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Annotated catalogue of the Australian Scoliidae (Hymenoptera)

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ABSTRACT. A catalogue of the Australian Scoliidae based on published literature is presented. The Australian fauna is represented by one subfamily, containing two tribes Campsomerini and Scoliini, 11 genera *Australelis, Laevicampsomeris, Phalerimeris, Pseudotrielis, Radumeris, Trisciloa, Austroscolia, Scolia, Diliacos, Laeviscolia*, and *Liacos* and 20 species. Four species have erroneously been recorded from Australia and some confusion surrounds reports of a fifth species. Many names are catalogued with annotations to explain confusing aspects of taxonomy and nomenclature applied by previous authors.

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Introduction

The Scoliidae are a cosmopolitan family of aculeate Hymenoptera that exclusively parasitize second instar larvae (Illingworth, 1919c: 15) and third instar larvae (Illingworth, 1921: 32) of the beetle superfamily Scaraboidea. Adults are usually medium to large diurnal, conspicuous insects, often seen in a lazy, meandering or weaving flight close to the ground or around foliage. In Australia the Scoliidae is represented by the single subfamily Scoliinae containing the two tribes Scoliini and Campsomerini almost evenly dividing the 11 genera and 20 species between them. Four species have been erroneously recorded as occurring in Australia and one species has probably been recorded in error.

Early research by the Queensland Bureau of Sugar Experiment Stations

Several Australian scoliids attack larval coleopteran pests (commonly known as "white grubs") of sugar cane in north Queensland, and were comprehensively investigated in the early 20th century by the Queensland Bureau of Sugar Experiment Stations (BSES) as possible biological control agents (e.g., Dodd, 1917; Illingworth, 1921). This research provided detailed information on many aspects of the life history of two species of Scoliidae viz. *Radumeris tasmaniensis* (Saussure, 1854) and *Radumeris radula* (Fabricius, 1775), with occasional notes on other species.

The work conducted by BSES included the exchange of living scoliids with other countries in an attempt to introduce species that would not be susceptible to hyperparasitism. An attempt in 1919 to import *Micromeriella marginella modesta* (Smith, 1855) (as *Scolia manillae*) from Hawaii, where it had successfully been introduced, failed when industrial action in New Zealand delayed the delivery boat by two weeks and all the wasps died (Illingworth, 1919a: 205). Further attempts in 1926 and 1927 to introduce the same species also failed (Wilson, 1960: 35). *Megascolia (Regiscolia) azurea azurea* var. *rubiginosa* (Fabricius, 1793) (as *Triscolia rubiginosa*) was imported in 1926 from Java and evaluated for its potential as a biological control agent, but it failed to propagate on any local species of white grub (Wilson, 1960: 35). In 1931 cocoons of *Campsomeriella collaris quadrifasciata* (Lepeletier, 1845) (as *Campsomeris aureicollis*) were imported into Australia, while a reciprocal shipment of *Radumeris tasmaniensis* and *Radumeris radula* was exported to the Philippines in an attempt at biological control of native cane grubs in both locations (Lopez, 1933: 6–9). In both cases the wasps failed to permanently establish.

Prior to 1918, research at the BSES also recorded information on *Laevicampsomeris formosa* (Guérin-Méneville, 1835) (as *Dielis formosus*), however, in 1918 Illingworth & Jarvis (1918f) stated that the work they had conducted up to this date on this species actually referred to *Radumeris tasmaniensis* (as *Campsomeris tasmaniensis*). They referred to information provided to them by the Queensland Museum that Turner (1915), working from the British Museum, had published work stating *L. formosa* was not found south of Cairns and identifications to this species were referrable to *R. tasmaniensis*. However, a great deal of the literature by Illingworth and Jarvis was published concurrently in several journals or bulletins and they have confused matters by continuing to use the name *Dielis formosus* after stating that their initial identifications of this insect were incorrect. Due to this confusion, the voucher material for the BSES studies needs to be re-examined to establish the correct nomenclature. As a consequence, I have retained the names published by the BSES associated with their current valid names.

Much of the work carried out by the BSES was published simultaneously in the Australian Sugar Journal and the Queensland Agricultural Journal, as well as being summarized and published again in separate reports of the BSES or in other journals. It is not uncommon to find the same data published two or three times in different journals or bulletins. Consequently, I have not provided references to all the articles in the Australian Sugar Journal and the Queensland Agricultural Journal published by the BSES as it is duplicated elsewhere and its inclusion would add little value to the catalogue. A comprehensive bibliography of BSES authors such as Dodd, Jarvis, Illingworth and Mungomery can be found in Daniels (2000).

Biology

The BSES research yielded important data on the life history of *Radumeris radula* and *Radumeris tasmaniensis*. Both species readily prey upon the two most common white grub pests of sugar cane, the greyback cane beetle, *Dermolepida albohirtum*, and French's cane beetle, *Lepidiota frenchi* (Scarabaeidae: Melolonthinae). *R. tasmaniensis* can lay up to two eggs per day, and will readily attack any grubs it encounters and attempt to sting them. *R. radula* and *R. tasmaniensis* are both capable of parthenogenesis, producing viable male and female offspring (Illingworth, 1919c: 18; Illingworth, 1921: 32–34). *R. radula* and *R. tasmaniensis* paralyse the cane grubs by grasping the grub by one mandible and injecting venom between the anterior coxae and the mouthparts, though the wasps are not always successful and may end up being killed by the grub. Under laboratory conditions the life cycle of *R. radula* and *R. tasmaniensis* lasts from 40 to 60 days, depending on season and species (Illingworth, 1921). Data was also collected by the BSES on egg size, larval feeding behaviour, oviposition behaviour, burrow construction, parasites, breeding cage design and a number of other factors (Illingworth, 1921; Jarvis, 1932).

Little further research has been conducted on Australian Scoliidae subsequent to the BSES ceasing investigations into biological control. Males of *Radumeris tasmaniensis* have been reported attempting copulation with the orchid *Calochilus campestris* R.Br. (Fordham, 1946; Bower and Branwhite, 1993), and an unknown scoliid male has been recorded pseudocopulating with *Calochilus holtzei* F. Muell. (Jones & Gray, 1974). *R. tasmaniensis* was accidentally introduced into New Zealand in the 1990's and was the focus of several studies on the impact on New Zealand scarab fauna (Barratt *et al*., 2002; Rawnsley, 2006).

The biology of the remaining Australian fauna is poorly known, with only occasional behavioural observations being recorded for a few species (e.g., Hawkeswood, 1982; Hawkeswood, 1990).

Taxonomy and nomenclature

The taxonomy of the Scoliidae is in a chaotic state, and attempts by previous workers to clarify the classification within the family have only marginally improved the situation for modern workers. As long ago as 1911 Turner (1911: 602) complained about the difficulty of attempting to clarify the taxonomy of the group due to the sloppy work

of a contemporary. Betrem's (1928) monograph improved matters considerably for Australian workers by taking a regional view of the family, and subsequent work by Betrem, often together with Bradley, further resolved the status of much of the available type material.

However, Betrem and Bradley were both prone to changing their minds about their previous work without explanation (for example, Betrem's replacement of *Scolia ruficeps* Smith, 1855 as a type of *Austroscolia* in 1927 with *Scolia nitida* Smith, 1858 in 1928 and the objective synonymy created by the replacement of the subgeneric name *Phaleromeris* Bradley, 1964 with *Annulimeris* Betrem, 1967 by designating the same species as type of both subgenera), and a willingness to publish work with the promise that full explanation for changes would follow in subsequent papers (e.g., Bradley, 1964a: 8; Bradley, 1964b: 186; Tuijn, 1961: 242).

Argaman (1996) revised the world genera, examining the taxonomy Betrem and Bradley promoted, and erected a new subfamily, 21 tribes and 62 genera. Subsequent workers have not followed Argaman's classification (e.g., Gupta & Jonathon, 2003; Osten, 2005; Kim, 2009) though none have explicitly argued against it apart from Osten (2005) who mentions Argaman's work in his checklist of the world Scoliidae, and claims it is nonsensical. The publications by Darling (1996) on Argaman's work on *Perilampus* and Kimsey (2009) on Argaman's work on the Tiphiidae suggest that Argaman's classification of the Scoliidae should be treated with caution. The world generic key included in Argaman's paper has limited value, including as it does several couplets, or parts thereof, which deal exclusively with one sex (e.g., 44b, 54b, 71a and 71b, 75a and 75b) or that do not delimit the character states clearly. Osten's (2005) world checklist also contains a minor number of errors and omissions, as well as an absence of explanations for changes in nomenclature. Argaman appears to have used only material in the Hungarian Natural History Museum as a source.

Argaman's higher classification is not followed here, simply because I am not in a position to examine it more closely and it appears that the wider community of scoliid workers have been reluctant to adopt it. Instead, this catalogue follows the higher classification suggested by Day *et al*., (1981) and followed by most workers since. In compiling the generic and specific names for this catalogue, I have been forced at times to choose between the untested and possible erroneous work of Argaman and the occasionally incomplete catalogue of Osten. I have, unfortunately, been unable to be consistent in which work to favour throughout this catalogue, and at times I have ignored both Argaman and Osten in order to favour prior works that include examined material as I believe these publications are built on stronger evidence. However, I have provided my reasoning for each decision so that future workers can judge the value of my decisions and argue against them should it become clear I have made errors, or further evidence clarifies a particular problem. Where Argaman erected a genus that has not been subsequently synonymized it is retained as valid and where Osten has synonymized Argaman's genera they are recorded as such.

A further nomenclatural problem has arisen from the use of old or dubious names by several authors publishing biological data. I have not listed these as new combinations as I believe it was not their intention to contribute to the taxonomy of the species, but to publish valuable data on a family with a confusing and chaotic nomenclature.

Needless to say, the Scoliidae are in great need of molecular and morphological phylogenetic analysis in order to clarify relationships within the family.

Catalogue format

Generic and specific names are listed alphabetically. Available names, unavailable names and new combinations are listed in order of publication. Available and unavailable names are in bold and italics, new combinations are in italics only. Subsequent uses of the names in the literature are appended after the data indicating the first publication of the name and are separated by a semi colon. Square brackets contain a summary of the contents of the work. Question marks indicate uncertainty about particular data.

General abbreviations

biol.	biology
cat.	catalogue
comb. nov.	new combination
descr.	description. Languages other than English are given in parentheses after the abbreviation
dist.	distribution. References to non-Australian distributions are given in parentheses after the abbreviation.
fig(s)	figure(figures)
gen. nov.	new genus
nom. nov.	new name
note(s)	general notes
stat. nov.	new status
syn.	synonymy
syn. nov.	new synonymy
subgen. nov.	new subgenus

Australian state abbreviations

ACT	Australian Capital Territory
NSW	New South Wales
NT	Northern Territory
QLD	Queensland
SA	South Australia
TAS	Tasmania
VIC	Victoria
WA	Western Australia

Abbreviations for museums

BMNH	Natural History Museum (formerly British Museum [Natural History]), London, England
HNHM	Hungarian Natural History Museum, Budapest, Hungary
MHNB	Muséum d'Histoire naturelle (Naturhistorisches Museum), Basel, Switzerland
MLUH	Martin Luther Universität, Wissenschaftsbereich Zoologie, Halle-Wittenberg, Germany
MNHP	Muséum national d'Histoire naturelle, Paris, France
NAMA	Museum of the Royal Zoological Society *Natura Artis Magistra* Amsterdam
NMBE	Naturhistorisches Museum, Bern, Switzerland
OUM	Hope Department Entomology, Oxford University, Oxford, England
RMNH	Nationaal Natuurhistorisch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden, Netherlands
SMK	Sarawak Museum, Sarawak, Malaysia
ZMA	Zoölogisch Museum, Universiteit van Amsterdam, Amsterdam, The Netherlands
ZMB	Museum für Naturkunde an der Universität Humbolt zu Berlin, Berlin, Germany
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen, Denmark

Tribe Campsomerini

Australelis Betrem, 1962

Australelis Betrem, 1962a: 146. Type species: *Elis consanguinea* Saussure, 1853 by original designation [as subgenus of *Trielis* Saussure, 1863. Raised to generic rank by Betrem, 1972: 181; The unusual situation has arisen here where a subspecies other than the nominal subspecies (*Australelis anthracina anthracina* (Burmeister, 1854)) is the type for the genus *Australelis* Betrem, 1962].

Campsomeria Bradley & Betrem, 1966: 74 [nomen nudum; it is clear that this is *lapsus calami* for *Campsomeris* Guérin, 1839. In the introduction to this publication Bradley and Betrem discuss generic and subgeneric names but neither mention the name in the introduction or assign it a type species in the body of the work].

Australelis anthracina (Burmeister, 1854)

Australelis anthracina anthracina (Burmeister, 1854)

Scolia anthracina Burmeister, 1854: 16. Type data: holotype MLUH ♀. Type locality: Australia (as Neu-Holland); Smith, 1855: 115 [cat.; dist.]; Froggatt, 1892: 206 [cat.]; Dalla Torre, 1897: 146 [syn. list; dist.].

Elis (Trielis) orientalis Cameron, 1892: 112. Type data: holotype OUM ♀. Type locality: Sri Lanka (as Ceylon) [incorrect locality label according to Krombein, 1978: 5; synonymy by Krombein, 1978: 5]; Bingham, 1897: 90 [descr.]; Osten, 2005: 18 [cat.; incorrect original combination given].

Elis (Trielis) anthracina: Saussure & Sichel, 1864: 141, 317 [comb. nov.; descr. (in Latin), dist.; note (p. 317)].

Scolia orientalis: Dalla Torre, 1897: 172 [cat.; comb. nov.].

Campsomeris anthracina: Turner, 1909a: 170 [comb. nov.; (in part), notes, dist., inclusion in key]; Hawkeswood, 1982: 30, 31, 35, 36 [Adult food source: *Eucalyptus cylindriflora* Maiden & Blakely (Myrtaceae)]; Hawkeswood, 1991: 231 [note on previous work].

