THE SYSTEMATICS OF THE AUSTRALASIAN EUNOTINAE (HYMENOPTERA: PTEROMALIDAE)

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...it is written that animals are divided into (a) those that belong to the Emperor, (b) embalmed ones, (c) those that are trained, (d) suckling pigs, (e) mermaids, (f) fabulous ones, (g) stray dogs, (h) those that are included in this classification, (i) those that tremble as if they were mad, (j) innumerable ones, (k) those drawn with a very fine camel's hair brush, (l) others, (m) those that have just broken a flower vase, (n) those that resemble flies from a distance.

Celestial Emporium of Benevolent Knowledge
Chinese encyclopedia

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ABSTRACT

A systematic revision of the tribe Moranilini (Pteromalidae: Eunotinae) is presented. The tribe has an Australasian, particularly Australian, distribution and its members are mostly parasitoids and egg predators of coccoids (Hemiptera). Thirteen genera are recognised: *Amoturella* Girault, *Aphobetus* Howard, *Australeunotus* Girault, *Australurios* Girault, *Eunotomyiia* Girault, *Globonila* Bouček, *Hirtonila* Bouček, *Ismaya* Bouček, *Kneva* Bouček, *Moranila* Cameron, *Ophelosia* Riley, *Tomicobiella* Girault and *Tomicobomorpha* Bouček. *Modronila* Bouček, *Pidinka* Bouček and *Strionila* Bouček are regarded as junior synonyms of *Aphobetus* Howard. Sixty-four species are described; 33 species are new and 31 are redescriptions of (mainly) Girault species. The following new species are described: *Amoturella brindabellensis*; *Aphobetus cultratus*, *A. erroli*, *A. garretti*, *A. paucisetosus*, *A. reticulatus*, *A. singeri*, *A. vandiemenensis*; *Eunotomyiia jamesii*; *Ismaya naumanni*; *Moranila aotearoae*, *M. basalis*, *M. bicolor*, *M. gullanae*, *M. longisetosa*, *M. maculata*, *M. punctata*, *M. striata*, *M. strigaster*; *Ophelosia australis*, *O. biaki*, *O. brevisetosa*, *O. charlesii*, *O. josephinae*, *O. mcglashani*, *O. missimi*, *O. odiosa*, *O. rieki*, *O. stenopteryx*, *O. tasmaniensis*; *Tomicobiella arsenei*, *T. giraulti* and *T. philiporum*. The following species are redescribed: *Amoturella saintpierrei* Girault; *Aphobetus cyanea* (Bouček), *A. goldsmithii* (Girault), *A. lecanii* (Girault), *A. maskelli* Howard, *A. moundi* (Bouček), *A. nana* (Bouček), *A. silvifilia* (Girault); *Australeunotus ruskini* Girault; *Australurios longispina* Girault; *Eunotomyiia corvus* Girault; *Globonila parva* Bouček; *Hirtonila dispar* Bouček; *Ismaya brevis* Bouček; *Kneva plana* Bouček; *Moranila baeusomorpha* (Girault), *M. brunneventris* (Girault), *M. californica* (Howard), *M. comperei* Ashmead, *M. pini* Girault, *M. viridivertex* Girault; *Ophelosia bifasciata* Girault, *O. crawfordi* Riley, *O. hypatia* Girault, *O. indica* Farooqi, *O. keatsi* Girault, *O. leai* Dodd, *O. saintpierrei* Girault; *Tomicobiella subcyanea* Girault, *Tomicobomorpha stellata* Girault and *Tomicobomorpha subplana* Bouček. Eleven synonymies are made at the species level, as follows (senior synonym first): *Moranila baeusomorpha* (Girault) = *Moranila australica* (Girault); *Moranila comperei* (Ashmead) = *Tomocera saissetiae* Girault, *T.*

transversifasciata Girault and *T. io* (Girault); *Ophelosia bifasciata* Girault = *O. viridinotata* Girault and *O. aligherini* (Girault); *O. crawfordi* Riley = *O. sulcata* Girault; *O. hypatia* Girault = *O. lucretti* Girault; *O. keatsi* Girault = *O. horatii* Girault; *O. leai* Dodd = *O. aligherini* Girault; *O. saintpierrei* Girault = *O. pinguis* Girault. The problematic status of the monotypic genus *Australurios* Girault is discussed. Lectotypes are designated for the following species: *Aphobetus maskelli*, *Australurios longispina*, *Tomocera transversifasciata*, *T. pini*, *Moranila viridivertex*, *Ophelosia sulcata*, *O. lucretii* and *O. leai*. Keys to the genera of Moranilini and species of all polytypic genera are presented. Distribution maps are provided for all species.

A phylogenetic analysis was carried out to assist in making decisions regarding the monophyly of genera. The programme PAUP, version 3.1.1., was used. Four taxa from the subfamily Eunotinae were used as outgroups; three species from the Eunotini and one from the Tomocerodini. The Eunotini is considered to be the basal tribe in the subfamily. A Permutation Tail Probability (PTP) test indicated that the data set had significant cladistic structure. The validity of various monophyletic groupings, both those produced by the analysis and those previously existing, were assessed using Topology-dependant PTP (T-PTP) tests. The results of the T-PTP tests supported making four generic synonymies, three of which were made (above) and one rejected due to inadequacies of the data set. The study reduced the number of monotypic genera in the tribe from 12 to five by addition of species and by generic synonymy.

Evidence from host relationships, biogeographic events and the phylogeny suggests that the Moranilini originated in Australia and that a minimum of five dispersal events to New Zealand occurred. A vicariance argument to account for the biogeography of the tribe would require some moraniline lineages to have been in existence for a minimum of around 80 million years. This is considered unlikely. It is not known whether the tribe Moranilini occurs in South America. Confirmation of the presence of endemic moranilines in South America would suggest a minimum age for the tribe of around 55 million years.

The biological control of three species of *Pseudococcus* (*P. longispinus, P. calceolariae* and *P. affinis*) which are pests in New Zealand is discussed. Two of

these species, and possibly the third, are of Australian origin. Using host relationship and distribution data, it is concluded that all known natural enemies of the pest species within the Moranilini are already present and well established in New Zealand. Further research on the Australian moranilines whose host relationships are not known is recommended, especially the genus *Ophelosia* and the species *Ophelosia leai.*

A catalogue of the Moranilini, a character list, the data matrix and the consensus tree from the analysis, a host/parasitoid list and distribution maps for each species are included as Appendices.

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1.1 Introduction: Current status of pteromalid taxonomy

The higher level classification of the group of microhymenoptera known as the "chalcidoids" has a confused history. The use of the name Chalcidoidea dates from Ashmead (1899), who upgraded the family Chalcididae to superfamily rank, recognising 14 families. Since that time the number of families recognised has ranged from one (Handlirsch, 1925) to 24 (Nikol'skaya, 1952). At present 21 families are almost universally accepted as valid, including the recently described endemic New Zealand family Rotoitidae (Bouček, 1988a).

The Pteromalidae makes up one of the largest families within the Chalcidoidea, and at present consists worldwide of about 3,000 (2,800: Grissell and Schauff, 1990; 3,100: Gauld and Bolton, 1988) morphologically and biologically diverse species. Although they have always been recognised as a group within the chalcidoids, the history of the Pteromalidae is as confused as that of the superfamily into which it fits. Family composition varies from author to author, and now includes many subfamilies which were formerly ranked as separate families, *e.g.* Cleonyminae, Spalangiinae, Miscogasterinae, Ormocerinae, Pireninae and Sphegigasterinae (Bouček, 1988b). Other groups with current family rank have at times been included as subfamilies in the Pteromalidae, *e.g.* Perilampidae, Eucharitidae and Ormyridae. Grissell and Schauff (1990) regard the Pteromalidae as the most artificial grouping within the Chalcidoidea, and according to Heraty and Darling (1984) the family is a repository for monophyletic (see below) groups not readily placed into other families and not considered to warrant separate family status. There is no doubt that the Pteromalidae includes many highly specialised smaller groups, which makes it almost impossible to define the group's common features. Bouček (1988b) cites examples of character states diagnostic of most pteromalids, but recognises that there are no universally diagnostic features. Some subfamilies stand out as being particularly derived (or apomorphic), but they can be recognised as being related to progressively less derived (or plesiomorphic) groups (detailed in Bouček 1988b).

Thus the family limits are not yet certain, but Bouček's recent revision (1988a) has provided some stability. This work recognises 28 subfamilies in the Australasian region; only the Ceinae, Philomidinae, Neodiparinae and Cratominae are absent (Naumann, 1991).

For a stabilised system, it is necessary to have clear definitions of all subfamilies based on characters which can withstand any deep analysis, cladistic or otherwise. These units should represent natural groupings (monophyletic lineages), from which a stable system of classification can be built. A high priority for a revised classification of the Chalcidoidea is to document the monophyly of the Pteromalidae or to subdivide the family into monophyletic groups. This study is an attempt to present a definition of one such unit, the tribe Moranilini (Pteromalidae: Eunotinae).

1.2 Taxonomic history of the Eunotinae

The eunotines were first mentioned as a group by Walker (1872), who called them a "small, distinct family". They were formally called the subfamily Eunotinae by Ashmead (1904), who included the following genera: *Anysis* Howard, *Cardiogaster* Motschulsky, *Cephaleta* Motschulsky, *Euargopelte* Förster, *Eurycranium* Ashmead, *Eunotus* Walker, *Mnoonema* Motschulsky, *Muscidea* Motschulsky, *Scutellista* Motschulsky and *Solenoderus* Motschulsky. Of these genera only *Scutellista* and *Cephaleta* occur in Australasia; both have probably been introduced from the Oriental region (Bouček, 1988a).

In his 1988a revision Bouček erected three tribes:

i) Eunotini: characterised by regular, short pilosity over the whole scutellum and by the posterior of the scutellum being produced over the propodeum. There are five genera in the tribe, all of which are from the Northern Hemisphere, but two have secondarily Australasian distributions.

ii) Tomocerodini: characterised by the scutellar pilosity being restricted to two pairs of setae (usually), and the second gastral tergite being longer than the first. This tribe is composed of one genus which occurs only in Mexico and Arizona.

iii) Moranilini: characterised by the first gastral tergite being the longest, usually covering more than half the gaster. Bouček (1988a) included 16 genera in this

group; all are almost exclusively southern in distribution.

The tribes Eunotini and Tomocerodini are thus Northern Hemisphere (Nearctic) in distribution, and the Moranilini are almost exclusively southern (Oriental and Australian). I have confined this study to the Australasian (*sensu* Bouček, 1988a) species of the subfamily, effectively limiting it to the tribe Moranilini.

Bouček's revision (1988a) included 16 genera in the Moranilini (Appendix I). The only two relatively speciose genera were *Ophelosia* Riley (15 species) and *Moranila* Cameron (10 species). *Aphobetus* Howard contained four species and *Tomicobomorpha* Girault two species. The remaining 12 genera (75% of the tribe) were monotypic (genera with only one species described). Such a high level of monotypy suggests a) that many species in these genera have yet to be collected or b) that the generic concept used by the author is not correct *i.e.* the monotypic genera may be derived members of some larger genera and have been separated on the basis of one or two autapomorphies (uniquely derived character states), but they more properly belong in these larger genera.

1.2.1 A. A. Girault

Much of the descriptive work on Australian Chalcidoidea was carried out by Alexandre Girault between 1912 and 1941. Although his knowledge of the Australian fauna was extensive, Girault created many problems for taxonomists who follow him. One of the most serious of these is the quality of his types, which are in notoriously bad condition. Girault was convinced that the shape of the mandibles was an extremely important character and almost always crushed the head of the type specimen in order to make slide mounts. In this way, many important characters on the head were completely destroyed. The task of matching morphological species to badly damaged type specimens in order to unravel the taxonomy of the group is a difficult one. Another important problem is the poor quality of Girault's descriptions. In the context of the time they were probably no better or worse than many others, but the problem is compounded when coupled with the lack of usable type specimens.

Girault described 31 species of Moranilini in 14 genera (Bouček's synonymies

are presented in Appendix I). He misplaced some of the genera in some other groups of Pteromalidae but not outside the family.

1.3 Diagnosis of the Eunotinae

The most recent definition of the group (Bouček, 1988a) lists the following character states, the combination of which diagnoses the subfamily Eunotinae:

- head and genae carinate
- male antennae with four funicular segments
- female antennae usually with five funicular segments
- notauli always complete
- thorax usually with paired setae
- first gastral tergite usually at least one-half the total length of the gaster

1.4 Biological control

1.4.1 Biology of the Eunotinae

In general, Eunotinae are associated with Sternorrhyncha (Hemiptera), mostly as parasitoids or egg predators of Coccoidea ("scale insects", including mealybugs (Pseudococcidae) and margarodids). They are occasionally associated with Aleyrodidae (whiteflies) or Aphididae. Since these groups of Hemiptera are often pests of economic importance, their natural enemies are of interest as biological control agents.

1.4.2 General principles of biological control

Biological control is defined as the action of parasitoids, predators, phytophagous organisms and pathogens in maintaining another organism at a lower average density than it would attain in their absence (Waterhouse and Norris, 1987). The concept of biological control arose from the observation that an organism is rarely a pest in the area to which it is endemic, presumably because it is controlled by co-evolved natural enemies. Once the organism moves out of its natural range without these enemies, population numbers may increase to the point at which it is a serious economic pest. There have been several spectacularly successful examples

of biological control in the Australasian area, all involving an introduced pest species which quickly multiplied to high and damaging densities in its new country, whereas in its endemic country it was quite inconspicuous. Introduction of the appropriate biocontrol agent in these examples led to a reduction in pest numbers to a lower, non-damaging level. Biological control rarely leads to eradication of pest populations. There are several techniques of biological control (listed in Waterhouse and Norris, 1987), the most important of which is classical biological control - the importation and permanent establishment of exotic natural enemies against an exotic pest after careful host-specificity testing.

1.4.3 Biological control and taxonomy

Unlike chemical control methods, which are usually broad spectrum, the use of classical biological control against pest populations depends on the specificity of an agent to a particular pest. Thus in chemical control it is not usually necessary to know the precise identity of the pest, whereas in biological control it is essential to have an accurate identification of the pest before a programme can be undertaken. Knowledge of the pest's identity usually leads to information on its endemic area, enabling the search for control agents to be undertaken most successfully. (Polyphagous pests with a cosmopolitan distribution are a problem, see for example Qin *et al* (in press) on the Chinese wax scale, *Ceroplastes sinensis* Del Guercio (Coccidae).) The accurate identification of the control agents is also necessary for a number of reasons. Some control agents may already be present in the country which is conducting the search, and for various reasons may not be successfully reducing pest population numbers. If the agent is not present, and is to be imported and reared, knowledge of its identity is necessary to ensure that only one natural enemy is being introduced. Rearing facilities must be monitored to ensure contamination of natural enemy cultures does not occur.

1.4.4 Relevance of the Eunotinae to New Zealand horticulture

Most of the mealybugs known from New Zealand are indigenous (Cox, 1987), but the major pests are introduced species of the genus *Pseudococcus* (Westwood) (Charles, 1989). Three species, *P. longispinus* (Targioni-Tozzetti), *P. calceolariae*

(Maskell) and *P. affinis* (Maskell) are pests of a wide variety of horticultural crops and ornamentals. All three species are probably Australian (there is some disagreement about the origin of *P. affinis*; according to Cox (1987) it is almost certainly a North American species, while Williams (1985) considers it to be Australian in origin). These mealybugs are not an economic problem in Australia; presumably natural enemies are controlling their populations. It is possible that these natural enemies could be introduced into New Zealand as biological control agents. However, in order for a biological control programme to be carried out effectively, it is necessary to know (a) which natural enemies are already present in the area where the organism is a pest, and (b) the identities of the natural enemies in the pest's endemic area.

Members of the genus *Ophelosia* have been reared as parasitoids of mealybugs and other coccoids in Australia and in New Zealand; specimens of *O. crawfordi* Riley have also been recorded as predators of *P. longispinus* (L.) (=*P. adonidum* L.) eggsacs (Wilson, 1963). As the New Zealand species of *Ophelosia* are undescribed and the Australian species either undescribed or so poorly described as to be virtually unidentifiable, the taxonomic revision of this group was a component of a Department of Scientific and Industrial Research (DSIR, New Zealand; now HortResearch Ltd. and Landcare Research Ltd.) project directed at the biological control of mealybugs in New Zealand.

1.5 Aims of the project

The aims of this project are:

i) to complete a taxonomic revision of the Australasian species of the subfamily Eunotinae;

ii) to determine the phylogenetic relationships of the genera within the Eunotinae; and

iii) to collect information on the biology of the members of the Eunotinae and to make recommendations for biological control of mealybugs in New Zealand.

Chapter 2: Materials and Methods

The materials and methods used in this study are presented, along with brief definitions of the taxonomic terms used. Selection of characters and scoring of character states are discussed in the following chapter (3), where some morphological features are discussed at greater length. The format of the taxonomic descriptions and text conventions are set out.

2.1 Materials and Methods

The Moranilini are reasonably large chalcidoids, ranging from slightly less than 1mm long (*Aphobetus nana* (Bouček)) to almost 3mm long (*A. cyanea* (Bouček)). They are also relatively heavily sclerotized and non-collapsing; accordingly most specimens were examined dry on points. Point-mounting was preferred to Noyes' (1988) method of card-mounting, since it was extremely difficult to examine and measure some characters in specimens mounted by card mounting. (Card-mounting does however provide much more protection for the specimens.) Specimens to be mounted were relaxed and the wings were set (spread to expose the dorsum) on non-porous card. Mounting was done under low magnification using a stereo microscope. Specimens for examination under the compound microscope were mounted on microscope slides using Noyes' (1988) technique. Body parts for drawing were cleared in KOH (except wings) and mounted on microscope slides in Hoyer's solution. Drawings were made with a drawing tube on a Wild Leitz compound microscope.

Scanning electron micrographs were taken on a JEOL JSM-35C Scanning Electron Microscope at Black Mountain Laboratories, Division of Entomology, CSIRO. All specimens were point-mounted and placed in a small rotatable, tiltable vice which allowed them to be viewed at several different angles; this is unlike the usual mounting procedure involving brass stubs. Specimens were prepared for SEM by washing in household dishwashing detergent solution and air-drying at 21°C.

Morphometric measurements were made for species descriptions and for use in coding characters for phylogenetic analysis. Absolute measurements were not used (Section 3.2.1.). Relative morphometric measurements were made using a light

microscope and a micrometer, and checked using the calibrating facility on the JEOL 6400 machine at the Research School of Biological Sciences, Australian National University. Measurements were found to be accurate to within 0.01 to 0.001mm (for example, the same distance measured by micrometer was 0.243mm and by SEM calibration 0.249mm). Ranges for measurements were achieved by measuring a sample of 10 specimens of each sex, where possible. Selected species were used for detailed morphometric analyses on larger sample numbers (below).

Collecting was by netting and by host collection and rearing. Hosts were held in ventilated plastic pots under ambient conditions until parasitoids emerged.

Specimens used for morphometric analyses (see Chapter 3) were reared from pure-line cultures where possible, *i.e.* the descendants of one pair of wasps only were used (to ensure conspecificity) and these descendants were reared on one species of host (to minimise host-induced variation). Where this was not possible (with *O. hypatia* Girault), the specimens used were from a series collected from the same species of host at the same locality at the same time and reared out in the laboratory under controlled-temperature conditions. Host mealybugs were reared on sprouting potatoes from field-collected mealybugs. Three species of *Ophelosia* were reared for morphometric analyses: *O. bifasciata* Girault, *O. charlesii* sp.n. and *O. hypatia* under the following conditions:

- Specimens of *O. bifasciata* were reared from parasitised *Pseudococcus calceolariae* collected from Loxton, S.A., and reared in the laboratory on *P. calceolariae* collected from Loxton and from the Australian National Botanic Gardens, A.C.T. Mealybugs from the two populations were identified by P.J.Gullan and karyotyped by Lyn Cook (2n=10), since they showed minor differences in appearance. This culture was contaminated with *P. longispinus* on several occasions and was discarded and re-started.

- Specimens of *O. charlesii* were reared at Mount Albert Research Centre, New Zealand, from parasitised *P. calceolariae* (identified by C.F.Morales) collected from Havelock North; and also at Black Mountain, A.C.T. from parasitised *P. calceolariae* collected from Loxton. (identified by P.J.Gullan).

- Specimens of *O. hypatia* were reared from parasitised *Icerya purchasi*

Maskell (Margarodidae) collected from Moree, N.S.W., (at the same time, from one citrus tree) and reared at Black Mountain laboratories, A.C.T.

2.2 Taxonomic features

Morphological terms generally follow Bouček (1988a). Fig. 2.2 illustrates the major anatomical terms used, which are defined briefly below:

Head

Vertex: top of head.

Occiput: area between vertex and foramen.

Occipital carina: carinate upper occipital margin.

OD: (ocular diameter) longest axis of posterior ocelli.

OOL: (ocular-ocellar line) shortest distance between posterior ocelli and eye.

Face: front of head, merging dorsally with vertex and delimited ventrally by clypeal margin and genal carina.

Face length: length from vertex to genal carina with head in full facial view.

Face width: measured at widest point with head in full facial view.

Gena: area between eye and mandibles (sometimes termed "malar space"), delimited posteriorly in this group by the *genal carina.*

Malar space: minimum distance between eye and mouth margin.

Malar groove: groove running from lower margin of eye to mouth margin.

Antennal toruli: antennal insertions or sockets, distance between toruli and clypeal margin is measured from ventral margin of torulus.

Antennal scrobes: more or less depressed area above toruli; may be margined dorsally by a weak or strong carina.

Antennae

Sensilla: Sense organs, present on funicular segments and club. Two forms occur in the Moranilini: a) placoid longitudinal sensilla (correctly referred to as *multiporous plate sensilla* (Bouček, 1988a)), attached to antennal surface by an elongate base, with a tapering free apex and b) *trichoid sensilla*, modified longitudinal sensilla with a short base but with greatly lengthened free apices.

Antennal scape: first basal antennal segment.

Pedicel: Second antennal segment, elongate pyriform.

Antennal funicle: Consists of five segments in females and four in males; these segments are referred to as F1 to F4 or F5 from base to apex of funicle.

Antennal club: last three flagellar segments, separated by partial or complete sutures.

Thorax

The term "thorax" is used to describe the median part of the body, *excluding* the propodeum. It is thus not equivalent term to the "mesosoma".

Pronotum: Broader than long, with undifferentiated regular setation; and with or without a row of long setae on apical margin (=*setal ring*).

Mesonotum: divided into several parts: anterior to *transcutal line* is the *mesoscutum*, in turn subdivided into a middle lobe and two lateral *scapulae* by the *notauli.* Posterior to transcutal line are the *scutellum* and laterally the *axillae*. The scutellum may have a *frenal area* delimited apically (*i.e.* posteriorly).

Metanotum: divided into a medial *dorsellum* and *dorsellar fovea* and a lateral *metanotal furrow*.

Mesopleuron: includes a *subalar area* from which an oblique groove (*pleural suture*) runs to the mid coxa. The *mesepimeron* is above the pleural suture and the *mesepisternum* below it.

Propodeum

The *propodeum* is the first segment of the metasoma, incorporated into thorax. A *nucha* or neck may be formed by a narrowed medial area before the apex. Carination present may include a longitudinal *median carina*, sublateral longitudinal *plicae* or a medial transverse carina, the *costula*.

Forewings

In many small parasitic Hymenoptera the wing venation is very reduced and a simplified nomenclature is used. From the base of the wing the veins are *submarginal*, *marginal* and *postmarginal*; the *stigmal* vein branches posteriorly from the junction of the marginal and postmarginal veins. The stigmal vein may be

knobbed apically (*stigma*), and this in turn may send off a stub (the *uncus*) towards the postmarginal vein. The measurement of the ratios marginal:stigmal vein length and postmarginal:stigmal vein length are detailed below (Fig. 2.1). Goulet and Huber (1993) note that the names of these veins do not connote any homology with similarly named veins in other groups of Hymenoptera, but are simply a convenient reference system.

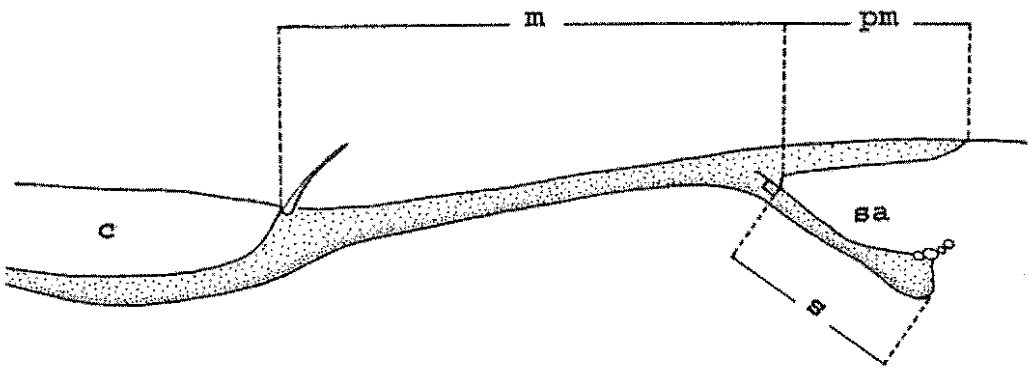

Fig. 2.1 Measurement of marginal, stigmal and postmarginal veins in the forewing; c = costal cell; m = marginal vein length; pm = postmarginal vein length; s = stigmal vein length; sa = stigmal area.

Other features of the wing are (all on the dorsal surface unless specified):

Costal cell: the area between the submarginal vein and the costal edge of the wing.

Ventral setal row: row of setae on ventral surface of costal cell; may be complete or broadly or narrowly interrupted.

Basal cell: area bounded by submarginal vein, basal vein, and *cubital hairline*.

Cubital hairline: pilose area on cubital vein, posterior boundary of basal cell.

Basal hairline: pilose area on basal vein, apical boundary of basal cell.

Parastigma: thickening at distal end of submarginal vein, may be extended down basal vein.

Speculum and *linea calva*: see discussion of these two characters in Section 3.4.

Stigmal area: area in the forewing between the postmarginal and stigmal veins.

Legs

From the base, the legs are made up of the *coxa*, the *trochanter*, the *trochantellus*, the *femur*, the *tibia* and the *tarsus*. The apex of the hind tibia has a single or two spurs, and these are measured against the length of the first hind tarsal segment, the *basitarsus*.

Gaster

The term "gaster" is used *sensu* Bouček, *i.e.* the metasoma, not including the first metasomal segment (the propodeum), which is treated separately.

T1: first dorsal segment (tergite) of gaster (second metasomal tergite).

S1: first ventral segment (sternite) of gaster (second metasomal sternite) .

Genitalia: male genitalia are very rarely used in pteromalid taxonomy. In females the ovipositing apparatus is derived from the ventral parts of the sixth and seventh gastral segments and is connected with the *epipygium* or fused seventh and eighth tergites.

2.3 Conventions

2.3.1 List of frequently mentioned collector's names:

JAdB: J. A. deBoer; ZB: Zdenek Bouček (NHM); JCC: Josephine Cardale (ANIC); MCC: Mary Carver (ANIC); JGC: John Charles (HortResearch); ECD: Edward Dahms (QM); JWE: John Early (LU); JAF: Jan Forrest (SAM); ESG: E. Gourlay (Cawthron Inst.); M-LJ: Marie-Louise Johnson (CSIRO); GK: Willy Kuschel (ex-DSIR); JFL: John Lawrence (ANIC); PAM: Peter Maddison (ex-DSIR); IDN: Ian Naumann (ANIC); JSN: John Noyes (NHM); GWR: Graeme Ramsay (ex-DSIR); EFR: Edgar Riek (ANIC); EWV: Errol Valentine (ex-DSIR); AKW: Annette Walker (CIE); TAW: Tom Weir (ANIC).

2.3.2 Sources of loaned material

ANIC:	Australian National Insect Collection, CSIRO, Canberra, ACT
BPBM:	Berenice P. Bishop Museum, Honolulu, Hawaii
NHM:	The Natural History Museum, London, UK
DPIH:	Department of Primary Industry, Hobart, Tasmania
IIE:	International Institute of Entomology, London, UK

LU: Lincoln University, Christchurch, NZ

NZAC: New Zealand Arthropod Collection, Landcare Research New Zealand Ltd, Auckland, NZ

QM: Queensland Museum, Brisbane, Queensland

SAM: South Australian Museum, Adelaide, South Australia

USNM: United States National Museum, Washington, USA

MVM: Museum of Victoria, Melbourne, Victoria

WARI: Waite Agricultural Research Institute, University of Adelaide, South Australia

2.3.3 Format of descriptions

Descriptions conform to the following format:

Name: Current valid name with authority and reference; figure(s) and distribution map.

Type details: Sex and deposition of the type specimen are stated. The label details are given verbatim under "Label data". Type labels by the present author are not quoted, but all follow the form "TYPE, species name, authority, designated J. A. Berry, date". All information on one label is enclosed by quotation marks, and the information on each line of the label is separated by a slash (/). Details are given in this format only for type material which has been seen by the author in person. If type material has not been seen this is explicitly stated. The publication details are given under "Publication data" where relevant.

Synonymy: All known synonymies are presented; new synonymies are identified; catalogue details are given.

Female: Females for all species are described or redescribed in the same format. Measurements are presented as ranges, with means given. Microsculpture terms follow Harris (1979). Bouček (1988a) criticises this system as having too many terms that are not descriptive enough; however for the purposes of this work it was quite suitable.

Male: Only character states which differ from those found in the female are listed.

Material: All specimens examined are listed grouped geographically by state in Australia (in the order west to east and north to south), or by area code in New Zealand. Details of the New Zealand system of area codes are given in Crosby *et al.* (1976). Areas are cited geographically, *i.e.* north to south, beginning with ND (Northland) and ending with SI (Stewart Island). All label data are given, in abbreviated form, including collector(s), date of collection and hosts. Latitudes and longitudes for the specimens are given, (in brackets if these data were not on the label).

Biology: All records are from specimens examined in the present study unless otherwise specified.

Distribution: All areas/ states/ countries from which the species is recorded are listed. Endemism is discussed in Chapter 7. "Australia" refers to a distribution anywhere within Australia, including Tasmania. "Mainland Australia" excludes Tasmania. Eastern Australia refers to any or all states east of W.A. W.A. refers to Western Australia exclusively.

Remarks: Any remaining points of interest are noted.

Note: authorities and families are given on their first occurrence at any place in the manuscript text and host families are given again on their first occurrence in Chapter 7, to facilitate discussions of host-parasitoid relationships. Authorities and families are not cited in the "Material examined" section of the alpha-taxonomic chapters since this information is a summary of label data.

Chapter 3: Scoring of character states

3.1 Introduction

The basis of alpha or descriptive taxonomy is the delimitation of morphological species by stable and consistent differences. Observable features, or characters, of taxa are variably exhibited in subdivisions called character states, *e.g.* a character (number of hind tibial spurs) could be divided into 2 states (0 or 1). An attribute is the possession or exhibition of a particular state of a character (*e.g.* has two hind tibial spurs). Thus a character consists of a group of mutually exclusive attributes that are alternative expressions of the same thing, *i.e.* are homologous (Cranston *et al.*, 1991). Thiele (in press) suggests that for characters and character states to be "cladistic" they must be features of taxa, discoverable and scorable, and they must at least potentially contain information on the pattern of cladogenesis of the taxa to which they belong, *i.e.* they must change at some time during cladogenesis (or more accurately, the frequency distribution of the character states must change). Before a collection of data can be used in a computer-based analysis, the data need to be coded in a form acceptable to the programme used. Coding the various states of a character is a crucial step of phylogenetic analysis since the shapes of the resulting trees are fully determined by the time the data matrix is completed, analysis merely making them apparent (Neff, 1986).

This chapter includes a discussion of the various types of character states and the scoring problems that result from intraspecific variation and difficulties in coding. The use of ratios and allometric effects is discussed. In Section 3.4, the character list used in the phylogenetic analysis is presented and coding decisions are discussed where necessary.

3.2 Scoring of character states

Characters scored into states for cladistic analysis may be qualitative or quantitative; continuous or discrete (meristic); and may have overlapping or non-overlapping values between taxa. Thiele (in press) discusses the distinction between qualitative and quantitative data in some detail, pointing out that many so-called qualitative characters are based on quantitative phenomena, for example the

expression of shape. All expressions of shape are descriptors of dimensional ratios, measurable and thus quantitative. In this context, qualitative and quantitative refer to modes of expression of data rather than intrinsic qualities of the data themselves (Wiley, 1981).

Phenotypic variation within species (intraspecific variation, Section 3.3) complicates the delimitation of character states. Where data show widely discontinuous patterns of variation there is no problem in expressing quantitative data as qualitative (*e.g.* oval or circular). Problems occur when there is a continuous range of variation in between states, which requires quantitative expression. In this sense, qualitative and quantitative are often used as synonyms for overlapping and non-overlapping. Quantitative data that are discrete in nature (*e.g.* number of setae), as opposed to continuous (*e.g.* ratio of length of marginal to stigmal vein), may still overlap between taxa and present a problem in scoring exclusive character states. Continuously varying, overlapping quantitative data prove to be the most difficult for scoring, and are often rejected as "non-cladistic". Their use in phylogenetic analysis has been much argued. Methods of coding this sort of data include simple gap coding (Mickevich and Johnson, 1976), which divides the attribute axis at points where no values occur, or where gaps between means exceed a pre-defined value. This method requires that gaps be present. Other methods are available for coding data where no gaps occur, for example Thiele (in press) outlines a new method of coding continuously varying data. His use of this method in analysing the phylogeny of the plant genus *Banksia* L.f. suggests that the morphometric characters map phylogeny in this case almost as accurately as qualitative morphological data. Other methods of scoring continuously varying overlapping data are also discussed in Thiele (in press) but are not tested.

3.2.1 Use of size and ratios

Reid (1990) states that direct measurements of any feature should be avoided a) because they are not discrete and b) because all measurements are a function of body size. As discussed above, it is quite possible to code continuous variables, so the fact that size measurements are not discrete should not prevent them from being used in a cladistic analysis. The second argument has more basis; measurements of

body parts will vary with the size of the organism and the use of raw measurement data should generally be avoided. The use of ratios as cladistic characters is more defensible, although it has been severely criticised (Atchley and Anderson, 1978). Any character with states in the form long/short; wide/narrow; longer than/shorter than (etc) involves a ratio. Dyar's law suggests that various sclerotised body parts increase in a constant geometric progression as an insect grows by moulting, so ratios should be constant in differently sized animals or at different stages. However deviations do occur, and some body parts grow at differential rates (Gould, 1966); for example antennal segments, ocellar distances, ovipositor length, and size and numbers of setae and sensilla (Grissell and Schauff, 1990). This function is termed allometry, and before a ratio can be used as a character in cladistic analysis it is preferable that allometric effects be ruled out. Ratios are often used in chalcid taxonomy, frequently without allometric consideration.

Janzon (1986) made a series of measurements of ratios commonly used in chalcidoid taxonomy on *Pteromalus* Swederus (Pteromalidae), with the aim of investigating their reliability. The study showed that of 24 ratios commonly used by hymenopterists, 60% show errors caused by allometry. Four characters used in this study were among the ratios that Janzon found did *not* show allometric effects:

Character 2: Face width: length

Character 15: Ratio of malar space: eye length

Character 43: Ratio of marginal:stigmal vein lengths in females

Character 44: Ratio of marginal:stigmal vein lengths in males

Morphometric analysis of these four characters in this study gave the same results as Janzon's work, *i.e.* no allometry was detected (see Section 3.4). Only one of the ratios which Janzon did find to show allometric relationships was used in this study, namely the ratio of marginal vein length to postmarginal vein length (characters 47 (♀) and 61 (♂)). This ratio was not measured in detail for the cladistic study, and Janzon's result suggests it may be unreliable. Note that Janzon's use of log transformation, normalization, pooling and regression analyses allowed the detection of allometry at much smaller sample sizes (n=6 to n=10) than were used in the present work. A correction procedure was employed for correcting ratios which were not reliable as raw data.

3.3 Intraspecific variation

Intraspecific variation is one of the most important problems in delineating species. The degree of morphological plasticity inherent in a single species is not yet understood, but many factors are known to influence phenotypic variation, some genetic and others environmental. Characters with large environmental components of variation are generally regarded as less reliable than those with large genetic components. For example, size is known to be largely influenced by environmental factors, whereas shape is thought to be under stricter genetic control and less likely to vary, making it a preferred character (Daly, 1985).

A knowledge of the degree to which environmental factors can influence phenotype is useful in understanding the limits of variation of species. Pungerl (1983) found that characters traditionally used to separate some *Aphidius* Nees (Braconidae) species were more variable than previously supposed. Species previously regarded as taxonomically distinct may, on closer investigation, prove to be extreme variants of a known species, and some apparently species-specific parasitoids may prove to be host-induced forms of commoner species. It is necessary to know the effect of the environment on morphological characters to establish the limits of environmentally induced variation in each species. There is a need to establish the stability of the characters used and a combination of several may be necessary to distinguish some species, most characters having been insufficiently investigated. Many works suggest that non-genetic factors can contribute to a large amount of phenotypic variation (Grissell and Schauff, 1990).

Some forms of variation known to occur in Hymenoptera are:

i) Temperature-induced variation is known to occur in many species, *e.g. Trichogramma minutum* Riley (Trichogrammatidae) is black when reared at low temperature, and pale at higher temperatures. This colour change corresponds with a change in isozyme banding, suggesting a loss of isozymes at high temperatures (S. Smith, University of Toronto, pers. comm.). In New Zealand, Harris (1987) noted temperature-induced colour change in a species of pompilid wasp.

ii) Seasonal dimorphism. Darker individuals are often produced in autumn (Grissell and Schauff, 1990).

iii) Host-induced variation. Different hosts, different parts of the same host or even different sizes of the same host may cause the progeny of the same female wasp to vary morphologically (Salt, 1937, 1940). Cox (1984) found that temperature, relative humidity and host plant all affected the morphology of adult female mealybugs, which may produce differences in parasitoids. Johnson *et al.* (1987) showed that host size caused variation in antennomere size in *Telenomus alsophilae* (Haliday) (Scelionidae).

Induced morphological differences may include changes in colour, microsculpture, carination, body size and presence or absence of wings.

Detailed character analyses for the purpose of character scoring for this study were carried out on individuals of the same line; these were reared from the same host under the same conditions (see Section 2.1), providing a baseline of morphological variation, *i.e.* individuals which express minimum character variation.

Three species of *Ophelosia* were chosen to investigate aspects of variation in certain characters: *O. charlesii, O. bifasciata* and *O. hypatia*; these were the only species for which a long series of specimens were available from the same host, collected at the same time, under the same conditions. All other morphological data were measured not from lines, but from selected specimens of the same species, and represent a wider range of intraspecific variation.

3.3.1 Intraspecific variation in New Zealand insects

Many authors have noted that the New Zealand fauna shows an extreme level of intraspecific variation. Noyes (1988) found the encyrtid fauna to be extremely variable, and that the variation did not appear to be linked to geographic distribution or to altitude, except in one species. Conversely, Harris (1987) found variation in spider wasps (Pompilidae), particularly colour, to be closely linked to geographical distribution. Noyes listed the following authors, who have noted the unusual amount of intraspecific variation in New Zealand: L. Mound, in Thysanoptera (pers. comm.); I.D. Gauld, in Ichneumonidae (pers. comm.); L. Masner in Proctotrupoidea (pers. comm.); C. Butcher (1984) in carabid beetles and Franciscolo (1980) in mordellid beetles. Naumann (1988) found sexual dimorphism (Section 3.3.2) very pronounced

in New Zealand Ambositrinae, particularly amongst wing-reduced forms.

The eunotine species showing the most variation are *Moranila comperei* (Ashmead), *Aphobetus maskelli* Howard and *A. cyanea* (see Figs 3.8, 3.9, 3.10, 3.20 and 3.21). Two of these species are New Zealand species and the third, *M. comperei*, is an Australian species. *Moranila comperei* however showed two forms on the basis of scutellar sculpture (Chapter 5) and the material examined may represent more than one species.

3.3.2 Sexual dimorphism

Sexual dimorphism is a form of intraspecific variation common in Hymenoptera, due to very different selective pressures acting on males and females (Gauld and Bolton, 1988). In the eunotines many characters are sexually dimorphic; for example the form of the antennae, which are specialised in the female for host location. Colour and morphometric characters are also highly sexually dimorphic. Sculpture is the most constant of the morphological characters and is sometimes the only way to associate sexes. However in the case of very small male specimens the microsculpural patterns are sometimes disturbed, for example Figs 3.1 and 3.2 show the propodeal sculpture of two male specimens of *Ophelosia charlesii*. Both were offspring of the same female. The difference in the sculpture of the propodeum correlates with a marked size difference.

In the large genera there are a number of species described for which the male is unknown and, amongst the unidentified material, there are leftover male specimens for which either the female has not been collected or the association cannot be made. Sixteen species have not had males described: six species of *Moranila* and four of *Ophelosia* for which only one or few specimens are known, the type species of the genera *Tomicobiella* Girault, *Eunotomyiia* Girault and *Tomicobomorpha*, and all species for the genera *Ismaya* Bouček and *Amoturella* Girault. These are all very rarely collected species so the problem probably lies with collection rather than failure to associate sexes. Characters in the matrix which do not have sex specified apply to both sexes, and notes are made in the discussion of each character exhibiting sexual dimorphism.

3.3.3 Wing reduction

The presence or absence of wings, or relative length of wings has an effect on some characters, for example the relative length of the pronotum, mesonotum and scutellum. The relative lengths of the pronotum and mesoscutum were initially measured for use in this analysis but discarded for the above reason. The shape of the scutellum (Character 29) is the only character used.

Since a large number of characters are derived from the forewings in this group, coding these characters from species with reduced wings was an important problem. A common suggestion in this situation is to code those taxa lacking the structure as having missing data (Swofford, 1985; Farris, 1988). Maddison (1988) outlines the difficulties arising from coding missing data for inapplicable characters; however I have used this method in the present analysis as the only practical solution to the problem.

3.4 List of characters

About half of the characters in this matrix are qualitative (*e.g.* character 1: head colour; character 36: sculpture of scutellum). A small number are quantitative and discrete (*e.g.* characters 48 and 56, number of setae along costal margins of males and females). The remainder are quantitative and continuous. In most cases the character states are almost entirely non-overlapping, and can be easily coded using simple gap coding (Mickevich and Johnson, 1976). A small number of characters present a problem, being quantitative, continuous and very much overlapping. These characters are discussed in greater detail as they are presented.

Note: The characters are presented here in a different order from that in which they were scored for the analysis, for greater ease of reading. The original order, used for scoring the data matrix, and the data matrix itself, are presented in Appendices II and III respectively. The original number used for the character in the data matrix is here given in parentheses.

HEAD

Character 1 (1): Female head colour: ranges from fairly bright orange through various orange-browns and dark browns to black. Many species also exhibit a metallic lustre, ranging from blue to green to purple. This may be in the form of a metallic sheen over the whole head or, in some species of *Moranila* in discrete patches of metallic colour in particular places. Although the occurrence of these patches seemed to be species-specific, the presence/absence, colour and degree of metallic lustre was both variable at the intra-specific level and very hard to score. Thus I have coded only two states for the head:

0 orange

1 brown-black

Head colour is sexually dimorphic, colour for males is scored in character 22. Males tend to have darker heads than females and metallicism is more common. Colour is an extremely environmentally labile character. The critical period for determining the degree of melanism of an adult occurs during pupal development after the prepupal moult, when pigment deposition in the cuticle begins (Harris, 1988). This is highly dependent on environmental conditions, especially temperature. Although colour was used extensively in chalcid taxonomy by authors such as Girault and Ashmead, I have concluded that it is too variable and unreliable for further use in this analysis. Descriptions of colour and ranges, where known, are included in the species descriptions.

Character 2 (2): Shape of female face; measured as a ratio of width of face by length of head. Face width and length is plotted in females and males of *Ophelosia bifasciata* in Figs 3.3 and 3.4 respectively, which show a linear relationship between width and length. When the ratio of width:length is plotted against width for females and males, there appears to be no allometric relationship; larger faces do not appear to have a different shape to smaller ones (Figs 3.5 and 3.6). The ratio of face width to length is also plotted against the length of the marginal vein in females of *O. bifasciata* (Fig. 3.7) to provide an independent measure of body size and once again no allometric relationship is apparent. Figs 3.3 to 3.6 also show that this character is sexually dimorphic, with males tending to have a ratio of width to length

closer to one than females.

The shape of the face in the Moranilini varies from almost square (*Cephaleta, Eunotomyiia*) to quite transverse (some species of *Moranila* and *Ophelosia; Kneva plana* Bouček and *Tomicobomorpha* were about 1.8x broader than long). At first sight this character seems to have potential for use at the generic level. Bouček (1988a) used it as a key character for *Tomicobomorpha* ("head unusually transverse, frontovertex more than half width of head"). However once the character ranges were measured and plotted for all species of Eunotini (Fig. 3.8), it was evident that there would be serious problems in scoring the character. Fig. 3.8 shows that there are no gaps present, thus simple gap coding cannot be used. More importantly there is a large amount of intraspecific variation present. The tribe ranges from face 1.1x as broad as long to 1.9x as broad as long, whereas ranges of variation in one species are commonly over half this range. An attempt to code the data was made using Thiele's method of gap-weighting (Thiele, in press). This method relies on differential weighting of gaps between coded states within one character, and range-standardisation is used. A complicating factor is the presence of species for which only one specimen is present, since in these cases there is no indication where the single data point lies along the range of variation for the species, and these measurements cannot be given an integer value using Thiele's method. In conclusion, it was decided that although this character clearly held some diagnostic information, it could not be sensibly scored for use in phylogenetic analysis.

Character 3 (3): Shape of dorsal margin of head

0 strongly concave

1 weakly or not concave

Character 4 (4): Occipital carina

0 strong (Fig. 5.82)

1 weak (Fig. 5.105)

2 absent

A strong occipital carina is a symplesiomorphy for the subfamily and the loss, in some species of Moranilini, is a secondary one. The character is ordered 0 to 2.

Character 5 (5): Setae on vertex

0 longer than OD

1 shorter than OD

2 absent

Character 6 (6) : Ocellar position

0 removed from occiput by <1 OD

1 removed from occiput by at least 1 OD

This quantitative character falls into two widely disjunct states: with ocelli either immediately adjacent to or crossing occiput; or removed by at least one OD.

Character 7 (7): OD

0 greater than or equal to OOL

1 less than OOL

Character 8 (8) : Scrobal carination

0 carinate anteriorly

1 not carinate anteriorly

2 weakly carinate

The antennal scrobes are can be delimited anteriorly by a strong transverse carina (*e.g.* Fig. 5.127), by a weak transverse carina, or not at all, grading smoothly into the vertex.

Character 9 (9): Scrobal sculpturing

0 wholly sculptured (Fig. 5.134)

1 partly sculptured or smooth (Fig. 5.127)

Character 10 (10): Antennal position in female

0 > 1 torulus diameter (td) above clypeus

1 < 1 td above clypeus

2 about 1 td above clypeus

Character 11 (11): F1 shape in female

0 broader than long (Figs 5.17, 5.22, 5.44)

1 not broader than long (Figs 5.5, 5.14)

Character 12 (12): F2 shape in female

0 broader than long (Figs 5.10, 5.17)

1 not broader than long (Figs 5.14, 5.47)

Character 13 (14): Club length in female

The ratio of club length to funicle length was measured for all species and the means and ranges are plotted in Fig. 3.9. These range from the club being considerably shorter than the funicle (0.46x) to considerably longer (1.57x). Using simple gap coding only two states are apparent:

0 ≤ funicle in length (Fig. 5.65)

1 > funicle in length (Fig. 5.22)

Character 14 (56): Club length in male

The ratio of club length to the length of the first funicular segment was measured for males of all species and plotted (Fig. 3.10). Values ranged from the club being very slightly shorter than F1 to the club being extremely long. In *Ophelosia indica* Farooqi, the club was 6.4x longer than F1, and this species was excluded from Fig. 3.10. Using simple gap coding the character was scored in two states:

0 less than or equal to twice the length of F1 (Fig. 5.15)

1 greater than twice the length of F1 (Fig. 5.19)

Character 15 (15): Malar space

0 < vertical length of eye

1 = vertical length of eye

2 > vertical length of eye

Character 16 (16): Presence or absence of the genal carina.

This character is only absent in *Scutellista cyanea* Motschulsky, so it is not useful in the phylogenetic analysis. Presence of a genal carina is a symplesiomorphy for the Moranilini, but a derived state within the Eunotinae.

Character 17 (17): Malar groove

0 complete

1 not complete

Character 18 (18): Genal carina and clypeal margin

0 widely offset (Figs 5.127, 5.128)

1 narrowly offset (Fig. 5.134)

2 not offset (Fig. 5.136)

Character 19 (48): Antennal insertion in male

0 >1 td above clypeus

1 <1 td above clypeus

2 about 1 td above clypeus

Character 20 (57): F1 length in male

0 <F2 (Fig. 5.40)

1 =F2 (Fig. 5.11)

2 >F2 (Figs 5.15, 5.54)

Character 21 (59): Male antennal type

0 filiform, each funicular segment closely opposed to the next

1 nodose, each funicular segment narrowed apically and basally; longer than broad (Figs 5.12, 5.15)

2 extremely nodose, funicular segments narrowed apically and basally; broader than long or as long as broad (Fig. 5.19)

3 branched, each segment much broader than long (Fig. 5.24)

According to Bouček (1988a), the plesiomorphic antennal type is filiform, occurring in the Eunotini. The branched condition occurs only in *Eunotomyiia*, a synapomorphy for this genus. This character is ordered 0 through 3.

Character 22 (65): Male head colour (see character 1)

0 orange

1 brown/black

Character 23 (69): Mandible shape

0 with 2 teeth, neither divided

1 1 lower tooth, 1 upper tooth and a truncation

2 1 lower tooth, 2 upper teeth

3 1 lower tooth, 3 upper teeth

4 reduced

Character 24 (22): Shape of thorax

0 flat in general facies

1 moderately convex in general facies

2 extremely convex in general facies

Character 25 (75): Club sensilla in male

0 plate (Figs 5.50, 5.54)

1 trichoid (Figs 5.40, 5.67)

Character 26 (76): Antennal setae in male

0 shorter than F2 (Fig. 5.43)

1 equal to F2 (Fig. 5.15)

2 longer than F2 (Fig. 5.19)

THORAX

Character 27 (13): Scutellum

0 with regular undifferentiated setation only

1 with more than 2 pairs of setae

2 with 2 pairs of setae only

According to Bouček (1988b) undifferentiated pilosity is plesiomorphic, so 0 is the plesiomorphic condition and 1 and 2 the derived conditions. The character is ordered 0 through 2.

Character 28 (26): Scapulae

0 sculptured

1 not sculptured

Character 29 (27): Shape of scutellum

0 longer than broad

1 square

2 broader than long

Character 30 (20): Pronotal ring

0 absent

1 less than 8 setae

2 8 to 14 inclusive setae

3 more than 14 setae

Character 31 (21): Setal bases on mesoscutum

0 reticulate

1 not reticulate

2 raised

3 punctate

Character 32 (23): Mesoscutum

0 with regular undifferentiated pilosity only

1 with regular and paired pilosity

2 with paired setae only

Regular undifferentiated pilosity is considered plesiomorphic (see character 27), so state 2 is the derived condition. The character is ordered 0 through 2.

Character 33 (24): Notauli

0 complete (Figs 5.82, 5.101)

1 expanded as narrow grooves (Figs 5.75, 5.79)

2 expanded as wide grooves (Fig. 5.73)

3 absent

The absence of notauli is a plesiomorphic state (Bouček 1988b). This condition only occurs in the Tomocerodini, which is not the basal tribe in the subfamily on other characters. Presumably the conditions of notauli being developed as narrow or wide grooves, as found in some species of *Aphobetus*, are derived.

Character 34 (25): Mesoscutum

0 sculptured

1 not sculptured

Character 35 (28) : Frenal area

0 not delimited

1 delimited by change in sculpture (Fig. 5.110)

2 delimited by line (Fig. 5.79)

3 delimited by groove/punctations (Figs 5.73, 5.75, 5.83, 5.89, 5.106)

According to Bouček (1988a) the subdivision of the scutellum into an anterior area and a posterior frenal area is plesiomorphic, with the frenal area probably corresponding to the mesopostscutum of some sawflies. In the Eunotini, the outgroup or plesiomorphic condition is to lack a divided frenal area and thus if Bouček is correct, the possession of a frenal area in the Moranilini is a reversal (Section 6.9.4).

Character 36 (29): Scutellum

0 sculptured

1 not sculptured

Character state 0 is an autapomorphy for *Aphobetus goldsmithii* (Girault) and the character was therefore excluded from the analysis as uninformative.

Character 37 (30): Axillae

0 sculptured

1 not sculptured

2 foveate

Character 38 (31): Dorsellum

0 sculptured

1 smooth

Character 39 (32): Metanotal furrow

0 sculptured

1 smooth

Character 40 (54): Mesepimeron

0 with dimple (Figs 5.97, 5.98)

1 without dimple (Fig. 5.107)

Character 41 (55): Mesepimeron

0 glabrous (Fig. 5.98)

1 striate (Fig. 5.93)

FOREWING

For a complete review of the terminology see Bouček (1988a). A number of characters were scored from the forewing of both the female and male separately

since many of the characters and ratios are sexually dimorphic. Characters of the hindwing are rarely used as taxonomic characters in Hymenoptera. The primitive pilosity is regular, across the entire surface of the wing without differentiation in the length, thickness or position of the hairs. The following characters were scored from the male and female forewings:

Character 42 (33): Female forewing, degree of infumation

This character shows considerable intraspecific variation and states 0 and 1 in particular were hard to distinguish, with a number of species showing a very faintly infumate patch which seemed to grade to hyaline in small specimens. State 2, the possession of two well-defined infumate patches is an autapomorphy for *Moranila viridivertex* (Girault). The character is scored only for females. Males show the same pattern but the degree of infumation is less, making the task of distinguishing states more difficult.

0 without definite infumate patch (Figs 5.29, 5.37)

1 maculate (Fig. 5.39)

2 bimaculate (Fig. 5.45)

3 completely infumate

Characters 43 and 44 (34 and 61): Ratio of marginal:stigmal vein lengths in females and males respectively

Bouček (1988a) has used the ratio of lengths of marginal to stigmal veins fairly extensively as a diagnostic character. To rule out any allometric effects detailed measurements were made for three species of *Ophelosia*.

Ratios of marginal vein length to stigmal vein length in:

O. charlesii female: Range= 2.2 to 3.3; mean =2.68; n=78

O. charlesii male: Range= 1.8 to 2.9; mean =2.31; n=68

O. bifasciata female: Range= 2.9 to 3.5; mean =2.79; n=21

O. bifasciata male: Range= 1.5 to 2.4; mean =1.93; n=16

O. hypatia female: Range= 2.4 to 3.6; mean =2.99; n=39

O. hypatia male: Range= 2.2 to 2.9; mean =2.55; n=31

Plotting the length of the marginal vein to the length of the stigmal vein

produces a straight line relationship (Figs 3.11 and 3.12 for females and males of *O. hypatia* and Figs 3.15 and 3.16 for females and males of *O. charlesii*), *i.e.* the longer the marginal vein, the longer the stigmal vein. Thus neither measure can be used alone as a scorable character, so the ratio of the two vein lengths was calculated. To ensure that the ratio was independent of the size of the wing (*i.e.* that there was no allometric effect), the length of the marginal vein was plotted against the ratio of the two vein lengths (Figs 3.13 and 3.14 for females and males of *O. hypatia* and Figs 3.17 and 3.18 for females and males of *O. charlesii*). The ratio was also plotted against the length of the scutellum in males of *O. charlesii* (Fig. 3.19) to provide an independent measure of body size. Ideally a straight line should be produced if the ratio remains the same independent of wing size. An allometric relationship would produce a sloping line depending on the relationship. Figs 3.13, 3.14, 3.17, 3.18, and 3.19 show that the ratio varies, but not in a fashion that shows any relationship between the two variables. Thus the ratio of the lengths of marginal and stigmal veins is independent of the size of the wing and can be used as a character. However, as with character 2, this character could not be scored satisfactorily due to wide ranges and missing data. Figs 3.20 and 3.21 show the m:s ratio for all species (females and males respectively), obviously this is a continuously varying, highly overlapping character. It was not used in the phylogenetic analysis, but was used in some specific diagnoses.

Despite the individual variation, it is clear that these characters are sexually dimorphic. The wings tend to be larger in the female, thus the lengths of the veins are greater, but the plot of marginal to stigmal vein length shows that the m:s ratio is also different, being higher in females than in males, thus the stigmal vein tends to be proportionately shorter in females.

Character 45 (36) : Stigmal area in female

0 setose (Fig. 4.2)

1 bare (Fig. 4.4)

Character 46 (37): Costal cell in female

0 excised at apex (Fig. 5.16)

1 slightly excised at apex (Figs 5.18, 5.26)

2 not excised at apex (Fig. 5.4)

Character 47 (35): Postmarginal vein length in female

0 <0.5x length of stigmal vein

1 0.5 to 0.8x length of stigmal vein

2 0.9 to 1.1x length of stigmal vein

3 >1.1x length of stigmal vein

This character was not tested for allometric effects, and Janzon (1986) found that this ratio is not reliable (Section 3.2.1).

Character 48 (38): Costal margin setation in female

The number of setae along the apical costal margin of the wing was plotted against the length of the marginal vein in females of *Ophelosia charlesii* (Fig. 3.22) to determine whether any allometric relationship existed between these two variables. The number of setae was found to be independent of marginal vein length. This character is sexually dimorphic, with males tending to have more setae than females.

0 with less than 10 setae (Figs 5.4, 5.37)

1 with setae along <0.5x margin (Fig. 5.31)

2 with setae along 0.5 to 0.9x margin (Fig. 5.26)

3 with setae along 0.9 to entire margin (Fig. 5.8)

4 without setae

Character 49 (39): Ventral setal row in costal cell in female

0 continuous

1 interrupted

2 absent

Character 50 (40): Basal hairline setation in female

The basal vein bounds the distal end of the basal cell. In many chalcidoids it has disappeared and its former position is indicated by the basal hairline. In eunotines this varies from being absent to being developed into a tuft of long setae. The number of setae on the basal hairline (in the wing tuft) of *Ophelosia hypatia* were counted for 40 females and 31 males. This number was plotted against the length of the marginal vein to determine whether an allometric relationship was present (Figs 3.23 (females) and 3.24 (males)). The results were two straight lines, the male at a lower value than the female, indicating that an allometric relationship existed between the number of setae in the tuft and the length of the wing: the longer the wing the greater the number of setae in the tuft. Thus the character could not be scored for number of setae on the basal hairline, and the following character states were coded:

0 with setal tuft: a strip of setae longer than proximal submarginal setae

1 with setal strip: a group of setae, two to more across; composed of setae shorter than proximal submarginal setae (Figs 5.49, 5.53)

2 with setal line: one line of setae (Figs 5.55, 5.66)

3 setae absent (Figs 4.4, 5.70)

4 not demarcated: basal cell is setose and basal hairline, if present, is not discernable (Figs 4.2, 5.8)

Character 51 (41): Basal cell setation in female

0 setose (Figs 5.8, 5.26)

1 bare (Figs 5.45, 5.53)

Character 52 (42): Basal cell margin in female

0 margined by cubital row of setae (Figs 5.6, 5.9)

1 partly margined (Figs 5.16, 5.66)

2 not margined (Figs 5.18, 5.30)

Character 53 (43): Speculum and linea calva

The *speculum* and the *linea calva* are two bare areas in the usually undifferentiated pilosity distal of the basal vein. Bouček (1988a) defines the speculum as a bare area immediately beyond the basal cell; and the linea calva as "an oblique bare strip further distad, towards the stigmal vein". Gauld and Bolton (1988) define the speculum as a bare area running obliquely from the parastigma (the intercept of the submarginal vein between basal and marginal veins) to the hind region of the wing and the linea calva as running from the stigmal vein to the hind margin. Thus the two features are defined on their position relative to the parastigma and the stigmal vein respectively, and the inference is also that the speculum is immediately distal to the basal vein and the linea calva is not. In the Eunotini, the width of the primary bare area or speculum ranges from very narrow to very wide, reaching past the stigmal vein. Using the Gauld and Bolton definition this feature cannot be classified as a speculum, since it reaches the stigmal vein; nor as a linea calva since it is immediately adjacent to the basal vein. In my opinion it is probably both, with a secondary loss of the setae dividing the two areas, but this is purely speculative. For the purpose of coding, I have used the Bouček (1988a) definition, and defined 5 character states on the position and extent of the bare area(s), if present.

0 no speculum or linea calva (Fig. 4.2)

1 narrow speculum present

2 wide speculum present (Fig. 5.16)

3 speculum and linea calva present (Figs 5.9, 5.29)

4 linea calva only present (Figs 5.8, 5.31)

Character 54 (58): Forewing development

0 complete (Figs 5.8, 5.21, 5.39, 5.68)

1 reduced (Figs 5.33, 5.46, 5.48)

2 narrow (Fig. 5.59)

Species with reduced wings had missing data (?) coded for all characters involving wings (Section 3.3.3). State 2 is an autapomorphy for *Ophelosia stenopteryx* sp.n. and thus not useful in phylogenetic analysis.

Character 55 (60): Forewing infumation in male (see figures for character 42)

0 without definite infumate patch

1 maculate

2 bimaculate

3 completely infumate

Character 56 (62): Costal margin setation in male (see figures for character 48)

0 with less than 10 setae

1 with setae along <0.5x margin

2 with setae along 0.5x to 0.9x margin

3 with setae along 0.9 to entire margin

Character 57 (63): Basal hairline setation in male (see figures for character 50)

0 with setal tuft

1 with setal strip

2 with setal line

3 setae absent

4 not delimited

Character 58 (64): Basal cell margin in male (see figures for character 52)

0 margined by cubital row of setae

1 partly margined

2 not margined

Character 59 (66): Basal hairline pigmentation in female

0 infumate (Figs 5.49, 5.53)

1 not infumate (Figs 5.18, 5.29)

Character 60 (67): Basal hairline pigmentation in male (see figures for character 59)

0 infumate

1 not infumate

Character 61 (68): Postmarginal vein in male

0 ≥ stigmal vein

1 < stigmal vein

LEGS

Character 62 (19): Number of hind tibial spurs

0 2 well-developed spurs

1 2, one rudimentary

2 1

According to Bouček (1988a) the possession of two hind tibial spurs is a symplesiomorphy for the Eunotinae. All of the Eunotini and Tomocerodini examined have two hind tibial spurs; within the Moranilini only *Tomicobiella, Tomicobomorpha, Amoturella* and most species of *Moranila* have two spurs, although some species of *Moranila* have a single long spur and a vestigial second spur (state 1), presumably intermediate. The remaining genera have the apomorphic condition of a single spur. The character is ordered 0 to 2.

Character 63 (44): Hind tibial spur length

0 less than 0.4x basitarsus

1 0.4-0.8x basitarsus

2 >0.8-as long as basitarsus

3 longer than basitarsus

Character 64 (45): Dorsal crest of setae on coxae

0 present

1 absent

Character 65 (46): Lateral crest of setae on coxae

0 present

1 absent

PROPODEUM

Character 66 (47): Nucha shape

0 longer than broad

1 square (Figs 5.129, 5.132)

2 broader than long (Fig. 5.71)

3 reduced

Character 67 (49): Median carina development

0 complete (Fig. 5.124)

1 incomplete (Figs 5.129, 5.132, 5.137)

2 absent (Fig. 5.71)

3 developed as a tooth (Figs 5.76, 5.80, 5.108)

GASTER

Character 68 (50): T1 sculpture

0 with striations (Fig. 5.90)

1 without striations

Character 69 (51): T1 length

0 >0.9x length gaster

1 between 0.9x and 0.6x length gaster

2 < 0.6x length gaster

Character 70 (52): Density of setal tuft at basal fovea

0 compact (Fig. 5.118)

1 not compact (Fig. 5.132)

2 sparse (Fig. 5.129)

3 absent (Figs 5.90, 5.91)

Character 71 (53): extent of setal tuft

0 confined to base

1 extended along margin

2 absent

Characters 72-76 (70-74): The form and microsculpture of the first sternite was found to be a very stable and informative character but was extremely difficult to code owing to the great diversity shown in the tribe. Naumann (pers. comm.) suggests that the various forms of sculpture may confer strength while preserving flexibility of the gaster (important in oviposition), and may be under strong selective pressure.

Character 72 (70): S1 microsculpture

0 surface entirely finely striate (Figs 5.87, 5.88, 5.94)

1 surface not finely striate (Figs 5.122, 5.126, 5.152)

Character 73 (71): S1 setation

0 without setae (Figs 5.91, 5.92, 5.112, 5.133)

1 with setae at base of sculpture (Figs 5.116, 5.117, 5.151)

2 with setae all over sculpture (Fig. 5.72)

Character 74 (72): S1 medial horizontal ridge

0 absent (Figs 4.5, 4.6, 4.7)

1 present as an interruption (Figs 5.74, 5.104)

2 present as a smooth ridge (Figs 5.126, 5.133)

3 present as a sculptured ridge (Figs 5.130, 5.131)

Character 75 (73): S1 anterior of ridge

0 unsculptured (Figs 4.5, 5.88)

1 alveolate (Figs 5.92, 5.113)

2 concave (Fig. 5.94)

3 foveate (Fig. 5.100)

4 grooved (Figs 5.104, 5.126)

Character 76 (74): S1 posterior of ridge

0 unsculptured (Fig. 4.5)

1 alveolate (Fig. 5.92)

2 concave

3 foveate (Figs 5.100)

4 grooved (Figs 5.104, 5.126)

3.5 Conclusion

Most of the characters scored for use in the data matrix for phylogenetic analysis were non-overlapping and thus relatively easily divided into character states. Problematic characters were subjected to morphometric analyses and decisions were made on an individual basis as to whether they were suitable for scoring and use in the analysis. Some characters which were found to be suitable for use, *i.e.* did not show any allometry, were still not able to be used as they showed a large range of intraspecific variation and overlap between species.

Chapter 4: Outgroups

4.1 Introduction

Bouček (1988a) divided the subfamily Eunotinae into three tribes, creating the two new tribes Tomocerodini and Moranilini. The Eunotini had been proposed as a tribe previously, *e.g.* Masi, 1931; Peck, 1963 (as a tribe of the subfamily Pteromalinae). Bouček defined the Eunotini by the possession of short regular pilosity over the entire scutellum, versus paired setae in the Tomocerodini and the Moranilini; and (often) the production of the scutellum over the propodeum, or even part of the gaster, as in *Scutellista*. The Tomocerodini were defined as having the second gastral tergite longer than the first and the mesoscutellar setae placed medially. Three species in three genera within the Eunotini and *Tomocerodes americanus* Girault, the only described species within the Tomocerodini, are used as outgroups in this study. These four taxa are redescribed here not for taxonomic purposes, but in order to provide data for the matrix (see Section 6.6 for a discussion of outgroup selection), and the synonymies and catalogue entries given are not comprehensive.

4.2 Tribe EUNOTINI

4.2.1 Genus *Cephaleta* Motschulsky

Cephaleta Motschulsky, 1859:173; Bouček, 1988a:352. Type species *Cephaleta purpureiventris* Motschulsky; designated by Ashmead, 1904:326.

Cardiogaster Motschulsky, 1863:72. Type species *Cardiogaster fusciventris* Motschulsky; by monotypy.

Anysis Howard, 1896:167; Peck, 1963:636-637. Type species *Anysis australiensis* Howard; by monotypy.

***Cephaleta* sp.**

Female

Head red-brown; dorsal margin deeply concave. Face 1.1 to 1.3x broader than long (mean 1.24). Occipital carina complete, sharp; back of head imbricate. Posterior

ocelli not removed from occipital carina. OD 2x OOL. Vertex smooth with slightly punctate setal bases. Entire head (except scrobes) covered in moderately long, regular setation. Face finely reticulate.

Antennae inserted below lower ocular line, about 1.5 torular diameters above clypeal margin. Scrobes reticulate medially with 2 smooth lateral strips; not carinate anteriorly. Antennae medium brown except pedicel and tip of club mid-brown. Scapes slender, pedicel elongate pyriform. F1 to F3 slightly longer than broad, F4 and F5 square. Flagellum with sensilla and very short setae; club 0.6 to 0.7x length of funicle (mean 0.64). Genae smooth. Malar groove absent; malar space as long as vertical axis of eye. Clypeal margin offset from genal carina; genal carina very narrow, not striate. Clypeal area delimited, smooth and with a line of conspicuous setae just above mandible; margin more or less straight. Mandible with broad, pointed, lower tooth and broad upper tooth divided indistinctly into 2 blunt teeth. Surface setose.

Thorax dark red-brown. Pronotum unsculptured; with short, close, regular setation and no setal ring. Mesoscutum broader than long; unsculptured except for punctate setal bases. Setation over entire mesoscutum regular, close and short, paired setae absent. Notauli complete grooves. Scapulae unsculptured except for punctate setal bases. Scutellum longer than broad, extending posteriorly over propodeum; slightly convex in lateral aspect; unsculptured except for slightly punctate setal bases anteriorly. Setation over entire scutellar surface close, short and regular. Frenal area delimited by change to coarsely punctate sculpture. Axillae demarcated by groove for almost entire length, excepting deep fovea posteriorly; sculpture and pilosity similar to that of anterior scutellum, not carinate laterally. Dorsellum reduced, smooth; metanotal furrow coarsely striate. Mesepisternum with large, matt, quadrate depression. Mesepimeron smooth dorsally, finely striate ventrally. Metapleuron striate, expanded into sharp point laterally.

Propodeum declivous; surface matt. Median carina present, no other carination. Nucha reduced; transversely striate. Large triangular lobe formed laterally, margined dorsally with short setae.

Forewing with faint infumate patch under entire marginal and apical submarginal vein. Marginal vein 3.7 to 4.3x longer than stigmal (mean 4.09). Stigmal

area setose. Postmarginal vein subequal to stigmal vein in length. Costal cell not excised at apex; with complete dorsal and complete ventral row of setae just below margin of cell; also with another ventral row and scattered dorsal and ventral setae. Submarginal vein not sinuate; with regular, close setation; setae numerous. Basal cell not delimited; cubital hairline absent. Wing setose over entire surface except for proximal posterior patch, *i.e.* speculum and linea calva absent.

Legs medium brown. Two hind tibial spurs present, longest 0.2x length of basitarsus. Hind coxae with basal, lateral and basal setal crests.

Gaster pointed apically, dark red-brown with faint metallic green lustre. Basal fovea with sparse setae at base; not extended down margin. T1 0.5x length of gaster. Ovipositor exserted beyond end of gaster. S1 with collar reduced, not sculptured, bare of setae (Fig. 4.5).

Male

Head dark red-brown, almost black, with slight metallic blue lustre.

Antennae inserted slightly more than 2 torular diameters above clypeal margin. Concolorous yellow-brown, filiform. Scape slender, pedicel small, pyriform. Funicular segments longer than broad; F1 longest, decreasing towards apex with F4 almost square. Sensilla dense, setae very short. Club 1.1 to 1.3x longer than F1 (mean 1.21).

Forewing with diffuse infumate patch posterior to marginal and apical submarginal vein; and long cubital hairline. Marginal vein 3.6 to 3.86x length of stigmal vein (mean 3.76). Postmarginal vein subequal to stigmal vein in length. Costal cell not excised at apex, with complete dorsal and complete ventral row of setae just posterior to margin and extra ventral setal row plus a few scattered ventral setae. Basal hairline not pigmented, obscured; basal cell not margined by cubital hairline. Speculum absent, linea calva not delimited.

Material examined: (females, males; BPBM). A long series of females and males from China, reared from "*Ceroplastes cajanae*", probably *Drepanococcus cajani* (Maskell) (Coccidae).

Biology: Members of the genus *Cephaleta* are parasitoids of coccoids, particularly the genera *Asterolecanium* Targioni-Tozzetti (Asterolecaniidae), *Cerococcus* Comstock (Cerococcidae), *Ceroplastes* Gray (Coccidae), *Chloropulvinaria* Borchsenius (Coccidae), *Ferrisia* Fullaway (Pseudococcidae) etc.

Distribution: Tropical and subtropical areas, including southern USA (Florida), South America, South Asia to Australia.

4.2.2 Genus *Mesopeltita* Ghesquière

Mesopeltis Masi, 1917:197. Type species *Mesopeltis atrocyanea* Masi; by monotypy. Preoccupied by *Mesopeltis* Cope, 1867.

Mesopeltita Ghesquière, 1946:370; Peck, 1963:638; Bouček, 1976:348; Burks, 1978:78-784; Clausen, 1978:69; Bouček, 1988a:352. Replacement name for *Mesopeltis* Masi.

***Mesopeltita truncatipennis* (Waterston)**

Mesopeltita truncatipennis Waterston, 1916:252-257; Bouček, 1976:348; Bouček, 1988a:352.

Holotype not seen

Female

Head shiny black, with faint metallic blue lustre; dorsal margin very deeply concave. Face 1.5x broader than long. Occipital carina complete, sharp; back of head alutaceous/imbricate. Posterior ocelli crossing occipital carina. OD 1.5x OOL. Vertex alutaceous with scattered short setation.

Antennae inserted 1 torular diameter above clypeal margin. Scrobes medially smooth, alutaceous on outer edges; not carinate anteriorly. Antennal scape and pedicel yellow-brown, flagellum paler. Scapes slender, pedicel elongate pyriform. Funicular segments all broader than long. Setae very short; club 1.2x length of funicle. Genae alutaceous. Malar groove absent; malar space slightly shorter than vertical axis of eye. Clypeal margin offset from genal carina; genal carina very narrow, not striate. Clypeal area not delimited; oral margin between toruli slightly

concave. Mandible with pointed lower tooth and rounded upper tooth.

Thorax shiny black. Pronotum much reduced, to a thin strip; alutaceous with short, close, regular setation and setal ring of 20 setae. Mesoscutum broader than long; alutaceous with regular, short setation over entire surface, paired setae absent. Notauli complete deep grooves. Scapulae with regular pilosity. Scutellum square, flat in lateral aspect; extending posteriorly over propodeum; sculpture alutaceous, with regular, short setation over entire surface. Frenal area not delimited; apical margin punctate, with longer setae. Axillae demarcated by groove for almost entire length; carinate laterally. Sculpture and pilosity similar to anterior scutellum. Dorsellar furrow smooth. Mesepisternum with large, engraved reticulate, quadrangular depression. Mesepimeron smooth, finely striate ventrally. Metapleuron smooth, foveolate; expanded into sharp point laterally.

Propodeum black. Median carina and costula present; sculpture closely reticulate above costula, largely alveolate below costula. Nucha reduced.

Forewing narrow; infumate in apical third. Marginal vein 1.3x longer than stigmal vein. Stigmal area setose. Postmarginal vein subequal to stigmal vein in length. Costal cell excised at apex; with 2 setae on apical margin and complete ventral row of setae and several partial rows. Basal hairline not infumate, without setae; basal cell bare; cubital hairline partly present. Setation distal to basal cell regular, undifferentiated, *i.e.* speculum and linea calva absent.

Coxae dark brown, striate; legs lightening to yellow apically. Two hind tibial spurs present, 0.1 and 0.2x length of basitarsus. Hind coxae with long, erect, dorsal setal crest, but no other pilosity.

Gaster rectangular; shiny dark brown-black. Basal fovea bare of setae. T1 0.9x length of gaster. Ovipositor exserted beyond end of gaster. S1 large but with reduced collar area. Collar sculptured, with medial longitudinal carina and smaller lateral longitudinal carinae. Surface bare of setae (Fig. 4.6).

Male

Head shiny black, not metallic.

Antennae inserted slightly more than 2 torular diameters above clypeal margin. Concolorous yellow-brown, filiform. Scape slender, pedicel small, pyriform.

Funicular segments longer than broad; F1 longest, decreasing towards apex with F4 square. Sensilla short and dense, setae very short. Club 1.75x longer than F1.

Forewing hyaline. Marginal vein 1.5x length of stigmal vein. Postmarginal vein subequal to stigmal vein in length. Costal cell deeply excised at apex, with 3 setae on apex. Basal hairline not pigmented, bare; basal cell partly margined by cubital hairline. Speculum absent, linea calva not delimited.

Material examined: (1 female, 1 male; NHM). 1 female, 1 male, Oman, Salalah, 25 Feb 1986, no.5, ex scale?, C.I.E.A.17957.

Biology: *M. truncatipennis* has been recorded as a parasitoid of coccids *e.g. Saissetia* Deplanche (Coccidae), according to Bouček (1988a).

Distribution: Neotropics north to U.S.A. and tropical Africa, including the Seychelles and Mauritius (2-3 spp.), and one Japanese species.

4.2.3 Genus *Scutellista* Motschulsky

Scutellista Motschulsky, 1859:172-173; Peck, 1963:633; Graham, 1969:75; Burks, 1978:784; Bouček, 1988a:351. Type species *S.cyanea* Motschulsky; by monotypy.

Aspidicoris Costa, 1863:25. Type species *Aspidicoris cyaneus* Costa; by monotypy.

Enargopelte Förster, 1878:62-63. Type species *Enargopelte obscura* Förster; by monotypy.

Eugastropelte Masi, 1931:452-454. Type species *Scutellista gigantea*; by original designation. Synonymised by Bouček, 1988a;351.

***Scutellista caerulea* (Fonscolombe)**

Encyrtus caeruleus Fonscolombe, 1832:304; Bouček, 1988a:351. Synonymised with *cyanea* by Graham, 1969:76.

Scutellista cyanea Motschulsky, 1832:304; Peck, 1963:634-636; Burks, 1978:784; Bouček, 1988a:351.

Note that Graham (1969:76) recommended the retention of the specific epithet "*cyanea*", although *caeruleus* has priority. Bouček (1988a:351) used *caerulea* as the valid name despite the widespread use of *cyanea* in economic entomology.

Holotype not seen

Female

Head black, with slight metallic blue lustre; dorsal margin deeply concave. Face 1.3 to 1.6x broader than long (mean 1.44). Occipital carina complete, sharp; back of head imbricate. Posterior ocelli crossing occipital carina. OD slightly less than OOL, about 0.8x. Vertex engraved reticulate/punctate, grading to rugose-punctate on lower face. Entire head except scrobes covered in short, regular setation. Eyes minutely hairy.

Antennae (Fig. 4.1) inserted below lower ocular line, slightly less than 2 torular diameters above clypeal margin. Scrobes smooth at bases, apically rugose with central dimple; centrally sculptured, not carinate anteriorly. Antennae honey-yellow except pedicel and tip of club mid-brown. Scapes slender, pedicel elongate pyriform. F1 to F3 more or less square, F4 and F5 slightly broader than long. Whole flagellum with sensilla and very short setae; club 0.6x to 0.8x length of funicle (mean 0.69). Genae alutaceous, sparsely punctate. Malar groove complete; malar space as long as vertical axis of eye. Clypeal margin offset from genal margin; genae not carinate. Clypeal area delimited, smooth and with line of conspicuous setae just above mandible; margin indented laterally. Mandible with broad, pointed, lower tooth and broad upper tooth divided indistinctly into 2 blunt teeth. Surface setose.

Thorax black, with slight metallic blue/purple lustre; sculpture and pilosity uniform over entire thorax. Pronotum rugulose; with short, close regular setation and no setal ring. Mesoscutum broader than long; covered entirely with regular, close, short pilosity, paired setae absent; setal bases rugulose/punctate. Notauli complete grooves. Scapulae rugulose/punctate anteriorly, punctate posteriorly. Scutellum much longer than broad; flat in lateral aspect; extending posteriorly over propodeum and over half of gaster; rugulose/punctate grading to alutaceous posteriorly; pilosity as for mesoscutum. Frenal area not delimited. Axillae small, demarcated by groove for

almost entire length, excepting deep fovea posteriorly; sculpture and pilosity similar to that of scutellum; not carinate laterally. Metanotum not visible. Mesepisternum with large, engraved reticulate, quadrate depression. Mesepimeron transversely rugose. Metapleuron striate, expanded into lateral lobe.

Propodeum declivous (almost at right angle to mesoscutum); surface longitudinally striate, lacking any carination. Nucha completely reduced. Large lobe formed laterally, margined dorsally with short, reddish setae, longitudinally rugose.

Forewing (Fig. 4.2) with very faint infumate patch under stigmal vein. Marginal vein 1.3 to 2.2x longer than stigmal (mean 1.61). Stigmal area setose. Postmarginal vein about 0.75x stigmal vein. Costal cell not excised at apex; with complete dorsal and complete ventral row of setae just posteror to margin of cell, also with scattered dorsal and ventral setae. Submarginal vein not sinuate, smoothly continuous with marginal vein; with regular close setation; setae numerous. Basal cell not delimited; cubital hairline absent. Wing setose over entire surface except for proximal posterior patch, *i.e.* no speculum, no linea calva.

Coxae and femora dark, with metallic blue lustre. Fore and mid tibiae and tarsi yellow-brown, hind tibiae and tarsi yellow. Last tarsal segments dark brown. Hind tibiae and femora expanded. Two hind tibial spurs present; both very short, longest 0.2x length of basitarsus. All coxae and femora alutaceous. Hind coxae with line of short setae dorsally.

Gaster pointed apically, dark with metallic green lustre. No pilosity at basal fovea. T1 0.5-0.8x length of gaster; with fine longitudinal striations on dorsal apex. Ovipositor exserted beyond end of gaster. S1 with collar area reduced; not sculptured, bare of setae (Fig. 4.7).

Male

Head black.

Antennae inserted 3 torular diameters above clypeal margin. Concolorous yellow-brown, filiform. Scape slender, pedicel small, pyriform. Funicular segments rectangular, subequal; sensilla dense, setae very short, whitish. Club 2 to 2.3x as long as F1 (mean 2.14).

Forewing completely hyaline. Marginal vein 1.7 to 2.2x length of stigmal vein

(mean 1.91). Costal cell not excised at apex, with complete dorsal and complete ventral row of setae just posterior to margin and a few scattered ventral setae. Basal hairline not pigmented, obscured; basal cell less setose than in female; not margined by cubital hairline. Speculum absent, linea calva not delimited.

