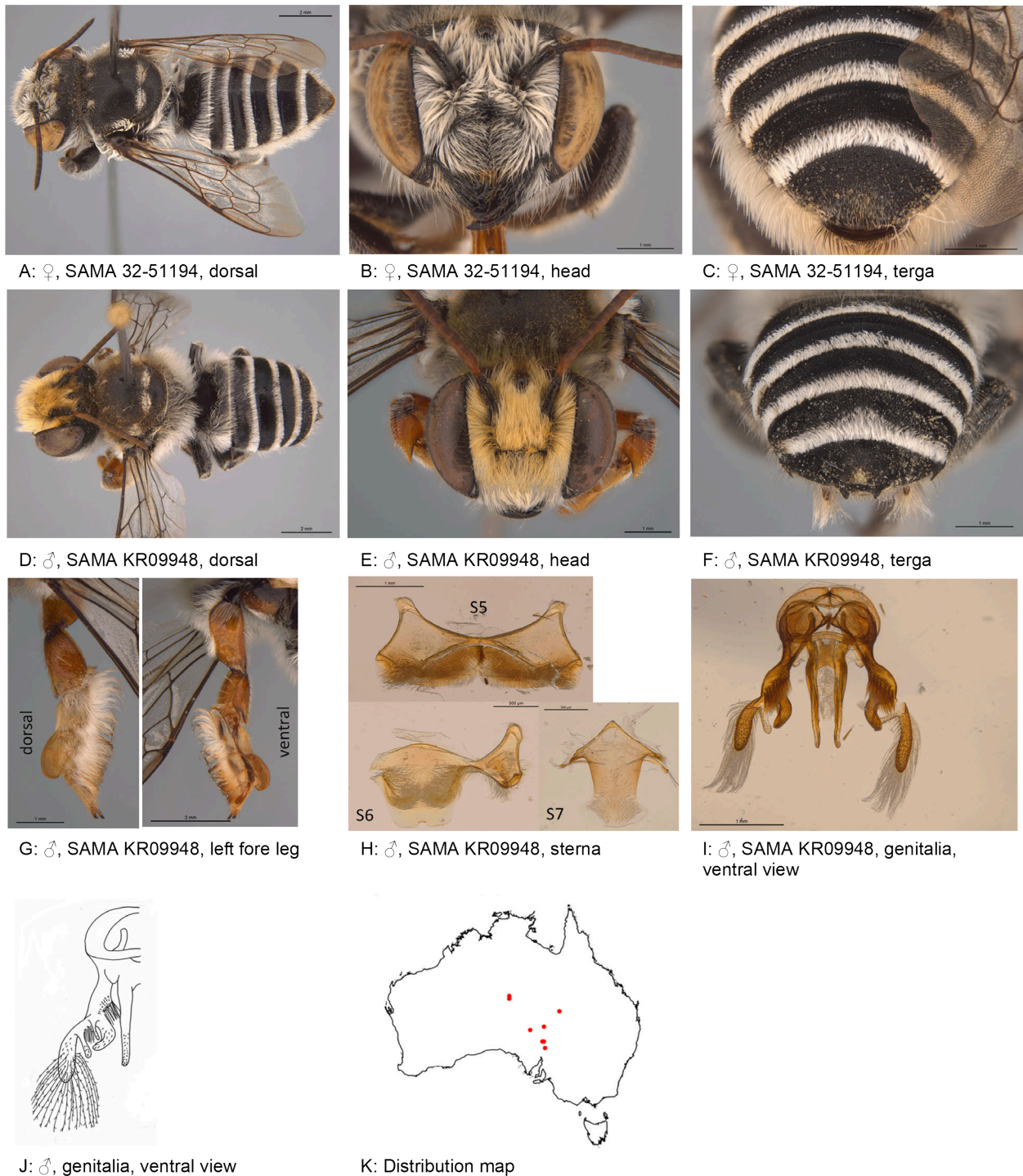


Figure 30A-K. ***Megachile (Notochile) storeyi*** King & Leijs *sp. nov.*

Female. Allotype, SAMA (32-51194): L 12 mm; W 7.6 mm. RHM: HW 100; OOD 11; OOC 14; OCL 36; CL 21; CW 44.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum with hair patches on notauli present, in some species only a few white hairs; mesepisternum below wing without

black hairs; metepisternum below spiracle with medium length white or gold erect hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 absent, only with sparse erect hairs; scopa white.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. The sexes were associated using DNA barcode and locality data.