Campsomeris (Trielis) anthracina: Tillyard, 1926: 294 [comb. nov.; descr.].

Campsomeris (Dielis) anthracina: Betrem, 1928: 113 [comb. nov.; synonymy; notes; descr. (in German); dist.; inclusion in key].

Campsomeris orientalis: Betrem, 1928: 335 [comb. nov.; reprint of Cameron's description].

Campsomeria (Australelis) anthracina anthracina: Bradley & Betrem, 1966: 74, 78, 79 [stat. nov.; notes on the type of *Scolia anthracina* Burmeister, 1954; notes on Klug's manuscript names used by Burmeister].

Australelis anthracina anthracina: Osten, 2005: 5 [cat.].

Distribution: NSW, QLD, SA, VIC, WA.

Adult food source: *Eucalyptus cylindriflora* Maiden & Blakely (Myrtaceae) (Hawkeswood, 1982: 30, 31).

Australelis anthracina form *consanguinea* (Saussure, 1854)

Though the rank "form" has no taxonomic validity, for much of its history *consanguinea* stood as a valid species or subspecies, only being given the rank of form by Betrem in Bradley and Betrem, 1966: 80. As such, I have kept *consanguinea* separate to *anthracina* in the catalogue to assist any future worker to trace the nomenclatural history, though for taxonomic purposes the two lists should be one under the name *Australelis anthracina anthracina* (Burmeister, 1854).

Elis consanguinea: Saussure, 1854: 50 [synonymy by Turner, 1909a: 170; resurrected by Betrem, 1928: 113]. Type data: lectotype MHNB ♂. Type locality: Australia (as Nouvelle-Hollande); Froggatt, 1892: 208 [cat.]; Ashmead, 1903: 8 [as type of *Trielis* sensu Saussure & Sichel, 1864 according to Betrem, 1962a: 146].

Scolia anthracina variety: Burmeister, 1854: 16 [as variety; males only, see Bradley & Betrem, 1966: 79].

Elis (Trielis) consanguinea: Saussure & Sichel, 1864: 140 [comb. nov.; descr. (in Latin)].

Scolia consanguinea: Dalla Torre, 1897: 153 [comb. nov.; syn. list; dist.].

Campsomeris (Trielis) anthracina: Turner, 1909a: 170 [comb. nov.; notes; dist.; inclusion in key].

Campsomeris (Trielis) anthracina consanguinea: Betrem, 1928: 113 [stat. & comb. nov.; synonymy; notes; dist.; inclusion in key; (in German)].

Trielis (Australelis) consanguinea: Betrem, 1962a: 146 [stat. & comb. nov.; as type species of *Australelis* subg. nov.].

Campsomeris (Australelis) anthracina infrasubspecific form *consanguinea*: Bradley & Betrem, 1966: 79 [stat. & comb. nov. (as invalid rank "infrasubspecific form"); though not explicitly naming this species as belonging to *Campsomeris (Australelis)* the placement of the nominal subspecies into this subgenus on page 74 infers placement of this subspecies as well; notes on Burmeister's variety specimens].

Australelis anthracina: Betrem, 1972: 181 [comb. nov.; *Australelis* given generic rank; Bradley, 1974: 431 lists this name in his synonymy list for *consanguinea*].

Australelis anthracina form *consanguinea*: Bradley, 1974: 431 [comb. nov.; designation of lectotype; syn. list].

Australelis anthracina f. *consanguinea*: Osten, 2005: 5, 9 [cat.].

Distribution: Australia.

Laevicampsomeris Betrem, 1933

Laevicampsomeris Betrem, 1933: 238. Type species: *Scolia nigerrima* Smith, 1860 by original designation [as subgenus of *Campsomeris* Guérin-Méneville, 1839; raised to generic rank by Argaman, 1996].

Laevicampsomeris formosa (Guérin-Méneville, 1835)

Scolia formosa Guérin-Méneville, 1835: pl. 69, fig. 10. Type data: holotype MNHP ♀. Type locality: Papua New Guinea: New Ireland (as Port Praslin à Nouvelle-Irlande); Guérin-Méneville, 1838: 252 [descr.]; Guérin-Méneville, 1844: 431[note; dist.]; Smith, 1855: 115 [syn. list; dist.]; Froggatt, 1892: 207 [cat.]; Dalla Torre, 1897: 161 [comb. nov.; syn. list; dist.; (Dalla Torre, 1897: 161 incorrectly listed *Elis tasmaniensis*, Saussure, 1854 as a synonym)].

Scolia culta Smith, 1860: 117. Type data: holotype (probable) BMNH ♀. Type locality: New Guinea: Dory [designated a subspecies of *formosa* by Betrem, 1928: 87; synonymy by Tuijn, 1961: 228]; Dalla Torre, 1897: 154 [comb. nov.; syn. list; dist.]; Osten, 2005: 9 [cat.].

Elis (Dielis) formosa: Saussure & Sichel, 1864: 207 [comb. nov.; misidentification of male and female except for variety according to Krombein, 1963: 571].

Scolia (Discolia) culta: Saussure & Sichel, 1864: 122 [descr. (in Latin); dist.].

Elis formosa: Girard, 1879: 986, pl. 75, fig. 10 [comb; nov.; dist.].

Dielis formosa: Froggatt, 1902a: 63, 64, 68 [notes; fig.; includes letter containing information on the larval biology; note that Froggatt uses the names *Scolia formosa* and *Dielis formosa* interchangeably within this article].

Dielis formosus: Tryon, 1902a: 151–154 [descr.; life history]; Tryon, 1902b: 133–140, Plate IX [descr.; life history; nomenclatural history; figs.]; Tryon, 1911: 532, 536, 537 [brief notes]; Jarvis, 1914: 583 [rates of infestation on some farms]; Jarvis, 1915: 527 [note on hyperparasitism]; Jarvis, 1916: 35, 38 [p. 35—in list of predators and parasites of *Dermolepida albohirtum* (Waterhouse, 1875) (as *Lepidiota albohirta*) (Scarabaeidae); p. 38—in list of predators and parasites of *Dermolepida lixi* (Nonfried, 1894) (Scarabaeidae)]; Illingworth & Jarvis, 1918d: 67 [emergence of adults; ovipositional behaviour of unfertilized females; attack behaviour]; Illingworth, 1919c: 12, 14, 15, 17, 20, 22 [notes on life history taken from articles by J.F. Illingworth and E. Jarvis previously published in various issues of Australian Sugar Journal]; Illingworth & Jarvis, 1920: 33 [host—*Lepidiota frenchi* Blackburn, 1912; life history].

Discolia culta: Cameron, 1906b: 51 [comb. nov.; syn. list; dist.]; Cameron, 1911: 196 [syn. list; dist.].

Dielis (Scolia) formosa: Froggatt, 1907: 104 [fig; note on host; misidentification of male as *Dielis 7-cincta* (Fabricius, 1775)].

Campsomeris (Dielis) subopaca Turner, 1909a: 175. Type data: type status unknown BMNH 8♂, 2♀. Type locality: QLD, Cairns. [Synonymy by Betrem, 1928: 86]; Osten, 2005: 23 [cat.].

Dielis formosa: Tryon, 1909: 81 [note]; Dodd, 1917: 25–26 [hosts]; Illingworth & Jarvis, 1918d: 67 [emergence of adults; ovipositional behaviour of unfertilized females; attack behaviour]; Illingworth & Jarvis, 1918e: 121, 122 [notice of previous misidentifications]; Illingworth & Jarvis, 1918f: 229 [note on Turner's name change to *tasmaniensis*].

Scolia (Dielis) subopaca: Turner, 1910: 404 [comb. nov.; notes]; Turner, 1911: 624 [note].

Campsomeris formosus: Illingworth, 1919e: 455 [captive breeding protocols].

Scolia (Dielis) formosa: Illingworth, 1921: 24, 39 [list; adult food sources—*Duranta* L. (Verbenacea), pumpkin (Cucurbitaceae) and *Euodia* (as *Evodia*) (Rutaceae)].

Scolia formosa: Illingworth & Dodd, 1921: 80 [comb. nov.; list]; Bequaert, 1926: 191 [date of publication of Guérin-Méneville's work]; Jarvis, 1929: 44, 45 [fig.]; Clausen, 1940: 304 [note on some of Tryon's work].

Campsomeris (Dielis) formosoides Betrem, 1928: 93 Type data: holotype MNHP ♂. Type locality: New Guinea: Jobi Island. [Synonymy by Tuijn, 1961: 228]; Osten, 2005: 11 [cat.].

Campsomeris (Pseudotrielis) formosa culta Betrem, 1928: 87 [stat. & comb. nov.; syn. list; descr. (in German); dist.; fig.; incl. in key; synonymy by Tuijn, 1961: 228].

Campsomeris (Pseudotrielis) formosa formosa: Betrem, 1928: 86 [comb. nov.; syn. list; descr. (in German); dist.; incl. in key; synonymy by Tuijn, 1961: 228; (this species is listed in the female key on page 71 as *formosa formosa*, but only as *formosa* under the species description)].

Campsomeris formosa: Tuijn, 1961: 228 [stat. nov.; syn. list; descr.; dist.; fig.]; Hawkeswood, 1991: 223, 224, 228 [pollen loads carried by adults; adult food source: *Vachellia bidwillii* (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae)].

Campsomeris (subg. ?) *formosa*: Krombein, 1963: 571 [syn. list; descr.; dist.; fig.; incl. in key. Krombein, 1963: 571 incorrectly refers to Betrem, 1928 as Betrem, 1938 in his synonymic list.].

Campsomeris (Laevicapsomeris) formosa: Krombein, 1968: 7 [comb. nov.; dist.; notes].

Campsomeris (Pseudotrielis) formosa: Bradley, 1973: 219 [comb. nov.; notes on the holotype and date of publication].

Laevicampsomeris formosa: Osten, 2005: 11 [cat.; incorrect original combination given as well as incorrect spelling of *Campsomeris*].

Distribution: QLD.

Hosts: *Lepidiota rothei* Blackburn, 1888 (Coleoptera: Scarabaeidae) (Jarvis, 1916: 38; Dodd, 1917: 26).

Lepidiota caudata Blackburn, 1890 (Coleoptera: Scarabaeidae) (Dodd, 1917: 26).

Dermolepida albohirtum (Waterhouse, 1875) (as *Lepidiota albohirta*) (Coleoptera: Scarabaeidae) (Jarvis, 1916: 35).

Lepidiota frenchi Blackburn, 1912 (Coleoptera: Scarabaeidae) (Illingworth & Jarvis, 1920: 33).

Adult food sources: *Duranta* L. (Verbenacea), pumpkin (Cucurbitaceae) and *Euodia* (as *Evodia*) (Rutaceae) (Illingworth, 1921b: 39).

Vachellia bidwillii (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae) (Hawkeswood, 1991: 223, 224, 228).

Phalerimeris Betrem, 1967

Phalerimeris Betrem in Bradley & Betrem, 1967: 294. Type species: *Elis (Campsomeris) phalerata* Saussure, 1858 by original designation [as subgenus of *Campsomeris* Guérin-Méneville, 1839. Raised to generic rank by Bradley, 1974: 460. Note that Argaman, 1996: 205 listed *Phalerimeris* Betrem, 1967 (erroneously listed as *Phalerimeris* Betrem, 1966) as a synonym of *Phaleromeris* Bradley, 1964. While the spelling of both names is similar, there is no indication that Betrem intended *Phalerimeris* to be an emendation of *Phaleromeris* as each genus was assigned a different type species when erected. Nor are they automatically considered to be homonyms under Article 56.2 of the ICZN (1999)].

Phalerimeris carinifrons (Turner, 1909)

Campsomeris carinifrons Turner, R.E., 1909a: 174. Type data: holotype BMNH ♀. Type locality: QLD, Mackay; Turner, 1911: 624 [compared to *Radumeris tasmaniensis* (as *Scolia (Dielis) tasmaniensis*) (Saussure, 1854) and *Radumeris radula* (Fabricius, 1775)]; Illingworth, 1921: 24, 39 [note; adult food sources: "pink burr" *Urena lobata* L. (Malvaceae) and "pigeon pea" *Cajanus cajan* (L) Millsp. (Fabaceae)]; Illingworth & Dodd, 1921: 80 [list]; Jarvis, 1929: 44 [fig.]; Hawkeswood, 1991: 223–225, 227, 228] [feeding behaviour at flowers; pollen loads carried by adults; adult food source: *Vachellia bidwillii* (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae)].

Campsomeris (Dielis) carinifrons: Betrem, 1928: 96 [comb. nov.; descr. (in German); dist.].

Phalerimeris? carinifrons: Osten, 2005: 8 [cat.].

Distribution: QLD.

Adult food sources: "pink burr" *Urena lobata* L. (Malvaceae).

"Pigeon pea" *Cajanus cajan* (L) Millsp. (Fabaceae) (Illingworth, 1921: 39).

Vachellia bidwillii (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae) (Hawkeswood, 1991: 223–225, 227, 228).

Phalerimeris dumonti (Betrem, 1928)

Campsomeris (Dielis) dumonti Betrem, 1928: 97. Type data: holotype MNHP ♂ (location of specimen not confirmed). Type locality: Sydney (as Port Jackson).
Phalerimeris? dumonti: Osten, 2005: 10 [cat.].

Distribution: NSW.

Pseudotrielis Betrem, 1928

Pseudotrielis Betrem, 1928: 83. Type species: *Scolia zonata* Smith, 1855 by original designation [as subgenus of *Campsomeris* Guérin-Méneville, 1839; raised to generic rank by Argaman, 1996: 205.].
Rucarcana Argaman, 1996: 206. Type species: *Campsomeris flavidula congener* Turner, 1909 by original designation (incorrectly given as *Campsomeris congener*). [Synonymy by implication by Osten, 2005: 9].