Material examined: (35 females, 12 males; ANIC). 35 females, 12 males, Sydney, CSIRO Biological control Station, Dec 1966- Jan 1969, (coll. Pietersberg, Transvaal, South Africa), lab reared on *Gascardia (=Ceroplastes) destructor* (Newstead) (Coccidae).

Biology: According to Smith and Compere (1928), *Scutellista cyanea* has been recorded as an egg predator of many coccoids, including the genera *Saissetia*, *Ceroplastes*, *Coccus* L. (Coccidae) and *Planococcus* Ferris (Pseudococcidae).

Distribution: U.S.A., Hawaii, Mediterranean, Africa, India, China, South Asia, Australia and New Zealand. Introduced into California and the southern U.S.A., Australia and New Zealand from south and east Africa for biological control.

4.3 Tribe TOMOCERODINI

4.3.1 Genus *Tomocerodes* Girault

Tomocerodes Girault, 1916:247-248; Burks, 1958:76; Peck, 1963:636; Burks, 1978:784; Bouček, 1988a:353. Type species *Tomocerodes americanus* Girault; by monotypy.

Tomocerodes americanus Girault

Tomocerodes americanus, Girault, 1916:247-248; Burks, 1958:76; Bouček, 1988a:353.

Holotype not seen

Female

Head orange-brown; dorsal margin slightly concave. Face 1.5x broader than

long. Occipital carina weak, crossed by posterior ocelli; back of head alutaceous. OD about 0.8x OOL. Vertex engraved reticulate, with scattered long setae.

Antennae (Fig. 4.3) inserted about 1.5 torular diameters above clypeal margin. Scrobes shallow, smooth, scarcely carinate anteriorly. Scapes orange-brown, pedicel and flagellum medium brown. Pedicel elongate, funicular segments all more or less square. Club 0.88x length of funicle. Setae same length as segments of origin. Genae alutaceous, malar groove absent. Malar space subequal to vertical axis of eye. Clypeal margin and genal carina offset. Genal carina narrow, not striate. Clypeus delimited; margin a narrow straight strip. Mandible with broad, pointed, lower tooth and 2 smaller rounded upper teeth.

Thorax orange-brown. Pronotum smooth with short, regular setation and ring of 8 long setae; setal bases not reticulate. Mesoscutum slightly broader than long, engraved reticulate; with 2 pairs of long setae medially, bases not reticulate. Notauli completely absent. Scapular area faintly engraved reticulate, with pair of setae. Scutellum square, slightly convex in lateral aspect; faintly engraved reticulate, with 2 pairs of setae, anterior pair closer together than posterior pair. Frenal area not delimited. Axillae delimited by groove apically, by slight fovea basally; faintly engraved reticulate; carinate laterally; with pair of setae. Dorsellum smooth, dorsellar fovea coarsely alveolate; remainder of metanotum smooth. Mesepimeron with very shallow, faintly engraved triangular depression; mesepisternum smooth.

Propodeum orange, short. Median carina complete, with smooth, raised, triangular area at base; costula and plicae present, costula curved up towards median carina; rest of surface smooth. Nucha very short, much broader than long.

Forewing (Fig. 4.4) with infumate patch posterior to marginal and stigmal veins. Marginal vein 0.88x length of stigmal vein. Stigmal area bare. Postmarginal vein 0.2x length of stigmal vein. Costal cell not excised at apex; with 2 setae on apex of margin; ventral row of setae incomplete. Submarginal vein slightly sinuate. Basal hairline not infumate, bare; basal cell bare; cubital hairline absent. Speculum present, linea calva not delimited. Disc sparsely setose, fringe long.

Legs orange-brown. Hind coxae with long, sparse, dorsal and lateral setal crest; basal crest absent. Hind tibial spur around 0.4x length of basitarsus.

Gaster orange grading to dark brown apically. T1 less than 0.2x length of

gaster, T2 0.85 x length of gaster. Sparse group of setae at base, not extended down margin. Ovipositor projecting slightly beyond end of gaster. S1 with collar area reduced; grooved anteriorly and posteriorly, with smooth, medial, horizontal ridge. Surface bare of setae (Fig. 4.8).

Male not seen.

Distribution: U.S.A.

Material examined: (1 female; NHM). 1 female, U.S.A., Arizona, Nogales, 3 Apr 1951, Westover, ex *Lecanodiaspis prosopidis* (Maskell) (Lecanodiaspididae).

Biology: reared from *Lecanodiaspis prosopidis.*

Chapter 5: Alpha-taxonomy of the Moranilini

The world species of the tribe Moranilini are described or redescribed and keys to the genera and species are presented. The generic classification presented in this chapter is partially based on the result of the cladistic analysis presented in Chapter 6. The format of the descriptions is given in Section 2.3.3.

5.0 Key to the genera of Moranilini

1. Marginal vein short, half length of stigmal vein (Fig. 5.26) *and* mesoscutum with regular setation only, without paired setae [thorax very convex in lateral aspect, propodeum with nucha reduced] ..... ***Globonila* Bouček**

Either marginal vein longer than half length of stigmal vein *or*, if shorter, mesoscutum with paired setae **2**

2. Propodeum regularly alveolate; scutellum with a row of coarse alveolae at apex (Fig. 5.71) ..... ***Amoturella* Girault**

Propodeum not regularly alveolate, otherwise sculptured; scutellum may or may not have frenal area delimited, but without a row of alveolae at apex **3**

3. Propodeum with median carina developed into a tooth (Figs 5.76, 5.80, 5.85, 5.99, 5.103); frenal area sometimes delimited by a groove or series of punctations (Figs 5.73, 5.89, 5.106) ..... ***Aphobetus* Howard**

Propodeum without a tooth developed from median carina; frenal area not so delimited **4**

4. Propodeum reticulate, with median carina developed only at anterior end (Figs 5.129, 5.137); female head orange; hind tibia with a single well-developed spur ..... ***Ophelosia* Riley**

Propodeum not as above; female head variously coloured; hind tibia with 1 or 2 spurs **5**

5. Posterior ocelli removed from occipital carina by 1OD; female antennae very strongly clavate (Fig. 5.22); male antenna branched (Fig. 5.24) ..... ***Eunotomyiia* Girault**

Posterior ocelli removed from occiput by much less than 1OD; female antennae scarcely to moderately clavate (*e.g.* Figs 5.34, 5.65); male antennae not branched (*e.g.* Figs 5.40, 5.64) **6**

6. Occipital carina absent; female antennae very slender, scarcely clavate (Figs 5.63, 5.65) ..... ***Tomicobiella* Girault**

Occipital carina present, at least weakly; female antennae moderately clavate (Figs 5.28, 5.34, 5.41, 5.44) **7**

7 Propodeum almost smooth, but with 3 longitudinal carinae in centre; male with striations radiating from clypeal region ..... ***Hirtonila* Bouček**

Propodeum not as above; male face without striations radiating from clypeal region **8**

8 Linea calva present, speculum absent (Fig. 5.31); setae at base of gaster not a compact tuft (*e.g.* Fig. 5.132) ..... ***Kneva* Bouček**

Linea calva absent, speculum present (Figs 5.30, 5.37, 5.39, 5.42, 5.70); setae at base of gaster in a compact tuft (Figs 5.118, 5.120) **9**

9 Hind coxae with lateral setae absent; forewing excised at apex of costal cell (Fig. 5.30) ..... ***Ismaya* Bouček**

Hind coxae with lateral setae; forewing not excised at apex of costal cell **10**

10 Hind coxae without dorsal setal crest ..... ***Tomicobomorpha* Girault**

Hind coxae with conspicuous dorsal setal crest **11**

11 Occipital carina weak; setae at base of gaster extended down margin of basal fovea; female antenna strongly clavate (Fig. 5.17) ..... ***Australeunotus* Girault**

Occipital carina weak to strong; setae at base of gaster not extended down margin of basal fovea; female antenna moderately to strongly clavate (Figs 5.34, 5.38, 5.41, 5.44) ..... ***Moranila* Cameron**

5.1 Genus *Amoturella* Girault

Amoturella Girault, 1913b:110; Bouček, 1988a:367. Type species *Amoturella saintpierrei* Girault; by monotypy.

Female

Head brown to black, with green metallic lustre; face from 1.3 to 1.4x broader than long. Occipital carina absent. Posterior ocelli crossing occiput. OD less than OOL. Eyes bare. Vertex sculptured with scattered short setae.

Antennal funicle short; F1 very reduced, ring-like, closely opposed to F2. F2 subsquare, F3-F5 square to transverse. Club 1 to 1.2x length of funicle; only slightly broader than funicle; setae short. Malar groove complete. Malar space subequal to vertical axis of eye. Genal carina offset from clypeal margin. Mandibles tridentate.

Thorax dark, with reddish metallic lustre; variously sculptured. Pronotum with setal ring absent; setal bases simple. Mesoscutum and scapulae variously sculptured. Notauli almost complete, composed of series of short, broad grooves. Scutellum 1.4 to 1.5x broader than long, slightly convex in lateral aspect; variously sculptured; with 2 pairs of setae. Frenal area not delimited by line or groove; apex coarsely alveolate with smooth band at hind scutellar margin (Fig. 5.71). Axillae sculptured. Mesepisternum with triangular depression; mesepimeron without dimple, variously sculptured. Dorsellum smooth, fovea alveolate; metanotum smooth, metanotal furrow striate.

Propodeum (Fig. 5.71) black with metallic lustre; regularly reticulate, median carina and costula absent. Nucha broader than long.

Forewing complete or reduced.

T1 0.5-0.75x length of gaster. Basal fovea without setae.

Biology: Hosts are unknown.

Distribution: The genus is found in Tasmania and in eastern Australia.

Key to the females of the genus *Amoturella* Girault.

1. Forewing reduced ..... *brindabellensis*

Forewing complete ..... *saintpierrei*

5.1.1 ***Amoturella brindabellensis*** **sp.n.** (Figs 5.1, 5.2, 5.71, 5.72; Map 18)

Holotype: female, ANIC.

Label details: "35.22S 148.48E/ Piccadilly Circus/ 1240m.ACT 1/10-/15/11/84 Weir/ Lawrence, Johnson" and "flight intercept/ window/ trough/ trap" and "Muscideoidea/ sp.P117. ♀/ det. I. D. Naumann 1986" and "1957".

Female

Head black, with or without metallic green lustre; dorsal margin weakly concave. Face 1.3x broader than long. Ocellar triangle large, posterior ocelli situated far back on vertex. OD approximately 0.75x OOL. Vertex alutaceous with scattered, very short setae.

Antennae (Fig. 5.1) inserted about 1 torular diameter above clypeal margin. Scrobes very shallow, unsculptured, not delimited anteriorly by carina. Antennae concolorous medium brown. Scapes slender, pedicel elongate-pyriform. Funicle short, F1 very reduced, ring-like, very closely opposed to F2. F2 subsquare, F3-F5 square to transverse. Club 1 to 1.1x length of funicle length (mean 1.04). Genal carina moderately wide, striate. Oral margin slightly emarginate, with striate, rectangular indentation above it. Genae very faintly reticulate. Mandible with pointed lower tooth and 2 smaller, blunt, upper teeth.

Thorax dark with or without red metallic lustre. Pronotum wide (about twice as broad as long); engraved reticulate/alutaceous; with regular, very short pilosity over entire surface. Mesoscutum reduced, slightly shorter than pronotum, broader than long; imbricate/alutaceous, also covered in regular short pilosity, with posterior pair of setae. Notauli almost complete, composed of series of short, broad grooves.

Scapulae imbricate/alutaceous. Scutellum engraved reticulate; upper pair of setae closer together than lower pair. Axillae longitudinally striate. Mesepisternum with triangular depression with 3 deep depressions within it. Mesepimeron strigate.

Propodeum black with blue/green lustre; narrow; regularly reticulate. Nucha very short, broader than long.

Forewing reduced (Fig. 5.2), length varying from not reaching end of propodeum to extending down to anterior third; infumate. Marginal vein present, stigmal absent. Costal cell present though very narrow. Submarginal vein complete. Distal margin of wing oblique; some setae on reduced disc beneath marginal vein.

Legs medium brown. Hind coxae long and slender, with lateral and very sparse dorsal setal crest. Hind femora stout. Two hind tibial spurs present; longest less than 0.1x length of hind basitarsus.

Gaster dark red-brown, elongate. T1 0.5- 0.6x length of gaster. Ovipositor projecting slightly from end of gaster. S1 foveate; foveae arranged in 2-3 rows. Setae scattered over entire surface. Surface not striate (Fig. 5.72).

Male unknown

Paratypes: (2 females; A.N.I.C.). **A.C.T.:** 1 female, 35.22 148.48, Piccadilly Circus, 1240m, Dec 1984, TAW, JFL, M-LJ, flight intercept window/trough trap; 1 female; same data except Jan 1984.

Note: The January female is small, non-metallic and with a longer T1 (0.75xl gaster) but I believe it is conspecific with the holotype.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Australian Capital Territory.

5.1.2 ***Amoturella saintpierrei*** **Girault** (Figs 5.3, 5.4; Map 18)

Amoturella saintpierrei Girault, 1913b:110; Dahms, 1986:493-494; Bouček, 1988a:367, Figs 683-7.

Holotype: female, SAM.

Publication details: "*Hab.*- Tasmania: Hobart (A. M. Lea). *Type*.- I1469 South Australian Museum. One specimen and a slide bearing head and posterior leg".

Label details: Card labelled "Amoturella/ saintpierrei/ Gir. ♀" and "I1469/ Amoturella/ saintpierrei Gir/ Tasmania/ Slide also/ TYPE"; bearing holotype minus head, wings and legs.
Slide labelled "Amoturella/ saintpierrei/ Girault/ type" with 2 complete coverslips containing the head (antennae separated, 1 in 2 pieces, the other incomplete), 2 legs (1 minus tarsus), 1 tibia and 1 forewing, all from the holotype.

Female

Head dark orange-brown, with metallic green lustre; face about 1.4x broader than long. OD about 0.5x OOL. Vertex sculptured with scattered short setae.

Antennae (Fig. 5.3, drawn from type specimen) inserted less than one torular diameter above clypeal margin. Top of scrobes engraved reticulate, but mostly smooth. Scapes slender, pedicel elongate-pyriform. F1 small, annellus-like, very closely opposed to F2. F2 subsquare, F3 square, F4-F5 transverse. Club 1.1 to 1.2x length of funicle (mean 1.04). Malar space slightly longer than vertical axis of eye. Oral margin straight. Mandibles with 3 pointed teeth, subequal in size.

Thorax black, with metallic red/orange lustre. Pronotum broader than long; imbricate, with very short regular setation. Mesoscutum broader than long, longer than pronotum; finely engraved reticulate with very short, regular pilosity. Notauli almost complete, composed of short, shallow grooves which are individually broader than long. Scapulae finely engraved reticulate. Mesoscutal-scutellar boundary sculptured, composed of 2 large pits medially and smaller ones laterally. Scutellum slightly convex in lateral aspect; finely engraved reticulate; anterior pair of setae closer together than posterior pair, both pairs short. Axillae delimited anteriorly by

groove and posteriorly by deep fovea, longitudinally striate. Mesepisternum with triangular depression, with 3 deep dimples within it; mesepimeron striate.

Propodeum coarsely and regularly reticulate, without carination, smooth around spiracles. Nucha short.

Forewing (Fig. 5.4, drawn from type specimen, details of setal distribution obscured and much of disc damaged) with pale, diffuse, infumate patch posterior to marginal vein and more darkly infumate triangular patch at basal hairline. Marginal vein 2.47x length of stigmal vein. Postmarginal vein indistinct, subequal in length to stigmal vein. Stigmal area bare. Costal cell not excised at apex, with about 5 setae along apical margin. Ventral row of setae not discernable. Submarginal setae obscured. Basal hairline present, with strip of about 10 setae; basal cell with scattered very short setae; cubital hairline absent. Narrow speculum present, linea calva not differentiated. Insertions for bases of marginal setae present but setae destroyed (see Remarks).

Legs and coxae orange-brown.

Gaster smooth, shiny black; longer than broad. T1 0.75x length of gaster. Ovipositor not produced beyond end of gaster. S1 obscured.

Male unknown.

Material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Australia:** Tasmania.

Remarks: The head of the holotype is crushed on a slide and some details, especially around the genal carina area are obscured. Bouček (1988a) uses absence of a marginal fringe on the forewing and presence of a reduced number of funicular segments (4) as key characters for this genus. These are both incorrect; F1 is present, but reduced and the setal base insertions on the forewing are present, but the setae have been destroyed. Bouček suggests a relationship to *Moranila* on the basis of a

general similarity between propodea of the two genera, and also to *Aphobetus* on the presence of a frenal line on the scutellum and the absence of adfoveal tufts (see Section 6.9.10).

5.2 Genus *Aphobetus* Howard

Aphobetus Howard, 1896:166; Ashmead, 1904:328; Bouček, 1988a:363. Type species *Aphobetus maskelli* Howard; by monotypy.

Muscideopsis Girault, 1915a:324. Type species *Muscideopsis goldsmithii* Girault; by original designation. Synonymised by Bouček, 1988a:363.

Austroeunotus Girault, 1938b:84-85. Type species *Austroeunotus silvifilia* Girault; by original designation. Synonymised by Bouček, 1988a:363.

Pidinka Bouček, 1988a:362. Type species *Pidinka nana* Bouček; by monotypy and original designation. **syn.n.**

Modronila Bouček, 1988a:364. Type species *Modronila cyanea* Bouček; by monotypy and original designation. **syn.n.**

Strionila Bouček, 1988a:365-366. Type species *Strionila moundi* Bouček; by monotypy and original designation. **syn.n.**

Female

Head brown-black to shiny black, with or without metallic lustre; dorsal margin weakly to strongly concave. Face from 1.1 to 1.8x broader than long. Occiput strongly to weakly margined; back of head posterior to carina variously sculptured. Posterior ocelli crossing edge of carina, or removed by less than 1 ocellar diameter. Ocelli clear to red; OD from 0.35 OOL to almost equal to OOL. Eyes minutely hairy. Face and vertex smooth to variously sculptured; with scattered setae, long on vertex.

Antennae inserted from slightly less than 1 to 2 torular diameters above clypeal margin. Antennal scrobes either smooth and unsculptured or finely striate centrally; very weakly or not carinate anteriorly. Antennae ranging in colour from yellow to dark brown, concolorous or not. Scape not extending to vertex; pedicel longer than F1; funicular segments increasing in width if not length towards club. F1 not broader than long; remaining funicular segments varying. Club ovoid; from 0.4

to 0.9x length of funicle. Malar groove ranging from complete and conspicuous to almost entirely absent. Genae weakly to strongly carinate; groove relatively wide, striate or not. Oral margin between toruli straight, sloping down to offset genal carina. Mandible with broad, pointed lower tooth; upper tooth blunt and undivided, or divided into 2 or 3 blunt or pointed teeth.

Thorax shiny, black to dark brown without metallic lustre. Pronotum much broader than long; narrower than mesoscutum, with transverse ring of 4 to 12 conspicuous setae ranging from weak and brown to strong and black; sculptured; with scattered short setae anterior to setal ring, smooth and shiny posterior to ring. Mesoscutum smooth and shiny to finely reticulate or finely transversely rugose. Notauli ranging from broad shallow grooves to complete, composed of a series of small, well-defined pits reaching scutellar boundary. Scapulae ranging from smooth and shiny to finely transversely rugose, reticulate or finely longitudinally striate. Scutellum longer than broad to broader than long, convex to flat in lateral aspect; usually divided in posterior third by frenal line or indented frenal groove consisting of row of punctures; upper part usually more heavily sculptured than lower part. Two pairs of setae present on scutellum. Axillae sculptured or not, with scattered setae. Mesepisternum with depressed, finely striate to smooth elongate triangular area centrally; upper and lower mesepimeron variously sculptured. Dorsellum triangular, sculptured or not. Remainder of metanotum variously sculptured.

Propodeum ranging from dark yellow-brown, often brown-black anteriorly to dark red or black, with or without metallic lustre. Broad at spiracles, narrowing into very short, fairly broad neck, with strong anteromedial tooth (expanded median carina). Costula and plica present, additional median plicae (complete or incomplete) present or absent. Basal fovea inconspicuous or deep; apical fovea present or absent. Tooth smooth or sculptured, may or may not be delimited by longitudinal or oblique carinae on either side.

Forewing hyaline or infumate. Marginal vein from 1.25 to 5.8x as long as stigmal vein. Postmarginal vein as long as or slightly longer than stigmal vein. Stigmal area from completely bare to setose. Costal cell straight or excised at apex; margined with varying number of setae; with continuous row of ventral setae and other setation. Submarginal vein not smoothly contiguous with marginal vein, and

with varying number of setae. Proximal part of wing from completely setose (excepting linea calva) to bare excepting basal and cubital hairlines. Distal part of wing with fine, close setation.

Legs ranging in colour from yellow to dark brown; tarsal claws dark. Hind coxae with or without dorsal and lateral crests of setae. One or 2 tibial spurs present, longest spur from 0.1 to almost as long as hind basitarsus.

Gaster ranging from concolorous pale to bright yellow through dark yellow-brown to dark brown or black with metallic lustre, often graduated towards apex and base. T1 from 0.4 to 0.95x as long as gaster; mostly unsculptured but with longitudinal striations in one species. Loose tuft of setae or several long setae present at base of T1; setae not extended down margin of fovea. Ovipositor short, scarcely extending beyond tip of gaster. S1 variously sculptured; surface finely striate or rarely smooth or alveolate; setae absent.

Male

Head shiny black to shiny dark brown or red-brown, with or without metalllic lustre.

Antennae inserted from 2 to 3 torular diameters above clypeal margin. Funicular segments nodose, separated by distinct constrictions and with long setae; F1 usually the longest funicular segment. Club from 1 to 2x longer than F1.

Thorax shiny, black to dark brown.

Forewing hyaline or with faint infumate patch posterior to marginal, stigmal, and/or postmarginal veins. Marginal vein from 1.6 to 4.9x length of stigmal vein. Postmarginal vein slightly longer than stigmal vein. Basal hairline pigmented or not, with line of setae; basal cell margined by cubital hairline.

Gaster more slender than that of female, T1 O.3- 0.7x length of entire gaster.

Biology: *Aphobetus* species are parasitoids or hyperparasitoids of Coccoidea or Aphididae. In cases where there are a number of rearing records they show little host specificity. *A. maskelli* has been reared as a parasitoid of Pseudococcidae, Diaspididae, Coccidae, Eriococcidae, Aphididae; and as a hyperparasitoid on coccids or eriococcids via encyrtids. All other host records for species of *Aphobetus* fall in

the above families.

Distribution: The genus occurs in both Australia and New Zealand without overlap of species. Six species are endemic to New Zealand. Two species are endemic to Tasmania; the remaining six to Australia.

Remarks. Bouček (1988a) synonymised *Muscideopsis* Girault and *Austroeunotus* Girault with *Aphobetus* Howard. The synonymy of *Pidinka, Modronila* and *Strionila* is discussed in Chapter 6.

Key to the species of *Aphobetus* Howard (male and female).

1. Tergite 1 with longitudinal striations in posterior half extending transversely across half surface (Fig. 5.90) ..... *moundi*
Tergite 1 without striations 2

2. Basal cell of forewing completely setose except for linea calva (Fig.5.8) [large, metallic blue in colour] ..... *cyanea*
Basal cell bare (Fig. 5.9) or with scattered setae (Fig. 5.13), speculum present 3

3. Mesoscutum smooth, unsculptured 4
Mesoscutum sculptured 5

4. Notauli absent, replaced by wide shallow groove (Fig. 5.73) ..... *cultratus*
Notauli complete, represented by a series of small, well-defined pits (Figs 5.83, 5.96) ..... *goldsmithii*

5. Occiput not definitely margined by a carina (Fig. 5.105) [mesepimeron without a dimple, long hind tibial spur, ♀ forewing hyaline] .... *vandiemenensis*
Occiput margined by a definite carina (Figs 5.82, 5.83)..... 6

6. Face entirely sculptured ..... *reticulatus*
Sculpture on face limited to scrobes and vertex 7

7. Propodeum with recurved plicae ..... *lecanii*
Propodeum without recurved plica 8

8. Linea calva present (Figs 5.9, 5.13) 9
Linea calva absent (Figs 5.6, 5.16) 11

9. Mesepisternal depression not striate (Fig. 5.84); ♀ forewing with a large, well-defined, infumate patch (Fig. 5.9) ..... *garretti*
Mesepisternal depression striate (Fig. 5.98); ♀ forewing hyaline or not, but without clearly defined infumate patch 10

10. Hind tibial spur less than half length of basitarsus ..... *silvifilia*
Hind tibial spur more than half length of basitarsus ..... *singeri*

11. Frenum not delimited by indented groove, but by faint line or change in sculpture (Figs 5.79, 5.80) 12
Frenum delimited by indented groove (Figs 5.73, 5.89) 13

12 Thorax depressed, scutellum flat in lateral aspect, 4 setae in pronotal ring ..... *nana*
Thorax not depressed, scutellum at least slightly convex in lateral aspect; more than 4 setae in pronotal ring ..... *erroli*

13. Pronotum with 4 setae in setal ring ..... *paucisetosus*
Pronotum with more than 4 setae in setal ring ..... *maskelli*

5.2.1 ***Aphobetus cultratus*** **sp.n.** (Figs 5.5, 5.6, 5.73, 5.74; Map 1)

Holotype: female, NZAC.

Label data: "NEW ZEALAND OL/ Kirks Bush/ L. Hawea Jan 1981" and "swept/ J. S. Noyes/ E. W. Valentine" and "*Nothofagus* For/ Broadleaf/ *P. totara*".

Female

Head shiny black; dorsal margin slightly concave. Face 1.3 to 1.5x broader than long (mean 1.41). Occipital carina strong; back of head longitudinally striate laterally, interrupted medially. Ocelli clear; OD 0.6x OOL. Vertex with long dark setae; frons with strong, dark setae along inner margins of eyes; base of each seta tuberculate.

Antennae inserted about 2 torular diameters above clypeal margin. Scrobes smooth; not carinate anteriorly. Scapes dark brown; pedicel and funicular segments yellow-brown; club grading to darker brown at apex, length approximately 2x width. Funicle relatively elongate with F1 longer than broad, and only F5 broader than long (Fig. 5.5). Club segmented, 0.5 to 0.7x length of funicle (mean 0.6). Malar groove incomplete, reduced to shallow remnant, malar space about equal to vertical axis of eye. Genal carina striate. Mandible with broad, pointed lower tooth and 2 blunt upper teeth.

Thorax shiny black, convex in lateral aspect. Pronotum unsculptured; pronotal ring with about 10 strong black setae. Mesoscutum and scapulae unsculptured, smooth and shiny; pilosity reduced to pair of black setae between notauli. Notauli incomplete, in the form of broad, shallow pits, finely and sparsely punctured around circumference (Fig. 5.73). Scutellum more or less square, convex in lateral aspect; irregularly striate anterior of frenal groove, frenal area smooth; scutellar setae long and black. Frenal area delimited by indented frenal groove consisting of row of punctures. Axillae smooth. Mesepisternal depression striate; mesepimeron smooth, with smooth dimple. Dorsellum longitudinally striate, rest of metanotum smooth, furrow finely striate.

Propodeum shiny black; basal fovea present. Plica absent, additional horizontal carinae present posterior to costula. Surface of tooth smooth. Nucha

rugose.

Forewing (Fig. 5.6) hyaline, or with diffuse, pale brown colour, without definite infumate patch. Marginal vein from 1.8 to 2.3x length of stigmal vein (mean 2.01). Postmarginal vein 1.2x length of stigmal vein. Stigmal area with scattered setae. Postmarginal vein about 1.2x length of stigmal vein. Costal cell not excised at apex; almost entirely margined by setae; ventral row of setae continuous. Submarginal vein with 9-11 setae. Basal hairline faintly pigmented, with line of about 5 setae; basal cell bare, margined by cubital hairline. Speculum present; linea calva not differentiated.

Coxae dark yellow-brown, not striate; hind coxae with dorsal crest of setae present, lateral absent. One hind tibial spur present; 0.2-0.3x length of hind basitarsus.

Gaster dark brown-black grading to brown at apex, or entirely brown. T1 covering 0.6 to 0.9x length of gaster. Setae at base long but sparse. Ovipositor projecting slightly from base of gaster. Entire surface of S1 finely striate, giving a matt appearance; anterior half with shallow alveolae (Fig. 5.74).

Male

Head very dark red-brown.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin. Scape and pedicel brown-black; funicle and club black. F1 longest funicular segment. Club 1.1 to 1.5x length of F1 (mean 1.25). Funicular setae approximately same length as segments of origin.

Mesoscutum with some transverse rugosity, but mostly smooth; with approximately 4 pairs of setae. Notauli defined anteriorly, becoming a groove posteriorly. Scapulae smooth and shiny.

Forewing hyaline, marginal vein 1.7 to 2.3x length of stigmal vein (mean 2.05). Setae along 0.95x length of margin of costal cell. Basal hairline infumate, with line of about 6 setae; basal cell sparsely setose, margined by cubital hairline. Linea calva narrower than in female.

Legs with fore and middle coxae dark brown, hind coxae black. Femora dark brown, yellow toward apices. Tarsi and tibiae yellow-brown to darker brown.

Gaster more narrow and elongate than that of female; basal fovea wide and deep.

Paratypes: (44 females, 11 males; most in NZAC; in ANIC, LU where stated). **NN:** 1 female, Cobb Rd summit, Asbestos Mine Track, 880m, 10 Feb 1985, R.M.Emberson, beaten from beech (LU); 3 females, 2 males, Nelson, 8 Mar 1966, DBR, ex *Eriococcus* on *Nothofagus truncata* (1164); 2 females, Upper Takaka R., asbestos mine track, JSN, EWV, AKW, 700 m, 2 Dec 1980, mixed *Nothofagus* forest; 1 female, Cobb Ridge (S), 1100 m, 3 Dec 1980, JSN, EWV, AKW, native tussock grassland; 2 females, Dun Mt, 2000 ft (=6100m), 25 Jan 1931, ESG. **BR:** 3 females, L. Rotoiti, 600 m, Dec 1980, FD, Malaise trap, edge of *Nothofagus* forest; 4 females, St Arnaud, 600 m, 9 Dec 1980, JSN, EWV, AKW, *Nothofagus* forest; 1 female, Lewis Pass, 500 m, 19 Jan 1976, AKW, sweeping in bush and beside road; 1 female, Mt Robert, 600-1400 m, 10 Dec 1980, JSN, EWV, AKW, *Nothofagus* forest and grass; 1 female, Mt Robert, 7 Nov 1971, EWV, swept grasses. **MC:** 1 female, Pudding Hill Domain, 800m, 19 Sep 1981, JWE, sweeping in *Nothofagus solandri* forest (LU); 4 females, Mt Hutt, 1000m, Scotts Saddle, 27 Nov 1981, JWE, *Nothofagus* forest edge (LU); 1 female, Alford Forest, 2 Nov 1960, RJM. **OL:** 13 females, 7 males (4 females, 2 males in ANIC), Kirks Bush, L. Hawea, Jan 1981, JSN, EWV, swept, *Nothofagus* forest, broadleaf, *P. totara*; 3 females, 1 male, Bobs Cove, L. Wakatipu, 23 Jan 1981, JSN, EWV, swept, *Nothofagus* forest, mixed broadleaf; 3 females, 1 male, Kinloch S.F., Dart R., Jan 1981, JSN, EWV, swept, *Nothofagus* forest, broadleaf, grass, *P. totara*. **FD:** 1 male, Fiordland NP, Grebe Vly, S arm L.Manapouri, 170m, 4 Jan 1982, JWE, C.A.Muir, P.T.Syrett, sweeping ferns (LUNZ).

Other material examined: Type series only.

Biology. The only host recorded is *Eriococcus* (Targioni-Tozzetti) (Eriococcidae) sp. on *Nothofagus truncata* (Col.) Ckn. (Fagaceae).

Distribution: **New Zealand:** NN, BR, MC, OL, FD.

Remarks: *Aphobetus cultratus* is diagnosed by the groove-like notauli. It is named from the Latin cultratus or knife-shaped, in reference to this feature.

5.2.2 *Aphobetus cyanea* (Bouček) (Figs 5.7, 5.8, 5.75, 5.76, 5.77, 5.78; Map 2)

Modronila cyanea Bouček, 1988a:364, Figs 680-681; Valentine and Walker, 1991:28.

Holotype: female, NZAC.

Publication details: "Holotype female (and 2 females and 1 male, paratypes), NZ: North Canterbury area, Lewis Pass, ex *Eriococcus nitidus* on *Poa caespitosa*, xii.1962 (B. B. Given)".

Label details: "617" and "NEW ZEALAND (NC)/ Lewis Pass? xii.1962 B. B. Given" and ex Eriococcus/ nitidus on/ Poa caespitosa" and "Holo/ -type" and underneath "Bck/ 86" and "HOLOTYPE/ ♀ Modronila/ cyanea g.sp.n./ det Z. Bouček, 1984".

Female

Head black, with strong metallic blue lustre to dark red with slight purple lustre; dorsal margin hardly concave. Head from 1.4 to 1.6x broader than long (mean 1.54). Occipital carina strong; posterior ocelli immediately adjacent to occipital carina, not crossing it; back of head smooth to very finely rugose, margined just below occipital carina with transverse row of setae. OD approximately 0.35x OOL. Vertex not sculptured, smooth, shiny; with scattered long white setae.

Antennae (Fig. 5.7) inserted slightly more than 1 torular diameter above clypeal margin. Scrobes not delimited, shallow even towards toruli, not sculptured; not carinate anteriorly. Antennae concolorous mid-dark brown; scapes long and slender. Pedicel elongate pyriform. F1 to F4 longer than broad, F5 square; setae shorter than segments of origin; sensilla present. Club 0.4 to 0.6x length of funicle (mean 0.51). Genae smooth, with 3 rows of white setae. Genal carina moderately wide, not striate. Malar groove represented only by deep remnant on either side of clypeus. Malar space slightly shorter than long axis of eye. Mandible with broad, pointed lower tooth and 2 pointed upper teeth.

Thorax black, with strong metallic blue lustre to dark red-brown with light purple lustre. Pronotum rugose anteriorly, smooth posteriorly; with scattered long setae with raised bases; pronotal ring of about 16 setae. Mesoscutum smooth anteriorly, imbricate posteriorly; with 2 pairs of setae posteriorly and anteriorly with paired setae to regular long setation. Notauli almost complete, narrow anteriorly and transversely striate, widening to a shallow groove posteriorly (Fig. 5.75). Scapulae smooth, with row of long setae running alongside notauli. Scutellum longer than

broad, flat in lateral aspect; engraved reticulate; anterior pair of setae closer together than posterior pair; without reticulate bases. Frenal area delimited by line consisting of fine short grooves (Fig. 5.75); large. Axillae mainly smooth, with several long setae separated anteriorly from scutellum by a shallow groove, which changes to a deep fovea. Dorsellum striate, fovea and rest of metanotum smooth. Mesepisternal depression quadrangular, mesepimeron smooth and shiny, with barely noticeable dimple.

Propodeum dark, with slight metallic blue lustre. Medial tooth present (Fig. 5.76), ending apically in a semi-cup. Surface of tooth smooth, flanked by longitudinal carinae. Nucha broader than long, rugose. Basal fovea, costula and medial plica present. Large whitish tuft of setae at spiracle.

Forewing hyaline (Fig. 5.8). Marginal vein from 3.0 to 5.8x length of stigmal vein (mean 4.27). Stigmal area setose. Postmarginal vein 1.2x length of stigmal vein. Costal cell excised at apex; entire margin setose; cell with several complete rows of ventral setae. Basal hairline not demarcated, not infumate; basal cell setose, margined by cubital row of setae. Speculum absent, linea calva present as almost only bare patch on forewing.

Legs dark orange-brown, darker brown on dorsal surface of femora; coxae metallic. Hind coxae without dorsal or lateral crests of setae, sparse ventral line present. Single hind tibial spur 0.95x length of hind basitarsus.

Gaster oval, black with strong metallic blue lustre to dark red-brown with faint purple lustre. T1 about 0.8x length of gaster. Surface of S1 not striate (Figs 5.77, 5.78).

Male

Head metallic blue to dark red, with faint metallic lustre.

Antennae inserted about 2 torular diameters above clypeal margin. F1 longest funicular segment. Funicular segments nodose; decreasing in length from base to apex. Setae conspicuous but shorter than length of segments of origin. Club 0.9 to 1.2x length of F1 (mean 1.06).

Forewing hyaline. Marginal vein from 2.8 to 4.9x length of stigmal (mean 3.61). Costal cell entirely margined with setae. Basal hairline not infumate, not

demarcated; basal cell less setose than in female; cubital hairline present.

Paratypes: (2 females, 2 males; NZAC). **TK:** 1 female, N Egmont, 21 Apr 1946, M.W.Carter, ex *Eriococcus* on *Danthonia*. **OL:** 1 female, Coronet Pk, 1640m, Jan 1981, Tussock/alpine shrubs, *Hebe* mat plants, swept, JSN, EWV. BR: 1 male, Mt Robert, 15 Mar 1968, EWV, 1521. **NC:** 1 male, Lewis Pass, Dec 1962, BBG, ex *Eriococcus nitidulus* on *Poa caespitosa*.

Other material examined: (14 males, 60 females; NZAC, in ANIC, LU where stated). **TK:** 1 female, N Egmont, 21 Apr 1946, M.W.Carter, ex *Eriococcus* on *Danthonia*; 5 females, Pouakai Ridge, 1280-1370m, Pouakai Range, 1-2 Dec 1975, JSD or AKW, sweeping or Malaise trap (1♀ ANIC). **NN:** 1 female, Mt Arthur, 914m, 2 Jan 1929, ESG; 1 female, Mt Arthur, 1340m, 22 Jan 1948, JTS, ex tussock; 1 female, Mt Arthur, 25 Feb 1924, A.Philpott; 1 male, 3 females, Burgoo Creek, 6 Dec 1960, ex *Eriococcus* on *Chionochloa*, FRI; 4 females, Cobb Ridge S, 1100m, 3 Dec 1980, JSN, EWV, AKW, native tussock grassland (1♀ ANIC); 6 females, Cobb Reservoir, 850m, 6 Dec 1980, *Nothofagus* forest, JSN, EWV, AKW. NN/MB: 1 female, Red Hills, 1370m, 10 Feb 1964, JSD, ex red narrow leaved tussock, host *?Eriococcus nitidulus*. **BR:** 1 male, 1 female, Travers Range, Angelus Hut, 1740m, 5 Feb 1964, JSD, ex *Eriococcus ??thoniae* (illegible) on *Chionochloa*; 8 males, 11 females, Mt Robert, 15 Mar 1968, EWV, 1521 (1♀ 1♂ ANIC); 1 female, Mt Robert, 823m, nr L Rotoiti, 16 Jan 1976, AKW, beating *Nothofagus menziesii* with parasitic fungi; 1 female, Mt Robert, 1340m, 16 Jan 1976, AKW, sweeping tussock. **WD:** 2 females, Westland N.P., Castle Rocks v, 1370m, 15 Jan 1986, JWE, sweeping subalpine tussock (LU). **NC:** 2 males, 1 female, 20 Dec 1962, BBG, ex *Eriococcus nitidulus* on *Poa caespitosa*. **MC:** 1 female, Cragieburn Range, Porter Creek, 1220m, Apr 1969, JSD, beating. **CO:** 1 female, Symes Rd, 1220m, 7 Feb 1986, C.A.Muir, sweeping tussock (LU). **DN:** 1 male, Table Hill, Hut Creek, 305m, 16 Feb 1968, JSD. **FD:** 1 female, Fiordland N.P., Murchison Mtns E McKenzie Burn, 1110m, 4 Dec 1993, C.A.Muir, sweeping *Hebe* and tussock scrub (LU); 1 male, 1 female, Turret Range, 1/2 way to Wolfe Flat, 22 Jan 1970, ACE, sweeping; 1 female, W Olivine Range, Tempest Spur, 914-1219m, 25 Jan 1975, GWR, under stones. **SI:** 9 females, Rakeahua Camp, 8 Feb, 1968, EWV, 1441 (2♀♀ ANIC).

Biology: *Modronila cyanea* is a primary parasitoid of the genus Eriococcidae. The species has been reared from *Eriococcus* sp. on *Danthonia* (Gramineae); *Eriococcus* sp. on *Chionochloa*; *Eriococcus nitidulus* Hoy on *Poa caespitosa* Forst. (Gramineae); *?Eriococcus nitidulus*; *Eriococcus ??thoniae* (label illegible, probably *Eriococcus danthoniae* Maskell) on *Chionochloa*.

Distribution: **New Zealand:** TK/ NN, BR, WD, NC, MC, OL, DN, CO, FD/ SI. Alpine.

Remarks: A series of 3 females and 1 male deposited in NZAC (**NN:** Dun Mt, 4 Feb 1924, A. Philpott) show slight differences. The body colour is dark red-brown with a slight purple metallic lustre. There are fewer pairs of setae between the notauli (5 pairs not 7). The basal cell in the forewing is slightly less setose. The differences are not sufficient to justify describing another species without further material.

5.2.3 ***Aphobetus erroli*** **sp.n.** (Figs 5.79, 5.80, 5.81; Map 3)

Holotype: female, NZAC.

Label data: "NEW ZEALAND WN/ Balance Bridge/ Res. 3 Jan 1975" and "J. C. Watt/ litter 75/25".

Female

Head brown to black, shiny; dorsal margin slightly concave. Face 1.4 to 1.6x broader than long (mean 1.48). Occipital carina strong, back of head imbricate. OD about equal to OOL. Vertex setose, setae long.

Antennae inserted about 2 torular diameters above clypeal margin. Scrobes sculptured centrally, smooth laterally; not carinate anteriorly. Flagellum and pedicel honey yellow, scape darker at base; F1 occasionally darker. Funicular segments not compressed, only F5 broader than long; club 0.7 to 0.8x length of funicle (mean 0.73). Malar groove incomplete, remnant above mandibles inconspicuous, striate. Malar space shorter than vertical axis of eye. Genal carina striate. Mandible with broad, pointed lower tooth and two blunter upper teeth.

Thorax shiny black. Pronotal ring with about 10 setae. Mesoscutum transversely rugose between notauli, setae paired. Notauli incomplete, composed of well-defined small pits anteriorly, grading to large, less well-defined groove posteriorly (Fig. 5.79). Scapulae longitudinally striate. Scutellum only slightly broader than long (length about 0.9x width), convex in lateral aspect; engraved reticulate in anterior two-thirds, the sculpture changing at posterior pair of setae to become faintly longitudinally striate; fine transverse line visible at this point, but no indented frenal groove (Figs 5.79, 5.80). Axillae weakly striate. Depression in mesepisternum striate around edges, smooth centrally; mesepimeron glabrous; with striate dimple. Dorsellum striate. Rest of metanotum finely striate, furrow smooth.

Propodeum dark brown-black, basal fovea present (Fig. 5.80). Plica complete, additional medial plica present posteriorly only. Tooth smooth, slightly striate. Nucha with apical fovea, transversely rugose.

Forewing with faint to dark infumate patch posterior to marginal and stigmal veins, fading out towards posterior margin. Wing hyaline proximally and in distal quarter to fifth. Marginal vein 1.8 to 2.4x length of stigmal vein (mean 2.07). Postmarginal vein 1.1 to 1.2x length of stigmal vein. Stigmal area bare of setae. Costal cell not excised at apex; setae along apical 0.75 of margin; ventral row of setae continuous. Submarginal vein with 6 to 8 setae. Basal hairline faintly pigmented, with about 4 setae; basal cell bare, margined by cubital hairline. Speculum present, linea calva not differentiated.

Legs brown-yellow; coxae brown. Hind coxae without dorsal or lateral crests of setae. One hind tibial spur present, 0.5x length of short hind basitarsus.

Gaster from pale brown basally and dark brown apically to entirely dark brown; rectangular. T1 0.95x length of gaster. Setae at base sparse. Ovipositor slightly extended past end of gaster. Surface of S1 finely striate, giving matt appearance. Anterior half with 2 large alveolae; smooth medial ridge; posterior half with 4 wide alveolae (Fig. 5.81).

Male

Head very dark red brown.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin. F1 longest funicular segment; club 1.1 to 1.5x longer than funicle (mean 1.28). Flagellar setae relatively short, about as long as segments of origin.

Forewing with infumate patch paler and less extensive than in female. Marginal vein 1.8 to 2.4x length of stigmal vein (mean 2.18). Apical 0.6 of costal cell margined with setae. Basal hairline faintly pigmented, with about 8 setae; basal cell sparsely setose, margined with cubital hairline.

Paratypes: (13 females, 5 males; most in NZAC, in ANIC where stated). **TO:** 1 female, Omoho Stream, 27 Mar 1969, HAO, Malaise. **NN:** 3 females, Lower Moutere, 24 July 1964, on *Coprosma repens* (1 ♀), 30 July 1964, on lemonwood in assoc. with *Ctenochiton* (2♀), DBR; 7 females, 1 male (1 female in ANIC), Nelson, 13 Jan 1965, EWV, *Ctenochiton perforatus* on *Pittosporum eugenioides* (719); 2

females, 2 males, Nelson, Feb 1962, EWV, on *Rhododendron*; 1 male, Nelson, 28 Jan 1965, EWV, ex *Ctenochiton perforatus* on *Pittosporum eugenioides* (719) (ANIC).

Other material examined: Type series only.

Biology. Reared from *Ctenochiton perforatus* Maskell (Coccidae) on *Pittosporum eugenioides* A. Cunn. (Pittosporaceae), and from *Ctenochiton* Maskell sp.

Distribution: **New Zealand:** TO, WN/ NN.

Remarks: *Aphobetus erroli* is diagnosed by the absence of an indented frenal groove. The species is named for Mr Errol Valentine, who provided much of the reared material in the NZAC.

5.2.4 ***Aphobetus garretti*** **sp.n.** (Figs 5.9, 5.82, 5.83, 5.84, 5.85, 5.86; Map 19)

Holotype: female, ANIC.

Label Data: "41.19S 147.56E/ Intake Bridge/ TAS 13 Jan 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol".

Female

Head shiny black; dorsal margin slightly concave. Face 1.5 to 1.7x broader than long (mean 1.58). Occipital carina strong (Fig. 5.82), back of head reticulate laterally, smooth to alutaceous medially. OD 0.75x OOL. Face smooth, very slightly rugose adjacent to eyes. Vertex alutaceous, with scattered long setae.

Antennae inserted about 2 torular diameters above clypeal margin. Scrobes unsculptured, not carinate anteriorly. Antennae concolorous, light yellow to brown; all flagellar segments square or longer than broad. Club 0.5 to 0.7x length of funicle (mean 0.61). Malar groove weak but complete; malar space shorter than vertical axis of eye. Genal carina not striate. Mandible with broad, pointed lower tooth; upper tooth divided into 3 points, 1 sharp and 2 blunt.

Thorax black. Pronotum with setal ring of approximately 10 brown setae. Mesoscutum alutaceous, with 3 to 4 pairs of setae between notauli. Notauli complete,

series of longitudinal pits defined anteriorly, groove posteriorly (Fig. 5.82). Scapulae faintly longitudinally striate. Scutellum convex in lateral aspect, slightly longer than broad; very finely reticulate anterior to frenal groove, frenal area smooth except for some slight crimping. Frenal area delimited by indented frenal groove consisting of row of punctures (Fig. 5.83). Axillae faintly longitudinally striate. Depression on mesepisternum smooth; lower mesepimeron smooth with conspicuous dimple (Fig. 5.84). Dorsellum striate, rest of metanotum smooth, metanotal furrow smooth.

Propodeum black; basal fovea small (Fig. 5.85). Plicae complete. Additional medial plica present only basally, diverging apically to form apical fovea and also producing side branch anterior to apical fovea. Tooth smooth.

Forewing (Fig. 5.9) with large infumate patch extending from basal hairline to stigmal vein. Marginal vein 1.5 to 2.3x length of stigmal vein (mean 1.82). Postmarginal vein 1.5x length of stigmal. Stigmal area setose. Postmarginal vein slightly longer than stigmal vein. Costal cell inconspicuously excised at apex; margined with setae along apical 0.75x length; ventral row of setae complete. Basal hairline pigmented, with line of about 5 setae; basal cell bare, margined by cubital hairline. Speculum and linea calva present, hairline 1-2 hairs thick.

Legs yellow, coxae yellow-brown; striate. Hind coxae with dorsal and lateral crests of setae. One hind tibial spur present; 0.5-0.6x length of basitarsus.

Gaster dark brown, globular. T1 0.5-0.7x length of gaster. Setal tuft at base sparse. Ovipositor projecting slightly from base of gaster. Entire surface of S1 finely striate; anterior half slightly concave, and 4 alveolae in posterior half; with medial flat area (Fig. 5.86).

Male

Head very dark red brown-black.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin; concolorous, yellow-brown; tip of club pale. F1 longest flagellar segment, F2 to F4 shorter, approximately equal in length. Club 1.2 to 1.3x longer than F1 (mean 0.64). Setae approximately as long as segments of origin. Malar groove present, stronger than in female.

Thorax black.

Forewing hyaline, basal hairline faintly pigmented. Marginal vein 1.6 to 1.7x length of stigmal vein (mean 1.69). Costal cell margined with setae along apical 0.8 to 0.9. Basal hairline infumate, with a line of about 5 setae; basal cell not setose; cubital hairline present.

Paratypes: (1 male, 7 females; most in ANIC, in NZAC where stated). **Tas.:** 1 male, 1 females, 41.19 147.56, Intake Bridge, 13 Jan 1983, IDN, JCC; 1 female, 42.53 146.22, 7 km S Frodshams Pass, 25 Jan 1983, IDN, JCC (NZAC); 1 female, 42.54S, 147.15E, Shoobridge Bend, Mt Wellington, 5 Feb 1983, IDN, JCC; 2 females (1 in NZAC), 40.57 144.49, 5 km SE by E Redpa, 18 Jan 1983, IDN, JCC; 1 female, 43.07 146.47, Edwards Road, Hartz Mtns, 4 Feb 1983, IDN, JCC; 1 female, 41.22 147.24, 10 km ENE of Nunamara, 11 Jan 1983, IDN, JCC.

Other material examined: Type series only.

Biology: Hosts are unknown. *A. garretti* has been recorded in temperate rainforest, wet sclerophyll and open woodland.

Distribution: **Australia:** Tasmania.

Remarks: *Aphobetus garretti* is diagnosed by the combination of unsculptured antennal scrobes and the mesepisternal depression being non-striate in both sexes; and by the large infumate patch in the female forewing. This species is named for Australian musician and conservationist Peter Garrett.

5.2.5 *Aphobetus goldsmithii* (Girault) (Figs 5.10, 5.11; Map 20)

Aphobetus goldsmithii (Girault); Bouček, 1988a:363.

Muscideopsis goldsmithii Girault, 1915a:324; Dahms, 1984:656. Transferred to *Aphobetus* by Bouček, 1988a:363.

Holotype: female, QM.

Publication data: One female, sweeping along jungle-clad forest streamlet, March 25, 1915. Gordonvale (Cairns), Queensland. Type Hy 2784, Queensland Museum, the specimen on a tag, the head and 2 hind tibiae on a slide.

Label data: 1 card and 1 slide as follows:

Card 1- only 2 whole legs and a leg fragment of the holotype remain on the card, labelled "TYPE" and "*Muscideopsis/ goldsmithii* ♀/ Gir. type" [GH] and "Holotype/ Hy. 2784/ E.C.D. 1983" and "Queensland/ Museum".

Slide- coverslip fragment covering the head (crushed, minus 1 antenna), 1 leg and part of 1 tibia and tarsus; all from the holotype, labelled "TYPE/ Hy/ 2784/ A. A. Girault" and "Queensland Museum./ *Muscideopsis/ goldsmithii/* ♀".

Female

Head shiny black, with slight metallic blue tinge; dorsal margin slightly concave. Face 1.7x broader than long. Occipital carina strong, back of head imbricate. OD approximately 0.75x OOL. Vertex with scattered long setae.

Antennae (Fig. 5.10) inserted about 1.5 torular diameters above clypeal margin, at lower ocular line. Scrobes sculptured medially, not carinate anteriorly. Antennae concolorous light yellow. Funicular segments compressed, at least F3 to F5 broader than long. Club 0.8 to 0.9x length of funicle (mean 0.84). Malar groove absent except above clypeus, where it forms a short deep indentation; malar space shorter than vertical axis of eye. Genal carina striate.

Thorax shiny black. Pronotal ring with about 10 long brown setae. Mesoscutum unsculptured, with 5 pairs of setae. Notauli complete, represented by a series of small well-defined pits. Scapulae very slightly longitudinally striate. Scutellum convex in lateral aspect; square; unsculptured. Axillae not sculptured. Frenal area delimited by indented frenal groove consisting of row of punctures; slightly longitudinally crimped. Depression in mesepisternum finely striate; lower mesepimeron with dimple, this also finely striate. Dorsellum, rest of metanotum and furrow smooth. Metanotum almost horizontal.

Propodeum black; basal fovea almost absent. Plica complete, additional complete medial plica also present. Tooth matt, nucha also matt posterior to costula.

Forewing hyaline. Marginal vein 1 to 2x longer than stigmal vein (mean 1.83). Stigmal area setose. Postmarginal vein subequal in length to stigmal vein.

Costal cell not excised at apex; setose along 0.9x length of margin; ventral setal row complete. Basal hairline with line of about 5 setae; basal cell bare, margined by cubital row of setae. Speculum broad, linea calva delimited.

Legs light yellow, fore coxae dark yellow-brown. Hind coxae with setal crests absent. One hind tibial spur present; 0.3 to 0.4x length of hind basitarsus.

Gaster light yellow. T1 0.6 to 0.7x length of gaster. Setae at base sparse. Ovipositor projecting slightly from base of gaster. S1 with 2 wide alveolae anteriorly, a smooth horizontal ridge medially and posterior obscured. Surface finely striate.

Male

Head dark brown-black.

Antennae (Fig. 5.11) inserted slightly less than 2 torular diameters above clypeal margin; concolorous light yellow. F1 slightly longer than F2 to F4, which are equal in length. Club 1.67x longer than F1. Setae on funicular segments longer than segments of origin.

Forewing hyaline. Marginal vein 1.67x longer than stigmal vein. Costal cell margined with setae along apical 0.8 length. Basal hairline not infumate, with double line of about 10 setae; basal cell slightly setose, margined by cubital hairline.

T1 about 0.7x length of gaster.

Other material examined: (2 females, 1 male; NHM). **Qld.:** 1 male, 1 female, Conway Range, nr. Proserpine, 2 Dec 1976, ZB (20.24 148.35); 1 female, Kuranda, 6 Dec 1982, ZB (16.49 145.38); type (17.06 145.47).

Biology: Hosts are unknown. *A. goldsmithii* has been collected in tropical and temperate rainforest.

Distribution: **Australia:** Queensland.

Remarks: *Aphobetus goldsmithii* is diagnosed by the combination of absent malar groove, sculptured prepectus, mesepimeron with dimple, unsculptured mesoscutum and complete notauli.

There is one further specimen in the QM on a card, with details as follows:

1♀, head with forelegs, separated from thorax and gaster. Coxae of remaining legs present, rest of legs absent or obscured. Right wings absent, left forewing present, hindwing absent or obscured. Labelled "*Muscideopsis/ goldsmithii* Gir. ♀/ Paratype" [GH] and "Queensland/ Museum"

Dahms (1984) notes that in his unpublished manuscript Girault says "The slide part of the type and an identified specimen from the type locality were used to revise the species" and points out that this indicates that the card-mounted body of the holotype was lost at that time. This second, Girault-determined specimen is presumably the identified specimen from the type locality and has no type status.

5.2.6 *Aphobetus lecanii* (Girault) (Fig. 5.87; Map 21)

Aphobetus lecanii (Girault); Bouček, 1988a:365.

Muscideopsis lecanii Girault, 1938a:76; Dahms, 1984:752. Transferred to *Aphobetus* by Bouček, 1988a:365.

Holotype: female, QM.

Publication data: A female reared from *Lecanium persicae* (Perth, W. Australia, L. J. Newman).

Label data: On card: gaster plus propodeum, hind coxae and one hind leg, metanotum and one hind wing; thorax plus one forewing, mid coxae and one leg; fore coxae and legs. Head, right wing and two legs missing. Labelled "HOLOTYPE/ T.9158/ E.C.D. 1984" and "*Muscideopsis/ lecanii* Girault/ Type" and on reverse "Perth, W. Aus./ H. Newmann/ ex lecanium" and "Queensland/ Museum".

Female

Head shiny black, dorsal margin moderately concave. Face from 1.5 to 1.7x broader than long (mean 1.6). OD 0.75x OOL. Occipital carina strong; crossed by posterior ocelli. Vertex engraved reticulate, with scattered long setae. Face smooth.

Antennae inserted slightly more than 1 torular diameter above clypeal margin. Scrobes not carinate anteriorly, smooth excepting medial striate area. Antennae concolorous yellow brown; funicular segments square, except F5 which is slightly

broader than long. Setae subequal in length to segments of origin. Club 0.8 to 0.9x length of funicle (mean 0.84). Malar groove absent except for deep, striate remnant over clypeal margin; malar space shorter than long axis of eye. Genal carina wide, striate. Oral margin between toruli straight, sloping down to offset genal carina. Mandible with broad, pointed lower tooth and 2 small, blunt, upper teeth.

Thorax dark brown. Pronotum imbricate anterior to setal ring, smooth posterior. Setal ring with 10 setae; bases slightly punctate. Mesoscutum imbricate to alutaceous; with 3 pairs of setae, bases slightly raised. Notauli composed of short grooves. Scapulae finely longitudinally striate. Scutellum square, slightly convex in lateral aspect; finely reticulate anteriorly, frenal area smooth to slightly crimped. Frenal area delimited by indented frenal groove consisting of row of punctures. Axillae smooth with slight longitudinal striations. Mesepisterum with a striate triangular depression; mesepimeron glabrous, with striate dimple. Dorsellum striate, fovea unsculptured; rest of metanotum and furrow smooth.

Propodeum dark brown. Basal fovea inconspicuous. Plica complete; additional complete medial plica also present, portion anterior to costula recurved towards tooth. Apical fovea present. Tooth smooth, with a punctate raised triangular area at base.

Forewing hyaline. Marginal vein 1.7 to 2.1x length of stigmal vein (mean 1.89). Postmarginal vein 1.2x length of stigmal vein. Stigmal area setose. Costal cell not excised at apex; margined with setae along apical 0.9x length; ventral costal setal line continuous. Basal hairline not infumate, with about 5 setae in basal hairline; basal cell sparsely setose, margined by cubital hairline. Speculum and linea calva present.

Legs yellow-brown, fore femora mid-brown. Hind coxae striate; sparse dorsal setal crest present. One hind tibial spur present, 0.3x length of basitarsus.

Gaster mid to dark brown; rectangular, almost square. T1 0.95x length of gaster. Setae at base of gaster sparse. Ovipositor slightly exserted. Surface of S1 entirely finely striate. Two large foveae present anteriorly; several small alveolae present medially; 4 large alveolae present posteriorly (Fig. 5.87).

Male

Head black, shiny.

Antennae inserted slightly less than 2 torular diameters above clypeal margin. Scape and pedicel medium brown, flagellum light. F1 longest funicular segment, F2 to F4 subequal in length. Setae 1.5x length of segments of origin; sensilla short. Club 1.67x length of funicle.

Forewing hyaline. Marginal vein 2.1x length of stigmal vein. Costal cell margined with setae along almost entire length; ventral setal hairline continuous, with partial second line. Basal hairline faintly pigmented, with line of setae; basal cell sparsely setose, margined with cubital hairline. Speculum narrow, linea calva delimited.

Other material examined: (29 females, 1 male; ANIC, in NZAC where stated). **W.A.:** 5 females, 1 male, Walpole-Nornalup N.P., 17-21 Jan 1987, JSN; 23 females (5 in NZAC), Porongorup N.P., Jan 1987, JSN (34.41 117.55); 1 female, Avon Valley N.P., c.50km NE Perth, 25 Dec 1986, JSN (31.36 116.13). (Type 41.34 147.11)

Biology: *Aphobetus lecanii* has been reared from *Parthenolecanium (=Lecanium) persicae* (Fab.) (Coccidae).

Distribution: **Australia:** Western Australia.

Remarks: *Aphobetus lecanii* is diagnosed by the combination of the recurved medial propodeal plicae and the hyaline, colourless wing in the female.

5.2.7 *Aphobetus maskelli* Howard (Fig. 5.88; Map 4)

Aphobetus maskelli Howard 1896:166-167; Ashmead, 1904:328; Valentine, 1967:1127; Bouček, 1988a:363; Valentine and Walker, 1991:28.

Lectotype: female, USNM, here designated.

Publication data: "One female, four males, reared by W. M. Maskell, New Zealand, from *Ctenochiton viridis*".

Since a holotype was not designated by Howard, these specimens have the status of syntypes. The female and three males are deposited at USNM, one male is deposited at NHM.

Label data: "from/ Maskell./ N. Zealand." and "Par: on/ *Ctenochiton/ viridis*" and "Type No./ 26030/ U.S.N.M." and "*Aphobetus/*

maskelli How./ type ♀".

Female

Head shiny, brown to black; dorsal margin slightly concave. Face 1.3 to 1.6x broader than long (mean 1.43). Occipital carina strong; back of head finely reticulate. Ocelli clear; OD from 0.5 to 0.7x OOL. Setae on vertex long, brown.

Antennae inserted 2 torular diameters above clypeal margin. Scrobes finely striate centrally only, not carinate anteriorly. Antennae variable in colour, ranging from yellow, with F1 and sometimes F2, F3 and tip or whole club darker, to concolorous medium brown. F1 longer than broad to square, only F5 broader than long. Club from 0.5 to 0.9x length of funicle (mean 0.68). Malar groove incomplete, remnant conspicuous; malar space shorter than vertical axis of eye. Genal carina striate. Mandible with broad, pointed lower tooth and 2 blunt upper teeth.

Thorax shiny black. Pronotum sculptured anterior to setal ring; ring with approximately 10 yellow-brown setae visible in dorsal view. Mesoscutum finely reticulate to finely transversely rugose, with 3 to 4 pairs of yellow-brown setae between notauli. Notauli almost complete, consisting of series of small, well-defined pits. Scapulae finely longitudinally striate to smooth. Scutellum convex in lateral aspect, square to slightly longer than broad; engraved reticulate anterior to frenal groove, frenal area almost smooth to finely longitudinally striate. Frenal area delimited by indented frenal groove consisting of row of punctures. Axillae almost smooth. Depression in mesepisternum striate; upper and lower mesepimeron glabrous, without dimple. Dorsellum, rest of metanotum and furrow striate.

Propodeum dark brownish-black; basal fovea present. Plica complete, no additional plicae present. Tooth smooth, delimited by additional longitudinal carinae. Nucha matt, long.

Forewing with infumate patch ranging from faint and diffuse to strong and compact. Marginal vein 1.5 to 2.7x longer than as stigmal vein (mean 1.85). Postmarginal vein subequal in length to stigmal vein. Stigmal area bare of setae. Costal cell not excised at apex; margined with setae along apical 0.75 of length; ventral row of setae continuous. Submarginal vein with 10-15 setae. Basal hairline infumate, with 5-6 setae; basal cell bare, margined by cubital row of setae. Speculum

wide, linea calva not differentiated.

Fore and middle coxae yellow-brown to dark brown, hind coxae dark brown. Femora grading from dark brownish-yellow basally to yellow-brown apically. Tarsi yellow-brown, tarsal segments yellow, darkening toward apices. Hind coxae with dorsal crest of setae only. One hind tibial spur present; approximately as long as basitarsus, but darker in colour.

Gaster dark brown, paler basally and apically. T1 0.6 to 0.9x length of gaster. Setae at base sparse. Ovipositor exserted beyond last tergite. Surface of S1 finely striate; slightly concave anteriorly; medially with a smooth, non-striate horizontal ridge; 4 large alveolae present posteriorly (Fig. 5.88).

Male

Head dark brown-black. Vertex very finely rugose.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin; dark brown, scape and pedicel sometimes paler. F1 longest funicular segment; club 1.2 to 1.7x longer than F1 (mean 1.47).

Forewing with very faint infumate patch. Marginal vein from 1.6 to 2.3x length of stigmal vein (mean 1.92). Costal cell margined with setae for apical 0.7 of length. Basal hairline infumate, with line of about 6 setae; basal cell sparsely setose, margined with cubital hairline. Speculum absent, but sparse setae present posterior to submarginal and marginal veins.

Hind tibial spur same colour as basitarsus.

Paralectotypes: 3 males (USNM, NHM).

Label data: 2 males (USNM), same data as lectotype except with added "Paratype"; 1 male (USNM), same data as lectotype except with added "Allotype" and "*Aphobetus maskelli* How./ type ♂". 1 male (NHM), same data as lectotype except with added (modern) "Para-/ type" and " ♂ *Aphobetus/ maskelli* Ashm./ PT, det. Bck. 76.".

Other material examined: (240 females, 49 males; most in NZAC, in LU, ANIC where stated). **ND:** 2 females, Waipoua Kauri Forest, 11-12 Dec 1983, L.Masner (ANIC); 1 female, Omahuta S.F., 6 Oct 1980, JSN. **AK:** 28 females (5 in ANIC), Waitakere Range, JSN, Aug 1980 (1), Sep 1980 (5), Oct 1980 (7), Nov 1980 (6), Dec 1980 (4), Jan 1981 (5); 3 females, Titirangi, GWR, Malaise trap in garden, Oct

1980 (2), Nov 1980 (1); 1 female, Kauri Park, 23 Oct 1980, JSN; 3 females, Lynfield, GK, 12 Feb 1975 (1), 7 Dec 1974 (1), Nov 1980 (1); 15 females, 4 males Takapuna, 18 Apr 1966, PSC, ex *Nipaecoccus aurilanatus* (Maskell) on *Araucaria excelsa* (1208); 1 female, Whatipu, 24 Feb 1979 AKW, on *Ulex* foliage; 2 females, Whatipu, 25 Feb 1979, LAM. **CL:** 1 female, Little Barrier I., 183 m, 21 Feb 1976, AKW, sweeping; 6 females, 19 km E of Tapu, 31 Jan 1981, JSN; 2 females, Kaueranga Valley, 1 Feb 1981, JSN. **TK:** 1 female, Waitaanga Plateau, 14-15 Dec 1983, L.Masner (ANIC). **WN:** 1 female, Days Bay, 8 May 1927, ESG; 1 female, Island Bay, 30 Mar 1931, ESG; 1 female, Orongorongo, 25 Jan 1961, RGO, ex fallen white rata (*Metrosideros robusta*); 1 female, Waikanae, 4 Oct 1980, CFB, ex *Leucaspis* sp. on *Podocarpus totara*. **SD:** 1 female, Stephens I., 14-28 Jan 1933, ESG. **NN:** 11 females, Eves Valley, 8 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 1 female, Totaranui, 600 m, 5 Dec 1980, JSN, EWV, AKW, mixed *Podocarpus* forest; 4 females, Upper Takaka R., asbestos mine track, JSN, EWV, AKW, 700 m, 2 Dec 1980, mixed *Nothofagus* forest; 1 female, Pokororo, 17 Jan 1964, EWV, on *Podocarpus* totara; 2 females, Farewell Spit, 4 Dec 1980, JSN, EWV, AKW, under *Leptospermum*; 2 females, 1 male, Canaan Saddle, 7 Dec 1980, JSN, EWV, AKW, *Nothofagus*/mixed *Podocarpus*; 2 females, Cobb Reservoir, 850 m, 6 Dec 1980, JSN, EWV, AKW, *Nothofagus* forest; 1 female, Whangamoa Saddle, 13 Dec 1980, JSN, EWV, AKW, *Nothofagus*/mixed *Podocarpus* forest; 1 male, Whangamoa, Nov 1964, EWV, ex ?encyrtid pupa on immature ♂ *Ctenochiton viridis* on *Griselinia littoralis* (909); 1 female, Mt Arthur, 4 Feb 1965, GK, *Nothofagus menziesii* (998); 1 female, Nelson, 1 May 1964, EWV, ex *Leucaspis* sp. on totara (756); 1 female, Kaihoka Lakes, 1 Feb 1979, AKW, LAM, *Phormium tenax*; 1 female, Kaihoka Lakes, 12 Jan 1966, AKW; 11 females, Kaihoka Lakes, 4 Dec 1980, coastal forest, JSN, EWV, AKW; 1 female, 1 male, Pelorus Bridge, Feb 1962, EWV, ex *Ctenochiton viridis* on *Nothopanax arboreum*, 2 females, 3 males, Pelorus Bridge, 12 Feb 1963, DBR, ex encyrtid on *Ctenochiton viridis* mature ♀ on *Nothopanax arboreum*; 1 female, Pelorus Bridge, 14 Mar 1966, DV8; 8 females, 6 males, Nelson, ESG, 8 Sep 1926 (1 ♀), 5 Dec 1926 (3 ♀, 5 ♂), 19 Mar 1927 (1 ♀), 9 Apr 1927 (1 ♀), 8 Jun 1927 (1 ♀, 1 ♂), 22 Jun 1926 (1 ♀); 2 males, Nelson, 28 Nov 1960, EWV, on totara (205); 1 female, Kaiteriteri, 4 Feb 1965, DBR, ex encyrtid on *Ctenochiton viridis* mature females on *Nothopanax arboreum* (993); 4 females, 1 male, Richmond, 1 Mar 1961, DBR (318); 1 female, Ruby Bay, 18 Nov 1964, EWV, swept native plants (558); 1 female, 3 males, Ruby Bay, Jan 1965, EEC, ex aphid! apterous females on mahoe (*Melicytus ramiflora*) (958); 1 female, Dun Mt, 1070m, 13 Feb 1961 GK, leafmould; 1 male, Nelson, 22 Dec 1964, EWV, on totara (921); 1 male, Kaiteriteri, 13 Feb 1965, DBR, ex chermid larva, *Nothopanax arboreum* (994); 2 females, 4 males, Kaiteriteri, 1 Feb 1965, DBR, *Ctenochiton viridis* on *Nothopanax arboreum* (993); 3 females, 1 male, West Haven Inlet, 27 Jan 1966, JAdB, ex *Ctenochiton viridis* on *Hedycarya arborea* (1138); 1 female, Marsden Valley, 26 Nov 1962, EWV, ex *Eriococcus* on *Hedycarya arborea*; 12 females, 5 males, Marsden Valley, BBG, ex encyrtids ex *Ctenochiton viridis* ovipositing females on *Hedycarya arborea*, 3 Dec 1963 (1 ♂), 22 Jan 1964 (1 ♀, 1 ♂), 24 Jan 1964 (7 ♀, 2 ♂), 13 Mar 1964 (4 ♀, 1 ♂) (716); 1 female, 1 male, Punakaiki, 23 Jan 1962, EWV, ex *Ctenochiton* sp. **MB:** 2 females, 2 males, Awatere Valley, 22 Dec 1965, BBG, secondary on *Coccophagus* in *Eriococcus* sp. on *Hebe raoulii* (1111); 4 females, Red

Hills, Wairau, 1070m, 23 Mar 1972, JAdB; 1 female, East Wairau Valley, 14 Oct 1964, DBR, ?secondary on *?Ctenochiton viridis* immature on *Phormium tenax*. **BR:** 9 females, L. Rotoroa, 11 Dec 1980, JSN, EWV, AKW; 1 male, L. Rotoiti, 4-9 Feb 1978, S&JP, Malaise by forest stream; 2 females, Buller R., Gowan Bridge, 3 Mar 1969, JAdB, ex *?Inglisia leptospermi* on *Leptospermum ericoides*; 4 females, St Arnaud, 600 m, 9 Dec 1980, native grassland, *Sphagnum* bog, JSN, EWV, AKW; 1 female, Maruia Saddle, 457 m, 6 Feb 1977, AKW, on *Rubus* leaves. **MC:** 1 female, W of Staveley, SH 72, 2 Dec 1977 ES, *Nothofagus* forest; 5 females, 1 male, Riccarton, 12 Jun 1922; 34 females, Riccarton Bush, ESG, 26 Jun -18 Aug 1920 (7), 6 Oct 1920 (6), 4 Apr 1921 (1), 11 Aug 1921 (8), Sep 1921 (7), Oct 1921 (3), 18 May 1923 (2); 1 female, Governors Bay, 1 Jan 1924, ESG; 1 female, Dallington, 8 Jan 1923, ESG; 3 females, Dallington, 18 Jan 1924, ESG; 1 female, Canterbury College, Oct 1921, ESG; 1 male, Banks Peninsula, Mt Fitzgerald, 457 m, 24 Jan 1922, ESG; 3 females, 1 male, Redcliffs, Nov 1922, ESG, *Ctenochiton viridis* on *Rubus australis*. **OL:** 3 females, 1 male, Kirks Bush, L. Hawea, Jan 1981, swept *Nothofagus* forest, broadleaf, *P. totara*, JSN, EWV; 3 females, Kinloch S.F., Dart R., Jan 1981, swept *Nothofagus* forest, broadleaf, grass, *P. totara*, JSN, EWV; 3 females, Mt Aspiring N.P., Makarora, 25 Jan 1981, swept *Nothofagus*, *Podocarpus*, broadleaf, JSN, EWV; 1 female, Bobs Cove, L. Wakatipu, 23 Jan 1981, swept, *Nothofagus* forest, mixed broadleaf, JSN, EWV; 6 females, 1 male, Coronet Peak, 1640 m, Jan 1981, swept tussock/alpine shrubs, *Hebe* mat plants, JSN, EWV. **CO:** 1 male, Cromwell Gorge, 12-21 Nov 1974, JCW, pit trap; 1 male (ANIC), Old Man Range, 1340 m, 11 Feb 1982, CFB, sweeping tussock; 1 female, Kawerau Gorge, 488m, 20 Mar 1975, JCW, Malaise trap. **FD:** 1 female, Fiordland N.P., Murchison Mtns, Plateau Creek, 1-3 Dec 1980, R.M.Emberson, Malaise at edge of *Nothofagus menziesii* forest (LU). **SL:** 4 males (2 in ANIC), Invercargill, Jan 1961, EWV, *?Ctenochiton* sp. on *Wintera colorata* (234). **SI:** 1 male, Leasks Bay, 27 Feb 1962, EWV, ex *Powellia* sp. on *Nothopanax arboreum* (458); 2 females, Mason Bay, 26 Feb 1968, EWV (1501).

Biology: *Aphobetus maskelli* has been recorded from *Nipaecoccus aurilanatus* (Maskell) (Pseudococcidae), *Leucaspis* de Boer sp. (Diaspididae), *Ctenochiton viridis* Maskell (Coccidae), *Eriococcus* sp., *?Inglisia leptospermi* Maskell (Coccidae), *Powellia* sp. (Psyllidae), from apterous aphids, and from a chermid larva. It has also been recorded as a hyperparasitoid through a possible encyrtid larva on *Ctenochiton viridis* and through *Coccophagus* Westwood (Aphelinidae) sp. in *Eriococcus* sp.

Distribution: **New Zealand:** ND, AK, CL, TK, WN / SD, NN, MB, BR, MC, OL, CO, FD, SL, SI.

Remarks: *Aphobetus maskelli* is diagnosed by the combination of a long hind tibial

spur and the number of setae on the pronotum (about 10) and submarginal vein (at least 10). This species shows far more variability than *A. paucisetosus*, *A. cultratus* or *A. erroli*, but there is also much more material available. Series show little variation in size or colour, but these features grade from the smallest, darkest specimens to the largest, most colourful ones, and no morphological feature is sufficiently disparate to justify recognizing more than one species.

5.2.8 *Aphobetus moundi* (Bouček) (Figs 5.12, 5.13, 5.89, 5.90, 5.91, 5.92; Map 22)

Strionila moundi Bouček, 1988a:365-366, Fig 682.

Holotype: female, NHM.

Publication details: "Holotype female (plus 3 female paratypes), WA: Perth, King's Park, ex *Synaleurodicus*, 26.ix.1967 (L. A. Mound).

Label details: "W. AUSTRALIA/ Perth 215/ Kings Park" and "L. A. Mound, ex/ Synaleurodicus/ sp. 26.ix.1967" and "Holo-/ type" and underneath "Bouček/ 1984" and "HOLOTYPE/ ♀ Strionila/ moundi g.sp./ det. Z. Bouček, 1984" and "B.M.TYPE/ HYM/ 5.3257".

Female

Head brown-black, dorsal margin strongly concave. Face 1.4 to 1.75x broader than long (mean 1.59). Occipital carina strong, crossed by posterior ocelli. OD 0.5 to 0.6x OOL. Vertex very faintly engraved reticulate with scattered long setae with raised bases.

Antennae inserted one torular diameter above clypeus. Scrobes not delimited but shallow towards toruli, unsculptured; not carinate anteriorly. Scapes dark brown basally, grading to yellow-brown apically. F1 square, F2 slightly longer than broad, F3 and F4 square, F5 broader than long. Setae dense, shorter than width of segments of origin. Club 0.5 to 0.7x length of funicle (mean 0.6). Malar groove only present in lower half, running into well developed supra-clypeal area; striate, carinate. Malar space shorter than vertical axis of eye. Clypeal area delimited. Mandible with broad, pointed lower tooth, upper tooth with 1 sharp point and 1 truncation.

Thorax black, mostly sculptured. Pronotum broader than long, imbricate.

Pilosity dense, with setal ring of about 20 setae with raised bases. Posterior margin smooth, unsculptured. Mesoscutum also short; engraved reticulate, with raised setal bases giving a rugose appearance; setae regular, not paired. Notauli complete continuous grooves. Scapulae engraved reticulate, setae with raised bases. Scutellum square, convex in lateral aspect; engraved reticulate anterior to frenal groove, frenal area smooth, declivous. Axillae separated from scutellum anteriorly by shallow groove which changes into deep fovea; finely longitudinally striate. Dorsellum large, sculptured; fovea small; rest of metanotum smooth; metanotal furrow coarsely striate. Mesepisternum with triangular depression with 2 deep depressions. Mesepimeron with central dimple, otherwise smooth and shiny.

Propodeum brown-black. Nucha broader than long; rugose. Tooth smooth, rounded at apex; plicae curved (Fig. 5.89).

Forewing faintly infumate, no defined infumate patch present. Marginal vein 1.6 to 2.1x length of stigmal vein (mean 1.88); stigmal vein slightly thickened. Postmarginal vein 1.2x length of stigmal vein. Stigmal area setose. Costal cell very slightly excised at apex; continuous row of setae margining entire length of costal cell dorsally and ventrally, with partial second row. Basal hairline faintly pigmented, with about 4 setae; basal cell with scattered long setae. Speculum narrow, linea calva differentiated.

Coxae dark brownish-black grading to yellow-brown tarsi. Single hind tibial spur present, 0.5 to 0.6x length of hind basitarsus. Hind coxae striate, sparse lateral crest only present.

Gaster subrectangular, dark brown-black with faint blue metallic lustre. Basal fovea deep, but without demarcated margins; setae absent. T1 0.95x length of gaster; with longitudinal striations in posterior half extending across half tergite transversely (Fig. 5.90). Surface of S1 entirely covered with small alveolae, not striate; excepting a medial horizontal band of larger alveolae (Figs 5.91, 5.92).

Male

Head black, shiny. Malar groove almost complete. Clypeus slightly emarginate.

Antennae (Fig. 5.12) inserted slightly more than 1 torular diameter above

clypeal margin. Scapes medium brown, flagellum slightly darker. F1 longest flagellar segment, F2 to F4 subequal. Club 1.4 to 1.5x length of F1 (mean 1.44). Sensilla short, setae shorter than to as long as segments of origin.

Wing hyaline (Fig. 5.13), basal hairline faintly infumate. Marginal vein 1.8 to 2x length of stigmal vein (mean 1.9). Costal cell margined for 0.9x length. Basal hairline with about 5 setae; basal cell setose, margined by cubital hairline.

Paratypes: 1 female, same details as holotype (ANIC); 1 male, 10km N Perth, 20 Nov 1982, ZB (NHM) (32.48 116.28); 1 female, Perth, 17 Nov 1982, ZB (NHM) (31.57 115.51);

Other material examined: (9 females, 4 males; ANIC unless stated). **W.A.:** 2 males, nr Boddington, 24 Mar-1 Apr 1984, A.Postle (32.48 116.28); 2 females, Kalamunda N.P., 30 km NE Perth, 26 Dec 1986, JSN (31.58 116.04); 1 female, 19km W Munglinup, 4 Jan 1987, JSN (33.42 120.51); 3 females, John Forrest N.P., c 25km E Perth, 23-27 Dec 1986, JSN (31.50 116.05) (2♀ NZAC); 1 female, Perenjori, 18 Dec 1986, JSN (29.26 116.17); 3 females, Walyunga N.P., 40km NE Perth, 24 Dec 1986, JSN (31.43 116.04); 1 male, Stirling Range N.P., Jan 1987, JSN (34.17 117.42) (NZAC).

Biology: Hosts are unknown.

Distribution: **Australia:** Western Australia.

5.2.9 ***Aphobetus paucisetosus*** **sp.n.** (Figs 5.93, 5.94; Map 6)

Holotype: female, NZAC.

Label data: "NEW ZEALAND BR/ Lake Rotoroa/ 11 Dec 1980" and "J. S. Noyes/ E. W. Valentine/ A. K. Walker".

Female

Head shiny black; dorsal margin slightly concave. Face 1.4 to 1.7x broader than long (mean 1.5). Occipital carina strong; back of head finely reticulate laterally, centrally imbricate. Ocelli clear to red, OD 0.5x OOL. Setae on vertex long, brown; those on frons reduced, not conspicuously tuberculate at base.

Antennae inserted about 1.5 torular diameters above clypeal margin. Scrobes striate centrally; not carinate anteriorly. Antennae ranging in colour from yellow-

brown with darker scape and pedicel to concolorous brown. First flagellar segment broader than long to square; F2 slightly broader than long; F3 to F5 square. Club 0.7 to 0.9x length of funicle (mean 0.82). Malar groove absent, remnant inconspicuous; malar space shorter than vertical axis of eye. Genal carina striate (Fig. 5.93). Mandible with pointed lower tooth and 2 blunt upper teeth.