Flower visitation. *Crotalaria*, *Crotalaria eremaea*, *Scaevola parvifolia*.

Distribution. Fig. 30K.

Phenology. March (8 records), September (1 record), October (5 records), November (1 record), December (1 record).

Etymology. The species is named after the collector of the holotype, Mr. Ross Storey who collected extensively with Dr E.M. Exley.

Comments. The structure of the male foreleg, the lack of a posterior fringe on the mid tarsus and the modified sterna and genitalia indicate that this species belongs to the *chrysopyga* group. It differs from others in that group in the lack of tomentum on T6.

***Megachile* (unplaced) *tenuicincta* Cockerell 1929 comb. nov.**

Figs 31A–K

Megachile tenuicincta Cockerell 1929, p.7

Megachile (*Eutricharaea*) *tenuicincta* Cockerell, Michener 1965, p.209 comb. nov.

Examined specimens. Holotype ♀ *M. tenuicincta*: AMNH, NT, 30 mi E. Darwin, G.F. Hill. Condition perfect. Paratype ♂ *M. tenuicincta*: same label data as holotype. Condition fair, both antennae broken. **Other specimens.** 2 males, 5 females, and 2 specimens sex not recorded.

Diagnosis. Male: ventral margin of mandible without basal projection; T6 tomentum lacking; mid basitarsus with fringe of long hairs on ventral margin. Female: Frons with white and black hairs; scopa light straw-coloured, not black laterally; clypeus evenly punctured.

Description.

Male. *Redescription*, QM (T262704): L 8 mm; W 6 mm. RHM: HW 100; OOD 18; OOC 16; OCL 40; CL 20; CW 49.

Structure. Ventral margin of mandible without projection, not expanded; mandible with 4 teeth, hypostomal area not modified; fore tarsus not modified, Ta1 at least 2x as long as wide, tarsomeres not flattened or expanded, without smooth areas or dark spots on ventral surface; Ta2 of fore tarsus without large bulbous swelling, not overlapping base of Ta3; Ta1 of fore tarsus without groove or shiny patch ventrally, not overlapping base of Ta2; inner hind tibial spur about as thick and less than 1.5x as long as outer spur; carina on T6 bilobed; modified sterna as in Figs 31G–H; genitalia as in Figs 31I–J.

Pubescence. Outer surface of Ta1 of mid tarsus with white or white-gold hairs; mid basitarsus with hairs on posterior margin much shorter than basitarsus length; mesepisternum below wing with white or gold, and black hairs; posterior hair bands on T3–T4 present lat-

erally, weak medially; general colour of hair bands on terga off-white or straw-coloured; sterna without patches of dense tomentum; hair bands on posterior margins with closely placed hairs; tomentum on T6 lacking, only a few sparse erect hairs.

Colouration. Ta1–Ta3 of fore tarsus brown or black; integument of sterna black or brownish black; integument of T6 black or brown.

Female. *Redescription*, QM (T262703): L 9.5 mm; W 7 mm. RHM: HW 100; OOD 16; OOC 16; OCL 36; CL 18; CW 44.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus closely and evenly punctured.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white and black hairs; scutum lacking hair patches on notauli, mesepisternum below wing with patch of black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna complete; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 black; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Sexes were associated based on collecting data.

Related species. Based on similarities in genitalia morphology *M. tenuicincta* is related to *M. pictiventris*.

Flower visitation. Not recorded.

Distribution. Fig. 31K. Recorded only from northern areas of Queensland and the Northern Territory.