Pseudotrielis congener (Turner, 1909)

Elis (Trielis) flavidula: Saussure & Sichel, 1864: 143 [misidentification of Smith's species according to Turner, 1909: 171].
Campsomeris flavidula congener Turner, 1909a: 171 [nom. nov. for *Elis (Trielis) flavidula* sensu Saussure & Sichel, 1864 which Turner distinguishes from Smith's type; notes, dist., inclusion in key].
Campsomeris (Pseudotrielis) congener: Betrem, 1928: 85 [stat. & comb. nov.; descr. (in German); dist].
Campsomeris congener: Argaman, 1996: 206 [as type of *Rucarcana* gen. nov.].
Pseudotrielis congener: Osten, 2005: 9 [comb. nov.; cat.].

Distribution: WA?

Pseudotrielis flavidula (Smith, 1855)

Scolia flavidula Smith, 1855: 115. Type data: holotype BMNH ♀. Type locality: Australia; Froggatt, 1892: 206 [cat.]; Dalla Torre, 1897: 158 [cat.].
Elis (Trielis) australensis Saussure & Sichel, 1864: 144. Type data: holotype MHNB ♂. Type locality: Australia (as Nova Hollandia). [Synonymy by Turner, 1909: 171]; Osten, 2005: 6, 11 [cat.].
Elis (Trielis) liturata Saussure & Sichel, 1864: 143. Type data: lectotype MHNB ♂. Subsequent designation: Bradley, 1974: 449. Type locality: Australia. [Synonymy by Turner, 1909: 171]; Osten, 2005: 11, 15 [cat.].
Elis australensis: Froggatt, 1892: 208 [cat.].
Scolia australensis: Dalla Torre, 1897: 148 [comb. nov.; cat.].
Scolia liturata: Dalla Torre, 1897: 168 [comb. nov.; cat.].
Scolia (Triselis) australiensis: Schulz, 1908: 464 [comb. nov.; descr. (in German); dist.; notes; *Triselis* is a *lapsus calumni* for *Trielis*].
Campsomeris (Trielis) flavidula: Turner, 1909a: 171 [comb. nov.; synonymy; dist.].
Campsomeris (Pseudotrielis) flavidula: Betrem, 1928: 85 [comb. nov.; syn. list; note; dist.].
Trisciloa (Pseudotrielis) flavidula: Bradley, 1974: 424 [comb. nov.; designation of holotype for *Elis (Trielis) australensis* p. 424; designation of lectotype for *Elis (Trielis) liturata* p. 449].
Pseudotrielis flavidula: Osten, 2005: 11 [comb. nov.; cat.].

Distribution: SA.

Pseudotrielis gilesi (Turner, 1909)

Campsomeris (Trielis) gilesi Turner, 1909a: 171. Type data: type status and whereabouts unknown 9♀, 3♂. Type locality: WA, Perth; NSW, Sydney.
Campsomeris (Pseudotrielis) gilesi: Betrem, 1928: 85 [comb. nov.; descr. (in German); dist.; inclusion in key.].
Pseudotrielis gilesi: Osten, 2005: 12 [comb. nov.; cat.].

Distribution: NSW, WA.

Pseudotrielis waterstoni (Betrem, 1928)

Campsomeris (Pseudotrielis) waterstoni Betrem, 1928: 84. Type data: holotype BMNH ♀. Type locality: QLD: Cairns.
Pseudotrielis waterstoni: Osten, 2005: 25 [comb. nov.; cat.].

Distribution: NSW, QLD, WA.

Pseudotrielis zonata (Smith, 1855)

Scolia zonata Smith, 1855: 116. Type data: type status unknown BMNH ♀♂. Type locality: Australia (as New Holland); Froggatt, 1892: 207 [cat.].
Elis (Trielis) zonata: Saussure & Sichel, 1864: 141 [comb. nov.; descr. (in Latin); dist.; notes].
Campsomeris (Trielis) zonata: Turner, 1909a: 171 [comb. nov.; notes, dist., inclusion in key].
Campsomeris (Pseudotrielis) zonata: Betrem, 1928: 83 [comb. nov.; syn. list; descr. (in German); dist.].
Pseudotrielis zonata: Osten, 2005: 25 [comb. nov.; cat.].

Distribution: NSW, QLD.

Radumeris Betrem, 1962

Radumeris Betrem, 1962b: 206. Type species: *Tiphia radula* Fabricius, 1775 by original designation [as subgenus of *Campsomeris* Guérin, 1839; raised to generic rank by Bradley, 1974: 472 (although on page 439 Bradley still lists *Radumeris* as a subgenus of *Campsomeris*)].

Radumeris radula (Fabricius, 1775)

Tiphia radula Fabricius, 1775: 354 [descr. (in Latin); dist.]. Type data: holotype BMNH ♀. Type locality: Australia (as "nova Hollandia"); Fabricius, 1781: 451 [descr. (in Latin); dist.]; Fabricius, 1787: 279 [descr. (in Latin)]; Roemer, 1789: 59, pl. 27 [descr. (in Latin); fig.; Roemer appears to have followed Sulzer, 1776 and listed the distribution as Sicily (as Sicilia). Roemer also reissued Sulzer's colour plates.]; Gmelin, 1790: 2741 [descr. (in Latin); dist.]; Fabricius, 1793: 226 [descr. (in Latin); dist.]; Fabricius, 1804: 235 [descr. (in Latin); dist.]; Zimsen, 1964: 395 [notes on the type].
Scolia 7 cincta Fabricius, 1775: 356. Type data: holotype BMNH ♂. Type locality: Australia (as "nova Hollandia"). [Synonymy by Turner, 1909b: 484; Froggatt (1907: 104) synonymized this species with *Pseudotrielis formosa* (Guérin-Méneville, 1835) claiming *7-cincta* was the male and *formosa* was the female]; Fabricius, 1781: 454 [descr. (in Latin); dist.]; Fabricius, 1787: 282 [descr. (in Latin)]; Fabricius, 1793: 237 [comb. nov.; descr. (in Latin); dist.]; Smith, 1855: 105 [comb. nov.; descr.; dist.]; Froggatt, 1892: 207 [comb. nov.; cat.].
Sphex radula: Sulzer, 1776: 192, pl. 27 [descr. (in German);

fig.; incorrectly listed distribution as Sicily (as Sicilia)].
Sphex radula hungarica: Christ, 1791: 258, pl. 25 [comb. nov.; descr. (in German); fig.].
Sphex septemcincta: Christ, 1791: 269 [comb. nov.; descr. (in German)].
Elis 7-cincta: Fabricius, 1804: 249 [comb. nov.; descr. (in Latin); dist.].
Scolia radula: Smith, 1855: 105 [comb. nov.; dist.]; Froggatt, 1892: 207 [cat.]; Dalla Torre, 1897: 179 [syn. list; dist.]; Froggatt, 1907: 103, 104 [brief description]; Turner, 1909b: 484 [Turner's identification of this insect is in doubt. It is unclear which of the homonyms of *radula* he was referring to, though his reference to Kirby and *plumipes* suggest it is not this insect].
Elis (Dielis) radula: Saussure & Sichel, 1864: 210 [comb. nov.; descr. (in Latin); dist.].
Scolia (Dielis) intrudens Smith, 1868: 241. Type data: holotype BMNH ♀. Type locality: WA, Champion Bay [preoccupied Smith, 1860: 53; synonymy by Turner, 1909a: 173 (whether Turner knew that Dalla Torre (1897: 156) had proposed a new name for this species is unclear]; Osten, 2005: 14 [cat.; incomplete original combination given].
Scolia intrudens: Froggatt, 1892: 207 [comb. nov.; cat.].
Scolia ehrendorferi: Dalla Torre, 1897: 156 [nom. nov. for *Scolia (Dielis) intrudens* Smith, 1868: 241; syn. list; dist.].
Scolia septemcincta: Dalla Torre, 1897: 181 [syn. list; dist.]; Turner, 1909b: 484 [synonymy with *Radumeris radula* (as *Tiphia radula*) Fabricius, 1775]; Zimsen, 1964: 399 [notes on the type].
Dielis 7-cincta: Cameron, 1906a: 218 [comb. nov.; descr.; notes].
Dielis formosa maculiceps Cameron, 1906a: 218. Type data: holotype ZMA. Type locality: New Guinea: Merauke [misidentification according to Turner, 1910: 403].
Dielis septmecincta[sic]: Froggatt, 1907: 104 [brief descr.; misidentification as male of *Dielis (Scolia) formosa* (Guérin-Méneville, 1835)].
Campsomeris (Dielis) radula: Turner, 1909a: 173 [comb. nov.; syn. list; dist.; inclusion in key; notes].
Scolia (Dielis) radula: Turner, 1910: 403 [comb. nov.; synonymy; notes].
Campsomeris radula: Jarvis, 1915: 527 [notes on hyperparasites]; Jarvis, 1916: 35 [in list of predators and parasites of *Dermolepida albohirtum* (Waterhouse, 1875) (as *Lepidiota albohirta*) (Scarabaeidae)]; Dodd, 1917: 25, 26 [host]; Illingworth & Jarvis, 1918a: 26 [note]; Illingworth & Jarvis, 1918b: 72 [host; note on similarity of male with males of *Pseudotrielis formosa* (Guérin-Méneville, 1835) (as *Dielis formosus*)]; Illingworth & Jarvis, 1918c: 116 [notes on breeding experiments and field observations]; Illingworth & Jarvis, 1918d: 67 [emergence of adults; ovipositional behaviour of unfertilized females; attack behaviour]; Illingworth & Jarvis, 1918e: 122 [hosts—*Lepidiota rothei* Blackburn, 1888, *Lepidiota frenchi* Blackburn, 1912, *Lepidiota caudata* Blackburn, 1890, *Anoplognathus boisduvalli* Boisduval, 1835, *Dermolepida albohirtum* (Waterhouse, 1875); Illingworth, 1919c: 12, 14, 15, 17, 18, 20, 23 [notes on life history taken from articles by J.F. Illingworth and E. Jarvis previously published in various issues of Australian Sugar Journal]; Jarvis, 1919: 301, Plate 29 [hosts; behaviour]; Illingworth, 1921: 24, 25, 27, 31–36 [hosts; fecundity; parthenogenesis; description of egg; attack and ovipositing behaviour]; Illingworth & Dodd, 1921: 80 [list; summary of previously published data]; Hardy, 1922: 45 [parasite—*Ligyra satyrus* (Fabricius, 1775) (Diptera: Bombylidae) (as *Hyperalonia satyrus*) based on specimen labelled by E. Jarvis deposited in Agricultural Department of Queensland collection]; Jarvis, 1929: 21, 22, 24–27, 46, 47 [figs. (although without a species name these figures are reproduced from Illingworth, 1929: Plate IV where they are labelled *Campsomeris radula*); hosts—*Dermolepida albohirtum* (as *Lepidoderma albohirtum*) (Waterhouse, 1875); *Lepidiota frenchi* Blackburn, 1912; *Dasygnathus dejeani* (as *Dasygnathus australis-dejeani*) W.S. Macleay, 1819]; Clausen, 1940: 304, 306 [note on some of Illingworth's work]; Tuijn, 1961: 232 [notes]; Simmonds, 1969: 464 [review of published literature on sugar cane pests]; Hawkeswood, 1991: 223, 224, 228 [pollen loads carried by adults; adult food source: *Vachellia bidwillii* (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae)].
Campsomeris (Dielis) radula: Betrem, 1928: 88 [comb. nov.; syn. list; descr. (in German); dist.].
Campsomeris (Radumeris) radula: Betrem, 1962b: 206 [comb. nov.; as type of *Radumeris* subgen. nov.]; Bradley, 1964a: 23 [notes on the type].
Campsomeris (subg.?) *radula*: Krombein, 1963: 581 [synonymy; descr.; dist.; fig.; incl. in key].
Radumeris radula: Osten, 2005: 20 [comb. nov.; cat.].

Distribution: NT, QLD, WA.

Hosts: *Dermolepida albohirtum* (Waterhouse, 1875) (as *Lepidiota albohirta*) (Coleoptera: Scarabaeidae) (Dodd, 1917: 26; Illingworth & Jarvis, 1918b: 122; Jarvis, 1929: 24).
Lepidiota rothei Blackburn, 1888 (Illingworth & Jarvis, 1918b: 122).
Lepidiota frenchi Blackburn, 1912 (Illingworth & Jarvis, 1918b: 122; Jarvis, 1929: 24).
Lepidiota caudata Blackburn, 1890 (Illingworth & Jarvis, 1918b: 122).
Anoplognathus boisduvalli Boisduval, 1835 (Illingworth & Jarvis, 1918b: 122).
Dasygnathus dejeani (as *Dasygnathus australis-dejeani*) W.S. Macleay, 1819 (Jarvis, 1929: 24).

Parasites: *Ligyra satyrus* (Fabricius, 1775) (Diptera: Bombylidae) (Hardy, 1922: 45).

Adult food sources: *Vachellia bidwillii* (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae) (Hawkeswood, 1991: 223, 224, 228).

Radumeris tasmaniensis (Saussure, 1854)

Elis (Campsomeris) tasmaniensis Saussure, 1854: 6, fig. 16. Type data: lectotype RMNH ♀. Subsequent designation: Betrem in Bradley, 1974: 472. Type locality: Tasmania (as Vandiemens Land on label according to Betrem, 1928: 90 or Tasmanie according to original description by Saussure, 1854: 6).
Elis (Campsomeris) ferox Saussure, 1859: 261. Type data: lectotype RMNH ♀ (designated by Betrem, 1928: 142). Type locality: New Guinea (as La Nouvelle Guinea). [Synonymy by Krombein, 1963: 578].
Elis (Dielis) ferox: Saussure & Sichel, 1864: 211; Plate 2 [comb. nov.; descr. (in Latin); fig.].
Elis (Dielis) formosa: Saussure & Sichel, 1864: 207 [descr. (in Latin); dist; syn. list; ♀ misidentification in part according to Turner, 1910: 624].
Elis tasmaniensis: Froggatt, 1892: 208 [cat.].
Scolia ferox: Dalla Torre, 1897: 158 [comb. nov.; syn. list; dist.].
Scolia formosa: Dalla Torre, 1897: 161 [comb. nov.; syn. list; dist.; in part according to Krombein, 1963: 578].
Elis (Dielis) formosa: Mantero, 1900: 592 [comb. nov.; note; dist.; misidentification according to Krombein, 1963: 578].
Scolia (Dielis) formosa: Schulz, 1905: 212 [notes; misidentification according to Krombein, 1963: 578].
Campsomeris (Dielis) formosa: Turner, 1909: 174 [comb. nov.; syn. list; dist.; inclusion in key; notes; misidentification according to Turner, 1910: 624].
Scolia (Dielis) tasmaniensis: Turner, 1911: 624 [comb. nov.; notes]; Turner, 1915: 550 [notes].