Thorax dark brown to black. Setae in pronotal ring reduced in number to 4. Mesoscutum finely reticulate, with 2 pairs of setae between notauli. Notauli complete, well-defined series of regular pits extending to scutellum. Scapulae finely reticulate. Scutellum from square to slightly longer than wide, convex in lateral aspect; anteriorly reticulate, frenal area less sculptured. Frenal area delimited by indented frenal groove consisting of row of punctures. Axillae sculptured. Mesepisternum and lower mesepimeron finely striate (Fig. 5.93), only upper mesepinotum glabrous; dimple absent. Dorsellum striate, rest of metanotum matt and very thin, furrow smooth.

Propodeum dark brown to black; basal fovea present. Plicae absent. Surface of tooth smooth anteriorly, matt posteriorly. Nucha matt.

Forewing with darkly infumate patch extending from basal line to end of stigmal vein. Marginal vein from 2 to 2.7x length of stigmal vein (mean 2.25). Postmarginal vein 1.1 to 1.2x length of stigmal vein. Stigmal area bare. Costal cell inconspicuously excised at apex; apical 0.75 of margin setose; ventral row of setae continuous. Submarginal vein with reduced number of setae (about 5). Basal hairline with 0-2 setae; basal cell bare, infumate; cubital line of setae absent. Speculum present, linea calva not differentiated. Setae on distal half of forewing sparse.

Legs yellow-brown, more yellow at apices of femora and tibiae; coxae dark yellow-brown, slightly striate, tarsi paler. Setal crests absent from hind coxae. One hind tibial spur present, length subequal to hind basitarsus.

Gaster dark yellow-brown to dark brown. Setae at base numerous, but not forming a compact tuft. T1 0.8-0.9x the length of the gaster. Ovipositor projecting slightly from end of gaster. Surface of S1 finely striate, with striae interrupted and confused medially in a raised band; an impressed line anteriorly and 2 vague fovea posteriorly (Fig. 5.94).

Male

Head dark red-brown.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin; scape and pedicel dark yellow-brown; funicular segments dark brown, club paler. F1 subequal in length to F2. Club 1.5 to 2x length of F1 (mean 1.79). Funicular setae long, approximately twice as long as segments of origin.

Forewing with infumate patch varying from pale to dark. Marginal vein 1.7 to 2.4x length of stigmal vein (mean 2.02). Costal cell margined with setae along apical 0.7x length. Basal hairline infumate, with 2 setae; basal cell sparsely setose, margined by cubital hairline.

Coxae, femora and tibiae dark yellow-brown, paler at apices (in some specimens quite markedly). Tarsi yellow, grading to dark claws.

Gaster rich brown anteriorly, grading to dark brown posteriorly or entirely dark brown.

Paratypes: (118 females, 17 males; most in NZAC, in ANIC where stated). **ND:** 1 male, Three Kings Is, Great I., 28-30 Nov 1983, CFB, on *Myoporum laetum*; 1 female, Poor Knights Is, Tawhiti Rahi, N Track, Dec 1980, MFT, sweeping; 1 female, Poor Knights Is, Tawhiti Rahi, Plateau, 8 Dec 1980, JCW, beaten at night. **AK:** 1 female, Waitakere, 20 Sep 1980, EWV; 21 females, 2 males (6 females, 1 male ANIC), Waitakere Range, JSN, Aug 1980 (1 ♀), Sep 1980 (11 ♀), Oct 1980 (7 ♀), Nov 1980 (2 ♀, 2 ♂); 1 female, Titirangi, Aug 1980; Kauri Park, 23 Aug 1980, JSN; 2 females, Birkenhead, JFL, Sep 1980 (1 ♀), Nov 1980 (1 ♀), Malaise trap in second growth bush; 1 female, Huia, Sep 1974, BMM, kauri/manuka, Malaise; 1 male, Huia, 29 Aug - 29 Sep 1980, CFB, ex *Leucaspis* on *Cyathodes fasciculatum* (80/247H); 2 males, Huia, 12 Sep - 10 Oct 1980, CFB, ex eriococcid on *Cyathodes fasciculatum* (80/247I); 7 females, Lynfield, GK, 3 Aug 1980 (2),10 Aug 1980 (1), 31 Aug 1980 (2), Sept 1980 (1), Oct 1980 (1). **CL:** 4 females, 19 km E of Tapu, 31 Jan 1981, JSN; 5 females, Kaueranga Valley, 1 Feb 1981, JSN; 2 females, 2 males, Waiomu Bay, 23 Oct 1968, RAC, from *Phyllocladus trichomanoides*; 1 female, Ohena Is, Ohena I., 25-27 Nov 1972, GWR, on *Coprosma melicytus*; 1 female, Ohena Is, Ohena I., Old Man Rock, 26 Nov 1972, DM, litter 72/240; 6 females, 3 males, Ruamahuanui I., GWR, 10 Nov 1972, on *Pittosporum* (3 ♀, 1 ♂), 12 Nov 1972, litter 72/202 (1 ♂), 8-12 Nov 1972 (1 ♀), 14 Nov 1972, litter 72/204 (1 ♀, 1 ♂), 14 Nov 1972, litter 72/203, (1 ♀). **TO:** 1 female, 20 miles SE of Taupo, 20 Feb 1979, LAM. **TK:** 1 female, Mt Egmont, Holly Hut, AKW, beating, 950 m, 28 Nov 1975. **WN:** 1 female, Tararua Range, Dundas Hut Ridge, 4 Feb 1985, BAH, beating; 2 males, Stokes Valley, 30 Dec 1958, BAH, beaten (DM250). **SD:** 1 male, Stephens I., 14-28 Jan 1933, ESG. **NN:** 22 females, Nelson, ESG, 22 Jun 1926 (14), 10 Oct 1926 (2), 11 Dec 1926 (3), 19 Mar 1927 (2), 8 Jun 1927 (1); 1 female, Nelson, 10 Sep 1964, DBR, on *Pittosporum tenuifolium*; 1 female, Nelson, 16 Aug 1971, JAdB,

ex "*Eriococcus hookerianus*"; 1 female, Pelorus Bridge, 19 Feb 1962, DBR, on *Myrtus bullata;* 1 female, Pelorus Bridge, 19 Sep 1968, EWV, ex *Eriococcus* on *Cyathodes*; 3 females, Pelorus Bridge, 13 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 1 female, Ruby Bay, 19 Feb 1964, EWV, *Eriococcus* past maturity, ngaio (726); 2 females, Ruby Bay, 14 Dec 1964, DBR, ex *Eriococcus* eggsac, mahoe (924); 2 females, Ruby Bay, 18 Nov 1964, EWV, swept from native plants (558); 1 female, Ruby Bay, 3 Dec 1969, JAdB, ex *Eriococcus* on *Loranthus*; 6 females, Totaranui, 600 m, 5 Dec 1980, JSN, EWV, AKW, mixed *Podocarpus* forest; 1 female, Karamea, Kongahu, Nov 1980, P. Quinn, Malaise trap; 2 females, Eves Valley, 8 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 2 females, Upper Takaka R., asbestos mine track, JSN, EWV, AKW, 700 m, 2 Dec 1980, mixed *Nothofagus* forest; 1 female, Roding R., 19 Oct 1965, JIT; 1 male, Kaihoka Lakes, 4 Dec 1980, coastal forest, JSN, EWV, AKW; 1 male, Aniseed Valley, 21 Jan 1969, JAdB, ex *Eriococcus* on *Myrtus obcordata*; 1 male, Whangamoa Saddle, 27 Jan 1979, LAM. **BR:** 4 females, L. Rotoroa, 11 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 2 females, St Arnaud, 600 m, 9 Dec 1980, JSN, EWV, AKW, *Nothofagus* forest. **MC:** 2 females, Banks Peninsula, Prices Valley, Nov 1980, RPM, Malaise trap, edge of native bush. **OL:** 1 female, Bobs Cove, L. Wakatipu, 23 Jan 1981, *Nothofagus* forest, mixed broadleaf, swept, JSN, EWV; 1 female, Makarora W, S of N.P., 18 Jan 1981, *Nothofagus* forest, *Coprosma, Pseudowintera*, swept, JSN, EWV; 1 female, Kirks Bush, L. Hawea, Jan 1987, swept, JSN, EWV, *Nothofagus* forest, broadleaf, *P. totara*; 1 female, 1 male, Kinloch S.F., Dart R., Jan 1981, *Nothofagus* forest, broadleaf, grass, *P. totara*, swept, JSN, EWV. **SI:** 1 female, Mason Bay, 27 Feb 1968, EWV (1505); 1 female, Butterfield Bay, 29 Feb 1968, EWV.

Other material examined: Type series only.

Biology: *A. paucisetosus* has been reared from an unidentified species of *Leucaspis*, from an unidentified eriococcid and from a species of *Eriococcus*. J. A. deBoer recorded rearing *A. paucisetosus* from "*Eriococcus hookerianus*", however I can find no such species. *Elaeocarpus hookerianus* Raoul (Elaeocarpaceae) is a host plant of *Eriococcus elaeocarpi* Hoy, a native New Zealand eriococcid (Hoy, 1962), and it is possible that this is the species to which the collector is referring.

Distribution: **New Zealand:** ND, AK, CL, TO, TK, WN / NN, BR, MC, OL / SI.

Remarks: *Aphobetus paucisetosus* is diagnosed by the reduced number of pronotal and submarginal setae and the striate mesepimeron. The name is derived from the Latin paucus for few and setosus for hairy or bristly.

5.2.10 ***Aphobetus reticulatus*** **sp.n.** (Map 23)

Holotype: female, ANIC.

Label data: "Clyde Mt. NSW/ (landslip)/ 27 Sept. 1979/ I. D. Naumann/ J. C. Cardale" and "*Austroeunotus/ silvifilia* Grlt/ I. D. Naumann det. 1983" and "*Aphobetus/ silvifilia* (Grlt)/ det. I. D. Naumann 1986". On card, head, one antenna and one foreleg separate.

Female

Head black; dorsal margin slightly concave. Face 1.6x broader than long. Occipital carina strong, back of head finely reticulate. OD 0.9x OOL. Face heavily sculptured, excepting smooth area between malar groove area and genal carina. Vertex imbricate, setae moderately long.

Antennae inserted less than 1 torular diameter above clypeal margin. Scrobes finely reticulate, not carinate anteriorly; sculpture grading to imbricate adjacent to eyes, heavily reticulate above clypeus. Antennae concolorous honey yellow; all flagellar segments longer than wide. Club 0.8x length of funicle. Malar groove deep, wide and smooth above clypeus, not complete; malar space shorter than vertical axis of eye. Genal carina not striate.

Thorax black. Pronotum heavily reticulate anterior to setal ring of about 6 setae, smooth and glabrous posterior to ring. Mesoscutum reticulate anteriorly, grading to smooth posteriorly; with paired setae. Notauli complete grooves. Scapulae finely longitudinally striate laterally, smooth adjacent to notauli. Scutellum longer than broad; convex in lateral aspect; medially finely reticulate, laterally smooth, frenal area also smooth. Frenal area delimited by indented frenal groove consisting of row of punctures. Axillae foveate. Depression in mesepisternum shallow, smooth; mesepimeron glabrous, with conspicuous dimple. Dorsellum, rest of metanotum and furrow smooth; furrow almost horizontal.

Forewing hyaline, tinged faintly yellow. Marginal vein 1.25x length of stigmal vein. Postmarginal vein 1.1x length of stigmal vein. Stigmal area with 2-3 setae. Costal cell wide, hardly excised at apex; margined with setae along apical 0.6 length; ventral row of setae continuous. Basal hairline faintly pigmented, lacking setae; basal

cell bare; margined by row of cubital setae. Speculum present, linea calva not delimited.

Legs honey yellow, with darker coxae. Hind coxae not striate, except at very base; lateral and dorsal crests of setae present. Two hind tibial spurs present, longest 0.1x length of hind basitarsus.

Propodeum black; basal fovea almost entirely absent. Plicae complete, additional complete medial plica also present, but weak posterior to costula. Nucha matt, apical foveae absent. Tooth smooth.

Gaster dark brown, T1 0.9x length of gaster. Setae at base sparse. Ovipositor exerted slightly. S1 not grooved, surface finely striate.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown. This specimen was collected in temperate rainforest.

Distribution: **Australia:** New South Wales.

Remarks: *A. reticulatus* is diagnosed by the combination of sculptured face and very short hind tibial spur. Known from the holotype only.

5.2.11 ***Aphobetus silvifilia*** **(Girault)** (Figs 5.95, 5.96, 5.97, 5.98, 5.99, 5.100; Map 24)

Aphobetus silvifilia (Girault); Bouček, 1988a:363.

Austroeunotus silvifilia Girault, 1938b:85; Dahms, 1986:539. Transferred to *Aphobetus* by Bouček, 1988a:363.

Holotype: female, QM.

Publication data: "A female taken in the almost virgin jungle at Mapleton on the Blackall Range, July 14, 1923".

Label details: Material at QM: 1 card and 2 slides as follows:

Card- ♀ thorax only with one mid leg and one pair of wings separately, labelled "*Austroeunotus/ silvifilia* Gir./ ♀/ Paratype" and on reverse "Gympie/ Q." and "Queensland/ Museum".

Slide 1- Two adjoined coverslip fragments and a patch of medium containing one forewing and the crushed head minus antennae from the holotype. Body now missing, one complete coverslip and a coverslip fragment covering an undescribed species of *Achrysocharis* (Eulophidae) labelled "*Achrysocharis/ silvifilia* Gir/ Types" [GH] and "*Austroeunotus* ♀/ *silvifilia* Gir., Type" [GH] and "Holotype/ T9986/ E.C.D. 1985".

Slide 2- One large coverslip fragment covering the head (antennae separated, one in two pieces) from the female on card, one empty, almost complete coverslip. Labelled "*Austroeunotus/ silvifilia* Gir./ ♀/ Gympie/ Q." [GH]. Also one deleted word, illegible.

Dahms (1986) notes that the specimen from Gympie has no type status since its data were not mentioned with the original description. The forewing and crushed head on slide 1 are the only surviving remains of the holotype.

Female

Head dark brown-black; dorsal margin moderately concave. Face 1.4 to 1.8x broader than long (mean 1.55). Occipital carina strong, back of head reticulate laterally, imbricate centrally. OD approximately 0.5 OOL. Vertex alutaceous; with scattered long setae. Face smooth and shiny, with scattered setae.

Antennae inserted about 2 torular diameters above clypeal margin, slightly below lower eye level. Scrobes sculptured medially only, not carinate anteriorly. Antennae usually concolorous honey yellow to medium brown. Funicular segments all longer than wide or square, none broader than long, F1 to F5 increasing in width. Club 0.7 to 0.8x length of funicle (mean 0.78). Malar groove inconspicuous except for short deep remnant just above mandibles (Fig. 5.95); malar space subequal in length to vertical axis of eye. Genal carina and malar groove striate (Fig. 5.95). Mandible with broad lower tooth, upper tooth divided into 2 points.

Thorax dark brown-black. Pronotum smooth posterior to setal ring of about 8 long brown setae. Mesoscutum alutaceous to imbricate; with 3 pairs of setae, sometimes with an extra pair. Notauli complete series of short, well-defined grooves. Scapulae alutaceous. Scutellum longer than broad; convex in lateral aspect; finely reticulate anterior to frenal groove, frenal area with some longitudinal striations, but mainly smooth. Frenal area delimited by indented frenal groove consisting of a row of punctures (Fig. 5.96). Axillae not sculptured. Mesepisternum with depressed, striate, elongate triangular area. Mesepimeron smooth, with central dimple (Figs 5.97, 5.98). Dorsellum mainly smooth with median fovea; rest of metanotum smooth, metanotal furrow smooth, almost horizontal.

Propodeum black, basal fovea inconspicuous (Fig. 3.99). Plicae complete; additional complete plica present medially, this diverging apically to form a small apical fovea on either side of tooth. Tooth smooth.

Forewing without definite infumate patch. Marginal vein 1.6 to 2.3x longer than stigmal vein (mean 1.99). Stigmal area setose. Postmarginal vein 1.2x length of stigmal vein. Apex of costal cell inconspicuously excised; almost entirely margined by setae; ventral row of setae continuous. Basal hairline pigmented, with 1 or 2 setae; basal cell setose, partly margined by cubital hairline. Linea calva wide, linea calva delimited.

Legs honey yellow, fore coxae brown. Hind coxae striate, with sparse dorsal and no lateral setal crests. One hind tibial spur present; 0.4x length of hind basitarsus.

Gaster medium to dark brown grading to darker at apex; globular. T1 0.5 to 0.9x length of gaster. Setae at base sparse. Ovipositor projecting from end of gaster. S1 striate over entire surface; with 2 deep alveolae anteriorly, a ridge medially and 6 alveolae posteriorly (Fig. 5.100).

Male

Head dark red-brown.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin. F1 longest flagellar segment, F2-F4 equal in length. Segments setose, setae longer than segments of origin. Club 1.2 to 1.5x longer than F1 (mean 1.35). Malar groove weak, but more

conspicuous than in female.

Forewing hyaline, basal hairline not infumate. Marginal vein 1.8 to 2.5x length of stigmal vein (mean 2.17). Costal cell margined with setae in apical 0.6x length. Basal hairline not pigmented, line of about 4 setae present; basal cell with approximately 5 setae; cubital hairline present. Linea calva narrower than in female.

Legs yellow-brown, fore and mid coxae brown, hind coxae yellow-brown.

Gaster oval, not globular as in female. T1 0.3-0.5x length of gaster.

Other material examined: (25 females, 8 males; ANIC unless otherwise stated). **W.A.:** 1 male, 31.27 116.08, 9 km SSW Bindoon, 25 Sep 1981, IDN, JCC. **Qld:** 4 females, 26.52 151.34, Bunya Mtns N.P., nr Westcott Plain, 6-7 Oct 1984, IDN, JCC; 4 females, 25.58 153.06, Cooloola N.P., 1 km N Poona Lake, 12 Oct 1984, IDN, JCC; 2 females, Cooloola N.P., 30 m., 7 Mar 1984, LM (25.58 153.09); 1 female, 26.53 151.37, Russell Park, nr Mt Mowbullan, 7 Oct 1984, IDN, JCC; 4 females, 28.15 152.28, The Head, nr Wilsons Peak, 13 Oct 1984, IDN, JCC; 2 females (NHM), Mt Glorious, nr Brisbane, 17 Nov 1976, ZB (27.20 152.46). **N.S.W.:** 1 female, Brown Mt, 17 Jul 1963, DHC (36.36 149.23); 1 male (NZAC), 35.38 149.54, Monga St. For., 18 Feb 1983, IDN, JCC; 1 male, 1 female, 31.54 151.36, Cobark For Pk., Barrington Tops, 11 Feb 1984, IDN: 1 female, Clyde Mt, 3 Dec 1977, IDN (35.33 149.57); 2 females (NHM), Tooloom Scrub, 8 Jan 1977, ZB (28.37 152.25). **Vic.:** 1 female, Toorloo Arm, Lakes Entrance, 22 July 1964, DHC (37.51 148.04). **Tas.:** 1 male, 41.22 147.24, 10 km ENE of Nunamara, 12 Jan- 6 Feb 1983, IDN, JCC; 1 male (NZAC), 42.06 145.44, Nelson R, 22 Jan 1983, IDN, JCC; 1 male, 42.13 146 01, Franklin R., 2 Feb 1983, IDN, JCC; 1 male, 42.5 146.19, 5 km S by S Frodshams Pass, 24 Jan 1983, IDN, JCC; 1 male, 42.52 146.22, 6 km S by W Frodshams Pass, 25 Jan 1983, IDN, JCC; 1 female (NZAC), 42.56 147 19, The Lea, 5 Feb 1983, IDN, JCC; 1 female (NZAC), 42.46 146.35, 4 km WSW Maydena, 11 Dec 1981, IDN; 1 female, 41.11 148.07, 19 km NW by N, St Helens, 14 Jan 1983, IDN, JCC; Type (26.38 152.52).

Biology: Hosts are unknown. *A. silvifilia* has been collected from subtropical rainforest and wet sclerophyll forest.

Distribution: **Australia:** Western Australia, Queensland, New South Wales, Victoria, Tasmania.

Remarks: *Aphobetus silvifilia* is diagnosed by the combination of malar groove remnant, dimple in mesepimeron, sculptured mesoscutum and short hind tibial spur in both sexes; and by the hyaline forewing in the female.

5.2.12 ***Aphobetus singeri*** **sp.n.** (Figs 5.14, 5.101, 5.102, 5.103, 5.104; Map 25)

Holotype: female, ANIC.

Label data: "42.37S 147.39E/ 5km W Buckland/ TAS 27 Jan 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol".

Female

Head shiny black; dorsal margin moderately concave. Face from 1.5 to 1.7x broader than long (mean 1.59). Occipital carina strong, back of head imbricate. OD 0.75x OOL. Face slightly longitudinally striate; lower face smooth. Vertex alutaceous with moderately abundant, long dark setae.

Antennae inserted about 2 torular diameters above clypeal margin, slightly below ocular line. Scrobes not sculptured, smooth; very weakly carinate anteriorly. Antennae honey yellow in colour, often with 1 or more funicular segments or club darker. Flagellar segments all square to slightly longer than wide (Fig. 5.14). Club 0.5 to 0.7x length of funicle (mean 0.58). Malar groove complete, conspicuous; malar space shorter than vertical axis of eye. Genal carina not striate. Mandible with broad, pointed lower tooth; upper divided into 2 blunt teeth.

Thorax shiny black. Pronotal setal ring with about 12 dark setae. Mesoscutum imbricate, with row of setae anteriorly plus 2 or 3 posterior pairs. Notauli complete; anteriorly short, well-defined longitudinal grooves, posteriorly shallow wide groove (Fig. 5.101). Scapulae alutaceous. Scutellum square; convex in lateral aspect; finely reticulate anterior to frenal groove, frenal area smooth with some longitudinal crimping. Frenal area delimited by indented frenal groove consisting of row of long punctures (Fig. 5.101). Axillae weakly striate. Mesepisternal depression coarsely striate; mesepimeron glabrous, dimple present (Fig. 5.102). Dorsellum striate, rest of metanotum smooth, furrow crossed by 1 or 2 carinae.

Propodeum black; deep basal fovea present. Plicae complete, additional medial plica present only basally. Tooth sculptured (Fig. 5.103), delimited by additional oblique carinae on either side. Apical foveae absent.

Forewing slightly yellow, hyaline or with slight darkening posterior to marginal and stigmal veins. Marginal vein 1.9 to 2.4x length of stigmal vein (mean 2.12). Postmarginal vein 1.1x length of stigmal vein. Stigmal area setose.

Postmarginal vein subequal to stigmal vein in length. Costal cell inconspicuously excised at apex; margined with setae along almost entire length; ventral row of setae complete. Basal hairline faintly pigmented, with about 5 setae; basal cell with row of setae, margined by cubital row of setae. Speculum and linea calva distinct, hairline 1 to 3 hairs thick.

Legs yellow-brown, tarsal segments on forelegs dark. Hind coxae striate, only ventral crest of setae present. One hind tibial spur present; 0.8x length of basitarsus.

Gaster honey yellow, contrasting with head and thorax, darker around basal fovea; globular. T1 0.4-0.5x length of gaster. Setae at base numerous, but not in form of compact tuft. Ovipositor exserted slightly. Surface of S1 not striate; with narrow longitudinal grooves, some bifurcating; raised but not interrupted medially (Fig. 5.104).

Male

Head dark brown.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin; scape and pedicel yellow-brown, flagellum brown. F1 longest flagellar segment, F2 to F4 decreasing in length, setae longer than segments of origin. Club 1 to 1.2x length of F1 (mean 1.12).

Thorax dark brown.

Forewing hyaline, basal hairline pigmented. Marginal vein from 1.8 to 2.4x length of stigmal vein (mean 2.16). Costal cell margined with setae in apical 0.9x length. Basal hairline with line of about 4 setae; basal cell setose, margined by cubital hairline. Speculum and linea calva less broad than in female.

Gaster yellow-brown anteriorly, grading to darker brown posteriorly; to dark brown at base and apex and lighter centrally. T1 0.3x length of gaster.

Paratypes: (80 females, 6 males; ANIC, NZAC where stated). **N.S.W.:** 1 female, 35.38 149.54, Monga State Forest, 18 Feb 1983, IDN, JCC; 1 female, Minamurra Falls, 5 Jul 1961, DHC (34.38 150.51). **Tas.:** 12 females (2 in NZAC), 42.56 147.19, The Lea, 5 Feb 1983, IDN, JCC; 30 females, 42.37 147.39, 5 km W Buckland, 27 Jan 1983, IDN, JCC; 1 female, 43.07 146.47, Edwards Road, Hartz Mtns, 4 Feb 1983, IDN, JCC; 2 females, 41.22 145.35, Wandle R., 10 km NNE Waratah, 1 Feb 1983, IDN, JCC; 2 females, 42.52 146.22, 6 km S by W, Frodshams Pass, 25 Jan 1983, IDN, JCC; 1 female, 42.54 147.15, Shoobridge Bend, Mt Wellington, 5 Feb

1983, IDN, JCC; 4 females, 42.06 145.44, Nelson R, 22 Jan 1983, IDN, JCC; 2 females, 41.22 147.24, 10 km ENE of Nunamara, 11 Jan 1983, IDN, JCC; 2 females, 42.13 146.01, Franklin R, 22 Jan 1983, IDN, JCC; 2 males, 2 females (1 male in NZAC), 43.09 146.47, Keoghs Road, Hartz Mtns, 4 Feb 1983, IDN, JCC; 2 males, 1 female, 41.21 147.22, Barrow Creek, 8 km NE Nunamara, 11 Jan 1983, IDN, JCC; 1 female, 41.16 145.37, Hellyer Gorge, 17 Jan 1983, IDN, JCC; 2 females, 42.10 146.08, 9 km WSW Derwent Bridge, 21 Jan 1983, IDN, JCC; 1 male, 1 km NE Kingston, 26 Dec 1979, JCC (42.59 147.58); 8 males, 12 females, (2 males, 4 females, NZAC), 42.39 146.34, Mt Field N.P., 7 Feb 1992, PJG, TQK, reared ex *Eriococcus* sp. on *Microstrobos niphophilus* (Podocarpaceae); 1 female, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, open forest, (W.E.B.S), Malaise 1, 30 Nov 1990-8 Jan 1991; 6 females, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, IDN, 1♀ 5-10 Feb 1990, 5 ♀♀ 18-23 Nov 1991; 1 female, 43.20 146.07, Mt Rugby, Bathurst harbour, 15 Feb 1990, IDN; 2 females, 43.25 146.10, Melaleuca, Bathurst Harbour, 3-7 Dec 1990, IDN, closed forest; 4 females, 43.19 146.10, Black Swan Is., Bathurst Harbour, 29 Nov 1991, IDN; 1 female, Claytons, Bathurst Harbour, 27 Nov 1991, IDN; 1 male, 1 female, 43.22 146.09, Celery Top Is., Bathurst Harbour, 12-17 Feb 1990, IDN, rainforest.

Other material examined: Type series only.

Biology: *A. singeri* has been reared from a species of *Eriococcus* (P. J. Gullan, pers. comm.). It has been collected from wet sclerophyll, temperate rainforest and the alpine zone of Tasmania.

Distribution: **Australia:** New South Wales, Tasmania.

Remarks: *A. singeri* is diagnosed by the combination of complete, conspicuous malar groove, long hind tibial spur, propodeal tooth with striate surface and short T1. The series of specimens reared from *Eriococcus* have long first gastral tergites but do not differ from the remaining material in any other way. It is possible that this is an artefact of the method of killing the specimens. *Aphobetus singeri* is named in honour of Professor Peter Singer of the Centre for Human Bioethics at Monash University.

5.2.13 ***Aphobetus vandiemenensis*** **sp.n.** (Figs 5.15, 5.105, 5.106, 5.107, 5.108, 5.109; Map 26)

Holotype: female, ANIC.

Label data: "43.07S 146 47E/ Edwards Road/ Hartz Mtns TAS/ 4 Feb 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol" and "*Austroeunotus*/ sp. P104. ♀/ det. I. D. Naumann 1986".

Female

Head black; dorsal margin slightly concave. Face 1.1 to 1.5x broader than long (mean 1.4). Occipital carina weak (Fig. 5.105); back of head imbricate. OD 0.6x OOL. Face smooth; vertex finely transversely rugose, setae on vertex long, black.

Antennae inserted about 2 torular diameters above clypeal margin. Scrobes unsculptured, not carinate anteriorly. Antennae concolorous yellow-brown to dark yellow-brown with darker scape. Flagellar segments square to longer than broad. Club from 0.5 to 0.7x length of funicle (mean 0.63). Malar groove complete, but weak except above clypeus, not striate; malar space shorter than vertical axis of eye. Genal carina not striate. Mandible with broad lower tooth, upper divided into 3 points.

Thorax black. Pronotum with setal ring of about 12 long brown setae. Mesoscutum alutaceous, approximately 6 pairs of setae between notauli. Notauli complete, composed of short, well-defined longitudinal grooves (Fig. 5.105). Scapulae transversely striate. Scutellum convex in lateral aspect, longer than broad; very faintly sculptured anterior to frenal groove, frenal area smooth and slightly crimped. Frenal area delimited by indented frenal groove consisting of row of short punctures (Fig. 5.106). Axillae weakly striate. Depression in mesepisternum coarsely striate; mesepimeron shiny, glabrous, without dimple (Fig. 5.107). Dorsellum striate, rugose medially. Rest of metanotum smooth, furrow smooth with several short carinae crossing it.

Propodeum black; basal fovea present (Fig. 5.108). Plicae complete, no medial plica present. Longitudinal carinae present below costula on nucha, which is rugose at apex and lacking apical foveae. Tooth smooth.

Forewing hyaline, slightly yellow. Marginal vein 2.2 to 2.6x stigmal vein

(mean 2.4). Stigmal area with some setae. Postmarginal vein 1.3x length of stigmal vein. Costal cell slightly excised at apex; margined with setae along 0.9x length; ventral row of setae continuous. Basal hairline very faintly pigmented, with line of about 6 setae; basal cell setose, margined by cubital hairline. Speculum and linea calva present.

Legs yellow-brown. Hind coxae with dorsal and lateral crests of setae. One hind tibial spur present; 0.8x length of basitarsus.

Gaster ranging from black basally grading to dark brown apically, to entirely dark brown; oval. T1 0.4 to 0.6x length of gaster. Setae at base not compact tuft. Ovipositor exserted slightly. Surface of S1 finely striate; longitudinally grooved, grooves longer than broad, interrupted medially by a horizontal ridge. Also with an impressed alveolate line at the very anterior of S1 (Fig. 5.109).

Male

Head shiny dark red-brown.

Antennae (Fig. 5.15) inserted 2.5 to 3 torular diameters above clypeal margin. Flagellum dark brown, scape and pedicel slightly paler. F1 longest funicular segment. F2 to F4 decreasing in length. Club 1 to 1.25x longer than F1 (mean 1.1). Setae on F1 0.75x length of segment of origin.

Thorax shiny black.

Forewing hyaline, basal hairline infumate. Marginal vein 2 to 2.7x length of stigmal vein (mean 2.41). Costal cell margined with setae in apical 0.9x length. Basal hairline with line of about 5 setae; basal cell setose, margined by cubital hairline. Linea calva and speculum narrow.

Hind tibial spur subequal to hind basitarsus in length.

Gaster dark brown to black. Petiole square and rugose. T1 0.4x length of gaster.

Paratypes: (19 females, 14 males; most in ANIC, in NZAC where stated). **Tas.:** 1 male, 2 females, 41.23 147.25, Mt Barrow, 11 km E by Nunamara, 11 Jan 1983, IDN, JCC (NZAC); 2 females, 43.09 146.47, Keoghs Road, Hertz Mtns, 4 Feb 1983, IDN, JCC; 2 females, 43.07 146.47, Edwards Rd, Hartz Mtns, 4 Feb 1983, IDN, JCC; 1 male, 1 female, 41.14 147.56, 4 km SE Weldborough, 29 Jan 1983, IDN, JCC; 2 males, 3 females (1 female in NZAC), 42.10 146.08, 9 km WSW Derwent

Bridge, 21 Jan 1983, IDN, JCC; 1 female, 42.54 147.15, Shoobridge Bend, Mt Wellington, 5 Feb 1983, IDN, JCC; 1 male, 1 female, 41.22 147.24, 10 km ENE of Nunamara, 11 Jan 1983, IDN, JCC; 2 males, 41.22 145.35, Wandle R., 10 km NNE Waratah, 1 Feb 1983, IDN, JCC; 4 males, 1 female, 40.57 144.49, 5 km SE by E Redpa, 18 Jan 1983, IDN, JCC; 1 male, 40.58 145.33, 3 km E by S Montumana, 19 Jan 1983, IDN, JCC; 1 male (NZAC), 42.37 147.39, 5 km W Buckland, 27 Jan 1983, IDN, JCC; 1 male, 41.18 145.36, Saxons Rd, 17 Jan- 1 Feb 1983, IDN, JCC, pantrap; 1 female, 41.18 145.36, Saxons Rd, 17 Jan 1983, IDN, JCC; 3 females, 41.30 146.05, 14 km SW by S Wilmot, 31 Jan 1983, IDN, JCC; 1 female, 42.54 147.18, Old Farm Rd, Cascades, 20 Jun 1989, PJG, forest; 1 female, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, Mar 1991, *Leptospermum* scrub.

Other material examined: Type series only.

Biology: Hosts are unknown. *A. vandiemenensis* has been collected from wet sclerophyll, temperate rainforest and open woodlands.

Distribution: **Australia:** Tasmania.

Remarks: *A.vandiemenensis* is diagnosed by the combination of weak occipital carina, mesepimeron without a dimple and long hind tibial spur in both sexes; and by the hyaline forewing in the female.

5.2.14 ***Aphobetus nana*** **(Bouček)** (Figs 5.16, 5.110, 5.111, 5.112; Map 5)

Pidinka nana Bouček 1988a:362, Figs 672-674; Valentine and Walker, 1991:28.

Holotype: female, NZAC.

Label data: " 869/2/ ♀" and "NEW ZEALAND/ Stoke NN/ 9.x.65 D. B. Read" and "*Ctenochiton/ perforatus/* on *Pittosporum/ eugenioides*" and "N.Z.Arthropod/ Collection NZAC/ Entomology Div./ DSIR, Auckland/ New Zealand" and "Holo-/type" and on underside "Bouček/ 1986" and "HOLOTYPE/ ♀ *Pidinka/ nana* g.sp.n./ det. Z. Bouček, 1986".

Female

Head brown to black, shiny; dorsal margin moderately concave. Face 1.4 to 1.8x broader than long (mean 1.64). Occipital carina moderately strong; back of head

smooth centrally, striate laterally. Ocelli clear to reddish; OD less than OOL. Frons with a green tinge, unsculptured; with sparse setae. Vertex also with sparse setae, moderately long; transversely reticulate between ocelli.

Antennae inserted slightly less than 2 torular diameters above clypeal margin. Scrobes shallow, not defined, but with a narrow, transversely striate groove in the centre; not carinate anteriorly. Antennae ranging from honey yellow with darker scapes to concolorous brown. Funicular segments compressed, broader than long, except for F1 which is square. Club 0.75 to 0.9x length of funicle (mean 0.84). Malar groove incomplete, reduced to small striate remnant above mandibles; malar space shorter than vertical axis of eye. Lower face convex with transverse groove parallel to mouth margin. Genal carina striate. Mandible with pointed lower tooth and broad, blunt, undivided upper tooth.

Thorax shiny brown to black, often with a distinct metallic blue tinge. Pronotum with about 6 setae in setal ring. Mesoscutum transversely striate anteriorly, reticulate to longitudinally striate posteriorly; with paired setae. Notauli complete, composed of series of small, well-defined pits. Scapulae finely longitudinally striate, grading to reticulate adjacent to notauli. Scutellum 0.8x broader than long, flat in lateral aspect; engraved reticulate over entire surface. Frenal area not delimited by groove or line, only by slight change in sculpture (Fig. 5.110). Axillae sculptured. Mesepisternum with depressed, finely striate, elongate triangular area. Lower mesepimeron with shallow inconspicuous striate dimple. Dorsellum short, triangular, with converging longitudinal striae; remainder of metanotum smooth, metanotal furrow smooth; declivous.

Forewing (Fig. 5.16) infumate from base, but hyaline in apical fifth. Marginal vein 1.7 to 2.3x length of stigmal vein (mean 2.02). Postmarginal vein 1.2x longer than stigmal vein. Stigmal area bare. Costal cell strongly excised at apex; margined with setae along apical 0.6x length; ventral row of setae continuous. Basal hairline pigmented, with several setae; basal cell with 1-2 setae, margined by ventral cubital hairline. Speculum present, linea calva not differentiated.

Coxae brown; femora apically brown, sometimes entirely brown; tibiae sometimes apically brown, basally yellow; tarsi yellow. Fore and hind femora slightly thickened. Hind coxae slightly striate; dorsal and lateral setal crests present. One hind

tibial spur present; 0.8x as long as short hind basitarsus.

Propodeum black; basal fovea present (Fig. 5.111). Plica complete, forming tooth with costula. Tooth shallow; anterior smooth, posterior delimited by converging longitudinal carinae. Lateral pilosity sparse but fairly long.

Gaster yellow or red-brown basally grading to dark brown to black apically; broad and short, almost square; dorsally somewhat collapsing. T1 usually covering more than 0.75x length of gaster. Pilosity at base reduced to several setae. Ovipositor slightly exserted. S1 finely striate over entire surface (except anterior smooth collar), anteriorly with small alveolae, posteriorly with larger alveolae, separated by a raised, striate median area (Fig. 5.112).

Male

Average body length 0.92 mm, range 0.63 mm to 1.13 mm, n=12.

Head dark orange-brown. Frons with striate indentation, more conspicuous than in female.

Antennae inserted 2.5 to 3 torular diameters above clypeal margin. Scape and pedicel yellow; funicle brown; club brown, sometimes paler apically. Funicular segments more or less equal in length, F1 only slightly longer than other funicular segments. Club 1.4 to 2.5x longer than F1 (mean 1.82). Flagellar setae long, approximately 1.5x length of segment of origin.

Forewing with an infumate patch, much smaller and paler than in female, only very faintly infumate proximally. Marginal vein 1.8 to 2.2x length of stigmal (mean 2.05). Costal cell margined with setae in apical 0.6x length; slightly excised at apex. Basal hairline faintly pigmented, hairline of about 6 setae; basal cell sparsely setose, margined by cubital hairline.

Gaster less broad and basal fovea less shallow than in females; T1 about 0.9x length of entire gaster.

Paratypes: (95 females, 12 males; most in NZAC, in ANIC where stated). **ND:** 3 females, Waipoua kauri Forest, 11-12 Dec 1983, L.Masner (ANIC); 1 female, Omahuta S.F., 6 Oct 1980, JSN; 8 females, Whangaroa, 12 Sep 1968, RAC, ex *Ctenochiton* sp. on *Corynocarpus laevigata*. **AK:** 2 females, Waitakere, 20 Sep 1980, EWV; 25 females, 1 male (4 females in ANIC), Waitakere Range, Aug 1980 (7 ♀, 1 ♂), Sep 1980 (12 ♀), Oct 1980 (1 ♀), Nov 1980 (4 ♀), Dec 1980 (1♀), JSN; 1

female, Laingholm, Oct 1980, RK, Malaise trap in native bush; 1 female, Lynfield, Wattle Bay, Apr 1980, GK; 1 female, Titirangi, Aug 1980, PAM; 1 female, Titirangi, Sep 1980, PAM, Malaise trap in garden; 2 females, Titirangi, Oct 1980, GWR, Malaise trap in garden; 1 female, Huia, May 1975, Malaise; 1 female, Huia Dam, 26 Sep - 10 Oct 1980, ex coccid on *Aristotelia serrata*, GH; 1 female, Huia, Oct 1980, BMM, Malaise trap in bush; 3 females, Birkenhead, Oct 1980 (1 ♀), Nov 1980 (2 ♀), JFL, Malaise trap in second growth bush. **SD:** 3 females, Q.Charlotte Sd, Mistletoe Bay, 13 Feb 1985, JWE, sweeping ferns in coastal forest (LU). **NN:** 1 female, Farewell Spit, 4 Dec 1980, JSN, EWV, AKW, under *Leptospermum*; 1 female, Canaan Saddle, 7 Dec 1980, JSN, EWV, AKW, *Nothofagus*/mixed *Podocarpus*; 5 females, Kaihoka Lakes, 4 Dec 1980, JSN, EWV, AKW, coastal forest; 4 females, Totaranui, 600 m, 5 Dec 1980, JSN, EWV, AKW, mixed *Podocarpus* forest; 4 females, Upper Takaka R., asbestos mine track, 700 m, 2 Dec 1980, JSN, EWV, AKW, mixed *Nothofagus* forest; 1 male, Maitai, 4 Nov 1963, ESG, *Ctenochiton* ♂ (702) on broadleaf; 4 females, Whangamoa, 26 Oct 1962, EWV, ex *Ctenochiton* on *Griselinia littoralis* (573); 3 females, Whangamoa, 20 Nov 1964, EWV, ex *Ctenochiton viridis* immature ♂♂ on *Griselinia littoralis* (910); 1 female, Whangamoa Saddle, 27 Jan - 3 Feb 1979, AKW, LAM, *Nothofagus* forest; 1 female, Whangamoa Saddle, 27 Jan 1979, LAM; 2 females, Whangamoa Saddle, 13 Dec 1980, JSN, EWV, AKW, *Nothofagus*/mixed *Podocarpus* forest; 3 females, 1 male, Nelson, 7 Sep 1964 (1 ♀, ex *Ctenochiton ?perforatus* immature males on *Coprosma robusta*), 12 Sep 1964 (1 ♀, ex *Ctenochiton perforatus* immature male on *Coprosma robusta*), 5 Oct 1964 (1 ♀, ex *Ctenochiton perforatus* on *Pittosporum eugenioides*), 6 Oct 1964 (1♂, ex *Ctenochiton ?perforatus* immature ♂ on *Pittosporum eugenioides*), JAdB; 1 female, Dun Mt, Third House, 29 Jan 1979, AKW, recently fallen *Nothofagus fusca*; 1 female, 2 males, Stoke, 9 Oct 1965, DBR, *Ctenochiton perforatus* on *Pittosporum eugenioides* (869); 1 female, 2 males, Cawthron Institute Gardens, 30 Oct 1967, EWV, *Ctenochiton* on *P. eugenioides*; 1 female, Pelorus Bridge, 8 Nov 1962, EWV, swept, short growth under beech; 3 females, Pelorus Bridge, 14 Mar 1966, DV8; 5 females, Pelorus Bridge, 13 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 2 males, Mt Cobb, 2 Nov 1960, ex *Ctenochiton* on Griselinea littoralis (FR4); 2 males, Eves Valley, 16 Dec 1963, DH, ex *Ctenochiton* ♂ on *Nothopanax arboreum* (710); 1 male, Eves Valley, 10 Nov 1964, DH, ex *Ctenochiton viridis* immature ♂ on *Nothopanax arboreum* (900). **SL:** 5 females, Invercargill, Jan 1961, EWV, ex ?*Ctenochiton* sp. on *Wintera colorata* (234).

Other material examined: 64 specimens (55 females, 3 males, NZAC; 5 females, 1 male, ANIC).

Biology: Hosts of *A. nana* include *Ctenochiton* sp., *C. viridis*, *C. perforatus* and *C. elaeocarpi* Maskell on *Elaeocarpus hookerianus*; *Pseudococcus longispinus* on *Lawsoniana* L. (Lythraceae) hedge; *Leucaspis mixta* de Boer (Diaspididae). One record reads from "*Ctenochiton pilporus*" on *Dysoxylum spectabile* (Forst. f.) Hook

(Meliaceae); presumably this is a misspelling of *C. piperus* Maskell.

Distribution: **New Zealand:** ND, AK, CL, BP, GB, TK, TO, WN / SD, NN, MC, MK, CO, OL, SL, SI.

Remarks: Bouček (1988a) distinguished the monotypic genus *Pidinka* by the combination of the propodeal tooth, flattened scutellum with the lack of differentiation of a frenum, compressed funicular segments in the female antennae and strong excision at the apex of the costal cell.

5.3 Genus *Australeunotus* Girault

Australeunotus Girault, 1922:153; Bouček, 1988a:361. Type species *Australeunotus ruskini* Girault; by monotypy.

Female

Dorsal margin of head moderately concave. Face flat to depressed. OD less than or equal to OOL; posterior ocelli crossing occiput.

Antennae inserted about 1 torular diameter above clypeal margin; short and strongly clavate. Funicular segments not elongate. Malar space shorter than vertical axis of eye. Mandible bidentate, upper tooth divided.

Thorax dark, without conspicuous punctures. Setal bases simple, not reticulate. Notauli complete. Scutellum with 2 pairs of setae. Frenal area not delimited by groove, at most by change in sculpture. Axillae delimited by groove apically, by fovea basally.

Propodeum with median carina and costula present, smooth around spiracles. Nucha broader than long.

Forewing with marginal vein subequal in length to stigmal vein. Postmarginal vein shorter than stigmal vein. Costal cell with several setae along apical margin. Basal hairline bare, or with line of setae; cubital hairline bare. Speculum present, linea calva not delimited.

Hind coxae with dorsal and smaller basal and lateral setal crests. Single hind

tibial spur present.

Gaster with setal tuft at base, not thick or compact; extended down margin of fovea, but not present medially.

Male

Antennae inserted higher than in female; flagellar segments very nodose. Setae on flagellum arranged in whorls.

5.3.1 ***Australenotus ruskini*** **Girault** (Figs 5.17, 5.18, 5.19, 5.113; Map 27)

Australeunotus ruskini Girault, 1922:153; Dahms, 1986:489; Bouček, 1988a:361, Fig. 664.

Holotype: female, QM.

Publication details: "Wynnum, forest, July 13, 1921".

Label details: Slide labelled "HOLOTYPE/ T9889/ E.C.D. 1985" and "HOLOTYPE/ I.9400/ E.C.D. 1985" and "Australeunotus/ ruskini Gir ♀ type/ Secodella" and "ovativentris/ Gir/ Type". 3 coverslip fragments; the two largest cover the head (in two pieces, part of both antennae separated), 3 legs and 1 pair of wings all from the holotype.

Card labelled "HOLOTYPE/ T9889/ E.C.D. 1985" and "Australeunotus/ ruskini Gir./ ♀ type". Holotype minus head, wings and some legs.

Female

Head dark red-brown. Face 1.6 to 1.9x broader than long (mean 1.73). Occipital carina weak; back of head alutaceous. OD 0.6 to 0.8x OOL; posterior ocelli crossing occiput. Vertex alutaceous with scattered short setae.

Antennae (Fig. 5.17) inserted less than 1 torular diameter above clypeal margin; concolorous yellow-brown. Scrobes smooth, not carinate anteriorly. Antennal club strongly clavate, around 3x as broad as pedicel, slightly laterally compressed. F1 broader than long to square, remaining segments broader than long. Setae as long as segments of origin; sparse on funicle, close and regular on club. Club 1.2 to 1.4x

as long as funicle (mean 1.26). Genae striate, with a strong lobate carina medially, narrowing laterally. Malar space about 0.5x vertical axis of eye; malar groove present but inconspicuous. Clypeal area shiny, convex; oral margin between toruli curved, broadly emarginate; genal carina not offset. Mandible with large rounded lower tooth and 2 small, blunt upper teeth.

Thorax black, with very slight metallic blue lustre. Pronotum engraved reticulate, with few scattered setae and a ring of 8 long setae, absent medially. Mesoscutum alutaceous; 2 pairs of setae between notauli, anterior pair short. Notauli composed of short broad grooves. Scapulae alutaceous, sparsely setose. Scutellum square, flat in lateral aspect; engraved reticulate to strigate;,anterior pair of setae short, slightly closer together than posterior pair. Frenal area delimited by change in sculpture. Axillae longitudinally striate, with scattered setae. Dorsellar fovea wide, longitudinally striate; remainder of metanotum smooth. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Propodeum dark brown-black. Coarsely reticulate medially; with short, rugose nucha.

Forewing (Fig. 5.18) with weakly infumate patch posterior to stigmal and marginal veins. Marginal vein from 0.9 to 1.4x length of stigmal vein (mean 1.14). Postmarginal vein 0.6x length of stigmal vein. Stigmal area sparsely setose. Costal cell with 2 to 7 setae along apical margin; ventral row of setae complete with partial second row. Basal hairline not infumate, with no setae to several setae present; basal cell bare; cubital hairline faintly infumate.

Coxae brown, legs yellow-brown. Dorsal setal crest on hind coxae conspicuous, erect. Hind tibial spur 0.3 to 0.4x length of hind basitarsus.

Gaster shiny dark red-black with slight metallic blue tinge. T1 0.7 to 0.9x length of gaster. Basal fovea short, shallow. Ovipositor short, scarcely projecting beyond end of gaster. S1 areolate-rugose anteriorly, grooved posteriorly, grooves broader than long. A smooth or pitted raised horizontal strip may or may not be present medially. Setae absent; surface not striate (Fig. 5.113).

Male

Head black, with blue metallic lustre.

Antennae (Fig. 5.19) inserted 2 torular diameters above clypeal margin. Antennae yellow-brown; setae about 2.5x length of segments of origin at base, decreasing in length to club. Funicular segments subequal in length; club 2.2 to 3x length of F1 (mean 2.57).

Thorax and propodeum dark brown-black.

Wing hyaline. Marginal vein 0.8 to 1.1x length of stigmal vein (mean 0.99). Costal cell with 8 to 11 setae along apical margin. Basal hairline not infumate, bare to with several setae present; basal cell bare; cubital hairline absent.

Other material examined: (71 females, 31 males; ANIC, in NZAC where stated). **W.A.:** 6 females, 16 males; 32.24 124.29, 59km E by N Balladonia Road House, 12 Oct 1981, IDN, JCC, ; 2 males, 3 females, Stirling Range N.P., Jan 1987, JSN (34.23 117.52) (NZAC); 11 females, Norseman, 29 Dec 1986, JSN (32.12 121.47); 8 females, 1 male, Fitzgerald R.N.P., Quaalup area, 6-9 Jan 1987, JSN (34.19 119.22); 2 females, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12); 1 male, 3 females, Avon Valley N.P., c50km NE Perth, 25 Dec 1986, JSN (31.36 116.13); 2 females, Walyunga N.P., 40km NE Perth, 24 Dec 1986, JSN (31.43 116.04); 1 female, 19km W Munglinup, 4 Jan 1987, JSN (33.42 120.51); 2 females, Esperance, 4 Jan 1987, JSN (33.51 121.53); 1 female, Yanchep Forest, c65km N Perth, 21 Dec 1986, JSN (31.29 115.41); 3 females, John Forest N.P., c25km E Perth, 23-27km Dec 1986, JSN (31.50 116.05); 1 female, 7km S Paynes Find, 17 Dec 1986, JSN (29.16 117.41); 1 female, Porongorup N.P., Jan 1987, JSN (34.41 117.55). **S.A.:** 2 females, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.27); 2 females, 1 male; 34.19 139.31, Brookfield Cons. Pk., 24 Nov 1992, IDN, JCC; 1 female, Adelaide, Waite Inst, 6 Aug 1952, ex *Lachnodius eucalypti* female (NHM) (34.56 138.36); 1 female, 34.24 139.26, SW corner, Brookfield Conservation Park, 20 Oct 1992, Rentz, Roach, Harwood, stop 29; 1 female, 33.17 137.10, nr Moonabbie Range, 28 Nov 1992, IDN, JCC; 4 females, Cox's scrub, 60km S Adelaide, 4 Dec 1986, JSN (35.20 138.48); 1 male, Bridgewater, Adelaide, 2 Dec 1986, 2 Dec 1986, JSN (34.56 138.36); 2 males, Mt Barker, 500m, Adelaide, 30 Nov-2 Dec 1986, JSN (34.56 138.36) (1 in NZAC). **Qld.:** 1 female; 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC; 1 female, Wyberba, E.Dahms, 27 Sep 1977, sweeping *Leptospermum* blossoms (QM) (28.52 151.52); 1 female, 26.42 150.31, Horse Gully, foot of Bunya Mtns, 7 Oct 1984, IDN, JCC; 1 male, Wongabel S.F., 7 May 1967, DHC (17.19 145.31). **N.S.W:** 1 female, King Falls, 16 May 1964, M.Nikitin (NHM); 1 male, Shoalhaven R, 30km W Nowra, 25 Dec 1986, G.A.Holloway, (34.46 150.20). **A.C.T.:** 1 female, 35.19 148.51, Wombat Creek, 6km NE Piccadilly Circus, 750m, Aug 1984, TAW, JFL, M-LJ. **Vic.:** 1 female, 18 km SE Robinvale, 30 Oct 1982, K.L.Walker, on *Eucalyptus* (VM) (34.35 142.46); 1 female, 34.29 141.54, 13 km S Pirlta, 18 Oct 1983, IDN, JCC; 1 female, 12km NNW Omeo, 28 Feb 1980, IDN, JCC (37.06 147.36); 1 male, Kinglake N.Prk, nr Melbourne, 31 Jan 1977, ZB (NHM) (37.28 145.22); 1 male, 1 female, Shepparton, 15 Dec 1974, IDN, sweeping grass by creek, dry sclerophyll forest (UQIC) (36.23 145.24). **Tas.:** 1 female, 40.54 145.21, Speedwell Rd, 18 Jan 1983,

IDN, JCC; 1 female, 40.58 148.01, 1km SSE Gladstone, 6 Feb 1983, IDN, JCC; 1 male, 1 female, 41.21 147.22, Barrow Creek, 8km NE Nunamara, 11 Jan 1983, IDN, JCC (NZAC); 1 male, 41.59 146.39, 6km W Miena, 20 Jan 1983, IDN, JCC; 1 male, 1 female, 41.06 147.53, 1km EbyN Herrick, 29-30 Jan 1983, IDN, JCC. (Type 27.27 153.10)
Note: The following three females differ in having the anterior pair of scutellar setae relatively long and slight differences in the propodeal sculpture: **W.A.:** 2 females, near Boddington, 24 Mar- 1 Apr 1984, A.Postle, (32.48 116.28). **Tas.:** 1 female, 42.38 147.38, 7km W by S Buckland, 27 Jan 1983, IDN, JCC.

Biology: The only host record for *A. ruskini* is from *Lachnodius eucalypti* (Maskell) (Eriococcidae).

Distribution: **Australia:** Western Australia, South Australia, Queensland, New South Wales, Australian Capital Territory, Victoria, Tasmania.

5.4 Genus *Australurios* Girault

Australurios Girault, 1926:134-135; Bouček, 1988a:353. Type species *Australurios longispina* Girault; by monotypy.

5.4.1 *Australurios longispina* Girault (Figs 5.20, 5.21)

Australurios longispina Girault, 1926:134-135; Dahms, 1984:773; Bouček, 1988a:353, Figs 651-654.

Lectotype: male, QM, here designated.

Publication details: "A female, Southport, sand dunes, July 2, 1925"

Label details: Slide labelled "Australurios/ longispina Gir/ Type ♀/ Southport, Q" and "HOLOTYPE/ T.9173/ E.C.D. 1984".

The type slide consists of a whole coverslip which covers a crushed male head, with complete antennae attached, one forewing and two legs; and a half coverslip which covers a crushed female gaster, and attached propodeum and metanotum; the remainder of the thorax is detached and crushed, with the hindwings attached. Dahms (1984) states that the holotype is female, while Bouček (1988a) states it is male. Girault (1926) describes the male head and thorax as a female, remarking on its resemblance to a male *Ophelosia*. On the basis of the sculpture of

S1 and the setation of the scutellum I am convinced that the female specimen is not a member of the tribe Moranilini and almost certainly not a eunotine pteromalid. Since there are two specimens here, they are both syntypes and I here designate the male fragments the lectotype of *Australurios longispina*.

Female unknown

Male

Head orange brown, face longer than broad. OD 0.8x OOL, vertex with scattered long setae.

Antennae (Fig. 5.20) inserted slightly more than one torular diameter above clypeal margin. Scrobes weakly carinate, smooth. Antennae concolorous orange brown. Scapes short, pedicel pyriform. Funicular segments nodose, F1 slightly longer than F2-F4. F1 about half as long as club. Setae not longer than segments of origin; sensilla short, half as long as funicular segments. Malar groove complete; malar space shorter than long axis of eye. Genal carina wide medially. Clypeal margin straight, mandibles small.

Forewing (Fig. 5.21) hyaline, except for slight infumation along basal hairline. Marginal vein more than twice as long as stigmal. Stigmal area setose. Postmarginal vein long, more than twice length of stigmal vein. Costal cell not excised at apex; margined with setae along 0.3x its length; ventral row complete with partial second row. Submarginal vein with about 9 setae. Basal cell bare; basal hairline with 5-6 setae, margined by cubital row of setae. Speculum narrow, linea calva not delimited.

Hind coxae striate dorsally, without setal crests. Hind tibial spur 0.7x length of basitarsus, femora slender.

Other material examined: Type only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland.

Remarks: *Australurios* is close to *Ophelosia* Riley. The forewing has a very narrow speculum but in other respects is very like some species of *Ophelosia*. The antennae are very similar to those of *O. crawfordi*. The lectotype is possibly a species of *Ophelosia*. If the lectotype is a species of *Ophelosia*, the name *longispina* is avaliable. Due to the fragmentary material available, I have not used this genus in the phylogenetic analysis.

5.5 Genus *Eunotomyiia* Girault

Eunotomyiia Girault, 1922:153; Bouček, 1988a:355. Type species *Eunotomyiia corvus* Girault; by monotypy.

Female

Head black, with slight metallic lustre on vertex; dorsal margin very weakly concave. Face slightly broader than long. Occipital carina not present, back of head rounded. Posterior ocelli removed from occiput. OD subequal to OOL. Vertex sculptured.

Antennae strongly clavate, club about 3x width of pedicel and slightly laterally compressed. Pedicel elongate pyriform. Club 1.4 to 1.6x length of funicle; covered in short regular setae. Malar groove complete, punctate above clypeus, not conspicuous otherwise. Malar space slightly shorter than vertical axis of eye. Oral margin between toruli straight, offset from genal carina.

Pronotum about half as long as broad, with scattered short setae. Setal ring present; setal bases not reticulate. Mesoscutum sculptured, without regular setation; only one pair of setae at apical margin. Notauli complete, composed of one long groove. Scapulae sculptured, with scattered short setae. Scutellum slightly longer than broad, flat in lateral aspect; two pairs of setae present. Frenal area not delimited by a line or groove. Axillae separated from scutellum by groove anteriorly and deep fovea posteriorly. Dorsellum smooth, fovea alveolate, metanotum not sculptured. Mesepisternum with unsculptured triangular depression. Mesepimeron variously sculptured.

Propodeum with median carina and strong costula present; smooth around

spiracles. Nucha as long as broad, rugose; anterior of costula reticulate.

Forewing hyaline. Marginal vein 2 to 2.2x length of stigmal vein. Postmarginal vein slightly shorter than stigmal vein. Stigmal area bare. Costal cell scarcely excised at apex. Basal hairline not infumate, with single line of short setae; basal cell bare, margined in apical half by cubital row of setae. Speculum present, linea calva not differentiated.

Coxae long and slender. Single hind tibial spur present; 0.4 to 0.5x length of hind basitarsus.

Gaster with deep basal fovea, with very thick, compact tuft of setae at sides; not extending down margin. T1 0.65 to 0.85x length of gaster. Ovipositor projecting slightly. Anterior of S1 with a narrow striate impressed band; medially with a smooth narrow ridge; grooved posteriorly, grooves longer than broad. Surface not striate except anterior band; setae absent.

Male

Antennae branched, branches stout and longer than segments of origin; covered in close regular short sensilla and sparse short setae.

Biology: Hosts are unknown.

Distribution: *Eunotomyiia* is found in eastern Australia, Tasmania and Western Australia.

Key to the species of *Eunotomyiia* Girault, females only.

1. Costal cell of forewing margined along apical half with setae (Fig. 5.23); F1 broader than long, F2 largest funicular segment (Fig. 5.22) ..... *corvus*
Costal cell with fewer than 10 setae on apical margin; F1 square, largest flagellar segment ..... *jamesii*

5.5.1 ***Eunotomyiia corvus*** **Girault** (Figs 5.22, 5.23, 5.24; Map 28)

Eunotomyiia corvus Girault, 1922:153; Dahms, 1983:199; Bouček, 1988a:355, Figs

657-659.

Holotype: female, QM.

Publication details: "Toowong, Brisbane, forest, November 2, 1917"

Label details: Card labelled "Holotype/ T.8715/ E.C.D. 1983" and "Eunotomyiia ♀/ corvus Gir/ Type" and bearing holotype minus head, left forewing and some legs.

Slide labelled "HOLOTYPE/ T.8715/ E.C.D. 1983" and "Eunotomyiia/ corvus Gir./ ♀ type/ Rhynchentedon/ maximus ♀ type" with 3 coverslip fragments: the one closest the label covering the head (both antennae separated, 1 in 2 pieces); 1 fore wing and 2 legs (1 minus tarsus) from the holotype.

Female

Head black, with slight metallic green lustre on vertex. Face 1.2x broader than long. Ocelli reddish-clear; posterior occelli removed from occiput by about 1OD> Vertex engraved reticulate. Eyes minutely hairy. Vertex with scattered short setae.

Antennae (Fig. 5.22) inserted less than 1 torular diameter above clypeal margin. Scrobes not carinate anteriorly, smooth and shiny, not sculptured. Funicle mid-brown, remainder dark brown. Scape short, slightly laterally compressed. F1 broader than long; F2 square, larger than other funicular segments; F3 and F4 broader than long; F5 slightly broader than long; setae short. Club 1.38x length of funicle. Genal carina very narrow, coarsely striate. Mandible with broad, pointed lower tooth and 2 narrower pointed upper teeth.

Thorax dark brown-black with or without strong metallic green lustre (Type without, Tasmanian specimens with metallic lustre. NHM specimen has an emarginate pronotal margin, but this is probably a mutation.) Pronotum imbricate; setal ring absent medially. Mesonotum and scapulae imbricate. Scutellum engraved reticulate, sculpture denser on frenum; anterior pair of setae shorter than posterior, pairs equally spaced. Axillae longitudinally striate. Mesepimeron convex, with faint transverse striae.

Forewing hyaline (Fig. 5.23). Marginal vein of forewing 2 to 2.2x length of stigmal vein (mean 2.13). Postmarginal vein 0.9x length of stigmal vein. Margin of

costal cell setose in apical half.

Legs yellow-brown, darker brown on dorsal surfaces. Coxae mid-brown, long and slender; hind coxae with dorsal, sparse lateral and no basal setal crests. Hind tibial spur 0.4x length of hind basitarsus.

Gaster ranging from quadrate (in Tasmanian specimens) to oval (in type). T1 about 0.85x length of gaster. T2-T4 emarginate medially.

Male unknown

Other material examined: (2 females; locations stated): **Tas.:** 1 female, Picaninny Point, 22 Dec 1977, R.Bashford, ex stem galls *Eucalyptus sieberi* (41.42 148.18) (ANIC); 1 female, Mt Wellington, 24 Mar 1913, 396m, R.E.Turner (42.54 147.14) (NHM). (Type: 27.29 152.59).

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland, Tasmania.

5.5.2 ***Eunotomyiia jamesii*** **sp.n.** (Map 28)

Holotype: female, ANIC.

Label details: " 32.24S 124.29E/ 59km E by N/ Balladonia RH/ 12 Oct. 1981 WA/ I. D. Naumann/ J. C. Cardale/ ex ethanol" and " Eunotomyiia sp.P116.♀/ det.I. D. Naumann 1986".

Female

Head black, with slight metallic purple-blue lustre on vertex. Face 1.2x broader than long. Ocelli reddish-clear; posterior ocelli removed from occiput by about 1OD. Vertex engraved reticulate; almost completely bare of setae.

Antennae inserted about 1 torular diameter above clypeal margin. Scrobes not carinate anteriorly, smooth and shiny, not sculptured. Scape and pedicel mid-brown; flagellum yellow-brown. Scape slightly laterally compressed. F1 square, remaining funicular segments broader than long, ring-like; setae short. Club 1.57x length of funicle. Genal carina wide, coarsely striate.

Thorax dark brown-black, with or without strong metallic green lustre.

Pronotum imbricate; setal ring absent medially. Mesonotum and scapulae imbricate. Scutellum engraved reticulate, sculpture denser on frenum; anterior pair of setae shorter than posterior, pairs equally spaced. Axillae longitudinally striate. Mesepimeron convex, smooth.

Marginal vein of forewing 2x length of stigmal vein. Postmarginal vein 0.8x length of stigmal vein. Margin of costal cell with 8 setae on apex. Wide speculum present.

Femora and tibiae mid-brown, with yellow apices; tarsi yellow. Coxae mid-brown, long and slender; hind coxae with dorsal crest of setae, sparse lateral and basal crests. Hind tibial spur 0.5x length of hind basitarsus.

Gaster oval. T1 approximately 0.65x length of gaster.

Male

Head dark red-brown, with metallic purplish lustre.

Antennae (Fig. 5.24) inserted at lower ocular level, about 3 torular diameters above clypeal margin. Scape short, slightly laterally compressed. Pedicel pyriform. F1-F4 about equal in length; branched, branches stout and longer than segments of origin; covered in close regular short sensilla and sparse short setae. Club 1.6x length of F1. Malar groove not punctate, genal carina narrow with widely spaced striations.

Thorax dark red-brown.

Forewing hyaline, marginal vein only slightly longer than stigmal. Postmarginal vein as long as or slightly shorter than stigmal vein. Costal cell margined with setae in apical half. Basal hairline not infumate, with several setae; basal cell bare; cubital hairline complete.

Legs brown, each segment lighter apically. Hind coxae with basal and dorsal setal crests.

Gaster red-brown, grading to dark brown apically. T1 0.6x length of gaster.

Other material examined: (1 male; ANIC). **W.A.:** 1 male, 31.18 119.37, 4km W of Yellowdine, 10 Oct 1981, IDN, JCC.

Biology: Hosts are unknown.

Distribution: **Australia:** Western Australia.

Remarks: This male is associated with the female of this species on a purely geographical basis.

Other species: *"Eunotomyiia capita"* (manuscript name). Two Girault specimens, both female, both labelled type, are present in QM. They differ from *E. corvus* in having a smooth area on the propodeum under the costula, and a marginal:stigmal vein ratio of about 1; but since both specimens are damaged and headless I am not going to describe this species until more material is available.

5.6 Genus *Globonila* Bouček

Globonila Bouček, 1988a:359-360. Type species *Globonila parva* Bouček; by monotypy and original designation.

Female

Dorsal margin of head weakly concave. Hind ocelli crossing occiput. OD less than or equal to OOL. Eyes conspicuously hairy. Vertex and face sculptured, with scattered setae.

Antennae inserted below lower ocular line; short. Scapes slender, pedicel comparitively large, elongate pyriform. Funicle segments not elongate. Club subequal to funicle in length; not strongly clavate. Setae short, sensilla present. Malar space shorter than long axis of eye. Genal carina and clypeal margin offset. Mandible with an undivided lower tooth; upper tooth subdivided.

Thorax extremely globular in general facies. Pronotum with no defined setal ring; other setal bases simple. Mesoscutum with regular setation. Scutellum convex in lateral aspect, with 2 pairs of setae. Frenal area not delimited by a groove or line of punctations. Axillae separated from scutellum by groove anteriorly and deep fovea posteriorly. Mesepisternum with simple triangular depression.

Propodeum sloping at about 45 degrees; smooth excepting medial carina and plicae which are faintly delimited; costula absent. Nucha reduced to a small raised

pitted area at base of median carina.

Forewing with marginal vein conspicuously shorter than stigmal vein. Postmarginal vein subequal to stigmal vein in length. Costal cell excised at apex; cell margined with setae along much of length. Basal hairline with single line of setae; basal cell at least partly margined by cubital hairline. Speculum present; linea calva not differentiated.

Hind coxae with dorsal, basal and lateral crests of setae. Single hind tibial spur present.

Gaster globular, convex in lateral profile. Basal fovea with a diffuse collar of long setae; not forming a compact tuft, extending down margin of fovea but not present medially. S1 grooved, interrupted by a horizontal ridge.

Male

Antennae inserted higher than in female. Scapes short; funicular segments elongate. Setae longer than segments of origin.

Forewing with marginal vein:stigmal vein ratio slightly less than in female. Costal cell margined with setae. Basal cell margined by cubital hairline; at least in part.

5.6.1 ***Globonila parva*** **Bouček** (Figs 5.25, 5.26, 5.27, 5.114; Map 29)

Globonila parva Bouček, 1988a:360, Fig. 669.

Holotype: female, QM.

Publication details: "Holotype female (plus 2 female paratypes), QLD: Braemar S.F. via Kogan, on *Callitris*, 15-19.x.1979 (G. B. Monteith)."

Label details: "Braemar S.F., via Kogan/ 15.-19.x.1979, Qld./ G. B. Monteith/ Pyrethrum on Callitris" and "Holo-/ type" and underneath "Bouček/ 1984" and "HOLOTYPE/ T.11753" and "HOLOTYPE/ ♀ Globonila/ parva g.sp.n./ det. Z. Bouček, 1984".

Female

Head dark red-brown, with green metallic lustre. Face 1.4 to 1.6x broader

than long (mean 1.47). Occipital carina weak; back of head engraved reticulate. Ocelli clear. Vertex and face engraved reticulate with scattered moderately long setae.

Antennae (Fig. 5.25) inserted about 1 torular diameter above clypeal margin. Scrobes unsculptured, smooth and shiny; not carinate anteriorly. Antennae grading from dark brown scapes to mid-brown club. F1-F3 square, small; F4 and F5 square to slightly broader than long. Club 0.9 to 1.1x length of funicle (mean 1.01), less than twice as wide as pedicel. Malar groove complete but inconspicuous, genal carina very narrow, not striate. Malar space slightly less than half long axis of eye. Oral margin convex between toruli, shallowly indented on both sides of clypeal margin. Lower face finely striate. Mandible with pointed lower tooth, upper tooth divided into 1 pointed lower tooth and 2 blunt upper teeth.

Thorax dark, with metallic blue-green lustre. Pronotum alutaceous, length about 0.3x width. Pronotum with short regular setation anteriorly and longer setation posteriorly. Mesoscutum imbricate; paired setae absent, pilosity regular, short and not dense. Notauli complete simple grooves. Scapulae alutaceous. Scutellum slightly longer than broad; engraved reticulate; pairs of setae about the same distance apart. Frenal area delimited by faint line; less sculptured than scutellum. Axillae finely longitudinally striate. Dorsellum smooth, fovea large. Metanotum smooth, metanotal furrow smooth. Mesepimeron smooth, without dimples.

Propodeum black, with metallic green lustre.

Forewing hyaline (Fig. 5.26). Marginal vein 0.5 to 0.7x shorter than stigmal vein (mean 0.57). Postmarginal vein 0.8x length of stigmal vein. Stigmal area setose. Costal cell margined along 0.75x length with setae; ventral row of setae continuous, several partial rows present. Basal hairline very faintly infumate, with single row of short setae; basal cell with scattered setae, margined in apical half by cubital hairline. Speculum broad.

Legs mid-brown, yellow at apices of femora and bases of tibiae. Hind coxae dark, with metallic green lustre; long crests of setae present. Hind tibial spur very delicate, 0.5x length of short hind basitarsus.

T1 of gaster 0.25 to 0.4x length of gaster, T2 almost as long or longer. Ovipositor slightly exerted. S1 longitudinally grooved, grooves widely spaced, longer than broad, interrupted by smooth medial horizontal ridge (Fig. 5.114).

Male

Head black, with metallic green lustre.

Antennae (Fig. 5.27) inserted 1.5 torular diameters above clypeal margin. Scapes and pedicels mid-brown, flagellum lighter. F1 slightly longer than F2-F4. Club 1.6 to 2.2x length of F1 (mean 1.86). Setae 1.5x longer than segments of origin.

Forewing hyaline. Marginal vein 0.5 to 0.6x length of stigmal vein (mean 0.53). Costal cell completely margined with setae. Basal hairline more strongly infumate than in female, with a line of setae; basal cell setose, completely margined by cubital hairline. Speculum wide.

Paratypes: (4 females, 1 male; deposition stated). 2 females, same details as holotype (QM) (27.11 150.52); 2 females, 1 male, 25km W of Inglewood, 31 Dec, 1976, ZB (NHM).

Other material examined: (6 females, 8 males; ANIC, NZAC). **S.A.:** 6 females, 8 males, 31.33 138.36, Wilpena Pound Gap, 5-6 Nov 1987, IDN, JCC (1 female, 1 male in NZAC).

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland, South Australia.

5.7 Genus *Hirtonila* Bouček

Hirtonila Bouček, 1988a:366. Type species *Hirtonila dispar* Bouček; by monotypy and original designation.

Female

Dorsal margin of head weakly concave. Hind ocelli crossing occipital carina. OD greater than or equal to OOL. Eyes minutely hairy. Vertex with scattered setae.

Antennae inserted high, above lower ocular line. Pedicel as long as or longer than any funicular segments. Club shorter than funicle; setae short and regular, sensilla present. Malar space shorter than long axis of eye. Clypeal margin and genal carina offset.

Thorax high, distinctly humped; not heavily sculptured. Pronotal setation regular. Distinct setal ring absent, other setal bases simple. Mesoscutum with some regular setation anteriorly, paired setae posteriorly. Notauli complete. Scutellum convex in lateral aspect, with 2 pairs of setae. Frenal area not delimited by groove. Mesepisternum reduced, without depressed triangular area.

Propodeum sloping at about 30 degrees; with complete median carina running into very short pitted nucha. Plicae present, costula absent. Smooth except for carinae and nucha.

Forewing with marginal vein longer than stigmal vein. Postmarginal vein subequal to stigmal vein. Costal cell not excised at apex; costal margin with setae along entire length. Basal hairline present; basal cell margined by cubital row of setae. Speculum present, linea calva differentiated.

Hind coxae bare of setae, excepting scattered ventral pilosity. Single hind tibial spur present.

Setal tuft at basal fovea absent, pilosity reduced to a few scattered setae, not extending down margin. Surface of S1 finely striate, foveate.

Male

Antennae inserted above lower ocular line; at same level as in female. Funicular segments nodose. Club longer than F1. Setae longer than segments of origin.

5.7.1 ***Hirtonila dispar*** **Bouček** (Figs 5.28, 5.29; Map 30)

Hirtonila dispar Bouček, 1988a:366, Figs 675-677.

Holotype: female, ANIC.

Publication details: "Holotype female (plus 1 female and 1 male paratypes), QLD: Kuranda, 2.xii.1982 (Bouček)".

Label details: "QUEENSLAND/ Kuranda/ 2.xii.82 Bouček" and "HOLO-/ type" and underneath "Bouček/ 1984" and "HOLOTYPE/ ♀ Hirtonila/ dispar g.sp.n./ det. Z. Bouček, 1984" and underneath "ANIC Type/ No 7830".

Female

Head shiny dark brown to black. Face 1.4 to 1.6x broader than long (mean 1.47). Occipital carina strong, back of head alutaceous. Ocelli clear to red. Vertex mainly smooth with some transverse rugosity and scattered long setae.

Antennae (Fig. 5.28) inserted almost 2 torular diameters above clypeal margin; concolorous honey yellow. Scrobes smooth, excepting 2 finely striate central lines which run together anteriorly and extend to anterior ocelli; not carinate anteriorly. Funicular segments all square, except F2 which is slightly longer than broad; no segments broader than long. Club 0.58x length of funicle. Malar groove reduced to deep striate remnant above clypeus; malar space less than half long axis of eye. Genal carina narrow, finely striate. Oral margin straight, with two symmetrical indentations. Some scattered setae above clypeal margin.

Thorax dark brown-black, shiny; not heavily sculptured. Pronotum only slightly narrower than mesoscutum, length 0.3x width; imbricate anteriorly, smooth posteriorly. Pronotal setation long and dense. Mesoscutum smooth. Notauli composed of continuous groove. Scapulae smooth and shiny, with several pairs of setae. Scutellum subsquare; faintly engraved reticulate. Narrow frenal area delimited by line, not sculptured. Axillae smooth. Dorsellum smooth, fovea coarsely striate; metanotal furrow finely striate. Mesepimeron with 2 large dimples, otherwise smooth.

Propodeum dark brown.

Forewing hyaline (Fig. 5.29). Marginal vein from 1.4 to 1.8x length of stigmal vein (mean 1.61). Stigmal area bare. Postmarginal vein 1.1x length of stigmal vein. Costal cell with complete ventral row of setae plus additional scattered setae. Submarginal vein with 8 setae. Basal hairline 1 seta thick, inconspicuous, not pigmented; basal cell bare.

Legs honey yellow, coxae yellow-brown. Hind tibial spur 0.5x length of hind basitarsus.

Gaster brown to dark brown. Basal fovea rectangular, deep, matt. T1 smooth, about 0.8x length of gaster. Ovipositor not exerted beyond end of gaster. Surface of S1 finely striate, giving a matt appearance; concave with 2 to 3 large foveae and wide matt unsculptured medial area; posteriorly with few large foveae; setae obscured.

Male

Head shiny black. Oral margin between toruli deeply emarginate, with small medial tooth. Clypeal area longitudinally striate.

Antennae inserted more than 2 torular diameters above lower ocular line; concolorous yellow brown. F1 longest funicular segment, F2-F4 equal in length. Club 1.45x length of F1. Setae longer than segments of origin. Toruli ridged with carinae which extend down to clypeal margin. Malar groove complete, running almost horizontally.

Thorax and propodeum shiny brown-black.

Forewing hyaline. Marginal vein 1.8x length of stigmal vein. Costal cell margined with setae along 0.95x length. Basal hairline not infumate, with setal line; cubital hairline present.

Gaster dark brown, T1 approximately 0.95x length of gaster.

Paratypes: (2 females, 1 male; NHM): 1 male, same details as holotype (16.49 145.38); 1 female, Cooloola N.P., 7 Mar 1984, L.Masner (25.58 153.09). 1 female, Wilson's Peak, 9 Jan 1977, ZB (28.15 152.29). Further paratypes in NHM.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland, New South Wales.

5.8 Genus *Ismaya* Bouček

Ismaya Bouček, 1988a:358-359. Type species *Ismaya brevis* Bouček; by

monotypy and original designation.

Female

Dorsal margin of head strongly concave; face broader than long. Occipital carina sharp; back of head engraved reticulate. Posterior ocelli crossing occiput. Vertex engraved reticulate, with scattered short setae. Ocelli reddish, OD about 0.75x OOL. Eyes bare.

Antennae inserted less than 1 torular diameter above clypeal margin. Scrobes smooth and shiny, not delimited anteriorly by a carina. Pedicel elongate-pyriform. Club about 1.1x length of funicle; setae short, sensilla only conspicuous on club. Genal carina moderately wide, not striate. Malar groove absent, except for short deep remnant above clypeus. Malar space shorter than vertical axis of eye. Clypeal margin straight, clypeus slightly produced, offset from genal carina. Genae smooth.

Thorax black, with or without metallic lustre. Pronotum broad; engraved reticulate anteriorly, smooth at apex. Setal ring present; setal bases not reticulate. Mesoscutum broader than long; engraved reticulate; setae between notauli paired. Notauli almost complete. Scutellum flat in lateral aspect; variously sculptured, with 2 pairs of setae present. Frenal area not delimited by line but by change in sculpture. Axillae smooth, delimited anteriorly by a groove and posteriorly by deep fovea. Dorsellum smooth, fovea large, triangular, alveolate; rest of metanotum smooth; metanotal furrow smooth or coarsely striate. Mesepisternum with triangular depression, mesepimeron without dimples, variously sculptured.

Propodeum with median carina and costula present. Nucha broader than long.

Forewing variously infumate. Marginal vein 0.6 to 1.2x length of stigmal vein, both short. Postmarginal vein shorter than stigmal vein. Stigmal area sparsely setose. Costal cell excised at apex. Basal hairline setose; basal cell bare, not margined by cubital row of setae. Speculum present, linea calva not delimited.

Legs yellow-brown, coxae brown. Hind coxae with thick dorsal crest along half dorsal surface, lateral crest absent. Single hind tibial spur present.

Gaster square; T1 0.9 to 0.95x length of gaster. Setae at basal fovea forming thick compact tuft. Ovipositor slightly exerted. Surface of S1 not striate.

Distribution: *Ismaya* is recorded from Papua New Guinea and Australia (Queensland).

Biology: Hosts are unknown.

Key to the species of *Ismaya* Bouček (females)

1. Marginal vein short, about 0.6x length of stigmal vein; scutellum engraved reticulate ..... *brevis*
Marginal vein about 1.2x longer than stigmal vein; scutellum alutaceous . ..... *naumanni*

5.8.1 *Ismaya brevis* Bouček

Ismaya brevis Bouček, 1988a:358-359, Figs 667-668.

Holotype: female, NHM.

Publication details: "Holotype female, PNG: Bulolo, 14.xii.1982 (Bouček)".

Label details: "PAPUA N.GUINEA/ Bulolo/ 14.xii.82. Bouček" and "Holo/ type" and underneath "Bouček/ 1984" and "HOLOTYPE/ ♀ Ismaya/ brevis/ det. Z. Bouček, 1984" and "B.M.TYPE/ HYM/ 5.3256".

Female

Head black, with metallic blue lustre. Posterior ocelli crossing and about 0.5 OD behind occipital carina.

Antennal scrobes shallow. Antennae yellow, except F1-F3 yellow-brown. Scapes slender. All flagellar segments more or less square, increasing in size from base to apex, except F2 which is disproportionately large. Club 1.08x length of funicle and not more than 2x width of pedicel. Malar space shorter than vertical axis of eye.

Thorax black, with metallic blue lustre. Pronotum wide, almost as wide as head and mesoscutum, length about 0.25x width; engraved reticulate anteriorly, smooth at apex. Pronotal ring with 14 setae. Mesoscutum broader than long, engraved reticulate; with 4 pairs of setae. Notauli complete grooves. Scapulae almost smooth,

faintly longitudinally striate. Scutellum broader than long; engraved reticulate anteriorly. Frenal area delimited by change in sculpture to longitudinally striate-smooth. Metanotal furrow smooth; mesepimeron smooth.