Phenology. January (1 record), April (2 records), May (1 record), June (3 records).

***Megachile* (*Notochile*) *variegata* Leijs sp. nov.**

BOLD:AEC4125

Figs 32A–D

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Examined specimens. Holotype, ♀, SAMA (32-37437), QLD, West Quinkan (15.813°S; 144.42°E), 8/03/2017, Wright, Burwell & Popple.

Diagnosis. Female: scopa light straw-coloured, orange laterally; clypeus medially with impunctate line; mesepisternum without black hairs; hair patches on notauli present; posterior hairbands on sterna incomplete; no white hairs on frons; tomentum T6 absent.

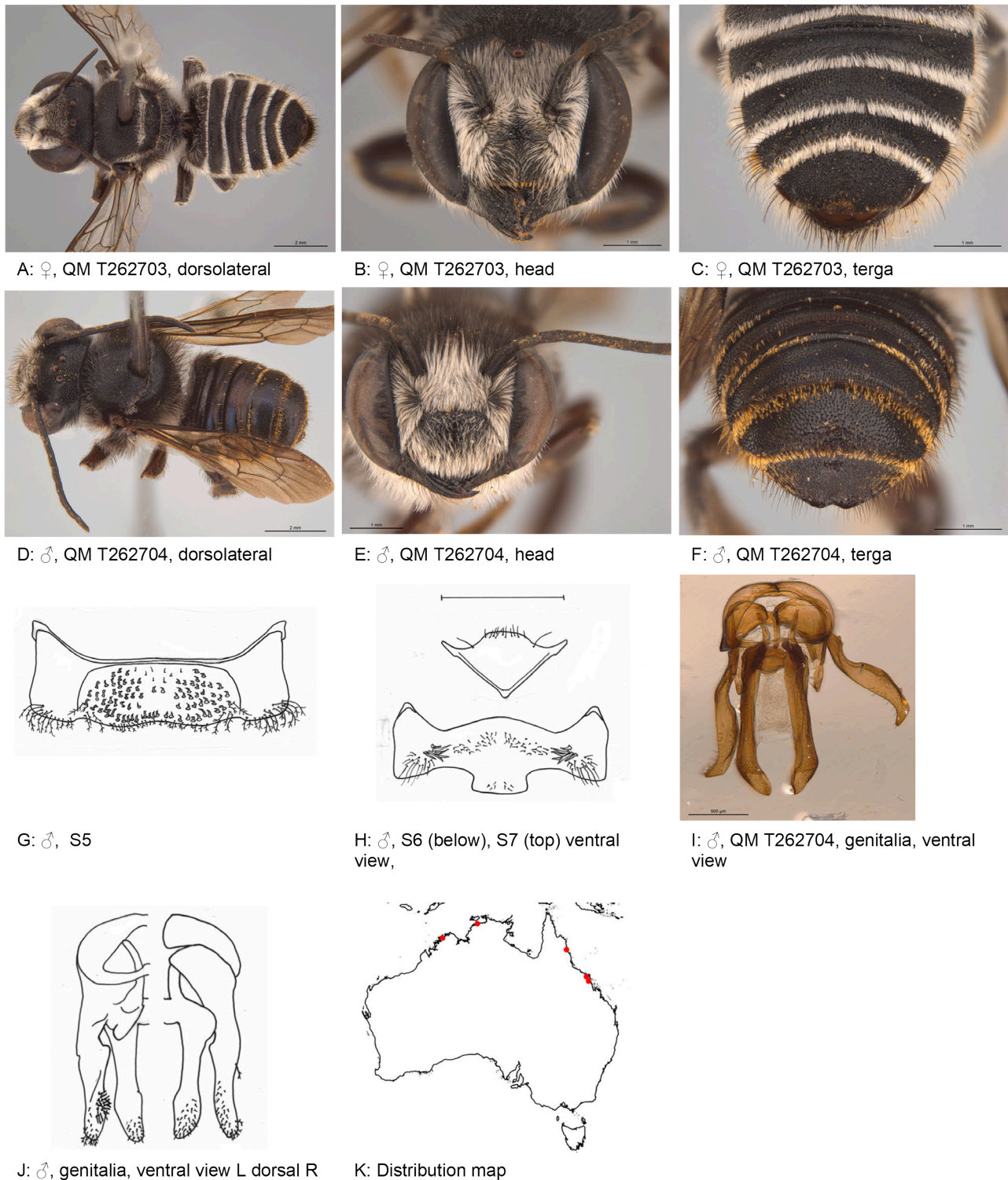


Figure 31A-K. *Megachile (unplaced) tenuicinta* Cockerell 1929

Description.