Campsomeris tasmaniensis: Illingworth & Jarvis, 1918e: 121, 122 [notice of previous misidentifications with *Pseudotrielis formosa* (Guérin-Méneville, 1835) (as *Dielis formosa*); hosts—*Lepidiota rothei* Blackburn, 1888, *Lepidiota frenchi* Blackburn, 1912, *Lepidiota caudata* Blackburn, 1890, *Anoplognathus boisduvalli* Boisduval, 1835, *Dermolepida albohirtum* (Waterhouse, 1875)]; Illingworth, 1919a: 213 [adults feeding on "klondike cosmoz" (sic) *Cosmos sulphureus* Cav. (Asteraceae) and "pigeon pea" *Cajanus cajan* (L) Millsp. (Fabaceae) (as *Cajanus indicus*)]; Illingworth, 1919b: 439 [note in letter]; Illingworth, 1919c: 22, 23 [notes on life history taken from articles by J.F. Illingworth and E. Jarvis previously published in various issues of Australian Sugar Journal]; Illingworth, 1919d: 50 [note on life history taken from article by J.F. Illingworth previously published in Australian Sugar Journal]; Illingworth, 1919e: 455 [captive breeding protocols]; Jarvis, 1919: 301 [hosts; behaviour]; Illingworth, & Dodd, 1921: 80 [list; summary of previously published data]; Illingworth, 1921: 24, 25, 28, 29, 31, 33–36, 39 [hosts; fecundity; parthenogenesis; description of egg; attack and ovipositing behaviour]; Jarvis, 1921: 321–322 [winter brood]; Jarvis, 1929: 21–29, 44, 45 [fecundity; figs.; parasite—*Macrosiagon cucullatum* (Macleay,W.J., 1887) (Coleoptera: Rhipiphoridae) (as *Macrosiagon (Emenadia) cucullata*); hosts—*Dermolepida albohirtum* (as *Lepidoderma albohirtum*) (Waterhouse, 1875); *Lepidiota frenchi* Blackburn, 1912]; Jarvis, 1932: 331–333 [captive breeding methods]; Lopez, 1933: 6–9 [introduction attempts into the Philippines]; Clausen, 1940: 306 [note on some of Illingworth's work]; Nicholls, 1951: Plate 52 [reference to Fordham's paper]; Tuijn, 1961: 233 [syn. list; dist.; notes]; Simmonds, 1969: 464 [review of published literature]; Nicholls, 1969: 15 [reference to Fordham's paper]; Wilson, 1969: 251 [review of published literature]; Jones & Gray, 1974: 605 [note on paper by Fordham, 1946]; Beardsell & Bernhardt, 1982: 168 [inclusion in list of orchid pollinators]; Hawkeswood, 1991: 222–225, 227, 228, 232 [feeding behaviour at flowers; pollen loads carried by adults; adult food source: *Vachellia bidwillii* (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae)]; Allsopp, 1992: 107–110 [attractiveness of various compounds]; Naumann, 1993: 64, 77, 183 [common name—"yellow flower wasp"]; Adams & Lawson, 1993: 557 [list]; Bower & Branwhite, 1993: 68–71 [pseudocopulation by males of *Radumeris tasmaniensis* (as *Campsomeris tasmaniensis*) with *Calochilus campestris* R.Br.]; Logan, 1999: 382–384 [hosts—*Antitrogus parvulus* Britton, *Lepidiota crinita* Brenske, *Lepidiota negatoria* Blackburn, *Lepidiota noxia* Britton, *Anoplognathus porosus* (Dalman) (all Scarabaeidae)]; Yeates, Logan, & Lambkin, 1999: 300, 301, 302, 304 [notes on biology, prey and parasites]; Ciotek *et al*., 2006: 368 [note on sexual deceit by an orchid].

Campsomeris (Dielis) tasmaniensis: Tillyard, 1926: 294 [comb. nov.; descr.; dist.]; Betrem, 1928: 89 [descr.; dist.; synonymy]; Betrem, 1933: 237 [descr. (in German); dist.; notes]; Fordham, 1946: 199–201 [notes on pseudocopulation with *Calochilus campestris* R. Br. (Orchidaceae)].

Campsomeris (Dielis) rosenbergi Betrem, 1928: 93. Type data: holotype RMNH ♀. Type locality: Indonesia: Aru Islands. [Synonymy by Tuijn, 1961: 233].

Campsomeris (Megacampsomeris) ferox: Betrem, 1928: 142 [descr.; designation of lectotype]; Betrem, 1941: 64 [note].

Campsomeris siebersi Betrem, 1928: 79. Type data: holotype RMNH ♂. Type locality: Indonesia: Kei Islands. [Synonymy by Tuijn, 1962: 233].

Campsomeris ferox: Tuijn, 1961: 237 [comb. nov.; notes; dist.].

Campsomeris (Subg) *tasmaniensis*: Krombein, 1963: 578 [synonymy; descr.; dist.; fig.; incl. in key].

Campsomeris (Radumeris) tasmaniensis: Krombein, 1968: 8 [comb. nov.; dist.].

Radumeris? rosenbergi: Osten, 2005: 21 [cat.; incomplete original combination given; note that Osten appears to have resurrected this name as a valid species without explanation and without definite generic placement. Given other errors, such as the incomplete original combination and the omission of the name *Campsomeris siebersi* Betrem, 1928 from the catalogue I have hesitated to follow Osten in this matter and retained it as a synonym as placed by Tuijn (1961: 233) and as followed by subsequent workers such as Krombein (1963) and Bradley (1974)].

Campsomeris (Radumeris) tasmaniensis form *ferox*: Bradley, 1974: 439 [notes on the types; stat. & comb. nov.; syn. list].

Radumeris tasmaniensis form *ferox*: Osten, 2005: 23 [cat.].

Radumeris tasmaniensis: Bradley, 1974: 472 [notes on the type. In this paper Bradley included *radula* and *7-cincta* in the synonymic list for *tasmaniensis* without giving any reason as to why he considered them synonyms in whole or part. He also quoted Turner on the type of *formosa*, without explaining how that relates to *tasmaniensis*. Due to the confused nature of this work, I have kept these species as separate entities until such time as research can determine a clearer picture.]; Berry, Osten & Emberson, 2001: 41–48 [descr.; biol.; dist.; taxonomic history; notes on possible hosts in New Zealand]; Barratt, *et al*., 2002: 25 [study to determine distribution and host in New Zealand]; Barratt, 2003: 5 [literature review of biology and behaviour]; Rawnsley, 2006: 6 [biol.; dist. (New Zealand); Rawnsley lists Dodd (1917) as a source for information on the distribution of *Radumeris tasmaniensis*. I have been unable to find any mention of this taxa in Dodd (1917).]; Osten, 2005: 23 [cat.; incorrect original combination given].

Distribution: NSW, NT, QLD, SA, TAS, VIC, New Guinea, New Zealand.

Hosts: *Anoplognathus boisduvalli* Boisduval, 1835 (Coleoptera: Scarabaeidae: Rutelinae) (Illingworth & Jarvis, 1918b: 122).

Anoplognathus porosus (Dalman, 1817) (Coleoptera: Scarabaeidae: Rutelinae) (Logan, 1999).

Antitrogus consanguineas (Blackburn, 1911) (Coleoptera: Scarabaeidae: Melolonthinae) (Berry, Osten & Emberson, 2001: 44).

Antitrogus parvulus Britton, 1978 (Coleoptera: Scarabaeidae: Melolonthinae) (Logan, 1999).

Dasygnathus spp. (Berry, Osten & Emberson, 2001: 44).

Dermolepida albohirtum (Waterhouse, 1875) (Coleoptera: Scarabaeidae: Melolonthinae) (Illingworth & Jarvis, 1918b: 122; Jarvis, 1929: 24; Yeates *et al*., 1999: 301, 304).

Lepidiota caudata Blackburn, 1890 (Coleoptera: Scarabaeidae: Melolonthinae) (Illingworth & Jarvis, 1918b: 122).

Lepidiota crinita Brenske, 1900 (Coleoptera: Scarabaeidae: Melolonthinae) (Logan, 1999).

Lepidiota frenchi Blackburn, 1912 (Coleoptera: Scarabaeidae: Melolonthinae) (Illingworth & Jarvis, 1918b: 122; Jarvis, 1929: 24).

Lepidiota negatoria Blackburn, 1912 (Coleoptera: Scarabaeidae: Melolonthinae) (Logan, 1999; Yeates *et al*., 1999: 301).

Lepidiota noxia Britton, 1985 (Coleoptera: Scarabaeidae: Melolonthinae) (Logan, 1999; Yeates *et al*., 1999: 301).

Lepidiota rothei Blackburn, 1888 (Coleoptera: Scarabaeidae: Melolonthinae) (Illingworth & Jarvis, 1918b: 122).

Rhopea magnicornis Blackburn, 1888 (Coleoptera:

Scarabaeidae: Melolonthinae) (Berry, Osten & Emberson, 2001: 44 (as *Rhopea magnicornis* Blackburn)).

Parasites: *Ligyra satyrus* (Fabricius, 1775) (Diptera; Bombylidae) (Dodd, 1917: 27 (as Bombylid Sp. D. 22); subsequent identification by Illingworth, 1921: 40 (as *Hyperalonia funesta* [Walker, 1849]).

Macrosiagon cucullatum (Macleay, W.J., 1887) (Coleoptera: Rhipiphoridae) (Dodd, 1917: 27 (as Mordellid Sp. C. 109); subsequent identification by Illingworth, 1921: 40 (as *Emenadia cucullata*)).

Adult food sources: "klondike cosmoz" (sic) *Cosmos sulphureus* Cav. (Asteraceae).

"Pigeon pea" *Cajanus cajan* (L) Millsp. (Fabaceae) (as *Cajanus indicus*) (Illingworth, 1919c: 213).

Vachellia bidwillii (Benth.) Kodela (as *Acacia bidwillii* Benth.) (Fabaceae) (Hawkeswood, 1991: 222–225, 227, 228, 232).

Common name: "yellow flower wasp" (Naumann, 1993: 64, 77, 183).

Pseudocopulation: *Calochilus campestris* R.Br. (Fordham, 1946: 199–201; Bower & Branwhite, 1993: 68–71).

Trisciloa Gribodo, 1893

Trisciloa Gribodo, 1893: 146. Type species: *Trisciloa saussurei* Gribodo, 1893 by monotypy.

Tetrasciloa Betrem, 1927: xcv [*lapsus calami* for *Trisciloa* Gribodo, 1893; synonymy by Betrem, 1928: 61].

Trisciloa ferruginea (Fabricius, 1775)

Scolia ferruginea Fabricius, 1775: 355. Type data: lectotype BMNH ♀. Type locality: Australia (as nova Hollandia though Turner, 1909b: 484 asserts the type locality is Cooktown); Fabricius, 1781: 453 [descr. (in Latin); dist.]; Fabricius, 1787: 281 [descr. (in Latin)]; Gmelin, 1790: 2736 [descr. (in Latin); dist.]; Fabricius, 1793: 231 [comb. nov.; descr. (in Latin); dist.]; Fabricius, 1804: 241 [descr. (in Latin); dist.]; Smith, 1855: 114 [cat.]; Froggatt, 1892: 206 [cat.]; Dalla Torre, 1897: 158 [syn. list; dist.]; Turner, 1909a: 173 [comb. nov.; notes]; Turner, 1909b: 484 [note]; Zimsen, 1964: 397 [notes on type material].

Sphex ferruginea: Christ, 1791: 268 [comb. nov.; descr. (in German)].

Scolia fulva Gray, 1832: 516. Type data: type status unknown OUM (Bradley & Betrem, 1967: 290) sex unknown. Type locality: Australia [location erroneously given as South America, see Shuckard, 1840: 482 and Shuckard, 1842: 222; synonymy by Betrem, 1928: 63]; Shuckard, 1841: 482 [note]; Shuckard, 1842: 222 [descr.; notes]; Smith, 1855: 115 [cat.]; Froggatt, 1892: 205; 207 [comb. nov.; cat.; note]; Dalla Torre, 1897: 161 [syn. list; dist.]; Froggatt, 1907: 103 [brief description]; Osten, 2005: 12 [cat.; note that Osten incorrectly assigns this name to Smith, 1862 and also incorrectly lists it as a synonym of *Trisciloa saussurei* Gribodo, 1893].

Elis (Trielis) ferruginea: Saussure & Sichel, 1864: 159 [comb. nov.; descr. (in Latin)].

Elis (Trielis) fulva: Saussure & Sichel, 1864: 159 [comb. nov.; descr. (in Latin); on page 160 under *Elis (Trielis) ferruginea* Saussure & Sichel suggest *fulva* might be a variety of *ferruginea*].

Trisciloa rufa Mocsáry, 1896: 3. Type data: syntypes? HNHM ♂. Type locality: Cooktown, QLD. [Synonymy by Betrem, 1928: 63].

Scolia (Triselis) ferruginea: Schulz, 1908: 465 [comb. nov.; descr. (in German); dist.; fig.; *Triselis* appears to be a *lapsus calami* for *Trielis* Saussure, 1863].

Campsomeris (Trielis) ferruginea: Turner, 1909a: 173 [comb. nov.; notes; dist.]; Illingworth, 1921: 24, 39 [list; note on habitats and adults feeding on *Tristania* (Myrtaceae) and *Euodia* (as *Evodia*) (Rutaceae).]; Tillyard, 1926: 294 [comb. nov.; note; fig.].