Propodeum black, with slight blue lustre. Median carina raised slightly anteriorly; lengthened areolae anterior to costula and smooth posterior. Plicae not present. Nucha rugose apically.

Forewing with large diffuse infumate patch posterior to marginal and stigmal veins. Marginal vein 0.62x length of stigmal vein. Postmarginal vein 0.9x length of stigmal vein. Costal cell margined with setae in distal half; with 2 complete rows and other scattered ventral setae. Basal hairline infumate, with 3-4 setae.

Legs yellow-brown, coxae brown. Hind coxae with thick dorsal crest along half dorsal surface, lateral crest absent. Hind tibial spur 0.3x length of hind basitarsus.

Gaster black, with slight metallic blue-purple lustre. T1 0.95x length of gaster. Setae at top of fovea extending down margin of fovea, absent medially. S1 concave anteriorly, shallowly foveate; posteriorly grooved, grooves longer than broad; medially with a wide smooth horizontal area. Setation obscured.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Papua New Guinea.**

5.8.2 ***Ismaya naumanni*** **sp.n.** (Fig. 5.30; Map 31)

Holotype: ANIC, female.

Label details: "Little Yabba Ck./ Via Kenilworth Q/ 8 Sept 1979/ I. D. Naumann/ in rainforest" and "ex alcohol/ collection" and

"Moranila/ sp.P50/ I. D. Naumann det 1985" and "?Ismaya/ det I. D. Naumann 1986".

Female

Head shiny black; face 1.6x broader than long. Posterior ocelli crossing and almost entirely behind occipital carina.

Antennae short, concolorous yellow-brown. Scapes slender. Flagellar segments all very slightly broader than long. Club 1.12x length of funicle. Malar space half long axis of eye.

Thorax black, not metallic; heavily sculptured. Pronotum broad; imbricate, with reduced number of setae. Pronotal ring of 6 setae present; bases not reticulate. Mesoscutum broader than long, alutaceous; with 4 pairs of setae. Notauli composed of several grooves. Scutellum square; alutaceous. Frenal area delimited only by slightly closer sculpture. Metanotal furrow coarsely striate; mesepimeron smooth medially and striate laterally.

Propodeum dark brown-black. Sculpture alveolate anterior to median carina, posteriorly smooth. Nucha broader than long.

Entire forewing darkly infumate (Fig. 5.30), including costal and basal cells, except distal fifth. Marginal vein 1.2x longer than stigmal vein. Postmarginal vein 0.3x length of stigmal vein. Costal cell margined with setae in distal third; with a complete row and other scattered ventral setae. Basal hairline oblique, with 4 setae.

Legs concolorous medium brown. Hind tibial spur 0.4x length of hind basitarsus. Hind coxae with dorsal and basal setal crests present; lateral absent.

Gaster dark brown-black. T1 0.9x length of gaster. Tufts of setae at basal fovea not extended down margin of fovea. S1 shallowly concave in anterior half, grooved, grooves longer than wide. Thin medial horizontal ridge present, with 4 large foveae posterior to ridge; setae obscured.

Male unknown

Material examined: Holotype only

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland (26.36 152.35).

Remarks: *Ismaya naumanni* is named for its collector, Dr I. D. Naumann.

5.9 Genus *Kneva* Bouček

Kneva Bouček, 1988a:361. Type species *Kneva plana* Bouček; by monotypy and original designation.

Female

Dorsal margin of head weakly concave. Posterior ocelli crossing occipital carina. OD subequal to OOL. Vertex with scattered punctations.

Antennae inserted about 1 torular diameter above clypeus. Funicular segments not elongate, setae short. Club moderately clavate, subequal in length to funicle. Malar space shorter than vertical axis of eye. Clypeal margin and genal carina offset.

Thorax flat, with short setae set in conspicuous punctures. Pronotum without setal ring. Mesoscutum with regular setation. Scutellum with 2 pairs of setae. Frenal area not delimited by groove. Axillae delimited by groove apically, by fovea basally. Dorsellar fovea large, triangular. Mesopleuron with triangular depression.

Propodeum with median carina and costula present; alveolate medially. Nucha reduced.

Marginal vein of forewing twice as long as stigmal vein. Postmarginal vein subequal in length to stigmal vein. Costal cell not excised at apex. Basal hairline present; basal cell setose; cubital hairline at least partially present. Speculum not present, broad linea calva delimited.

Hind coxae with dorsal and lateral setal crests. Two short hind tibial spurs present.

Setal tuft at base of gastral fovea not compact; not extending down margin of fovea. S1 foveate; setae absent.

Male

Antennae inserted higher than in female; nodose; setae slightly longer than segments of origin.

5.9.1 ***Kneva plana*** **Bouček** (Figs 5.31, 5.32; Map 32)

Kneva plana Bouček, 1988a:361, Figs 670-671.

Holotype: female, ANIC.

Publication details: "Holotype female, ACT: Coree Creek, 9.iv.1961 (D. H. Colless)".

Label details: "Coree Ck ACT/ 9 Apr 1961/ D. H. Colless" and "Holo/ -type" and underneath "Bouček/ 1984" and "HOLOTYPE/ ♀ Kneva/ plana g.sp.n./ det Z. Bouček, 1984".

Female

Head dark brown-black. Face 1.82x broader than long. Occipital carina weak between ocelli, absent between eye and ocelli; back of head alutaceous. Vertex alutaceous, with numerous close punctations and scattered short setae.

Antennae inserted slightly less than 1 torular diameter above clypeus. Antennal scrobes shallow, smooth; delimited anteriorly by very strong convex carina which runs along inner side of eyes. Antennae concolorous medium brown; F1-F3 square, F4 and F5 broader than long. Club 1.12x as long as funicle; less than 2x width of pedicel. Face smooth, genae weakly engraved reticulate, malar groove complete, inconspicuous except over clypeus, where it forms an impressed groove. Malar space 0.7x vertical axis of eye. Genal carina wide, striate. Clypeus not produced; oral margin between toruli straight.

Thorax dark, with slight metallic green lustre. Pronotum broader than long, engraved reticulate; with close conspicuous punctures in setal bases; setation close, regular short. Mesoscutum short, alutaceous, with regular short setation arising in punctate setal bases between notauli. Notauli complete. Scapulae imbricate, with regular setation; bases of setae not punctate. Scutellum 1.25x broader than long, flat to depressed in lateral aspect; alutaceous; setae very short, anterior pair with punctate bases. Frenal area delimited by change in sculpture. Axillae smooth. Dorsellum

smooth, declivous; dorsellar fovea alveolate; remainder of metanotum smooth. Mesopleuron with triangular depression; mesepimeron smooth, without dimple.

Propodeum black, with slight blue lustre. Sculpture coarsely alveolate; alveolae generally in transverse lines separated by strong costula, and by 1 less strong transverse carina anteriorly and 1 posteriorly; alveolate part broader than long, on either side of it a deep smooth depression. Nucha not rugose; broader than long.

Forewing (Fig. 5.31) with very faint indistinct infumate patch. Marginal vein twice the length of stigmal vein. Stigmal area setose. Postmarginal vein 1.2x length of stigmal vein. Costal cell with slightly less than half margin setose; ventral row of setae continuous, with partial second row. Submarginal vein not sinuate. Basal hairline not infumate, present as a strip; basal cell setose; cubital hairline present distally.

Legs mid-brown, apices grading to yellow. Hind coxae with conspicuous dorsal and inconspicuous lateral setal crests. Longest hind tibial spur 0.2x length of basitarsus.

Gaster red-brown; longer than broad. T1 about 0.75 x length of gaster. Ovipositor short, scarcely projecting beyond end of gaster. S1 with double row of foveae anteriorly, posteriorly grooved, grooves longer than broad. Surface not striate; setae absent.

Male

Head black, with faint metallic green lustre. Vertex with close regular, moderately long, setation, continuing behind occipital carina.

Antennae (Fig. 5.32) inserted slightly more than 1 torular diameter above clypeal margin. Antennae concolorous medium brown. Club 1.12x longer than F1; F1 longest flagellar segment. Setae slightly longer than segments of origin; decreasing in length towards club. Sensilla not long.

Scutellum more or less square; very faintly striate, almost smooth.

Coxae dark brown-black, femora and tibiae mid-brown with apices grading to yellow, tarsi yellow.

Forewing hyaline. Marginal vein of forewing 2.25x length of stigmal vein. Margin of costal cell setose for about 0.3x length. Postmarginal vein longer than

stigmal. Basal hairline not infumate, with strip of setae present; basal cell setose, cubital hairline almost complete.

Other material examined: (1 male; ANIC). **A.C.T.:** 1 male, Piccadilly Circus, Brindabella Range, 24 Dec 1982, JFL, under bark, *Eucalyptus* (35.22 148.48). (Type 35.18 148.50).

Biology: *K. plana* has only been recorded from a pupa of ?*Megaselia* sp. (Diptera: Phoridae) (P. S. Cranston, pers. comm.). *Megaselia* breeds in a wide range of media and habitats (Ferrar, 1987). It is most likely that the presence of this pupa is incidental and the host record erroneous.

Distribution: **Australia:** Australian Capital Territory.

Remarks: the male differs from the female more than is usual in conspecifics but in the absence of further material and since it was collected near the type locality I am reluctant to describe it as a second species of *Kneva*.

5.10 Genus *Moranila* Cameron

Tomocera Howard, 1881:368; Ashmead, 1904:328. Type species *Tomocera californica* Howard; by monotypy. Preoccupied by *Tomocera* Desmarest, 1858.

Moranila Cameron, 1883:188; Burks, 1958:75; Peck, 1963:631; Graham, 1969:70-71; Burks, 1978:783 (and see references within for biology); Bouček, 1988a:356; Naumann, 1991:965. Type species *Moranila testaceipes* Cameron; by monotypy.

Dilophogaster Howard, 1886:98. Replacement name for *Tomocera* Howard.

Aphobetoideus Ashmead, 1904a:328. Type species *Aphobetoideus comperei* Ashmead; by original designation. Synonymised by Bouček, 1988a:356.

Muscidea Girault, 1915a:323-324. Type species *Muscidea brunneiventris*

Girault; by original designation. Synonymised by Bouček, 1988a:356.

Eurycraniella Girault, 1916a:227. Type species *Eurycranium baeusomorpha* Girault; by original designation. Synonymised by Bouček, 1988a:356.

Muscideoidea Girault, 1916a:227. Replacement name for *Muscidea* Girault. Synonymised by Bouček, 1988a:356.

Eunotomyia Masi, 1917:197. Type species *Eunotomyia festiva* Masi; by monotypy. Synonymised by Burks, 1958:75.

Female

Head orange to brown, with or without discrete metallic patches or metallic lustre. Dorsal margin slightly to strongly concave. Face 1.3 to 1.9x as broad as long. Occipital carina weak to strong; crossed by posterior ocelli. Back of head sculptured. OD less than to equal to OOL. Vertex variously sculptured, with scattered short setae.

Antennae inserted less than 1 torular diameter above clypeal margin; moderately to strongly clavate. Scrobes smooth to entirely sculptured; carinate or not anteriorly. Club from 0.7 to 1.5x length of funicle. Malar groove present or absent. Malar space shorter than to longer than vertical axis of eye. Genal carina narrow to moderately wide; smooth or striate. Oral margin straight or curved. Genal carina and oral margin offset or not. Mandible with broad lower tooth and 2 narrower upper teeth; sharply pointed, blunt or truncate.

Thorax from brown to orange to dark metallic green. Pronotum with setal ring of 8 to 14 setae; bases simple, punctate or reticulate. Mesoscutum and scapulae variously sculptured; mesoscutum with regular or paired setae, bases simple, punctate or reticulate. Notauli complete grooves or composed of pits. Scutellum variously shaped, flat to convex in lateral aspect; variously sculptured; with 2 pairs of setae with simple, reticulate or punctate bases. Frenal area variously delimited. Axillae delimited by groove apically, by fovea basally; smooth to sculptured, with scattered setae. Dorsellum smooth to sculptured, declivous; dorsellar fovea variously sculptured. Metanotal furrow sculptured or smooth. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron variously

sculptured or smooth; without dimples.

Propodeum variously sculptured. Median carina complete to nucha; costula present. Nucha broader than long to square.

Forewing immaculate, or with one or two infumate patches; basal hairline infumate or not. Marginal vein 0.9 to 3.3x length of stigmal vein. Stigmal area setose or bare. Postmarginal vein half the length of to subequal in length to stigmal vein. Costal cell not excised to moderately excised at apex; with 0 to 9 setae on apex of margin; ventral row of setae complete to interrupted; with partial second row. Submarginal vein weakly to strongly sinuate. Basal hairline bare, or with a setal line; basal cell bare or setose; cubital hairline absent. Speculum wide or narrow, linea calva not delimited.

Hind coxae with lateral, basal and dorsal pilosity. Tibiae with 1 or 2 hind spurs present, the longest 0.1; b to 0.5x length of hind basitarsus.

Gaster rectangular, circular or oval. T1 0.5 to 0.9x length of gaster. Basal fovea with a setal tuft at base, not extended down margin. Ovipositor exerted or not. S1 variosly sculptured; surface not striate; base with pilosity, ranging from scattered setae to compact tufts.

Male

Head broader than long, less broad than in female.

Antennae inserted more or less than 1 torular diameter above clypeal margin; unbranched. Funicular segments nodose or not; F1 longer than or equal in length to other funicular segments. Setae and sensilla long or short. Club 1.5 to 3x as long as F1.

Forewing hyaline, or with infumate patch. Marginal vein 1.2 to 2.7x as long as stigmal. Costal margin with 4 to 6 setae on apical margin. Basal hairline with line of setae; infumate or not; cubital hairline absent.

Biology: *Moranila* is usually a primary parasitoid but has been recorded as a hyperparasitoid and (once) as an egg predator. *Moranila* species do not appear to be host-specific; in those species where a number of records are available a range of families is parasitised. *M. californica* has been recorded from Coccidae,

Asterolecaniidae, Pseudococcidae and as a hyperparasitoid through an encyrtid. *M. comperei* has been recorded from Coccidae, Pseudococcidae, Aleyrodidae (probably as a hyperparasitoid via Mymaridae), Psyllidae and in several cases as a hyperparasitoid of Aphididae through Braconidae. Two other species have been recorded from Eriococcidae.

Distribution: One species is cosmopolitan, but is undoubtedly Australian in origin and has been introduced into North America and Europe via one of its hosts, *Saissetia oleae* (Olivier) (Coccidae). Two other commonly collected species are Australian in distribution; one of these has also been collected in New Zealand. Six species are east Australian, but are represented very poorly in the material I have examined. One species is from mainland Australian, and another from Tasmania. Two species are endemic to New Zealand.

Remarks: There are 7 specimens in the BPBM which are close to *M. californica* but which differ in propodeal sculpture in a variety of ways, with no two the same. All are from PNG or the Solomons. I have elected not to describe these as seven new species on the basis of one specimen each. Two specimens show moderate development (more so in one) of the anterior end of the medial carina on the propodeum, a condition almost approaching the propodeal tooth in *Aphobetus*.

Key to the species of the genus *Moranila,* females and males.

1. Forewings reduced, reaching just beyond propodeum (Fig. 5.33) .... *aotearoae*

Forewings reaching at least half way down gaster 2

2. T1 longitudinally striate over most of surface ..... *strigaster*

T1 smooth 3

3. Antennal scrobes and face entirely finely transversely striate ..... *striatus*

Antennal scrobes smooth, except in central hollow 4

4. Forewing hyaline (Fig. 5.37) ..... *brunneiventris*
Forewing with at least one infumate patch 5

5. Forewing with 2 defined infumate patches (Fig. 5.45) ..... *viridivertex*
Forewing with one weak or strong infumate patch 6

6. Forewing with half of costal cell lined with setae; basal hairline darkly infumate ..... *basalis*
Costal cell margined with setae for less than half length, if at all; basal hairline infumate or not 7

7. F1 and F2 both strongly transverse (Fig. 5.41) 8
F1 and F2 not both strongly transverse (Fig. 5.38) 10

8. Head and thorax with pronounced punctation at setal bases ..... *punctata*
Head and thorax without pronounced punctation at setal bases 9

9. Thorax inconspicuously metallic; basal cell of forewing setose .... *gullanae*
Thorax conspicuously metallic; basal cell bare ..... *bicolour*

10. Setal bases on pronotum and mesoscutum conspicuously reticulate 11
Setal bases on pronotum and mesoscutum not conspicuously reticulate ....
..... 13

11. Propodeum with large, unsculptured, medial patches posterior to costula ...
..... *californica*
Propodeum without large, unsculptured, medial patches posterior to costula
..... 12

12. Setae on vertex long, longer than OD ..... *longisetosa*
Setae on vertex short, shorter than OD ..... *maculatus*

13. Mesoscutum with regular setation ..... *comperei*

Mesoscutum with paired setae ..... *baeusomorpha*

5.10.1 ***Moranila aotearoae* sp.n.** (Figs 5.33, 5.115; Map 7)

Holotype: female, NZAC.

Label details: "NEW ZEALAND NN/ Mt Arthur/ 1341m" and "24 Mar 1971/ J. S. Dugdale/ swards 71/84" and "1835".

Female

Head shiny black; not triangular. Dorsal margin slightly concave. Face 1.4x broader than long. Occipital carina weak; back of head alutaceous. Ocelli small, OD about 0.3x OOL. Vertex faintly engraved reticulate, with regular short setae.

Antennae inserted slightly more than 1 torular diameter above clypeal margin. Scrobes shallow, faintly engraved reticulate, not carinate anteriorly. Antennae concolorous orange-brown. Pedicel elongate, all funicular segments broader than long except F1 square. Club 1.1 to 1.2x length of funicle (mean 1.19). Setae short. Genae slightly striate, malar groove absent. Malar space shorter than vertical axis of eye. Genal carina wide, not striate, with a row of setae. Oral margin slightly concave between toruli, sloping down to offset genal carina. Mandible with 1 broad, sharp lower tooth and 2 upper teeth.

Thorax shiny black. Pronotum broader than long, engraved reticulate. Setation reduced, except in ring of about 15 short, strong setae; bases not reticulate. Mesoscutum reduced to a narrow strip, engraved reticulate; with 2 pairs of setae between notauli, bases not reticulate. Scapulae similarly sculptured. Notauli complete grooves. Scutellum slightly broader than long, flat in lateral aspect; engraved reticulate, with setal pairs set about same distance apart. Frenal area delimited by change in sculpture. Axillae delimited by groove apically, by deep fovea basally; faintly longitudinally striate, carinate laterally; with a posterior line of setae.

Dorsellum reduced to a thin smooth strip, dorsellar fovea wide and coarsely alveolate; remainder of metanotum smooth. Mesepimeron with smooth triangular depression, mesepisternum faintly transversely striate, mostly posteriorly.

Propodeum black, short; entirely coarsely alveolate-reticulate, except rugulose area around spiracles. Nucha broader than long.

Wings reduced, wedge-shaped, infumate (Fig. 5.33); forewing reaching just beyond propodeum. Submarginal vein present, slightly sinuate. Short marginal vein present. Costal cell margin convex, slightly excised at apex, with scattered ventral setae. Apical edge of wing straight, varying from completely bare to with a complete setal fringe.

Legs orange-brown, coxae dark orange-brown. Hind coxae with dorsal, lateral, and basal setal crests. Single hind tibial present; 0.5x length of basitarsus.

Gaster dark orange-brown. T1 engraved reticulate, about 0.95x length of gaster. Compact setal tuft at base, setae short. Ovipositor projecting slightly beyond end of gaster. S1 with an anterior row of foveae present, separated from a posterior row of grooves by a wide smooth medial area. Grooves with many scattered setae in bases and extending down sternite (Fig. 5.115).

Male

Head shiny black.

Antennae inserted about 2 torular diameters above clypeal margin; clypeal area markedly convex. Club about 2 to 2.5x as long as F1 (mean 2.16). Funicular segments nodose, all about equal in length. Setae fairly sparse, about twice length of segments of origin.

Forewing reduced, infumate.

Paratypes: (11 females, 4 males; NZAC). **NN:** 1 female, Mt Arthur, 1341m, 24 Mar 1971, JSD, swards, 71/84; 1 female, L Sylvester, Iron Hill, 1600m, 18 Nov 1972, JSD, litter, 72/193; 2 males, Mt Dommett, 30 Nov 1971, GK, mat plants, 71/164. **MB:** 1 female, Richmond Range, Mt Johnson, 1585m, 13 Mar 1969, JSD, litter 69/89; 1 female, Blackbirch Range, Mt Altimarlock, 1670m, 16 Feb 1970, GK, plants 70/121. **BR:** 2 females, Mt Robert, 15 Mar 1968, WWV, 1521; 1 male, Paparoa Range, Mt Dewar, 1310m, Lochnagar Ridge, 10 Dec 1969, JSD, swards, 69/247; 1 female, Paparoa Range, Mt Dewar, 1697m, 2 Dec 1969, JIT, mat, plants, 69/238. **NC:** 1 female, Mt Domett, 1250m, 30 Nov 1971, GK, litter 71/174. **CO:** 2 females, Rocklands Stn, 800m, Feb-Mar 1979, BIPB, pit trap in tussock; 1 female, Grandview Pk, 1433m, 12 Jan 1971, JSD, swards 71/12; 1 male, Dunstan Range, 1585m, 13 Jan 1971, JSD, swards 71/3.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **New Zealand:** NN, MB, BR, NC, SC, CO, WD.

5.10.2 ***Moranila baeusomorpha*** **(Girault)** (Figs 5.34, 5.35, 5.116; Map 33)

Eurycranium baeusomorpha Girault, 1915a:322-323; Dahms, 1983:116. Transferred to *Eurycraniella* by Girault, 1916a:227.

Eurycraniella baeusomorpha Girault, 1916a:227; Dahms, 1983:116. Transferred to *Moranila* by Bouček, 1988a:356.

Holotype: female, QM.

Publication details: "Described from one female caught in forest, December 20, 1913 (A. P. Dodd). *Habitat:* Gordonvale (Cairns), Queensland. *Type:* No. *Hy 2781,* Queensland Museum, Brisbane, the specimen on a tag, the head and hind tibiae on a slide." Transferred to *Eurycraniella* by Girault 1916a (p227) since *Eurycranium* was preoccupied.

Label details: Card labelled "TYPE" and "HOLOTYPE/ Hy. 2781/ E.C.D. 1982" and "*Eurycranium* ♀/ *baeusomorpha*/ Gir. Type".
Slide labelled "TYPE/ Hy/2781/ A. A. Girault" and "Queensland Museum./ *Eurycranium~~um~~ella*/ ♀/ *baeusomor-*/ *(G&D) pha*".

Tomocera australica Girault, 1917:147-148; Dahms, 1983:92; Bouček, 1988a:356. **syn.n.**

Holotype: USNM

Publication details: "From two females in the U.S.National Museum (G. Compere). *Habitat.*- Swan River, West Australia. *Types.*-Cat.No. 20470, U.S. Nat. Mus.; the female on tags, a head and three caudal tibiae on a slide".

Label details: Card: "796" and "Swan Riv/ W. Austr" and "G. Compere/ Collector" and "20470" and "Tomocera/ australica/ Girault/ ♀

type".

Female

Head triangular; orange, darker around posterior ocelli (not behind occipital carina) and metallic green around antennal scrobes and genal carina. Dorsal margin slightly concave. Face from 1.5 to 1.7x broader than long (mean 1.58). Occipital carina complete; back of head alutaceous. OD about 0.5x OOL. Vertex alutaceous, with scattered short, inconspicuous setae.

Antennae (Fig. 5.34 and Fig. 5.35, holotype) inserted very close to clypeal margin, <0.5 toruli diameters above clypeal margin. Scrobes smooth, very weakly carinate anteriorly. Entire antennae orange, except F1 and F2 which are darker. F1 to F4 slightly broader than long, F5 more or less square. Setae short; club 1.1 to 1.2x length of funicle (mean 1.17). Genae smooth, malar groove absent. Malar space equal to vertical axis of eye. Genal carina narrow, striate, with a row of setae. Oral margin produced between toruli and emarginate on either side; sloping down to offset genal carina. Mandible with broad, pointed lower tooth and 2 pointed upper teeth.

Thorax dark metallic green. Pronotum engraved reticulate; with regular fine short setation, and a ring of 8 long setae; setal bases not reticulate. Mesoscutum imbricate, with 4-6 inconspicuous paired setae between notauli, setal bases not reticulate. Notauli complete, composed of discrete pits. Scapulae imbricate. Scutellum as long as broad, flat in lateral aspect; engraved reticulate; anterior pair of setae fine and short, closer together than posterior pair; without reticulate bases. Frenal area indicated by change in sculpture to longitudinally striate. Axillae delimited by groove apically, by fovea basally; longitudinally striate; with scattered setae; carinate laterally. Dorsellum smooth, dorsellar fovea alveolate; remainder of metanotum smooth, furrow not striate. Mesepisternum with triangular depression, deeper dorsally and at ventral point; mesepimeron very faintly transversely striate.

Propodeum dark metallic green; medially reticulate/alveolate, area around spiracles smooth and shiny. Nucha as long as broad; reticulate, rugose apically.

Forewing with central, very faint infumate patch. Marginal vein 1.4 to 1.8x length of stigmal vein (mean 1.56). Stigmal area sparsely setose. Postmarginal vein subequal in length to stigmal vein. Costal cell slightly excised at apex; with no setae

on apex of margin; ventral row of setae continuous, with a partial second row. Submarginal vein sinuate. Basal hairline slightly infumate, bare; basal cell bare.

Legs orange, apical tarsal segments darker. Hind coxae with conspicuous dorsal, lateral and basal setal crests. Single hind tibial spur present; 0.3x length of basitarsus.

Gaster almost circular; orange. T1 about 0.8x length of gaster. Basal fovea short, shallow; with thick compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. S1 with a row of grooves present posteriorly: anteriorly with a row of foveae; separated by a narrow smooth ridge. Medial posterior grooves with a compact tuft of setae at base, scattered setae at the base of other grooves (Fig. 5.116).

Male unknown

Other material examined: (18 females; ANIC, NZAC, USNM). **W.A.:** 1 female, Paratype of *T. australica*, same details as holotype (USNM). **Qld.:** 12 females, 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC (2 females in NZAC); 2 females, 26.53 151.37, Russell Park, nr Mt Mowbullen, 7 Oct 1984, IDN, JCC; 1 female, 26.50 151.33, Burtons Well, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC; 1 female, 26.52 151.53, nr Paradise Falls, Bunya Mtns N.P., 6 Oct 1984, IDN, JCC; 1 female, 2km E by S Hidden Valley, 12 May 1980, IDN, JCC (20.57 147.12). **S.A.:** 1 female, 33.32 135.30, 24km WbyN Lock, 30 Nov 1992, IDN, JCC, flowers, *Eucalyptus*. Types: 17.06 145.47.

Biology: Hosts are unknown.

Distribution: **Australia:** Western Australia, Queensland, South Australia.

5.10.3 ***Moranila basalis*** **sp.n.** (Map 34)

Holotype: female, ANIC.

Label details: "34.34S 150.40E/ Macquarie Pass/ 7km ENE Robertson/ 8 Feb.1984 NSW/ I. D. Naumann/ ex ethanol" and "Muscidoidea/ sp.P113♀/ det. I. D. Naumann 1986".

Female

Head dark red-brown; not triangular. Dorsal margin deeply concave. Face 1.8x broader than long. Occipital carina weak; back of head alutaceous. OD 0.8x OOL. Vertex engraved reticulate between ocelli, alutaceous elsewhere; with scattered short setae.

Antennae inserted about 1 torular diameter above clypeal margin. Scrobes smooth, not or hardly carinate anteriorly. Scape and pedical yellow, F1-F3 brown, F4-F5 and club yellow. F1 to F4 square, F5 slightly broader than long. Setae as long as segments of origin. Club 0.9x length of funicle. Genae striate, malar groove absent. Malar space about 0.3x vertical axis of eye. Genal carina wide medially, not striate. Shiny clypeal area delimited; oral margin slightly convex between toruli, slightly emarginate at each side of toruli and sloping to meet offset genal carina. Mandible with broad lower tooth and 2 pointed upper teeth.

Thorax black, with very slight metallic blue lustre. Pronotum engraved reticulate, with few scattered setae and ring of 8 long setae; bases not reticulate. Mesoscutum alutaceous, with 2 pairs of setae between notauli, setal bases not reticulate; anterior pair only slightly anterior of centre. Notauli complete grooves. Scapulae alutaceous, sparsely setose. Scutellum longer than broad, flat in lateral aspect; engraved reticulate; anterior pair of setae slightly closer together than posterior pair; without reticulate bases. Frenal area delimited by faint line. Axillae delimited by a groove apically, by a fovea basally; longitudinally striate, with scattered setae. Dorsellar fovea wide, longitudinally striate; remainder of metanotum smooth, furrow non-striate. Mesepisternum with triangular depression, deeper dorsally and at ventral point; mesepimeron smooth.

Forewing with central infumate patch, strongly infumate basal hairline and cubital hairline. Marginal vein 0.9x length of stigmal vein. Stigmal area sparsely setose. Postmarginal vein 0.5x length of stigmal vein. Costal cell not excised at apex; 9 setae on apical margin; ventral row of setae continuous, with 2 additional partial rows. Submarginal vein slightly sinuate. Basal hairline darkly infumate, bare; basal cell sparsely setose; cubital hairline absent.

Coxae brown, legs yellow-brown. Hind coxae with dorsal, partial lateral and basal crests of setae. Two hind tibial spurs present; the longer 0.1x length of hind basitarsus, the shorter vestigial.

Propodeum dark brown-black; coarsely reticulate medially; smooth around spiracles. Nucha short, rugose, broader than long.

Gaster shiny dark red-black, with slight metallic blue tinge. T1 about 0.7x length of gaster. Basal fovea short, shallow; setal tuft at base not thick or compact. Ovipositor short, scarcely projecting beyond end of gaster. S1 with 4 large foveae anteriorly, a smooth medial horizontal ridge and widely spaced grooves (longer than broad) posteriorly; some sparse setae at the bottom of grooves.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Australia:** New South Wales.

5.10.4 ***Moranila bicolor*** **sp.n.** (Map 35)

Holotype: female, ANIC

Label details: "42.34S 147.50E/ 4km W Orford/ TAS 27 Jan 1983/ I. D. Naumann &/ J. Cardale/ ex ethanol" and "Moranila/ sp.P 112 ♀/ det I. D. Naumann 1986" and "1771".

Female

Head orange, with metallic green behind eyes, around antennal toruli and genal carina; not strongly triangular; dorsal margin slightly concave. Face 1.5x broader than long. Occipital carina weak but complete; back of head alutaceous. OD about 0.75x OOL. Vertex alutaceous; with scattered very short setae.

Antennae inserted about 0.5 torular diameters above clypeal margin. Scrobes very shallow, smooth; not carinate anteriorly. Scapes orange, pedicel and F1-3 brown, F4 and F5 orange; club orange basally, darkening basally. F1 square, F2 to F4 slightly broader than long, F5 more or less square. Club subequal to funicle in length; setae short. Genae smooth; malar groove present but weak. Malar space about equal

to vertical axis of eye. Genal carina moderately wide, not striate. Oral margin straight, sloping down to offset genal carina. Mandible with broad, pointed lower tooth, upper tooth divided into 2 blunt truncations.

Thorax dark metallic green. Pronotum broader than long; engraved reticulate; with short, regular setae and pronotal ring of 8 setae; setal bases reticulate. Mesoscutum engraved reticulate; with 2 pairs of setae between notauli, setal bases moderately reticulate. Notauli complete grooves. Scapulae engraved reticulate, with 2 pairs setae on each. Scutellum as long as broad, slightly convex in lateral aspect; engraved reticulate; anterior pair of setae about as far apart as posterior pair; bases reticulate. Frenal area delimited by line. Axillae delimited by groove apically, by fovea basally; longitudinally striate anteriorly, smooth posteriorly, with scattered setae; laterally carinate. Dorsellar fovea alveolate, remainder of metanotum smooth, except furrow slightly striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Forewing with large central infumate patch. Marginal vein 1.3x length of stigmal vein. Stigmal area setose. Postmarginal vein 0.75 to 0.8x length of stigmal vein. Costal cell slightly excised at apex; 0 or 1 setae on apical margin; ventral row of setae broadly interrupted, with partial second row. Submarginal vein sinuate. Basal hairline not infumate, bare; basal cell bare; cubital hairline absent.

Legs orange, except last tarsal segment and hind tibiae brown. Hind coxae with dorsal, lateral and basal crests of setae. Two hind tibial spurs present; the longer 0.3x length of hind basitarsus, the shorter vestigial.

Propodeum dark, with metallic green lustre; alveolate-reticulate anteriorly and irregularly rugulose posteriorly, area below costula and above nucha rugose-matt, smooth around spiracles. Nucha short, globose, broader than long.

Gaster dark red-brown, with greenish metallic lustre. T1 about 0.6x length of gaster. Basal fovea with thick compact setal tuft at base. Ovipositor projecting beyond end of gaster. S1 with longitudinal grooves anteriorly, grooves as long as broad; medial raised smooth area; posteriorly with longitudinal grooves, longer than broad. Sparse scattered setae present at base of collar.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Australia:** Tasmania.

5.10.5. *Moranila brunneiventris* (Girault) (Figs 5.36, 5.37, 5.117; Map 36)
Muscidea brunneiventris Girault, 1915a:324; Dahms, 1983:154-155; Bouček, 1988a:356. Transferred to *Muscideoidea* (by implication) by Girault, 1916a:227.

Muscideoidea brunneiventris Girault, 1916a:227; Dahms, 1983:154-155. Transferred to *Moranila* by Bouček, 1988a:356.

Holotype: female, QM.

Publication details: "Described from one female captured in forest, August 7, 1913. *Habitat*: Gordonvale, (Cairns), Queensland. *Type:* No. Hy 2783, Queensland Museum, Brisbane, the specimen on a tag; head, a forewing, middle and hind tibia on a slide." Slide not located.

Label details: Card labelled "TYPE" and "HOLOTYPE/ Hy 2783/ E.C.D. 1982" and "Muscidea/ brunneiventris/ Gir. ♀ type" and "QUEENSLAND/ MUSEUM".

Female

Head dark red-brown; not triangular. Dorsal margin slightly concave. Face 1.5 to 1.7x broader than long (mean 1.59). Occipital carina very weak; back of head alutaceous. OD slightly less than OOL. Vertex engraved reticulate, with scattered short setae. Lower face with scattered setae.

Antennae (Fig. 5.36) inserted about 0.5 torular diameters above clypeal margin. Scrobes smooth, not carinate anteriorly. Antennae concolorous orange; all funicular segments broader than long. Setae short; club broad; 1 to 1.3x length of funicle (mean 1.21). Genae smooth and short, malar groove present and complete. Malar space about 0.25-0.3x vertical axis of eye. Genal carina narrow, striate. Oral margin slightly emarginate medially between toruli, sloping to meet offset genal

carina. Mandible with rounded lower tooth and 2 blunt upper teeth.

Thorax dark red-brown. Pronotum imbricate, with regular short setation and a ring of 10 long setae; setal bases not reticulate. Mesoscutum alutaceous; with 2 pairs of setae between notauli, setal bases not reticulate. Notauli complete, composed of discrete pits. Scutellum as broad as long, flat in lateral aspect; alutaceous; anterior pair of setae slightly closer together than posterior pair, anterior pair very close to scutum-scutellum boundary; without reticulate bases. Frenal area not delimited. Axillae delimited by groove apically, by fovea basally; longitudinally striate, with scattered setae. Dorsellar fovea wide, coarsely alveolate; remainder of metanotum smooth, furrow non-striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Propodeum dark red-brown; coarsely reticulate medially, smooth around spiracles. Nucha short, matt, broader than long.

Forewing (Fig. 5.37) hyaline. Marginal vein short, 1.1 to 1.2x longer than stigmal vein (mean 1.16). Stigmal area sparsely setose. Postmarginal vein about 0.5x length of stigmal vein. Costal cell not excised at apex; with 5-6 setae on apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein slightly sinuate. Basal hairline not infumate, with 4-5 setae; basal cell bare. Speculum wide.

Legs yellow. Single hind tibial spur present; 0.2x length of hind basitarsus. Hind coxae with dorsal, lateral and basal setal crests.

Gaster orange-brown; oval. T1 about 0.7x length of gaster. Basal fovea with compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. S1 with an anterior row of foveae present, separated from a posterior row of foveae/grooves by a wide smooth medial area. Base of medial grooves with sparse scattered setae (Fig. 5.117).

Male

Head red-brown.

Antennae inserted less than 1 torular diameter above clypeal margin; concolorous yellow. F1-F3 same size, F4 longer and broader; setae sparse, longer than segments of origin. Club 2.6 to 3x length of funicle (mean 2.83), more than 2x

length of F1.

Thorax red-brown.

Forewing hyaline. Marginal vein 1.2 to 1.6x length of stigmal vein (mean 1.4). Costal cell with 6 setae on apex. Basal hairline not infumate, with line of setae; basal cell bare.

Gaster yellow; T1 0.6x length of gaster.

Other material examined: (21 females, 2 males; ANIC, in NZAC where stated). **Qld.:** 20 females, 2 males, 50 SW Ayr, 9 Oct 1950, EFR (20.00 147.15). All reared from a ?mealybug in a *Melaleuca* seed head (3 ♀♀ in NZAC); 1 female, Bellenden Ker S.F., nr. cable car station, Central Pk., Bellenden Ker (17.16 145.51).
Also one Girault specimen (QM): Card: "Muscidea ♀/brunneiventris/ Gir." and under "Indooroopilly/ window, Dec. 1929" and slide: " ♀/Muscidea/ brunneiventris Gir/ Indooroopilly/ Dec 1929" (27.30 152.58). Type: 17.06 145.47.

Biology: *M. brunneventris* has been reared from a ?mealybug (Pseudococcidae) in a *Melaleuca* seed head.

Distribution: **Australia:** Queensland.

5.10.6 ***Moranila californica*** **(Howard)** (Fig. 5.118; Maps 8, 37)

Moranila californica (Howard); Burks, 1958:75; Peck, 1963:631; Valentine, 1967:1128; Graham, 1969:70-71; Burks, 1978:783; Bouček, 1988a:356-357; Valentine and Walker, 1991:28; Morales, 1989:237-239.

Tomocera californica Howard, 1881:368; Smith and Compere, 1928:317-321, Figs 55-57; Bouček, 1988a:356. Preoccupied by Desmarest, 1858. Transferred to *Dilophogaster* by Howard, 1886:98; transferred to *Moranila* by Burks, 1958:75. Type material from Los Angeles, California, not seen.

Dilophogaster californica (Howard); Howard 1886:98; Bouček, 1988a:356. Replacement name for *Tomocera* Howard. Transferred to *Moranila* by Burks, 1958:75.

Moranila testaceipes Cameron, 1883:188-189; Burks, 1958:75; Burks, 1978:783;

Bouček, 1988a:357. Synonymised by Howard, 1896:165. Type material from Oahu, Hawai'i, not seen.

Tomocera ceroplastis Perkins, 1906:76.; Bouček, 1988a:357. Regarded as synonymous with *californica* by Burks, 1978:783. Type material from Cairns, Qld., not seen.

Tomocera glabriventris Girault, 1915b:207-208; Girault, 1927:334; Dahms, 1984:651; Bouček, 1988a:357. Regarded as synonymous with *californica* by Burks, 1978:783.

Holotype: female, SAM

Publication details: "*Habitat:* Gordonvale (Cairns), Queensland. Jungle, November 1, 1913 (A.P.D.). *Type:* No. *Hy 3198,* Queensland Museum, Brisbane, the female on a tag; head and a hind leg on a slide".

Label details: The card-mounted holotype body and additional material listed in the description (2 females from Gordonvale and 1 from Chindera) are lost. The only remnant of the holotype in QM is a slide with 2 coverslip fragments covering the head with one complete and one incomplete antenna, 1 leg, 2 forewings and 1 hindwing, labelled "TYPE, Hy/ 3198, A. A. Girault" and "Queensland Museum/ ♀ *Tomocera glabriventris* Gir".

Further material identified by Girault as *T. glabriventris* is deposited in the QM (2 females from Montville, Qld) and SAM (1 female from Cornwallis Island, Torres Straits); none of this material has type status.

Tomocera flaviceps Girault, 1915b:208; Dahms, 1984:603; Bouček, 1988a:357. Regarded as a synonym of *californica* by Burks, 1978:783.

Type material: not seen

Publication details: "Described from three females reared from a coccid. October 10. 1913 (G. F. Hill). Labelled "No.24." *Habitat*: Port Darwin. Northern Territory. Types: No. *Hy 3199*, Queensland Museum. Brisbane. Three females on a tag.

Eunotomyia festiva Masi, 1917:195-197. Synonymised by Bouček, 1988a:357. Lectotype from Mahe, Seychelles, not seen (NHM).

Female

Head orange-brown with 2 metallic green spots behind occipital carina, directly behind eyes; also metallic green genal carina; not strongly triangular. Dorsal margin deeply concave. Face 1.4 to 1.7x broader than long (mean 1.56). Occipital carina complete; back of head alutaceous. OD about 0.75x OOL. Vertex alutaceous, with scattered short setae.

Antennae inserted <0.5 torular diameters above clypeal margin. Scrobes smooth, very weakly carinate anteriorly. Scapes orange-brown, pedicel and flagellum brown. F1 to F4 as long as broad, F5 broader than long. Setae short; club 0.8 to 1x length of funicle (mean 0.92). Genae smooth; malar groove absent. Malar space as long as vertical axis of eye. Genal carina narrow, not striate but with a row of setae. Oral margin between toruli straight, sloping down to offset genal carina. Mandible with broad, pointed lower tooth, 2 upper teeth, 1 pointed and 1 blunt.

Thorax dark metallic green; engraved reticulate. Pronotum entirely sculptured, with regular short setation and a ring of 8 long, strong setae; setal bases reticulate. Mesoscutum engraved reticulate; with 2 to 4 pairs of setae between notauli; setal bases reticulate, reticulation may be inconspicuous in smaller specimens. Notauli complete grooves. Scapulae engraved reticulate; wide, with 2 pairs of setae. Scutellum as long as broad, convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair. Frenal area delimited by a very faint line, sculpture becoming less dense towards apex. Axillae delimited by groove apically, by fovea basally. Axillae smooth and shiny, unsculptured; each with only 1 conspicuous setae; carinate laterally.

Dorsellum smooth, dorsellar fovea alveolate; remainder of metanotum smooth, furrow non-striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Forewing with large infumate patch extending from basal hairline to well beyond stigmal vein, also infumation along apical cubital hairline. Marginal vein 1.2 to 1.5x longer than stigmal vein (mean 1.29). Postmarginal vein 0.5x length of

stigmal vein. Stigmal area sparsely setose. Costal cell slightly excised at apex; with 3-4 setae on apex of margin; ventral row of setae broadly interrupted, with no partial second row. Submarginal vein sinuate. Basal hairline not infumate, single seta present or absent; basal cell bare.

Legs and coxae orange, except mid tibiae brown, hind leg brown dorsally. Mid tarsal segments whitish, fore and hind yellow. Hind coxae with conspicuous dorsal, lateral, basal and ventral crests. Two hind tibial spurs present, the longer 0.3x length of basitarsus.

Propodeum dark brown-black; medial areas posterior to costula, anterior to nucha and around spiracles smooth and shiny. Nucha as long as broad, globose; alveolate-reticulate basally and irregularly rugulose apically.

Gaster dark red-brown, rectangular. T1 about 0.9x length of gaster. Basal fovea short, shallow; with compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. T1 with or without 2 oval matt areas. Upper area of S1 broadly concave, with vague grooves laterally; medial area wide flat and pitted; posteriorly a row of grooves as long as broad medially and longer laterally present. Sparse setae at base of medial groove (Fig. 5.118).

Male.

Head very dark red brown to black, with metallic blue lustre.

Antennae inserted almost 2 torular diameters above clypeal margin; concolorous mid-brown. Funicular segments strongly nodose; F1 slightly longer than F2-F4. Setae arranged in clumps, at least twice length of segments F1 to F3; setae on F4 about equal to length of F4. Setae on club much shorter than length of club. Sensilla moderately long. Club 1.7x length of F1.

Thorax dark red-brown to black.

Forewing hyaline. Marginal vein 1 to 1.1x as long as stigmal vein. Costal cell margined with setae for apical 0.5 to 0.6 of length; ventral setal row continuous with partial second row. Basal hairline not pigmented, with 4 to 5 setae; basal cell bare; cubital hairline absent.

Gaster dark red-brown.

Other material examined: **Australia:** (72 females, 20 males; ANIC unless otherwise stated). **W.A.:** 1 female, 14.52 125.50, 4km S by W Mining Camp, Mitchell Plateau, 13 May 1983, IDN, JCC; 1 male, 1 female, Stirling Range N.P., Jan 1987, JSN (34.23 117.52); 5 females, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12); 2 males, 33.36 119.55, Ravensthorpe, 22 Sep 1981, IDN, JCC. **N.T.:** 1 female, Baroalba Creek Springs, 19 km NE by N Mt Cahill, 13 June 1973, D.H.C.(12.48 132.49). **S.A.:** 1 female, 33.17 137.10, nr Moonabbie Range, 28 Nov 1992, IDN, JCC; 15 females, 5 males, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.33) (5 females in NZAC); 1 female, 33.46 135.06, Lake Tungketta, 30 Nov 1992, IDN, JCC. **Qld.:** 7 females, 16km N Boonah, 27.54 152.41, C.J.Burwell, 3♀♀ Jun 1990, 1♀ Jul 1991, 1♀ Aug 1991, 2♀♀ Dec 1991 (UQIC); 1 female, 1.5km N Roadvale 27.54 152.41, 11 Aug 1991, C.J.Burwell (UQIC); 1 female, 20km S Lotus Creek, Brigalow Forest, ECD, 26 Apr 1979 (22.24 149.10) (QM); 2 males, Garland Creek, 12 Oct 1984, IDN, JCC; 1 female, Bribie Island, 25 Oct 1976, ZB (26.57 153.07) (NHM); 3 females, Brisbane, 23 Oct- 3 Nov 1987, ECD, ex scale on *Ficus* (27.28 153.02) (QM); 1 female, Cape Hillsborough, Hidden Valley Track, ECD, 16 Apr 1979 (20.57 147.12) (QM); 1 female, Charleville, Rd to Quilpie, 5 Mar 1989, ECD, GS, sweeping coccoid and psyllid-infested plants (26.24 146.15) (QM); 3 females, Braemar S.F., via Kogan, 15-19 Oct 1979, GBM, Pyrethrum on *Acacia harpophylla* (27.11 150.52) (QM); 1 female, Cooloola, Thannae Rainforest, 22 Apr 1981, ECD (25.58 153.09) (QM); 8 females, Acacia Ridge, Brisbane, ECD, Sep 1977 (27.35 153.01) (QM); 1 female, Cooloola, sweeping *Wallum*, ECD, 10 Oct 1979 (QM); 2 females, Acacia Ridge, Brisbane, ECD, 1♀ Nov 1976, 1♀ Dec 1976 (QM); 1 female, Lake Eacham, Atherton Tablelands, N.Qld, 24 Apr 1970, S.R.Curtis (17.17 145.37); 1 female; 15.16 144.39, 14km W by N Hope, Vale Mission, 8-10 Oct 1980, JCC; 1 female, Forest Stn, 609m, Bulburin S.F., via Many Peaks, 2-5 Apr 1972, S.R.Montieth (24.18 151.25); 1 female, Pine Creek, 12mi S Bundaberg, 15 Sept 1975, H.Frauca (24.57 152.21); 1 female, 18.055 144.52, Forty Mile Scrub N.P., 52km SW by S Mt Garnet, 21 July 1986, JCC. **N.S.W.:** 5 females, 1 male, Kenthurst, 20 Oct 1972, W.Milne, reared from *Saissetia oleae* on mandarin (33.40 150.59); 7 females, 5 males, Dural, 31 Oct 1972, G.J.Snowball, ex *Saissetia oleae* on *Osteospermum moniliferum* (33.41 151.02) (1 female, 2 males in NZAC); 3 males, Kenthurst, 8 Nov 1972, W,Milne, *Saissetia oleae* on lemon; 1 female, Harrington, Nov 1991, G.Williams, blossom *Euroschinus falcata*, littoral rainforest (33.40 150.59). **Tas.:** 1 male, 42.22 146.29, 3km NE by E Wayatinah, 23 Jan 1983, IDN, JCC. (Types: 17.06 145.47; 12.27 130.48)

The following 4 females have differences in the sculpture of S1 from the above specimens:
W.A.: 1 female, 14.49 125.50, Mining Camp, Mitchell Plateau, 9-19 May 1983, IDN, JCC, ex yellow tray; 1 female, Walpole-Nornalup N.P., 17-21 Jan 1987, JSN, Malaise/yellow pan trap (35.00 116.45). **A.C.T.:** 1 female, Black Mt, 28-29 Apr 1968, light trap (35.16 149.06). **Tas.:** 1 female, 42.53 146.22, 7km S Frodsham's Pass, 25 Jan 1983, IDN, JCC.

New Zealand: (10 females; NZAC). **AK:** 1 female, Lynfield, 17 May 1975, G.K.; 1 female, Massey, 26 Mar 1975, EWV, *Saissetia coffeae* eggs. **NN:** 1 female,

Oakleigh, mangrove, on *Ceroplastes sinensis*, Feb 1971, RAC; 3 females, Nelson, 16-19 Mar 1965, BBG, ex *Saissetia oleae* on grapefruit leaf (1006); 1 female, Nelson, 20 Feb 1963, BBG, ex *Saissetia oleae* immature on *Prostanthera* (660); 3 females; Nelson, 6-15 feb 1960, EWV, ex *Saissetia oleae*. **Extralimmital:** (deposition as stated): **Cook Islands:** 1 female, Aitutaki, Maungapu, 23 Oct 1975, AKW, LLD, sweeping (NZAC). **Samoa:** 1 female, Upolu Is, Apia, 2 Aug 1925, ex coccid on *Hibiscus*, P.A.Buxton and G.H.Hopkins (NHM). **Tonga:** 1 female, Nuku'alofa, 19 May 1949, B.A.O'Connor, bred from *Saissetia nigra* on cassava (NHM). **Papua New Guinea:** 1 female, 20 km SE of Port Moresby, 26 Jan 1985, J.Ismay (NHM). **Hawaii:** 1 female, Oahu, J.B.Blackburn (*M. testaeicepes* paralectotype) (NHM). Sandwich Is., 1 female, Olinda, 910-1220m, May 1896 (NHM). **Mauritius:** 1 female, Perier Reserve, 14 June 1971, A.M.Hutson (NHM). **Admiralty Is.:** 2 females, Manus, 1 Dec 1936, J.L.Froggatt, ex *Lecanum* on Frangipani (NHM). **Seychelles:** 1 female, Mahe Is, 9 Sept 1938, D.V.Fitzgerald, *Ceroplastes* (NHM). **Italy:** 1 female, Ortovero, near Albenga (Savona), 5 Oct 1969, ZB (NZAC). **Israel:** 1 female, Bezet River, ex *Saissetia oleae* on oleander, 7 June 1971, D.Rosen (NHM). **U.S.A.:** 1 female, Los Angeles Co., CAB, 1639 (NHM).

Biology: The present study records the hosts of *M. californica* as follows: *Saissetia oleae* on mandarin, lemon (*Citrus limon*), *Osteospermum moniliferum* L (Compositae), on oleander (*Nerium oleander*, Apocynaceae); *Ceroplastes sinensis*, *C. sinensis* on grapefruit; *Ceroplastes* sp.; immature *Saissetia oleae* on *Prostanthera*; *Saissetia coffeae* (Walker) (Coccidae) eggs; *Parasaissetia (=Saissetia) nigra* (Nietner) (Coccidae) on cassava; *Coccus* (=*Lecanium*) (Coccidae) on frangipani.

Graham (1969) records *M. californica* as a parasitoid of scale insects, particularly Coccidae, especially *Saissetia* and *Ceroplastes* spp., and rarely as a hyperparasitoiid through encyrtids. Peck (1963) also records *M. californica* from an unidentified species of *Asterolecanium* (Asterolecaniidae); *Chaetococcus (=Antonina) bambusae* (Maskell) (Pseudococcidae); *Coccus hesperidum* L. (Coccidae); *Saissetia hemisphaerica* (=*S.coffeae*) (Coccidae) and as a hyperparasitoid through *Microterys flavus* (Howard) (Encyrtidae). Burks (1978) describes *M. californica* as an egg predator and, rarely, a hyperparasitoid. Smith and Compere (1928) record *Asterolecanium pustulans* (Cockerell) (Asterolecaniidae) and *Ceroplastes rubens* Maskell (Coccidae) as hosts of *M. californica*; and Mercet (in Compere and Smith, 1928) lists *Ceroplastes rusci* (L.) and *C. sinensis* as hosts in Spain. Bouček (1988a) lists *Ceroplastes ceriferus* (Fab.) as a host.

In summary, *M. californica* has been reared on occasion as a hyperparasitoid

and as an egg predator, but is most frequently a primary parasitoid of Coccidae, particularly *Saissetia* and *Ceroplastes*.

Distribution: Cosmopolitan. Smith and Compere (1928) consider that *M. californica* is native to Australia but arrived in California with one of its hosts *S. oleae* and became more widespread there than in its native country. *M. californica* is rarely collected in Australia.

5.10.7 ***Moranila comperei*** **(Ashmead)** (Figs 5.38, 5.39, 5.40, 5.119, 5.120; Maps 9, 38).

Moranila comperei (Ashmead); Bouček, 1988a:357, Figs 662-663; Valentine and Walker, 1991:28.

Aphobetoideus comperei Ashmead, 1904a:328; Smith and Compere, 1928:312-317, Figs 51-54; Gahan and Peck, 1946:314. Transferred to *Moranila* by Bouček, 1988a:357.

Holotype: no designation of type specimen(s), description occurs in key only.
Bouček (1988a) cites Swan River, W.A. as a collection locality. It is unclear whether he means this to be the original collecting locality, and if so, how he determined it.

Tomocera io Girault, 1929:319-320; Dahms, 1984:728. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Holotype: female, SAM

Publication details: "A female, from galls on leaves of *Eucalyptus obliqua*, Blakiston, South Australia (T. D. Smeaton). Hatched May, 1888."

Label details: Card labelled "Type" and "Tomocera/ io/ Girault. Type ♀" and "Tomocera/ io Girault/ South Australia/ also Slide/ TYPE" and "S. A. Museum/ Specimen".
Slide labelled "TYPE" and "Ent.Div./ Dep.Ag & Stk., Qld./

Tomocera/ io Girault Type ♀/ No. S. Aus. Mus." One complete coverslip covering 1 ♀ forewing and 2 ♀ antennae (fragmented). Half coverslip with head.

Tomocera saissetiae Girault, 1925b:2-3; Dahms, 1986:498. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Holotype: female, QM.

Publication details: " A female, Wahroonga, N.S.Wales, on *Saissetia oleae*, May 23, W. B. Gurney"

Label details: Slide labelled "HOLOTYPE/ T.9890/ E.C.D. 1985" and "Tomocera/ flaviceps Gir./ ♀ type (inner)" and "♀/ Tomocera/ saissetiae Gir./ Type (outer)". Almost complete coverslip with 1 leg and ♀ forewing (*flaviceps*) and 1 part coverslip with ♀ gaster, parts of thorax, 1 ♀ club and wing, 1 part coverslip with 1 leg, 1 head, 1 antennae minus club (*saissetiae*).

Tomocera transversifasciata Girault, 1925a:91; Dahms, 1986:592. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Lectotype: female, QM, here designated

Publication details: "Several pairs, damp forest, Wynnum, Queensland, November 4, 1921." A holotype was not designated, so the remaining type material has the status of syntypes. This consists of one slide, with details as below. I here designate the most complete ♀ on the slide as lectotype and the remaining material as paralectotypes.

Label details: Slide: "SYNTYPES/ T.10017/ E.C.D. 1985" and "Epitetracnemus ♀/ auricornis Gir./ Type" and "Tomocera/ transversifasci-/ ata Gir./ ♀ ♂ types". 1 complete coverslip with 1 syntype ♀ with head and some legs separated (designated lectotype) and head and 1 pair of wings from another type specimen (designated paralectotype, 1 head minus part of 1 antenna); 1 cracked complete coverslip containing *E. auricornis*

Girault.

Female

Head orange, with metallic green and/or purple around ocelli; not strongly triangular, more square; dorsal margin slightly concave. Face 1.3 to 1.5x as broad as long (mean 1.39). Occipital carina weak; back of head alutaceous. OD about 0.75x OOL. Vertex alutaceous, with scattered short setae.

Antennae (Fig. 5.38) inserted <0.5 torular diameters above clypeal margin. Scrobes smooth, not carinate anteriorly. Scapes orange, pedicel and flagellum brown. F1 from slightly broader than long to square; F2 from longer than broad to square; F3 to F5 more or less square. Club from 0.7 to 1x length of funicle (mean 0.84). Genae smooth, malar groove present and complete. Malar space subequal to vertical axis of eye. Genal carina moderately wide, coarsely striate; metallic green. Oral margin very slightly concave between toruli, sloping very gently to offset genal carina. Mandible with broad lower tooth and 2 narrow upper teeth.

Thorax dark metallic green. Pronotum imbricate, with regular short setation and a ring of 10 to 14 long, strong setae; bases not reticulate. Mesoscutum imbricate, with few to numerous scattered short setae and pair of setae (posteriorly) between notauli, setal bases not reticulate. Notauli complete, composed of defined grooves. Scapulae similarly sculptured. Scutellum subsquare, slightly convex in lateral aspect; engraved reticulate to almost smooth with very faint engraved reticulate pattern discernable; anterior pair of setae closer together than posterior pair, bases not reticulate. Frenal area faintly delimited by change in sculpture to almost smooth, not by line. Axillae delimited by groove apically, by fovea basally; smooth, with scattered setae. Dorsellum smooth, declivous; dorsellar fovea alveolate; remainder of metanotum smooth, furrow non-striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron mainly smooth, with some slight transverse striation.

Forewing (Fig. 5.39) with large central infumate patch. Marginal vein 2.1 to 3.3x length of stigmal vein (mean 2.69). Stigmal area sparsely setose or bare. Postmarginal vein 0.9x length of stigmal vein. Costal cell slightly excised at apex; with 2 setae on apex of margin; ventral row of setae narrowly interrupted, with

partial second row. Submarginal vein slightly sinuate. Basal hairline not infumate, bare; basal cell bare.

Legs orange, except mid and hind tibiae brown. Two hind tibial spurs present; the longer 0.2x length of hind basitarsus. Hind coxae with lateral, basal and sparse dorsal setal crests.

Propodeum dark metallic green; regularly reticulate anterior to costula and irregularly reticulate posterior to costula, with a smooth triangular plate at very base of median carina. Smooth around spiracles, with long setal tuft. Nucha broader than long.

Gaster rectangular; ranging in colour from orange grading to brown apically, to dark brown excepting mid-brown base. T1 0.5 to 0.6x length of gaster. Basal fovea short, shallow; with compact setal tuft at base. Ovipositor projecting beyond end of gaster. S1 anteriorly with 2 rows of foveae, separated by narrow ridges; posteriorly grooved, grooves longer than broad; with sparse scattered setae in bases of medial four (Figs 5.119, 5.120).

Male

Head orange-brown to brown with metallic blue and/or purple lustre on vertex, grading to orange round mouth. Head slightly less broad than that of female, about 1.2x as broad as long.

Antennae (Fig. 5.40) inserted higher than in female, at least 1 torular diameter above clypeal margin. Scape and pedicel orange, flagellum orange to brown. F1-F4 similar size, strongly nodose; setae about as wide as segments of origin. Sensilla conspicuous, as long as segments of origin. Club from 1.7 to 2.8x as long as F1 (mean 2.05).

Forewing with faint central infumate patch. Marginal vein 2 to 2.7x as long as stigmal (mean 2.28). Costal margin with about 5 setae on apical margin. Basal hairline not infumate, with 0 to 2 setae; basal cell sparsely setose.

Gaster ranging in colour from medium brown in anterior half and dark brown in posterior half to yellow brown in anterior half and dark brown in posterior half, with two dark brown patches adjacent to basal fovea.

Other material examined: (28 females, 25 males; ANIC unless otherwise stated). **W.A.:** 3 females, 1 male, Yanchep N.P., c50km N Perth, 20 Dec 1986, JSN on *Eucalyptus* (31.29 115.41); 3 females, 3 males, Porongorup N.P., Jan 1987, JSN (34.41 117.55); 2 males, 2 females, Stirling Range N.P., Jan 1987, JSN (34.23 117.52); 2 females, Walpole-Nornalup N.P., 17-21 Jan 1987, JSN (35.00 116.45); 3 females, 1 male, Cape Arid N.P.,Yokinup Bay area, 31 Dec 1986- 3 Jan 1987, JSN (33.50 123.12); 1 male, 13km S Norseman, 29 Dec 1986, JSN (32.19 121.47); 1 male, Parra Wirra Rec.Pk., 50km NE Adelaide, 9 Dec 1986, JSN (34.44 138.56); 1 female, Kalbarri N.P., 650km N Perth, 12-18 Dec 1986, JSN (27.47 114.18); 1 female, Walyunga N.P., 40km NE Perth, 24 Dec 1986, JSN (31.43 116.04); 1 female, John Forrest N.P., 24-28 Dec 1986, JSN, Malaise/yellow pan trap (31.50 116.05); 1 male, Yanchep N.P., 20-21 Dec 1986, J.S.Noyes, Malaise/yellow pan trap (31.29 115.41). **S.A.:** 2 females, 1 male, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.27) (2 females in NZAC);9 females, 2 males (NZAC), Cox's Scrub, 60km S Adelaide, 4 Dec 1986, JSN (35.20 138.48); 3 females, 31.33 138.36, Wilpena Pound Gap, 5-6 Nov 1987, IDN, JCC; 1 female, 1 male, Kudriemitchie OS, Malaise trap edge Coopers Creek, 10-15 Oct 1991, J.A.Forrest (27.23 140.12) (S.A.M.); 1 female, Adelaide, Brighton, 12 Nov 1975, MCC, ex *Cavariella aegopodii/Aphidius salicis* on carrot (35.01 138.31); 1 female, 2 males, Mortlock, 11 Dec 1974, MCC, ex *Diaretiella rapae* in *Brevicoryne brassicae*; 1 female, Wari, May 1974, L.Coleman, ex suction trap; 1 female, 2 males, Wari, Claremont, 30 Aug 1974, C.Crawford, ex *Myzus persicae* on Kale (28.47 149.22); 2 females, 33.46 135.06, Lake Tungketta, 30 Nov 1992, IDN, JCC; 1 female, 31.35 130.22, 54km W by S Nullarbor, 17 Sep 1981, IDN, JCC; 1 female, 31.56 133.08, 12km E Penong, 16 Sep 1981, IDN, JCC; 1 female, Wari, 29 Nov 1974, M.Carver, ex *Aphidius colemani* and *Ephedrus persicae* in *Myzus persicae* on peach; 3 females, Mt Barker, 500m, Adelaide, 30 Nov-2 Dec 1986, JSN (34.56 138.36); 2 females, 34.38 135.27, nr. Coffin Bay, 29 Nov 1992, IDN, JCC; 1 female, 34.37 135.40, Coffin Bay, 29 Nov 1992, IDN, JCC; 2 females, Carey Gully, Wottons Scrub, Adelaide, 1 Dec 1986, JSN (34.58 138.47); 2 females, 31.08 136.31, Parachilna Creek, 8 Nov 1987, IDN, JCC; 1 male, 32.44 138.05, Willowie Forest Res., 8km SbyW Wilmington, 11 Nov 1987, IDN, JCC. **Qld:** 1 male, Mt Tamborine, 21 Dec 1976, ZB (27.55 153.10) (NHM); 1 female, Brisbane, Brookfield, 9 Jan 1983, ZB (27.30 152.55) (NHM); 2 females, 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC; 1 female, 26.52 151.35, nr Paradise Falls, Bunya Mtns N.P., 6 Oct 1984, IDN, JCC. **N.S.W.:** 1 female, Cowra, 10 Oct 1977, L.T.Woolcock, ex *Therioaphis trifolii/ Trioxys complanatus*; 1 female, 1 male, Wentworth, Oct 1991, W.A.Milne, ex *Lipaphis ersimi/Diaeretiella rapae* on canola (34.06 141.55) (NZAC); 1 male, 1 female, Warrumbungles N.P., via Coonabarabran, 17 Dec 1974, IDN, sweeping grass by creek, dry sclerophyll forest (31.13 149.05) (♀UQIC, ♂NHM); 9 females, 16 males, Armidale, Dec 1992, S.Asante, ex *Eriosoma lanigerum* on apple (30.29 151.40) (2 ♀♀ in NZAC); 2 females, Sydney, ex aphid mummies (33.53 151.13); 1 male, Queanbeyan, 29 Nov 1986, JSN (35.21 149.14); 3 males, 3 females, Kenthurst, Oct-Nov 1972, W.Milne, ex *Saissetiae oleae* on lemon (33.40 150.59). **A.C.T.:** 1 female, Canberra, Black Mountain, 23 Oct 1976, ZB (35.16 149.06) (NHM); 1 female, Black Mt, 24 Oct-1 Nov 1982, IDN, FIT/ethanol; 2 females, 35.35 149.00, Honeysuckle Creek, 21-31 Mar 1985, IDN, JCC, Malaise trap/ethanol; 1 male,

Piccadilly Circus, 1240m, Feb 1984, JFL, TAW, M-LJ, flight intercept window/trough trap (l); 1 male, 35.19 148.51, Wombat Creek, 750m, 6km E Piccadilly Circus, Mar 1985, JFL, TAW, M-LJ, flight intercept/window trough trap; 5 males; Canberra, 3 Mar 1985, C.Beaton, reared from *Trialeurodes vaporariorum* (Westw.) with a mymarid (35.18 149.08); 1 male, 35.22 148.50, Blundells Creek, Feb 1987, DHC, Malaise trap/ethanol. **Vic.:** 1 female, Kinglake N.P., nr Melbourne, 3 Jan 1977, ZB (37.28 145.22) (NHM). **Tas.:** 1 male, Austins Ferry, 15 Nov 1979, R.Brieze-Stegeman (42.47 147.14) (NHM); 2 females, 1 male, 42.56 147.19, The Lea, 5 Feb 1983, IDN, JCC; 1 female, 42.49 146.23, Frodshams Pass, 24-25 Jan 1983, IDN, JCC; 1 female, 40.58 148.01, 1km SSE Gladstone, 6 Feb 1983, IDN, JCC; 2 females, 1 male, Kingston, host coll 20 Nov 1986, para em 26 Nov 1986, R.K.Mensah, ex 4th or 5th instar nymph, *Ctenarytiana thysanura* (Psyllidae) on *Boronia megastigma* (Nees) (42.59 147.18); 1 female, 41.06 147.53, 1km E by N Herrick, 29&30 Jan 1983, IDN, JCC; 1 female, Kingston, Nov 91- Jan 92, Brown, ex margarodids. (Types: 34.26 148.14; 27.27 153.10).

New Zealand: (3 females, 1 male; NZAC). **AK:** 3 females, 1 male, New Lynn, Lynmall, 4 Apr 1994, N.A.Martin, ex *Nipaecoccus aurilanatus* on *Araucaria heterophylla.*

Biology: The present study records *M. comperei* as reared from: *Cavariella aegopodii* (Scopoli) (Aphididae)/*Aphidius salicis* Haliday (Braconidae) on carrot; *Diaretiella rapae* (M'Intosh) (Braconidae) in *Brevicoryne brassicae* L. (Brassicaceae); *Myzus persicae* (Sulzer) (Aphididae) on kale (*Brassica oleracea* L. var. *acephala*); *Aphidius colemani* Viereck (Braconidae) and *Ephedrus persicae* (Froggatt) (Braconidae) in *Myzus persicae* on peach (*Prunus persica* (L.) Batsch (Rosaceae); *Lipaphis ersimi* (Kalt.) (Aphididae)/*Diaeretiella rapae* on canola; *Eriosoma lanigerum* (Aphididae) on apple (*Malus sylvestris* (L.) Mill. (Rosaceae); aphid mummies; Mymaridae/ *Trialeurodes vaporariorum* (Westw.) (Aleyrodidae); *Ctenarytiana thysanura* (Psyllidae) on *Boronia megastigma* (Nees) (Labiatae); *Saissetiae oleae* (Coccidae) on lemon; *Nipaecoccus aurilanatus* mummies (Pseudococcidae) on *Araucaria heterophylla* (Araucariaceae).

Smith and Compere (1928) assume that *M. comperei* is usually a primary parasitoid of coccoids, but Bouček (1988a) records it as reared from a mummified aphid on peach (A.C.T) and from *M. persicae*. Smith and Compere (1928) reared *M. comperei* from *S. oleae*; but they also recorded a pupae of *M. comperei* inhabiting the body of a scale in company with a pupae of *Metaphycus lounsburyi* (Howard) (Encyrtidae) and conclude that this indicates facultative hyperparasitism.

In summary, *M. comperei* is a primary parasitoid of *Saissetia oleae*; a primary parasitoid of *Nipaecoccus aurilanatus*; a hyperparasitoid of Aphididae through Braconidae; is a probable hyperparasitoid of Aleyrodidae through Mymaridae and has been reared in unknown circumstances from Psyllidae.

Distribution: **Australia:** West Australia, South Australia, Australia Capital Territory, Victoria, Tasmania. **New Zealand:** AK.

Remarks: Specimens of *comperei* can be divided into two groups on the basis of whether the scutellum is smooth or sculptured. However, since the other diagnostic characters vary, and reared series have specimens falling into both groups I cannot justify separating these specimens into two morphospecies. Bouček identified 5 specimens with sculptured scutellums and a specimen with a smooth scutellum as *Moranila comperei* Ashmead; but he also identified some New Zealand material of an undoubtedly different species as *comperei*. There is no type material of *M. comperei*, and the species is described only in a key.

5.10.8 ***Moranila gullanae*** **sp.n.** (Figs 5.41, 5.42, 5.43, 5.121; Map 39)

Holotype: female, ANIC.

Label details: "Canberra ACT/ June 1962/ E F Riek".

Female

Head brown, with metallic green lustre. Dorsal margin not concave. Face 1.7 to 1.9x as broad as long (mean 1.78). Occipital carina weak; back of head alutaceous. OD about equal to OOL. Vertex alutaceous, with scattered short setae.

Antennae (Fig. 5.41) inserted less than 1 torular diameter above clypeal margin. Scrobes smooth, very weakly carinate to not carinate anteriorly. Antennae concolorous brown. F1 to F4 broader than long; F5 slightly broader than long; setae short. Club broad, 1.1 to 1.4x length of funicle (mean 1.29). Genae smooth, malar groove complete. Malar space shorter than eye. Genal carina narrow, striate. Oral margin straight between toruli, sloping to offset genal carina.

Thorax red-brown. Pronotum engraved reticulate, with regular short setation

and a ring of 12 long setae; setal bases not reticulate. Mesoscutum engraved reticulate, with 3 pairs of setae and some additional setae between notauli, bases not reticulate. Notauli complete, composed of discrete pits. Scapulae similarly sculptured. Scutellum slightly broader than long, flat in lateral aspect; reticulate; anterior pair of setae closer together than posterior pair; without reticulate bases. Frenal area faintly delimited by change of sculpture. Axillae delimited by groove apically, by fovea basally; longitudinally striate, with scattered setae. Dorsellum smooth, dorsellar fovea alveolate; remainder of metanotum smooth, furrow not striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Propodeum brown; reticulate medially, smooth around spiracles. Nucha short, globose, broader than long.

Forewing (Fig. 5.42) with central faint infumate patch and infumation along apical cubital hairline. Marginal vein 1.6 to 2x length of stigmal vein (mean 1.7). Postmarginal vein about 1.2x length of stigmal vein. Stigmal area sparsely setose. Costal cell slightly excised at apex; with 3-4 setae on apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein slightly sinuate. Basal hairline not infumate, with 2-3 setae; basal cell slightly setose. Speculum wide.

Legs orange. Two hind tibial spurs present; the longer 0.2x length of hind basitarsus. Hind coxae with sparse dorsal, lateral and basal setal crests.

Gaster orange-brown, grading to brown apically; rectangular. T1 about 0.9x length of gaster. Basal fovea short, shallow; with compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. S1 with two rows of foveae present, posterior row larger than anterior row; separated by a wide smooth raised area. Sparse scattered setae present in base of medial posterior foveae (Fig. 5.121).

Male

Head brown, with slight metallic blue lustre.

Antennae (Fig. 5.43) inserted 1 torular diameter above clypeal margin; antennae with 4 funicular segments equal in length, not nodose. Club 2 to 3x length of F1 (mean 2.43). Setae shorter than length of segments of origin.

Forewing with very faint infumate patch. Marginal vein 2x length of stigmal

vein. Costal cell with 4-5 setae on apex. Basal hairline not infumate, with about 3 setae.

Paratypes: (15 females, 4 males; ANIC, in UQIC, NZAC where stated). **A.C.T.:** 12 females, 4 males, Canberra, June 1962, EFR (35.18 149.08). All reared from 2nd instar males of an unidentified eriococcid, probably *Eriococcus* (P.J.Gullan, pers. comm.); along with an encyrtid; 2 females, same data, UQIC. 1 female, same data, NZAC.

Other material examined: Type series only.

Biology: *M. gullanae* has been reared from an unidentified eriococcid, probably *Eriococcus* (P. J. Gullan, pers. comm.).

Distribution: **Australia:** Australian Capital Territory.

Remarks: *M. gullanae* is named after Dr Penny Gullan (ANU).

5.10.9 ***Moranila longisetosa*** **sp.n.** (Map 40)

Holotype: female, ANIC.

Label details: "26.52S 151.34E/ nr Westcott Plain/ Bunya Mts Nat.Pk Qld/ 6-7 Oct. 1984/ I. Naumann, J. Cardale/ ex ethanol".

Female

Head orange-brown, with 2 metallic green spots behind occipital carina, directly behind eyes; also metallic green around antennal toruli and genal carina. Face 1.8x broader than long; triangular, dorsal margin deeply concave. Occipital carina complete; back of head alutaceous. OD about 0.9x OOL. Vertex alutaceous, with scattered short setae, and a row of long dark setae just behind and another just in front of occipital carina.

Antennae inserted almost directly above clypeal margin, less than 0.5 torular diameters. Scrobes smooth, not carinate anteriorly. Scapes orange-brown, pedicel and flagellum brown. Funicular segments all square; setae short. Club 0.8x length of funicle. Genae smooth, malar groove absent. Malar space as long as vertical axis of

eye. Genal carina wide, not striate, with a row of setae. Oral margin straight between toruli, sloping down to slightly offset genal carina. Mandible with broad, pointed lower tooth and 2 blunt upper teeth.

Thorax dark metallic green. Pronotum broader than long; engraved reticulate, with regular short setation and a setal ring of about 8 setae; setae with reticulate bases, more pronounced in setal ring. Mesoscutum engraved reticulate; 2 pairs of setae between notauli, setal bases heavily reticulate. Notauli complete grooves. Scapulae engraved reticulate/striate, with 2 pairs of setae, bases reticulate. Scutellum as long as broad, convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair; bases heavily reticulate. Frenal area delimited by faint line. Axillae delimited by groove apically, by deep fovea basally; smooth with faint longitudinal striations, 2 setae on each; carinate laterally. Dorsellum smooth except medially sculptured, dorsellar fovea coarsely alveolate; remainder of metanotum smooth, furrow coarsely striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point, mesepimeron smooth.

Propodeum dark; area below costula and above nucha rugose/matt, smoother around spiracles. Nucha short, globose, broader than long; alveolate-reticulate basally and irregularly rugulose apically.

Forewing with large infumate patch. Marginal vein 1.5x length of stigmal vein. Postmarginal vein 0.5x length of stigmal vein. Stigmal area setose.Costal cell not excised at apex; with 5 setae on apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein sinuate. Basal hairline not infumate, bare; basal cell bare; cubital hairline absent.

Legs and coxae orange-brown, except tibiae dark brown with metallic lustre. Hind coxae with conspicuous dorsal, lateral, and basal crests. Two hind tibial spurs present; the longer 0.3x length of basitarsus.

Gaster dark brown-black, with metallic lustre, medially red-brown. T1 about 0.9x length of gaster. Basal fovea with a compact setal tuft at base. Ovipositor projecting beyond end of gaster. S1 with strigate anterior margin and wide, raised, irregularly punctate medial ridge; a row of square foveae present anterior to ridge, posteriorly grooved, grooves closely spaced and broader than long; some sparse hairs at the base of these.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland.

5.10.10 ***Moranila maculata*** **sp.n.** (Map 41)

Holotype: female, ANIC.

Label details: "26.52S 151.34E/ nr Westcott Plain/ Bunya Mts Nat.Pk Qld/ 6-7 Oct 1984/ I. Naumann, J. Cardale/ ex ethanol".

Female

Head orange, with metallic green around antennal toruli and genal carina; not strongly triangular. Dorsal margin slightly concave. Face 1.6x broader than long. Occipital carina weak; back of head alutaceous. OD about equal to OOL. Vertex alutaceous; with scattered short setae.

Antennae inserted just above clypeal margin, much less than 1 torular diameter. Scrobes smooth, not carinate anteriorly. Scapes orange, pedicel and club brown, F1-F3 darker, F4 and F5 light yellow. Funicular segments all broader than long, F1 and F2 particularly so, anellus-like; setae short. Club 1.2x longer than funicle. Genae smooth, malar groove complete but inconspicuous. Malar space slightly shorter than vertical axis of eye. Genal carina moderately wide, not striate. Oral margin straight between toruli, sloping down to offset genal carina. Mandible with broad, pointed lower tooth and 2 narrower pointed upper teeth.

Thorax dark metallic green. Pronotum engraved reticulate, with short regular setae and a pronotal ring of 8 setae, setal bases not reticulate. Mesoscutum engraved reticulate, with 2 pairs of setae and 1 single seta between notauli. Notauli complete grooves. Scapulae engraved reticulate, with few scattered setae. Scutellum as long as broad, flat in lateral aspect; engraved reticulate; anterior pair of setae about as far apart as posterior pair; without reticulate bases. Frenal area delimited by definate line,

longitudinally striate. Axillae delimited by groove apically, by fovea basally; longitudinally striate anteriorly, smooth posteriorly, with scattered setae. Dorsellar fovea alveolate, remainder of metanotum smooth, except furrow slightly striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron smooth.

Forewing with large central infumate patch. Marginal vein about 1.25x length of stigmal vein. Stigmal area sparsely setose. Postmarginal vein 0.5x length of stigmal vein. Costal cell slightly excised at apex; 8 setae on apical margin; ventral row of setae continuous, with partial second row. Submarginal vein sinuate. Basal hairline very faintly infumate, with 5 setae; basal cell bare.

Legs orange, tibiae brown. Hind coxae with dorsal, lateral and basal setal crests. Two hind tibial spurs present; the longer 0.1x length of hind basitarsus, the shorter vestigial.

Propodeum black; reticulate anteriorly, striate posteriorly, smooth around spiracles. Nucha short, rugose, broader than long.

Gaster dark-brown, grading to paler apically and basally, rectangular. T1 about 0.7x length of gaster. Basal fovea with thick compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. Anterior half of S1 reticulate; raised wide smooth horizontal ridge medially; posterior half deeply grooved, grooves longer than wide with a small tuft of setae in each of two medial ridge bases.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland.

5.10.11 ***Moranila pini*** **(Girault)** (Map 42)

Tomocera pini Girault, 1925b:4; Dahms, 1986:412. Transferred to *Moranila* by Bouček, 1988a:357.

Lectotype: female, QM, here designated as the headless female nearest the apex of the card. The remaining specimens on the card are paralectotypes.

Publication details: "Two pairs from "white scales" (coccids) on pine, Miles, 27th January, 1924."

Label details: Card labelled "SYNTYPES/ T.9468/ E.C.D. 1985" and "Tomocera ♀ ♂/ pini Girault/ Types" and "Queensland/ Museum", with 2 ♀♀ and 2♂♂, the ♀♀ without heads, the males intact except for the loss of some antennal segments in 1 specimen. These specimens have the status of syntypes.
Slide labelled "SYNTYPES/ T.9468/ E.C.D. 1985" and "Ent. Div./ Dep Ag.& Stk., Qld." and "Tomocera/ pini Girault/ ♀ ♂ types". Half coverslip containing ♀ forewing and segments of ♂ antennae. The ♀ and ♂ antennae are assumed to be from the syntypes, the wing is of unknown origin since all syntypes have wings intact.

Female

Head lost.

Antennae with pedicel elongate, F1 broader than long, F2 square, other funicular segments broader than long. Club subequal to funicle in length; about 2x width of pedicel.

Thorax black, with green metallic lustre. Pronotum broader than long, imbricate. Setal ring of about 10 setae; setal bases raised. Mesoscutum imbricate; with 3 pairs of setae medially between notauli and a few extra unpaired setae, bases raised. Notauli complete grooves. Scapulae sculptured, setal bases not raised. Scutellum longer than broad, convex in lateral aspect; engraved reticulate; anterior pair of setae slightly closer together than posterior pair. Frenal area not delimited. Axillae delimited by groove apically, by deep fovea basally. Faintly engraved

reticulate, carinate laterally.

Dorsellum smooth, wide and declivous; dorsellar fovea narrow, coarsely alveolate; remainder of metanotum smooth, furrow coarsely striate. Mesepisternum with smooth triangular depression; mesepimeron mainly smooth.

Propodeum black; entirely coarsely alveolate-reticulate excepting rugose strip on apex and smoother area around spiracles. Nucha short, square.

Forewing with large central infumate patch. Marginal vein about 2x longer than stigmal vein. Stigmal area bare. Postmarginal vein about 0.8x length of stigmal vein. Costal cell not excised at apex; 1 seta dorsally at apex of margin; ventral row of setae broadly interrupted, with partial second row. Submarginal vein only slightly sinuate. Basal hairline not infumate, bare; basal cell bare. Setation on disc sparse.

Legs yellow with brown tibiae. Hind coxae with dorsal, lateral, and basal setal crests. Two hind tibial spurs present; the longer 0.2x length of basitarsus.