Female. Holotype, SAMA (32-37437): L 11.7 mm; W 8.8 mm. RHM: HW 100; OOD 12; OOC 15; OCL 37; CL 17; CW 40.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with tuft of hairs; frons with orange or golden hairs; scutum with hair patches on notauli present, in some species only a few white hairs; mesepisternum below wing without black hairs; metepisternum below spiracle with medium length white adjacent hairs; axilla with white or pale gold hairs; posterior hair bands on sterna only present laterally; posterior hair bands on T3-T4 present on entire width; general colour of tergal hair bands orange;

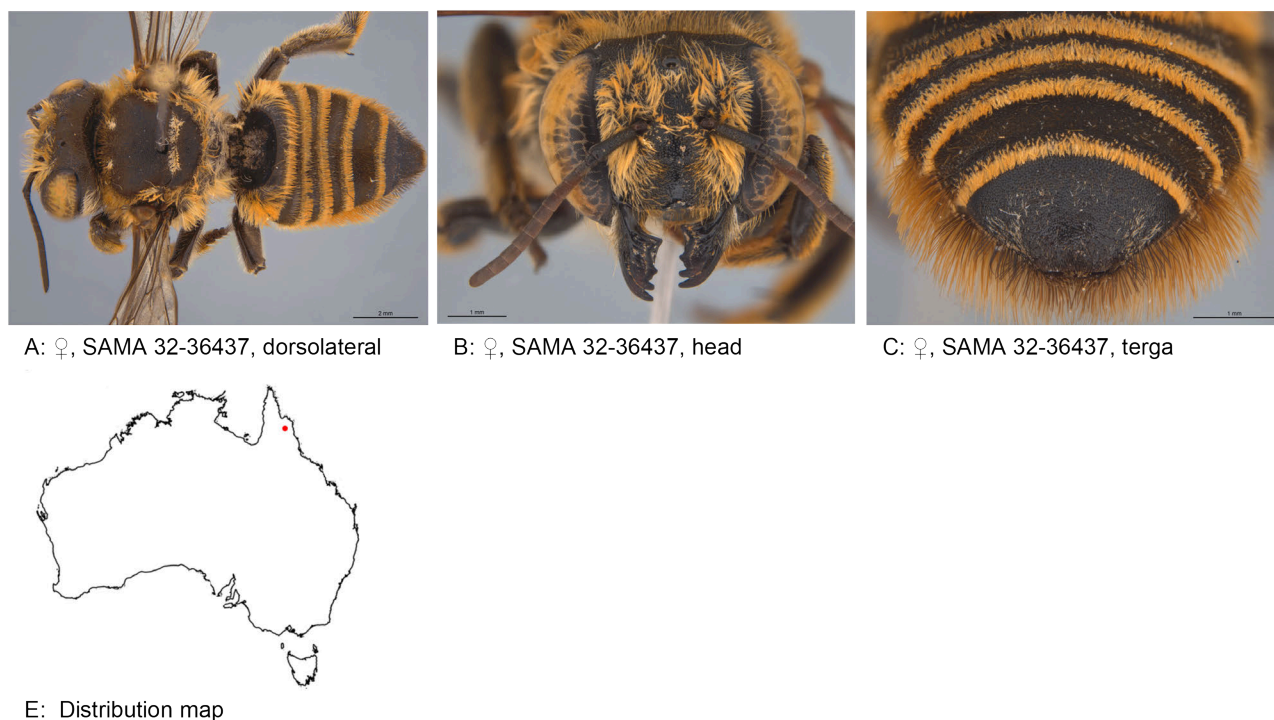


Figure 32A-D. *Megachile (Notochile) variegata* Leijs *sp. nov.*

tomentum on disc of T6 absent, only with sparse erect hairs; scopa light straw-coloured centrally, orange laterally.