Campsomeris ferruginea: Illingworth & Dodd, 1921: 80 [list]; Jarvis, 1929: 44, 45 [fig.].

Trisciloa ferruginea: Betrem, 1928: 63 [comb. nov.; descr. (in German); syn. list; dist.]; Bradley, 1964a: 13 [designation of lectotype]; Riek, 1970: 932 [note]; Goode, 1980: 200 [note]; Naumann, 1991: 979 [note]; Osten, 2005: 11 [cat.].

Distribution: NT, QLD.

Adult food sources: *Tristania* (Myrtaceae) and *Euodia* (as *Evodia*) (Rutaceae) (Illingworth, 1921b: 39).

Tribe Scoliini

Austroscolia Betrem, 1927

Austroscolia Betrem, 1927: xcviii [as subgenus; raised to generic rank by Bradley & Betrem, 1967: 293]. Type species: *Scolia ruficeps* Smith, 1855 by original designation. Note that Betrem, 1927: xcviii originally designated *Scolia ruficeps* Smith, 1855 as type, then a year later (Betrem, 1928: 208) changed his mind and designated *Scolia nitida* Smith, 1858 as genotype.

Austroscolia commixta (Turner, 1909)

Scolia soror: Saussure & Sichel, 1864: 126 [misidentification of Smith's species according to Turner, 1909: 170].

Scolia commixta Turner, 1909a: 170 [descr., dist., inclusion in key]. Type data: holotype BMNH ♂. Type locality: NT, Darwin.

Scolia (Austroscolia) commixta: Betrem, 1928: 214 [comb. nov.; descr., inclusion in key, (in German)].

Austroscolia commixta: Osten, 2005: 30 [cat.].

Distribution: NT.

Austroscolia nitida (Smith, 1858)

Austroscolia nitida varifrons (Cameron, 1906)

Discolia varifrons Cameron, 1905: 54. Type data: type status unknown NAMA ♂. Type locality: New Guinea.

Discolia nitida: Cameron, 1906: 217 [misidentification by Cameron of ♀ of Smith's species according to Krombein, 1963: 641].

Scolia (Austroscolia) punctatissima punctatissima: Betrem, 1928: 212 [misidentification by Betrem in part of Kirby's species according to Krombein, 1963: 641].

Scolia (Austroscolia) punctatissima punctatissima: Betrem, 1933: 254 [misidentification by Betrem in part of Kirby's species according to Krombein, 1963: 641].

Scolia (Austroscolia) varifrons cupreopennis: Tuijn, 1961: 242 [misidentification by Tuijn in part of Betrem's species according to Krombein, 1963: 641].

Scolia (Austroscolia) nitida varifrons: Krombein, 1963: 641 [stat. & comb. nov.; synonymy, descr., dist., inclusion in key].

Austroscolia nitida varifrons: Krombein, 1968: 18 [comb. nov.; dist.]; Petersen, 1970: 63 [dist.; notes]; Osten, 2005: 39 [cat.].

Distribution: NSW, NT, QLD, New Guinea, Solomon Islands.

Notes: The history of this species name is typical of the confusion surrounding the nomenclature of Australian Scoliidae. *Discolia varifrons* was described from a female specimen (not a male as stated in the original description) by Cameron (1905: 54) who claimed it might actually be the male of *Discolia nitida* (Smith, 1858). It was synonymized, along with the male from a description of *Discolia nitida* (Smith, 1858) published by Cameron (1906a: 217), with *Scolia (Austroscolia) punctatissima punctatissima* (Kirby, 1889) by Betrem (1928: 212). Betrem gave *punctatissima* a new status of subspecies, erecting a new subspecies *Scolia (Austroscolia) punctatissima cupreopennis*, and listing an individual synonymy for *cupreopennis*.

In 1961 Tuijn resurrected *varifrons* as a specific name and placed Betrem's subspecies *cupreopennis* as a subspecies of *varifrons*. A footnote in the work explained the reasoning behind this was to be found in a forthcoming work by Betrem (which it never did). In 1963 Krombein placed *varifrons* as a subspecies of *nitida* and synonymized part of the material Tuijn had used to establish *varifrons cupreopennis* with *nitida varifrons* (the rest of Tuijn's material was synonymized with *nitida nitida* (Smith, 1858)). In the same work Krombein also synonymized portions of the material assigned to *punctatissima punctatissima* by Betrem in 1928 and 1933 with *nitida varifrons*.

Austroscolia soror (Smith, 1855)

Scolia cyanipennis Lepeletier, 1845: 524 [misidentification according to Smith, 1855: 96; preoccupied Fabricius, 1804]. Type data: no type designated. [Bradley & Betrem, 1967: 321–322 discuss the status and location of a type specimen but do not identify or designate a valid type].

Scolia soror Smith, 1855: 96 [[in part]; nom. nov. for *Scolia cyanipennis*, Lepeletier, 1845; dist.]; Froggatt, 1892: 207 [comb. nov.; cat.]; Dalla Torre, 1897: 183 [syn. list; dist.]; Child, 1968: 79 [brief description; fig.]; Hadlington & Johnston, 1990: 96 [photograph].

Scolia viridipennis Smith, 1855: 96 [[in part]; nom. nov. for *Scolia cyanipennis*, Lepeletier, 1845; dist.; synonymy by Saussure & Sichel, 1864: 126]; Froggatt, 1892: 207 [cat.; it is unclear whether Froggatt was aware of the synonymy of *viridipennis* with *soror* by Saussure & Sichel, he was certainly aware of their work, mentioning it in the introduction to the section on Scoliidae in his catalogue, and listing the synonyms without reference to the valid name]; Osten, 2005: 45 [cat.].

Scolia (Discolia) soror: Saussure & Sichel, 1864: 126 [comb. nov.; descr. (in latin); synonymy; dist.]; Turner, 1909a: 169 [dist., inclusion in key]; Tillyard, 1926: 295 [note]; Hawkeswood, 1990: 73, 74, 75, 77, 78, 82 [notes on behaviour at flowers; adult food source: *Bursaria spinosa* Cav. (Pittosporaceae)]; Hawkeswood, 1993: 241 [note].

Discolia soror: Froggatt, 1907: 103 [brief description and note on habits]; Jarvis, 1916: 35 [in list of predators and parasites of *Dermolepida albohirtum* (Waterhouse, 1875) (as *Lepidiota albohirta*) (Scarabaeidae)]; Dodd, 1917: 25, 26 [hosts; parasites]; Illingworth & Dodd, 1921: 80 [list]; Illingworth, 1921: 24, 39 [list; adult food sources *Eugenia* L. (Myrtaceae) and leafhopper secretions]; Clausen, 1940: 303 [brief note on some of Illingworth's work]; Brewster, Brewster & Crouch, 1946: 132, 134 [adult food sources—"Marigolds" (Asteraceae) and "pincushions" *Scabiosa*? (Dipsacaceae)].

Scolia (Austroscolia) soror: Betrem, 1928: 213 [comb. nov.; syn. list; descr. (in German); dist.]; Betrem, 1933: 254 [dist. (Australia and New Guinea)].

Austroscolia soror: Osten, 2005: 43 [cat.].

Distribution: NSW, QLD, VIC., New Guinea

Adult food sources: *Bursaria spinosa* Cav. (Pittosporaceae) (Hawkeswood, 1990: 73, 74, 75, 77, 78, 82).

Eugenia L. (Myrtaceae) and leafhopper secretions (Illingworth, 1921b: 39).

"Marigolds" (Asteraceae) and "pincushions" *Scabiosa*? (Dipsacaceae) (Brewster *et al*., 1946: 134).

Parasites: *Macrosiagon cucullatum* (Macleay, W.J., 1887) (Coleoptera: Rhipiphoridae) (Dodd, 1917: 27 (as Mordellid Sp. C. 109); subsequent identification by Illingworth, 1921: 40 (as *Emenadia cucullata*)).

Scolia Fabricius, 1775

Subgenus *Discolia* Saussure, 1863

Discolia Saussure, 1863: 18. Type species: *Scolia nobilitata* Fabricius, 1804 by subsequent designation, see Betrem & Bradley, 1964a: 433 [as subgenus of *Scolia* Fabricius, 1775; raised to generic rank by Argaman, 1996: 197 but ignored by subsequent workers; note that Ashmead, 1903: 7 designated *Scolia apicicornis* Guérin, 1838 as the type, but this was rejected by Betrem & Bradley, 1964a: 433 as *Scolia apicicornis* Guérin, 1838 was not an included species when the genus was erected].

Tonsoygata Argaman, 1996: 192. Type species: *Scolia verticalis* Fabricius, 1775 by original designation. [Synonymy by implication by Osten, 2005: 45].

Scolia (Discolia) bedoti (Betrem, 1928)

Scolia (Scolia) bedoti Betrem, 1928: 265. Type data: holotype NMBE ♀. Type locality: NSW, Sydney (as Sidney).

Scolia (Discolia) bedoti: Osten, 2005: 27 [comb. nov.; cat.; incomplete original combination given].

Distribution: NSW.

Scolia (Discolia) verticalis (Fabricius, 1775)

Scolia verticalis Fabricius, 1775: 56. Type data: holotype BMNH ♂. Type locality: Australia (as Nova Hollandia); Fabricius, 1781: 453 [descr. (in Latin); dist.]; Fabricius, 1787: 282 [descr. (in Latin)]; Gmelin, 1790: 2737 [descr. (in Latin); dist.]; Fabricius, 1793: 234 [comb. nov.; descr. (in Latin); dist.]; Fabricius, 1804: 244 [descr. (in latin); dist.]; Smith, 1855: 96 [syn. list; dist.]; Dalla Torre, 1897: 186 [syn. list; dist.]; Turner, 1909b: 485 [note]; Zimsen, 1964: 398 [notes on the type]; Simpson, 1990: 72 [host—*Protaetia fusca* (Herbst, 1790) (Coleoptera: Scarabaeidae)].

Sphex verticalis: Christ, 1791: 259 [comb. nov.; descr. (in German); dist.].

Scolia (Lacosi) tuberculiventris Saussure, 1854: 47. Type data: lectotype NMBE ♂. Type locality: Australia (as Nouvelle-Hollande). [Synonymy by Saussure and Sichel, 1864: 127].

Scolia (Discolia) verticalis: Saussure & Sichel, 1864: 127 [descr. (in Latin); synonymy; dist.]; Turner, 1909a: 169 [notes, dist., inclusion in key]; Tillyard, 1926: 294 [descr.; dist.]; Betrem & Bradley, 1964b: 93 [comb. nov.; list]; Hawkeswood, 1990: 73, 74, 75, 77, 78, 82 [notes on behaviour at flowers; adult food source: *Bursaria spinosa* Cav. (Pittosporaceae)]; Hawkeswood, 1993: 241 [note].

Scolia tuburculiventris: Froggatt, 1892: 207 [cat.].

Scolia verticollis: Froggatt, 1892: 207 [*lapsus calami* for *verticalis*; cat.].

Discolia ocina Cameron, 1903: 154 [synonymy by Betrem, 1928: 297]. Type data: type status unknown SMK ♀. Type locality: Indonesia: Java.

Scolia (Scolia) verticalis fulvifrons Betrem, 1928: 298. Type data: type status unknown BMNH ♀. Type locality: QLD, Mackay. [Synonymy by Krombein, 1963: 634].

Scolia (Scolia) verticalis verticalis: Betrem, 1928: 297 [stat. nov.; syn. list; descr. (in German); dist.].

Scolia (Scolia) verticalis: Betrem, 1933: 259 [dist.]; Krombein, 1963: 634 [stat. nov.; synonymy, descr., dist., inclusion in key].

Scolia (Discolia) verticalis verticalis: Osten, 2005: 45 [cat.; Osten also includes *Scolia erratica* Smith, 1855 and its synonym *Scolia molesta* Saussure & Sichel, 1864 in his list of synonyms of this species. In reaching this conclusion Osten cited no prior substantive evidence and I therefore hesitate to include them in the catalogue under *Scolia (Discolia) verticalis*].

Scolia (Discolia) verticalis fulvifrons: Osten, 2005: 45 [cat.; Osten resurrected this species without explanation. I have instead followed Krombein, 1963: 634 who synonymized this subspecies after examining material].

Distribution: NSW, NT, QLD, SA, VIC, WA, Indonesia?, New Guinea.

Adult food sources: *Bursaria spinosa* Cav. (Pittosporaceae) (Hawkeswood, 1990: 73, 74, 75, 77, 78, 82).

Host: *Protaetia fusca* (Herbst, 1790) (Coleoptera: Scarabaeidae) (Simpson, 1990: 72).

Diliacos Saussure and Sichel, 1864

Diliacos Saussure & Sichel, 1864: 14, 36. Type species: *Campsomeris violacea* Lepeletier, 1845 by original designation [as subgenus of *Liacos* Guérin-Méneville, 1839; most recently raised to generic rank by Bradley & Betrem, 1967: 293].

Diliacos glabrata Micha, 1927

Taxonomic decision for subspecific arrangement: Krombein, 1963: 620.

Diliacos glabrata glabrata Micha, 1927

Diliacos dubia: Kirby, 1889: 444 [♀ from Ceram only, the rest of the material a misidentification according to Krombein, 1963: 622].

Liacos (Diliacos) insularis: Turner, 1909: 168 [misidentification according to Krombein, 1963: 622; notes, dist., inclusion in key].

Liacos insularis: Illingworth, 1921: 24, 39 [list; note on habitat and breeding attempts]; Illingworth & Dodd, 1921: 80 [list]; Wood, Hasenpusch & Storey, 1996: 41, 47 [note on larvae and egg on host: *Phalacrognathus muelleri* (Macleay) (Coleoptera: Lucanidae); photograph of adult and larvae (note that the photograph shows what appears to be two larvae attached to the instar and the authors use the term larvae)].