Gaster yellow-brown anteriorly, dark brown posteriorly. T1 about 0.9x length of gaster. Compact setal tuft at base. Ovipositor not projecting beyond end of gaster. S1 obscured.

Male

Head dark red-brown, with slight green metallic lustre. OD about equal to OOL. Occipital carina complete, ocelli crossing occiput. Setae on vertex short.

Antennae inserted about 2 torular diameters above clypeal margin; concolorous yellow-brown. Funicular segments long and nodose; F1 longer than F2 - F4. Setae very long, at least 2x length of segments of origin. Club about 1.75x length of F1.

Biology: *M. pini* has been reared from "white scales" on *Pinus* L. sp (Pinaceae).

Distribution: **Australia:** Queensland (26.40 150.11).

Remarks: Bouček (1988a) regards *M. pini* as "probably the same as *baeusomorpha*" (p357). The amount of material available is small and it is in bad condition, but *M. baeusomorpha* differs from *M .pini* in the following character states: ♀ F2 transverse;

only 1 hind tibial spur present; scutellum square; frenal area delimited by a change in sculpture; mesepimeron striate; metanotal furrow smooth; stigmal area setose; ventral setal row in costal cell continuous; costal cell slightly excised; ♀ costal margin without setae; ♀ basal hairline infumate.

5.10.12 ***Moranila punctata*** **sp.n.** (Fig. 5.122; Map 43)

Holotype: female, ANIC.

Label details: "26.52S 151.34E/ nr Westcott Plain/ Bunya Mts Nat.Pk Qld/ 6-7 Oct. 1984/ I. Naumann, J. Cardale/ ex ethanol" and "Moranila/ sp.P 112 ♀/ det I. D. Naumann 1986".

Female

Head red-brown, with metallic blue-green lustre; not triangular. Dorsal margin of head concave. Face 1.6 to 1.9x broader than long (mean 1.75). Occipital carina complete; back of head alutaceous. OD about equal to OOL. Vertex alutaceous-punctate; with short setae in punctations.

Antennae inserted less than 1 torular diameter above clypeal margin; moderately strongly clavate. Scrobes smooth, fairly strongly carinate anteriorly. Scape, pedicel, F5 and club yellow-brown, F1-F4 brown. Funicular segments all broader than long, F1 and F2 particularly so, anellus-like; setae short. Club 1.3x length of funicle (mean 1.29), about 2x width of pedicel. Genae smooth, malar groove complete. Malar space equal to eye length. Clypeal margin and genal carina offset. Genal carina moderately wide, striate. Oral margin produced between toruli and slightly emarginate medially, sloping down to offset genal carina. Mandible with broad, pointed lower tooth and 2 upper teeth, 1 pointed and 1 almost a truncation.

Thorax dark red-brown, with metallic blue-green lustre. Pronotum alutaceous-punctate, with short regular setae and a pronotal ring of 12 setae; bases not reticulate. Mesoscutum alutaceous-punctatae, with regular unpaired setae in pits between notauli. Notauli complete, composed of discrete pits. Scapulae engraved reticulate, with few scattered setae. Scutellum as long as broad, flat in lateral aspect; engraved reticulate; setal pairs at extreme anterior and posterior of scutellum; bases not reticulate but slightly pitted. Frenal area not delimited. Axillae delimited by groove

apically, by fovea basally; longitudinally striate, with scattered setae. Dorsellar fovea alveolate, remainder of metanotum smooth, except furrow slightly striate. Mesepisternum with triangular depression, deeper dorsally and at the ventral point. Mesepimeron transversely striate.

Propodeum dark brown; reticulate medially, smooth around spiracles. Nucha short, rugose, broader than long.

Forewing with large central infumate patch and infumate anterior cubital hairline. Marginal vein from 1.6 to 2x as long as stigmal vein (mean 1.95). Postmarginal vein 0.75 to 0.8x length of stigmal vein. Stigmal area sparsely setose. Costal cell not excised at apex; 2-3 setae on apical margin; ventral row of setae continuous, with partial second row. Submarginal vein sinuate. Basal hairline not infumate, with 2 setae; basal cell bare.

Legs yellow-brown, dorsal tibiae darker. Hind coxae with dorsal, lateral and basal setal crests. Two hind tibial spurs present; the longer 0.1x length of hind basitarsus.

Gaster orange-brown grading to dark brown posteriorly, rectangular. T1 about 0.9x length of gaster (except in 1 specimen 0.5x). Basal fovea with thick compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. S1 with an anterior row of foveae and a posterior row of foveate grooves, separated by a narrow raised smooth ridge. Medial grooves with scattered setae at bases (Fig. 5.122).

Male unknown

Paratypes: (3 females; ANIC). **Qld.:** 1 female, 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC. **A.C.T.:** 1 female, 35.35 149.00, Honeysuckle Creek, 1-10 Apr 1985, IDN, JCC, Malaise trap/ethanol; 1 female, 35.19 148.51, Wombat Creek 750m, 6km E Piccadilly Circus, Mar 1985, JFL, TAW, MF-J, flight intercept/window trough trap.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland, Australian Capital Territory.

5.10.13 ***Moranila striata*** **sp.n.** (Map 44)

Holotype: female, ANIC.

Label details: "35.22S 148.50E/ Blundells Ck. 3km/ E of Piccadilly/ Circus, 850m, ACT/ Feb. 1984 Weir, Lawrence, Johnson" and "flight intercept/window/ trough trap".

Female (antennae missing)

Head dark metallic green, not triangular. Dorsal margin moderately concave. Face 1.7x as broad as long. Occipital carina complete but weak, posterior ocelli almost entirely behind occipital carina; back of head alutaceous. OD about equal to OOL. Vertex engraved reticulate, with scattered short setae.

Antennae inserted almost directly above clypeal margin, less than 0.5 torular diameters. Scrobes and entire face transversely striate, scrobes not carinate anteriorly. Genae smooth, malar groove complete. Malar space as long as vertical axis of eye. Genal carina wide, coarsely striate, with a row of setae. Oral margin between toruli slightly emarginate, sloping gently to offset genal carina. Mandible with broad, pointed lower tooth and 2 sharply pointed upper teeth.

Thorax dark, with metallic green lustre. Pronotum about half as broad as long, engraved reticulate/punctate, with regular short setation and a setal ring of about 14 short setae; setal bases punctate. Mesoscutum engraved reticulate/punctate; with 9 unpaired setae between notauli, setal bases in punctations. Notauli complete grooves. Scapulae engraved reticulate/punctate. Scutellum as long as broad, flat in lateral aspect; engraved reticulate; anterior pair of setae closer together than posterior pair. Frenal area delimited by incomplete line of punctations. Axillae delimited by groove apically, by deep fovea basally; smooth with faint longitudinal striations, carinate laterally. Dorsellum smooth, dorsellar fovea coarsely alveolate; remainder of metanotum smooth, furrow coarsely striate. Mesepisternum with smooth triangular depression, mesepimeron completely transversely striate.

Propodeum dark metallic green; area around spiracles smooth. Nucha short, globose, broader than long; alveolate-reticulate basally and rugulose-reticulate

apically.

Forewing without definite infumate patch. Marginal vein 1.4x longer than stigmal vein. Stigmal area setose. Postmarginal vein 0.8x length of stigmal vein. Costal cell slightly excised at apex; with 3 setae on apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein sinuate. Basal hairline not infumate, bare; basal cell bare; cubital hairline absent.

Legs orange, with brown tibiae. Hind coxae with conspicuous dorsal, lateral, and basal setal crests. Two hind tibial spurs present; the longer 0.2x length of basitarsus.

Gaster dark red-brown, longer than broad. T1 about 0.5x length of gaster. Basal fovea short, shallow; with compact setal tuft at base. Ovipositor projecting beyond end of gaster. S1 foveate anteriorly, medial ridge absent, grooved posteriorly, grooves longer than broad and with some sparse setation at bases.

Male

Head metallic blue.

Antennae inserted slightly less than 1 torular diameter above clypeal margin. Scape and flagellum orange, pedicel dark brown. F1-F4 and pedicel equal in length. Setae longer than segments of origin. Club 2.2 to 2.5x length of F1 (mean 2.35).

Forewing with slightly infumate patch. Marginal vein 1.4 to 1.6x length of stigmal vein (mean 1.53). Costal cell with 5 setae on margin. Submarginal cell only very slightly sinuate. Basal hairline very faintly infumate, with 6 setae; basal cell bare.

Paratypes: (2 males; ANIC). **A.C.T.:** 2 males, 35.22 148.50, Blundells Creek, 3km E of Piccadilly Circus, 850m, Feb 1984, TAW, JFL, M-LJ, flight intercept/window trough trap.

Other material examined: Type series only

Biology: Hosts are unknown.

Distribution: **Australia:** Australian Capital Territory.

5.10.14 ***Moranila strigaster*** **sp.n.** (Fig. 5.123; Map 10)

Holotype: female, NZAC

Label details: "NEW ZEALAND NN/ Mt Domett/ N. W. Nelson 1250m" and "30 Nov 1971/ G. Kuschel/ litter 71/167".

Female

Head very dark red-brown without metallic lustre to black with metallic blue and/or purple lustre; not triangular. Dorsal margin moderately concave. Face 1.5 to 1.8x as broad as long (mean 1.6). Occipital carina complete but weak; back of head alutaceous. Ocelli small, OD about 0.4x OOL. Vertex faintly engraved reticulate, with scattered short setae.

Antennae inserted about 1.5 torular diameters above clypeal margin. Scrobes shallow and smooth, not carinate anteriorly. Concolorous orange to medium brown. Pedicel elongate, F1 and F2 slightly broader than long to square, other funicular segments longer than or as long as broad. Club 0.8 to 1.1x length of funicle (mean 0.93). Genae smooth, malar groove complete but inconspicuous; malar groove remnant deep. Malar space shorter than vertical axis of eye. Genal carina wide, not striate, with a row of setae. Oral margin straight between toruli, sloping down to offset genal carina. Mandible with broad, sharp lower tooth and 2 upper teeth.

Thorax black with metallic lustre to very dark red-brown, without metallic lustre. Pronotum broader than long, faintly engraved reticulate; sparsely setose, with ring of about 8 short light setae; setal bases not reticulate. Mesoscutum faintly engraved reticulate; with 2 pairs of short setae between notauli, bases not reticulate. Notauli complete grooves. Scapulae faintly engraved reticulate. Scutellum as long as broad, flat in lateral aspect; engraved reticulate; anterior pair of setae slightly closer together than posterior pair. Frenal area only very faintly delimited by change in sculpture. Axillae delimited by groove apically, by deep fovea basally; faintly longitudinally striate, carinate laterally.

Dorsellum smooth, dorsellar fovea coarsely alveolate; remainder of metanotum smooth. Mesopleuron with smooth triangular depression, mesepisternum faintly transversely striate, mostly posteriorly.

Forewing with small faint to larger dark infumate patch. Marginal vein 1.7

to 2.7x longer than stigmal vein (mean 2.22). Postmarginal vein 0.8x shorter than stigmal vein. Stigmal area bare. Costal cell slightly excised at apex; 2 setae dorsally at apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein only slightly sinuate. Basal hairline not infumate, bare; basal cell bare; cubital hairline absent. Setation on disc sparse.

Legs yellow with brown tibiae to entirely brown. Hind coxae with dorsal, lateral, and basal setal crests. Single hind tibial spur present; 0.2x length of basitarsus.

Propodeum black with faint blue sheen to very dark red-brown without metallic lustre; entirely coarsely alveolate-reticulate excepting rugose strip on apex; area around spiracles smooth and shiny. Nucha short.

Gaster dark red-brown, paler apically. T1 about 0.9x length of gaster; coarsely longitudinally striate over most of surface. Compact setal tuft at base. Ovipositor projecting slightly beyond end of gaster. S1 with two rows of foveae present, separated by a medial smooth narrow ridge. Base of medial posterior foveae with a large tuft of foliaceous setae present (Fig. 5.123).

Male

Head black, with slight blue metallic lustre.

Antennae inserted at lower ocular level, about 2 torular diameters above clypeal margin. Scapes orange-brown, pedicel and flagellum orange-brown. Funicular segments very long and nodose; all subequal in length. Setae very long, at least 2x length of segments of origin. Club about 1.5 to 1.8x length of F1 (mean 1.64).

Frenal area delimited by a change in sculpture.

Forewing with very faint infumation. Marginal vein 2 to 2.2x length of stigmal vein (mean 2.1). Costal cell with about 5 setae on apical margin. Basal hairline infumate, with 1 seta; cubital hairline absent.

Striations on T1 less conspicuous than in female.

Paratypes: (7 females, 2 males; NZAC). **NN:** 1 female, Mt Fell, 13 Mar 1969, EWV, 1689; 1 female, Mt Domett, 1250m, 30 Nov 1971, GK, litter 71/167. **BR:** 1 male, 1 female, Mt Robert, 15 Mar 1968, EWV, 1521. **NC:** 1 male, 1 female, Arthurs pass, 9 Feb 1978, tussock, em 20 Feb 1978, AKW. **CO:** Rocklands Stn, 800m, Apr 1979, BIPB, pit trap in tussock. **SI:** 1 female, Mason Bay, 27 Feb 1968, EWV, 1505.

Area code not known: 1 female, Mt Fell, 13 Mar 1969, EWV, 1689.

Other material examined: (5 females; NZAC). **BR:** 1 female, Mt Robert, 15 Mar 1968, EWV, 1521. **CO:** 1 female, Old Man Range, 1372m, 20 Nov 1974, JCW, mixed moss and tussock 74/96. **MK:** 2 females, Lake Tekapo, Dec 1980, PQ, Malaise trap in tussock near pine plantation. **OL:** 1 female, Coronet peak, 1200m, Jan 1981, tussock, grasses, *Hebe*, alpine shrubs, swept, JSN, EWV.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **New Zealand:** NN, BR, MC, CO/ SI.

Remarks: Specimens of this species fall into two groups; one comprising females with a metallic lustre and yellow antennae and legs, no transverse funicular segments and more definite propodeal sculpture, and the other females without a metallic lustre, with darker antennae and legs, with F1 and F2 broader than long and with somewhat reduced propodeal sculpture.

5.10.15 ***Moranila viridivertex*** **(Girault)** (Figs 5.44, 5.45, 5.124, 5.125; Map 45)

Tomocera viridivertex Girault, 1927:333-334; Dahms, 1986:645. Transferred to *Moranila* by Bouček, 1988a:357.

Holotype: female, SAM.

Publication details: "S. Aust.: Melrose, Oct. (A. M. Lea). Two females".

Label details: Card labelled "Melrose/ S. Aust, Oct/ A. M. Lea" and "Type" and "Tomocera viridi-/ vertex Girault/ Type ♀" and "Tomocera/ viridivertex Gir/ South Australia./ TYPE".

Note: there is further type material in the QM, which Dahms (1986) refers to as syntypes. Girault labelled the SAM specimen quite clearly as "Type ♀" and this specimen is the holotype. Lectotype designation is not necessary. One of the specimens in the QM is labelled as "Cotype ♀" and is a paratype. The third specimen to which Dahms refers, from Stanthorpe, has no type status.

Female

Head orange, with continuous metallic green strip across vertex between eyes, in front of and behind occipital carina; also metallic green genal carina and around antennal toruli. Triangular; dorsal margin deeply concave. Face 1.5 to 1.7x broader than long (mean 1.6). Occipital carina complete; back of head alutaceous. OD about 0.5x OOL. Vertex alutaceous, with scattered short setae.

Antennae (Fig. 5.44) inserted less than 1 torular diameter above clypeus. Scrobes smooth, very weakly carinate anteriorly. Scape and pedicel orange-brown, flagellum brown. F1 broader than long, F2-F5 as long as broad; setae short. Club 0.7 to 0.9x as long as funicle (mean 0.8). Genae smooth, malar groove absent. Malar space longer than vertical axis of eye. Genal carina narrow, not striate, with a row of setae. Oral margin between toruli straight, sloping down to offset genal carina. Mandible with broad, pointed lower tooth and 2 blunt upper teeth.

Thorax dark metallic green; engraved reticulate. Pronotum entirely sculptured; with regular short setation and also 8 long setae in posterior setal ring, bases of setae in pronotal ring reticulate. Mesoscutum engraved reticulate/imbricate, with 2 to 3 pairs of setae between notauli, 2 pairs centrally and 1-2 unpaired setae; setal bases reticulate. Notauli complete grooves. Scapulae imbricate, with 1-2 pairs of setae. Scutellum as long as broad, convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair; setae reticulate basally. Frenal area delimited by faint line. Axillae delimited by groove apically, by fovea basally. Axillae alutaceous, with 2 pairs of setae with reticulate bases; laterally carinate. Dorsellum and dorsellar fovea alveolate; remainder of metanotum smooth, furrow striate over half its width. Mesepisternum with triangular depression, deeper dorsally and at the ventral point; mesepimeron almost all smooth with some lateral striation.

Propodeum dark, with metallic green lustre; alveolate at base of nucha, and irregularly reticulate apically, less sculptured around spiracle (Fig. 5.124). Nucha broader than long, globose.

Forewing bimaculate (Fig. 5.45), with an infumate patch posterior to apex of submarginal vein and a more diffuse patch below stigmal vein. Marginal vein 1.2 to 1.9x length of stigmal vein (mean 1.6). Postmarginal vein approximately 0.7x length of stigmal. Stigmal area sparsely setose. Costal cell slightly excised at apex; with

about 3 setae on apex of margin; ventral row of setae continuous, with partial second row. Submarginal vein sinuate. Basal hairline not infumate, setae absent or single seta present; basal cell bare.

Legs orange, tarsi darker dorsally. Hind coxae with thick dorsal, basal and lateral setal crests. Two hind tibial spurs present; the longer 0.4-0.5x length of basitarsus.

Gaster dark, with metallic green reflections; oval. T1 convex, about 0.8x length of gaster. Basal fovea short, shallow; with very thick compact setal tuft at base. Ovipositor short, scarcely projecting beyond end of gaster. Anterior 0.3x length of S1 coarsely rugose; posteriorly with a row of grooves/foveae, longer than broad. Bases of medial grooves with scattered setae (Fig. 5.125).

Male

Head black, with metallic green-blue lustre; not as strongly triangular as female. OD about 0.75x OOL.

Antennae inserted 1.5 to 2 torular diameters above clypeal margin. Antennal scapes honey yellow, pedicel and flagellum yellow-brown. F1-F4 equal in length, strongly nodose. Sensilla conspicuous; setae long, 2x length of segments of origin. Club 2 to 2.7x length of F1 (mean 2.2), with short setae.

Thorax black, with slight metallic blue tinge.

Propodeum black, with metallic green lustre.

Forewing hyaline. Marginal vein about 1.2 to 1.6x stigmal vein (mean 1.45). Costal cell with about 4 setae on apical margin. Basal hairline not infumate, with 2 setae; basal cell with scattered setae.

Gaster black, with metallic green lustre.

Paratype: (female; QM). Label details: "SYNTYPE/ T10069/ E.C.D. 1985" and "Tomocera viridi-/ vertex Girault/ cotype ♀" and "QUEENSLAND/ MUSEUM".

Other material examined: (149 females, 11 males; most in ANIC, other where stated). **W.A.:** 12 females, Yanchep Forest, c.65km N Perth, 21 Dec 1986, JSN (31.29 115.41); 11 females, Porongorup N.P., Jan 1987, JSN (34.41 117.55) (1 female in NZAC); 3 females, 2 males, Stirling Range N.P., Jan 1987, JSN (34.23 117.52) (1

female, 1 male in NZAC); 2 females, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12) ; 4 females, 1 male, John Forrest N.P., c25km E Perth, 23-27 Dec 1986, JSN (31.50 116.05); 1 female, Fitzgerald R. N.P., Quaalup area, 6-9 Jan 1987, JSN (34.19 119.22); 1 female, 19km W Munglinup, 4 Jan 1987, JSN (33.41 120.37). **S.A.:** 1 female, 34.45 135.49, 4km SWbyS Port Lincoln, 29 Nov 1992, IDN, JCC; 1 female, 33.20 137.06, 43km NNE Cowell, 28 Nov 1992, IDN, JCC; 1 female, Mt Barker, 500m, Adelaide, 30 Nov-2 Dec 1986, JSN (34.56 138.36); 1 female, Parra Wirra Rec.Pk., 50km NE Adelaide, 9 Dec 1986, JSN (34.44 138.56); 1 female, 34.38 135.27, nr Coffin Bay, 29 Nov 1992, IDN, JCC; 7 females, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.33). **Qld.:** 1 female, Acacia Ridge, Brisbane, ECD, 22 Dec 1976 (27.35 153.01)(QM); 2 females, Acacia Ridge, Brisbane, ECD, 19-20 Sep 1977 (QM); 1 male, 23.46 149.06, 2km S Horseshoe Lookout Blackdown Tableland, 23-24 Apr 1981, IDN; 1 male, 17.41 145.26, Millstream Falls N.P., 24-25 May 1980, IDN, JCC; 2 females, 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct. 1984, IDN, JCC; 1 female, 26.53 151.37, Russell Park, near Mt Mowbullan, 7 Oct. 1984, IDN, JCC; 1 female, Rockhampton, Mt Archer, 4 Dec 1976, ZB (23.22 150.31) (NHM). **N.S.W.:** 1 female, Grafton, 13 May 1980, JSN (29.41 152.56) (NHM). **A.C.T.:** 1 female, Canberra, Black Mt, 23 Oct 1976, ZB (35.16 149.06) (NHM); 1 male, Murrumbidgee R., nr Belconnen, 27 Nov 1989, emerged mid-late Dec 1990, CAMR, ex *Eriococcus* sp. on *Hibbertia obtusifolia* (35.14 149.02). **Tas.:** 1 male, 42.37 147.39, 5km W Buckland, 27 Jan 1983, IDN, JCC; 96 females, 3 males, 42.56 147.19, The Lea, 5 Feb. 1983, IDN, JCC (5♀♀ in NZAC). (Type 32.50 138.11)

Biology: *M. viridivertex* has been reared from *Eriococcus* sp. (P. J. Gullan, pers. comm.).

Distribution: **Australia:** Western Australia, South Australia, Queensland, Australian Capital Territory, Tasmania.

5.11 Genus *Ophelosia* Riley

Ophelosia Riley, 1890:249; Ashmead, 1904:328; Valentine, 1967:1129; Bouček, 1988a:353-354; Charles, 1989:226-227; Naumann, 1991:965. Type species *Ophelosia crawfordi* Riley; by monotypy.

Asaphomorphella Girault, 1913b:104-105. Type species *Asaphomorphella rousseaui* Girault; by original designation. Synonymised by Bouček, 1988a.

Female

Head orange-brown, with or without metallic lustre; dorsal margin from

weakly to moderately concave. Face from 1.3 to 1.9x broader than long. Occipital carina weak to strong, ocelli removed from margin by 0.1 to 1.0x OD. Vertex variously sculptured, with scattered short to long setae; OD less than to subequal to OOL.

Antennae inserted less than 1 torular diameter above clypeal margin. Scrobes from not carinate to moderately carinate anteriorly, smooth to entirely sculptured. Club from 0.6 to 1.3x length of funicle. Malar groove present or absent; malar space 0.5 to 1.3x vertical axis of eye. Genae smooth to sculptured; genal carina narrow to wide, striate or not. Oral margin variously shaped; clypeus produced or not. Genal carina offset or not offset from clypeal margin. Mandible with broad lower tooth and 2 narrow upper teeth.

Thorax ranging from orange to dark orange-brown; with or without metallic green reflections. Pronotum from 2 to 4x as broad as long. Setal ring present, with 8 to 14 setae; setal bases simple. Mesoscutum variously sculptured; with regular and paired setae, or paired setae only; setal bases simple. Notauli complete grooves. Scapulae variously sculptured. Scutellum about as long as wide, flat to slightly convex in lateral aspect; variously sculptured; with 2 pairs of setae. Frenal area may or may not be delimited, if so only by faint line or change in sculpture, never by groove. Axillae variously sculptured. Dorsellum sculptured or not; declivous. Fovea rugose to alveolate, metanotal furrow smooth to coarsely striate. Mesepisternum with shallow triangular depression; mesepimeron smooth to sculptured, without dimples.

Median carina of propodeum present anteriorly; costula present laterally to almost absent. Sculpture variously rugose/reticulate/alveolate; smooth to sculptured around spiracles. Nucha square or longer than broad; smooth or sculptured at apex. Apical margin weakly to deeply emarginate medially.

Forewing complete or variously reduced. Complete wing with faint to dark infumate patch posterior to stigmal vein and distal marginal vein. Marginal vein from 1.7 to 4.6x length of stigmal vein. Stigmal area from bare to sparsely setose. Postmarginal vein from slightly shorter than to slightly longer than stigmal vein. Costal cell very slightly excised at apex. Costal margin with 1 to 15 setae on apical margin. Ventral line of setae in costal cell complete or interrupted, with or without partial second line. Basal hairline with a line, strip or long tuft of setae, faintly or

strongly infumate; basal cell bare or with scattered setae; cubital setal line present or absent. Speculum present, narrow to wide; linea calva not delimited. Marginal fringe moderately long.

Single hind tibial spur present; from 0.6 to 1.2x length of basitarsus, usually 0.8x length or longer. Hind coxae variously setose.

Gaster variously setose at base; setae not extended down margin of fovea. T1 0.5 to 0.9x length of gaster. Collar of S1 variously sculptured anteriorly, grooved posteriorly; surface not striate; setae absent.

Male

Antennae inserted from slightly less than to slightly more than 1 torular diameter above clypeal margin. Funicular segments from subequal in length to F1 longer than F2 to F4; setae short to long. Club from 1 to 6.4x length of F1.

Forewing hyaline or weakly to strongly infumate under distal marginal and stigmal veins. Basal hairline weakly to strongly infumate, with a line, strip or tuft of setae; cubital hairline infumate or not. Marginal vein from 1.5 to 5.2x length of stigmal vein. Postmarginal vein subequal to stigmal in length.

Biology: The genus includes primary parasitoids and egg predators of margarodids and pseudococcids, and occasional hyperparasitoids. Some species, *e.g. O. crawfordi* and *O. hypatia* are host specific and niche-specific to the extent of being exclusively egg predators of *Icerya* Signoret (Margarodidae). Others, most notably *O. bifasciata* are more general and behave as egg predators and parasitoids and also on occasion as hyperparasitoids via encyrtids on pseudococcids or on aphids. *O. charlesii* is almost exclusively a predator of pseudococcid ovisacs but there are some records from New Zealand of individuals behaving as parasitoids of *Pseudococcus* species. *O. indica* is a pseudococcid parasitoid.

Distribution: *Ophelosia* has been recorded from North America, India, PNG, Java, Australia, the Chathams and New Zealand. The genus undoubtedly occurs throughout Asia but has not been collected. *Ophelosia crawfordi* occurs in North America, presumably having been introduced along with its host, *Icerya purchasi*; as well as

in Java, East Australia, and New Zealand. Two species appear to be endemic to PNG but are only represented by one specimen each. Of the more widespread species, *O. bifasciata* is distributed throughout Australia, New Zealand and PNG; and *O. keatsi* occurs in Australia, New Zealand and the Chathams. Two brachypterous and one narrow-winged species are endemic to New Zealand. Two species are found throughout mainland Australia and Tasmania; two in East Australia; one in East Australia and Tasmania and one in East Australia and New Zealand. One species is restricted to Western Australia and one to Tasmania.

Key to the Australasian species of *Ophelosia* Riley, females and males.

1. Petiole longer than broad, conspicuous ..... *missimi*
Petiole not longer than broad, not conspicuous 2

2. ♀ club long, 1.5x length of funicle; all funicular segments longer than broad ..... *biaki*
All ♂♂, ♀ club at most as long as funicle; funicular segments of variable lengths 3

3. Antennal scrobes transversely straite (Fig. 5.134) 4
Antennal scrobes smooth (Fig. 5.127) 5

4. Propodeal nucha longer than broad; ventral line of setae in costal cell continuous ..... *crawfordi*
Propodeal nucha square; ventral line of setae in costal cell broadly interrupted ..... *rieki*

5. Face square, malar space longer than vertical axis of eye ..... *odiosa*
Face broader than long, malar space variable 6

6. Scrobes heavily carinate anteriorly, carina extended down almost to lower ocular level, crescent shaped ..... *saintpierrei*

Scrobes carinate or not, but carina not as above 7

7. ♀ only: F1 in antenna almost invisible, funicle apparently 4 segmented .... *josephinae*
♂♂ or ♀♀: F1 may be square or transverse but 5 segments are visible 8

8. Wings reduced, at most reaching half way down T1 (Figs 5.48, 5.56) 9
Wings reaching end of gaster 12

9. Occipital carina weak, hind ocelli removed from margin by about 1 OD 10
Occipital carina sharp, hind ocelli less than 0.5 OD from margin 11

10. ♀ forewing with infumate basal hairline, disc with about 40 setae and rudimentary stigmal vein present (Fig. 5.56); ♂ unknown ..... *mcglashani*
♀ forewing without infumate basal hairline, disc with fewer than 10 setae, stigmal vein absent (Fig. 5.46) ..... *australis*

11. Wings reaching past end of propodeum, reduced but with a portion of setose disc (Fig. 5.60) ..... *tasmaniensis*
Wings extremely reduced, not reaching end of propodeum, without setose disc (Fig. 5.48) ..... *brevisetosa*

12. Wing long but narrow (Fig. 5.59); occipital carina weak; ocelli removed from occiput by 1OD ..... *stenopteryx*
Wing normal width; occipital carina strong; ocelli removed from occiput by less than half of one OD 13

13. Setal tuft on forewing thick, strong, triangular; composed of setae as long as proximal submarginal setae ..... *bifasciata*
Setae on basal hairline composed of line, strip or tuft but always shorter than proximal submarginal setae 14

14 Clypeal margin and genal carina not offset, genal carina runs straight into clypeal margin (Fig. 5.136); mandibles inconspicuous, setal strip present (Fig. 5.53) 15

Clypeal margin and genal carina offset (Fig. 5.127); setal strip or line present 16

15 Costal cell in ♀ with sparse ventral setation, only amounting to a few setae; antenna in ♂ with long club, about 6x length of F1 ..... *indica*

Costal cell in ♀ with continuous ventral row of setae; club in ♂ 1.4 to 1.9x length of F1 ..... *hypatia*

16. Costal cell in ♀ margined with setae for almost 0.5x length; ♀ basal cell setose; ♂ antennae inserted more than 1 torular diameter above clypeal margin ..... *leai*

Costal cell in ♀ margined with setae for less than 0.5x length; ♀ basal cell bare; ♂ antennae inserted less than one torular diameter above clypeal margin 17

17. Antennal scrobes not carinate; ♀ cubital hairline partly present; m:s ratio over 3; ♂ cubital hairline absent ..... *keatsi*

Antennal scrobes weakly carinate; ♀ cubital hairline absent; m:s ratio less than 2.5; ♂ cubital hairline present (Figs 5.49♀, 5.51♂) ..... *charlesii*

5.11.1 ***Ophelosia australis*** **sp.n.** (Figs 5.46, 5.126; Map 11)

Holotype: female, NZAC.

Label details: "Upcot saddle/ 2750' 28.ix.65/ J. I. Townsend" and "Moss in Tussock/ and pasture".

Female

Head orange-brown, dorsal margin weakly concave. Face 1.4 to 1.6x broader than long (mean 1.52). Occipital carina present but weak, ocelli removed from margin by slightly less than 1 OD. OD about 0.75x OOL. Vertex alutaceous, with

scattered long setae.

Antennae inserted slightly less than one torular diameter above clypeal margin. Scrobes not sculptured; not carinate anteriorly. Antennal scape orange, pedicel and flagellum medium brown. Funicular segments all broader than long. Club 0.7x to subequal to funicle in length (mean 0.87). Lower face smooth, genal carina narrow, not striate. Malar groove complete, inconspicuous; malar space 0.5x long axis of eye. Genal carina narrow, not striate. Clypeal margin slightly produced, oral margin concave between toruli, sloping to offset genal carina. Mandible with sharp lower tooth and 2 blunt upper teeth.

Thorax orange-brown. Pronotum alutaceous, with short regular setae and with a setal ring of about 10 setae; smooth posterior of ring. Mesoscutum broader than long, imbricate; with sparse regular setae and pair of long setae at scutellar boundary. Scapulae imbricate. Scutellum broader than long, flat in lateral aspect; engraved reticulate. Frenal area not delimited, except by change in sculpture to smooth in posterior quarter. Axillae smooth. Dorsellum reduced,smooth; furrow reduced, alveolate; rest of metanotum smooth. Mesepisternum with triangular depression, mesepimeron smooth.

Propodeum orange-brown; median carina present anteriorly, costula present laterally. Sculpture rugose-reticulate, smooth around spiracles and on apex of nucha. Nucha broader than long, very shallowly emarginate apically. Tuft of setae at spiracles long, conspicuous.

Forewing (Fig. 5.46) reduced, reaching slightly past propodeum, with submarginal and marginal veins present, stigmal and postmarginal absent. Disc setose; very reduced, with about 13 setae. Wing weakly infumate, stronger cubital hairline, basal hairline and distally. Costal cell reduced to a thin strip; with no setae on apical margin, but some ventral setae. Setae on submarginal and marginal veins very long. Submarginal vein with 2 setae. Basal hairline infumate; basal cell bare; not margined by cubital hairline. Wing fringed distally.

Legs orange. Hind tibial spur 0.8x length of hind basitarsus. Hind coxae with sparse dorsal, basal and lateral setal crests.

Gaster orange-brown. Basal fovea with scattered setae at base. T1 0.6x length of gaster. Ovipositor exerted. S1 with moderately spaced long grooves, interrupted

medially by a smooth horizontal ridge (Fig. 5.126).

Male

Head dark red-brown, with faint purple metallic lustre. OD about 0.5x OOL.

Antennae inserted 1 torular diameter above clypeal margin; concolorous mid-brown. F1 longest flagellar segment, F2-F4 shorter than F1, all subequal in length and slightly longer than broad. Club 1.6 to 2x longer than F1 (mean 1.76). Setae shorter than segments of origin.

Thorax orange-brown, with faint purple-green metallic lustre.

Propodeum and gaster orange-brown.

Forewing reduced, reaching slightly past propodeum, with submarginal and marginal veins present, rudimentary stigmal, without postmarginal vein. Reduced setose disc present, with at least 50 setae. Basal hairline not infumate, with 1 or 2 setae. Costal cell reduced, scarcely excised at apex, with 6 setae on apical margin. Speculum present, linea calva absent. Wing fringed posteriorly and distally.

Legs orange-brown, sparse lateral, dorsal and basal crests of setae present.

Paratypes: (10 females, 3 males; NZAC, in LU where stated). **MB:** 1 female, Upcot Saddle, 830m, 28 Sep 1965, JIT, moss in tussock and pasture. **BR:** 3 males, S Victoria Range, nr Rahu Sdle, 1310m, 27 Jan 1972, JCW, litter and moss. **CO:** 1 female, Lindis Pass, 971m, 11 Jan 1971, JSD, litter; 3 females, Rocklands, 800m, 400m, 14-28 dec 1979, B.I.P.Barrett, pit trap in tussock; 1 female, Rocklands Stn, 800m, Apr 1979, BIPB, pit trap in tussock; 1 female, Lindis Pass, 971m, 11 Jan 1971, JSD, Litter 71/9. **MC:** 1 female, Arthur's Pass, 915m, 14-23 Apr 1984, JWE, yellow pan in subalpine scrub (LU). **SC:** 1 female, Hunters Hills, Rd to Meyer's Pass, 430m, 20 Jan 1966, GWR, in moss. **SL:** 1 female, Hokonui Hills, 365m, Sdle W Dollamore Park, 2 May 1968, JCW, Litter.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **New Zealand:** - / BR, CO, MC, SL.

5.11.2 *Ophelosia biaki* sp.n.

Holotype: female, BPBM.

Label details: "NEW GUINEA: NETH./ Biak Airport/ May 19-24, 1959" and "T. C. Maa/ Collector/ BISHOP".

Female

Head orange-brown, without metallic lustre; dorsal margin moderately concave. Face 1.43x broader than long. Occipital carina strong, posterior ocelli removed from margin by 0.1 OD. Ocelli clear; OD greater than or equal to OOL. Vertex finely transversely rugose, with scattered long setae.

Antennae inserted well below lower eye level, less than half a torular diameter above clypeal margin. Scrobes weakly carinate anteriorly; smooth. Antennae orange; all flagellar segments broader than long, ring-like, except F1 which is only slightly broader than long. Club 1.3x length of funicle. Genal carina wide; not striate. Malar groove absent; malar space 0.6x long axis of eye. Oral margin very slightly convex between toruli; genal carina not offset.

Thorax orange-brown, without metallic reflections. Pronotum broader than long; with regular short pilosity over entire surface and about 12 setae in pronotal ring; sculptured over entire surface, smooth band absent. Mesoscutum imbricate, with regular pilosity, and a pair of long setae at posterior edge, abutting scutellum. Scapulae imbricate with regular pilosity. Scutellum more or less square, convex in lateral aspect; engraved reticulate, grading to longitudinally striate apically; anterior pair of setae closer together than posterior pair. Frenal area not delimited. Axillae longitudinally striate. Mesepisternum with depressed triangular area, slightly striate; mesepimeron glabrous. Metapleuron glabrous. Dorsellum smooth, wide and declivous, dorsellar fovea alveolate; metanotum smooth, metanotal furrow coarsely striate.

Propodeum light orange; median carina present anteriorly only, costula present laterally; reticulate anteriorly, rugose-reticulate posteriorly; smoother round spiracles and at apex of nucha. Nucha square, apical margin sightly emarginate.

Forewing infumate at basal hairline and with a small diffuse infumate patch under stigmal vein. Marginal vein 2.5x length of stigmal vein. Postmarginal vein

about same length as stigmal. Stigmal area bare. Costal cell with 12 setae on apical cell margin; ventral setal row continuous, with a partial second row. Basal hairline with strip of 13 setae shorter than submarginal setae; basal cell bare; not margined by cubital row of setae. Speculum present.

Legs and coxae orange-brown. Hind tibial spur longer than basitarsus (about 1.2x length). Hind coxae with lateral setal crest, without dorsal and ventral crests.

Gaster orange, grading to red-brown apically; elongate. Basal fovea with scattered setae at base. T1 0.9x length of gaster. Ovipositor projecting beyond end of gaster. S1 with widely spaced longitudinal grooves interrupted by a horizontal smooth raised patch.

Male unknown.

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Papua New Guinea**.

5.11.3 ***Ophelosia bifasciata*** **Girault** (Figs 5.47, 5.127, 5.128, 5.129, 5.130; Maps 12, 46)

Ophelosia bifasciata Girault, 1916a:228; Dahms, 1983:136-137; Bouček, 1988a:354.

Holotype: female, USNM.

Publication details: "Described from one female in U.S.N.M. labelled "Australia. Koebele. From Dep. Agric. 12." Associated with coccinellid larvae."

Label details: "12" and "Australia/ Koebele" and "From Dept./ Agriculture" and "1968♀/ Type" and "Ophelosia/ bifasciata/ ♀ type. Gir."

Ophelosia viridinotata Girault, 1916a:228; Dahms, 1986:639; Bouček, 1988a:354. **syn.n.**

Holotype:	female, USNM
Publication details:	"Described from a female labelled "Australia. Koebele." *Type*: U.S.N.M., the above female."
Label details:	"Australia/ Koebele" and "Type/ 19690/ USNM" and "Ophelosia/ viridinotata/ Gir ♀ type".

Asaphomorphella rousseaui Girault, 1913b:104-105; Dahms, 1986:480. Transferred to *Ophelosia* by Bouček, 1988a:354. **syn.n.**

Holotype:	female, QM
Publication details:	"*Hab.*-South Australia: Port Lincoln (A. M. Lea)."
Label details:	"Asaphomorphella/ rousseaui Gir/ ♀ type"

Female

Head entirely orange-brown to dark brown along occipital carina; dorsal margin deeply concave. Face 1.3 to 1.7x broader than long (mean 1.45). Occipital carina strong, ocelli less than 0.1 OD from occipital carina. Back of head alutaceous. OD greater than OOL. Vertex finely transversely striate, with scattered long setae. Eyes minutely hairy.

Antennae (Fig. 5.47) inserted less than half a torular diameter above clypeal margin. Scrobes smooth (Fig. 5.127), weakly to moderately strongly carinate anteriorly. Scapes orange-brown, pedicel and flagellum dark brown. F1 broader than long, F2 to F4 square, F5 slightly broader than long; setae short. Club 0.8 to 1x length of funicle (mean 0.89). Genae smooth and shiny. Malar groove complete; malar space 0.5x long axis of eye. Genal carina narrow, not striate, with row of setae. Clypeus slightly produced, oral margin between toruli straight, sloping down to offset genal carina (Figs 5.127, 5.128). Mandibles with pointed lower tooth and 2 rounded upper teeth.

Thorax ranging in colour from entirely orange-brown, with very faint metallic green/blue/purple reflections through orange-brown with dark brown markings and strong metallic lustre (often axillae and frenum, or with medial dark area) to entirely

dark brown. Pronotum imbricate anterior to setal ring, alutaceous posterior. Setal ring with 10-12 setae. Mesoscutum imbricate, covered with regular pilosity and a pair of long setae at posterior end. Scapulae alutaceous, with several pairs of setae and regular pilosity. Scutellum slightly convex in lateral aspect, more or less square; alutaceous; anterior pair of setae closer together than posterior pair. Frenal area delimited only by a change of sculpture to mainly smooth with faint longitudinally striations. Axillae smooth, metallic reflections very prominent; with several pairs of setae. Dorsellum smooth, dorsellar fovea alveolate; metanotum smooth, metanotal furrow coarsely striate. Mesepisternum with very shallow depression, slightly striate, mesepimeron smooth.

Propodeum ranging from orange-brown to dark brown and black anteriorly. Median carina present anteriorly, costula present laterally (Fig. 5.129); reticulate laterally, above costula, rugose-reticulate below costula; smooth around spiracles. Nucha about as long as wide. Tuft of setae at spiracle conspicuous, with short horizontal carina extending horizontally from spiracle to edge of propodeum. Apical margin slightly emarginate medially.

Forewing with large diffuse infumate patch posterior to marginal and stigmal veins. Marginal vein 2.3 to 3.5x length of stigmal vein (mean 2.8). Postmarginal vein subequal to stigmal vein in length. Stigmal area sparsely setose. Submarginal vein with about 8 setae. Costal cell with 1 to 3 setae on apex of margin. Ventral row of setae ranging from broadly interrupted medially to narrowly interrupted medially to continuous, with partial second row. Basal hairline infumate, with a triangular tuft of dark setae, upper setae as long as proximal submarginal setae, lower setae short, totalling more than 40 setae; basal cell bare; cubital hairline absent. Wide speculum present.

Legs orange-brown, mid and hind tarsiae darker. Hind tibial spur 0.9x length of hind basitarsus. Hind coxae with lateral crest of setae, dorsal surface ranging from bare to sparsely setose, sparse ventral and basal patches of setae present.

Gaster oval, orange-brown, darker centrally and anteriorly. T1 0.8-0.9x length of gaster. Basal fovea with scattered setae at base. Ovipositor exerted. S1 with widely spaced grooves anteriorly (grooves as long as broad medially), medial ridge irregularly alveolate and laterally and posteriorly grooved (grooves longer than broad)

(Fig. 5.130).

Male

Head dark brown, with metallic green reflections. Ocelli red.

Antennae inserted about 1 torular diameter above clypeal margin. Scape yellow-brown, flagellum mid-brown. Funicular segments not nodose, setae slightly shorter than segments of origin. F1 slightly longer than other segments. Club 1.4 to 1.8x length of F1 (mean 1.6). Malar groove complete, conspicuous.

Thorax dark red-brown, with metallic green reflections.

Propodeum dark brown-black anteriorly, orange-brown posteriorly.

Hind coxae with lateral and ventral pilosity, basal crest absent; some scattered setae.

Forewing faintly infumate to hyaline posterior to marginal and stigmal veins. Marginal vein 1.5 to 2.4x length of stigmal vein (mean 1.93). Costal cell margined setose for slightly less than half its length. Basal hairline very faintly infumate, with sparse strip of about 8 setae; basal cell sparsely setose; cubital row of setae present.

Gaster dark orange-brown anteriorly, grading to brown-black posteriorly; almost square. T1 0.95x length of gaster.

Material examined: **Papua New Guinea:** (4 females; BPBM). 4 females, NE, Morobe Prov, Wau, Namie Rd, 1240m, 23 VI 1984, pyrethrum fog of *Castanopsis acumin alissima* mature canopy, W.C. Gagne and UREP session III, colls. sample #14, tree #3314 (BPBM).
Australia: (185 females, 63 males; ANIC, in SAM, UQIC, QM, WARI where stated). 6 females, 3 males, locality not stated, Australia, Koebele (USNM). **W.A.:** 2 males, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12); 8 females, Yanchep, c50km N Perth, 20 Dec 1986, JSN (31.29 115.41); 2 females, 6 males, Avon Valley N.P., c50km NE Perth, 25 Dec 1986, JSN (31.36 116.13); 1 female, 13km S Norseman, 29 Dec 1986, JSN (32.20 121.47); 1 female, 34.10 115.18, 21 km E by N Dianella, 5 Oct 1981, IDN, JCC; 1 female, 2 males, 33.37 115.29, Ludlow, 2 ♂♂, 2 Nov- 22 Dec 1980, 1 ♀, 2 Nov- 23 Dec 1981, S.J.Curry, Malaise/Tuart forest; 1 male, Walpole-Nornalup N.P., 17-21 Jan 1987, JSN (35.06 116.45). **S.A.:** 9 females, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.33); 11 males, Loxton, Solora, 11 Feb 1991, J.Altmann, ex *Pseudococcus* sp. on grapefruit (34.27 140.34); 11 females, 9 males, Lab. cult. stock from Loxton, Oct 1978, G.O.Furness, ex *Pseudococcus longispinus* (USNM); 1 female, host collected at Loxton, Solora orchards, 19 Feb 1992, J.A.Berry, ex *Pseudococcus* on grapefruit; 21 females, 3 males, hosts collected at Loxton, Solora orchards, 27-28 Feb 1993, J.A.Berry, ex *Pseudococcus calceolariae* on grapefruit,

emerged ex mummies, Mar 1993; 1 female, Adelaide, Government House, 18 Jun 1953, ex *Planococcus citri* (Risso) on orange (34.56 138.36); 2 females, Berri, pears, em 24 June 1971, G.Furness, ex mealybug mummies (34.17 140.36); 2 females, 31.33 138.36, Wilpena Pound Gap, 5-6 Nov 1987, IDN, JCC; 1 female, 31.35 130.22, 54km W by S Nullarbor, 17 Sep 1981, IDN, JCC; 1 female, Renmark, at light, Jan 1980, R.Laughlin (34.10 140.45) (SAM); 1 female, 1 male, Aldinga Sellicks Beach Res., Malaise trap, 25 Mar- 13 Apr 1987, E.Matthews, J.Forrest (35.20 138.27) (SAM); 1 female, Morgan, 20 Mar 1964, coll. as pupae from woolly mass surrounding mealybugs infesting *Myoporum insulare* (34.02 139.40) (SAM); 45 females, 2 males, Waikerie, Feb 1956, ex *Pseudococcus* sp., on *Myoporum* (identified as *O. crawfordi* by H. Compere) (WARI) (34.11 139.59); 1 female, 33.32 135.30, 24km W by N Lock, 30 Nov 1992, IDN, JCC, flowers *Eucalyptus*; 1 female, 34.21 139.29, Brookfield Cons. Pk., 24-26 Nov 1992, IDN, JCC; 1 female, 34.21 139.32, Brookfield Cons. Pk., 26 Nov 1992, IDN, JCC, on flowers *Cratystylis conocephala*; 1 female, 33.46 135.06, Lake Tungketta, 30 Nov 1992, IDN, JCC. **Qld:** 1 female, Goondiwindi, 10 July 1993, JAB, ex *Pseudococcus* sp. mummies on citrus (28.33 150.18); 1 male, Carnarvon N.P., 30 Jun 1993, J.A.Berry, ex *Pseudoripersia turgipes* Maskell on *Casuarina cunninghami* (24.55 148.05); 4 females, Mulgrave Rd, Bruce highway, 1/2km S Gordonvale, 13 Apr 1987, ECD, GS, (17.06 145.47) (QM); 1 female, Bald Mt Area, 3-4000 ft, via Emu Vale, S.E.Qld, 2-27 Jan 1971, S.R.Monteith (28.14 152.25); 3 females, 1 male, Mundubbera, Jan 1992, ex citrus mealybug, det. C.J.Burwell (25.35 151.18) (UQIC); 1 female, Braemar SF via Kogan, 15-19 Oct 1979, GBM, Pyrethrum on *Capparis* (27.11 150.52) (QM); 1 female, Brisbane, Acacia Ridge, Oct 1976, ECD, Malaise trap (27.35 153.01) (QM); 1 female, Mt Glorious, SEQ, 27 Apr- 26 Oct 1989, A.Hiller, Malaise trap (27.20 152.46) (QM). **N.S.W.:** 1 male, 31.17 142.18, Homestead Gorge, Mootwingee N.P., 7-13 Oct 1988, E.D.Edwards, Malaise trap/ethanol; 1 female, Eastwood, 1931, R.W.Burrell (33.47 151.05) (USNM); 2 females; Eastwood, 29 Dec 1930, from bandages (identified as *Ophelosia viridinotata* by Gahan) (USNM); 3 females, Armidale, Feb- Apr 1992, S.Asante, ex *Parapriasus australiasiae* (Aphidiidae) (30.29 151.40); 2 females, 5 males, Armidale, 2 ♀♀, 21 Feb 1992, 5 ♂♂, Feb- Apr 1992, S.Asante, ex *Eriosoma lanigerum* (Aphididae) on apple; 5 females, 14 males, Armidale, Dec 1992, S.Asante, ex *Eriosoma lanigerum* (Aphididae) on apple; 2 females, The Creel, Thredbo, 26 Aug 1965, E.F.Riek (36.30 148.19); 2 females, 31.87 151.25, Polblue Swamp, Barrington Tops SF, 17 Nov 1981, TAW, pyrethrin spray on *Eucalyptus*; 1 female, 35.36 149.54, Monga S.F., 18 Feb 1983, IDN, JCC; 1 female, Sheepstation Creek, 16 km NE of Wiangaree, 600m, 13 Jun- 24 Aug 1982, S&J Peck, SBP 36, FIT, rainforest (28.24 153.02); 2 females, Broken Hill, NSW, 20 Nov 1949, E.F.Riek, *Acacia* fruit galls (31.58 141.27); 1 male, 32.51 141.37, 100km SbyE Broken Hill, 3-13 Oct 1988, E.D.Edwards, Malaise trap/ethanol. **A.C.T.:** 11 females, 2 males, Blundell's, FCT, 30 Apr 1930, M.Fuller, hyperparasitoid of Lepidoptera (35.21 148.50); 1 male, Canberra, 21 May 1948, EFR (35.18 149.08); 1 female, Canberra, 23 July 1948, E.F.Riek; 1 female, Canberra, 18 Mar 1952, EFR; ?1 female, 35.19 148.51, Wombat Creek, 750m, 6km E Piccadilly Circus, Aug 1985, JFL, TAW, M-LJ, FI/window trough trap; 1 female, 35.22 148.48; Piccadilly Circus, 1240m, May 1984, JFL, TAW, M-LJ, FIW/trough trap; 2 females, 35.22 148.50, 850m, Blundells Creek, 3km E of Piccadilly Circus, 1 ♀, 13/11/1984, 1 ♀, Jan 1985,

JFL, TAW, M-LJ, FIT/window trough trap; 1 female, 35.35 149.00, Honeysuckle Creek, 21-31 Mar 1985, IDN, JCC, Malaise trap/ethanol; 6 females, 8 males, Canberra, 10 Aug 1950, EFR; ?ex coccinellid host; 1 female, 1 male, Canberra, ♀, 15 Feb 1951, ♂, 10 Aug 1950, EFR (UQIC); 1 female, 2 males, Cotter, 16 Feb 1953, LRC, woolly coccid complex, free in sac with dead female and some live young, *Kunzea* sp.(35.20 148.58). **Vic.:** 1 female, 18km NW by N Omeo, 28 Feb 1980, IDN, JCC (37.00 147.32); 1 female, Hamilton, 24 Jul 1948, C.Stephens (MV) (37.45 142.02).

New Zealand: (20 females, 27 males; NZAC). **ND:** 3 females, Kerikeri, 5 Mar 1991, JGC, ex *Pseudococcus longispinus* mummy on persimmon. **AK:** 2 females, Mt Albert, MARC, 5 Apr 1991, JGC, 1♀ ex *Anagyrus fusciventris* (Encyrtidae) in *Pseudococcus longispinus* persimmon, 1♀ ex *P. calceolariae* mummy on persimmon; 2 males, Glenfield, 21 Nov 1990, D.Steven, ex *P. longispinus*; 1 female, Glenfield, 27 Apr 1987, D.Steven, on desk; 13 females, 26 males, Auckland, Takapuna, 22 Apr 1966, P.S.Crowhurst, ex *Nipaecoccus aurilanatus* on *Araucaria excelsa*, 1208; 2 females, Auckland, Alison Park, 15 Feb 1966, P.S.Crowhurst, ex *Nipaecoccus aurilanatus* (Maskell) on *Araucaria excelsa*. **BP:** 1 female, Edgecumbe, 14 Apr 1990, JGC, reared ex *Pseudococcus longispinus* mummies from willow shelter in kiwifruit orchard. **HB:** 1 female, Havelock Nth Research Orchard, 31 May 1983, JGC, from mealybugs on apples, Opou Band 3, *P. calceolariae;* 1 female, Havelock Nth, 23 Apr 1991, JGC, ex *Pseudococcus calceolariae* ovisac; 1 male, Havelock Nth, 24 Apr 1991, JGC, ex *Pseudococcus* mummy. **GB:** 1 female, Matawhero, 30 July 1989, JGC, ex *Pseudococcus sp.* on grapevine; 1 female, Manutuke, Opou vineyards, 31 May 1983, JGC, ex *P. calceolariae*; 1 male, Gisborne, 8 Aug 1989, JGC, ex *Pseudococcus* sp.; 2 females, Ormond, 27 Feb 1991, JGC, ex *Pseudococcus* mummies on grapefruit. **WO:** 1 male, Ohinewai, 5 Apr 1991, D.Steven, ex *Pseudococcus longispinus* mummy.

Distribution: **Papua New Guinea; Australia:** Western Australia, South Australia, Queensland, New South Wales, Australian Capital Territory. **New Zealand:** AK, BP, HB, GB, WO.

Biology: Reared from *Pseudococcus calceolariae*; *P. calceolariae* mummies on persimmon; *Pseudococcus calceolariae* ovisacs; *Pseudococcus longispinus*; *Pseudococcus longispinus* mummies from *Salix* (Salicaceae) shelter in kiwifruit orchard; hyperparasitic on *Anagyrus fusciventris* (Encyrtidae) in *P. longispinus Planococcus citri* (Risso) (Pseudococcidae); *Nipaecoccus aurilanatus* on *Araucaria excelsa* R. Br. (Araucariaceae); *Pseudoripersia turgipes* (Maskell) (Pseudococcidae) mummies on *Casuarina cunninghami* (Casuarinaceae); ex mealybug mummies; ex *Parapriasus australiasiae* (Aphididae); *Eriosoma lanigerum* on apple; woolly coccid

complex, free in sac; collected as pupae from woolly mass surrounding mealybugs infesting *Myoporum insulare*; hyperparasitoid of Lepidoptera; ex coccinellid host; ?*Acacia* fruit galls.

The above records document *O. bifasciata* as an pseudococcid egg predator and a primary parasitoid of pseudococcids; the species has also been reared from Aphididae, presumably as a hyperparasitoid, and as a hyperparasitoid of *P. longispinus* via an encyrtid. There are two records, one as a hyperparasitoid via a lepidopteran and one as a coleopteran parasitoid that I consider to be unreliable; along with the record from *Acacia* fruit galls.

Remarks: Girault designated type specimens labelled *Ophelosia keatsi regis*, *Ophelosia bifasciata infausta* and *Ophelosia hypatia multiseta*; but no publications have been found containing these names. All specimens are deposited in QM, they are indistinguishable from *O. bifasciata;* except in the specimen labelled *O. keatsi regis*, the ventral line of setae in the costal cell of the ♀ forewing is broadly interrupted. However since there exists a gradient within *O. bifasciata* from a complete ventral setal line through narrowly interrupted to a broadly interrupted ventral line, without any other characters consistently varying I can see no reason to designate any separate species. Details of the specimens are given below:

Ophelosia bifasciata infausta Girault

Deposition: QM

Label details: Card: "Ophelosia ♀/ bifasciata infausta/ Gir. Type" and under "Window, Indoroopilly/ 10 Oct. 1929."and "ON LOAN FROM/ QUEENSLAND MUSEUM/ BRISBANE".

Slide: "Ophelosia bifasciata ♀/ infausta Gir., Type/ Indoroopilly, window x.10.1929" and label for *Ophelosia aligherini.*

Ophelosia hypatia multiseta Girault.

Deposition: QM

Label details: Card: "Ophelosia ♀/ hypatia multiseta/ Gir. Type" and "QUEENSLAND/ MUSEUM".

Slide: "Ophelosia ♀/ hypatia multiseta/ Gir. Type./ (inner)"

Ophelosia keatsi regis Girault, 1927:334.

Deposition: QM

Label details: Card: "Ophelosia ♀/ keatsi Gir. regis/ Gir. Type" and underneath "Indoroopilly 1933/ window, 8 July" and "ON LOAN FROM/ QUEENSLAND MUSEUM/ BRISBANE". Slide: "Ophelosia keatsi Gir. ♀/ regis Gir. Type/ (inner)" and "Ophelosia/ ex tag/ Ipswich/ 26 Oct. 1919" Slide with 2 cover slips, larger containing the head with both antennae, one whole and one missing club, 2 forewings, 1 hind wing, 2 hind legs, one without coxa, 1 foreleg with pronotum attached.

5.11.4 ***Ophelosia brevisetosa*** **sp.n.** (Figs 5.48, 5.131; Map 47)

Holotype: female, ANIC.

Label details: "35.19S 148.51E ACT/ Wombat Ck. 750m/ 6km E Piccadilly Circus/ Apr. 1985 Lawrence, Weir,/ Johnson flight intercept/ window trough trap."

Female

Head light orange-brown; dorsal margin of head moderately concave. Face 1.3 to 1.5x broader than long (mean 1.39). Occipital carina strong; ocelli removed from margin by 0.5 OD. Back of head alutaceous. Ocelli small, reddish; OD about 0.5x OOL. Eyes minutely hairy. Vertex and face alutaceous; vertex with very short, light setae.

Antennae inserted just above clypeal margin. Scrobes smooth, unsculptured; not delimited anteriorly by a carina. Scape, pedicel and funicle orange-brown; club and sometimes F5 dark brown. F1 broader than long, F2 to F5 square. Club 0.8 to 0.9x length of funicle (mean 0.88). Genal carina narrow, striate. Malar groove complete, not conspicuous; malar space 0.5x long axis of eye. Clypeus slightly produced, margin straight between toruli, sloping to offset genal carina. Mandible with pointed lower tooth and 2 rounded upper teeth.

Thorax pale orange, without metallic reflections. Pronotum 0.5x as long as broad; imbricate anteriorly, smooth posteriorly; setal ring with 12 long setae.

Mesoscutum broader than long, imbricate. Setae regular, reduced in number, one pair at posterior margin. Scapulae striate. Scutellum slightly broader than long, slightly convex in lateral aspect; alutaceous; anterior pair of setae slightly closer together than posterior pair. Frenal area delimited by a gradual change in sculpture to smooth. Axillae delimited by groove which changes to fovea posteriorly, longitudinally striate. Dorsellum reduced to long smooth strip; fovea also reduced, scarcely alveolate; metanotum reduced, smooth and furrow coarsely striate. Mesepisternum with shallow triangular depression, smooth; metapleuron smooth.

Propodeum yellow-brown; median carina present, costula discernable laterally; rugose-reticulate over whole surface. Nucha short, square; apical margin emarginate.

Forewing (Fig. 5.48) extremely reduced, scarcely reaching end of scutellum. Submarginal vein only present, with 2 to 4 long setae.

Legs yellow, fore and hind femora slightly expanded. Hind coxae with dorsal crest and some lateral and basal setosity. Hind tibial spur 0.8x length of hind basitarsus.

Gaster orange-brown basally, dark brown apically, with dark brown patches medially. T1 0.7x length of gaster. Basal fovea with small clump of short setae at the base. Ovipositor exerted. S1 with moderately spaced grooves laterally, anteriorly and posteriorly, grading to foveate medially; and a raised alveolate ridge medially (Fig. 5.131).

Male

Head orange.

Antennae inserted about 1 torular diameter above clypeal margin. Scape and pedicel orange, flagellum mid-brown. F1 slightly longer than F2-F4, which are about equal in length. Setae about as long as segments of origin. Club 1.5 to 2x length of F1 (mean 1.73).

Forewing reduced, hyaline. Submarginal vein with only 1 seta. Setal fringe absent, no other setation.

Hind coxae with dorsal, lateral and basal setal crests.

Remarks: Males associated with females on the basis of similar wing and dorsellum

and also on the basis of distributional records.

Paratypes: (13 females, 13 males; ANIC, in NZAC where stated). **W.A.:** 1 female, Stirling Range N.P., Jan 1987, JSN (NZAC) (34.23 117.52); 1 female, John Forrest N.P., 24-28 Dec 1986, JSN (31.50 116.05), Malaise/yellow pan. **A.C.T.:** 5 females, 5 males; 35.19 148.51, Wombat Creek, 6km NE of Piccadilly Circus, 750m, TAW, JFL, M-LJ, 2♂♂ Mar 1984, 1♀ Dec 1984 (NZAC), 1♂ Mar 1985, 1♂ Apr 1985, 1♂ Jun 1985, 1♀ Sep 1985, 2♀♀ Oct 1985; 6 females, 6 males, 35.22 148.48, Piccadilly Circus, 1240m, JFL, TAW, M-LJ, 2♂♂ Feb 1984 (1 in NZAC), 1♂ Mar 1984 (NZAC), 1♀ Sep 1984, 1♀ 15/11/84, 2♀♀ 5♂♂ Dec 1984. **N.S.W.:** 1 female, 33.58 150.04, Kanangra-Boyd N.P., West Morong Creek, 1200m 3 Oct 1982, L.Hill, *Poa* tufts/moss; 1 female, Kanangra-Boyd N.P., 20 Mar 1982, L.Hill, rush and sedge turfs.

Biology: Hosts are unknown.

Distribution: **Australia:** Western Australia, New South Wales, Australian Capital Territory.

5.11.5 ***Ophelosia charlesii*** **sp.n.** (Figs 5.49, 5.50, 5.51, 5.132, 5.133; Maps 13, 48)

Holotype: female, ANIC.

Label details: "Australia/ Loxton, S.A./ J. Altmann/ 1989" and "ex laboratory/ culture/ Pseudococcus/ citrophilus."

Female

Head orange-brown, with metallic green-blue reflections on vertex; dorsal margin of head moderately concave. Face 1.3 to 1.6x broader than long (mean 1.48). Occipital carina strong; ocelli removed from margin by 0.1 OD. Back of head imbricate. OD less than or equal to OOL. Eyes minutely hairy. Vertex transversely striate to rugose, with scattered long setae.

Antennae inserted less than 1 torular diameter above clypeal margin. Scrobes weakly dorsally carinate, smooth. Antennal scapes and pedicel orange-brown, flagellum and club concolorous dark brown, setae shorter than segments of origin. F1 slightly broader than long, F2 and F3 subsquare, F4 and F5 slightly broader than long. Club 0.6 to 0.8x length of funicle (mean 0.74). Genal carina moderately wide, not striate. Genae smooth. Malar groove complete but weak; malar space 0.6x long axis of eye. Clypeus slightly produced; oral margin concave between toruli, sloping

down to weakly offset genal carina. Mandible with pointed lower tooth and 2 blunt upper teeth; equivalent size.

Thorax light orange-brown, without metallic reflections. Pronotum imbricate with short regular setae; setal ring of about 14 light setae, not much longer than regular setation. Mesoscutum imbricate, with short regular pilosity and pair of long setae posteriorly. Scapulae matt, with scattered setae and 2 pairs of long setae. Scutellum as long as wide, slightly convex in lateral aspect; alutaceous; setae long and dark. Frenal area not delimited except by change in sculpture to smooth and shining, about 0.3x length of scutellum. Axillae with purple-blue metallic reflections, smooth excepting a few longitudinal striations anteriolaterally, and with pair of long setae. Mesepisternum with triangular depression, mesepimeron glabrous. Dorsellum mainly smooth, declivous, fovea alveolate; metanotum smooth, furrow coarsely striate.

Propodeum dark orange-brown to dark brown anteriorly, with orange-brown nucha. Median carina present anteriorly, costula present laterally. Sculpture reticulate anterior to costula and alveolate-rugose anteriorly, smooth around spiracles (Fig. 5.132). Nucha as long as wide, posterior margin emarginate. Spiracle with longitudinal carina.

Forewing (Fig. 5.49) with diffuse infumate patch posterior to stigmal vein and infumate basal hairline. Marginal vein 2.2 to 3.3x length of stigmal vein (mean 2.69). Stigmal area setose. Postmarginal vein subequal to stigmal vein in length. Costal cell with 2 to 6 setae on wing margin anterior to marginal vein. Costal cell with uninterrupted ventral row of setae. Basal hairline with a strip of setae about 4 wide; basal cell bare; not margined by cubital row of setae. Wide speculum present.

Legs yellow-brown. Mid and hind tibiae darker dorsally. Hind tibial spur 0.8x length of hind basitarsus. Hind coxae with lateral, basal and small dorsal setal crests.

Gaster mid-brown, darker anteriorly, mediolaterally and posteriorly. T1 0.9x length of basitarsus. Basal fovea with numerous setae, not in the form of a compact tuft. Ovipositor not extended past end of gaster. S1 with moderately spaced long grooves, interrupted medially by smooth horizontal ridge. Anterior margin concave (Fig. 5.133).

Male

Head dark brown, with metallic green lustre. Malar groove more conspicuous than in female.

Antennae (Fig. 5.50) inserted about 1 torular diameter above clypeal margin. Scapes yellow, pedicel and flagellum mid-brown. F1 longest funicular segment, F2 to F4 decreasing in length; setae shorter than width of segments of origin. Club from 1.6 to 2x as long as F1 (mean 1.78).

Thorax medium to dark brown, with metallic green reflections.

Forewing (Fig. 5.51) hyaline, except for infumate basal hairline. Marginal vein 1.8 to 2.9x length of stigmal vein (mean 2.31). Costal cell margined with setae along apical half. Basal hairline with line of setae, pigmented; basal cell with scattered setae; margined by cubital row of setae. Speculum present, very narrow.

Hind coxae with sparse dorsal, lateral and basal crests.

Gaster subquadrate, ranging from mid-brown anteriorly to dark brown posteriorly.

Paratypes: **Australia:** (9 females, 16 males; ANIC). **S.A.:** 5 females, 11 males, hosts collected at Loxton, Solora orchards, 19 Feb 1992, J.A.Berry, from *Pseudococcus calceolariae* ovisacs on grapefruit, reared at Black Mt Laboratories, ACT, from Feb-June 1992 (32.48 116.28); 3 females, 5 males, Loxton, J.Altmann, 1989, ex *P. calceolariae* culture. **A.C.T.:** 1 female, 35.35 149.00, Honeysuckle Creek, 11-22 Apr 1985, IDN, JCC, Malaise/ethanol. **Tas.:** 2 females, 1 male, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, closed forest, (W.E.B.S), Malaise, 2 ♀♀ 11 Feb-1 Mar 1990, 1 ♂ 8 Jan-12 Feb 1991.

Material examined: **New Zealand:** (262 females, 149 males; NZAC). **ND:** 1 female, Tangihua Range, Horokaka, 6 Apr 1993, R.C.Henderson, reared from ovisac of *Paraferrisia podocarpi* on *Dacrydium cupressinum*; 6 females, 3 males, Kerikeri, 5-6 Mar 1991, JGC, 2 ♀♀ ex *P. calceolariae* ovisac. **AK:** 1 female, 1 male, Huia, Sep 1980, CFB, ex *Paraferrisia podocarpi* (Br.) on *Dacrycarpus dacrydioides*; 2 males, Whatipu, 25 Feb 1979, L.A.Mound; reared series from MARC, Mt Albert, Auckland (originally collected in HB.) 83 ♀♀, 71 ♂♂, May- October 1990, J.A.Berry, ex *Pseudococcus calceolariae* culture; 1 female, 1 male, Titirangi, Oct 1980, G.W.Ramsay, Malaise trap in garden; 5 females, Waitakere Range, Sep-Nov 1990, JSN; 4 females, Massey, EWV, Malaise trap, 1♀ 27 Sep 1979, 1 ♀ 17 Jun 1979, 1♀ 24 Jul 1980, 1 ♀ 16 Aug 1980. **BP:** 1 male, Welcome Bay, Tauranga, 5 Apr 1991, D.Steven, ex *Pseudococcus* mummy; 1 female, Edgecumbe, 30 Jun 1989, JGC, ex *P. longispinus* on *Salix*. **HB:** 19 females, 17 males, Havelock North Research Orchard, 3 Nov 1982, JGC, from mealybugs in corrugated bands on apple trunks; 1 female, 2 males, Havelock North Research Orchard, 12 Jan 1983, JGC, ex

Pseudococcus calceolariae egg batch; 1 male, Havelock North Research Orchard, Jan 1981, JGC, ex *Pseudococcus obscurus* egg sac; 86 females, 8 males, HNRO, 15 Dec 1982, JGC, ex *P. calceolariae*; 1 male, Havelock North Research Orchard, 15 Dec 1982, ex *P. obscurus*; Havelock North Research Orchard, 5♀♀, 14♂♂, 3 Nov 1982, 2♀♀, 1♂, 24 Nov 1982, 15 ♀♀, 16♂♂, 15 Dec 1982, 26♀♀, 31♂♂, 3 Feb 1983, 69♀♀, 104♂♂, 9 Mar 1983, 5 ♀♀, 4 ♂♂, 30 Mar 1983, 7♀♀, 8♂♂, 2 May 1983, JGC, from mealybugs on apples (Hosts: *P. calceolariae* 34 records from ♂♂, one specifying eggsacs; 31 records from ♀♀, one specifying eggsacs. *P. affinis* 98 records from ♂♂, one specifying 2nd instar; 66 records from ♀♀); 4 females, 1 male, Havelock Nth, 23-24 Apr 1991, JGC, 2 ♀♀ ex *Pseudococcus affinis* ovisac, 2 ♀♀ ex *P. calceolariae* ovisac; 3 females, 2 males, Hastings, 23 Apr 1991, JGC, ex *P. affinis* ovisac. **GB:** 1 female, Manutuke, 30 July 1989, JGC, from *Pseudococcus* infested bark of grapevine; 1 male, Manutuke, 2 Aug 1989, JGC, ex *Pseudococcus* sp from grapevine; 3 females, 4 males, Manutuke, Opou vineyards, 31 Mar 1983, ex *P. calceolariae* on apples; 8 females, 1 male, Manutuke, Opou vineyards, 31 May 1983, ex *P. calceolariae* on apples; 3 males, Manutuke, 8 Aug 1990, JGC, ex *Pseudococcus* mummies on citrus; 3 females, 3 males, Opou vineyards, 23-28 Sep 1982, ex *Pseudococcus* egg batches; 4 males, Gisborne, 27 Feb 1991, JGC, ex *P. calceolariae* (one from a mummy) on citrus; 1 female, 1 male, Patutahi, 28 Feb 1991, JGC, ex *P. calceolariae* ovisac; 2 females, Ormond, 27 Feb 1991, JGC, on navel orange property; 3 males, Gisborne, 3 May 1961, ex *Pseudococcus longispinus* on lemon. **WO:** 2 females, Waitomo Caves, 24 Mar 1991, D.Steven; 1 female, 6 males, Ohaupo, McFall Rd, 4 Apr 1990, JGC, ex *Pseudococcus calceolariae* ovisac. **SD:** 1 male, 1 female, Shakespeare Bay, 11 Aug 1969, G.Kuschel, Litter 69/147, 1 female, Kenepuru Sd, foot Mt Stokes, 10 Oct 1967, J.I.Townsend, beating. **NN:** 1 female, Farewell Spit, 4 Dec 1980, JSN, EWV, AKW; 2 females, Pelorus Bridge, 28 Mar 1966, DBR, ex mealybug eggsac on *Leptospermum ericoides*; 7 females, 1 male, Kaihoka Lakes, 4 Dec 1980, costal forest, JSN, EVW, AKW; 2 females, Eves Valley, 8 Dec 1980, JSN, AKW, EWV; 2 females, Totaranui, 600m, 5 Dec 1980, JSN, EWV, AKW; 2 females, Wakefield, 7 Jan 1964, EWV, ex mealybug egg sac on *Dacrydium colensoi*; 4 females, 6 males, Appleby Research Orchard, June 1963, EWV, feeding on eggs of *Phenacoccus graminicola* McKenzie; a long series of males and females, Nelson, Feb-Mar 1925, 14 Oct 1926, 6 Mar 1927, 19 Mar 1927, 26 Mar 1927, 12 May 1928; 1 female, 4 males, Riwaka, 31 Aug 1965, JAdB, ex *Pseudococcus* sp. **BR:** 2 males, Mt Robert, 600-1400m, 10 Dec 1980, JSN, EWV, AKW, *Nothofagus* forest and grass. **KA:** 1 female, Oaro, 21 Mar 1982, JWE (LU); 1 female, Oaro, 18 Mar 1978 (LU). **MC:** 1 female, Christchurch, Dallington, 27 Jun 1920, ESG.

i) This group of specimens differ in having more setae on costal wing margin (up to 11) and less setae on basal hairline, and also a metallic tinge to the thorax and a darker propodeum: **ND:** 1 female, Waipoua SF, along Waipoua Stm, 70m, 16-21 Mar 1978, S&J Peck, Malaise trap; 1 female, Omahutu SF, 6 Oct 1980, JSN. **AK:** 1 female, Birkenhead, Sep 1980, JFL, Malaise trap. **CL:** 1 female, Kauaranga V, 1 Feb 1981, JSN; 1 female, Little Barrier Is, 10 Mar 1974, JSD, *Nothofagus/Agathis* forest. **MB:** 1 female, Onamalutu, 4 Sep 1966, E.Collyer, ex mealybug eggsac on

Podocarpus dacrydioides. **NN:** 1 female, Maitai V, 26 Jan 1968, J.A.deBoer, ex mealybug on *Fuschia excorticata*; 1 female, 2 males, Golden Bay, 25 May 1960, ex *Trionymus podocarpi* egg sac on *Podocarpus dacrydioides*; 1 female, Wairoa Gorge, Garden V, 24 Sep 1964, J.I.Townsend, from litter; 1 female, Wakefield, Regents Park, 26 Jan 1965, EWV, ex mealybug on *Dacrydium colensoi*, 1 female, 1 male, Nelson, Nov 1924, ESG; 1 female, Pelorus Bridge, 13 Dec 1980, JSN, EWV, AKW, *Podocarpus* forest; 1 female, Wakefield, 30 Aug 1967, JSD; 1 female, Upper Takaka R, Asbestos Mine Tr., JSN, EWV, AKW, 700m, 2 Dec 1980, mixed *Nothofagus* forest. **BR:** 1 female, Lake Rotoroa, 11 Dec 1981, JSN, EWV, AKW; 1 female, Capleston Beetle Res, Redmans Creek, 245m, litter. **SD:** Ship Cove, 27-30 Nov 1972, GK. **SI:** 1 female, Thule, 7 Feb 1968, EWV, ex mealybug on *Dacrydium cupressinum*.

ii) This group of specimens have differences in the sculpture of S1 and a broader wing tuft on the forewing: **S.A.:** 2 females, 31.21 138.42, Oraparinna Creek, Dingly Dell Camp, 4-10 Nov 1987, IDN, JCC, Malaise trap/ethanol. **Qld.:** 2 females, 26.52 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC. **N.S.W.:** 1 female, 3km N Lansdowne, 9 Dec 1991, G.Williams, rainforest blossom *Cuttsia viburnea*. **A.C.T.:** 1 female, 32.22 148.50, Blundells Creek, 850m, 3km E Piccadilly Circus, Oct 1985, JFL, TAW, M-LJ, FIT/window trough trap; 1 male, 35.22 148.50, Blundells Creek, Feb 1987, DHC, Malaise trap/ethanol.

Biology: reared from ovisac of *Trionymus (=Paraferrisia) podocarpi* (Brittin) (Pseudococcidae) on *Dacrydium cupressinum* Lamb. (Podocarpaceae), on *Dacrycarpus (=Podocarpus) dacrydioides* (A. Rich.) Laubenf. (Podocarpaceae) and from *Trionymus podocarpi* eggsac on *Dacrycarpus dacrydioides*; mealybugs on *Malus sylvestris* (apple); ex mealybug on *Lagarostrobos colensoi* (silver pine); ex mealybug on *Dacrydium cupressinum*; mealybug eggsac on *Lagarostrobos colensoi* Hook. Ic. Pl. (Podocarpaceae); mealybug eggsac on *Dacrycarpus dacrydioides* (kaihikatea); ex mealybug eggsac on *Fuschia excorticata* (J. R. & G. Forst.) L.f. (Onagraceae); mealybug eggsac on *Kunzea ericoides* (A. Rich.) J. Thompson (Myrtaceae); feeding on eggs of *Phenacoccus graminosus* (= *graminicola* Leonardi) (Pseudococcidae); *Pseudococcus* infested bark of grapevine (*Vitis vinifera* L. (Vitidaceae)); *P. longispinus; P. longispinus* on *Salix*; *Pseudococcus longispinus* (=*P. adonidum*) on *Citrus limon* (lemon); *P. calceolariae* (= *P. citrophilus*) culture; reared from *Pseudococcus calceolariae* ovisacs on grapefruit; *P. calceolariae* eggsacs on *Malus sylvestris*; *P. calceolariae* on *V. vinifera*; *P. calceolariae* on citrus; *Pseudococcus affinis (=P. obscurus)* egg sac; *Pseudococcus affinis*; *P. affinis* 2nd instar on *M. sylvestris*.

Most detailed rearing data for *O. charlesii* record the species as a gregarious egg predator. The only exceptions are 7 males from New Zealand (BP, GB, HB and WO) on card tags in the NZAC along with their mummified host remains (all *Pseudococcus* sp.); and data from J. G. Charles (pers. comm.) which records *O. charlesii* as a primary parasitoid of young third instar *P. longispinus* and *P. calceolariae*.

Distribution: **Australia:** South Australia, New South Wales, Australian Capital Territory. **New Zealand:** ND, AK, CL, BP, HB, GB, WO/ NN, BR, MC, SD, SI.

Remarks: *O. charlesii* is very close to *O. leai*, and is differentiated by the relatively bare basal cell in the forewings of both sexes, by the relative lack of pilosity on the apex of the margin of the costal cell of both sexes and by the first funicular segment of the male *O. charlesii* being considerably shorter than the scape. *O. charlesii* is named for Mr John Charles (HortResearch NZ Ltd.), who did much of the collecting and rearing.

A relatively small group of specimens are selected as paratypes because of the variation noted in the material examined. Since *O. charlesii* is presumed to be endemic to Australia (Sect. 7.5), paratypes have been selected from this country, excluding those specimens noted to differ in forewing and S1 character states.

Life history parameters were recorded for *O. charlesii* as follows: mean time between introduction of adult female and male wasps to host and emergence of offspring at ambient laboratory temperature: 51.92 days (n=53, sd=4.41). Broken down for males and females: mean time ♂: 51.69 days (n=29, sd=4.32); mean time ♀: 24 days (n=52.21, sd=4.6). Longest period recorded for adult female survival in laboratory: 56 days.

5.11.6 ***Ophelosia crawfordi*** **Riley** (Figs 5.52, 5.134, 5.135; Maps 14, 49)

Ophelosia crawfordi Riley, 1890:249; Girault, 1916a:227; Wilson, 1963:4, 9; Smith and Compere, 1931:1109; Charles, 1989:226-227, 234; Bouček, 1988a:354 (Fig. 650).

Syntypes: not seen.

Publication data: "described from four female and two male specimens

reared by F. S. Crawford, at Adelaide, from specimens of *Icerya purchasi* received from S. Australia, 50 miles north of Adelaide". These specimens have the status of syntypes. Girault (1927:227) states that the types ("three females, two males on a tag, a male antenna on a slide. Catalogue No. 1510, U.S.N.M.) are deposited at the USNM. I did not see this material and have not designated a lectotype.

Ophelosia sulcata Girault, 1925b:1; Dahms, 1986:571-572; Bouček, 1988a:354. **syn.n.**

Lectotype: female, QM, here designated as the intact female on card. The remaining specimens are paralectotypes.

Publication details: "A male, 4 females from *Icerya purchasi*, Toowong, Q., July 26, 1923, J. H. Simmonds, Department of Agriculture and Stock". These specimens have the status of syntypes.

Label details: Card labelled "SYNTYPES/ T. 10000/ E.C.D. 1985" and "Ophelosia ♀/ sulcata Girault/ Types" and "QUEENSLAND MUSEUM", with 2 females (1 intact, designated as lectotype, the other minus head and right wings), plus legs from lost specimen.

Slide 1 labelled "Ophelosia ♂♀/ sulcata Gir./ Type" and "SYNTYPES/ T.10000/ E.C.D. 1985" and label for *Zaomommoencyrtus dayboroensis*. Half coverslip with 2 crushed heads, fragments of antennae and a thorax with hind coxa and femur and separated leg parts.

Slide 2 labelled " Ophelosia ♀/ sulcata Gir./ Type (Inner)" and label for *Ophelosia hypatia*. One coverslip fragment, inner, with 2 forewings.

Female

Head orange-brown, without metallic lustre, dorsal margin moderately convex. Face 1.5 to 1.9x broader than long (mean 1.61). Occipital carina strong, back of head

alutaceous. Ocelli about 0.2 OD from occipital carina. OD subequal to OOL. Eyes minutely hairy. Vertex and face transversely rugose, with scattered long setae.