Colouration. Integument black; mandibles predominantly dark brown or black.

Association of sexes. Male unknown.

Flower visitation. Not recorded

Distribution. Fig. 32D.

Phenology. March (1 record).

Etymology. The specific epithet 'variegata' refers to the multi-coloured scopa in the female of this species.

Megachile (unplaced) waterhousei Cockerell 1906 *comb. nov.*

Figs 33A–D

Megachile waterhousei Cockerell 1906, p.534

Megachile (Eutricharaea) waterhousei Cockerell, Michener 1965, p.209 *comb. nov.*

Examined specimens. Holotype ♀, *M. waterhousei*, BMNH HYM 17a 2394, QLD, Mackay 92/62. Condition reasonable, both antennae and left hind wing broken; left hind tarsus missing, apical segment embedded in metasomal sternum. **Other specimens.** 10 females.

Diagnosis. Female: scopa light straw-coloured; clypeus medially with impunctate line; mesepisternum without black hairs; hair patches on notauli present; posterior hairbands on sterna incomplete; pubescence on frons white; T6 with narrow white band of tomentum.

Description.

Female. *Redescription*, QM (T262702): L 12 mm; W 9.5 mm RHM: HW 100; OOD 13; OOC 14; OCL 35; CL 19; CW 55.

Structure. Ventral margin of mandible more than 1.5x medial length of clypeus; clypeus with impunctate medio-longitudinal line.

Pubescence. Anterolateral corners of pronotum with openly placed hairs; frons with white hairs; scutum with hair patches on notauli present; mesepisternum below wing without black hairs; metepisternum below spiracle with short black or brown hairs; axilla with white or pale gold hairs; propodeum with short, dark hairs ventral to spiracle, long, white hairs on propodeum medially; posterior hair bands on sterna only present laterally; posterior hair bands on T3–T4 present on entire width; general colour of tergal hair bands white; tomentum on disc of T6 a narrow white band across width at posterior half of tergum; scopa light straw-coloured.

Colouration. Mandibles predominantly dark brown or black.

Association of sexes. Male unknown.

Flower visitation. *Crotalaria*

Distribution. Fig. 33D.

Phenology. January (5 records), February (1 record), June (1 record), November (2 records).