Diliacos glabrata glabrata Micha, 1927: 75. Type data: type status unknown ZMB (possible location according to Krombein, 1963: 622) ♀. Type locality: Papua New Guinea: Goodenough Island (as Goodenough, D'Entrecasteau); Osten, 2005: 34 [cat.].

Scolia (Diliacos) morata: Betrem, 1928: 192 [misidentification according to Krombein, 1963: 622].

Scolia (Diliacos) papuasiae Betrem, 1933: 249. Type data: type status unknown BMNH ♀♂. Type locality: QLD, Mackay. [Synonymy by Krombein, 1963: 622]; Osten, 2005: 40 [cat.; incomplete original combination given].

Scolia (Diliacos) glabrata glabrata: Krombein, 1963: 622 [stat. nov.; descr.; dist.; fig.].

Diliacos glabrata glabrata: Krombein, 1968: 14 [dist.].

Distribution: QLD, New Guinea.

Host: *Phalacrognathus muelleri* (Macleay) (Coleoptera: Lucanidae) (Wood, Hasenpusch & Storey, 1996: 41, 47).

Laeviscolia Betrem, 1928

Laeviscolia Betrem, 1928: 222. Type species: *Scolia frontalis frontalis* Saussure, 1854 by original designation [as subgenus of *Scolia* Fabricius, 1775; raised to generic rank by Bradley & Betrem, 1967: 293].

Laeviscolia frontalis (Saussure, 1854)

Laeviscolia frontalis frontalis (Saussure, 1854)

Scolia frontalis Saussure, 1854: 38. Type data: lectotype NMBE ♀. Subsequent designation: Betrem, 1928: 223. Type locality: Australia (as Nouvelle-Hollande); Froggatt, 1892: 207 [comb. nov.; cat.]; Dalla Torre, 1897: 161 [syn. list; dist.].

Scolia bimaculata Smith, 1855: 115. Type data: holotype BMNH Hym. 15-1423 ♀. Type locality: NSW: Port Stephens. [Synonymized with *Scolia anthracina* Burmeister, 1853 by Saussure and Sichel, 1864: 140; current synonymy by Bradley & Betrem, 1967: 299]; Froggatt, 1892: 206 [cat.; it is unclear whether Froggatt was aware of the synonymy of *bimaculata* with *consanguinea* by Saussure & Sichel, he was certainly aware of their work, mentioning it in the introduction to the section on Scoliidae in his catalogue, and listed the synonyms without reference to the valid name]; Bradley & Betrem, 1967: 299 [syn. nov.; notes on type]; Osten, 2005: 28 [cat.].

Scolia coronata Smith, 1855: 112. Type data: lectotype BMNH ♀. Subsequent designation: Betrem in Bradley & Betrem, 1967: 301. Type locality: SA: Adelaide. [Synonymy by Saussure & Sichel, 1864: 41]; Froggatt, 1892: 206 [cat.; it is unclear whether Froggatt was aware of the synonymy of *coronata* with *frontalis* by Saussure & Sichel, he was certainly aware of their work, mentioning it in the introduction to the section on Scoliidae in his catalogue, and listed the synonyms without reference to the valid name]; Bradley & Betrem, 1967: 301 [designation of lectotype; notes]; Osten, 2005: 30 [cat.].

Scolia (Triscolia) frontalis: Saussure & Sichel, 1864: 41 [comb. nov.; descr. (in Latin); synonymy]; Tillyard, 1926: 295 [note].

Scolia (Triscolia) frontalis frontalis: Turner, 1909a: 168 [stat. nov.; descr.; dist.; inclusion in key].

Triscolia frontalis frontalis: Micha, 1927: 92, 93–96 [comb. nov.; descr. (in German); notes].

Scolia (Laeiviscolia) frontalis frontalis: Betrem, 1928: 222 [comb. nov.; syn. list; descr.; dist.].

Scolia (Laeviscolia) frontalis: Tuijn, 1961: 244 [stat. nov.?; syn. list; dist.; notes]; Krombein, 1963: 625 [synonymy, descr., dist., inclusion in key].

Laeviscolia frontalis: Bradley & Betrem, 1967: 299 [comb. nov.; synonymy of *Scolia bimaculata* Smith, 1855]; Bradley, 1974: 440 [notes on type].

Laeviscolia frontalis frontalis: Bradley & Betrem, 1967: 301 [comb. nov.; synonymy of *Scolia coronata* Smith, 1855]; Osten, 2005: 33 [cat.].

Scolia (Discolia) bimaculata: Hawkeswood, 1993: 239, 241 [adult food source—*Leucopogon parviflorus* (Andrews) Lindl. (Epacridaceae)].

Distribution: NSW, QLD, SA, VIC.

Adult food source: *Leucopogon parviflorus* (Andrews) Lindl. (Epacridaceae) (Hawkeswood, 1993: 241).

Laeviscolia frontalis nicoladonii (Dalla Torre, 1897)

Scolia laeviceps Kirby, 1889: 447. Type data: syntypes BMNH 2♀. Type locality: Australia [preoccupied Smith, 1855]; Froggatt, 1892: 207 [cat.]; Osten, 2005: 36 [cat.].

Scolia nicoladonii Dalla Torre, 1897: 171 [*nom. nov*. for *Scolia laeviceps* Kirby, 1889; syn. list; dist.].

Scolia (Triscolia) frontalis nicoladonii: Turner, 1909a: 169 [stat. nov.; descr.; dist.; inclusion in key].

Triscolia frontalis nicoladonii: Micha, 1927: 93 [comb. nov.; notes].

Scolia (Laeviscolia) frontalis nicoladonii: Betrem, 1928: 223 [comb. nov.; notes].

Laeviscolii frontalis nicoladonii: Osten, 2005: 33, 38 [cat.].

Distribution: SA?, WA?

Laeviscolia frontalis obscuriceps (Turner, 1909)

Scolia (Triscolia) frontalis obscuriceps Turner, 1909a: 168. Type data: holotype BMNH, sex unknown. Type locality: NT: Darwin (as Port Darwin).

Triscolia frontalis obscuriceps: Micha, 1927: 93 [comb. nov.; notes].

Scolia (Laeviscolia) frontalis obscuriceps: Betrem, 1928: 223 [comb. nov.; notes].

Laeviscolia frontalis obscuriceps: Osten, 2005: 33 [cat.; incomplete original combination given].

Distribution: NT.

Liacos Guérin-Méneville, 1838

Liacos Guérin-Méneville, 1838: 246 Type species: *Scolia (Liacos) dimidiata* Guérin-Méneville, 1838 (= *Scolia analis* Fabricius, 1804) by monotypy [as subgenus of *Scolia* Fabricius, 1775; Liacos has been raised to generic rank a number of times, most recently raised to generic rank by Bradley & Betrem, 1966: 73].

Tetrascolia Ashmead, 1903: 8. Type species: *Campsomeris urvillii* Lepeletier, 1845 (= *Compsomeris urvillii* Guérin, 1845; *lapsus calami* for *Campsomeris urvillii* Lepeletier, 1845) by original designation. [Synonymy by Betrem, 1928: 166 via synonymy of the type species *Campsomeris urvillii* with *Scolia dimidiata* Guérin-Méneville, 1830. Note that *Campsomeris urvilli*i has not stood as a valid species since its description and has variously been a synonym of *Scolia dimidiata* Guérin-Méneville, 1830 (see for example Dalla Torre, 1896: 154) or *Scolia analis* Fabricius, 1804 (see for example Saussure & Sichel, 1864: 33). Note also that the previous year Betrem, 1927: XCIV synonymized *Tetrascolia* Ashmead, 1903 with *Triscolia* Saussure, 1863. *Liacos dimidiata* Guérin-Méneville, 1838 has also been considered a synonym of *Scolia analis* by various workers, though in Bradley, 1972: 4–5 Betrem considers them distinct subspecies, an opinion not shared a year later by Bradley, 1973: 219. See also Argaman, 1996: 175 and Osten, 2005: 26].

Liacos fulgidipennis (Smith, 1859)

Scolia fulgidipennis Smith, 1859: 152. Type data: lectotype BMNH ♀. Subsequent designation: Bradley, 1967: 307. Type locality: Indonesia: Aru.

Scolia (Discolia) fulgidipennis: Saussure & Sichel, 1864: 109 [comb. nov.; descr. (in Latin); dist.].

Diliacos eximius Kirby, 1889: 444. Type data: type status unknown BMNH ♂. Type locality: Indonesia: Aru [preoccupied Smith, 1855: 99; Kirby based this species on the male of *Scolia fulgidipennis* Smith, 1859; synonymy by Micha, 1927: 76]; Osten, 2005: 32 [cat.; incorrect original combination given].

Diliacos fulgidipennis: Kirby, 1889: 444 [comb. nov.; provisional designation of lectotype of *Scolia fulgidipennis* Smith, 1859].

Diliacos dorycus Kirby, 1889: 445. Type data: type status unknown BMNH ♀. Type locality: Indonesia: Dorey. [Synonymy by Betrem, 1928: 175]; Osten, 2005: 31 [cat.; incorrect original combination given].

Scolia aruensis: Dalla Torre, 1897: 146 [*nom. nov.* for *Diliacos eximius* Kirby, 1889; syn. list; dist.].

Scolia dorycus: Dalla Torre, 1897: 155 [comb. nov.; syn. list; dist.].

Scolia fulgidipennis: Dalla Torre, 1897: 161 [comb. nov.; syn. list; dist].

Liacos (Diliacos) dorycus: Mantero, 1900: 590 [notes; dist.].

Discolia nigerrima: Cameron, 1911: 196 [misidentification of Smith's species, female only according to Betrem, 1928: 175; descr.; syn. list; dist].

Diliacos fulgidipennis dorycus: Micha, 1927: 76 [stat. & comb. nov.; descr. (in German); dist.].

Diliacos fulgidipennis splendidipennis Micha, 1927: 78. Type data: holotype ♀. Type locality: Queensland. [Synonymy by Betrem, 1928: 175].

Scolia (Liacos) fulgidipennis: Betrem, 1928: 175 [stat. nov.; syn. list; descr. (in German); dist.]; Betrem, 1933: 245 [notes (in German); dist.]; Tuijn, 1961: 239 [syn. list; notes]; Krombein, 1963: 609 [synonymy, descr., dist., figs., incl. in key].

Liacos fulgidipennis: Krombein, 1968: 13 [dist.]; Osten, 2005: 33 [cat.].

Distribution: QLD.

Scoliidae possibly erroneously recorded from Australia

Scolia Fabricius, 1775

Subgenus *Discolia* Saussure, 1863

Scolia (Discolia) hottentotta Saussure, 1858

Scolia (Lacosi) hottentotta Saussure, 1858: 206. Type data: holotype ZMUC ♀. Type locality: South Africa: Cape of Good Hope (as Le Cap de Bonne-Espérence); Osten, 2005: 41 [cat.].

Scolia (Lacosi) pygmaea Saussure, 1858: 217 [synonymy by Petersen, 1970: 61; Petersen, 1970: 58–61 discussed the probable type material for this species and concluded that previous designations of type material were incorrect. He declined to designate a neotype. Bradley, 1974 (with Betrem) discussed the type material of *Scolia (Lacosi) pygmaea* twice (pages 443 and 463) and gave two conflicting opinions. On page 443 they state that the lectotype is in the Geneva Museum (presumably with the Saussure Collection) but on page 463 state that the lectotype designations in the Saussure Collection are incorrect]. Type data: type status unknown ♂. Type locality: Western Australia: Swan River (as La Nouvelle-Hollande (Swan River)).

Scolia (Discolia) hottentotta: Saussure & Sichel, 1864: 89 [comb. nov.; descr. (in Latin); dist.]; Betrem, 1928: 95 [list].

Scolia (Discolia) pygmaea: Saussure & Sichel, 1864: 127 [comb. nov.; descr. (in Latin); dist.]; Turner, 1909: 169 [descr., dist., inclusion in key].

Scolia pygmaea: Froggatt, 1892: 207 [comb. nov.; cat.]; Dalla Torre, 1897: 175 [comb. nov.; syn. list; dist.].

Scolia hottentotta: Dalla Torre, 1897: 164 [comb. nov.; syn. list; dist.].

Scolia (Microscolia) pygmaea: Betrem, 1928: 207 [comb. nov.; descr. (in German); dist.; syn. list; designation of lectotype (since rebutted, see Petersen, 1970: 58)].

Scolia (Scolia) hottentotta: Petersen, 1970: 58 [comb. nov.; discussion of type material].

Scolia (Discolia) hottentotta: Osten, 2005: 35 [cat.].

Distribution: WA?

Scoliidae erroneously recorded from Australia

Dielis Saussure & Sichel, 1864

Dielis dorsata Fabricius, 1787

Elis (Campsomeris) sabulosa Saussure, 1858: 235 [misidentification of *Tiphia dorsata* Fabricius, 1787 according to Bradley, 1974: 465; synonymy by Bradley, 1974: 465].

Elis sabulosa: Froggatt, 1892: 208 [cat.].

Distribution: Neotropical region.

Dielis tolteca Saussure, 1857

Elis (Dielis) sabulosa Saussure & Sichel, 1864: 209 [misidentification of *Elis (Campsomeris) tolteca* Saussure, 1857 according to Bradley, 1974: 465].

Distribution: North America.

Austroscolia Betrem, 1927

Austroscolia punctatissima (Kirby, 1889)

Discolia punctatissima Kirby, 1889: 449 [misidentified and erroneously recorded from Australia by Betrem, 1928: 212 according to Krombein, 1963: 641].

Distribution: Solomon Islands, Papua New Guinea.

Liacos Guérin-Méneville, 1838

Liacos analis analis (Fabricius, 1804)

Scolia analis Fabricius, 1804: 245 [erroneously recorded from NSW (as Nova Cambria)] according to Betrem, 1928: 172].

Distribution: Indonesia, Philippines, Singapore.

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References

Adams, P.B., & S.D. Lawson, 1993. Pollination in Australian orchids: a critical assessment of the literature 1882–1992. *Australian Journal of Botany* 4 & 5: 553–575.