Antennae inserted well below lower eye level, less than 1 torular diameter above clypeal margin. Scrobes weakly transversly rugose laterally, smooth medially; delimited anteriorly by weak carina, or not at all (Fig. 5.134). Scape and funicle yellow, pedicel darker and club grading to mid-brown apically. F1 to F3 square; F4 and F5 slightly broader than long. Club 0.7 to 0.9x length of funicle (mean 0.86). Genal carina wide, not striate. Malar groove complete but inconspicuous; malar space 0.6x long axis of eye. Lower face and genae striate. Clypeus slightly produced; oral margin between toruli straight, sloping to very slightly offset genal carina (Fig. 5.134). Mandible reduced; with 2 very blunt teeth, equal in size.

Thorax light orange-brown, without metallic reflections. Pronotum only slightly narrower than mesoscutum. Pronotum with regular short pilosity over entire surface, setal ring of 10 setae present; sculptured anterior to ring, smooth and shiny posteriorly. Mesoscutum finely transversely rugose, covered in regular short pilosity, with pair of long dark setae at posterior edge, abutting scutellum. Scapulae transversely rugose with regular pilosity and 2 pairs of long dark setae. Scutellum slightly longer than wide, convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair. Scutellum with a very subtle to almost nonexistant longitudinal groove medially. Frenal area not delimited, except very apex as a smooth strip. Axillae slightly longitudinally striate, with pair of setae. Mesepisternum with depressed triangular area, slightly striate. Mesepimeron glabrous to faintly striate transversely. Dorsellum smooth and triangular, dorsellar fovea alveolate; metanotum smooth, metanotal furrow striate.

Propodeum orange-brown, slightly paler apically and dark brown to black around spiracles. Median carina present anteriorly, costula present laterally; reticulate anterior to costula, rugose-reticulate posteriorly, smooth around spiracles. Nucha longer than wide, apex smooth. Spiracle with horizontal carina leading to setal tuft, and forming acute tooth at lateral margin. Apical margin not centrally emarginate.

Forewing darkly infumate at basal hairline and also posterior to stigmal vein. Marginal vein 2.3 to 2.9x as long as stigmal vein (mean 2.72). Postmarginal vein 1.2x longer than stigmal vein. Stigmal area slightly setose. Costal cell with 2 to 6

setae on apical margin; continuous ventral setal row and partial second row present. Submarginal row with 8 setae. Basal hairline with conspicuous triangular tuft of long dark setae, slightly shorter than submarginal setae, about 5 wide at top; basal cell bare; not margined by cubital row of setae.

Legs and coxae yellow-brown, mid and hind tibiae darkened dorsally. Hind tibial spur as long or longer than hind basitarsus. Hind coxae with sparse lateral setal crest, no dorsal crest and some basal pilosity.

Gaster orange-brown, darker basally and apically and with a medial dark spot. Basal fovea with scattered setae at base. T1 0.9x length of gaster. Ovipositor not projecting beyond end of gaster. S1 with moderately spaced longitudinal grooves interrupted by a horizontal ridge (Fig. 5.135).

Male

Head black, with metallic green lustre. OD about 2x OOL. Vertex rugose.

Antennae (Fig. 5.52) inserted less than 1 torular diameter above clypeal margin; concolorus yellow. Scrobes transversely striate laterally and smooth medially, delimited anteriorly by carina, which is obscured by the sculpture of the scrobes. Funicular segments slightly longer than broad, strongly nodular. F1 slightly longer than F2 to F4; setae no longer than 1.5x length of segment of origin. Sensilla not conspicuous. Club 1.4 to 2x longer than F1 (mean 1.66).

Thorax black, with metallic green lustre.

Propodeum dark brown-black, grading to orange-brown at apex.

Forewing hyaline. Marginal vein 2.3 to 2.8x length of stigmal (mean 2.53). Costal cell with about 9 setae on apical margin; ventral row of setae continuous, with a partial second row. Submarginal vein with 10 setae. Basal hairline infumate, with single line of setae; basal cell almost bare; cubital row of setae present.

Legs mid-brown, darker dorsally. Hind coxae with a ventral row of setae only.

Gaster dark orange-brown, grading to dark brown apically. Fovea with sparse setae. T1 0.9x length of gaster.

Other material examined: (49 females, 11 males; ANIC, unless otherwise stated).
Java: 1 female, Salo, Java, C.L.Marlatt, xii.ii.01, on *Icerya purchasi* on lemon (USNM); 9 females, Garoet, Java, C.P.Clausen, Oct 1929, ex *Icerya seychellarum*

(USNM).
Australia: 3 females, 1 male, locality not recorded, Koebele, det. by Riley (USNM). **S.A.:** 3 females, Glen Osmond, 30.v.1980, M. Heap, ex *Icerya purchasi* (36.02 140.45) (2 in NZAC). **Qld:** 4 females on card, Indoroopilly, Nov 1938, A.A.Girault (27.30 152.58) (QM); 1 female, 20km S Lotus Creek, SEQ, brigalow forest, ECD, 26 Apr 1979 (QM); 1 female, Mt Glorious, 22 Jun- 18 Oct 1982, A.Hiller, Malaise trap, rain forest (27.20 152.46) (QM); 1 female, Brisbane, Acacia Ridge, SEQ, ECD, 20 Aug 1978 (27.35 153.01) (QM); 2 females, 1 male, Brisbane, 4 Mar 1992, V. Brancatini, LPL 9514, ex *Icerya purchasi* on *Leptospermum* (27.28 153.02) (1♀ in NZAC); 5 females, Indooroopilly, Nov 1938, A.A.Girault (QM), 15 females, 9 males, 27.28 153.01, 11 Dec 1992, V.Brancatini, ex *Icerya purchasi* on *Mimosa pigra*, LPL 9514 (2♀♀, 2♂♂ in NZAC); 2 females, 1 male, Brisbane, Sherwood, 5 Feb 1993, em 15 Feb 1993, P.van der Graaf, ex *Icerya purchasi* on *Cassia* sp., LPL 9514 (27.32 152.59); 1 female, Brisbane, Indoroopilly, AAG, Nov 1938. **N.S.W.:** 1 female, 3 km N Lansdowne, 9 Dec 1991, G.Williams, rainforest blossom *Curtsia viburnia* (31.47 152.32). (Types: 34.00, 138.40; 27.29 152.59).
New Zealand: NN: 1 female, Nelson, 15 Jan 1926, Philpott.

Biology: *O. crawfordi* is a predator of margarodid eggs, and has been reared from *Icerya purchasi* (Margarodidae) on lemon, on *Leptospermum* J. R. & G. Forst. (Myrtaceae), on *Mimosa pigra* (Leguminosae), on *Cassia* sp. (Leguminosae) and from *Icerya seychellarum* (Westwood).

Distribution: **Australia:** South Australia, Queensland, New South Wales. **Java. New Zealand:** NN.

Remarks: Girault distinguished *O. sulcata* from *O. crawfordi* on the basis of a well-defined medial longitudinal groove on the scutellum of *sulcata*. However among the specimens I have included in *O. crawfordi* there exists a range from a well-defined groove to a very faint groove to a perturbation in the sculpture without a groove. Since there are no other consistently varying characters I have synonymised *O. sulcata* with *O. crawfordi.*

5.11.7 ***Ophelosia hypatia*** **Girault** (Figs 5.53, 5.54, 5.136, 5.137, 5.138; Map 50)

Ophelosia hypatia Girault, 1916a:227; Dahms, 1984:705; Bouček, 1988a:354.

Syntypes: females, QM, USNM, ♀ and ♂ antennae on slide, USNM. Lectotype not designated as all syntype material not seen.

Publication details: "Described from four females, two males in the U.S.N.M., labelled "*O. Crawfordi*. From Icerya. Alex. Craw. California. Imported from Australia. G. Compere, July, 1900." Also a large series in the U.S.N.M. labelled "12. Sydney, N.S.W." *Types*: Catalogue No. 19687, U.S.N.M., a pair on tags plus a slide with antennae of both sexes and the female hind leg (Australia). *Cotypes* :No. Hy 3566, Queensland Museum, two females on tag." These four females and the slide material (♀ and ♂ antennae and 1 leg) are the syntypes, since they are specifically designated by Girault.

Label details: (USNM syntype), intact ♀. "From Icerya/ California/ Alex. Craw./ import from/ Australia/ July 1900" and "Type No./ 19689/ U.S.N.M." and "Ophelosia/ hypatia/ Gir/ ♂♀ types."

Ophelosia lucretii Girault, 1921:189. Dahms, 1984:777; Bouček, 1988a:354. **syn.n.**

Lectotype: female, QM, here designated as specimen with all wings present on apex of card.

Publication details: "Jungle, Inkerman, December 9, two females." These specimens have the status of syntypes.

Label details: Card labelled "SYNTYPES/ T.9179 (outer)/ T.9180 (inner)/ E.C.D. 1984" and "Ophelosia/ lucretii Gir/ ♀ type" and "QUEENSLAND/ MUSEUM", bearing 2 ♀♀, both headless, one missing all wings except right hind wing (this is a paralectotype).

Slide labelled "Ophelosia Type/ lucretii Gir./ ♀ type Epistenia/ miripes/ Xenostryxis ♀/ margiscutellum/ TYPE." Centre of 3 coverslips, head and scattered antennal segments, also designated as lectotype.

Female

Head orange-brown, grading to darker on vertex; with metallic green reflections; dorsal margin weakly concave. Face from 1.4 to 1.8x broader than long

(mean 1.6). Occiput sharp; ocelli 0.1 OD from occipital carina. OD equal to OOL. Vertex finely transversely striate, with scattered long setae. Back of head finely imbricate.

Antennae inserted less than half a torular diameter above clypeus margin; scrobes smooth, carinate anteriorly. Scapes yellow-brown, pedicel and flagellum mid-brown grading to dark brown. Funicular segments all square or longer than broad, (note: Girault's description says F1 is broader than long) club 0.6 to 0.8x length of funicle (mean 0.70). Genae smooth. Malar groove complete and conspicuous; malar space 0.5x long axis of eye. Genal carina wide, not striate. Oral margin straight between toruli, not offset from genal carina (Fig. 5.136). Mandibles reduced, teeth not defined.

Thorax dark orange-brown to dark brown. Pronotum darkening anteriorly; setal ring with about 10 thick black setae present. Mesoscutum imbricate, regular setae long, as long as the posterior pair of setae. Scapulae imbricate, with regular pilosity. Scutellum longer than wide, orange-brown anteriorly and dark brown posteriorly. Slightly convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair. Frenal area delimited only by change in sculpture to almost smooth. Axillae smooth. Dorsellum smooth, dorsellar furrow alveolate; metanotum smooth, furrow striate. Mesepisternum with slightly striate depression; mesepimeron smooth, with a few striae anteriorly.

Propodeum (Fig. 5.137) dark brown anteriorly, orange-brown posteriorly. Median carina present anteriorly, costula present laterally; reticulate laterally, above costula, alveolate below costula; smooth around spiracles. Nucha slightly longer than wide. Slightly emarginate on apical margin.

Forewing (Fig. 5.53) with darkly infumate patch posterior to distal marginal and stigmal veins, also broadly infumate along basal hairline. Marginal vein 2.4 to 3.6x length of stigmal vein (mean 2.99). Postmarginal vein subequal in length to stigmal vein. Costal cell with 1 to 5 setae (mean 3) on apical margin; ventral row of setae continuous. Stigmal area sparsely setose. Setal tuft on basal hairline composed of 18 to 78 setae (mean 54), shorter than submarginal setae; basal cell bare, cubital row of setae absent. Speculum present.

Legs yellow-brown, fore tibiae and femora darkened dorsally, hind tibiae,

femora and coxae darkened dorsally. Hind coxae with lateral and basal setal crests, but without dorsal pilosity. Hind tibial spur 0.95x length of hind basitarsus.

Gaster dark brown anteriorly, dark brown-black posteriorly. T1 0.85x length of gaster. Basal fovea with scattered setae at base. Ovipositor not exerted. S1 with moderately spaced longitudinal grooves anterior to a smooth horizontal ridge and posterior surface medially foveate and laterally grooved (Fig. 5.138).

Male

Head dark brown-black, with metallic green reflections.

Antennae (Fig. 5.54) inserted about 1 torulus diameter above clypeal margin. Scape yellow, pedicel and flagellum brown. F1 slightly longer than other flagellar segments. Flagellar segments not nodose; setae short, not as long as segments of origin. Club about 1.4 to 1.9x longer than F1 (mean 1.59). Lower face finely longitudinally striate, genae smooth.

Thorax black, with metallic green reflections.

Propodeum black, grading to dark orange-brown apically.

Forewing with darkly infumate patch posterior to distal marginal and stigmal veins, and darkly infumate basal hairline. Marginal vein 2.2 to 2.9x length of stigmal vein (mean 2.55). Costal margin with 4 to 10 (mean 6.7) setae on apical margin. Basal hairline pigmented, with small tuft of 7 to 28 strong setae (mean 18); basal cell bare; margined by cubital row of setae.

Hind coxae with lateral and sparse basal setal crests, no dorsal pilosity.

Gaster dark orange-brown basally, grading to dark brown-black apically; almost square.

Other material examined: (128 females, 53 males; in ANIC, UQIC, QM, NZAC, USNM where stated). 4 females, Australia, no locality recorded, Koebele. **W.A.:** 1 female, near Boddington, 24 Mar-1 Apr 1984, A.Postle (32.48 116.28); 3 females, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12); 1 female, John Forrest N.P., c25km E Perth, 23-27 Dec 1986, JSN (31.50 116.05); 2 females, Yanchep, c50km N Perth, 1♀ 20 Dec 1986, on *Eucalyptus*, 1♀ 21 Dec 1986, JSN (31.33 115.42). **S.A.:** 3 females, 31.21 138.42, Oraparinna Creek, Dingly Dell Camp, near water, 4-10 Nov 1987, IDN, JCC, Malaise trap/ethanol (2 in NZAC); 1 female, 31.20 138.37, Trezona Camp, Brachina Creek, 7 Nov 1987, IDN, JCC. **Qld.:** 1 female, Acacia Ridge, Brisbane, Dec 1976, ECD, Malaise trap (27.35 153.01) (QM); 2 females, 26.52 151.35, nr Paradise Falls, Bunya Mtns Nat Pk, 6 Oct

1984, IDN, JCC; 1 female, 12.39 142.42, 4km NE Batavia Downs, 16 Sep- 24 Oct 1992, FIT, P.Zborowski, TAW; 1 female, 12.39 142.42, 4km NE Batavia Downs, 11 Dec-17 Jan 1993, PZ. **N.S.W.:** 7 females, 2 males, Shoalhaven River, c15km NNW of Braidwood, PJG, coll 30 Apr 1987, em from *Icerya purchasi* on *Acacia* sp. on 26 May 1987 (35.21 149.44); 37 females, 5 males, Sydney, (identified as *Ophelosia hypatia* Girault by Girault, one det label in Girault's hand, another not) (33.53 151.13) (USNM); 1 female, 2 males, no locality, W.W.Froggatt, parasitic *I. purchasi*, 1895 (2 males lost, only one male flagellum remains); 1 female, Barrengarry Mt, 24km SW Mossvale, c600m, 9 Jun-29 Aug 1982, S&J Peck, SBP 31, FIT (34.40 150.30); 64 females, 48 males, Moree, 18 Feb 1992, J.Seymour, ex *I. purchasi* on citrus, LPL 9512 (29.28 149.51) (5 ♀♀, 5♂♂ in NZAC); 1 female, NSW, W.W.Froggatt, 1895, parasite of *I. purchasi*; 1 female, 33km NE Wiangeree, nr. Tweed Valley Lookout, c1000m, 13 Jun-24 Aug 1982, S&J Peck, FIT, rainforest (28.31 152.58). **A.C.T.:** 3 females, 1 male, Forrest, Apr 1982, MCC, ex *Icerya purchasi* on lemon (35.19 149.07); 2 females, 3 males, Canberra, Mar 1983, MCC, ex *Icerya purchasi* on lemon (35.18 149.08); 1 female, Canberra, Apr 1984, MCC, ex *Icerya purchasi*; 1 female, 35.35 149.00, Honeysuckle Creek, 21-31 Mar 1985, IDN, JCC, malaise trap/ethanol; 1 female, Canberra, 31 May 1948, EFR (UQIC); 1 female, 35.19 148.51, Wombat Creek, 750m, 6km E Piccadilly Circus, Apr 1985, JFL, TAW, M-LJ, FIT. **Tas.:** 1 female, 42.15 146.29, 14km S Bronte Park, 15 Jan-3 Feb 1983, IDN, JCC, Malaise trap/ethanol; 1 female, 41.22 147.24, 10km ENE Nunamara, 12 Jan-6 Feb 1983, IDN, JCC, Malaise/ethanol; 1 female, 41.50S, 146.03E, Pelion Hut, 3km S Mt Oakleigh, open forest, (W.E.B.S.), Malaise, 30 Nov 1990-8 Jan 1991. (Type: 19.45 147.29).

Biology: *Ophelosia hypatia* is a predator of margarodid ovisacs, and has been reared from *Icerya purchasi* (Margarodidae) on citrus, including *Citrus limon* (lemon).

Distribution: **Australia:** all states, (including Tasmania) except Nortern Territory.

5.11.8 *Ophelosia indica* Farooqi

Ophelosia indica Farooqi, 1983:185 (Figs 1-6); (for citation in Bouček, 1988a see Remarks section, below).

Holotype: not seen, National Pusa Collection, Delhi

Publication details: "Holotype ♀ on tag, India. Nasik (Maharashtra) ex *Nippaecoccus* sp., Coll. Hayat, 15.x.1967 (in National Pusa Collection, Delhi); Paratype ♀ data same as holotype in British Museum (Natural History) London.

Label details (Paratype, NHM): "INDIA: Nasik,/ Maharashtra/ ex *Nipaecoccus* sp./ Hayet, 15.x.1967" and "♂" and "PARA-/ TYPE" and "♂

Ophelosia/ indica Farooqi/ det. Z. Bouček, 1985".

Female

Head orange-brown, without metallic lustre; dorsal margin moderately concave. Face 1.3 to 1.5x broader than long (mean 1.43). Occipital carina strong, posterior ocelli removed from occiput by 0.1 OD. Ocelli clear; OD greater than or equal to OOL. Vertex finely transversely rugose, with scattered long setae.

Antennae inserted well below lower eye level, less than half a torular diameter above clypeal margin. Scrobes weakly carinate anteriorly; smooth. Scape orange, pedicel and flagellum darker and club grading to dark brown apically. F1 much broader than long, F2 and F3 square, F4 and F5 slightly broader than long. Club subequal to flagellum (mean 1.04). Genal carina narrow, especially medially; not striate. Malar groove complete but inconspicuous; malar space 0.6x long axis of eye. Oral margin slightly concave between toruli, sloping to meet offset genal carina.

Thorax orange-brown, without metallic reflections. Pronotum broader than long; with 10 setae in setal ring, also with regular short pilosity over entire surface, and sculptured over entire surface, smooth band absent. Mesoscutum imbricate, with regular long pilosity, additional pair of long dark setae at posterior edge, abutting scutellum. Scapulae imbricate with regular pilosity and 2 pairs of long dark setae. Scutellum subsquare, convex in lateral aspect; engraved reticulate; anterior pair of setae closer together than posterior pair. Frenal area delimited by change in sculpture to less sculptured, almost smooth with some fine longitudinal striations. Axillae mostly smooth. Mesepisternum with depressed, slightly striate, triangular area; mesepimeron glabrous. Metapleuron glabrous. Dorsellum smooth, wide and declivous, dorsellar fovea narrow and alveolate; metanotum smooth, metanotal furrow coarsely striate.

Propodeum orange-brown. Median carina present anteriorly, costula present laterally. Sculpture reticulate anterior to costula, alveolate-rugose posteriorly; smooth around spiracles. Nucha square; basal margin emarginate.

Forewing infumate at basal hairline and with a diffuse infumate patch under stigmal vein. Marginal vein 2.8 to 3x as long as stigmal vein (mean 2.93).

Postmarginal vein 1.2x longer than stigmal. Stigmal area slightly setose. Costal cell with 1 seta on apical cell margin; ventrally with an interrupted setal row, only amounting to a few setae, and no partial second row. Basal hairline with a conspicuous triangular tuft of at least 40 dark setae, as long as proximal submarginal setae at anterior and short at posterior; basal cell bare; not margined by cubital row of setae. Speculum present.

Legs and coxae orange-brown. Hind tibial spur 0.9x length of hind basitarsus. Hind coxae with sparse lateral setal crest, no dorsal pilosity.

Gaster elongate, dark brown. Basal fovea with scattered setae at base. T1 0.75x length of gaster. Ovipositor not projecting beyond end of gaster. S1 obscured.

Male

Head mid-brown, with a metallic green lustre ranging from faint to very strong at vertex.

Antennae inserted slightly less than 1 torular diameter above clypeal margin; yellow-brown, tips of club medium brown. Funicular segments not nodose; subequal in length; 1 to 3 square; F4 slightly broader than long; setae short, shorter than segments of origin, with short sensilla. Club extremely long, about 6x length of F1 (mean 6.2), or slightly longer than funicle; covered in very short, close setae. Malar space shorter than in female

Thorax yellow-brown.

Forewing without infumation except slightly infumate basal hairline. Marginal vein 2.5 to 2.8x length of stigmal (mean 2.65). Costal cell with 3 setae on apical margin, ventral row of setae continuous. Basal hairline with strip of about 15 short setae; basal cell sparsely setose; margined by cubital hairline.

Legs yellow-brown; hind coxae with lateral and basal pilosity, bare dorsally.

Gaster medium brown.

Other material examined: (2 females, 2 males; NHM). Paratype ♂, Marashtra, Nasik, ex *Nipaecoccus* sp., Hayet, 15 Oct 1969; 1 female, 1 male, Bangalore, Karuataka, May 1985, ex *Planococcus citri* (id'd by B.R.Subba Rao and ZB as *O. indica*); 1 female, Bangalore, Karnab, May 1985, S.P.Singh, ex *Planococcus citri.*

Biology: *O. indica* is recorded as a pseudococcid exploiter, it is unknown whether

it is a parasitoid or an egg predator. It has been reared from a species of *Nipaecoccus* Sulc (Pseudococcidae) and from *Planococcus citri* (Risso) (Pseudococcidae).

Remarks: the female is remarkably close to *O. hypatia*, and I can only distinguish the two by the sparse setation on the ventral side of the costal cell in the forewing of *O. indica*. The male is easily distinguishable and quite distinct. The holotype description (Farooqi, 1983) does not match the description given here because Farooqi mistakenly described a male as a female. Farooqi (1983, p.185) also describes the male (as female) club as "huge in size, half as long as the funicle (13:26)". The club in the male is, according to my own measurements, and also to Farooqi's illustration (p.186), slightly longer than the funicle, but about half the length of the *flagellum*.

Note that Bouček, 1988a does not list *Ophelosia indica* in his catalogue entries, but does mention (in text, p354) *O. hayati* Farooqi, 1984, from India. There is no reference for this species and I have not been able to confirm its existance; probably Bouček has confused *Cephaleta hayati* Farooqi, which is described in the same (1983) paper with *O. indica*.

Distribution: **India**.

5.11.9 ***Ophelosia josephinae*** **sp.n.** (Figs 5.55, 5.139; Map 51)

Holotype: female, ANIC

Label details: "26.52S 151.34E/ nr Westcott Plain/ Bunya Mts Nat.Pk Qld/ 6-7 Oct. 1984/ I. Naumann, J. Cardale/ ex ethanol".

Female

Head orange-yellow, vertex (between ocelli) metallic green; dorsal margin very weakly concave. Face 1.3 to 1.4x broader than long (mean 1.36). Occipital carina strong, ocelli removed from margin by 0.2x OD. Back of head alutaceous-coriaceous. OD greater than OOL. Setae on vertex moderately long.

Antennae inserted slightly less than 1 torular diameter above clypeal margin; scrobes centrally smooth, laterally alutaceous, not anteriorly carinate. Concolorous orange-brown excepting darker F5 and club. F1 almost invisible, F2-F4 equal and

square and F5 transverse; club 0.7 to 0.8x length of funicle (mean 0.75). Malar groove complete, conspicuous; malar space 0.6x long axis of eye. Genae finely striate. Genal carina moderately wide, not striate. Oral margin straight between toruli, sloping down to offset genal carina. Mandible with large pointed lower tooth and 2 smaller, rounded upper teeth.

Thorax ranging from metallic green over entire thorax (except pronotum), to orange-brown except frenal area. Pronotum anteriorly orange-brown, metallic green posteriorly; imbricate, smooth posterior to setal ring. Setal ring of 14 setae present. Mesoscutum metallic green, imbricate; with regular close pilosity and long pair of setae at posterior margin. Scapulae imbricate. Scutellum slightly convex in lateral aspect, longer than broad; metallic green; alutaceous. Frenal area not delimited, apex impressed. Axillae alutaceous. Dorsellum rugose, dorsellar furrow absent; metanotum smooth, furrow striate. Mesepisternum with alutaceous triangular depression, mesepimeron transversely striate dorsally, smooth ventrally. Metapleuron with heavy transverse sculpture.

Propodeum metallic green-blue. Small remnant of median carina present anteriorly, costula present laterally. Sculpture reticulate anteriorly, rugose-reticulate posteriorly. Nucha as long as broad; sculptured at apex; with very slightly emarginate margin. Setal tuft long, conspicuous.

Forewing (Fig. 5.55) with infumate patch posterior to stigmal vein, basal vein only very faintly infumate. Marginal vein 1.8 to 2.2x length of stigmal vein (mean 2.0). Stigmal area setose. Postmarginal vein subequal in length to stigmal vein. Costal cell with 3 to 4 setae on apical margin; row of ventral setae uninterrupted, and a partial second line. Basal hairline with line of setae shorter than setae on submarginal vein; totalling 5; basal cell bare; cubital row of setae absent. Speculum wide.

Legs yellow-brown, dorsal tibiae darker on hind and mid legs. Hind tibial spur subequal in length to hind basitarsus. Hind coxae with compact tuft of setae present dorsally and sparse lateral setae.

Gaster orange-brown anteriorly, grading to dark brown posteriorly; oval. T1 0.8x length of gaster. Basal fovea with scattered setae at base. Ovipositor not exerted. S1 with widely spaced grooves anterior to ridge, alveolate between grooves; moderately spaced grooves present posterior to medial ridge (Fig. 5.139).

Male unknown

Paratypes: (3 females; ANIC). **N.T.:** 1 female, 23.41S, 134.15E, 39 km E of Alice Springs, NT, 25 Sep 1978, JCC. **Qld:** 1 female, 26.52 151.34, nr Westcott Plain, Bunya Mtns. N.P., 6-7 Oct 1984, IDN, JCC. **N.S.W.:** 1 female, 31.05 141.42, Fowlers Gap Res.Stn, 8-9 Dec 1982, JCC.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Northern Territory, Queensland, New South Wales.

Remarks: *Ophelosia josephinae* is named for its collector, Ms Josephine Cardale.

5.11.10 ***Ophelosia keatsi*** **Girault** (Figs 5.140, 5.141; Maps 15, 52)

Ophelosia keatsi Girault, 1927:334; Dahms, 1984:738; Bouček, 1988a:354.

Holotype: female, SAM.

Publication details: "S. Aust.: Hughes (A. M. Lea)."

Label details: Card labelled "Hughes/ S. Australia/ A. M. Lea" and "Type" and "Ophelosia Type ♀/ keatsi Girault" and "Ophelosia/ keatsi Gir./ South Australia/ TYPE" and "S. A. Museum/ Specimen"; head and right wings missing, prothorax separated.

Ophelosia horatii Girault, 1937:(2); Dahms, 1984:695; Bouček, 1988a:354. **syn.n.**

Holotype: female, QM

Publication details: No specimen designated. Only information "Queensland".

Label details: Card labelled "HOLOTYPE/ T.9083/ E.C.D. 1983" and "Ophelosia ♀/ horatii Gir/ Type" and under "Queensland/ A.A.G" and "QUEENSLAND MUSEUM"; head, fore and 1 hind wing absent, some legs missing.

Slide labelled "Ophelosia ♀/ horatii Gir. Type" and "HOLOTYPE/ T.9083/ E.C.D. 1983"; inner coverslip covering

crushed head and 1 forewing. Also label for *Ophelosia semirufa*, on same slide.

Female

Head orange-brown, with purple metallic reflections ranging to metallic green on vertex; dorsal margin moderately concave. Face 1.4 to 1.7x broader than long (mean 1.5). Occipital carina strong, ocelli removed from carina by 0.2 OD. Back of head alutaceous, OD less than or equal to OOL. Vertex alutaceous with scattered long setae.

Antennae inserted less than half a torular diameter above clypeal margin, scrobes smooth, not carinate anteriorly. Scapes orange-brown, pedicel and flagellum ranging from concolorous orange-brown to concolorous dark brown, or sometimes with club and possibly F5 dark brown and other segments orange brown. F1 slightly broader than long, all other funicular segments square. Club 0.7 to 0.9x length of funicle (mean 0.81). Malar groove complete but not conspicuous; malar space 0.6x long axis of eye. Genae smooth, genal carina moderately wide, not striate. Oral margin very slightly emarginate between toruli, sloping to weakly offset genal carina. Mandible with pointed lower tooth; upper divided into 2 small upper teeth and a larger rounded middle tooth.

Thorax orange-brown to dark orange-brown with weak to strong metallic green and purple reflections. Pronotum imbricate, with regular short light setation. Setal ring of about 14 brown setae present. Mesoscutum imbricate, with regular light setation and one pair of longer setae. Scapulae imbricate. Scutellum slightly longer than broad, flat in lateral aspect; alutaceous; anterior pair of setae slightly closer together than posterior pair. Frenal area short, delimited only by change in sculpture to smooth. Axillae smooth and shiny, dark orange-brown with metallic green reflections. Dorsellum smooth and shiny, fovea alveolate; metanotum smooth, furrow coarsely striate. Mesepisternum with shallow triangular depression, mesepimeron smooth.

Propodeum orange-brown to dark brown-black, with metallic blue reflections. Median carina present anteriorly, costula present laterally; reticulate laterally, posterior to costula, rugose-reticulate anterior to costula; smooth around spiracles.

Nucha as long as broad. Tufts of setae under spiracles conspicuous, long. Apical margin conspicuously excised apically.

Forewing with infumate basal hairline and large diffuse infumate patch posterior to marginal and stigmal veins. Marginal vein 2.7 to 4.6x as long as stigmal vein (mean 3.37). Stigmal area sparsely setose. Postmarginal vein subequal in length to stigmal vein. Costal cell with 2 to 7 setae on apical margin; row of ventral setae continuous, with partial second row. Basal hairline infumate, with triangular strip of setae shorter than submarginal setae, totalling from 10 to 25; basal cell bare; cubital hairline may be present distally. Speculum present.

Legs orange-brown, mid and hind tibiae may be darker dorsally. Hind tibial spur 0.7 to 0.9x hind basitarsus. Hind coxae with diffuse dorsal and lateral crests of setae.

Gaster orange-brown to dark brown-black, with or without medial and apical darkening, oval. Basal fovea with a small tuft of setae present. T1 0.5 to 0.8x length of gaster. Ovipositor exerted. S1 with moderately spaced longitudinal grooves, interrupted by medial ridge which varies from smooth to alveolate (Figs 5.140, 5.141).

Male

Head orange-brown.

Antennae inserted about 1 torular diameter above clypeal margin. Scapes yellow, remainder mid-brown. F1 slightly longer than F2, F2-F4 subequal in length; setae and sensilla shorter than segments of origin. Club 1.2 to 2.1x length of F1 (mean 1.66).

Thorax orange, grading to orange-brown, with slight metallic blue-purple lustre.

Hind coxae with sparse dorsal, lateral and basal pilosity.

Forewing infumate. Marginal vein 3.8 to 5x length of stigmal vein (mean 3.63). Costal cell with about 8 setae along apical margin. Basal hairline with a strip of short setae (about 8), infumate; basal cell bare; cubital hairline absent.

Gaster yellow-brown, grading to mid-brown apically. T1 0.6x length of gaster.

Other material examined: (120 females, 9 males; ANIC, unless otherwise stated). **Australia: W.A.:** 2 females Mt Magnet, 17 Dec 1986, JSN (30.49 121.50); 2 females, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN (33.50 123.12); 1 female, Fitzgerald River N.P., Quaalup area, 6-9 Jan 1987, JSN (34.19 119.22) (NZAC); 5 females, 32.08 126.18, 23km ESE of Cocklebiddy, 12 Oct 1981, IDN, JCC; 2 females, 31.45 128.33, 37km Wby S Eucla, 13 Oct 1981, IDN, JCC; 1 female, 34.59 116.45, Walpole Nornalup N.P., 6 Oct 1981, IDN, JCC; 1 female, Nornalup N.P., 9 Oct 1970, DHC; 2 females, Walpole-Nornalop N.P., 21 Jan 1987 (1 in NZAC), JSN; 5 females, Walpole-Nornalup N.P., 17-21 Jan 1987, JSN, Malaise/yellow pan trap; 1 male, 33.37 115.29, Ludlow, 4 Nov-22 Dec 1980, S.J.Curry, Malaise/Tuart forest. **S.A.:** 1 female, 1 male (NZAC), 31.21 138.42, Dingly Dell Camp, Oraparinna Creek, ♀ 7 Nov 1987, ♂ 4-10 Nov 1987, IDN, JCC; 1 female, 32.44 138.37, Orroroo, 11 Nov 1987, IDN, JCC; 5 females, 3 males, Lab culture stock, from Loxton, G.O.Furness, ex *Pseudococcus longispinus* (34.27 140.34) (USNM); 1 female, Bayree Farm, 4km E Coonalpyn, 18-22 Nov 1991, JAF, Malaise trap (35.42 139.51) (SAM); 1 female, Muston, Kangaroo Is., 24-25 Jun 1967, H.M.Cooper (35.49 137.44) (SAM); 1 female, 30km E Poeppels Corner, Simpson Desert, Bench Peg 6878 in Aristida, 25 Aug 1977, P.J.M.Greenslade (26.00 138.22) (SAM); 1 female, Scorpion Springs Conservation Park, 0.5km SW Nanam's Well 15th, Dec 1983, at light, G.F.Gross, D.Lacis, JAF (35.30 140.55) (SAM); 1 female, 34.21 139.29, Brookfield Conservation Park, 24-26 Nov 1992, IDN, JCC, yellow trays; 4 females, 33.46 135.06, Lake Tungketta, 30 Nov 1992, IDN, JCC; 2 females, 34.21 139.31, Brookfield Cons. Park, 2 Dec 1991-2 Jan 1992, J.Stelman, S.Williams, Malaise #2, Mallee; 3 females, Mt Barker, 500m, Adelaide, 30 Nov-2 Dec 1986, JSN (35.04 138.52); 1 female, Aldinga Scrub, 50km S Adelaide, 5-6 Dec 1986, JSN (35.16 138.33) ; 3 females, 33.22 137.03, nr. Pine Hill, 26 Nov 1992, IDN, JCC; 1 female, 33.40 134.54, 1km S by E Elliston, 30 Nov 1992, IDN, JCC. **Qld:** 1 female, along creek, 2km SE Drillham, 8 Oct 1974, I.D.Galloway (26.39 149.59) (UQIC); 1 female, Sunday Creek S.F., 600-700m, nr Jimna, 28-29 Sep 1974, IDN, beating and sweeping rainforest margin (26.40 152.28) (UQIC); 3 females, 1 male, 26.5 151.34, nr Westcott Plain, Bunya Mtns N.P., 6-7 Oct 1984, IDN, JCC; 1 male, 15.16 144.59, 14km W by N, Hope Vale Mission, 8-10 Oct 1980, JCC. **N.S.W.:** 2 females, 31.05 141.42, Fowlers Gap Research Station, 8-9 Dec 1982, JCC; 1 female, Bathurst, Feb-Mar 1962, yellow pan (33.25 149.35); 2 females, 31.57 151.24, 2km W Polblue Swamp, Barrington Tops S.F., 18 Nov 1981, TAW, AC, Berlesate; 1 female, 5km S by W Monga, 9 Nov 1981, IDN, JCC (35.35 149.55); 1 female, Trangie, 5-7 Oct 1979, R.Farrow, aerial netting (32.02 147.59). **A.C.T.:** 1 female, Canberra, Oct 1946, E.K.Riek, ex aphid nets (35.18 149.08); 1 female, Black Mt, 28-29 Mar 1968, light trap (35.16 149.06); 2 females, Black Mt, 16 Apr 1968, light trap; 1 female, Canberra, 13 Jul 1961, EFR; 23 females, 1 male, 35.35 149.00, Honeysuckle Creek, IDN, JCC, Malaise trap/ethanol, 13 ♀♀ 21-31 Mar 1985 (3 in NZAC), 2 ♀♀ 23 Apr-8 May 1985, 5 ♀♀ 1-10 Apr 1985, 4 ♀♀, 1♂, 11-22 Apr 1985; 15 females, 35.22 148.48, Piccadilly Circus, 1240m, TAW, JFL, M-LJ, FIT, 7 ♀♀ Feb 1984 (2 in NZAC), 5 ♀♀ Mar 1984, 3 ♀♀ Dec 1984; 5 females, 1 male, 35.22 148.50, 850m, Blundells Creek, 3km E of Piccadilly Circus, 4♀♀, Feb 1984, 1♀, 1♂, Jan 1985, JFL, TAW, M-LJ, FI/window trough trap; 2 females, 35.19 148.51, 750m, Wombat Creek, 6 km NE Piccadilly Circus, 1 ♀, Mar 1984, 1 ♀, Jan 1985, JFL, TAW, M-LJ, FI/window trough trap; 1 female, 23 July 1948, EFR. **Vic.:** 1 male, Tatura, 9 Jul

1987, I.Barrass, ex *Pseudococcus longispinus*, (36.27 145.14) (QM); 1 female, Creswick, L.George, sweeping, 28 Jun 1984, P.Greenslade (37.26 143.54) (SAM). **Tas:** 3 females, 40.58 148.01, 1km SSE Gladstone, IDN, JCC, 2 ♀♀ 29 Jan 1983, 1 ♀ 6 Feb 1983; 1 female; 42.53 146.22, 7km S Frodshams Pass, 25 Jan 1983, IDN, JCC (NZAC); 1 female, 42.10 146.08, 9km WSW Derwent Bridge, 21 Jan 1983, IDN, JCC; 1 female, 1 male, 41.22 147.24, 10km ENE of Nunamara, 11 Jan 1983, IDN, JCC (♀ in NZAC). (Type 30.42 129.30).

New Zealand: (22 females, 8 males; NZAC). **BP:** 1 female, L.Rotoiti Res, N Rotorua, 24-29 Mar 1978, S&J Peck, *Podocarpus* forest. **WI:** 1 male; Palmerston Nth, Munro's Bush, Mar 1981, P.Watt, Malaise trap. **GB:** 1 female, Gisborne, 27 Feb 1991, JGC, reared ex *Pseudococcus* sp. on citrus. **HB:** 2 females, Hastings, 24 Apr 1991, JGC, ex *Pseudococcus affinis* on citrus. **NN:** 2 females, 5 males, Appleby Research Orchard, Jun 1963, feeding on eggs of *Phenacoccus graminosus* McKenzie, 0148; 2 females, Saxon's Road, Nelson, 14 Feb 1964, ESG; 1 female; Parkes Farm, 88 Valley, 2 Mar 1971, N.A.Martin. **CO:** 1 female, The Horn Range, 900m, 8 Feb 1986, JWE, sweeping tussock (LU). **OL:** 1 female, Coronet Pk, 1640m, Jan 1981, Tussock/Alpine shrubs, *Hebe* mat plants, JSN, EWV, AKW.

Chatham Is.: 4 females, 4 males, Chatham Is., Waitangi, 24 Feb 1967, D-vac, *Juncus*, EWV; 1 female, 1 male, Chatham Is., Mangahou, 10 Feb 1967, moss sample, AKW, EWV.

Biology: *O. keatsi* is an egg predator and possibly also a parasitoid of pseudococcids. It has been reared from *Pseudococcus longispinus*; *Pseudococcus affinis* on citrus; feeding on eggs of *Phenacoccus graminicola.*

Distribution: **Australia:** all states (including Tasmania), except Northern Territory. **Chatham Islands; New Zealand:** WI, GB, HB/ NN, CO, OL.

Remarks: some specimens from Western Australia, New South Wales and the Australian Capital Territory have metallic thoraces. There are two forms of S1 morphology within this species (Figs 5.140, 5.141), but no other characters vary consistently between the two groups produced on this basis.

5.11.11 ***Ophelosia leai*** **Dodd** (Fig. 5.142; Map 53)

Ophelosia leai Dodd, 1924:169; Bouček, 1988a:354.

Lectotype: female (SAM), here designated.

Publication data: Original series "Described from two females labelled "Lord

Howe Island, A. M. Lea," and one female labelled "Norfolk Island." Type, I.14555, South Australian Museum." These specimens have the status of syntypes.

Label details: "Norfolk I,/ A. M. Lea" and "Ophelosia/ leai ♀/ Dodd, Co-Type" and "S. A. Museum/ Specimen".

Paralectotypes: two females (SAM)

Label details: "Lord Howe I,/ A. M. Lea" and "Ophelosia/ leai ♀/ Dodd, Co-Type" and "I20555/ Ophelosia/ leai Dodd/ L. Howe I: Norfolk I:/ Also slide/ Syn" and "S. A. Museum/ Specimen".

:"Lord Howe I,/ A. M. Lea" and "Ophelosia/ leai ♀/ Dodd, Co-Type" and "I20555/ Ophelosia/ leai Dodd/ L. Howe I: Norfolk I:/ Also slide/ Syn" and "S. A. Museum/ Specimen".

Ophelosia aligherini Girault, 1927:334; Dahms, 1983:38; Bouček, 1988a:354. **syn.n.**

Holotype: female, SAM

Publication details: "Tasm.: Waratah (A. M. Lea and H. J. Carter). One female.

Label details: Card labelled "Waratah/ Tas: Lea/ & Carter" and "Type" and "Ophelosia/ ali-/ gherini Girault/ Type ♀" and "Ophelosia/ aligherini Gir/ Tasmania/ also slide/ TYPE" and "S. A. Museum", specimen with 1 pair of wings missing.

Slide labelled "TYPE" and "Outer/ Ophelosia ali-/ gherini Girault/ Type ♀", with 1 forewing and 1 antenna covered by fragment of coverslip.

Female

Head orange-brown, dorsal margin weakly concave. Face 1.4 to 1.8x broader than long (mean 1.57). Occipital carina strong, ocelli removed from carina by 0.2x OD. Vertex transversely rugose-striate with scattered long setae; OD about equal to OOL.

Antennae inserted almost directly above clypeus. Scrobes carinate anteriorly, smooth; scapes and pedicels orange-brown, F1 brown, F2 and F3 orange brown, F5 brown, club medium brown. F1 and F5 slightly broader than long, F2 to F4 square.

Club 0.8 to 0.9x length of funicle (mean 0.79). Malar groove complete; malar space 0.5 x long axis of eye. Genae smooth; genal carina narrow, not striate. Oral margin straight between toruli, clypeus slightly produced, margin sloping down to offset genal carina. Mandible with lower pointed tooth and upper tooth divided into rounded lower tooth and 1 or 2 smaller blunt teeth.

Thorax orange-brown to dark orange-brown with metallic green reflections. Pronotum orange-brown, imbricate; setal ring of about 12 setae present. Mesoscutum darker orange-brown than pronotum, with metallic green reflections; imbricate, with short regular pilosity and pair of very long setae on apex. Scapulae imbricate. Scutellum subsquare, slightly convex in lateral aspect; dark orange-brown with green reflections; setae long; alutaceous anteriorly, very finely reticulate centrally. Frenal area delimited by change in sculpture to smooth. Axillae more or less smooth, slightly longitudinally striate. Dorsellum reduced, declivous, smooth; fovea expanded, rugose; metanotum smooth, furrow smooth except posteriorly. Mesepisternum with shallow triangular depression, mesepimeron smooth.

Propodeum dark brown. Median carina present anteriorly, costula present laterally; reticulate laterally, anterior to costula, rugose-reticulate posterior to costula; smooth around spiracles and smoother at apex of nucha. Nucha as long as broad; deeply emarginate medially at apical margin.

Forewing with infumate basal hairline and diffuse infumate patch posterior to stigmal vein and distal marginal vein. Marginal vein 2.1 to 2.9x length of stigmal vein (mean 2.5). Stigmal area sparsely setose. Costal cell with about 15 setae on apical margin; ventral line of setae uninterrupted, with partial second line. Basal hairline with a strip of setae (about 15), not triangular, shorter than submarginal setae; basal cell with scattered setae; cubital setal line absent. Speculum narrow.

Legs orange-brown, dorsal mid and hind tibiae darker; hind tibial spur 0.9x length of basitarsus. Hind coxae with dorsal, lateral and ventral setal crests.

Gaster dark orange-brown, oval. Basal fovea with numerous setae, not forming a compact tuft. T1 0.65 to 0.8x length of gaster. Ovipositor exserted. S1 with close longitudinal grooves interrupted by a smooth horizontal ridge medially (Fig. 5.142).

Male

Head dark red-brown, with slight metallic green lustre.

Antennae inserted slightly more than 1 torular diameter above clypeal margin. Scrobes smooth excepting a pair of setose patches anteriorly. Scapes yellow, pedicel and funicle yellow-brown. F1 longest funicle segment, F2-F4 approximately equal in length and shorter than F1; setae shorter than segments of origin. Club 1 to 1.4x length of F1.

Thorax dark red-brown, with slight metallic blue lustre. Scutellum longer than broad, longer than that of female. Dorsellum and fovea rugose; metanotum smooth, furrow smooth except posteriorly.

Propodeum dark brown-black; rugose-reticulate, median carina present anteriorly, costula present. Nucha as long as broad; deeply emarginate medially at apical margin.

Forewing hyaline except for infumate basal cell and cubital hairline. Marginal vein 2 to 2.6x length of stigmal vein (mean 2.3). Postmarginal vein about as long as stigmal vein. Costal cell with apical 0.6x length of margin setose. Basal hairline with a double line of setae; basal cell setose, cubital hairline infumate and setose.

Hind coxae with diffuse dorsal setal crest and lateral and ventral setal crests.

T1 0.5x length of gaster.

Other material examined: (27 females, 78 males; ANIC, QM, NZAC). **N.S.W.:** 1 male, Sunny Corner S.F., 25km E by S Bathurst, 19 Apr 1981, JCC (33.17 149.55). **Vic.:** 5 females, Belgrave, 26/12/26, A.P.Dodd (4 QM, 1 ANIC) (37.55 145.21); 1 female, Growler Creek, Lind N.P., 26 Feb 1980, IDN, JCC, (37.35 148.58); 2 females, 37.34 145.53, Cumberland Creek, 13km ESE Marysville, 18 Jan 1978, JFL, TAW; 1 female, 37.37 145.47, Cement Creek, 5km N Warburton, 17 Jan 1978, JFL, TAW. **Tas.:** 2 females, 43.07 146.47, Edwards Rd, Hartz Mtns, 4 Feb 1983, IDN, JCC; 1 female, 3 males, 41.22 147.24, 10km ENE of Nunamara, 1 ♀, 12 Jan-6 Feb 1983, 3 ♂♂, 11 Jan 1983, IDN, JCC, Malaise/ethanol; 1 female, 1 male, 41.16 145.37, Hellyer Gorge, 1 ♀, 1 Feb 1983, 1 ♂, 9 Dec 1981, IDN, JCC; 1 female, 43.09 146.47, Keoghs Road, Hartz Mtns, 4 Feb 1983, IDN, JCC; 1 female, 8 males, 41.19 147.56, Intake Bridge, 13 Jan 1983, IDN, JCC; 1 female, 19 males, 41.23 147.25, Mt Barrow, 11km E by N Nunamara, 8 ♂♂, 11 Jan, 1 ♀, 8 ♂♂, 30 Jan 1983, 6 ♂♂, 7 Feb, IDN, JCC; 6 males, 41.22 145.35, Wandle R., 10km NNE Waratah, 1 Feb 1983, IDN, JCC (2 in NZAC); 12 males, 41.14 147.56, 4km SE Weldborough, 13 Jan 1983, IDN, JCC; 4 males, 41.18 145.36, Saxons Rd, 17 Jan-1 Feb 1983, IDN, JCC, ex pantrap; 2 males, 40.58 148.01, 1km SSE Gladstone, 6 Feb 1983, IDN, JCC; 2 males, 40.49 145.24, 2km W Commonwealth Hill via Renison Bell, 1 Feb 1983,

IDN, JCC; 1 male, 43.05 146.17, Huon Camping Area, 25 Jan 1983, IDN, JCC; 1 male, 40.57 144.49, 5km SE by E Redpa, 18 Jan 1983, IDN, JCC; 1 male, 42.50 146.19, 5km W by S Frodshams Pass, 24 Jan 1983, IDN, JCC; 3 males, 41.38 148.13, Elephant Pass, 28 Jan 1983, IDN, JCC; 4 females, 9 males, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, closed forest, (W.E.B.S), Malaise, 3 ♀♀ 3 ♂♂ 8 Jan-12 Feb 1991 (2 ♀♀ in NZAC), 1♀ 4 Oct-6 Nov 1990, 1 ♀ 30 Nov 1990-8 Jan 1991, 1 ♀ 2 ♂♂ 11 Feb-1 Mar 1990, 2 ♂♂ 4 Apr-15 May 1990; 2 females, 1 male, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, 5-10 Feb 1990, IDN; 3 females, 41.35 145.56, Cradle Mt Camp, 880m, 17 Nov 1989, R.Coy, myrtle pyrethrum knockdown; 1 male, 43.22 146.09, Celery Top Is., Bathurst Is., 12-17 Feb 1990, IDN, rainforest; 1 male, 43.25 146.10, Melaleuca, Bathurst Harbour, 3 Dec 1990-1 Jan 1991, ESN, EDE, Malaise; 1 male, 43.22 146.08, Claytons, Bathurst Harbour, 3 Dec 1990-15 Jan 1991, ESN, EDE; 1 male, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, 860m, 8 Jan-12 Feb 1991, A.Calder, W.Dressler, Malaise, closed forest; 1 female, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, Mar 1991, IDN, crepuscular sweeping (NZAC). Type; 41.27 145.33.

Biology: Hosts are unknown.

Distribution: **Australia:** New South Wales, Victoria, Tasmania. **Lord Howe Island. Norfolk Island.**

Remarks: The Lord Howe I. specimens have fewer setae on the costal margin and in the basal cell of the forewing than do mainland specimens.

5.11.12 ***Ophelosi mcglashani*** **sp.n.** (Figs 5.56, 5.143; Map 16)

Holotype: female, NZAC.

Label details: "1861" and "Cobb Dam/ 4.v.72/ J. A. deBoer" and "Mealybug/ mature ♀/ on Chinochloa sp" and "19391".

Female

Head orange-brown, dorsal margin of head weakly concave. Face 1.4 to 1.6x broader than long (mean 1.49). Occipital carina very weak, barely present; ocelli removed from ocellar margin by 1OD. Vertex very finely transversely striate, with scattered long setae. OD about 0.5x OOL.

Antennae inserted slightly less than 1 torular diameter above clypeal margin, scrobes smooth and shiny, not carinate anteriorly. Scape and pedicel orange-brown,

flagellum darkening towards apex. F1 broader than long, other segments square or longer than broad. Club 0.8 to 0.9x length of funicle (mean 0.88). Genae smooth; genal carina narrow, not striate. Malar groove complete, inconspicuous; malar space 0.5x long axis of eye. Clypeal margin slightly produced, oral margin concave between toruli, sloping to offset genal carina. Mandible with pointed lower tooth and 2 pointed upper teeth.

Thorax dark orange-brown. Pronotum with close regular setation, setal ring with 8 setae. Mesoscutum broader than long, imbricate, with 3 pairs of setae. Scapulae imbricate. Scutellum slightly broader than long, flat in lateral aspect; engraved reticulate. Frenal area delimited only by change in sculpture to smooth in apical third; anterior pair of setae slightly closer together than posterior pair. Axillae smooth, with several setae. Dorsellum smooth, dorsellar fovea alveolate; metanotum smooth, metanotal furrow coarsely striate. Mesepisternum with shallow, alutaceous triangular depression, mesepimeron smooth and shiny.

Propodeum dark brown anteriorly, orange-brown posteriorly. Median carina present, costula present laterally; sculpture rugose-reticulate, smoother round spiracles. Nucha slightly broader than long, emarginate medially.

Forewing reduced (Fig. 5.56), reaching slightly past propodeum; submarginal and marginal veins present, rudimentary stigmal vein present, postmarginal vein absent. Reduced setose disc present, with at least 50 setae. Wing weakly infumate, darkened slightly along cubital hairline, basal hairline and at distal end. Costal cell reduced, scarcely excised at apex, with 2 setae on apical margin, and 7 long ventral setae which overlap costal margin. Basal hairline infumate; basal cell bare; not margined by cubital hairline. Wing fringed posteriorly and distally.

Legs orange-brown. Hind coxae with sparse lateral, basal and dorsal pilosity. Hind tibial spur 0.8x length of hind basitarsus.

Gaster orange-brown basally grading to darker brown apically; oval. Basal fovea with scattered setae at base. T1 0.9x length of gaster. Ovipositor exerted. S1 with moderately spaced long grooves, interrupted medially by a wide smooth horizontal ridge (Fig. 5.143).

Male

Head dark orange-brown.

Antennae inserted 1 torular diameter above clypeal margin. Antennae with short setation, setae about as long as width of segments of origin. F1 longer than F2 to F4; club 2.2x length of F1.

Thorax orange-brown, not metallic.

Wings reduced, as in female.

Gaster rectangular, orange-brown with dark brown band apically.

Paratypes: (11 females, 3 males; NZAC). **NN:** Cobb Dam, 5 May 1972, J.A.deBoer, mealybug mature ♀ on *Chionochloa* sp. **BR:** 1 female, Mt Murchison, 1220m, 21 Nov 1971, EWV, swept cushion grass; 3 males, S Victoria Range, nr Rahu Sdle, 1310m, 27 Jan 1972, JCW, litter and moss; 10 females, 3 males, Mt Roberts, 15 Mar 1968, EWV.

Biology: *O. mcglashani* has been reared from a mealybug on *Chionochloa*.

Distribution: **New Zealand:** -/ NN, BR.

5.11.13 *Ophelosia missimi* sp.n.

Holotype: female, BPBM.

Label details: "PNG: NEW GUINEA: NE:/ Morobe Prov.: Mt/ Missimi S side;/ 2000m, 28.v.1984" and "pyrethrum fog of/ *Castanopsis* sp.' mature canopy" and "sample #4, tree #3304? N. C. Gagne, coll./ BISHOP Museum".

Female

Head orange-brown, vertex dark brown with green metallic lustre; dorsal margin moderately concave. Face 1.62x broader than long. Occipital carina strong, posterior ocelli removed from margin by 0.1OD. Ocelli clear; OD slightly greater than OOL. Vertex transversely rugose, with scattered long setae.

Antennae inserted well below lower eye level, almost immediately above clypeal margin. Scrobes weakly carinate anteriorly; smooth. Scape orange-brown, pedicel and flagellum brown and club dark brown. F1 to F3 square, F4 and F5 slightly broader than long. Club 1.07x longer than flagellum. Genal carina narrow

medially; not striate. Malar groove absent; malar space 0.6x long axis of eye. Clypeus slightly produced, oral margin slightly concave between toruli; sloping to very slightly offset genal carina.

Thorax dark red-brown, with green metallic reflections. Pronotum broader than long; regular short pilosity over entire surface; sculptured over entire surface, no smooth band. Setae in pronotal ring number about 14. Mesoscutum imbricate; with regular long pilosity, additional pair at posterior edge, abutting scutellum. Scapulae imbricate with several long setae. Scutellum subsquare, convex in lateral aspect; alutaceous; anterior pair of setae closer together than posterior pair. Frenal area not delimited by line, but by change in sculpture to smooth. Axillae mostly smooth, with several long setae. Mesepisternum with depressed triangular area, smooth. Mesepimeron glabrous, slightly striate around edges. Metapleuron glabrous. Dorsellum longitudinally striate, wide and declivous; dorsellar fovea wide and coarsely alveolate; metanotum smooth, metanotal furrow coarsely striate.

Propodeum dark red-brown. Median carina present anteriorly, costula present laterally; surface reticulate anterior to costula, alveolate-reticulate posteriorly. Nucha slightly longer than broad, apical margin slightly emarginate. Petiole long and conspicuous.

Forewing infumate at basal hairline and with a narrow infumate strip posterior to stigmal vein. Marginal vein 3.1x as long as stigmal vein. Postmarginal vein subequal to stigmal vein in length. Stigmal area slightly setose. Costal cell with 8 setae on apical cell margin; ventrally with a complete setal row and a partial second row. Basal hairline with line of about 6 setae, shorter than submarginal setae; basal cell bare; not margined by cubital row of setae. Speculum present.

Legs and coxae orange-brown, hind coxae darker. Mid and hind tibiae dark brown. Hind coxae without basal setal crest, with sparse dorsal and lateral crest. Hind tibial spur same length as hind basitarsus.

Gaster elongate, dark orange-brown, grading to dark brown apically. Basal fovea with scattered very sparse setae at base; setae not extended down margin of fovea. T1 0.7x length of gaster. Ovipositor not projecting beyond end of gaster. S1 with coarsely spaced longitudinal grooves interrupted by a longitudinal smooth patch.

Male unknown

Other material examined: Holotype only.

Biology: Hosts are unknown.

Distribution: **Papua New Guinea.**

5.11.14 ***Ophelosia odiosa*** **sp.n.** (Fig. 5.144; Map 54)

Holotype: female, ANIC.

Label details: "near Boddington W. A./ 24 Mar.-1 Apr 1984/ A. Postle/ ex ethanol".

Female

Head orange-brown, with slightly metallic lustre on ocelli; dorsal margin weakly concave. Face 1.3 to 1.5x broader than long (mean 1.37). Occipital carina complete, ocelli 0.1 OD from margin. Back of head alutaceous with line of setae posterior to occipital carina. Ocelli clear; OD approximately 0.6x OOL. Eyes minutely hairy. Vertex alutaceous, with moderately long scattered setae.

Antennae inserted just above clypeal margin. Scrobes not sculptured, not carinate anteriorly. Scape and funicle orange, pedicel, F1 and club darker. F1 transverse, F2 to F5 from longer than broad to square; setae short. Club elongate, 0.6 to 0.7x length of funicle (mean 0.67). Genal carina narrow, striate. Malar groove complete but inconspicuous; malar space 0.8x long axis of eye. Oral margin straight between toruli, sloping down to offset genal carina. Mandibles large; with pointed lower tooth and 2 upper teeth, upper rounded and middle pointed.

Thorax orange, grading to dark orange-brown with slight metallic green reflections. Pronotum orange, imbricate; setae numerous and conspicuous. Setal ring with 12 setae. Mesoscutum alutaceous, orange to dark orange-brown with metallic green reflections; covered with regular light setae and pair of long setae. Scapulae alutaceous. Scutellum subsquare, slightly convex in lateral aspect; orange-brown; alutaceous; anterior pair of setae slightly closer together than posterior pair. Frenal

area not delimited. Axillae smooth, with metallic reflections. Dorsellum smooth, dorsellar furrow alveolate; metanotum smooth, metanotal furrow coarsely striate. Mesepisternum with alutaceous triangular depression, mesepimeron smooth medially and striate around edges. Metapleuron finely transversely striate.

Propodeum dark brown-black anteriorly, orange posteriorly. Median carina present, costula scarcely discernable; sculpture alveolate-reticulate over entire surface. Nucha longer than broad. Apical margin slightly emarginate.

Forewing infumate at basal hairline and also with faint infumate patch posterior to marginal and stigmal veins. Marginal vein 2.7 to 3.2x length of stigmal vein (mean 2.92). Postmarginal vein equal in length to stigmal vein. Stigmal area setose. Costal cell with about 6 setae on apical cell margin, ventral row of setae continuous, with partial second line. Basal hairline with strip of setae about 3 wide, setae shorter than submarginal setae, totalling about 10; basal cell bare; not margined by cubital hairline. Speculum present.

Legs and coxae orange, hind tibiae and femora darker dorsally. Hind coxae with diffuse dorsal and lateral crests of setae. Hind tibial spur 0.6x length of basitarsus.

Gaster striped, orange and dark brown; elongate, pointed. T1 0.6x length of gaster. Basal fovea with scattered setae at base. Ovipositor exerted. S1 with moderately spaced longitudinal grooves anterior to smooth horizontal ridge, posteriorly grooves are more closely spaced (Fig. 5.144).

Male

Head dark metallic green; OD approximately equal to OOL.

Antennae inserted about 1 torular diameter above clypeal margin; orange, brown dorsally. Flagellar segments not transverse; F1 longest and widest, decreasing in length toward apex; not nodose; setae very short and numerous; sensilla also short and numerous. Club 1.2 to 1.4x longer than F1 (mean 1.3). Genal carina reduced.

Thorax metallic green, setae brown. Metanotum black.

Forewing infumate at basal hairline and with large diffuse infumate patch posterior to stigmal vein. Marginal vein 2.2 to 2.5x length of stigmal vein (mean 2.35). Costal cell setose for about 0.3x length of apical margin. Basal hairline with

line of setae; basal cell slightly setose, margined by cubital hairline.

Hind coxae with diffuse dorsal and lateral pilosity.

Paratypes: (8 females, 8 males; ANIC, in NZAC where stated). **W.A.:** 8 females, 8 males, near Boddington, 24 Mar-1 Apr 1984, A.Postle (1♀ and 1♂ deposited in NZAC) (32.48 116.28).

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Western Australia.

5.11.15 ***Ophelosia rieki*** **sp.n.** (Figs 5.57, 5.145; Map 55)

Holotype: female, ANIC.

Label details: "Broken Hill NSW/ 20 Nov 49/ E F Riek".

Female

Head orange-brown; dorsal margin very weakly concave, almost straight. Face 1.5 to 1.7x broader than long (mean 1.59). Occiput strongly margined; ocelli about 0.1 OD from margin. Vertex finely transversely striate, with scattered moderately long setae. OD more than 2x greater than OOL.

Antennae (Fig. 5.57) inserted less than half a torular diameter above clypeal margin, scrobes finely transversely rugose, no smooth area, carinate anteriorly. Scapes orange-brown, pedicel and flagellum darker. F1 about 2x as broad as long, F2 square, F3 to F5 slightly broader than long. Club 0.7 to 0.8x length of funicle (mean 0.79).

Genae smooth; genal carina narrow, not striate. Malar groove complete but inconspicuous; malar space 0.5x long axis of eye. Oral margin straight between toruli, sloping slightly to very slightly offset genal carina. Mandible with pointed lower tooth and 2 rounded upper teeth.

Thorax dark orange-brown, with metallic green reflections. Pronotum with close short regular setation and setal ring of 12-14 setae. Mesoscutum imbricate, with

regular pilosity and pair of slightly longer setae at mesoscutum-scutellum boundary. Scapulae imbricate. Scutellum subsquare, slightly convex in lateral aspect; alutaceous basally, almost smooth apically; anterior pair of setae only slightly closer together than posterior pair. Frenal area not delimited, no abrupt change in sculpture. Axillae smooth, with pair of setae. Dorsellum smooth, dorsellar fovea alveolate; metanotum smooth, metanotal furrow coarsely striate. Mesepisternum with shallow triangular, coarsely transversely striate depression, mesepimeron smooth and shiny. Metapleuron mainly smooth with some transverse striae around edges.

Propodeum orange-brown. Median carina present anteriorly, costula present laterally; reticulate laterally, anterior to costula, alveolate-rugose posterior to costula; smooth around spiracles. Nucha as long as broad. Apical margin of nucha smooth, emarginate.

Forewing with large pale diffuse infumate patch posterior to marginal and stigmal veins, and infumate basal hairline. Marginal vein 2.2 to 3.3x length of stigmal (mean 2.69). Postmarginal vein about same length as stigmal vein. Stigmal area setose. Costal cell with 2 setae on apical margin; ventral row of setae broadly interrupted. Basal hairline with triangular tuft of setae as long as proximal submarginal setae, posterior setae shorter; totalling about 30; basal cell bare; cubital row of setae absent. Speculum present.

Legs orange-brown, tibiae and femora darker dorsally. Hind coxae with lateral and sparse basal but no dorsal pilosity. Hind tibial spur 0.9x length of hind basitarsus.

Gaster oval; orange-brown basally grading to darker brown apically. T1 0.8x length of gaster. Basal fovea with scattered setae at base. Ovipositor not exerted. S1 longitudinally grooved anteriorly, grooves as wide as long; medially with a wide raised, irregularly alveolate area; posteriorly and laterally grooved, grooves as wide as long (Fig. 5.145).

Male

Head black, with metallic green reflections.

Antennae inserted about 1 torular diameter above clypeal margin; concolorous yellow-brown. Flagellar segments not nodose; setae no longer than width of segments

of origin. F1 slightly longer than other segments. Club 2 to 2.3x longer than F1 (mean 2.15). Malar groove complete but not conspicuous.

Thorax black, with metallic green reflections.

Propodeum dark orange-brown.

Forewing hyaline, very faintly infumate along basal hairline. Marginal vein twice length of stigmal vein. Costal cell margined with setae along apical third. Basal hairline with tuft of setae 3 wide, not conspicuous; basal cell with several scattered setae; cubital hairline present. Speculum almost absent.

Legs yellow-brown, darker on mid and hind tibiae and on coxae; hind coxae with lateral and basal pilosity, bare basally.

Gaster longer than wide, mid-brown anteriorly, grading to dark brown posteriorly. T1 0.9x length of gaster.

Paratypes: (11 females, 1 male; ANIC, NZAC). **N.S.W.:** 11 females, 1 male, Broken Hill, NSW, 20 Nov 1949, E.F.Riek, *Acacia* fruit galls (31.58 141.27) (2♀♀ deposited in NZAC).

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** New South Wales.

5.11.16 ***Ophelosia saintpierrei*** **Girault** (Figs 5.58, 5.146; Map 56)

Ophelosia saintpierrei Girault, 1913a:315; Dahms, 1986:497; Bouček, 1988a:354.

Holotype: female, QM.

Publication details: "Described from a single female captured by sweeping in forest, February 16, 1911 (A. M. Lea and A. A. G.). *Habitat:* Nelson (Cairns), Queensland. *Type:* No. *Hy.1961*, Queensland Museum, the above specimen on a tag, the head and legs on a slide."

Label details: Card labelled "TYPE" and "HOLOTYPE/ Hy.1961/ E.C.D.1985" and "Asaphomorphelleus ♀/ saintpierrei/ Gir./

Type" and "Published in 1913/ as Ophelosia/ saintpierrei Grlt./ det. Z. Bouček. 1976" and "QUEENSLAND/ MUSEUM", with the pronotum and part of remaining thorax, and part of 1 leg. Slide labelled "Ophelosia/ Asaphomorpheus/ saintpierrei Gir/ ♀ type" and "TYPE" with a complete coverslip and a part coverslip covering the head, antennae, 1 forewing, part of the thorax and 4 legs.

Ophelosia pinguis Girault, 1913a:315; Dahms, 1986:411-412; Bouček, 1988a:354. **syn.n.**

Holotype: female, QM

Publication details: "Described from one female captured from a window, November, 1912. *Habitat*: Nelson (Cairns), Queensland. *Type*: No. *Hy 1962*, Queensland Museum, the above specimen on a tag, the head, fore and hind legs on a slide."

Label details: Card labelled "TYPE" and "HOLOTYPE/ Hy. 1962/ E.C.D. 1985" and "Asaphomorphellus/ pinguis Gir ♀/ Type" and "Published in 1913/ as Ophelosia/ pinguis Grlt./ det. Z. Bouček. 1976" and "QUEENSLAND/ MUSEUM".
Slide labelled "Asaphomor-/ phelleus pin-/ guis Gir ♀ type" and "Ophelosia" and "TYPE". 1 whole coverslip with head, 2 entire detatched antennae, mid and hind legs and front coxae and 1 broken coverslip with 1 forewing.

Female

Head orange-brown, dorsal margin moderately concave. Face 1.4 to 1.6x broader than long (mean 1.48). Occipital carina strong, ocelli about 0.1 OD from carina. Back of head imbricate. OD less than or same as OOL. Vertex alutaceous, with scattered long setae in punctations.

Antennae (Fig. 5.58) inserted slightly less than 1 torular diameter above clypeal margin; scrobes very strongly carinate anteriorly; carinae extending to lower ocular level, margined with long strong setae. Scrobes not sculptured; antennal scape

and pedicel yellow, flagellum slightly darker dorsally. F1 much broader than long, annelus-like; F2 very slightly longer than broad, F3 and F4 square, F5 slightly broader than long. Club 0.6 to 0.7x length of funicle (mean 0.64). Lower face finely striate; genal carina wide, not striate. Malar groove complete; malar space 0.6x long axis of eye. Genal carina moderately wide, coarsely striate. Clypeus conspicuous, produced; oral margin convex between toruli, sloping down to offset genal carina. Mandibles with pointed lower tooth and 2 blunt upper teeth.

Thorax orange-brown to dark brown, with slight metallic purple-green reflections. Pronotum imbricate anteriorly, alutaceous posterior to setal ring. Setal ring with about 10 setae. Mesoscutum orange-brown with metallic purple reflections; engraved reticulate; with paired setae only (3 to 5 pairs), regular setae absent. Scapulae engraved reticulate, with only paired setae. Scutellum slightly longer than wide, slightly convex in lateral aspect; orange-brown anteriorly darkening to dark brown posteriorly, with metallic reflections; alutaceous; anterior margin crimped. Frenal area not delimited. Axillae alutaceous. Dorsellum smooth, declivous, fovea heavily alveolate; metanotum smooth, metanotal furrow coarsely striate. Mesepisternum with striate triangular depression, mesepimeron smooth centrally, striate round edges. Metapleuron smooth centrally, striate around edges.

Propodeum orange-brown. Median carina present anteriorly, costula present laterally; reticulate laterally anterior to costula, alveolate-rugose posteriorly; smooth around spiracles. Nucha as long as wide, deeply emarginate at apical margin. Tuft of setae at spiracles long, conspicuous.

Forewing with infumate patch posterior to distal half of marginal and stigmal vein. Marginal vein 2.1 to 3.1x length of stigmal vein (mean 2.56). Postmarginal vein 1.1x length of stigmal vein. Stigmal area setose. Costal cell with 3 to 5 setae on apical margin; row of ventral setae continuous, and partial second row. Basal hairline infumate, with a strip of setae, shorter than submarginal setae, totalling from 15 to 25. Basal cell bare; cubital hairline absent. Speculum wide.

Legs honey-yellow, with dorsal tibiae darkened on mid and hind legs. Hind tibial spur 0.6x length of hind basitarsus. Hind coxae with lateral setal crests present, dorsal crests absent.

Gaster orange-brown anteriorly, grading to darker posteriorly; convex in

lateral aspect. Basal fovea with scattered setae at base. T1 0.6x length of gaster. Ovipositor not exerted. S1 with broad foveate grooves anteriorly; wide medial irregularly alveolate area and posteriorly grooved, grooves longer than broad (Fig. 5.146).

Male

Head dark orange-brown, metallic blue on vertex. Vertex with scattered setae in punctations, punctations more distinct than in female.

Antennae inserted about 1.5 torular diameters above clypeal margin; concolorous light brown. F1 longest, F2- F4 approximately equal in length. Club 1.47x longer than F1, setae shorter than segments of origin.

Thorax metallic blue. Mesoscutum with 4 pairs of setae.

Forewing with infumate patch and infumate basal hairline. Marginal vein 2.5x length of stigmal vein. Apical margin of costal cell with 2 setae on apex. Basal hairline with a strip of setae; basal cell bare; cubital hairline absent.

Hind coxae with lateral but no dorsal pilosity.

Gaster dark red-brown, convex.

Other material examined: (18 females, 1 male; ANIC, in QM, NHM, NZAC where stated). **W.A.:** 1 female, 20km N Denmark, 16 Jan 1987, JSN (34.47 117.21); 4 females, Stirling Range N.P., 10-16 Jan 1987, JSN (34.23 117.52) (1 in NZAC). **N.T.:** 1 female, 24.03 133.59, 41km S by E Alice Springs, 4 Oct 1978, JCC. **S.A.:** 1 female, 31.08 138.33, Parachilna Creek, 8 Nov 1987, IDN, JCC. **Qld:** 1 female, 25.09 151.11, 24km N by E Eidsvold, 11 Oct 1984, JCC, IDN (NZAC); 1 female, 7.5km on rd to Granite Gorge, nr Mt Aunt, Atherton Tableland, 2 May 1988, ECD, GS (17.05 145.23) (QM). **A.C.T.:** 8 females, Canberra, Black Mt, early Feb, 1977, ZB (NHM); 1 female, Canberra, Oct 1946, E.F.Riek, ex aphid nets (35.18 149.08). **Tas.:** 1 male, 42.56 147.19, The Lea, 5 Feb 1983, IDN, JCC. (Type: 16.55 145.46).

Biology: Hosts are unknown.

Distribution: **Australia:** Collected in all states excepting New South Wales and Victoria.

Remarks: Girault obviously recognised the similarity between the species he

designated *O. saintpierrei* and *O. pinguis,* since he appears to have intended to describe both of the in another genus *Asaphomorphelleus* (or *Asaphomorpheus*) but apparently changed his mind and published the two as species of *Ophelosia* without changing the type labels.

5.11.17 ***Ophelosia stenopteryx*** **sp.n.** (Figs 5.59, 5.147; Map 17)

Holotype: female, NZAC

Label details: "NEW ZEALAND: N.Is/ 20. mls. S. Turangi/ 19.ii.1979 L. A. Mound".

Female

Head orange-brown to dark brown, with faint metallic lustre; dorsal margin not concave. Face 1.3 to 1.4x broader than long (mean 1.36). Occipital carina weak, ocelli removed from margin by more than one OD. Back of head alutaceous; OD 0.8x OOL. Vertex alutaceous, with scattered moderately long setae.

Antennae inserted less than 1 torular diameter above clypeal margin. Scrobes smooth, not carinate anteriorly. Scapes orange, pedicel and flagellum medium brown, club slightly darker. Funicular segments all subsquare, setae short. Club 0.75x length of funicle. Malar groove complete; malar space subequal to long axis of eye. Genae smooth, genal carina narrow, not striate. Clypeus produced, forming long narrow strip, margin curved. Genal carina and clypeal margin offset. Mandible with pointed lower tooth and 2 upper teeth, upper blunt and lower pointed.

Thorax orange-brown. Pronotum long, length about 0.3x width; imbricate, with regular setation; setal ring with 10 setae present. Mesoscutum reduced; broader than long; imbricate, with 4 pairs of setae. Notauli composed of discrete pits. Scapulae imbricate. Scutellum square, flat in lateral aspect; engraved reticulate; anterior pair of setae slightly closer together than posterior pair. Frenal area metallic green; delimited by a change in sculpture to smooth. Axillae smooth and shiny, dark orange-brown with metallic reflections. Dorsellum smooth and shiny, declivous; fovea alveolate; metanotum smooth, furrow coarsely striate. Mesepisternum with shallow, faintly engraved reticulate triangular depression, mesepimeron smooth.

Propodeum orange-brown to dark brown-black. Median carina present anteriorly, costula present laterally; sculpture entirely alveolate-reticulate except for area round spiracles and at apex of nucha. Nucha as long as broad; apical margin slightly emarginate. Tufts of setae under spiracles conspicuous, long.

Forewing narrow (Fig. 5.59); with infumate basal hairline and large diffuse infumate patch posterior to marginal and stigmal veins. Marginal vein 3.3 to 4.2x as length of stigmal vein (mean 3.72). Stigmal area bare. Postmarginal vein 1.3x longer than stigmal vein. Costal cell narrow, with 3 setae on apical margin; not excised at apex. Ventral row of setae in costal cell broadly interrupted, consisting only of a couple of setae at base and apex. Basal hairline infumate, with triangular strip of setae shorter than submarginal setae, totalling from 12-14. Basal cell slightly setose, cubital hairline absent. Speculum wide, linea calva not delimited.

Legs orange-brown. Hind tibial spur 0.8x length of hind basitarsus. Hind coxae with basal and sparse lateral crests of setae; dorsal crest absent.

Gaster orange-brown, dark brown basally and apically, oval. Basal fovea with a few setae at base; not extended down margin. T1 0.6 to 0.8x length of gaster. Ovipositor exerted. S1 with moderately spaced longitudinal grooves interrupted medially by wide, closely alveolate area (Fig. 5.147).

Male

Head dark red-brown, with metallic blue lustre.

Antennae inserted about 1.5 torular diameters above clypeal margin. Scapes yellow, remainder mid-brown. F1 slightly longer than F2-F4, these latter subequal in length; no flagellar segments conspicuously nodose; setae about as long as segments of origin. Club 2.2 to 2.7x length of F1 (mean 2.45).

Thorax dark red-brown, with metallic blue lustre. Setal ring on pronotum with 8 setae. Mesoscutum with 2 pairs of setae.

Forewing narrow; with infumate patch and infumate basal hairline. Marginal vein 5 to 5.2x longer than stigmal vein (mean 5.1). Costal cell with 2 setae along apical margin. Basal hairline infumate, with a strip of short setae; basal cell bare; cubital hairline absent.

Gaster yellow-brown, grading to medium brown apically. T1 0.9x length of

gaster.

Paratypes: (6 females, 2 males; NZAC, in ANIC where stated). **AK:** 1 female, Auckland, Cornwallis Beach, Aug 1980, JSN. **WN:** 2 females, Otaki, 31 Jan 1957, R.A.Cumber, pasture. **NN:** 1 female, Nelson, Saxon's Rd, 14 Feb 1964, ESG, rushes; 1 female, Appleby, 23 Dec 1965, EWV; 1 male, Cobb Dam, Mar 1981, R.Curtis, Malaise trap. **CO:** 1 female, Kawarau Gorge, Roaring Meg, Upper Power House, 17 Mar 1975, JCW, moss; 1 male, Watts Rock, 1200m, Jan 1981, swept JSN, EWV.

Biology: Hosts are unknown.

Distribution: **New Zealand:** AK, WN/ NN, CO.

5.11.18 ***Ophelosia tasmaniensis*** **sp.n.** (Figs 5.60, 5.148; Map 57)

Holotype: female, ANIC

Label details: "41.23S 147.25E/ Mt Barrow 11km E/ by N Nunamara/ TAS, 30 Jan 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol".

Female

Head light orange-brown, dorsal margin slightly concave. Face 1.3 to 1.6x broader than long (mean 1.47). Occipital carina strong, ocelli removed from margin by 0.1 OD. Back of head alutaceous. Ocelli small; OD approximately 0.5x OOL. Eyes minutely hairy. Vertex and face alutaceous, vertex with moderately long dark setae.

Antennae inserted just above clypeal margin; scrobes smooth, unsculptured, not delimited anteriorly by a carina. Scape, pedicel and some funicular segments orange-brown, club and some funicular segments dark brown. F1 slightly broader than long, F2 slightly longer than broad, F3 square, F4 and F5 slightly broader than long. Club 0.8 to 0.9x length of funicle (mean 0.86). Genal carina narrow, not striate. Malar groove complete, not deep; malar space 0.6x long axis of eye. Clypeal margin slightly produced; oral margin straight between toruli, sloping down to offset genal carina. Mandible with pointed lower tooth and 2 rounded upper teeth.

Thorax orange-brown to dark brown, without metallic reflections. Pronotum imbricate anteriorly, smooth posteriorly. Setal ring with 14 setae. Mesoscutum

broader than long, alutaceous; with regular setation and pair setae posteriorly. Scapulae imbricate. Scutellum slightly broader than long, flat in lateral aspect; alutaceous anterior to posterior setae. Frenal area delimited only by change in sculpture to smooth. Axillae shiny, unsculptured. Dorsellum reduced to a smooth declivous strip; fovea triangular, alveolate over whole area; rest of metanotum smooth, furrow coarsely striate. Mesepisternum with reduced depression, mesepimeron smooth. Metapleuron mainly smooth, a few peripheral striae.

Propodeum dark orange-brown. Median carina present anteriorly, costula present laterally; alveolate reticulate. Nucha as long as wide, emarginate posteriorly. Tufts of setae at spiracles.

Wings reduced (Fig. 5.60), wedge-shaped; reaching half way down T1. Submarginal and marginal veins present, marginal vein approximately 0.5x length of submarginal. Rudimentary stigmal and postmarginal veins present. Costal cell narrow with no setae on costal margin, an interrupted row of ventral setae present. Basal hairline 2-3 setae; basal cell bare, not margined by cubital hairline. Speculum present, disc reduced. Apical wing margin with setal fringe.

Legs orange-yellow, mid and hind tarsi darker dorsally. Hind coxae with dorsal and lateral crests of setae. Hind tibial spur 0.95x length of basitarsus.

Gaster orange-brown, grading to dark brown posteriorly. Basal fovea with a small tuft of setae at base. T1 0.6x-0.7x length of gaster. Ovipositor exerted. S1 grooved anteriorly, grooves longer than wide; medially with a smooth horizontal ridge and posteriorly grooved, grooves longer than anterior grooves (Fig. 5.148).

Male unknown

Paratypes: (15 females; ANIC, in NZAC where stated). **Tas.:** 6 females, 41.23 147.25, Mt Barrow, 11km E by N Nunamara, IDN, JCC, 5 ♀♀, 30 Jan 1983 (1 in NZAC), 1 ♀, 7 Feb 1983 (NZAC); 1 female, 41.30 146.05, 14km SW by S Wilmot, 31 Jan 1983, IDN, JCC; 1 female, 41.19 147.56, Intake Bridge, 13 Jan 1983, IDN, JCC; 1 female, 42.37 147.39, 5km W Buckland, 27 Jan 1983, IDN, JCC; 1 female, 41.18 145.36, Saxons Rd, 17 Jan-1 Feb 1983, IDN, JCC, ex pan trap; 1 female 42.10 146.10, 7km SW by W Derwent Bridge, 16 Jan-2 Feb 1983, IDN, JCC, ex pantrap; 3 females, 41.14 147.56, 4km SE Weldborough, IDN, JCC, 2 ♀♀, 13 Jan 1983, 1 ♀ 29 Jan 1983; 1 female, 41.50S, 146.03E, Pelion Hut, 3km S Mt Oakleigh, open forest, (W.E.B.S.), Malaise, 30 Nov 1990-8 Jan 1991; 1 female, 41.51 146.03, nr Barers Hut Creek, 5km S Mt Oakleigh, 29 Nov 1990, IDN.

