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Revision of *Goniocolletes* and seven Australian subgenera of *Leioproctus* (Hymenoptera: Apoidea: Colletidae), and description of new taxa

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Abstract

This paper provides a revision of *Goniocolletes* Cockerell, and of Australian subgenera of *Leioproctus* Smith (Hymenoptera: Colletidae: Paracolletini) with three submarginal cells. Seven subgenera were revised: *Leioproctus* s.str., *L. (Ceratocolletes)* Michener, *L. (Cladocerapis)* Cockerell, *L. (Excolletes)* Michener, *L. (Lamprocolletes)* Smith, *L. (Odonocolletes)* Maynard, and *L. (Protomorpha)* Rayment, and seven new subgenera are herein described: *L. (Alokocolletes)* subgen.n., *L. (Charicolletes)* subgen.n., *L. (Exleycolletes)* subgen.n., *L. (Fragocolletes)* subgen.n., *L. (Hadrocolletes)* subgen.n., *L. (Minycolletes)* subgen.n. and *L. (Zosterocolletes)* subgen.n. Seven new species of *Goniocolletes* (*Goinocolletes anthedonus* sp.n.; *Goniocolletes badius* sp.n.; *Goniocolletes ciliatus* sp.n.; *Goniocolletes comatus* sp.n.; *Goniocolletes dasypus* sp.n.; *Goniocolletes parvus* sp.n.; *Goniocolletes rugosus* sp.n.) and 13 new species of *Leioproctus* (*Leioproctus (Minycolletes) aquilus* sp.n.; *Leioproctus (Leioproctus) crinitus* sp.n.; *Leioproctus (Minycolletes) eruditus* sp.n.; *Leioproctus (Minycolletes) exiguus* sp.n.; *Leioproctus (Charicolletes) exleyae* sp.n.; *Leioproctus (Minycolletes) insitus* sp.n.; *Leioproctus (Leioproctus) litotes* sp.n.; *Leioproctus (Minycolletes) paulus* sp.n.; *Leioproctus (Minycolletes) pygmaeus* sp.n.; *Leioproctus (Leioproctus) quadrimaculatus* sp.n.; *Leioproctus (Fragocolletes) rutiliventris* sp.n.; *Leioproctus (Charicolletes) saltus* sp.n., and *Leioproctus (Alokocolletes) sequax* sp.n.) are described. Additionally seven new species-level synonymies are recognized in *Goniocolletes* and 59 new species-level synonymies in *Leioproctus*. Most of the species in *Leioproctus (Leioproctus)* are placed in species groups. One species of *Leioproctus* with three submarginal cells was not assigned to any subgenus and is therefore treated as *incertae sedis* regarding its subgeneric placement: *Leioproctus opaculus* (Cockerell 1929). Additionally some notes on the biology of *Leioproctus* are provided. *Leioproctus* in Australia, as recognised in this paper, has 172 species.

Key words: Hymenoptera, Colletidae, Paracolletini, subgenera revise

Introduction

Leioproctus Smith (Hymenoptera: Colletidae) occurs throughout Australia, New Zealand and a few islands of the Pacific as well as South America. *Leioproctus* is one of the largest genera of bees in Australia. As well, it forms the major component of native bee fauna of New Zealand, comprising 18 of the 29 endemic species (Donovan 2007). Species in the subgenus of *Leioproctus* s.str. occur in Australia (69 species), New Zealand (10 species), Misool and New Guinea (two species) (Michener 1965; Cardale, 1993; Almeida 2008). All the other Australian species occur in subgenera that are unique to Australia, with one exception (one species that is recorded from New Caledonia) (Michener 1965).

When the current revision began in 1987 there were 280 nominal species of *Leioproctus* in Australia. Since 1987 more than 30 new Australian species have been described. Both Almeida (2008) and Almeida and Danforth (2009) recognised all of the subgenera of *Leioproctus* from Australia at generic level, based on the phylogenetic results in Almeida and Danforth (2009). Whilst the conclusions of papers of Almeida (2008) and Almeida & Danforth (2009) are interesting, they were based on data from single specimens of 14 species previously all placed in *Leioproctus*. However definition of generic or subgeneric boundaries were not clear with regards to the placement of species nor did these papers consider any specimens from New Zealand where the type species (*Leioproctus imitatus*) occurs. Hence this paper recognises the subgeneric placements of Michener (2007), except for *Goniocolletes* Cockerell, which is recognised here at the genus level. This paper is based on the study of over 6000 specimens including specimens from New Zealand. *Goniocolletes* is raised to genus level as it forms a distinct group of Australian Paracolletini; characters of males, especially those of the legs and metasomal sterna, readily distinguish them from other Paracolletini. Additionally, the majority of species of *Goniocolletes* have the head and mesosoma black and the metasoma orange/red, and at first glance may be confused with honey bees (*Apis mellifera* Linnaeus).

In Australia, *Leioproctus* contains two major groups- those with three submarginal cells (the majority of species) and those with two submarginal cells, although this distinction is somewhat blurred in one species *Leioproctus abnormis* (Cockerell). It should be noted that although *L. abnormis* is a part of the group with three submarginal cells, many specimens of this species have two submarginal cells and some specimens have two submarginal cells in one forewing and three submarginal cells in the other forewing. This revision has only considered species that have three submarginal cells. Here seven new species of *Goniocolletes* are described and 13 new species and seven new subgenera of *Leioproctus* are described. In this revision 59 new species-level synonyms are recognised in *Leioproctus* and seven new species level synonyms in *Goniocolletes*. Hence, as recognised in this