Allsopp, P.G., 1992. Volatile compounds as attractants for *Campsomeris tasmaniensis* (Saussure) (Hymenoptera: Scoliidae). *Australian Entomological Magazine* 19: 107–110.

Argaman, Q., 1996. Generic synopsis of Scoliidae (Hymenoptera, Scolioidea). *Annales Historico-Naturales Musei Nationalis Hungarici* 88: 171–222.

Ashmead, W.H., 1903. Classification of the fossorial, predaceous and parasitic wasps, or the superfamily Vespoidea. *Canadian Entomologist* 35(1): 3–8.
http://dx.doi.org/10.4039/Ent353-1

Barratt, B.I.P., 2003. *Aspects of reproductive biology and behaviours of scoliid wasps*. DOC Science Internal Series 147. Wellington: Department of Conservation pp. 1–11.

Barratt, B.I.P., B.E. Willoughby, D. Wilson, & A.M. Booth, 2002. The Yellow Flower Wasp, *Radumeris tasmaniensis* Saussure (Hymenoptera: Scoliidae): Potential threat to New Zealand native fauna. *New Zealand Plant Protection* 55: 25–29.

Beardsell, D.V., & P. Bernhardt, 1982. Pollination Biology of Terrestrial Orchids. In *Pollination '82: Proceedings of a Symposium held at the Plant Cell Biology Research Centre, School of Botany, University of Melbourne, Parkville, Vic. 3052*, ed. E.G. Williams, R.B. Knox, J.H. Gilbert, & P. Bernhardt, pp. 166–183. Melbourne: School of Botany, University of Melbourne, 197 pp.

Bequaert, J., 1926. The date of publication of the Hymenoptera and Diptera described by Guérin-Méneville in Duperrey's "Voyage de La Coquille". *Entomologische Mitteilungen* 15(2): 186–195.

Betrem, J.G., 1927. Verslag van de Twee-En-Tachtigste Zomervergadering der Nederlandsche Entomologische Vereeniging, gehouden de vaals, op Zaterdag 28 Mei 1927, des morgens te 11 uur. *Tijdschrift voor entomologie* 70(1): XCIII–XCVIII.

Betrem, J.G., 1928. Monographie der Indo-Australischen Scoliiden (Hym. Acul.) mit zoogeographischen betrachtungen. *Treubia* 9(Suppl.): 1–388.

Betrem, J.G., 1933. Die Scoliiden der Indoaustralischen und Palaearktischen Region aus dem Staatlichen Museum fur Tierkunde zu Dresden. *Stettiner Entomologische Zeitung* 94(2): 236–263.

Betrem, J.G., 1941. Etude Systematique des Scoliidae de Chine et Leurs Relations Avec Les Autres Groupes de Scoliidae. *Notes d'Entomologie Chinoise* 8(4): 47–188.

Betrem, J.G., 1962a. The Taxon *Trielis* (Hym. Scoliidae) and its Type. *Entomological News* 73(6): 146.

Betrem, J.G., 1962b. The Taxon *Dielis* (Hymenoptera: Scoliidae) and its Type. *Entomological News* 73(8): 205–207.

Betrem, J.G., 1967. The natural groups of *Campsomeriella* Betr., 1941 (Hymenoptera Scoliidae). *Entomologische Berichten* 27: 25–29.

Betrem, J.G., 1972. The African Campsomerinae. *Monografieen van de Nederlandse Entomologische Vereniging* 6: 1–326; 6 plates.

Betrem, J.G., & J.C. Bradley, 1964a. Annotations on the genera *Triscolia, Megascolia* and *Scolia* (Hymenoptera, Scoliidae). *Zoologische Mededelingen (Leiden)* 39(24): 433–444.

Betrem, J.G., & J.C. Bradley, 1964b. Annotations on the genera *Triscolia, Megascolia* and *Scolia* (Hymenoptera, Scoliidae) (second part). *Zoologische Mededelingen (Leiden)* 40(11): 89–96.

Bingham, C.T., 1897. *Fauna of British India, including Ceylon and Burma. Hymenoptera. Vol. 1. Wasps and Bees*. Taylor and Francis. xxix+579 pp.

Bower, C.C., & P. Branwhite, 1993. Observations on the Pollination of *Calochilus campestris* R.Br. *The Orchadian* 11(2): 68–71.

Bradley, J.C., 1964a. The Fabrician types of Scoliidae (Hymenoptera). *Spolia Zoologica Musei Hauniensis* 21: 1–38.

Bradley, J.C., 1964b. The type-specimens of the Scoliidae described by Amedee Lepeliter, Comte de Saint-Fargeau (with notes by J.G. Betrem) and by the Marchese Massimiliano Spinola. *Annali del Museo civico di storia naturale di Genova* 74: 186–196.

Bradley, J.C., 1973. The Scoliid Types of Guérin-Méneville (Insecta: Hymenoptera: Scoliidae). *Bulletin du Muséum National D'Histoire Naturelle* (3)112: 217–221.

Bradley, J.C., 1974. The types of the Scoliidae (Hymenoptera) described by Henry de Saussure or by Jules Sichel, or by them jointly. *Revue suisse de Zoologie* 81(2): 417–485.

Bradley, J.C., & J.G. Betrem, 1966. Burmeister's work on Scoliidae with especial reference to types and synonymy. *Beiträge zur Entomologie* 16(1/2): 73–84.

Bradley, J.C., & J.G. Betrem, 1967. The types of Scoliidae described by Frederick Smith (Hymenoptera). *Bulletin of the British Museum (Natural History). Entomology* 20(7): 289–327.

Brewster, M.N., A.A. Brewster, & N. Crouch, 1946. *Life Stories of Australian Insects*. Sydney: Dymocks viii+332 pp.

Burmeister, H., 1854. Bemerkungen über den allegemeinen Bau und die Geschlechtsunterschiede bei den Arten der Gattung *Scolia* Fabr. *Abhandlungen der Naturforschenden Gesellschaft zu Halle* 1(4): 1–46, 1 plate.

Cameron, P., 1892. Hymenoptera Orientalis; or Contributions to a knowledge of the Hymenoptera of the Indian Zoological Region. *Memoirs and Proceedings of the Manchester Literary & Philosophical Society* (4)5: 97–137.

Cameron, P., 1903. Descriptions of new genera and species of Hymenoptera taken by Mr. Robert Shelford at Sarawak, Borneo. *Journal of the Straits Branch of the Royal Asiatic Society* 39: 89–181.

Cameron, P., 1905. On the Malay fossorial Hymenoptera and Vespidae of the Museum of the Royal Zool. Soc. "Natura Artis Magistra" at Amsterdam. *Tijdschrift voor entomologie* 48: 48–78.

Cameron, P., 1906a. Hymenoptera of the Dutch Expedition to New Guinea in 1904 and 1905. Part I: Thynnidae, Scoliidae, Pompilidae, Sphegidae and Vespidae. *Tijdschrift voor entomologie* 49(4): 215–233.

Cameron, P., 1906b. Hymenoptera I (all families except Apidae and Formicidae). *Nova Guinea* 5. Zoologie: 41–65.

Cameron, P., 1911. Hymenoptera (except Anthophila and Formicidae). *Nova Guinea* 9: 185–248.

Child, J., 1968. *Australian Insects*. Melbourne: F.W. Cheshire Publishing Pty Ltd and Lansdowne Press Pty Ltd. rev. edn. x+109 pp.

Christ, J.L., 1791. *Naturgeschichte, Klassification, und Nomenclatur der Insekten vom Bienen, Wespen, und Ameisengeschlect: als der fünften Klasse fünfte Ordnung des Linneischen Natursystems von dem Insekten: Hymenoptera. Mit häutigen Flügeln*. Frankfurt am Main: Publisher Unknown. Pp. 1–535, plates I–LX.

Ciotek, L., P. Giorgis, S. Benitez-Vieyra, & A.A. Coccuci, 2006. First confirmed case of pseudocopulation in terrestrial orchids of South America: Pollination of *Geoblasta pennicillata* (Orchidaceae) by *Campsomeris bistrimacula* (Hymenoptera, Scoliidae). *Flora* 201(5): 365–369.

Clausen, C.P., 1940. *Entomophagous Insects*. New York and London: McGraw-Hill.

Dalla Torre, C.G. de, 1897. *Catalogus hymenopterorum hucusque descriptorum systematicus et synonymicus. Fossores (Sphegidae)*. Leipzig: G. Engelmann. Vol. 8. pp. 1–749.

Darling, D.C., 1996. Generic Concepts in the Perilampidae (Hymenoptera: Chalcidoidea): An Assessment of Recently Proposed Genera. *Journal of Hymenoptera Research* 5: 100–130.

Day, M.C., G.R. Else, & D. Morgan, 1981. The most primitive Scoliidae (Hymenoptera). *Journal of Natural History* 15(4): 671–684.

Dodd, A.P., 1917. The Cane Grubs of Australia. Part II. Being a continuation of the results of investigations as commenced in Bulletin No. 2. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 6: 1–30.

Fabricius, J.C., 1775. *Systema Entomologicae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, Descriptionibus, observationibus*. Korte, Flensburgi et Lipsiae. 832 pp.

Fabricius, J.C., 1781. *Species Insectorum exhibentes eorum differentias specificas, synonyma auctorum, loca natalia, metamorphosis adiectis observationibus, descriptionibus.* Hamburgi er Lionii [= Hamburg & Cologne]: C.E. Bohni. Tom. 1.

Fabricius, J.C., 1787. *Mantissa insectorum sistens species nuper detectas adiectis characteribus genericis, differentiis specificis, emendationibus, observationibus.* Hafniae: Proft. Vol. 1, 348 pp.

Fabricius, J.C., 1793. *Entomologia systematica emendata et aucta. Secundum classes, ordines, genera, species, adjectis synonimis, locis observationibus, descriptionibus. Tome 2.* Copenhagen [=Hafniae]: C. G. Proft. 519 pp.

Fabricius, J.C., 1804. *Systema Piezatorum*. Brunsvigae. Pp. 1–439.

Fordham, F., 1946. Pollination of *Calochilus campestris. Victorian Naturalist* 62: 199–201.

Froggatt, W.W., 1892. Catalogue of the described Hymenoptera of Australia. Part 2. *The Proceedings of the Linnean Society of New South Wales* (2)7: 205–248.

Froggatt, W.W., 1902a. A Natural Enemy of the Sugar Cane Beetle in Queensland. *The Agricultural Gazette of New South Wales* 13(1): 63–68, 1 plate. (Also reprinted as Froggatt, W.W. (1902b).

Froggatt, W.W., 1902b. A Natural Enemy of the Sugar Cane Beetle in Queensland. *The Agricultural Gazette of New South Wales. Miscellaneous Publication* no. 548: 1–6, 1 plate.

Froggatt, W.W., 1907. *Australian Insects*. Sydney: William Brooks pp. 1–449, 37 plates.

Girard, M., 1879. *Traité élémentaire d'entomologie comprenant l'histoire des espèces utiles et de leurs produits des espèces nuisibles et des moyens de les détruire, l'étude des métamorphoses et des moeurs, les procédés de chasse et de conservation par Maurice Girard.* Paris: J. B. Baillière et Fils. 1028 pp.

Gmelin, J.F., 1790. *Caroli a Linné Systema Naturae.* Lipsiae: Georg Emanuel Beer. Vol. 1(5) pp. 2225–3020.

Goode, J., 1980. *Insects of Australia*. Australia: Angus & Robertson. x+260 pp.

Gray, G.R., 1832. Insecta: Notices of new genera and species. *In,* Griffith, E. and Pidgeon (ed.) *The Animal Kingdom arranged in conformity with its organization, by the Baron Cuvier, with supplementary additions to each order*. London: Whittaker, Treacher and Co. Vol. 15. 796 pp.

Gribodo, G., 1893. Descrizione di un nuovo genere e di nuove specie di Imenotteri Scolidei con osservazioni sopra specie gia conosciute. *Bullettino della Società Entomologica Italiana* 25: 145–185.

Guérin-Méneville, F.É., 1835. *Iconographie du Règne Animal de G. Cuvier, ou représentation d'après nature de l'une des espèces les plus remarquables et souvent non encore figurées, de chaque genre d'animaux; pouvant servir d'atlas à tous les traités de zoologie.* Paris: J.B. Baillière. Livraison 39. 10 pl.

Guérin-Méneville, F.É., 1838. Histoire Naturelle des Crustacés, Arachnides et Insectes, recueillis dans le voyage autour du Monde de la Corvette de S.M. la Coquille, exécuté pendant les anées 1822–1825 sous le commandement du capitaine Duperry. In *Voyage Autour du Monde, exécuté par ordre du Roi, sur la corvette de S.M. la Coquille, pendant les anées 1822–1825. Zoologie*, L.I. Duperrey, pp. 57–302. Paris: Arthus Bertrand. Vol. 2. 319 pp.

Guérin-Méneville, F.É., 1844. *Iconographie du Règne Animal de G. Cuvier, ou représentation d'après nature de l'une des espèces les plus remarquables et souvent non encore figurées, de chaque genre d'animaux; pouvant servir d'atlas à tous les traités de zoologie.* Paris: J.B. Baillière. 576 pp.

Hadlington, P.W., & J.A. Johnston, 1990. *An Introduction to Australian Insects*. Kensington: New South Wales University Press, viii+116 pp.

Hardy, G.H., 1922. Australian Bombylidae and Cyrtidae (Diptera). *Papers & Proceedings of the Royal Society of Tasmania* 1921: 41–83.

Hawkeswood, T.J., 1982. Notes on Insect Pollination of Two Species of *Eucalyptus* (Myrtaceae) from South-West Western Australia. *Victorian Naturalist* 99: 28–37.

Hawkeswood, T.J., 1990. lnsect pollination of *Bursaria spinosa* (Pittosporaceae) in the Armidale area, New South Wales, Australia. *Giornale Italiano di Entomologia* 5: 67–87.