Biology: Hosts are unknown.

Distribution: **Australia:** Tasmania.

Note: Unplaced short-winged forms: (Figs 5.61, 5.62)

A group of specimens with a wing length intermediate between *O. brevisetosa* and *O. tasmaniensis* are described below. Several of the specimens do not fully fit the description and the variation is discussed under "Remarks".

Female

Head orange-brown, dorsal margin moderately concave. Face 1.4 to 1.5x broader than long. Occipital carina strong, ocelli removed from margin by 0.2 OD. Ocelli small; OD approximately 0.75x OOL. Vertex and face alutaceous, vertex with moderately long dark setae.

Antennae inserted just above clypeal margin, less than 0.5 torular diameters; scrobes smooth, unsculptured, not delimited anteriorly by a carina. Scape orange, pedicel and flagellum darkening toward mid-brown club. Funicular segments all broader than long, setae close and short. Club subequal to funicle in length. Genal carina narrow, not striate. Malar groove complete, not deep; malar space 0.5x long axis of eye. Clypeal margin slightly produced, oral margin convex between toruli, sloping down to offset genal carina.

Thorax orange-brown, without metallic reflections. Pronotum imbricate anteriorly, smooth posteriorly, with a setal ring of about 12 setae. Mesoscutum broader than long, alutaceous; with 5 pairs of setae. Scapulae alutaceous. Scutellum broader than long, flat in lateral aspect; alutaceous anterior to posterior pair of setae. Frenal area delimited only by change in sculpture to smooth in apical quarter. Axillae shiny, unsculptured. Dorsellum long narrow strip, unsculptured; dorsellar furrow narrow, alveolate. Remainder of metanotum smooth. Mesepisternum with reduced depression, mesepimeron smooth. Metapleuron smooth.

Propodeum orange-brown. Median carina present anteriorly, costula present laterally; alveolate reticulate, smoother round spiracles. Nucha as long as wide, deeply emarginate posteriorly. Tufts of setae at spiracles.

Wings reduced, wedge-shaped; reaching half way down propodeum (Figs 5.61, 5.62); faintly infumate, with a darker patch just proximal to marginal vein. Submarginal and reduced marginal veins present, marginal vein about 0.3x length of submarginal vein. Submarginal vein with 2 or 3 long setae, marginal vein with 3-4 long setae at apex. Stigmal vein reduced to a slight knob at apex of marginal vein, postmarginal vein absent. Costal cell narrow, with no setae on costal margin, and no ventral setae present. Basal cell not delimited, no proximal setae present including cubital hairline or basal hairline. Speculum absent, disc reduced, with only one or few dorsal setae. Setal fringe absent.

Legs orange. Hind coxae with sparse dorsal and lateral crests of setae. Hind tibial spur 0.85x length of basitarsus.

Gaster orange-brown, darkening slightly posteriorly. Basal fovea with scattered setae at base. T1 0.5x length of gaster. Ovipositor exerted. S1 variously sculptued.

Male

Antennae inserted about 1 torular diameter above clypeal margin. Mid-brown, flagellar segments about equal in length, F1 slightly longer than others. Club 1.5x longer than F1. Setae slightly shorter than segments of origin.

Malar groove complete, conspicuous.

Pronotum mid-brown anteriorly, nucha orange-brown.

Forewing reduced; hyaline except at apex. Submarginal vein present, with 2 setae; 3 setae at apex. Some setae on reduced disc. Basal and cubital hairlines absent, also postmarginal vein and setal fringe.

Hind coxae with dorsal, lateral and basal setal crests.

Gaster orange basally, apical half dark brown.

Other material examined: (8 females, 1 male; ANIC). **N.S.W.:** 1 female, 30.29 152.25, Point Lookout, New England N.P., 12-22 Feb 1984, IDN, ex pantraps. **A.C.T.:** 3 females, 1 male, 35.22 148.50, Blundells Creek, 3km E of Piccadilly Circus, 850m, 1♀ Mar 1984, 1♀ Sep 1984, 1♀ 1♂, Jan 1985, TAW, JFL, M-LJ, FIT; 2 females, 35.19 148.51, Wombat Creek, 750m, 6km E of Piccadilly Circus, 1♀ Apr 1984, 1♀ Jul 1985, JFL, TAW, M-LJ, FIT. **Tas.:** 1 male, 41.22 147.24, 10km ENE of Nunamara, 11 Jan 1983, IDN, JCC; 1 male, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, open forest, (W.E.B.S.), Malaise, 4 Apr-15 May 1990; 1 male, 41.50

146.03, Pelion Hut, 3km S Mt Oakleigh, 5-9 Apr 1991, JAB; 1 female, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, 5-10 Feb 1990, IDN; 1 male, 41.44 146.42, Central Plateau nr Projection Bluff, 1200m, 27 Apr 1988, L.Hill, suction trap.

Remarks: Another group of specimens with wings of the same intermediate size and similar to the above species in most aspects differ as follows:

-vertex with short setae

-T1 varies from 0.6-0.8x length of gaster

-forewing with several dorsal setae on wing disc, only 2 long setae and a number of short setae at the apex of the marginal vein

-rudimentary stigmal vein is slightly more developed

N.S.W.: 1 female, Cabbage Tree Creek, foot of Clyde Mt, 27 Sep 1979, IDN, JCC. **A.C.T.:** 1 female, 35.22 148.50, Blundells Creek, 3km E of Piccadilly Circus, 850m, Feb 1984, TAW, JFL, M-LJ, FIT; 2 females, 35.19 148.51, Wombat Creek, 750m, 6km E of Piccadilly Circus, 1♀ Sep 1985, 1♀ Oct 1985, JFL, TAW, M-LJ, FIT.

One specimen which fits in *O. tasmaniensis* (flat scutellum, alveolate dorsellar fovea, long setae on vertex, non-alveolate S1) has slightly different forewings (slightly shorter and darkly infumate at basal hairline and at apex), one reduced hindwing and the other twice the length of the reduced forewing, *i.e.* is almost complete.

A.C.T.: 1 female, 35.19 148.51, Wombat Creek, 6km NE of Piccadilly Circus, 750m, Apr 1984, TAW, JFL, M-LJ.

Biology: Hosts are unknown.

Note I: Holotype not located

Ophelosia viridithorax Girault, 1916a:228

Holotype: U.S.N.M.

Publication details: "From one female on a tag in the U.S.N.M. labelled "Australia. Koebele." The type is in the U.S.N.M. Catalogue No. 19688"

Note II: Unplaced specimens

i) Unassociated males only, long club, scrobes not carinate: **W.A.:** 1 male, Cape Arid N.P., Yokinup Bay area, 31 Dec 1986-3 Jan 1987, JSN; 2 males,

31.54 127.09, 11km E Madura, 13 Oct 1981, IDN, JCC. **N.T.:** 1 male, 22.18 137.52, Illungnarra WH, 90km SW by S of Urandangi, 15 Oct 1978, JCC. **S.A.:** 1 male, Mt Barker, 500m, Adelaide, 30 Nov-2 Dec 1986, JSN. **N.S.W.:** 6 males, 32.51 141.37, 100km SbyE Broken Hill, 3-13 Oct 1988, E.D.Edwards, Malaise trap/ethanol; 1 male, 31.05 141.42, Fowler's Gap, Research Station, 8-9 Dec 1982, JCC. **A.C.T.:** 1 male, 32.22 148.48, Piccadilly Circus, 1240m, Feb 1984, JFL, TAW, M-LJ, FIT.

5.12 Genus *Tomicobiella* Girault

Tomicobiella Girault, 1915b:211; Bouček, 1988a:355. Type species *Tomicobiella subcyanea* Girault; by monotypy.

Female

Head black and shiny, dorsal margin slightly concave to straight. Face 1.2 to 1.5x broader than long. Occipital carina weak to absent; posterior ocelli removed from margin by less than 1 OD. OD from 0.7 to subequal to OOL. Eyes minutely hairy. Vertex with scattered long setae, variously sculptured.

Antennae inserted from 0.5 to 1 torular diameters above clypeal margin. Scrobes carinate or not carinate anteriorly; not sculptured, shiny and smooth. Antennae long and slender, only very slightly clavate. Scape long and slender, funicular segments all elongate. Club from 0.5 to 1x length of funicle. Genal carina narrow, coarsely striate to smooth. Malar groove present or absent except for remnant above clypeus. Malar space shorter than vertical axis of eye. Oral margin between toruli straight, sloping to offset genal carina.

Thorax shiny black. Pronotum variously sculptured, with scattered short setae and a setal ring of 10 to 12 long setae. Mesoscutum variously sculptured, with paired setae. Notauli composed of a series of short grooves or a complete line. Scapulae variously sculptured. Scutellum subsquare, slightly convex in lateral aspect; variously sculptured. Frenal area delimited by change in sculpture to faint line; with two pairs of setae. Axillae separated by groove anteriorly and fovea posteriorly; smooth and shiny, not sculptured. Dorsellum smooth, rest of metanotum variously sculptured. Mesepisternum with triangular depression, deeper dorsally and at the ventral point;

mesepimeron smooth and unsculptured.

Propodeum transverse, except for short rugose nucha. Median carina and costula present. sculpture coarsely reticulate anterior to costula, rugose posteriorly.

Forewing hyaline or with a single moderately dark infumate patch posterior to marginal and stigmal veins; basal hairline infumate. Marginal vein from 1 to 1.4x longer than stigmal vein. Postmarginal vein 0.8x to subequal to stigmal vein. Stigmal area setose. Costal cell not excised at apex; margined almost entire length with setae. Ventral row of setae in costal cell continuous, with a partial second row. Basal hairline with single row of setae; basal cell bare or setose, margined by cubital row of setae. Speculum present, linea calva not differentiated.

Coxae elongate. Two hind tibial spurs present; the longer 0.3 to 0.6x length of hind basitarsus. Hind coxae with basal, dorsal and lateral setal crests.

Gaster with tuft of setae at base, extending down margin of fovea, but absent medially. T1 0.6 to 0.8x length of gaster. Ovipositor exerted. Surface of S1 not striate; sparse setae present at base; sculpture ranging from foveate to grooved.

Male

Head black, shiny.

Antennae inserted less than or about 1 torular diameter above clypeus. Funicular segments nodose; F1 to F4 decreasing slightly in length towards apex or subequal in length. Funicle and club with long or short setae and sensilla. Club 1.7 to 2.5x length of F1.

Forewing hyaline, basal hairline infumate or not. Marginal vein 0.9 to 1.42x length of stigmal vein. Costal cell margined with setae along almost entire length. Basal hairline with a line of setae; basal cell setose, margined by cubital hairline.

Biology: no host records are available for this genus.

Distribution: *Tomicobiella* has only been collected from the eastern states of mainland Australia and in Tasmania.

Key to the species of *Tomicobiella* Girault

1. Scutellum with smooth raised margin or a row of punctations at apex 2
Scutellum with simple apex 3

2. Frenum with raised smooth margin at apex; basal cell bare ..... *subcyanea*
Frenum with a punctate groove at apex; basal cell sparsely setose (Fig. 5.66) ..... *giraulti*

3. ♀ forewing with darkly infumate patch (Fig. 5.68); mandible with 1 lower and 3 upper teeth ..... *philiporum*
♀ forewing hyaline or with a very faint infumate patch; mandible with 1 lower and 2 upper teeth ..... *arsenei*

5.12.1 ***Tomicobiella arsenei*** **sp.n.** (Figs 5.63, 5.64, 5.149; Map 58)

Holotype: female, ANIC.

Label details: "41.21S 146.50E/ 6km ESE of/ Frankford Tas/ 8 Dec 1981/ I. D. Naumann/ ex ethanol".

Female

Head shiny black, dorsal margin not concave. Face 1.3 to 1.5x as broad as long (mean 1.34). Occipital carina not present; back of head alutaceous. OD less than OOL, hind ocelli removed from margin by less than 1 OD. Vertex engraved reticulate to edge of antennal scrobes, with scattered long setae.

Antennae (Fig. 5.63) inserted slightly less than 1 torular diameter above clypeal margin. Scrobes very shallow except medially, smooth, not carinate anteriorly. Scapes dark brown, rest of antennae medium brown, filiform. F1 and F2 square, other segments slightly longer than broad, setae short. Club from 0.8 to 0.9x length of funicle (mean 0.84). Genae smooth, malar groove complete. Genal carina narrow, striate. Mandible with sharp lower tooth and 2 blunt upper teeth, all equal in length.

Thorax black, shiny. Pronotum broader than long; alutaceous, with scattered short setation and a setal ring of 10 to 12 setae. Setal bases simple. Mesoscutum almost as long as broad, with about 5 pairs of setae between notauli, setal bases not

reticulate. Notauli complete grooves. Scapulae with 2-3 pairs of setae. Scutellum longer than broad, slightly convex in lateral aspect; engraved reticulate; posterior pair of setae further apart than anterior; without reticulate bases. Frenal area delimited by a very faint line. Dorsellum smooth, dorsellar fovea large and carinate; remainder of metanotum smooth.

Propodeum brown-black. Median carina extending below costula; sculpture reticulate anteriorly, smooth around spiracles. Nucha short, broader than long, rugose.

Forewing with very faint infumation or hyaline. Marginal vein 1.1 to 1.4x longer than stigmal vein (mean 1.28). Postmarginal vein 0.8x stigmal vein. Stigmal area setose. Margin of costal cell lined with setae along 0.75x length. Submarginal vein not sinuate. Basal hairline very faintly infumate, with about 4 setae; basal cell setose.

Coxae dark brown, femora brown, tibiae yellow, tarsi yellow excepting dark apical segment. Hind coxae with conspicuous dorsal setal crest and smaller basal and lateral crests. Longer hind tibial spur 0.3 to 0.4x length of basitarsus.

Gaster dark brown, elongate. T1 about 0.6x length of gaster. Ovipositor slightly projecting beyond end of gaster. S1 with small foveae in anterior half, posteriorly foveate-grooved; median raised area with shallow alveolae. Surface not striate; sparse setae present at base of median alveolae (Fig. 5.149).

Male

Head shiny black. OD about equal to OOL. Malar groove complete.

Antennae (Fig. 5.64) inserted more than 1 torular diameter above clypeal margin; concolorous yellow-brown. Funicular segments nodose but apices not as long and narrow as those of *T. giraulti*; setae on funicle very long, about twice the length of segments of origin. Sensilla not longer than segments of origin. F1 slightly longer than other funicular segments. Club 2.1 to 2.5x length of F1 (mean 2.37); setae and sensilla short.

Forewing hyaline. Marginal vein 0.9 to 1.2x length of stigmal vein (mean 1.07). Costal cell margined with setae for about 0.75x length. Basal cell setose; basal hairline with a few setae, faintly infumate.

Gaster dark red-brown, 0.5x length of gaster.

Paratypes: (8 females, 3 males; ANIC, in NZAC where stated). **Tas.:** 1 female, 1 male (NZAC), 40.57 144.49, 5km SE by E Redpa, 18 Jan 1983, IDN, JCC; 1 female, 41.59 146.39, 6km W Miena, 20 Jan 1983, IDN, JCC; 1 female, 42.54 147.15, Shoobridge Bend, Mt Wellington, 5 Feb 1983, IDN, JCC; 2 females, 42.37 147.39, 5km W Buckland, 27 Jan 1983, IDN, JCC (NZAC); 1 female, 42.02 146.33, 12km NNE Bronte Park, 2 Feb 1983, IDN, JCC; 1 male, 40.58 145.33, 3km E by S Montumana, 19 Jan 1983, IDN, JCC; 1 male, 42.52 146.22, 6km S by W, Frodshams Pass, 25 Jan 1983, IDN, JCC; 1 female, 41.21 147.22, Barrow Creek, 8km NE Nunamara, 7 Dec 1981, IDN.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Tasmania.

Remarks: *T. arsenei* is named in honour of Alexandre Arsene Girault.

5.12.2 ***Tomicobiella girault*i sp.n.** (Figs 5.65, 5.66, 5.67, 5.150, 5.151; Map 59)

Holotype: female, ANIC.

Label details: "42.10S 146.08E/ 9km WSW TAS/ Derwent Bridge/ 21 Jan 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol".

Female

Head shiny dark brown-black; dorsal margin not concave. Face from 1.2 to 1.4x as broad as long (mean 1.34). Occipital carina not present; back of head alutaceous. Hind ocelli crossing occiput; OD about 0.7x OOL. Vertex engraved reticulate only around ocellar triangle.

Antennae (Fig. 5.65) inserted less than half a torular diameter above clypeal margin. Scrobes very shallow except medially, smooth; not carinate anteriorly. Antennae yellow-brown, darker apically; filiform. Funicular segments all longer than broad; F1 slightly shorter than pedicel; setae short. Club narrow, less than twice as broad as pedicel; 0.6 to 0.8x length of funicle (mean 0.7). Genae smooth, malar groove absent. Genal carina narrow, not striate. Mandible with broad, sharp lower tooth and 2 upper teeth, the upper divided into 2 small blunt teeth, the lower sharply

pointed.

Thorax dark brown-black, shiny. Pronotum broader than long; alutaceous, with scattered short setation and a setal ring of about 10 setae; setal bases simple. Mesoscutum imbricate-engraved reticulate; broader than long; with 2 to 3 pairs of setae between notauli, setal bases not reticulate. Notauli complete grooves. Scapulae imbricate-engraved reticulate, with 2-3 pairs of setae. Scutellum subsquare, slightly convex in lateral aspect; engraved reticulate with 2 pairs of setae which are the same distance apart; without reticulate bases. Frenal area delimited by faint line and change in sculpture; apex of scutellum with row of punctations. Dorsellum smooth, dorsellar fovea coarsely alveolate; remainder of metanotum smooth, furrow striate.

Propodeum (Fig. 5.150) brown-black. Median carina present, costula present; sculpture reticulate anteriorly, smooth around spiracles. Nucha square, almost as long as anterior of propodeum, globose; sculpture rugose.

Forewing (Fig. 5.66) without infumate patch. Marginal vein 1 to 1.4x length of stigmal vein (mean 1.14). Postmarginal vein subequal in length to stigmal vein. Stigmal area setose. Costal cell margin lined with setae along apical 0.75x length. Submarginal vein not sinuate. Basal hairline slightly infumate, with about 4 setae; basal cell setose.

Legs honey yellow. Hind coxae long; with conspicuous dorsal setal crest along 0.75x length of dorsal surface, and smaller basal and lateral crests. Longer hind tibial spur 0.6x length of basitarsus.

Gaster dark red-brown, elongate. T1 about 0.6-0.8x length of gaster. Ovipositor projecting slightly beyond end of gaster. Anterior half of S1 grooved; foveate-grooved posteriorly; separated by a horizontal pitted ridge. Surface not striate; sparse setae present at base of posterior medial alveolae (Fig. 5.151).

Male

Head black, shiny.

Antennae (Fig. 5.67) inserted 1 torular diameter above clypeus; scape and pedicel present, flagellum yellow-brown. Funicular segments with long narrow apices, very nodose in appearance. F1 to F4 decreasing slightly in length towards apex. Funicle apparently setose but in fact setae are sparse and trichoid sensilla are long

and slender, setae-like. F1-F4 with sensilla and setae not much longer than length of segments of origin, club with shorter setae and sensilla. Club 1.68x length of F1.

Forewing hyaline. Marginal vein 1.18x length of stigmal vein. Costal cell margined with setae along almost entire length. Basal hairline not infumate, with a line of setae; basal cell setose.

Gaster shiny dark brown-black. Setae at base sparse. T1 about 0.6x length of gaster.

Paratypes: (12 females, 1 male; ANIC, in NZAC where stated). **Qld.:** 1 male, 12.44 143.14, 3km ENE Mt Tozer, 28 June- 4 July 1986, JCC, at MV. **N.S.W.:** 1 female, 31.54 151.36, Cobark For.Pk., Barrington Tops, 11 Feb 1984, IDN; 1 female, 31.54 151.34, nr Moppy Lookout, Barrington Tops, 11 Feb 1984, IDN. **Tas.:** 8 females (3 in NZAC), 41.18 145.36, Saxon's Rd, 17 Jan 1983, IDN, JCC; 1 female, 41.23 147.25, Mt Barrow, 11km E by N Nunamara, 30 Jan 1983, IDN, JCC, ex yellow pan; 1 female, 41.30 146.05, 14km SW by S Wilmot, 31 Jan 1983, IDN, JCC.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland, New South Wales, Tasmania.

Remarks: *T. giraulti* is named in honour of A. A. Girault.

5.12.3 ***Tomicobiella philiporum*** **sp.n.** (Figs 5.68, 5.152; Map 60)

Holotype: ANIC, female.

Label detail: "41.14S 147.56E/ 4km SE/ Weldborough TAS/ 13 Jan 1983/ I. D. Naumann &/ J. C. Cardale/ ex ethanol".

Female

Head shiny black; dorsal margin not concave. Face 1.25 to 1.4x broader than long (mean 1.29). Occipital carina not present; back of head alutaceous. OD about equal to OOL. Vertex engraved reticulate around ocelli, striate anterior to ocelli. Face smooth.

Antennae inserted slightly less than 1 torular diameter above clypeal margin.

Scrobes very shallow except medially, smooth, not carinate anteriorly. Antennae yellow-brown, filiform. F1 square, other funicular segments longer than broad. Setae short; club 0.7 to 0.9x length of funicle (mean 0.82). Genae smooth, malar groove complete, but only conspicuous around clypeal margin. Malar space shorter than vertical axis of eye. Genal carina narrow, not striate.

Thorax black, shiny. Pronotum broader than long; imbricate, with scattered short setation and a setal ring of about 12 setae. Mesoscutum imbricate, with 5-7 pairs of setae between notauli, setal bases simple. Notauli complete grooves. Scapulae alutaceous, with scattered moderately long setae. Scutellum as long as broad; alutaceous, seta;l pairs equidistant, without reticulate bases. Frenal area indicated by change to longitudinal striation at posterior pair of setae. Dorsellum smooth, dorsellar fovea coarsely alveolate, remainder of metanotum smooth.

Propodeum dark red-brown. Median carina extending below costula; plicae present and complete, otherwise smooth. Nucha broader than long, rugose.

Forewing (Fig. 5.68) with central infumate patch. Marginal vein 1.1 to 1.4x longer than stigmal vein (mean 1.28). Postmarginal vein subequal to stigmal vein in length. Stigmal area setose. Margin of costal cell lined with setae along 0.6x length. Submarginal vein not sinuate. Basal hairline faintly infumate, with about 5 setae; basal cell setose.

Legs yellow-brown, coxae slightly darker. Hind coxae with conspicuous dorsal setal crest and smaller basal and lateral crests. Longer hind tibial spur 0.5x length of basitarsus.

Gaster red-brown, elongate. T1 about 0.75x length of gaster. Ovipositor projecting slightly beyond end of gaster. S1 with small alveolae anteriorly, 4 large alveolae posteriorly; smooth median area. Surface not striate; sparse setae at base of median alveolae (Fig. 5.152).

Male

Head dark brown.

Antennae inserted 2 torular diameters above clypeus. Funicular segments subequal in length, nodose; with setae which are about twice as long as segment of origin basally and becoming shorter distally. Club 1.26x length of F1. Malar groove

complete.

Forewing with faint, diffuse infumate patch below marginal vein. Marginal vein 1.2 to 1.4x longer than stigmal vein (mean 1.34). Costal cell margined with setae for about 0.75x length. Basal hairline faintly infumate, with a line of setae; basal cell setose.

Paratypes: (11 females, 2 males; ANIC, in NZAC where stated). **N.S.W.:** 1 female, 35.36 149.54, Monga St.For., 18 Feb 1983, IDN, JCC; 1 female, 31.54 151.34, nr Moppy Lookout, Barrington Tops, 11 Feb 1984, IDN. **Tas.:** 1 female, 1 male, 41.22 147.24, 10 km ENE Nunamara, 11 Jan 1983, IDN, JCC (NZAC); 1 female, 41.21 146.55, Notely Fer Gorge, 5km NW by W, Bridgenorth, 8 Dec 1981, IDN; 1 male, 41.30 146.05, 14km SW by S Wilmot, 31 Jan 1983, IDN, JCC; 3 females, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, open forest, (W.E.B.S.), Malaise, 2♀♀ 30 Nov 1990-8 Jan 1991, 1♀ 8 Jan-12 Feb 1991; 2 females, 41.50 146.03, Pelion Hut, 3km S Mt Oakleigh, IDN, 5-10 Feb 1990, open forest/grassland, Malaise; 1 female, 42.41 146.37, Mt Field, 980m, 9 Oct 1989, R.Coy, suction trap.

Other material examined: Type series only.

Biology: Hosts are unknown.

Distribution: **Australia:** New South Wales, Tasmania.

Remarks: *Tomicobiella philiporum* is named in honour of Desmond and Phyllis Philip of Auckland, New Zealand.

5.12.4 *Tomicobiella subcyanea* Girault (Map 61)

Tomicobiella subcyanea Girault, 1915b:211; Dahms, 1986:567; Bouček, 1988a:355, (Figs 655-656).

Holotype: female, QM.

Publication details: "Described from one female captured in jungle, February 13, 1914, (A. P. Dodd). *Habitat:* Babinda, Queensland. *Type*: No. *Hy 3206*, Queensland Museum, Brisbane, one female on a tag; head and hind tibiae on a slide with type appendages of *Chrysocharomyia cyancicorpus*".

Label details Card labelled "TYPE" and "HOLOTYPE/ Hy 3206/ E.C.D.

1985" and Tomicobiella ♀/ subcyanea Gir/ Type". Only some legs and 1 forewing remain of the holotype on the card.
Slide: 3 coverslip fragments (1 cracked); the cracked coverslip fragment contains the head (parts of both antennae separated) and parts of 2 legs all from the Holotype.

Female

Head black and shiny, dorsal margin slightly concave. Face 1.2x broader than wide. Occipital carina absent; back of head alutaceous. Ocelli crossing occiput; OD about equal to OOL. Eyes minutely hairy. Vertex very finely rugose.

Antennae inserted less than 0.5 torular diameters above clypeal margin. Scrobes not delimited by carina anteriorly. Scape and pedicel yellow, flagellum yellow-brown grading to dark brown club. Scape long and slender, funicular segments all elongate. Club approximately 0.6x length of scape, 0.5x length of funicle (mean 0.52). Genal carina narrow, coarsely striate. Malar groove absent except for remnant above clypeus. Mandible with pointed lower tooth and 2 upper teeth, 1 divided into 2 blunt points, the other rounded.

Thorax shiny black. Pronotum imbricate with scattered short setae, smooth posterior to setal ring; setal ring with 12 setae. Mesoscutum engraved reticulate, with paired setae; scapulae similar. Notauli composed of a series of short grooves. Scutellum as long as broad; engraved reticulate. Frenal line indistinct; frenum with a raised smooth margin at apex. Dorsellum smooth, fovea alveolate; metapleural furrow smooth, crossed only by a few carinae.

Propodeum dark brown to black, transverse except for short rugose nucha. Anterior part coarsely reticulate.

Forewing hyaline. Marginal vein 1.3x longer than stigmal vein. Postmarginal vein 0.8x length of stigmal vein. Stigmal area setose. Costal cell margined with setae for about 0.9x length. Basal hairline slightly pigmented, with a single row of short setae; basal cell bare.

Legs honey yellow, except fore coxae which are elongate and dark brown and fore femora which are yellow-brown. Longer hind tibial spur half length of hind basitarsus. Hind coxae with basal, dorsal and lateral setal crests.

Gaster dark brown-black, elongate. T1 0.8x length of gaster. Ovipositor conspicuously exerted. S1 obscured.

Male unknown

Other material examined: (1 female; NHM). **Qld:** 1 female, Eungella N.P., Broken R, 30 Nov 1976, ZB (NHM) (21.10 148.30). (Type: Babinda 17.21 145.56).

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland.

5.13 Genus *Tomicobomorpha* Girault

Tomicobomorpha Girault, 1915b:207; Bouček, 1988a:357-358. Type species *Tomicobomorpha stellata* Girault; by original designation.

Female

Face broader than long. Vertex with scattered very short light setae.

Antennae inserted 0.5 to 1 torular diameters above clypeal margin. Club 0.8 to 1.1x length of funicle; setae short and regular. Oral margin straight between toruli.

Thorax black, with or without metallic lustre. Pronotum broader than long, engraved reticulate; setal ring with about 8 long setae, bases simple. Mesoscutum engraved reticulate, with 2 pairs setae; bases raised. Notauli complete grooves. Scapulae engraved reticulate. Scutellum square to longer than broad, with 2 pairs of setae. Frenal area not delimited. Axillae separated by a groove anteriorly and a fovea posteriorly; variously sculptured. Dorsellum variously sculptured. Mesepisternum with smooth triangular depression; mesepimeron smooth and unsculptured.

Propodeum black, with or without metallic sheen. Costula, median carina and plicae present, area around spiracle smooth. Nucha broader than long.

Forewing with infumate patch posterior to stigmal vein, weak to strong. Marginal vein 1.4 to 1.7x length of stigmal vein, both short. Postmarginal vein shorter than stigmal vein. Costal cell excised at apex, ventral line of setae continuous.

Basal cell bare; not margined by cubital row of setae. Speculum present, linea calva not differentiated.

Two hind tibial spurs present; longest 0.4 to 0.5x length of hind basitarsus.

Gaster brown to dark red-brown. Basal fovea with short compact tuft of setae at base, not margined with setae. T1 0.9 to 0.95x length of gaster. Ovipositor exerted slightly.

Key to females of *Tomicobomorpha* Girault

1. F1 broader than long (Fig.5.69); antennae inserted about 1 torular diameter above clypeal margin ..... *stellata*

F1 square; antennae inserted about 0.5 torular diameters above clypeal margin ..... *subplana*

5.13.1 ***Tomicobomorpha stellata*** **Girault** (Figs 5.69, 5.70; Map 62)

Tomicobomorpha stellata, 1915b:207; Dahms, 1986:562-563; Bouček, 1988a:358.

Holotype: female, QM.

Publication details: "*Habitat:* Kuranda, Queensland. Jungle, May 19, 1913 (A.P. Dodd). *Type:* No. *Hy 3197*, Queensland Museum, Brisbane, the female on a tag, the legs and head on a slide.

Label details: Card labelled "HOLOTYPE/ Hy. 3197/ E.C.D. 1985" and "Tomicobomorpha/ stellata Gir./ ♀ type" and "QUEENSLAND/ MUSEUM". Holotype minus head, left forewing and some legs.

Slide: 1 cracked, complete coverslip containing the head (antennae separated) and 3 legs, 1 coverslip fragment (added later by Girault) containing 1 forewing, all from the Holotype.

Female

Head dark red-brown. Occipital carina present; posterior ocelli crossing occiput.

Antennae (Fig. 5.69) inserted almost 1 torular diameter above clypeal margin; concolorous medium brown. Pedicel pyriform. F1 broader than long, F2 subsquare, F3 to F5 broader than long; setae almost as long as segments of origin. Club broad, about 3x width of pedicel; 0.9x length of funicle. Malar space subequal to long axis of eye. Mandible with lower sharp tooth and upper tooth divided into 2 blunt points.

Thorax shiny black. Pronotum engraved reticulate, without unsculptured band at apex. Setation reduced to 1 row of shorter setae and setal ring. Mesoscutum with 2 pairs of setae medially, anterior pair shorter than posterior pair. Scutellum slightly longer than broad, convex in lateral aspect; alutaceous; setal pairs the same distance apart. Axillae longitudinally striate. Dorsellum smooth, diamond shaped, angled at about 45 degrees; fovea deeply alveolate; rest of metanotum smooth.

Propodeum black. Costula curved to the anterior. Nucha rugose.

Forewing (Fig. 5.70) with large infumate patch extending from submarginal vein to beyond stigmal vein. Marginal vein 1.7x as long as stigmal vein. Postmarginal vein less than half length of stigmal vein. Costal cell with 5 setae on margin at apex of costal cell. Basal hairline not infumate, setae absent

Hind coxae with sparse lateral and basal setal crests. Longest hind tibial spur 0.5x length of basitarsus.

Gaster dark brown. T1 0.9x length of gaster. S1 grooved anteriorly and posteriorly, grooves longer than broad; separated by a raised flat horizontal strip; surface pitted, not striate or matte; setae absent.

Male unknown

Other material examined: Holotype only (16.49 145.38).

Biology: Hosts are unknown.

Distribution: **Australia:** Queensland.

5.13.2 *Tomicobomorpha subplana* Bouček

Tomicobomorpha subplana Bouček, 1988a:358 (Figs 665-666).

Holotype: female; NHM, not seen. [♀ and ♂ paratypes seen.]

Publication details: "Holotype female, PNG; New Britain, Rabaul, ex coccid on *Gliricidia*, 21.ii.1941 (J. L. Froggatt).

Female

Head black and shiny, with purple-blue lustre. Face 1.8x as broad as long. Occipital carina defined between posterior ocelli, weaker from eye to ocelli. Back of head engraved reticulate. Posterior ocelli crossing occipital carina, most of ocelli behind carina. OD less than half OOL. Vertex engraved reticulate.

Antennae inserted about 0.5 torular diameters above clypeal margin. Scrobes very shallow; not delimited by carina anteriorly, not sculptured, shiny and smooth. Scapes short, slightly laterally compressed, medium brown. Flagellum yellow, pedicel yellow-brown. Pedicel elongate-pyriform. F1 square, all other funicular segments broader than long, setae short. Club wide; 1.1x as long as funicle. Genal carina wide medially to absent laterally; smooth. Malar groove absent; malar space slightly shorter than long axis of eye. Oral margin not offset from genal carina.

Thorax shiny black with shiny blue-purple lustre. Length of pronotum about 0.25x width; sculpture engraved reticulate. Scutellum subsquare, flat in lateral aspect; longitudinally striate; setal pairs long, equally spaced. Axillae smooth and shiny, not sculptured. Dorsellum very narrow, smooth; fovea alveolate; rest of metanotum smooth.

Propodeum black, with metallic purple sheen; reticulate anterior to costula. Nucha broader than long.

Forewing with diffuse infumate patch posterior to stigmal vein. Marginal vein 1.4x length of stigmal vein. Postmarginal vein 0.5x length of stigmal vein. Costal cell with 4 setae on apex of costal cell. Basal hairline slightly infumate, with 2 strong setae. Marginal fringe present, setae on disc long and regular but quite sparse.

Legs medium brown, tarsi pale. Longest hind tibial spur about 0.4x length of hind basitarsus. Hind coxae with sparse basal, lateral and ventral setal crests; no dorsal pilosity.

Gaster dark red-brown. T1 0.95x length of gaster. S1 obscured.

Male

Head black and shiny.

Antennae inserted 1.5 torular diameters above clypeal margin. Scapes short, medium brown. Pedicel, flagellum and club yellow. Funicular segments strongly nodose, all approximately the same length. Each funicular segment with a dorsal tuft of long setae, about 2x width of segment of origin. Club around 1.5x longer than F1, elongate, with bands of setae which are shorter than length of club.

Punctations at base of setae on mesoscutum inconspicuous.

Forewing hyaline. Marginal vein 1.2x longer than stigmal vein. Postmarginal vein 0.6x length of stigmal vein. Costal cell with 6 setae along apical margin. Basal hairline not infumate, with 3 setae; basal cell not margined by cubital hairline.

Paratypes: (1 female, 1 male; NHM). 1 female, New Britain, Rabaul, 13 Jan 1941, JLF, ex *Lecanium* on *Gliricidia maculata;* 1 male, New Britain, Rabaul, 21 Feb 1941, ex coccid 110 on *Gliricidia*.

Biology: *T. subplana* has been reared from *Lecanium* (Coccidae) on *Gliricidia maculata* (Leguminosae).

Distribution: **Papua New Guinea**.

Chapter 6: Phylogenetic relationships

6.1 Introduction: the formation of classifications

Futuyma (1979) lists the following tasks as being the domain of systematics: i) distinguishing among the kinds of organisms, generally by separating them into species; ii) grouping species into more inclusive sets to establish a classification consisting of higher categories; iii) naming such categories and iv) determining the evolutionary relationships among taxa.

Thus, the formation of classifications is an integral part of the practice of systematics. The main functions of biological classification systems are: i) to provide an information storage and retrieval system, and ii) to allow biological prediction with respect to new taxa and previously unobserved characters. Ideally, classifications should be informative and robust. The informativeness of a classification refers to its predictive value with respect to new taxa and previously unobserved characters. Robustness refers to the effect of adding or deleting taxa and or characters. It is highly desirable that a taxonomic classification should remain stable in the face of such changes. A robust classification will be unperturbed by the correct addition of new taxa. However, if the taxa are initially misplaced, the resulting classification may be sensitive to the addition of new taxa (Trueman, 1993).

Grouping organisms together into a hierarchy of increasing inclusiveness ideally should involve using some rationale for the formation of the groups. Historically, the systematic methods used in classification formation have been a heterogenous assemblage, characterised predominantly by the intuitive recognition of the course of evolution by experts in their fields. The evolution of a few important characters may have been traced but generally groups were erected using a few uniquely derived features (Cranston *et al.*, 1991). Efforts to derive testable, repeatable methods of classification from these narrative or traditional methods lead to the three main current approaches to biological classification: cladistics, phenetics and evolutionary systematics. Cladistics uses phylogenetic relationship to group species. Phenetics (Sect. 6.3) uses phenotypic similarity as a basis for grouping and hence classification, on the premise that natural patterns

based on resemblance can be detected, whereas the pathways of the evolutionary process are unknowable (Cranston *et al.*, 1991). Cladistic classifications are based entirely on genealogy (cladogenesis) and phenetic ones on estimates of morphological divergence (anagenesis). In contrast, evolutionary systematics is based on all aspects of evolutionary theory (Sect. 6.4).

Most taxonomists prefer classifications to be consistent with phylogeny in the broad sense; that is, they prefer classifications to be "natural", reflecting the evolutionary history or phylogeny of the group as opposed to being special groupings based on biological or ecological attributes of organisms. It is likely that classifications that reflect phylogeny are maximally informative and robust. De Pinna (1991) asserts that cladistics has reached the status of standard method for systematic research, and can be considered as the current paradigm in systematics. A cladistic analysis is used in this study to examine the phylogeny of the Moranilini and to assist in making decisions regarding the monophyly of the genera in the group. Before the analysis is undertaken the approaches used to infer the phylogeny are explained and the two alternative methods of phenetics and evolutionary systematics are discussed very briefly.

6.2 Cladistics

Phylogenetic classification or cladistics is based purely on the evolutionary proximity of species. Hennig (1965, 1966) argued that relationship could be clearly defined only in terms of recency of common ancestry. All descendants of an ancestor should be placed in the same taxon, and all the members of a taxon should stem from the same ancestor. This is the concept of **monophyly**. Prior to Hennig (1966), the concept of a monophyletic or natural group was one that included taxa that shared common ancestry. Hennig (1966) recognised that, if life arose once, all organisms may be reasonably assumed to be related through common ancestry, the consequence being that any group was monophyletic. He argued that therefore common ancestry alone is not a rigorous criteria for the justification of taxonomic groups, and he defined monophyly more precisely: a taxon A is more closely related to taxon B than to any other taxa if A+B have a common ancestor that is not also an ancestor of any other taxon. From this

definition arose the concepts of **paraphyly** and **polyphyly**. Paraphyletic groups are diagnosed by plesiomorphies (see below), and do not include all the descendants of a common ancestor. Polyphyletic groups are those in which the most recent common ancestor is assigned to some other group and not the group itself.

All taxa, of whatever rank, uniquely possesses a sister group, that is, a taxon which is its closest relative. Thus the cladistic reconstruction of phylogeny consists of the search for successive sister groups. The hierarchical pattern of sister groups is represented by a cladogram, or branching diagram. The node in a cladogram represents the homologies shared by taxa united by the node and is a hypothetical, not an actual, ancestor.

6.2.1 Definition of terms

Within the context of a particular group of organisms, an **apomorphy** is a character state derived from within the group, while a **plesiomorphy** is the ancestral character state (the state at the most recent common ancestor of the group). A derived character state shared by members of a group is a **synapomorphy** of the members of the group and an **autapomorphy** of the group. When a character state evolves more than once in different branches of the tree there is **homoplasy**, i.e. similarity that cannot be directly attributed to common ancestry. A character which changes from its original state and then changes once again, back to the original state, is said to have undergone a **reversal**. If a state evolves separately on different branches of the phylogenetic tree (branches that are not in ancestor-descendant relationship) the process is called **convergence** or **parallelism**. The concept of homoplasy can be made slightly broader by saying that whenever a character evolved with more changes or more costly changes (in the sense of "cost" used in a parsimony analysis) than the minimum conceivable, then homoplasy is implied.

6.2.2 Reconstruction of the phylogenetic tree

A lineage does not evolve through time by a progression of concerted changes in all its characters; rather in every lineage some characters change rapidly and others do not change. Thus, every species is a mosaic of characters that have persisted unchanged from remote ancestors (plesiomorphies), and characters that have just evolved (apomorphies). However, an organism is not a random combination of plesiomorphic and apomorphic character states. If the derived state of a character arises in an ancestral species, all species descended from this ancestor (members of the clade) will share the derived character, unless there is a reversal of evolution. Thus Hennig (1966) argued that a clade can be recognised if its members share characters that are derived within the larger group of species being considered i.e. they share synapomorphies.

However, character state distributions do not align themselves neatly into nested sets delimited by more and more restricted characters. Some characters disagree with others as to what monophyletic groups they suggest. Homoplasy (convergence and reversal) serves to make members of different clades appear to be marked by the same apomorphy, or members of a clade to lack the apomorphies which would otherwise distinguish the clade. Some criteria are needed to assess the conflicting evidence that results in several phylogenetic estimates (i.e. more than one cladogram). **Parsimony** is generally accepted. This principle chooses the tree which requires the least amount of convergence and reversal. The use of the parsimony principle in cladistic analysis is a means to support one phylogenetic hypothesis over another, it does not suggest that evolution is parsimonious in action.

The Consistency Index (CI) (Kluge and Farris, 1969) is a measure of how well a data set fits the tree topology, and of the amount of homoplasy. The CI ranges from zero and one. A CI of one indicates there is no homoplasy; it diminishes toward zero as the amount of homoplasy increases. It is defined as m/s, where m is the minimum amount of change possible for the character (i.e the number of states of the character minus one); and s is the actual number of changes of the character observed. The CI is the most commonly reported

measure of fit between a character matrix and a tree, although it is influenced by the size of the data set (Archie, 1989).

Hennig and his contemporaries constructed cladograms by hand, as do many present-day systematists. However the use of computer phylogenetic analysis packages has allowed analysis of the large data sets generally produced by modern systematic methods. For a cladistic or a phenetic analysis, whether carried out by hand or by computer, the characters must be partitioned into states (see Chapter 3). The difference between phenetic and cladistic analyses is that cladistics considers the **polarity** of the character states, that is plesiomorphic states are distinguished from apomorphic states to indicate the direction of evolution. This assignment is crucial to the cladistic method of derivation of phylogeny from morphology (or molecular data, etc.). Thus a character is polarised if the state ancestral to all other character states is specified. There are several methods of determining polarity: i) the use of fossils; ii) ontogeny (the direct method) and iii) outgroup determination (the indirect method). These three methods are discussed in Forey *et al.* (1992). In many cases, outgroup determination is the only practical method and it is used in this study.

6.2.3 Outgroups

Computer-based parsimony algorithms generally proceed by first arranging the taxa into an unrooted tree (or network), which may then be rooted by the assignment of an **outgroup** (below). Rooting a tree indicates the direction of evolutionary change, and involves imparting polarity onto at least one character transformation, although it is often the case that all or many characters will be polarised. The usual method of rooting is outgroup comparison.

The ingroup is a set of taxa, often assumed to be monophyletic, and designated as being the focus of interest, as compared to the outgroup, which is brought into the analysis to provide a broader phylogenetic context to aid in determining ancestral states. Wiley *et al.* (1991) stated that the most important outgroup is the sister group. In some cases considerable phylogenetic research may be needed to find the sister group (e.g Qin, 1993), but in others, for example this study, a phylogenetic hypothesis is already available (Section 6.6).

According to Watrous and Wheeler (1981), for any given character with 2 or more states within a group, the state occurring in related groups (outgroups) is determined to be the plesiomorphic state. If the character contains only two states, the alternative is assumed to be apomorphic, thereby forming a more restricted character. Maddison *et al.* (1984) argue that when the character varies among the outgroups, the above rule is inadequate and polarity must be solved with algorithms.

6.3 Phenetics

Pheneticists infer phylogeny from grouping of species solely on the similarity of their observable characteristics or phenotypes. The proponents of the phenetic school (e.g. Sokal and Sneath, 1963) believe that it is impossible to know the pathways of evolution, so organisms should be grouped on purely phenetic criteria: how similar they are to each other. The process of estimating phenetic similarity involves i) selection of operational taxonomic units (objects of study or OTUs); ii) preparation of a data matrix; iii) estimation of distance or similarity coefficients between each OTU and every other; iv) tabulation of a distance matrix of each OTU against every other; v) analysis of the matrix by either clustering or ordination to produce, respectively, a phenogram showing degrees of similarity or a scatter diagram (summarised from Cranston *et al.*, 1991). The translation of this information (phenogram or scatter diagram) into a classification must be made by a taxonomist. There are problems with inferring a group's phylogeny by phenetic means, since similarities can occur due to the group's common ancestry, or due to homoplasy, especially convergence. Further, the use of shared ancestral character states for grouping taxa can lead to paraphyletic groupings, which exclude some descendants. Only through cladistic analysis can homoplasious characters be detected and treated as differences.

6.4 Evolutionary systematics

In evolutionary systematics, classification is based on evolutionary proximity and also on phenetic similarity or difference. Proponents of this approach stress that cladistic classifications based entirely on cladogenesis and

those based entirely on estimates of anagenesis should both be rejected in favour of an integrated approach. Similarity is balanced with genealogy in the construction of a classification. The results are represented by a phylogram, which records both the branching points and the degree of subsequent divergence (Mayr, 1981).

6.5 Extant classification of the Eunotinae

In his seminal work, Bouček (1988a) did not use strictly phylogenetic methods in the construction of his classification; instead he used a mixture of approaches. Genera were erected on an intuitive basis, often using a few visually striking features. The revision catalogued 16 genera of Moranilini, seven of which were newly described (Appendix I). Bouček listed 15 species (mainly from the literature) for the largest genus, *Ophelosia*. *Moranila*, the next largest genus contained 10 species, whereas *Aphobetus* had four species and *Tomicobomorpha* had two species. The remaining 12 genera, or 75% of the tribe, were monotypic (Table 6.1). This preponderance of monotypic groups suggests that either many species in these genera had not been collected, or that the generic concepts are phylogenetically invalid, i.e. the monotypic genera may contain derived members of some other genera, which are rendered paraphyletic or polyphyletic by the removal of these unusual species.

After examination of all material, the present study contained 68 species, four in the outgroups (tribes Eunotini and Tomocerodini) and 64 in the Moranilini. Placement of new material into the existing framework produced the following changes to the Moranilini (summarized in Table 6.1):

Ophelosia: Bouček listed 14 names from the literature, mostly Girault species. A further species, *O. indica* was omitted by Bouček (Section 5.11.8), totalling 15 species. I found seven of these to be synonyms, leaving seven existing species (excluding *O. viridithorax* Girault, of which I have seen no material, and which Bouček considers may be a form of *O. viridinotata*. I described 11 new species to give a total of 18 species.

Moranila: Ten names existed, but four synonymies left six species. Nine new species were described in this study to give a total of 15 species.

Aphobetus: Four names existed, and all four were found to be valid species. Seven new species were described in this work to give a total of 11 species.
Tomicobiella: One Girault species existed and three new species have been added.
Australurios: For a discussion on the taxonomic status see Section 5.4. *Australurios* has not been included in the analysis.
Eunotomyiia, Ismaya and *Amoturella* were monotypic; a second species of each has been described in this study.
Tomicobomorpha had two Girault species; no further species were found.
The genera *Australeunotus, Globonila, Hirtonila, Kneva, Modronila, Pidinka* and *Strionila* were left as monotypic (Table 6.1, page 259) for the purposes of the phylogenetic analysis and their status is reconsidered later in this chapter. The reduction in the number of monotypic genera from 12 to five prior to cladistic analysis occurred because more material was available to the present study than was available to Bouček: both a) more specimens within most species and b) more species within most genera. Thus species limits have become wider to accommodate increased variation, and generic limits have changed where the examination of new species within genera showed a gradation of character states spanning gaps previously used to define separate genera. A phylogenetic analysis was carried out on these taxa to test the robustness of the extant classification.

6.6 Analysis of the Moranilini

After completing the alpha-taxonomy, the material available to the analysis consisted of 63 species of Moranilini (not including *Australurios*) and 4 species in the outgroup. For this analysis two species in the tribe Eunotini and one species in the tribe Tomocerodini (using Bouček's (1988a) classification) were used as outgroups. Of the subfamily as a whole, Bouček states that it shows a combination of plesiomorphic and apomorphic features, for example, complete deep notauli and two hind tibial spurs (plesiomorphic) but a reduced number of antennal segments (apomorphic). Bouček (1988a) divided the subfamily into 3 tribes, erecting the two new tribes Moranilini (M) and Tomocerodini (T); thus there are four possible relationships (Eunotini = E): i) a trichotomy (ETM); ii) ((ET)M); iii) (E(TM)) or iv) (T(EM)).

Genus	Species 1988	Synonymies this study	New species this study	Species 1994
Ophelosia	15	8	11	18
Moranila	10	4	9	15
Aphobetus	4	0	7	11
Tomicobiella	1	0	3	4
Eunotomyiia	1	0	1	2
Ismaya	1	0	1	2
Amoturella	1	0	1	2
T'bomorpha	2	0	0	2
Modronila	1	0	0	0
A'eunotus	1	0	0	1
Globonila	1	0	0	1
Hirtonila	1	0	0	1
Strionila	1	0	0	0
Kneva	1	0	0	1
Pidinka	1	0	0	0
Australurios	1	0	0	1
All genera	43	12	33	64

Table 6.1 TAXONOMY OF THE MORANILINI AFTER THE 1988 AND 1994 REVISIONS, PRIOR TO CLADISTIC ANALYSIS

On the basis that undifferentiated regular pilosity and a higher number of antennal segments are plesiomorphic character states, Bouček suggested that the Eunotini is basal to the subfamily. Accepting this relationship rules out a trichotomy and suggests that the relationship (E(TM)) is the most likely, with the Tomocerodini+Moranilini being the sister group of the Eunotini. Three species of Eunotini from three genera (*Cephaleta, Mesopeltita* and *Scutellista*) were designated as the outgroup for the analysis and the remaining species not belonging to the Moranilini (*Tomocerodini*) was also included in the analysis but fell within the Moranilini in the cladograms, suggesting that the erection of the tribe Tomocerodini may not be justified.

Seventy-five characters for 67 taxa were coded into a data matrix (Chapter 3). Sixty-three of the taxa belonged to the ingroup, of which 33 are new species and 34 were previously described species. Thus the data matrix for the analysis was composed of 67 taxa x 75 characters. There are a number of computer programmes available for phylogenetic analysis. This matrix was analysed using PAUP (Phylogenetic Analysis Using Parsimony), version 3.1.1 on a Macintosh computer.

The data matrix was checked with a checker programme (Taxon Check; John Trueman, unpublished) to detect any identical taxa. None were found. Constant (the same in all taxa) or uninformative (differing in only one taxon, i.e autapomorphies) characters were checked for using the PAUP option "show character status". Only one character was found to be uninformative (character 31). This character was deleted from the matrix using the "exclude" option in the PAUP block.

6.6.1 Exhaustive versus heuristic searches

The data matrix of 67 taxa x 75 characters is a reasonably large one. Since there is no direct analytical method for computing the shortest tree, tree-building algorithms operate by searching the space of possible trees to find the shortest (Baum, 1994). In small data sets, all combinations of taxa and character states can be tested and the shortest trees discovered using exact, or exhaustive, methods. Swofford (1990) does not recommend exhaustive searches for more than 11 taxa

since in large complex data sets the number of combinations quickly becomes unwieldy, in terms of computer time and memory space. In this study, the only viable method is the heuristic search, which does not guarantee that the shortest tree, or trees, will be found. Heuristic searches proceed by generating one or a set of starting trees, and from this starting point the branches are successively rearranged and only trees of shorter lengths saved. Two critical steps in a heuristic search process are the construction of the starting tree, and the choice of procedure for branch swapping. The starting tree elected determines which trees are available, each of which may potentially provide a different starting point for branch-swapping. According to Trueman (1994) the starting tree need not be short, but for overall success needs to be one from which the global optimum, or shortest tree can be reached. The best approach to finding starting trees which will lead to global optima is to try a number of approaches (Swofford, 1990).

6.6.2 Islands of trees

The reason that the shortest trees may not be reached from some starting trees is that all trees which can be found from a given starting tree are always members of a single island, or set of trees below a given minimum length, such that for every tree there is at least one other which is a single branch swap away (Maddison, 1991). Search algorithms become stuck at local optima because they cannot jump between islands, since they are separated by longer trees (or because the search terrain is locally flat and does not reach the edge of the plateau (Trueman, 1993)). The set of trees which comprises an island or plateau varies with the branch-swapping algorithm, so, as with starting trees, one strategy for finding the most parsimonious trees is to use a variety of branch-swapping algorithms.

6.6.3 Branch swapping options

There are three branch-swapping options available in PAUP: NNI (nearest neighbour interchange); TBR (tree-bisection regrafting) and SPR (subtree pruning regrafting). The SBR and TBR routines each remove a single part of the tree and replace it in a new position. They differ in the rearrangements evaluated at each

step, with TBR allowing re-rooting of the clade. NNI operates by cutting the tree at both ends of an internal branch and swapping the parts. NNI, TBR and SPR were each performed on the data matrix using the general heuristic search option with the following results:

NNI: 48 trees saved, shortest 668 steps.

SPR: 161 trees saved, shortest 651 steps.

TBR: 309 trees saved, shortest 647 steps.

Qin (1993) ran exhaustive tests of each tree-swapping option for each search option and found TBR to be the most effective at finding minimum length trees, and SPR to be almost as effective. Both of these options consistently outperformed NNI. The same results were found in this study, where the NNI option produced minimum length trees 21 steps longer than TBR; and the SPR option produced minimum length trees four steps longer than TBR. TBR is the default branch-swapping option.

6.6.4 Addition sequence options

Heuristic searches have four types of addition sequences (from Swofford, 1990):

i) **As is**: The taxa are added in the order presented in the matrix.

ii) **Closest**: The shortest of all possible 3-taxon trees is chosen for the starting tree. At each successive step all remaining taxa are evaluated for connection to every branch of the tree, and the shortest resulting tree is chosen.

iii) **Simple**: The first taxon in the data matrix is used as a reference taxon and an advancement index is calculated for each other taxon (the distance between it and the reference taxon). Taxa are added to the starting tree (formed from the reference taxon and its two closest taxa) in order of increasing advancement.

iv) **Random**: A pseudorandom number generator is used to obtain a permutation of taxa to be used as an addition sequence.

Since there is no one strategy which works best for all data sets, the best strategy is to try as many as possible (Section 6.6.1). Qin (1993) found that

random was the most effective strategy, followed closely by **simple**, which always found minimum-length trees of the same length as **random**, but sometimes found fewer. Qin (1993) found **as is** to be as effective as **simple** in most cases, and **closest** to be the least effective of all options. This is in contrast to Swofford, who claimed **closest** to be more effective than **as is**. The final data matrix for this study was analysed using all four heuristic search options:

i) **as is**: shortest trees: 649 steps
trees saved: 646

ii) **closest**: shortest trees: 650 steps
trees saved: 432

iii) **simple**: shortest trees: 647 steps
trees saved: 309

iv) **random**: (100 reps, save no more than 20 trees ≥ length of 500 each rep.)
shortest trees: 647
trees saved: 100

These results were very similar to those of Qin (1993), except that **simple** found more minimum length trees than **random**. **As is** found minimum length trees two steps longer than **simple** or **random**, and again **closest** performed the least efficiently, finding minimum length trees three steps longer than the most effective options. Simple is the default heuristic search option.

6.6.5 Consensus trees

Consensus techniques were introduced by Adams (1972) as a method of comparing cladograms produced by different data matrices with a common set of taxa, e.g. morphological and molecular data. Consensus methods also can be used to combine minimum-length trees from the same data set, where there are a number of equally parsimonious explanations of a group's phylogeny. Such

consensus trees contain only those monophyletic groups that are common to all competing trees, and provide a visual impression of resolved versus unresolved parts of the tree. This use has been criticised by Carpenter (1988), who pointed out that a consensus tree is less parsimonious than any of the trees from which it is composed and thus any one of these could be considered a better phylogenetic hypothesis. Trueman (1994) argues that they are useful in indicating taxon groups which are common to a set of minimum-length trees and Qin (1993) recommends their use in determining which groups are always monophyletic.

6.7 Results of analysis

Fig. 6.1 (p265) shows the strict consensus of the 309 most parsimonious trees derived by using the **simple** heuristic search option and TBR branch swapping. The consensus tree presents only those monophyletic groups common to all 309 minimum-length trees (Section 6.6.5). Among the trees which make up the consensus tree, relationships of taxa within the monophyletic groups may vary. For example, the clade containing the four New Zealand *Aphobetus* species *A. erroli, A. maskelli, A. paucisetosus* and *A. nana* occurs in all the minimum-length trees in various arrangements. In tree 306, the relationship is ((*erroli*, *nana*) (*maskelli*, *paucisetosus*)); tree 307 (*erroli* (*nana* (*maskelli*, *paucisetosus*))); tree 308 (*erroli* (*maskelli* (*paucisetosus*, *nana*))). In the consensus tree, the relationships between these four species are unresolved, and we can only conclude that these four species are more closely related to each other than to any other species. The 309 minimum-length trees are made up of combinations of all the equally parsimonious arrangements of such groups of taxa.

The monophyletic units will be presented after a short discussion on the reliability of trees.

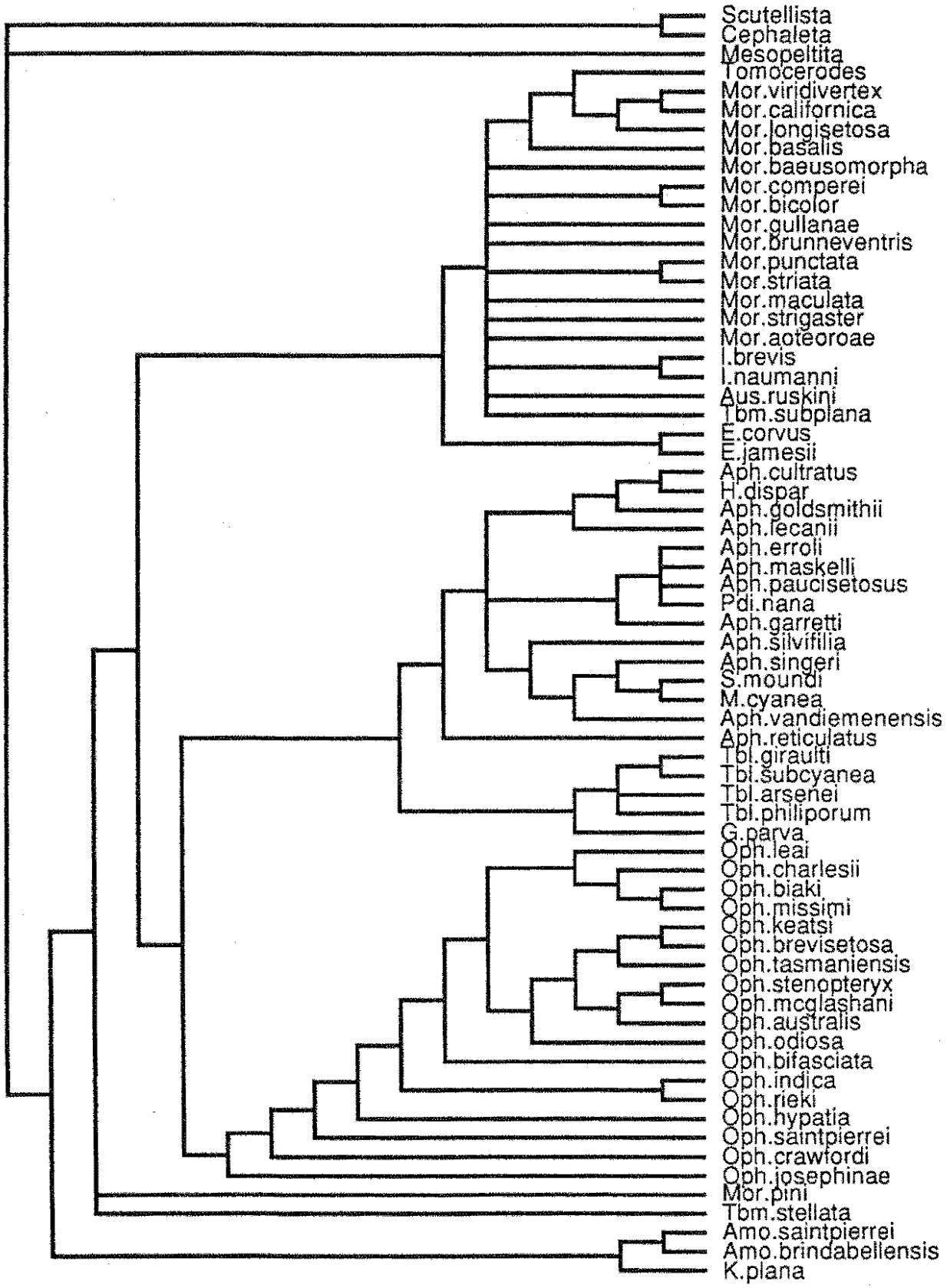

Fig. 6.1 Strict consensus of 309 minimum-length trees. Mor = *Moranila*; I = *Ismaya*; Aus = *Australeunotus*; Tbm = *Tomicobomorpha*; E = *Eunotomyiia*; Aph = *Aphobetus*; H = *Hirtonila*; Pdi = *Pidinka*; S = *Strionila*; M = *Modronila*; Tbl = *Tomicobiella*; G = *Globonila*; Oph = *Ophelosia*; Amo = *Amoturella*; K = *Kneva*.

6.8 Reliability of trees

According to Trueman (1994), a tree ought not be considered a best phylogenetic estimate unless at least three conditions are fulfilled:

i) The tree is the most parsimonious for its data (see above),

ii) The data matrix from which the tree is derived has a significant PTP score, and

iii) The matrix is as complete as possible, giving all currently available data for the terminal taxa (see Chapter 3).

6.8.1 PTP test

The algorithms used in phylogenetic analysis programmes produce hierarchical structure independent of the confidence in the data set, so an estimation of the reliability of the trees produced is highly desirable. Faith and Cranston (1990) commend the PTP-test (cladistic permutation tail probability), in which each character's states are reassigned randomly to the taxa (excepting the outgroups), so that the resulting randomised data set(s) represents random covariation among the characters. However, all the values for each character, and hence its mean distribution, are preserved. These data sets are then used to search for the shortest trees. If the original data set produces a tree or trees shorter than, for example, all but 4 of the 100 random data sets (the original set is included in the 100), one can accept that, at the 95% level (PTP $\leq$ 0.05), the original data has more hierarchical structure than would be expected by chance.

A PTP test was carried out on the data matrix using the RANDOMISER programme written by John Trueman (unpublished). The procedure was as follows:

1. The search is set up using the actual data file (with modifications) and run in PAUP. Output is logged to a PAUP file.
2. The executed actual data file is input into the RANDOMISER programme, which generates a file containing the commands for the randomised searches.
3. The output from the RANDOMISER is run through PAUP, and forms a PAUP log file.

4. EXTRACTOR is used to get the tree lengths out of the PAUP log file.

5. An Excel spreadsheet is used to test the significance of the results.

Results of PTP-test: Sixty randomisations were carried out. Faith and Cranston (1991) recommended estimating PTP from the actual data plus 99 randomised data sets but this number was not feasible since the data set used in this study was so large (60 replicates took 332 hours or just under two weeks). Trueman (1994) considered that such extensive replication may not be necessary. At any specified confidence level, what is required are sufficient replicates to estimate whether the minimum tree length for the actual data falls within the relevant tail. The length of the shortest tree using the actual data set is 647 steps. The shortest trees produced by the randomised data matrices ranged from 908 to 939 steps, i.e. the randomised data sets produced shortest trees from 261 to 292 steps longer than the actual data set (Fig. 6.2). Since minimum tree lengths from the actual data set were well removed from the 99% confidence limits of 903 to 940 steps, fewer replications are justified. This suggests that the actual data set has significant cladistic structure (PTP=0.01).

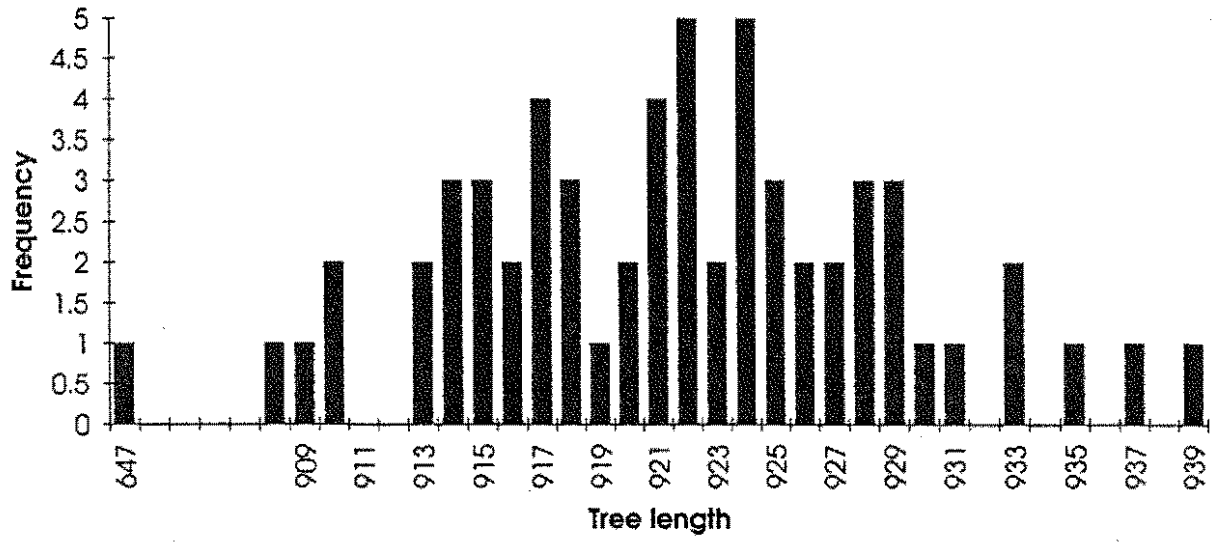

Fig. 6.2 Frequency distribution of 60 minimum-length trees produced from randomised data sets. The minimum-length trees produced from the actual data (647 steps) are at the far left of the graph.

However, the problem of whether the monotypic genera are valid still remains. An assertion of monophyly supported through a cladistic analysis can lead to changes in the existing classification. Therefore, evaluation of the strength of the evidence for monophyly, by means of *a priori* and *a posteriori* T-PTP tests may be a critical requirement for proposed taxonomic revisions. Failure to find statistically significant departure from randomness indicates that more evidence is needed before taxonomic revision is considered.

6.8.2 T-PTP tests

PTP tests are not appropriate for the evaluation of particular hypotheses of monophyly, as the test focuses on the explanatory power of the data set as a whole, rather than on the degree of support for a particular tree topology or parts of that topology (Faith and Cranston, 1991). The tree topologies are incidental to the outcome of the test beyond determining a minimum length. The PTP test can be extended to tests of monophyly. This form of the test, the T-PTP or topology-dependent cladistic permutation tail probability test can be used to evaluate the monophyly or non-monophyly of a particular group.

The "topological constraints" option in PAUP can be used to specify the monophyly or non-monophyly of a particular group (Swofford, 1990). The difference between the shortest cladogram with constrained non-monophyly and the shortest with constrained monophyly is measured; a large difference gives good evidence for the monophyly of the particular group. Randomisation of data sets can be used to decide what constitutes "a large difference" (Faith, 1991). In the production of randomised data sets for PTP tests, each character is taken and the states are randomly assigned to the taxa (excepting the specified outgroups). For T-PTP tests the labels of the taxa are maintained, so character states assigned to members of monophyletic groups can be noted and the monophyly or non-monophyly of the group can be recorded for the corresponding minimum tree-lengths. The observed difference in minimum length achieved under the non-monophyly versus monophyly constraints for the actual data set can be compared with the corresponding values that can be found for randomised data sets. The

proportion of occasions that the observed difference value is matched or bettered among all data sets (actual and randomized) gives the T-PTP value.

Faith (1991) distinguishes between *a priori* and *a posteriori* T-PTP tests. *A priori* tests are those in which the robustness of a grouping derived from extraneous sources is tested, for example, Bouček's concept of the genus *Aphobetus*. *A posteriori* tests are used to examine a hypothesis of monophyly that has arisen because of apparent support for a particular group in a cladistic analysis of the data, for example the group [*Aphobetus* + *Pidinka* + *Modronila* + *Strionila* + *Hirtonila*].

6.9 Monophyletic groups

In the following sections, the monophyletic groups produced by the cladistic analysis are evaluated using the PAUP option "topological constraints" and by T-PTP tests on the entire and reduced data matrices. The synapomorphies defining the groups in this analysis are contrasted with the key character states used by Bouček (1988a) to define his genera.

6.9.1 The Moranilini

The Moranilini is strongly supported as a monophyletic group by the following synapomorphies:

Character (Ch)3: dorsal margin of head weakly concave (CI=0.118); Ch11: first flagellar segment in females transverse (CI=0.077); Ch13: scutellum with paired setae (CI=1.0); Ch25: mesoscutum with paired setae (CI=0.143); Ch38: stigmal area bare (CI=0.01); Ch45: forewing with speculum (CI=0.375); Ch50: nucha broader than long (CI=0.231); Ch63: male antennae nodose (CI=0.375); Ch67: ♂ basal hairline with setal strip (CI=0.571); Ch73: mandible with 2 teeth, upper tooth divided (CI=o.364); Ch76: S1 with median horizontal ridge sculptured (CI=0.188); Ch77: S1 anterior of collar foveate (CI=0.25); Ch78: S1 posterior of collar grooved (CI=0.375); Ch81: ♂ antennae with F1 longer than F2 (CI=0.167).

6.9.2 The Tomocerodini

The Tomocerodini (represented by *T. americanus* Girault in the analysis) are not supported by any synapomorphies and it is doubtful whether they form a valid group. The genus *Tomocerodes* is monotypic, but Bouček (1988a:353) mentions a further undescribed genus, presumably from Argentina. The tribal structure of the Eunotinae is beyond the scope of this study.

6.9.3 *Ophelosia*

The genus *Ophelosia* is supported by the following synapomorphies: Ch1: female head orange (CI=0.333); Ch25: mesoscutum with regular and paired setae (CI=0.143); Ch47: hind tibial spur 0.6 to same length as basitarsus (CI=0.188); Ch50: nucha broader than long to square (CI=0.231); Ch52: median carina incomplete (CI=0.6); Ch76: medial ridge on S1 present as a sculptured ridge (0.188); Ch77: anterior collar of S1 grooved (0.25).

Bouček (1988a) used the following key character states to define the genus *Ophelosia*: i) scutellum with only 2 pairs of setae (sometimes 3), without short hairs (this state is used to differentiate *Ophelosia* from *Australurios* Girault in Bouček's key, see discussion in Section 5.4); ii) postmarginal vein at most slightly longer than stigmal; iii) propodeum "produced into a conspicuous long horizontal neck, its sides strongly shortened as if cut off just behind the spiracles, there with dense hair" (p.228); iv) petiole short; v) marginal vein at least twice as long as stigmal; vi) forewing in female often with 2 brown bands; vii) spur of hind tibia often longer than breadth of tibia. Character state ii) shows a large amount of homoplasy in the tribe, and is not useful in diagnosing this genus. The sculpture of the propodeum is undoubtedly one of the most important diagnostic characters in this tribe, with this genus being no exception. The shape (iii) varies within *Ophelosia*, although all species have the nucha developed to some degree, and only some species (e.g. *O. crawfordi*) show an extreme elongation. State iv) was not scored for the analysis. Characters in the forewing, e.g. v) marginal:stigmal vein length ratio and vi) forewing banding showed a large amount of variation within the genus, for example the marginal vein was found to be 1.7 to 4.6x the length of the stigmal vein. Bouček's state vi) "forewing often with 2 brown

bands" corresponds to a forewing with one infumate patch (Ch.35) and an infumate basal hairline (Ch.70). These characters were highly homoplasious within the tribe. Bouček also mentions a species from Tasmania in which the infumate patch is broken into several spots. I have not seen this species in the ANIC; in fact the only state approaching this is shown in *Moranila viridivertex*, with its bimaculate forewing. Ch47 corresponds to the key character state "spur of hind tibia often longer than breadth of tibia".

One problem with running multiple T-PTP tests on the actual data set is that its large size makes running multiple randomisations through PAUP extremely time-consuming. It is possible to use reduced data sets in a conditional test (Faith and Cranston, 1991). However it was not possible to reduce the data matrix to test the monophyly of *Ophelosia* since there were no clear monophyletic units which could be deleted from the matrix. Thus the whole data matrix was run with the following species used in constrained tree one: *Ophelosia australis, O. biaki, O. bifasciata, O. brevisetosa, O. charlesii, O. crawfordi, O. hypatia, O. indica, O. josephinae, O. keatsi, O. leai, O. mcglashani, O. missimi, O. odiosa, O. rieki, O. saintpierrei, O. stenopteryx,* and *O. tasmaniensis*. The results of constraining the monophyly of the genus versus constraining the non-monophyly of the genus were as follows:

Shortest tree with taxa 34-51 (above) constrained to be monophyletic: 647 steps.
Shortest tree with taxa 34-51 constrained to be non-monophyletic: 654 steps.
Difference value: 7 steps.

Thus the most parsimonious trees were 7 steps longer when the genus *Ophelosia* was constrained to be non-monophyletic. A T-PTP test run on the entire matrix produced difference values of -50 to -16 steps, none of which matched or was longer than the difference value for the actual data (+7 steps) (Fig. 6.3). This suggests that the T-PTP randomisation test provides highly significant evidence for the monophyly of *Ophelosia*. Since this was an *a priori* test with the monophyletic group defined prior to the analysis, this is all the more significant. On this basis no changes have been made to the generic level taxonomy.

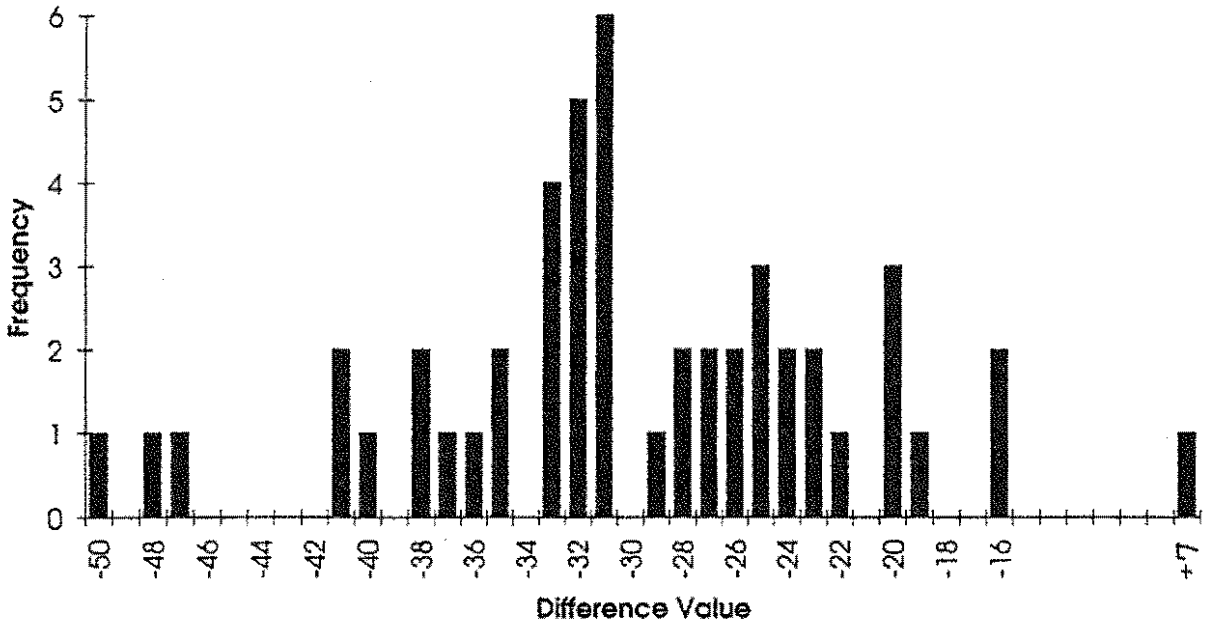

Fig. 6.3 T-PTP test for the monophyly of *Ophelosia* Riley. Difference values for trees with constrained monophyly vs. constrained non-monophyly of the genus *Ophelosia* produced from 49 randomised and 1 actual data set. The actual data set value is at extreme right.

6.9.4 The *Aphobetus*-group

The genus *Aphobetus* plus the four monotypic genera *Pidinka, Strionila, Hirtonila* and *Modronila* formed a monophyletic group in the analysis in all 309 minimum-length trees. I will refer to this unit as the *Aphobetus*-group. The synapomorphies supporting the group are as follows:

Ch7: OD less than OOL (CI=0.083); Ch18: malar incomplete (CI=0.083); Ch30: frenal area delimited by a groove/punctations (CI=0.136); Ch52: median carina developed as a tooth (CI=0.6); Ch58: mesepimeral dimple present (CI=0.25); Ch74: S1 surface finely striate (CI=0.5); Ch78: S1 posterior collar foveate (CI=0.375); Ch81: male antennae with F1 equal to F2 (CI=0.167).

The results of constraining the monophyly of the *Aphobetus*-group versus constraining the non-monophyly of the group on the entire data matrix were as follows:

Shortest tree with *Aphobetus*-group (taxa 5-16, 59, 63 and 64) constrained to be monophyletic: 647 steps.

Shortest tree with *Aphobetus*-group constrained to be non-monophyletic: 656 steps.

Thus the most parsimonious trees with constrained monophyly of these genera were 9 steps shorter than with constrained non-monophyly, indicating that *Pidinka, Hirtonila, Strionila* and *Modronila* form a monophyletic group with *Aphobetus*. Note however that this is an *a posteriori* test with the monophyletic group defined after a cladistic analysis of the group had been performed.

When the data matrix was reduced to 50 taxa by deleting all species of *Ophelosia* except *O. crawfordi*, the type species, the results of constraining the monophyly of the *Aphobetus*-group were as follows:

Shortest tree with taxa 5-16, 59, 63 and 64 constrained to be monophyletic: 542 steps.

Shortest tree with above taxa constrained to be non-monophyletic: 543 steps.

Thus the difference in this case was only 1 step.

A T-PTP test carried out on the reduced data matrix gave difference values of -39 to -9 steps, none of which matched or was longer than the actual value of +1 (Fig. 6.4). This provides significant evidence (T-PTP = 0.01) that the above genera formed a monophyletic unit.

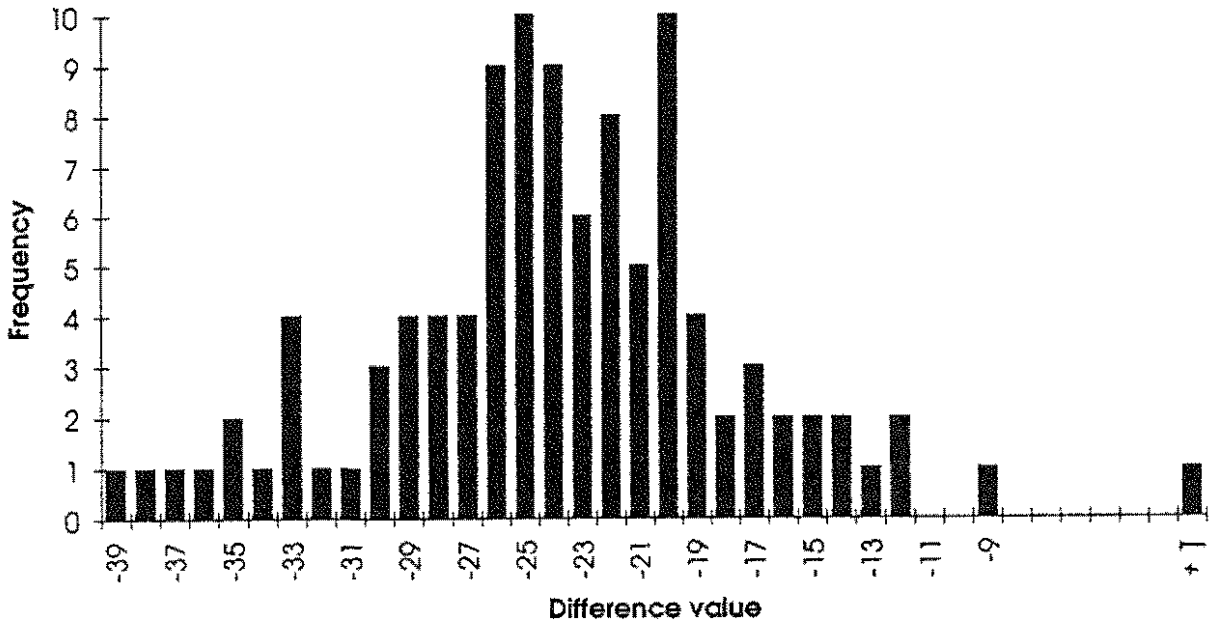

Fig. 6.4 T-PTP test for the monophyly of the *Aphobetus*-group. difference values for trees with constrained monophyly vs. constrained non-monophyly of the *Aphobetus*-group produced from 99 randomised and 1 actual data set. The actual data set value is at the right.