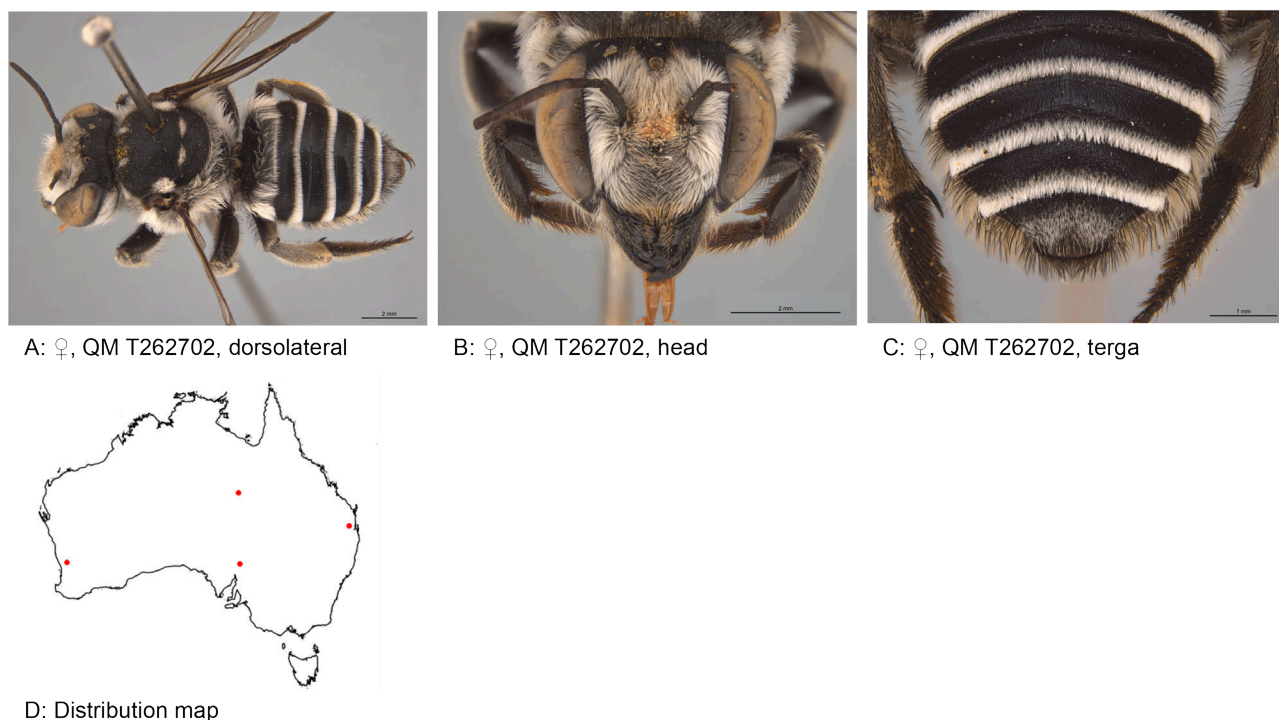


Figure 33A-D. ***Megachile (unplaced) waterhousei*** Cockerell 1906

***Megachile (unplaced) rufopilosa* Friese 1911**

Megachile rufopilosa Friese 1911, p.453

Megachile (Eutricharaea) rufopilosa Friese, Michener 1965, p.209

Comments. The whereabouts of the holotype, male, is uncertain (Cardale,1993). The type locality is Freemantle, WA. The original description is restricted to stating how two characters differ from *M. fimbriventris* Smith 1911, a species from Fiji and Tonga, which seems similar to *M. pictiventris*. The species is only known from the type locality. Because the type could not be located and no other specimens are known, no redescription can be provided.

***Megachile (unplaced) wyndhamensis* Rayment 1935 comb. nov.**

Megachile wyndhamensis Rayment 1935, p.714

Megachile (Eutricharaea) wyndhamensis Rayment, Michener 1965, p.209 comb. nov.

The whereabouts of the holotype, female, is uncertain. Cardale (1993) states ANIC, but it could not be located there. It was also not present at MV, where several of Rayment's specimens are stored. *Megachile wyndhamensis* is only known from the type locality Wyndham, WA. Because the type could not be located and no other specimens are known, no redescription can be provided.

***Megachile (unplaced) hampsoni* Cockerell 1906, comb. nov.**

Megachile hampsoni Cockerell 1906, p.533

Megachile (Eutricharaea) hampsoni Cockerell 1906, Michener 1965 p.209 comb. nov.

Comments. The type of *M. hampsoni*, female, is in the BMNH and is in good condition. The type locality is Freemantle, WA. Both the type specimen as viewed by high resolution images provided by the BMNH and its elaborate original description points to a non-leaf cutting species, probably *M. (Hackeriapis)* or *M. (Austrochile)*, particularly because of lacking cutting edges on the mandible, lacking sternal posterior hair bands, lacking hair spots on the scutum. The short vertex may point to a species of *M. (Austrochile)*, although it does not fit any of the known species. Because this species did not belong in the leafcutter s.l. taxon, its redescription does not belong in this revision and is therefore not included."

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