Hawkeswood, T.J., 1991. Insect pollination of *Acacia bidwillii* Benth. (Mimosaceae) at Townsville, northern Queensland, Australia. *Giornale Italiano di Entomologia* 5: 219–238.

Hawkeswood, T.J., 1993. Observations on insect pollination of *Melaleuca lanceolata* Otto and *Verticordia picta* Endl. *(Myrtaceae), Leucopogon parviflorus* (Andr.) Lindl. *(Epacridaceae)* and *Eryngium pinnatifidum* Bunge *(Apiaceae)* in Western Australia. *Giornale Italiano di Entomologia* 6: 239–242.

Illingworth, J.F., 1919a. Cane grub investigation. *Queensland Agricultural Journal* 12(4): 204–207.

Illingworth, J.F., 1919b. Combating insect pests. *The Australian Sugar Journal* 11(9): 438–439.

Illingworth, J.F., 1919c. Monthly notes on grubs and other cane pests. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 7: 1–29.

Illingworth, J.F., 1919d. Monthly notes on grubs and other cane pests (second series). *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 8: 1–51.

Illingworth, J.F., 1919e. A successful method of breeding parasites of White Grubs. *Journal of Economic Entomology* 12: 455–457.

Illingworth, J.F., 1921. Natural enemies of sugar-cane beetles in Queensland. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 13: 1–47, VIII Plates.

Illingworth, J.F., & A.P. Dodd, 1921. Australian sugar-cane beetles and their allies. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 16: 1–104.

Illingworth, J.F., & E. Jarvis, 1918a. Cane grub investigation. *Queensland Agricultural Journal* 9(1): 24–26.

Illingworth, J.F., & E. Jarvis, 1918b. Cane grub investigation. *Queensland Agricultural Journal* 9(1): 72–73.

Illingworth, J.F., & E. Jarvis, 1918c. Cane grub investigation. *Queensland Agricultural Journal* 9(3): 115–116.

Illingworth, J.F., & E. Jarvis, 1918d. Combating insect pests. *The Australian Sugar Journal* 10(1): 66–67.

Illingworth, J.F., & E. Jarvis, 1918e. Combating insect pests. *The Australian Sugar Journal* 10(2): 121–122.

Illingworth, J.F., & E. Jarvis, 1918f. Predaceous enemies of the sugar-cane and their parasites. *Queensland Agricultural Journal* 9(6): 229–230.

Illingworth, J.F., & E. Jarvis, 1920. Cane grub investigation. *Queensland Agricultural Journal* 13(1): 33–36.

International Commission on Zoological Nomenclature, 1999. *International Code of Zoological Nomenclature*. 4th edn. London, United Kingdom (English).

Jarvis, E., 1914. Cane grub destruction. *The Australian Sugar Journal* 6: 582–584.

Jarvis, E., 1915. Combating insect pests. *The Australian Sugar Journal* 7: 525–529.

Jarvis, E., 1916. Notes on insects damaging sugar-cane in Queensland. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 3: 1–48.

Jarvis, E., 1919. Insect friends of the canegrower. *Queensland Agricultural Journal* 12(6): 301–304.

Jarvis, E., 1921. Entomological notes. *Queensland Agricultural Journal* 16(5): 321–324.

Jarvis, E., 1929. Some notes on the economy of Cockchafer Beetles. *Queensland Bureau of Sugar Experimental Stations. Division of Entomology. Bulletin* 20: 1–49.

Jarvis, E., 1932. The biological control of cane-grubs. *Tropical Agriculture* 9(11): 331–333.

Jones, D.L., & B. Gray, 1974. The pollination of *Calochilus holtzei* F. Meull. *American Orchid Society Bulletin* 43: 604–606.

Kim, J.K., 2009. Taxonomic review of the tribe Campsomerini (Scoliinae, Scoliidae, Hymenoptera) in Korea. *Korean Journal of Systematic Zoology* 25(1): 99–106.

Kimsey, L.S., 2009. Taxonomic purgatory: sorting out the wasp genus *Myzinum* Latreille in North America (Hymenoptera, Tiphiidae, Myzininae). *Zootaxa* 2224: 30–50.

Kirby, W.F., 1889. Descriptions of new species of Scolidae in the collection of the British Museum, with occasional reference to species already known. *The Transactions of the Entomological Society of London* 1889: 443–454.

Krombein, K.V., 1963. The Scoliidae of New Guinea, Bismarck Archipelago and Solomon Islands. *Nova Guinea, Zoology* 22: 543–651.

Krombein, K.V., 1968. Records and descriptions of additional Scoliidae from New Guinea, Bismarck Archipelago, and Solomon Islands (Hymenoptera: Aculeata). *Proceedings of the United States National Museum* 125(3659): 1–19.

Krombein, K.V., 1978. Biosystematic studies of Ceylonese wasps, II: a monograph of the Scoliidae (Hymenoptera: Scolioidea). *Smithsonian Contributions to Zoology*. Number 283. iv+1–56.

Lepeletier, A. St. Fargeau de, 1845. *Histoire Naturelles des Insectes; Hyménoptères*. Paris: Roret Vol. 3 pp. 1–646.

Logan, D.P., 1999. Insect parasites of scarabs from sugarcane fields in southern Queensland (Coleoptera: Scarabaeidae). *Australian Journal of Entomology* 38: 382–384.
http://dx.doi.org/10.1046/j.1440-6055.1999.00115.x

Lopez, A.W., 1933. II. Progress report on the exchange of Scoliid wasps with Australia. *International Society of Sugar Cane Technologists. Bulletin* no. 50: 6–9.

Mantero, G., 1900. Viaggio di Lamberto Loria Nella Papuasia Orientale XXV. *Annali del Museo Civico di Storia Naturale di Genova* (2)20(49): 580–592.

Micha, I., 1927. Beitrag zur Kenntniss der Scoliiden (Hym. Acul.) (*Liacos* Guer., *Diliacos* Sauss. Sich. und *Triscolia* Sauss. Sich.). *Mitteilungen aus dem Zoologischen Museum in Berlin* 13(1): 1–156.

Mocsáry, A., 1896. Species Hymenopterorum magnificae novum in collectione Musaei Nationalis Hungarici. *Természetrajzi Füzetek* 19: 1–8.

Naumann, I.D., 1991. Hymenoptera. (Wasps, bees, ants, sawflies). 61. Scoliidae. In *The Insects of Australia. Volume II*, ed. I.D. Naumann *et al*., pp. 978–979. Melbourne: Melbourne University Press, 2nd edn.

Nicholls, W.H., 1951. *Orchids of Australia*. Melbourne: Georgian House.

Nicholls, W.H., 1969. *Orchids of Australia*. Melbourne, Sydney: Thomas Nelson (Australia).

Osten, T., 2005. Checkliste der Dolchwespen der Welt (Insecta: Hymenoptera, Scoliidae). Teil 1: Proscoliinae und Scoliinae: Campsomerini. Teil 2: Scoliinae: Scoliini. Teil 3: Literatur. *Bericht der Naturforschenden Gesellschaft Augsburg* 62(220–221): 1–62.

Petersen, B., 1970. Some records of Indo-Australian Scoliidae (Hym.), with notes on a case of character release in a *Campsomeria* species. *Entomologiske Meddelelser* 38: 15–67.

Rawnsley, V., 2006. *Observations of Yellow Flower Wasp Activity at Butlers Creek, Ninety Mile Beach*. DOC Research & Development Series 242. Wellington: Department of Conservation pp. 1–14.

Roemer, J.J., 1789. *Genera insectorum Linnaei et Fabricii iconibus illustrata*. Vitoduri Helvetorum (=Winterthur, Switz): Henric Steiner 86 pp. with plates and engravings.

Riek, E.F., 1970. Hymenoptera (wasps, bees, ants). In *The Insects of Australia. A Textbook for Students and Research Workers*, ed. CSIRO, pp. 867–959. Melbourne: Melbourne University Press.

Saussure, H.L.F. de, 1854. Mélanges Hyménoptérologiques. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève* 14: 1–64.

Saussure, H., 1858. Description de Diverses Especes Nouvelles ou peu Connues du Genre *Scolia*. *Annales de la Société Entomologique de France* (3)6: 193–249.

Saussure, H.L.F. de, 1859. Description d'une série d'Hymenoptéres nouveaux de la tribu des Scoliens. *Stettiner Entomologische Zeitung* 20: 260–269.

Saussure, H. de, 1863. Sur quelques Scolies de Basse-Californie. *Annales de la Société Entomologique de France* (4)3: 17–19.

Saussure, H. de, & J. Sichel, 1864. *Catalogue des espèces de l'ancien genre* Scolia*, contenant les diagnoses, les descriptions et la synonymie des espèces, avec des remarques explicatives er critiques.* Genève & Paris: Henri Georg & V. Masson et Fils pp. 1–350.

Schulz, W.A., 1905. Ein Beitrag zur Kenntnis der papuanischen Hymenopteren-Fauna. *Berliner entomologische Zeitschrift* 49: 209–239.

Schulz, G.L., 1908. Fossores. In *Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise*, ed. W. Michaelsen & R. Hartmeyer, pp. 447–488. Jena: G. Fischer. Vol. 1(13) 488 pp.

Shuckard, W.E., 1840. On the history and natural arrangement of insects. In *Lardner's Cabinet Cyclopedia*, ed. W. Swainson & W.E. Shuckard, pp. 1–406. London: Publisher Unknown.

Shuckard, W.E., 1841. Proceedings of the Entomological Society. *The Annals and Magazine of Natural History* 6: 482.

Shuckard, W.E., 1842. Description of *Scolia fulva. The Transactions of the Entomological Society of London* 3: 222.

Simmonds, F.J., 1969. Biological control of sugar cane pests: a general survey. In *Pests of Sugar Cane*, ed. J.R. Williams, J.R. Metcalfe, R.W. Mungomery, & R. Mathes, pp. 461–479. Amsterdam, London, New York: Elsevier, xiii+568 pp.

Simpson, G.B., 1990. Immature stages of *Protaetia fusca* (Herbst) (Coleoptera: Scarabaeidae: Cetoniinae) with notes on biology. *Journal of the Australian Entomological Society* 29: 67–73.
http://dx.doi.org/10.1111/j.1440-6055.1990.tb00317.x

Smith, F., 1855. *Catalogue of hymenopterous insects in the collection of the British Museum. Mutillidae and Pompilidae.* London: B.M.N.H. Vol. 3 pp. 1–206.

Smith, F., 1860. Catalogue of hymenopterous insects collected by Mr A. R. Wallace in the islands of Bachian, Kaisaa, Amboyna, Gilolo, and at Dory in New Guinea. *Journal of the Proceedings of the Linneaen Society. Zoology* 5: 93–143.

Smith, F., 1868. Descriptions of aculeate Hymenoptera from Australia. *The Transactions of the Entomological Society of London* 1868: 231–258.

Sulzer, J.H., 1776. *Dr. Sulzers Abgekürtze Geschichte der Insecten: nach dem Linaeischen System. Erster Theil*. H. Steiner: Winterthur i–xxviii, 1–274 pp., 32 plates.

Tillyard, R.J., 1926. *The Insects of Australia and New Zealand*. Sydney: Angus and Robertson.

Tryon, H., 1902a. A parasite of sugar-cane beetle grubs. (*Dielis formosus* Guerin). *The Sugar Journal and Tropical Cultivator* 11: 151–154 (reprinted in expanded form as Tryon, 1902b).

Tryon, H., 1902b. A parasite of sugar-cane beetle grubs (*Dielis formosus* Guerin). *Queensland Agricultural Journal* 10(2): 133–140.

Tryon, H., 1909. A cane grub parasite. *The Australian Sugar Journal* 1: 79–82.

Tryon, H., 1911. Grub pest of sugar cane: a neglected aspect. *The Australian Sugar Journal* 2: 532–537.

Tuijn, P., 1961. Annotated list of the Scoliidae of New Guinea in the Leiden Museum (Hymenoptera). *Nova Guinea, Zoology* 13: 227–244.

Turner, R.E., 1909a. A revision of the Australian species of the genus *Scolia. The Annals and Magazine of Natural History* (8)4: 165–176.

Turner, R.E., 1909b. Remarks on some genera of the Scoliidae, with descriptions of new species. *The Annals and Magazine of Natural History* (8)3(18): 476–486.

Turner, R.E., 1910. Notes on the Scoliidae. *The Transactions of the Entomological Society of London* 1910(4): 391–406.

Turner, R.E., 1911. Notes on fossorial Hymenoptera. V. *The Annals and Magazine of Natural History* (8)8(47): 602–624.

Turner, R.E., 1915. Notes on Fossorial Hymenoptera—XVI. *The Annals and Magazine of Natural History* (8)15(90): 537–559.

Wilson, F., 1960. *A Review of Biological Control of Insects and Weeds in Australia and Australian New Guinea*. Commonwealth Institute of Biological Control Technical Report No. 1. Farnham Royal, Bucks, England: Commonwealth Agricultural Bureaux.

Wilson, G., 1969. White grubs as pests of sugar cane. In *Pests of Sugar Cane*, ed. J.R. Williams, J.R. Metcalfe, R.W. Mungomery, & R. Mathes, pp. 237–258. Amsterdam, London, New York: Elsevier, xiii+568 pp.

Wood, G.A., J. Hasenpusch, & R.I. Storey, 1996. The life history of *Phalacrognathus muelleri* (Macleay) (Coleoptera: Lucanidae). *Australian Entomologist* 23(2): 37–48.

Yeates, D.K., D.P. Logan, & C. Lambkin, 1999. Immature stages of the bee fly *Ligyra sotyrus* (F.) (Diptera: Bombyliidae): A hyperparasitoid of canegrubs (Coleoptera: Scarabaeidae). *Australian Journal of Entomology* 38: 300–304. http://dx.doi.org/10.1046/j.1440-6055.1999.00127.x

Zimsen, E., 1964. *The Type Material of I.C. Fabricius*. Copenhagen, Denmark: Munksgaard pp. 1–656.

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