Further testing of the monophyly of the *Aphobetus*-group was carried out on the entire data matrix by comparing constrained monophyly to constrained non-monophyly of various subsets of the *Aphobetus*-group. Since the four monotypic genera which fell into this group are obviously derived enough to be described as different genera, tests of the monophyly of the *Aphobetus*-group were made by successively dropping each of these genera from the group and comparing difference values. T-PTP tests were not carried out on these groups, due to the prohibitive amount of computer time that would be needed, so these estimates are non-quantitative.

i) Test of *Aphobetus* species: An *a priori* test of the genus *Aphobetus* was carried out by comparing constrained monophyly and constrained non-monophyly of the species *Aphobetus cultratus, A. erroli, A. garretti, A. goldsmithii, A. lecanii,*

A. maskelli, A. paucisetosus, A. reticulatus, A. silvifilia, A. singeri and *A. vandiemenensis,* on the entire matrix. The results were as follows:
Shortest tree with taxa 5-15 constrained to be monophyletic: 662 steps.
Shortest tree with taxa 5-15 constrained to be non-monophyletic: 647 steps.
A difference of 15 steps was produced.

ii) Test of *Aphobetus* species + *Pidinka*: A test of the genera *Aphobetus* and *Pidinka* was carried out by comparing constrained monophyly and non-monophyly of the 11 species listed above and *Pidinka nana*. The results were as follows:
Shortest tree with taxa 5-16 constrained to be monophyletic: 656 steps.
Shortest tree with taxa 5-16 constrained to be non-monophyletic: 647 steps.
A difference of 9 steps was produced.

iii) Test of entire *Aphobetus*-group except *Hirtonila*: A test of the monophyly of the group comprising *Aphobetus* species, *Pidinka nana*, *Strionila moundi*, and *Modronila cyanea* was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5-16, 63 and 64 constrained to be monophyletic: 652 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.
A difference of 5 steps was produced.

iv) Test of entire *Aphobetus*-group except *Modronila*: A test of the monophyly of the group comprising *Aphobetus* species, *Pidinka nana*, *Strionila moundi* and *Hirtonila dispar* was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5-16, 59 and 63 constrained to be monophyletic: 651 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.
A difference of 4 steps was produced.

v) Test of entire *Aphobetus*-group except *Strionila*: A test of the monophyly of the group comprising *Aphobetus* species, *Pidinka nana*, *Modronila cyanea* and *Hirtonila dispar* was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5-16, 59 and 64 constrained to be monophyletic: 652 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.

A difference of 5 steps was produced.

vi) Test of entire *Aphobetus*-group except *Pidinka*: A test of the monophyly of the group comprising *Aphobetus* species, *Strionila moundi*, *Modronila cyanea* and *Hirtonila dispar* was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5 to 15, 59, 63 and 64 constrained to be monophyletic: 652 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.
A difference of 5 steps was produced.

vii) Test of entire *Aphobetus*-group except *Pidinka* and *Modronila*: A test of the monophyly of the group comprising *Aphobetus* species, *Strionila moundi* and *Hirtonila dispar* (all genera with Australian species) was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5-15, 59 and 63 constrained to be monophyletic: 655 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.
A difference of 8 steps was produced.

viii) Test of entire *Aphobetus*-group except *Hirtonila* and *Strionila*: A test of the monophyly of the group comprising *Aphobetus* species, *Pidinka nana* and *Modronila cyanea* (all genera with New Zealand species) was carried out by comparing constrained monophyly and non-monophyly of the above taxa. The results were as follows:
Shortest tree with taxa 5-16 and 64 constrained to be monophyletic: 658 steps.
Shortest tree with above taxa constrained to be non-monophyletic: 647 steps.
A difference of 11 steps was produced.

In conclusion, all the above tests give significant evidence for the monophyly of the *Aphobetus*-group. However I will discuss each of the component genera in turn and then hopefully present a rationale for the following changes to the taxonomy.

a) *Aphobetus* Howard: Bouček (1988a) used the following key character states to define the genus *Aphobetus*:

i) marginal vein less than 3 times length of stigmal. This character was not included in the analysis (Section 3.4).

ii) propodeum with strong antero-median tooth and additional sculpture. This state is a synapomorphy for the entire *Aphobetus*-group, except *Hirtonila*, in which it has undergone a reversal, according to the analysis. As mentioned above, the sculpture of the propodeum is a very important character in the Moranilini, and one of the weaknesses of this data set is that only two characters were coded from the propodeum. I consider the propodeal tooth and associated carination to be diagnostic of the group [*Aphobetus* + *Pidinka* + *Modronila* + *Strionila*]; excluding *Hirtonila.*

iii) scutellum in posterior half with distinct frenal cross-groove or cross-line of punctures. Bouček used this character to define the group *Aphobetus, Strionila* and *Modronila*; excluding *Pidinka. P. nana* and *A. erroli* both lack a frenal cross-groove. According to the analysis this is due to a reversal, and the absence of this character state in the above two species should not be used to remove them from the monophyletic *Aphobetus*-group. This character state also appears convergently in *Moranila striata.*

iv) hind coxa dorsally bare and shiny, rarely slightly pilose. This character state occurs in only 3 of the 10 species of *Aphobetus sensu* Bouček. *Hirtonila, Strionila* and *Modronila* also lack dorsal pilosity on the hind coxa. The remaining 7 species of *Aphobetus sensu* Bouček, *Pidinka nana,* and *A. erroli* (*Pidinka sensu* Bouček) have dorsal pilosity present in this area. Obviously, this character shows a high amount of homoplasy in this group and is not useful in indicating generic-level relationships.

b) *Modronila* Bouček: Bouček uses the following key character states to define the monotypic genus *Modronila*:

i) forewing proximally with dense pilosity; ii) linea calva only present, no speculum; iii) marginal vein almost 4 times as long as stigmal vein.

These three wing characters are autapomorphies within this group and cannot be used to deduce relationship. The form of S1 is also autapomorphic. *Modronila* is a highly derived, endemic New Zealand form of *Aphobetus*.

c) *Strionila* Bouček: Bouček uses the following key character states to define the monotypic genus *Strionila*:

i) first tergite with transverse area of longitudinal striae on disc. This state is an autapomorphy within this group and is not useful for deriving relationships. It has also arisen independently in one New Zealand species of *Moranila.*

ii) punctate frenal groove coarse, and delimited posteriorly by slight carina. Although the punctations are coarser than those found in *Aphobetus sensu* Bouček and in *Modronila* Bouček, I can see no evidence of the "slight carina" claimed by Bouček (Fig. 5.89). The form of S1 is also autapomorphic. *Strionila* is a derived West Australian form of *Aphobetus.*

d) *Pidinka* Bouček: Bouček distinguished the monotypic genus *Pidinka* using the following character states:

i) "propodeum with broad triangular tooth raised towards middle (suggesting broad median carina), its sides formed by transverse costula, without grid-like sculpture" (p.229). I can see no major difference in the form of the propodeal tooth in *Pidinka* compared to the other members of the genus *Aphobetus* (see Figs 5.76, 5.85, 5.99, 5.103, 5.108, 5.111).

ii) "base of gaster on sides with loose hair" (Bouček, 1988a p229). I found the condition of setosity at the base of the gaster to be the same in *Pidinka*, all species but 3 of *Aphobetus sensu* Bouček, and *Hirtonila.* The character state is not diagnostic of any grouping.

iii) hind coxa dorsally with short curved pilosity. See state iv) under *Aphobetus.*

iv) thorax dorsally depressed. This is an autapomorphy.

Pidinka is an endemic New Zealand form of *Aphobetus.* It is most closely related to *A. erroli*, which in several characters is intermediate between Bouček's concepts of the two genera.

e) *Hirtonila*. Bouček (1988a) used the following key character states to define this monotypic genus: i) propodeum almost smooth but in convex median part with 3 longitudinal carinae; ii) in male lower face with striation radiating from the emarginate clypeal margin, which bears a median tooth (an autapomorphy).

The cladistic analysis placed *Hirtonila* within the *Aphobetus*-group. On the basis of the importance of the propodeum to this group and the shortcomings of this data matrix in coding the characters associated with the propodeum, I do not consider *Hirtonila* to fall within the *Aphobetus*-group, and retain it as a valid monotypic genus. Thus the synapomorphy defining the *Aphobetus*-group is the development of the median carina of the propodeum into a tooth, and the group consists of the erstwhile genera *Aphobetus, Pidinka, Strionila* and *Modronila.*

6.9.5 The *Moranila*-group

The group including *Moranila viridivertex, M. californica, M. longiseta, M. basalis, M. baeusomorpha, M. comperei, M. bicolor, M. gullanae, M. brunneventris, M. punctata, M. striata, M. maculata, M. strigaster, M. aotearoae, Australeunotus ruskini, Tomocerodes americanus, Ismaya brevis, I. naumanni* and *Tomicobomorpha subplana* formed a monophyletic group in all of the minimum length trees, and will be referred to as the *Moranila*-group. Note that *T. americanus* is one of the outgroup taxa, yet it fell within the ingroup in all most parsimonious trees. *Moranila pini* did not fall into this monophyletic group, the species was unresolved near the base of the tree, along with *Tomicobomorpha stellata* (Section 6.9.7).

The *Moranila*-group was supported by the following apomorphies: Ch29: scutellum square (CI=0.118); Ch47: hind tibial spur less than 0.4x length of basitarsus (CI=0.118); Ch60: male club more than 2x length of F1 (CI=0.143); Ch68: male basal cell not margined (CI=0.4); Ch75: S1 with setae at base (CI=0.4).

In his 1988a key, Bouček has very few key character states defining the genus *Moranila*, which is mostly defined by default. The only two positive features in the key are: i) hind coxa with dorsal crest of hairs and basal pilosity; ii) forewing often with central infumation.

The results of constraining the monophyly of the *Moranila*-group versus constraining the non-monophyly of the group were as follows (using the entire data matrix):

Shortest tree with taxa 4, 19-30, 32, 33, 57, 58, 62, 67 constrained to be monophyletic: 647 steps.
Shortest tree with above taxa constrained to be non-monophyletc: 648 steps.

The difference between constrained monophyly and constrained non-monophyly of this group is only one step; compared to 7 steps for *Ophelosia* and 9 steps for the *Aphobetus*-group; also note that it is an a-posteriori test. Thus this analysis does not provide good evidence for the monophyly of this group, but does not contradict monophyly either. No T-PTP tests were carried out on this group but a further test was performed on the monophyly of *Moranila sensu* Bouček using the "monophyly constraint" option and the reduced data matrix of 50 taxa:

i) Test of *Moranila sensu* Bouček: The results of an a priori test on the monophyly of the extant species of the genus *Moranila* were as follows:
Shortest tree with taxa 19-33 constrained to be monophyletic: 545 steps.
Shortest tree with taxa 19-33 constrained to be non-monophyletic: 542 steps.

The shortest trees obtained with constrained non-monophyly of the genus *Moranila* were 3 steps shorter than those obtained with constrained monophyly of the genus, i.e the difference value is -3. This indicates that the genus as presently defined is not monophyletic. However there is not enough information available to the present analysis to resolve the relationships within the *Moranila*-group and the current taxonomy is left unchanged, with discussion of the genera comprising it below.

6.9.6 *Ismaya* Bouček

The analysis placed *Ismaya* inside the poorly supported *Moranila*-group. No change is made to the current taxonomy at the generic level on this basis. This genus was weakly supported by the following synapomorphies:
Ch4: occipital carina strong (CI=0.167); Ch39: female costal cell excised at apex (CI=0.222); Ch40: female costal margin with setae along less than half of margin (CI=0.364); Ch49: lateral crest of setae on coxae absent (CI=0.143); Ch54: T1 more than 0.9x length of gaster (CI=0.167).

Bouček (1988a) defined *Ismaya* by the following key character states: i) forewing with excision at apex of costal cell; ii) marginal vein shorter than stigmal; iii) basal vein indicated by shaded line; iv) dorsellum large, triangular; v) first tergite with thick hair extending along most of foveal edge; vi) body short; vii) antennae of female rather hairy.

The discovery of a second species of the genus during the course of this study widened the generic limits, excluding Bouček's character states ii) and v). This analysis found state iii) to have a high level of homoplasy; however it did support the use of state i) for the definition of this group.

6.9.7 *Tomicobomorpha* Girault

The two species comprising *Tomicobomorpha*, *T. stellata* Girault and *T. subplana* Bouček did not form a monophyletic group in the analysis. *T. subplana* fell into the *Moranila*-group, while *T. stellata* was unresolved near the base of the cladogram.

Bouček (1988a) used the following key character states to define the genus: i) head unusually transverse; ii) genae concave in frontal view; iii) "eye horizontally longer than high" (p.229); iv) hind coxa without conspicuous dorsal pilosity; v) wings hyaline; vi) fore and hind femora thickened. Character i) was not able to be included in the analysis due to coding problems (Section 3.4), however some species of *Moranila* have head width:length ratios approaching that found in *Tomicobomorpha*. Character ii) was not coded for the analysis and this oversight is partly the reason the two species of *Tomicobomorpha* did not form a monophyletic unit, since it is an apomorphy for the genus. Additional reasons are a) the poor coding of the propodeal characters (previously discussed in Section 6.9.4), since the propodeum is sufficiently distinct from *Moranila* to justify the separate genera and b) the scoring of character 13, the female club:funicle ratio, since *T. stellata* fell into the upper limit of one character state's range, and *T. subplana* into the bottom of the next range. Bouček's characters iv) and v) are highly homoplasious, presumably only used to distinguish *Tomicobomorpha* from *Moranila* in the key. Although *Tomocobomorpha* and *Moranila* are closely related, separate generic status is maintained in this revision.

6.9.8 *Eunotomyiia* Girault

Eunotomyiia corvus and the new species *E. jamesii* formed a monophyletic unit in the analysis, the sister to the *Moranila*-group. The genus was supported by the following synapomorphies:

Ch4: occipital carina absent (CI=0.167); Ch6: ocelli removed from occiput by 1OD (CI=0.5); Ch35: female forewing without a definite infumate patch (CI=0.25); Ch38: female stigmal area bare (CI=0.1); Ch44: ♀ basal cell partly margined (CI=0.22); Ch50: nucha square (CI=0.3); Ch63: ♂ antennae branched (CI=0.375); Ch66: ♂ costal margin with setae along 0.5 to 0.9 length (CI=0.23); Ch77: S1 with anterior of collar concave (CI=0.25); Ch79: female antenna strongly clavate (CI=0.5).

Bouček (1988a) defined the then monotypic genus *Eunotomyiia* by the following key character states: i) head very stout; ii) vertex posteriorly rounded; iii) lateral ocelli removed from occiput; iv) temples developed; v) thorax elongate with semidecumbent pilosity; vi) antenna of female strongly clavate; vii) preclaval segments strongly transverse. States ii) (=occipital carina absent, Ch4), iii) and vi) are supported by this analysis. Character i), head width:length was not able to be coded; characters iv) and v) were not coded and character vii) was found to be highly homoplasious.

6.9.9 *Tomicobiella* Girault

The four species comprising the genus *Tomicobiella* (three of them new) formed a monophyletic unit in the analysis, which is supported by the following synapomorphies:

Ch4: occipital carina absent (CI=0.167); Ch21: two hind tibial spurs present (CI=0.143); Ch29: scutellum square (CI=0.118); Ch32: axillae not sculptured (CI=0.143); Ch76: medial horizontal ridge of S1 sculptured (CI=0.185); Ch79: female club not clavate (CI=0.5); Ch81: ♂ antennae with setae longer than F2 (CI=0.167)

Bouček (1988a) defined the genus by the following key character states: i) female antenna very slender; ii) hairs on side of basal fovea of gaster loose, extended along edges; iii) vertex posteriorly rounded; iv) thorax elongate, fairly

convex, bristly. All of these character states are supported by the analysis except iv) which was not coded.

6.9.10 *Globonila* Bouček

Globonila formed the sister group to the genus *Tomicobiella* in the analysis. The extant taxonomy has not been changed. This monotypic genus is supported by the following synapomorphies:
Ch14: ♀ club less than or equal to funicle in length (CI=0.1); Ch22: pronotal ring absent (CI=0.33); Ch24: thorax extremely convex (CI=0.22); Ch25: mesoscutum with regular pilosity only (CI=0.143); Ch39: ♀ costal cell slightly excised (CI=0.22); Ch44: ♀ basal cell partly margined by setae (CI=0.22); Ch50: nucha reduced (CI=0.231); Ch54: T1 less than 0.6x length of gaster (CI=0.167).

Bouček (1988a) defined this genus by the following key character states: i) marginal vein hardly more than half as long as stigmal; ii) thorax globose; iii) propodeum nearly vertical, almost smooth; a congruent subset of the synapomorphies found to support the genus in the analysis.

6.9.11 *Amoturella* Girault

This genus is supported by the following synapomorphies:
Ch4: occipital carina absent (CI=1.67); Ch 7: OD less than OOL (CI=0.083); Ch44: ♀ basal cell margined by cubital row of setae (CI=0.222); Ch52: median carina complete (CI=0.6); Ch56: setal tuft absent (CI=0.429); Ch59: mesepimeron striate (CI=0.143); Ch70: ♀ forewing with basal hairline infumate (CI=0.1); Ch75: S1 entirely setose (0.4); Ch78: S1 posterior of collar foveate (0.375).

Bouček uses the following key character states to define the genus: i) forewing without marginal fringe; ii) with rudimentary postmarginal vein; iii) with short marginal vein at very low angle (*sic;* presumably Bouček intended to say stigmal vein, not marginal vein); iv) thorax depressed; v) engraved reticulate vi) scutellum before apex with a cross row of coarse alveolae; vii) propodeum almost regularly alveolate; viii) female funicle four-segmented. The use of i) absence of a marginal fringe on the forewing and viii) presence of a reduced number of funicular segments (4) as key characters for this genus are incorrect; F1 is present,

but reduced and the setal base insertions on the forewing are present, but the setae have been destroyed (Section 5.1). The key characters v) and vi) are certainly synapomorphies for this genus however, due to the limitations of the coding system used for these two characters in the analysis, they did not show up as such in this analysis. For each character (30 and 52) a further category should have been included to encompass the conditions found in this genus.
Bouček suggests a relationship to *Moranila* on the basis of a general similarity between propodea of the two genera, and also to *Aphobetus* on the presence of a frenal line on the scutellum and the absence of adfoveal tufts. The taxonomy is unchanged at the generic level.

6.9.12 *Kneva* Bouček

This genus is supported by the following synapomorphies:
Ch8: scrobes carinate anteriorly (CI=0.2); Ch11: ♀ F1 not transverse (CI=0.077); Ch15: malar space shorter than vertical axis of eye (CI=0.2); Ch23: setal bases on mesoscutum punctate (CI=0.429); Ch25: mesoscutum with paired setae (CI=0.143); Ch32: axillae not sculptured (CI=0.143); Ch34: metanotal furrow smooth (CI=0.062); Ch38: ♀ stigmal area setose (CI=0.1); Ch40: ♀ costal margin with setae along 0.5 to 0.9x length (CI=0.364); Ch45: ♀ linea calva only present (CI=0.375); Ch55: setal tuft at base of thorax not compact (CI=0.214)

The analysis supported retaining *Kneva* as a monotypic genus. Bouček (1988a) used the following key characters to define the genus: i) thorax dorsally depressed; ii) antennae moderately clavate; iii) bristles on scutellum short; iv) scutum and pronotum with conspicuous deep punctures. Character states i) and ii) were scored (29 and 79) but were not found to support *Kneva*. Character iii) was not scored, but iv) was scored for the analysis and was found to have a relatively high CI, occurring in this state only in 3 other unrelated taxa.

6.10 Conclusion

Prior to this cladistic analysis, the tribe Moranilini consisted of 16 genera, seven of which were described by Bouček in his 1988 revision. Four of these genera were polytypic, ranging from 15 to two species per genus. The remaining

12 genera, or 75% of the tribe, were monotypic. A total of 30 described species existed, these were mainly Girault species. This revision has added 33 new species to the tribe and synonymised three genera (*Modronila, Strionila* and *Pidinka*) with the Howard genus *Aphobetus*). Table 6.2. summarizes the changes made. The percentage of monotypic genera in the tribe has been reduced from 75% to 38% (five genera of 13).

Genus	Species 1988	Synonymies this study	New species this study	Species 1994
Ophelosia	15	8	11	18
Moranila	10	4	9	15
Aphobetus	4	3 (generic)	7	14
Tomicobiella	1	0	3	4
Eunotomyiia	1	0	1	2
Ismaya	1	0	1	2
Amoturella	1	0	1	2
T'bomorpha	2	0	0	2
A'eunotus	1	0	0	1
Globonila	1	0	0	1
Hirtonila	1	0	0	1
Kneva	1	0	0	1
Australurios	1	0	0	1
All genera	43	14	33	64

Table 6.2 TAXONOMY OF THE MORANILINI AFTER CLADISTIC ANALYSIS

Chapter 7: Biogeography and host relationships

7.1 Introduction

The disciplines of systematics, biogeography and biological control are closely interrelated; biogeographical theory and the practice of biological control are heavily dependent on systematic input. This chapter will discuss the biogeography of the Eunotinae and their hosts, the interrelationship of biological control, biogeography and systematics, and the applications of new taxonomic information to the biological control of mealybug pests in some New Zealand horticultural crops.

7.2 Biogeography

Biogeography is defined as faunistics or floristics (the study of where contemporary species occur) in combination with recognition of areas of endemism (see below), explanation of their genesis, and interpretation of the interrelationships of faunas and floras and the areas they occupy (Cranston and Naumann, 1991). All taxa, of whatever rank, have their own distribution. A taxon is endemic if confined to a particular area through historical, ecological or physiological reasons (Major, 1988). The endemic taxon can be of any rank, though usually family or below, and areas of endemism can be large or small. For some organisms, these areas are relatively easily determined. For other organisms however, determination of their endemic area is much more difficult. When cryptic phytophagous insects are transported around the world with their plant hosts, it may be particularly difficult to determine their areas of origin. In some cases, the native area of such pests can be predicted on the basis of their association with host plants, but many such organisms are polyphagous and thus this method cannot be used (but see Qin *et al*, in press). Even when the distribution is not cosmopolitan, but merely common to two or more relatively distinct areas (see below), there may be problems in assigning endemism.

Fortunately, however, the distributions of many organisms can be determined more or less accurately. Global patterns of plant and animal distribution can be demonstrated to be non-random, showing distinct and highly repetitive patterns between unrelated taxa. Biogeographers investigate these patterns and the ecological

and historical reasons behind them (Mayr and Ashlock, 1991). When areas of endemism are examined on a broad scale, it can be shown that many taxa are restricted to certain common areas; these are considered to be areas of high endemism. The number of major regions of distinctive endemism or biogeographic regions is commonly accepted as six, following those of Sclater and Sclater (1899): namely the Nearctic, Palearctic, Neotropical, Oriental, Australian and Afrotropical regions.

Cranston and Naumann (1991) distinguish three partially overlapping categories of biogeographical theory: i) ecological or physical biogeography, ii) dispersal biogeography and iii) vicariance biogeography. These theories each attempt to explain the distribution of taxa in different ways.

i) Ecological biogeography attempts to explain the distribution of organisms in terms of their biotic and abiotic needs. To a certain extent, distributions are dependent on such variables. Abiotic variables include, for example, climate, soil, and topology. Biotic variables include such factors as competition, predation and host plant or animal distributions (these can be doubly important for insects whose hosts distributions are in turn circumscribed by the host plant). However purely ecological factors fail to explain the phenomenon of areas with similar ecological attributes supporting widely disparate groups of plants and animals. Further, the relationship between distributions of higher taxa and ecological factors is not clear. Thus, although in many cases ecological factors are important in constraining the distribution of organisms, the key factors in determining more fundamental patterns are historical ones. Two major historical theories of biogeography are dispersal and vicariance biogeography.

ii) Dispersal biogeography: Central to this theory is the view that organisms have a centre of origin, from which they migrate or disperse to other areas across pre-existing barriers. They then speciate in isolation behind these barriers. A number of criteria have been suggested for recognising a centre of origin (after Cranston and Naumann, 1991): i) the area most ecologically suitable for the group of organisms; ii) the area with the greatest number of species of the group; iii) the area circumscribing the greatest morphological diversity of the group; iv) the area containing the greatest number of derived forms or, conversely, v) the area containing

the greatest number of primitive forms (Hennig's progression rule). Before the theory of continental drift was generally accepted, the only explanation for the occurrence of related taxa in different areas was by dispersal. Where seemingly uncrossable barriers existed, some biologists proposed ephemeral landbridges, but in general these explanations were not well received. A major problem with using dispersal as a sole explanation for all extant distributions is the occurrence of repeated similar distribution patterns for unrelated organisms with very different powers of dispersal.

iii) Vicariance biogeography: Wide acceptance of the plate tectonic theory of continental drift led to the proposal of another mechanism to explain the occurrence of congruent distribution patterns between unrelated taxa, namely the vicariance theory. This view is that present biotic distributions represent fixed ancient patterns that have been disrupted or vicariated in the past by the movement of landmasses. This movement created impassable barriers dividing many taxa, thus producing congruent patterns of speciation whose geographic relationships were identical (Croizat, 1964). A major difference between dispersal and vicariance theories of biogeography is that the barrier predates the disjunction and the taxa are younger than the barrier in dispersal theories; whereas according to vicariance biogeography the barrier causes the disjunction and the taxa involved are of a similar age to the barrier.

The fusion of cladistic biogeography and vicariance biogeography gave rise to cladistic vicariance biogeography, with Hennig's (1960) method of phylogenetic reconstruction providing a framework within which biogeographic patterns could be examined. When taxon names in a cladogram are replaced by their respective areas of endemism the result is an area cladogram. Thus area cladograms, branching diagrams of areas, express the interrelationship between areas as determined from systematic information (Humphries and Parenti, 1986). Improvements in phylogenetic estimates can be expected to lead to increases in the number of supported biogeographic hypotheses and to a better general understanding of biogeographic processes.

Before analyses can be carried out concerning the distribution of organisms, their taxonomy must be well enough known for their distributions to be documented. Hence the importance of worldwide taxonomic revisions.

7.3 Current distribution of the Eunotinae

Representatives of the subfamily Eunotinae are found worldwide. When the subfamily is broken into tribes however, the distributions are seen to be clearly disjunct. Members of the basal tribe, the Eunotini, have the following distribution (from Bouček, 1988a): *Scutellista* is found in Europe, the Mediterranean and South Asia, Japan, Africa and one species is widespread through many tropical and subtropical countries as well as temperate zones such as Australia. Although introductions have been attempted, it has not established in New Zealand (Morales, 1989). *Cephaleta* is found in tropical and subtropical regions including North America (Florida), South America, and South Asia to Australia. *Mesopeltita* is found in the Neotropics up to the USA and in tropical Africa; there is also one Japanese species. *Eunotus* is recorded from North America and Europe; *Epicopterus* Westwood is from Europe. Thus the genera in this tribe are distributed throughout the world, in all six zoogeographic regions.

The Tomocerodini, with its one described genus *Tomocerodes*, is confined to the Nearctic region, ranging from Arizona to Argentina.

In contrast, the tribe Moranilini occurs almost exclusively in the Southern Hemisphere. A summary of the distribution of the species within each genus follows, and is also presented in the area cladogram (Fig. 7.1, p.291):

Aphobetus: there is no overlap between Australia and New Zealand. Six species are endemic to New Zealand. Two species are endemic to Tasmania; two to Western Australia; two to eastern Australia and two are distributed throughout Australia.

Moranila: *M. californica* is cosmopolitan. *M. comperei* is distributed throughout Australia and has recently been collected in New Zealand. *M. viridivertex* is distributed throughout Australia. Eight species are eastern Australian (but are represented very poorly in the material I have examined, so may be more widely distributed). One species is from mainland Australia, one from Tasmania. Two species are endemic to New Zealand.

The genus *Ophelosia* has been recorded from North America (introduced, see Section 7.5), India, Papua New Guinea, Java, Australia, the Chathams and New Zealand. No doubt it occurs throughout Asia but has not been collected. *Ophelosia*

crawfordi occurs in North America; as well as in Java, east Australia, and New Zealand. *O. bifasciata* is distributed throughout mainland Australia, New Zealand and Papua New Guinea; and *O. keatsi* occurs in Australia, New Zealand and the Chathams. One species is found throughout Australia; two in eastern Australia; one in eastern Australia including Tasmania and one in eastern Australia and New Zealand. One species is restricted to Western Australia, and one to Tasmania. Two species are restricted to mainland Australia. Two species appear to be endemic to Papua New Guinea but are only represented by one specimen in each case. Two brachypterous and one narrow-winged species are endemic to New Zealand. One species has only been collected in India.

Amoturella saintpierrei has been recorded only from Tasmania; *A. brindabellensis* and *Kneva plana* have only been collected in the Australian Capital Territory. *Tomicobiella subcyanea* is recorded from Queensland; *T. giraulti* from Queensland, New South Wales and Tasmania; *T. arsenei* from Tasmania and *T. philiporum* from New South Wales and Tasmania. *Ismaya brevis* is from Papua New Guinea and *I. naumanni* from Queensland. *Hirtonila dispar* has only been collected in Queensland. *Eunotomyiia corvus* is endemic to Tasmania and *E. jamesii* to Western Australia. *Tomicobomorpha subplana* has only been collected from Papua New Guinea, and *T. stellata* from Queensland. *Globonila parva* is recorded from Queensland and South Australia. *Australeunotus ruskini* has been collected from every state in Australia except the Northern Territory, and also from Tasmania.

In summary, no member of the Moranilini has been recorded outside the Australasian or Oriental regions, with the exceptions of *Moranila californica* and *Ophelosia crawfordi*, which are almost certainly introduced outside their native areas (Section 7.5).

7.4 Host relationships

The following sections summarize the available host records for the subfamily Eunotinae. More detailed information can be found in the "Biology" section under the taxonomic treatment of each species. Generally, host records should be approached with a certain amount of caution, but all published records and information from labels are used here (with exceptions discussed under "Biology").

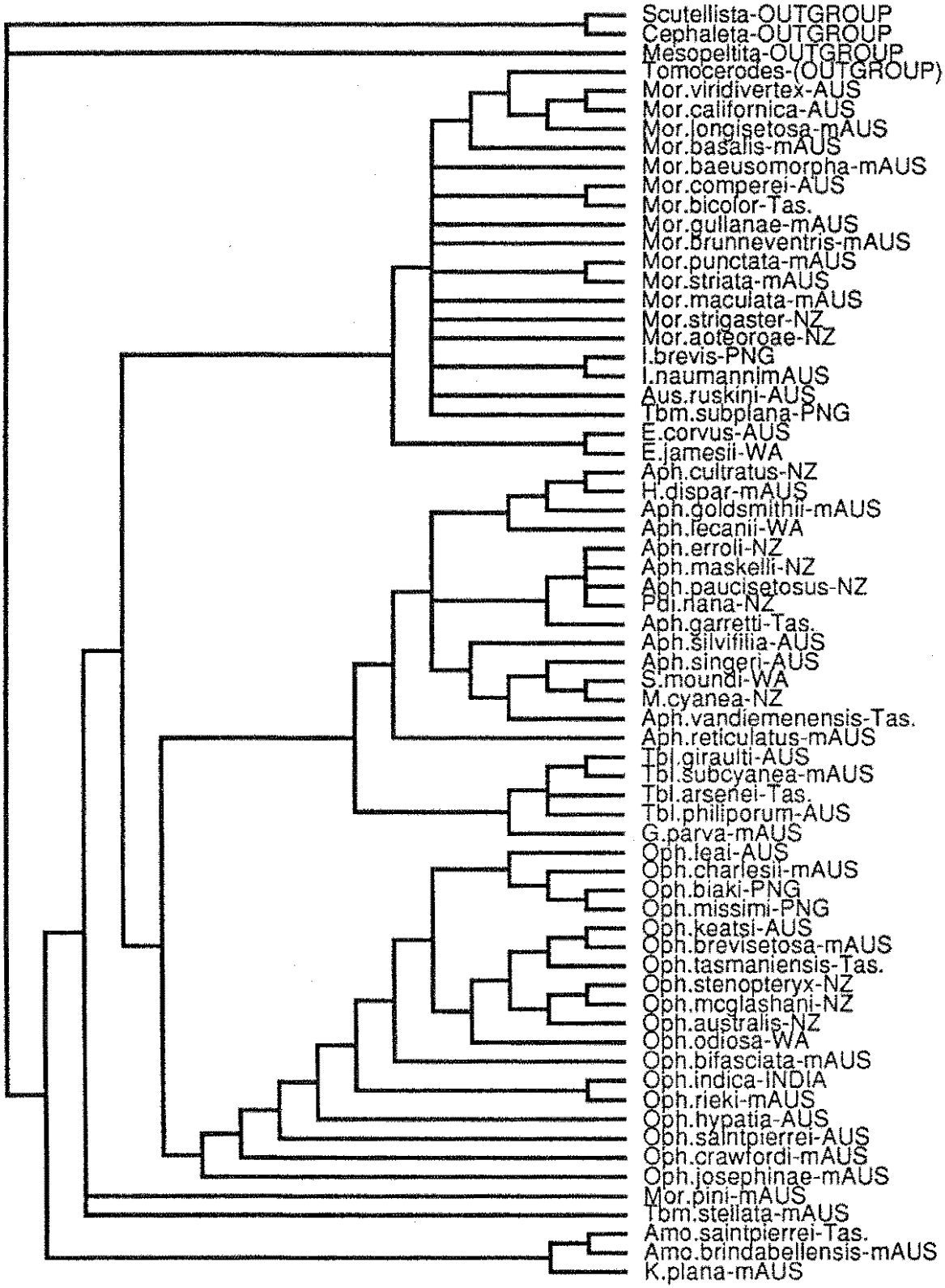

Fig. 7.1 Area cladogram. Mor = *Moranila*; I = *Ismaya*; Aus = *Australeunotus*; Tbm = *Tomicobomorpha*; E = *Eunotomyiia*; Aph = *Aphobetus*; H = *Hirtonila*; Pdi = *Pidinka*; S = *Strionila*; M = *Modronila*; Tbl = *Tomicobiella*; G = *Globonila*; Oph = *Ophelosia*; Amo = *Amoturella*; K = *Kneva*. AUS = Australia; mAUS = mainland Australia (excluding Tasmania); PNG = Papua New Guinea; Tas. = Tasmania; NZ = New Zealand.

7.4.1 Host relationships of the outgroup

Cephaleta: parasites of coccoids, particularly the genera *Asterolecanium* (Asterolecaniidae), *Cerococcus* Comstock (Coccidae), *Ceroplastes* Gray (Coccidae), *Chloropulvinaria* Borchsenius (Coccidae), *Ferrisia* Fullaway (Pseudococcidae), etc.

Mesopeltita: Parasitoids of coccids e.g. *Saissetia* Deplanche (Coccidae) spp. (Bouček, 1988a).

Scutellista: egg predators of coccoids, especially *Saissetia*, *Ceroplastes*, *Coccus* L. (Coccidae) and *Planococcus* Ferris (Pseudococcidae) (Smith and Compere, 1928).

Tomocerodes: reared from *Lecanodiaspis prosopidis* (Maskell) (Lecanodiaspididae).

The Eunotini and Tomocerodini are parasitoids and egg predators of Coccoidea.

7.4.2 Host relationships of the Moranilini

Only five genera have host information available. In general there is much more known about the biology of New Zealand species that of Australian species.

1. *Aphobetus*: *Aphobetus* species are parasitoids or hyperparasitoids of Coccoidea or Aphididae. In cases where there are a number of rearing records they show little host specificity. There are only two host records for Australian species (*A. lecanii* and *A. singeri*):

- *A. lecanii* has been recorded from *Parthenolecanium (=Lecanium) persicae* (Fab.) (Coccidae), which has a cosmopolitan distribution.
- *A. singeri* has been reared from an unidentified species of *Eriococcus* Targioni-Tozzetti (Eriococcidae). The genus *Eriococcus* is distributed throughout the world.

The following host relationships have been recorded for the New Zealand species of *Aphobetus*:

- *A. maskelli* has been reared from *Nipaecoccus aurilanatus*; a species of *Leucaspis* de Boer, (Diaspididae); *Ctenochiton viridis* Maskell (Coccidae) and *Inglisia leptospermi* Maskell (Coccidae), both endemic New Zealand species (Ben-Dov, 1993); and *Powellia* sp. (Psyllidae).

• *A. paucisetosus* has been reared from a species of *Leucaspis*; and several probably native species of Eriococcidae.

• *A. nana* has been reared from the following coccids: *Ctenochiton viridis*, *C. elaeocarpi* Maskell and *C. perforatus* Maskell, all endemic New Zealand species (Ben-Dov, 1993); *C. piperis* Maskell, found in New Zealand and the Pacific region (Ben-Dov, 1993); from *Pseudococcus longispinus* and from *Leucaspis mixta* de Boer (Diaspididae).

• *A. cyanea* is a primary parasitoid of Eriococcidae. The species has been reared from *Eriococcus* sp. on *Danthonia* (Gramineae), an introduced grass, and *Chinochloa* (Gramineae, a New Zealand native tussock grass); and from *Eriococcus nitidulus* Hoy, endemic to New Zealand (Hoy, 1962) on *Poa caespitosa* (native tussock grass). *A. cyanea* shows an alpine distribution (Map 2), being restricted to habitats in which the native tussocks grow.

2. *Australeunotus*: *Australeunotus ruskini* has been reared only from *Lachnodius eucalypti* (Maskell) (Eriococcidae), an Australian species (Hoy, 1963).

3. *Moranila*: *Moranila* species do not appear to be host-specific. In those species where a number of records are available, a range of families is parasitised.

• *M. californica* has been reared from the following **Coccidae**: *Saissetia oleae* (Olivier), *S. coffeae* (Walker) *(=S. hemisphaerica)*, *Parasaissetia (=Saissetia) nigra* (Nietner), *Ceroplastes sinensis*, *C. rubens* Maskell, *C. rusci* (Linnaeus), *C. ceriferus* (Fabricius) and *Coccus hesperidum* Linnaeus. *Saissetia oleae* is cosmopolitan but is probably of South African origin (Delucchi *et al*, 1976) [according to Morales (1989, p.237), *S. oleae* occurs in both Australia and New Zealand but Ben-Dov (1993) does not list the species as occurring in either country]. *S. coffeae* is a very common tropicopolitan species (Williams and Watson, 1990), introduced to Australia (Williams, 1991) and present in New Zealand according to Ben-Dov, (1993). *Parasaissetia (=Saissetia) nigra* (Nietner) is cosmopolitan, its distribution including Australia, New Zealand and Papua New Guinea (Ben-Dov, 1993). *Ceroplastes sinensis* has a cosmopolitan distribution (including New Zealand and Australia), but

is probably of South American origin (Qin *et al.*, in press). *C. rubens* has a tropicopolitan and temperate distribution (Williams and Watson, 1990), occurring in Australia and parts of the Pacific but not in New Zealand (Ben-Dov, 1993). *C. rusci* has been recorded from temperate regions, (Williams and Watson, 1990), but not from Australia or New Zealand (Ben-Dov, 1993). *C. ceriferus* is recorded from S. E. Asia, Australia, Papua New Guinea, parts of the Pacific, has been introduced into the U.S.A (Williams and Watson, 1990), but is not present in New Zealand according to Ben-Dov (1993). *Coccus hesperidum* is cosmopolitan (Williams and Watson, 1990), and was introduced into Australia (Williams, 1991) and New Zealand (Ben-Dov, 1993). *M. californica* has also been reared from *Asterolecanium pustulans* (Cockerell) (Asterolecaniidae) a common species found throughout the tropics and sometimes occurring in tropical areas (Williams and Watson, 1990), but not found in Australia or New Zealand (Commonwealth Institute of Entomology, 1984). The only record of *M. californica* from a pseudococcid is from *Chaetococcus (=Antonina) bambusae* (Maskell), found in Australia (Williams, 1985), but not present in New Zealand (Cox, 1987).

- *M. comperei* has been reared from *S. oleae*; as a primary parasitoid of *Nipaecoccus aurilanatus*; as a hyperparasitoid of Aphididae through Braconidae; is a probable hyperparasitoid of Aleyrodidae through Mymaridae and has been reared in unknown circumstances from Psyllidae.

- *M. gullanae* has been reared from an unidentified eriococcid, probably *Eriococcus* (P. J. Gullan, pers. comm.).

- *M. viridivertex* has been reared from *Eriococcus* sp. (P. J. Gullan, pers. comm.).

4. *Ophelosia*: The genus *Ophelosia* has only been reared from margarodids and pseudococcids (excepting occasional records of hyperparasitism). Some species are very host specific, others have wide host ranges within the Pseudococcidae. There are no reliable host records for the endemic New Zealand species, nor for the endemic Papua New Guinea species. The Australian species fall into two groups: margarodid egg predators and the species which exploit pseudococcids.

i) Margarodid egg predators: The genus *Icerya* Signoret (Margarodidae) is Neotropical, Australian, Oriental and African.

• *O. hypatia*, endemic to Australia, is host-specific and has been recorded only from *Icerya purchasi* Maskell, which is cosmopolitan, but is thought to have originated in Australia (Williams and Watson, 1990).

• *O. crawfordi* has been recorded from *I. purchasi* and also from *I. seychellarum* (Westwood) which is present in Australia and has been intercepted in New Zealand but has not established (Morales, 1991). *O. crawfordi* has spread to other parts of the world with the movement of its hosts.

ii) Pseudococcid exploiters (parasitoids, egg predators, or, where not explicitly stated, unknown):

• *O. bifasciata* has been reared from: *Pseudococcus calceolariae* Maskell (Pseudococcidae), which is found in both Australia and New Zealand but which is of Australian origin according to Cox (1987) and Williams (1985); *Pseudococcus longispinus* (Targioni-Tozzetti), which is cosmopolitan, but Williams (1985) presents evidence that it is Australian in origin. [*P. longispinus* was first recorded in New Zealand in 1890 (Cox, 1987)]; *Planococcus citri* (Risso) (Pseudococcidae), which Williams (1985) also considers to be Australian in origin, but which is also found in the Pacific (Williams, 1985) but not in New Zealand (Cox 1987); *Pseudoripersia turgipes* (Maskell) (Pseudococcidae), Australian (Williams, 1985), not found in New Zealand (Cox, 1987); *Nipaecoccus aurilanatus* (Maskell) (Pseudococcidae), introduced to New Zealand from Australia, and is also present in the U.S.A. (Cox, 1987).

• *O. charlesii* is almost exclusively a predator of pseudococcid ovisacs. The recorded host species are: *Paraferrisia podocarpi* (Brittin) (Pseudococcidae), endemic to New Zealand (Cox, 1987); *Pseudococcus affinis* (Maskell), found in Australia and New Zealand but North American in origin according to Cox (1987), though Williams (1985, p.9) considers it to be Australian; *Phenacoccus graminicola* Leonardi (Pseudococcidae), also found in New Zealand but North American in origin (Cox, 1987); *P. longispinus* and *P. calceolariae*.

• *Ophelosia indica* has been recorded from an unidentified species of

Nipaecoccus Sulc, and from *Planococcus citri.*

• *Ophelosia keatsi* has been reared from *Pseudococcus longispinus, P. affinis* and *Phenacoccus graminicola.*

5. *Tomicobomorpha*: *T. subplana* has been reared from *Coccus (=Lecanium)* on *Gliricidia maculata* (Leguminosae). The genus *Coccus* is worldwide, but most species are tropical.

7.5 Endemic areas of the Moranilini

In this section I will discuss each of the three large genera in turn and attempt to assign endemism to their members on the basis of the available evidence - cladistic, biogeographic and information from host relationships. Clearly, the inferences drawn from distribution and host records rely on the accuracy of the records; equally, inferences drawn from cladistic analyses assume that the sister group relations are justified. This assumption made, Qin *et al* (in press) consider that when a widely distributed species occurs in a clade of reasonable size (about four species), in which all other members are restricted to a single geographic region, an assertion of endemism can be confidently made for the species in question.

1. *Aphobetus*: Species of the genus *Aphobetus* occur in both Australia and New Zealand, but no species are found in both countries. The New Zealand species have been reared from both endemic New Zealand coccoids and from coccoids introduced from Australia. Four of these endemic New Zealand *Aphobetus* species, *A. erroli, A. maskelli, A. paucisetosus* and *A. nana,* form an unresolved clade in the consensus tree (Fig. 6.1), being more closely related to each other than any other species. *A. cultratus* appears to be most closely related to *Hirtonila dispar,* an endemic Australian genus which, due to shortcomings of the data set, falls within the *Aphobetus*-group. Likewise, *A. cyanea,* a derived member of the group, appears to be most closely related to *A. moundi,* a derived endemic West-Australian species. *A. reticulatus* is the sister-species to the rest of the group, according to the analysis.

The Tasmanian species *A. garretti* and *A. vandiemenensis* do not fall together on the cladogram, however it is likely that one or both these species shows a

distribution that is a remnant of an earlier eastern Australian distribution.

2. *Moranila*: Two species of *Moranila* are endemic to New Zealand, 11 species are endemic to Australia and two species, *M. californica* and *M. comperei*, have wider distributions.

• *Moranila californica* has the widest distribution of any member of the tribe, having been collected from all biogeographic regions. It also has the widest host range recorded for the tribe, having been recorded occasionally as a hyperparasitoid or egg predator, but most commonly as a primary parasitoid of Asterolecaniidae, Pseudococcidae and Coccidae, particularly *Saissetia* and *Ceroplastes*. Many of the hosts are also cosmopolitan in distribution and cannot be used to help determine the origin of *M. californica*. In the cladistic analysis, the *Moranila* group was largely unresolved, but *M. californica* formed a clade with two Australian species, *Moranila viridivertex* and *M. longisetosa*. This indicates an Australian origin for *M. californica*, with its propensity for host switching allowing a wide distribution.

• *Moranila comperei* is recorded from Australia and from New Zealand. Its hosts include one Australian species, no endemic New Zealand species, and the cladistic analysis indicates that it is most closely related to an Australian species, *M. bicolor*.

3. *Ophelosia*: Eight species in this genus, *O. leai, O. hypatia, O. rieki, O. saintpierrei, O. odiosus, O. josephinae, O. tasmaniensis* and *O. brevisetosus*, are endemic to Australia. Three species are endemic to New Zealand and these form a clade in the consensus tree. The two endemic Papua New Guinea species also form a clade, the sister to *O. charlesii*.

• *O. bifasciata* is recorded from Papua New Guinea, mainland Australia, and the North Island of New Zealand. The only hosts recorded for *O. bifasciata* are Australian (Section 7.4.2). Although this species is commonly collected in New Zealand, the earliest date of collection is 1966. The distribution map (Map 12) shows that *O. bifasciata* has been collected from the major citrus growing regions in the North Island. Its host mealybugs are pests of citrus. I have concluded from the above

evidence that *O. bifasciata* is Australian in origin, and has been introduced into New Zealand along with its hosts.

• *O. crawfordi* is distributed through the Australasian region and is also found in North America. It is host specific, having been reared only from *Icerya purchasi* and *I. seychellarum*, which argues for an Australian origin. No other species of this genus have been recorded from outside the Australasian or Oriental regions, and it seems clear that *O. crawfordi* is an Australian species which has established in North America as a result of the movement of one of its hosts, *I. purchasi*.

• *O. keatsi* is only recorded from Australian hosts, with the possible exception of *P. affinis*, which may be North American (Section 7.4.2). *O. keatsi* is most closely related to two brachypterous Australian species, according to the cladistic analysis (Fig. 6.1). The available evidence points to *O. keatsi* being of Australian origin.

• *O. charlesii*: unlike the above species of *Ophelosia*, the hosts of *O. charlesii* are not indicative of its origin. Two of its hosts, *P. longispinus* and *P. calceolariae* are Australian, two hosts, *P. affinis* and *Phenacoccus graminicola* are possibly North American and possibly Australian, and one species is endemic to New Zealand. Evidence from the cladistic analysis indicates that *O. charlesii* is most closely related to the Australian species *O. leai*. According to Qin *et al.* (above), this is fairly slender evidence for an assertion that *O.charlesii* is Australian in origin, but it is certainly the most probable explanation of its origin.

The conclusion of the above argument is that all species of *Ophelosia* with distributions common to New Zealand and Australian are originally Australian and have been accidentally introduced into New Zealand.

7.6 Levels of endemism

At the generic level and higher, discussions of endemism are obviously intimately related to systematic concepts. According to Bouček (1988a), the tribe Moranilini is composed of 16 genera; the results of the present analysis of the tribe indicate that three of Bouček's genera are derived species of the larger genus *Aphobetus*, and that the tribe is made up of 13 genera. Of the three Bouček genera synonymised in this work, two are endemic to New Zealand and one to Western

Australia; thus a different system of classification will affect calculations of endemism at the generic level. Other taxonomic changes will also affect generic levels of endemism, for example the genus *Ismaya* was monotypic prior to this study; the sole species was collected from Papua New Guinea. The discovery of a further species of *Ismaya* occurring in Queensland reduces the percentage of genera of Moranilini endemic to Papua New Guinea to zero.

Although the Eunotinae are worldwide in distribution, the largest and most speciose tribe is exclusively southern; all members of the Moranilini are endemic to the Australasian or Oriental biogeographic areas. Within parts of these regions, the levels of endemism of Moranilini are high. According to the present study, 8 of 13 genera (over 60%) of the Moranilini are endemic to Australia. New Zealand and Papua New Guinea however have no endemic genera. In Bouček's 1988 revision, 540 genera of Chalcidoidea were recorded from the Australasian region. Of these, 167 (31%) are endemic to Australia; 14 (2.6%) are endemic to New Zealand and 19 (3.5%) are endemic to Papua New Guinea and the Solomons. Thus, the Moranilini show a much higher level of endemism to Australia at the generic level than do most chalcidoids, but the levels of endemism to New Zealand and Papua New Guinea are almost as low as those for the superfamily.

Table 7.1 shows the levels of endemism at the species level for Moranilini in the various areas of the Australasian region. The highest level of endemism is found in Australia including Tasmania (87%). The levels of endemism for mainland Australia and Tasmania, 62% and 37% respectively, are significantly lower. This indicates that for these organisms, mainland Australia + Tasmania is a biogeographic unit. The lowest level of endemism is found in Western Australia (31%). This is unusual, as Western Australia is generally considered an area of high endemism. The level of endemism for New Zealand (65%) is considerably lower than that for Australia.

Area	No. species recorded	No. of endemic species	% endemism
Mainland Australia +Tasmania	47	41	87
Mainland Australia	40	25	62
Western Australia	15	4	31
Tasmania	19	7	37
Papua New Guinea	6	4	66
New Zealand	17	11	65

Table 7.1: LEVELS OF ENDEMISM OF MORANILINI IN SELECTED BIOGEOGRAPHIC AREAS

7.7 Zoogeographic relationships

The Moranilini is a monophyletic group with an Australasian, predominantly Australian distribution. Eighty-seven per cent of moraniline species and 75% of the genera (61% excluding Papua New Guinea, which will be discussed below) are found nowhere but in Australia. Only two species in the tribe are known to be found outside the Australian or Oriental regions; these distributions are almost certainly secondary. There is no record of the presence of the Moranilini in South America, but as the fauna is poorly documented this does not preclude the possibility that the tribe occurs there. The only area apart from Australia with a significant number of species recorded is New Zealand, which has no endemic genera, but at the species level endemism is reasonably high (65%).

The common ancestor of the Moranilini probably originated in the Australian area, considering i) the high level of generic endemism shown by the group, ii) almost all the necessary criteria proposed by the dispersal theory of biogeography for a centre of origin (Section 7.2) are met by Australia, and iii) the taxa indicated by the phylogenetic analysis to be basal to the tribe (*Kneva plana*, *Amoturella saintpierrei* and *A. brindabellensis*) are all Australian (see Fig. 7.1). Bouček (1988a, p.21) suggested that their radiation in Australasia is because "Australasia, especially Australia, has a rich coccoid fauna (e.g. mealybugs; Williams, 1985) ", and the eunotines, being natural enemies of the Coccoidea have correspondingly diversified.

The history of the tribe is linked with the geological history of the Australasian region, which is summarised below.

It is generally accepted that Australia and New Zealand were once a part of Gondwana, joined directly to Antarctica and indirectly to South America, Africa, India and Madagascar. At the beginning of the Cretaceous, 140mya, the southern continent began to break up. By the middle Lower Cretaceous (120mya), India, Madagascar and Africa had begun to separate. At this time New Zealand began to separate from Australia, Antarctica and South America. The creation of the Tasman Sea was a late Cretaceous event [80mya (Fleming, 1975); 78-56mya (Coleman, 1980); 80-70mya (Walley and Ross, 1991)]. The precise timing of the loss of land connections between Australia and New Zealand is uncertain, but 80mya is generally accepted for new sea floor creation and complete continental separation. Australia remained adjacent to Antarctica until 55mya, and until this time an archipelagic connection probably remained between Australia and South America. The first chalcidoids were found in the fossil record in the late Cretaceous (80 mya) according to Rasnitsyn (1988), but Poinar (1992) reports chalcidoid wasp inclusions in Lebanese amber, 120-130mya, indicating that the superfamily is at least 120my old, and probably older, since there are no amber deposits older than 130mya, and chalcidoids fossilise extremely poorly. Bouček (1988a, p22) states that the oldest resins containing pteromalids are 60my old (Tertiary), and that among the chalcidoids, only the pteromalids contain groups old enough to have been in existence at the time Gondwana split up, (assuming that he is excluding the separation of India (140-100mya, Coleman, 1980) and New Zealand (80mya)). Thus

Bouček reasons that the only chalcidoid group old enough to have Gondwanic affinities (Australia-South America) are the pteromalids. However Poinar (1992) reports that the oldest pteromalids that have been found are in Siberian amber and thus have a minimum age of 78-115my. Using Poinar's 1992 figures as the most recent estimates of the minimum age of the Pteromalidae, the family was probably extant at the time New Zealand began to separate from Gondwana, and almost certainly, as Bouček suggests, present as a family when South America, Antarctica and Australia diverged. The discovery of endemic moraniline genera in South America would suggest a minimum age for the tribe of about 55my old. For vicariance to be an explanation for the presence of Moranilini in New Zealand, the minimum age of the tribe would need to be 80my. According to the vicariance theory (Section 7.2), the barrier which divides an ancestral population into incipient species is contemporaneous with the species, thus this explanation would require some of the ancestral species of modern day New Zealand moranilines to be present at the time land connections to Australia were lost, which, considering that the tribe may not have even been in existence at that time, is not likely. Had these species been present however, their vicariance, effected by the opening of the Tasman Sea, should have produced a congruent pattern of speciation, whose geographical relationships were identical. No such pattern is observable in the New Zealand moranilines (Fig. 7.1). An explanation which fits the pattern of distribution much better is the occurrence of five dispersal events:

i) within *Moranila*, the ancestor of the two endemic New Zealand species *M. strigaster* and *M. aotearoae* (while relationships within the genus *Moranila* remain unresolved (Fig. 7.1), the most parsimonious explanation is that one dispersal event took place).

ii) *Aphobetus cultratus*, or its ancestor, due to the sister relationship with *A. goldsmithii*.

iii) the ancestor of the clade containing the endemic New Zealand *Aphobetus* species *A. erroli, A. maskelli, A. paucisetosus* and *A. nana*, sister group to *A. garretti*.

iv) *M. cyanea* or its ancestor, due to the sister relationship with *S. moundi*.

v) the ancestor of the clade containing the endemic New Zealand *Ophelosia*

species *O. stenopteryx, O. mcglashani* and *O. australis.*

7.7.1 Papua New Guinea

Three moraniline genera, *Ismaya, Ophelosia* and *Tomicobomorpha* are shared between Australia and Papua New Guinea (c.f. one between Australia and New Zealand). There are no known moraniline genera endemic to Papua New Guinea; but endemism at the specific level is relatively high, four of the six species recorded are endemic. However the fauna is very poorly known, and the endemic species have been rarely collected. *Ophelosia biaki* and *O. missimi* form a clade and a possible explanation for their relationship is one dispersal event from mainland Australia, and *in situ* speciation from their common ancestor. The remaining endemic species, *Tomicobomorpha subplana* and *Ismaya brevis* fall into the unresolved *Moranila*-group (Section 6.9.5), and there is likewise no evidence from their host relationships to enable conclusions to be drawn regarding their biogeographical history.

7.8 Special features of the New Zealand chalcidoid fauna

According to Bouček (1988a) the New Zealand fauna of chalcidoids is much poorer than in other parts of Australasia; he cites only 14 New Zealand chalcidoid genera as being endemic (about 8%, using Noyes and Valentine's (1989b) estimate of the number of chalcidoid genera in New Zealand), and several other genera as being shared between Australia and New Zealand, but with different species in each country. Conversely, Noyes and Valentine (1989b) consider that the New Zealand chalcidoid fauna shows a high level of endemism, listing 43 genera endemic to New Zealand, which they estimate to be 25% of the total chalcidoid fauna. They estimate endemism at the species level to be up to 50%. The reason for this discrepancy is that the majority of endemic forms occur within the families Mymaridae, Encyrtidae and Eulophidae; and the first two families were not covered by Bouček's (1988a) opus. Among other groups of Hymenoptera, Naumann (1988) found that five out of seven (71%) of the genera and all of the species of Ambositrinae (Proctotrupoidea) occurring in New Zealand were endemic. The Proctotrupoidea are an older group than the chalcidoids, which may explain the very high levels of endemism found in New Zealand at the generic level.

There are several ancestral elements in the New Zealand chalcidoid fauna, for example the family Rotoitidae and the pteromalid genera *Zeala, Fusiterga* and *Errolia*, but the remaining 10 endemic chalcidoid genera listed by Bouček (1988a) are closely related to Australian forms. Bouček (1988a) considers that the latter genera are probably descendants of forms which arrived at various times from Australia, carried by the wind. This explanation certainly fits the patterns of distribution shown by the Moranilini (Section 7.7), with no endemic genera and only three genera which share species in both regions. Bouček (1988a) suggested that the progeny of the new arrivals speciated extensively in new habitats, and to judge by the wide variation in some New Zealand species, the process is still going on. The New Zealand species *Aphobetus maskelli* shows the highest level of intraspecific variation among the tribe (Section 3.3.1).

Noyes (1988) found 44% of the species of Encyrtidae recorded from New Zealand to be endemic. Within New Zealand, 60% of endemic encyrtids are found on both the North and South Islands; 25% are found only in the South Island and 15% found only in the North Island. For the Moranilini, the figures are as follows: 55% of endemic species are found on both islands; 45% are found only in the South Island; and none are found only on the North Island. This may reflect the different geological histories of the North and the South Islands. In the Oligocene (35-25mya) most of the present land area of New Zealand was under water (McGlone, 1985). In the late Miocene-early Pliocene (5mya), extensive mountain-building occurred, and New Zealand gained a significant alpine and sub-alpine habitat. In the Southern Alps, these habitats acted as centres of speciation for alpine flora, perhaps by plants derived by long distance dispersal from Australia (Raven, 1973). At the end of the Pliocene, a glaciation bisected New Zealand north of Cook Strait, leaving the South Island with a predominantly alpine environment, and the North Island with mainly temperate forest. Since that time, there have been approximately 20 glaciations, along with marked changes of sea level. At the time of the final glaciation, the sea level fell by about 200m, creating one continuous landmass with a predominantly alpine/subalpine vegetation and small amounts of temperate forest. At the end of this glaciation the sea level rose again and New Zealand took its present form. Thus at times of rises in sea level, mountain refugia were created and the biota were reduced

to alpine and subalpine forms, which recolonised the lowlands when the sea level dropped again. The North Island had fewer alpine areas and thus fewer refugia during times of sea level rises, and extinctions during these times may account for the presence of fewer endemic taxa in the North Island.

7.8.1. Wing reduction

The New Zealand hymenopteran fauna appears to contain a high proportion of flightless species, or species which have some flightless members. Noyes and Valentine (1989a) noted that amongst New Zealand Mymaridae 40% of the genera include species with abbreviated wings. Naumann (1988) noted wing reduction in 89% of species of New Zealand Ambositrinae, as compared to 66% of Australian species. Amongst the Moranilini, levels of wing reduction are lower than in the mymarids and ambositrines. Only 11% of all species occurring in New Zealand show some degree of wing reduction, but levels for Australian and New Zealand species were markedly different: 36% of the endemic New Zealand species exhibited wing reduction, as opposed to 7% of the endemic Australian species.

Brachyptery or aptery is often associated with alpine habitats (Mani, 1968). Noyes and Valentine (1989a) speculated that in dense habitats such as leaf litter and alpine tussock grasses, flight is not advantageous, and wings may be an encumbrance to searching for hosts. Recolonisation of the lowlands by taxa isolated in mountain refugia (Section 7.8) and subject to such selective pressures may explain the high percentage of aptery and brachyptery in the New Zealand fauna.

7.9 Biological Control

7.9.1 Biological control and systematics

One of the most important threats to agriculture worldwide is the introduction of exotic pests (DeBach and Rosen, 1991). With the growth of international trade and rapid transport systems, the possibility of introducing new pests is greatly increased. Such organisms are rarely pests in their endemic area because they are controlled by co-evolved natural enemies. Once they move out of their natural range without these enemies, population numbers may increase to the point at which they are serious economic pests. Transporting the natural enemies of such pests into new areas to help

control spread of the pests is the basis of biological control, which is defined as "the reduction of pest populations by means of living organisms (parasitoids, predators and pathogens), encouraged and disseminated by man" (Pfadt, 1978).

The most efficient natural enemies (and certainly the only ones which would be considered for introduction into most developed countries for biological control) are monophagous or narrowly oligophagous. Correct taxonomy is vitally important, since misidentification of the pest in the native habitat, where closely related species are likely to be present, may lead to the introduction of the wrong natural enemies. Delucchi *et al* (1976) present numerous examples. The correct identification of a pest species can help direct biocontrol workers to the area of origin of the pest. Since many pests were introduced into new areas by agricultural activities long before they were known to science, the places of origin of these organisms are often uncertain or unknown, and difficult to determine. However, knowledge of the native area of a pest is very important in biological control since it is here that the most effective natural enemies can be sought. Attempts to use biological control to reduce populations of cosmopolitan pests may be ineffective until the area of origin of the pest is determined. A cladistic analysis of *Ceroplastes sinensis*, the Chinese wax scale, by Qin *et al* (in press) indicates that this pest probably originated in South America, and that the search for effective natural enemies could more economically be directed in that part of the world.

7.9.2 Biological control of mealybugs in New Zealand

Most of the mealybugs (Coccoidea: Pseudococcidae) known from New Zealand are indigenous, but the major pests are introduced species of the genus *Pseudococcus* Westwood (Charles, 1989). Three species, *P. affinis*, *P. calceolariae* and *P. longispinus* are pests of a wide variety of horticultural crops and ornamentals. All three species are probably Australian (there is some disagreement about the origin of *P. affinis*; according to Cox (1987) it is almost certainly a North American species, while Williams (1985) considers it to be Australian in origin). These mealybugs are not an economic problem in Australia unless the natural enemies presumed to be controlling their populations are disrupted by pesticides (J. G. Charles, pers. comm.; Williams, 1985). Thus Australia is a logical place to search for

organisms for introduction into New Zealand as biological control agents. In order for a biological control programme to be carried out most effectively, it is necessary to know both i) the identities of the natural enemies in the pest's endemic area and ii) whether any or all of these natural enemies are already present in the area where the organism is a pest.

The genus *Ophelosia* in Australia was known to contain species which preyed on pseudococcid eggs (Wilson, 1963) and which would be possible candidates for mealybug biocontrol in New Zealand. However the host relationships and taxonomy of the genus were not well known in Australia, and although *Ophelosia* was known to be present in New Zealand (Valentine, 1967), the identity and number of species present were unknown. The most recent catalogue (Valentine and Walker, 1991) recorded only five species of Eunotinae from New Zealand (*Aphobetus maskelli, Modronila cyanea, Moranila californica, Moranila comperei* and *Pidinka nana*), and one of these records (*Moranila comperei*) was based on a misidentification.

This revision records 17 eunotine species from New Zealand, among which are seven species of *Ophelosia,* three endemic and four Australian in origin. None of the endemic New Zealand species of *Ophelosia* have reliable host records, nor are they likely to be effective against members of the genus *Pseudococcus*, since their distributions (*O. australis*, Map 11; *O. mcglashani*, Map 16; *O. stenopteryx*, Map 17) are typical of species with endemic hosts. The Australian species present in New Zealand are: *Ophelosia bifasciata, O. charlesii, O. crawfordi* and *O. keatsi*. Charles (1993) recorded *Ophelosia* sp. A and sp. B from mealybugs in New Zealand. This material was examined as part of the present study; sp. A was found to be *O. bifasciata* and sp. B to be *O. charlesii*.

This study recorded the following Australian species of *Ophelosia* as natural enemies of the three important New Zealand pest species of *Pseudococcus*:

Pseudococcus affinis:	*Ophelosia charlesii, O. keatsi*
Pseudococcus calceolariae:	*Ophelosia bifasciata, O. charlesii*
Pseudococcus longispinus:	*Ophelosia bifasciata, O. charlesii, O. keatsi*

O. bifasciata was recorded as a solitary parasitoid of *P. longispinus* and *P. calceolariae*, in one instance as a hyperparasitoid of *Anagyrus fusciventris* (Encyrtidae) in *P. longispinus*, and also as a predator of *P. calceolariae* ovisacs. *O.*

charlesii was recorded as a solitary parasitoid of *P. longispinus* and *P. calceolariae* and, most commonly, as a gregarious egg predator in ovisacs of *P. calceolariae* and *P. affinis*. *O. keatsi* was reared from *P. longispinus* and from *P. affinis*, but the specific feeding habits are unknown. All of these species of *Ophelosia* are already present in New Zealand, almost certainly having been introduced along with their hosts on plant material. *Aphobetus nana*, endemic to New Zealand, has also been reared from *Pseudococcus longispinus*.

Smith and Compere (1931) reported that live *O. crawfordi* specimens, which were collected by Flanders in Australia from *Planococcus citri* ovisacs and from the mummies of an unidentified species of *Pseudococcus* (presumably as a hyperparasitoid), were sent to California, where they were reared on the ovisacs of unidentified mealybugs. The reared specimens were not released. Wilson (1963) identified *Ophelosia crawfordi* as a common natural enemy of *P. longispinus* (as *P. adonidum* L.) in Australia. Charles (1989) mentioned this latter reference and recommended the description and characterisation of the New Zealand species of *Ophelosia*, and their comparison to *O. crawfordi* as a mealybug parasitoid. In fact, *O. crawfordi* is neither common, nor has it been reliably recorded as an enemy of any pseudococcid; so it is likely that both these records are based on misidentifications. *O. crawfordi* has been recorded from New Zealand only once, so it is dubious whether it has established here. In any case, the results of this study show that it is specific to *Icerya*, and since this genus is already under good biological control in New Zealand (Morales and Bain, 1989), there is no necessity for further introductions of natural enemies.

Other pest or possible pest coccoid species which have natural enemies within the Moranilini are discussed below:

- *Phenacoccus graminicola* is a grass-feeding mealybug species which is an occasional pest of fruit trees in New Zealand. *O. charlesii* has been reared from the ovisacs of this species, and *O. keatsi* has been reared, presumably as a primary parasitoid.

- *Planococcus citri* is an important pest of citrus overseas and is frequently intercepted in New Zealand but is not an established pest. *O. bifasciata* and *O. indica*

have been recorded as natural enemies of this pest.

• *Icerya purchasi* is not a problem in New Zealand, being under good control since the introduction of *Rodolia cardinalis* (Mulsant) (Coleoptera: Coccinellidae) and *Cryptochetum iceryae* (Williston) (Diptera: Cryptochetidae), both Australian natural enemies (Morales and Bain, 1989). Should these natural enemies prove to be ineffective in the future, *Ophelosia hypatia* and *Ophelosia crawfordi* would be ideal candidates for importation.

• Black scale, *Saissetia oleae* (Olivier) is a minor pest in New Zealand (Morales, 1989). *Moranila californica* has been recorded as a parasitoid of black scale, but *Scutellista cyanea* is much more common. This species has been introduced to New Zealand several times but has failed to establish.

7.9.3 Recommendations for Biological Control

All of the species of *Ophelosia* known to be natural enemies of pest mealybugs in New Zealand are well established, therefore further introductions are unnecessary, unless different strains which are more vigorous, or have slightly different host ranges, are present in Australia. Further research would be needed to determine if this is the case.

Ophelosia bifasciata was first recorded in New Zealand in 1966; *O. charlesii* in 1925; and *O. keatsi* in 1963. The single record of *O. bifasciata* as a hyperparasitoid suggests that it may develop as an egg predator in unparasitized mealybug populations but may be a facultative hyperparasitoid of encyrtid primary parasitoids in parasitized populations. Charles (1993) suggests that *O. bifasciata* and *O. charlesii* may be desirable egg predators but undesirable hyperparasitoids, however there is no evidence to show that *O. charlesii* acts as a hyperparasitoid.

The Australian species of *Ophelosia* for which no host records exist are: *O. brevisetosa, O. josephinae, O. leai, O. odiosa, O. rieki, O. saintpierrei* and *O. tasmaniensis.* Any of these species would be worthy of further investigation as candidates for the biological control of *Pseudococcus* in New Zealand, but *O. leai* is of particular interest for two reasons: i) it is commonly collected. This may be either because it has a broad range of hosts, which would make it unsuitable for

introduction as a biological control agent; or alternatively it may be specific to a relatively commonly occurring host, such as *P. longispinus, P. affinis* or *P. calceolariae*, in which case it would be a possible candidate for introduction, and ii) in the consensus cladogram (Fig. 6.1), *O. leai* is most closely related to a clade including *O. charlesii*, which is an egg predator of several species of *Pseudococcus.*

Other Australian natural enemies of *P. longispinus, P. affinis* and *P. calceolariae* include the encyrtids *Tetracnemoidea brevicornis* (Girault), *Parectromoides varipes* (Girault), *Tetracnemoidea sydneyensis* (Timberlake) and *Anagyrus fusciventris* (Girault). All four species are known to be present in New Zealand (Charles, 1993), though *A. fusciventris* has only been collected from the Auckland area and only very recently. Charles (1993) recommends its distribution throughout the rest of New Zealand to facilitate control. *Coccophagus gurneyi* Compere (Aphelinidae) was introduced from Australia to the U.S.A. and from there to New Zealand, where it is now widespread (Charles, 1989). According to Charles (1993), the encyrtids listed above and *C. gurneyi* are the most effective natural enemies of the pest mealybug species *P. longispinus* and *P. calceolariae*, and since they are already present in New Zealand, classical biocontrol programmes against these two mealybugs are not warranted. Since no encyrtids were reared from *P. affinis* in New Zealand, Charles (1993) recommends the evaluation of *Pseudaphycus maculipennis* (Mercet) (Encyrtidae), a Mediterranean species, for introduction against *P. affinis*, on the grounds that it has provided control in the south of France.

7.10 Conclusion

The Moranilini, a derived tribe of the pteromalid subfamily Eunotinae, radiated primarily in Australia. Their hosts are mainly restricted to the Coccoidea, as parasitoids or egg predators, although occasional instances of hyperparasitism outside this superfamily have been recorded. Individual species within the tribe range from specific to one genus or even one species of host, to broadly non-specific within the superfamily and occasionally hyperparasitic outside it. All of the parasitoids within the tribe which are known to exploit the three pest species of *Pseudococcus* in New Zealand are already well established there. Recommendations are made for species of *Ophelosia* worthy of further consideration for biological control introductions.

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Appendix I

Catalogue of the Moranilini (Hymenoptera: Pteromalidae)

1. Genus *Amoturella*

Amoturella Girault, 1913b:110; Bouček, 1988a:367. Type species *Amoturella saintpierrei* Girault; by monotypy.

• ***brindabellensis* sp.n.**

Distribution: Eastern Australia

• ***saintpierrei* Girault**

Amoturella saintpierrei Girault, 1913b:110-111; Dahms, 1986:493-494; Bouček, 1988a:367, Figs 683-7.

Distribution: Tasmania

2. Genus *Aphobetus*

Aphobetus Howard, 1896:166; Ashmead, 1904:328; Bouček, 1988a:363. Type species *Aphobetus maskelli* Howard; by monotypy.

Muscideopsis Girault, 1915a:324. Type species *Muscideopsis goldsmithii* Girault; by original designation. Synonymised by Bouček, 1988a:363.

Austroeunotus Girault, 1938b:84-85. Type species *Austroeunotus silvifilia* Girault; by original designation. Synonymised by Bouček, 1988a:363.

Pidinka Bouček, 1988a:362. Type species *Pidinka nana* Bouček; by original designation. **syn.n.**

Modronila Bouček, 1988a:364. Type species *Modronila cyanea* Bouček; by original designation. **syn.n.**

Strionila Bouček, 1988a:365-366. Type species *Strionila moundi* Bouček; by original designation. **syn.n.**

• ***cultratus* sp.n.**

Distribution: New Zealand

• ***cyanea* (Bouček)**

Modronila cyanea Bouček, 1988a:364, Figs 680-681; Valentine and Walker, 1991:28.

Distribution: New Zealand

• ***erroli* sp.n.**

Distribution: New Zealand

• ***garretti* sp.n.**

Distribution: Tasmania

• ***goldsmithii* (Girault)**

Aphobetus goldsmithii (Girault); Bouček, 1988a:363.

Muscideopsis goldsmithii Girault, 1915a:324; Dahms, 1984:656. Transferred to *Aphobetus* by Bouček, 1988a:363.

Distribution: Eastern Australia

• ***lecanii* (Girault)**

Aphobetus lecanii (Girault); Bouček, 1988a:365.

Muscideopsis lecanii Girault, 1938a:76; Dahms, 1984:752. Transferred to *Aphobetus* by Bouček, 1988a:365.

Distribution: Western Australia

• ***maskelli* Howard**

Aphobetus maskelli Howard 1896:166-167; Ashmead, 1904:328; Valentine, 1967:1127; Bouček, 1988a:363; Valentine and Walker, 1991:28.

Distribution: New Zealand

• ***moundi* Bouček**

Strionila moundi Bouček, 1988a:365, Fig. 682.

Distribution: Western Australia

• ***nana* Bouček**

Pidinka nana Bouček 1988a:362, Figs 672-674; Valentine and Walker, 1991:28.

Distribution: New Zealand

• ***paucisetosus* sp.n.**

Distribution: New Zealand

• ***reticulatus* sp.n.**

Distribution: Eastern Australia

• ***silvifilia* (Girault)**

Aphobetus silvifilia (Girault); Bouček, 1988a:363.

Austroeunotus silvifilia Girault, 1938b:85; Dahms, 1986:539. Transferred to *Aphobetus* by Bouček, 1988a:363.

Distribution: Australia

• ***singeri* sp.n.**

Distribution: Australia

• ***vandiemenensis* sp.n.**

Distribution: Tasmania

3. Genus *Australeunotus*

Australeunotus Girault, 1922:153; Bouček, 1988a:361. Type species *Australeunotus ruskini* Girault; by monotypy.

• ***ruskini* Girault**

Australeunotus ruskini Girault, 1922:154; Dahms, 1986:489; Bouček, 1988a:361, Fig 664.

Distribution: Australia

4. Genus *Australurios*

Australurios Girault, 1926:134-135; Bouček, 1988a:353. Type species *Australurios longispina* Girault; by monotypy.

• ***longispina* Girault**

Australurios longispina Girault, 1926:134-135; Dahms, 1984:773; Bouček, 1988a:353, Figs 651-654.

Distribution: Eastern Australia

5. Genus *Eunotomyiia*

Eunotomyiia Girault, 1922:153; Bouček, 1988a:355. Type species *Eunotomyiia corvus* Girault; by monotypy.

• ***corvus* Girault**

Eunotomyiia corvus Girault, 1922:153; Dahms, 1983:199; Bouček, 1988a:355, Figs 657-659.

Distribution: Australia

• ***jamesii* sp.n.**

Distribution: Western Australia

6. Genus *Globonila*

Globonila Bouček, 1988a:359; Bouček, 1988a:359-360. Type species *Globonila parva* Bouček; by monotypy and original designation.

• ***parva* Bouček**

Globonila parva Bouček, 1988a:359-360, Fig. 669.

Distribution: Mainland Australia

7. Genus *Hirtonila*

Hirtonila Bouček, 1988a:366. Type species *Hirtonila dispar* Bouček; by monotypy and original designation.

- ***dispar* Bouček**

Hirtonila dispar Bouček, 1988a:366, Figs 675-677.

Distribution: Mainland Australia

8. Genus *Ismaya*

Ismaya Bouček, 1988a:358-359. Type species *Ismaya brevis* Bouček; by monotypy and original designation.

- ***brevis* Bouček**

Ismaya brevis Bouček, 1988a:358-359, Figs 667-668.

Distribution: Papua New Guinea

- ***naumanni* sp.n.**

Distribution: Eastern Australia

9. Genus *Kneva*

Kneva Bouček, 1988a:361. Type species *Kneva plana* Bouček; by monotypy and original designation.

- ***plana* Bouček**

Kneva plana Bouček, 1988a:361, Figs 670-671.

Distribution: Eastern Australia

10. Genus *Moranila*

Tomocera Howard, 1881:368; Ashmead, 1904:328. Type species *Tomocera californica* Howard; by monotypy. Preoccupied by *Tomocera* Desmarest, 1858.

Moranila Cameron, 1883:188; Timberlake, 1924:*; Burks, 1958:75; Peck, 1963:631; Graham, 1969:70-71; Burks, 1978:783 (and see references within for biology); Bouček, 1988a:356; Naumann, 1991:965. Type species *Moranila testaceipes* Cameron; by monotypy.

Dilophogaster Howard, 1886:98. Replacement name for *Tomocera* Howard.

Aphobetoideus Ashmead, 1904a:328. Type species *Aphobetoideus comperei* Ashmead; by original designation. Synonymised by Bouček, 1988a:356.

Muscidea Girault, 1915a:323-324. Type species *Muscidea brunneiventris* Girault; by original designation. Synonymised by Bouček, 1988a:356.

Eurycraniella Girault, 1916a:227. Type species *Eurycranium baeusomorpha* Girault; by original designation. Synonymised by Bouček, 1988a:356.

Muscideoidea Girault, 1916a:227. Replacement name for *Muscidea* Girault. Synonymised by Bouček, 1988a:356.

Eunotomyia Masi, 1917:197. Type species *Eunotomyia festiva* Masi; by monotypy. Synonymised by Burks, 1958:75.

• ***aotearoae* sp.n.**

Distribution: New Zealand

• ***baeusomorpha* (Girault)**

Eurycranium baeusomorpha Girault, 1915a:322-323; Dahms, 1983:116. Transferred to *Eurycraniella* by Girault, 1916a:227.

Eurycraniella baeusomorpha Girault, 1916a:227; Dahms, 1983:116; transferred to *Moranila* by Bouček, 1988a:356.

Distribution: Mainland Australia

• ***basalis* sp.n.**

Distribution: Eastern Australia

• ***bicolor* sp.n.**

Distribution: Tasmania

• ***brunneventris* (Girault)**

Muscideoidea brunneiventris Girault, 1916a:227; Dahms, 1983:154-155. Transferred to *Moranila* by Bouček, 1988a:356.

Muscidea brunneiventris Girault, 1915a:324; Dahms, 1983:154-155; Bouček, 1988a:356. Transferred to *Muscideoidea* (by implication) by Girault, 1916a:227.

Distribution: Eastern Australia

• ***californica* (Howard)**

Moranila californica (Howard); Burks, 1958:75; Peck, 1963:631; Valentine, 1967:1128; Graham, 1969:70-71; Burks, 1978:783; Bouček, 1988a:356-357; Valentine and Walker, 1991:28; Morales, 1989:237-239.

Tomocera californica Howard, 1881:368; Smith and Compere, 1928:317-321, Figs 55-57; Bouček, 1988a:356. Preoccupied by Desmarest, 1858. Transferred to *Dilophogaster* by Howard, 1886:98; transferred to *Moranila* by Burks, 1958:75.

Dilophogaster californica (Howard); Howard 1886:98; Bouček, 1988a:356. Replacement name for *Tomocera* Howard. Transferred to *Moranila* by Burks, 1958:75.

Moranila testaceipes Cameron, 1883:188-189; Burks, 1958:75; Burks, 1978:783; Bouček, 1988a:357. Synonymised by Howard, 1896:165.

Tomocera ceroplastis Perkins, 1906:76; Bouček, 1988a:357. Regarded as synonymous with *californica* by Burks, 1978:783.

Tomocera glabiventris Girault, 1915b:207-208; Girault, 1927:334; Dahms, 1984:651; Bouček, 1988a:357. Regarded as synonymous with *californica* by Burks, 1978:783.

Tomocera californica Howard, 1881:368.

Tomocera flaviceps Girault, 1915b:208; Dahms, 1984:603; Bouček, 1988a:357. Regarded as a synonym of *californica* by Burks, 1978:783.

Eunotomyia festiva Masi, 1917:195-197. Synonymised by Bouček, 1988a:357.

Distribution: Cosmopolitan

• ***comperei*** **(Ashmead)**

Aphobetoideus comperei Ashmead, 1904a:328.

Tomocera saissetiae Girault, 1925b:2-3 **syn.n.**

Tomocera transversifasciata Girault, 1925a:91 **syn.n.**

Tomocera io Girault, 1929:319-320 **syn.n.**

Moranila comperei (Ashmead); Bouček, 1988a:357, Figs 662-663; Valentine and Walker, 1991:28.

Aphobetoideus comperei Ashmead, 1904a:328; Smith and Compere, 1928:312-317, Figs 51-54; Gahan and Peck, 1946:314. Transferred to *Moranila* by Bouček, 1988a:357.

Tomocera io Girault, 1929:319-320; Dahms, 1984:728. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Tomocera saissetiae Girault, 1925b:2-3; Dahms, 1986:498. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Tomocera transversifasciata Girault, 1925a:91; Dahms, 1986:592. Transferred to *Moranila* by Bouček, 1988a:357. **syn.n.**

Distribution: Australia, New Zealand

• ***gullanae*** **sp.n.**

Distribution: Eastern Australia

• ***longisetosa*** **sp.n.**

Distribution: Eastern Australia

• ***maculata*** **sp.n.**

Distribution: Eastern Australia

• ***pini*** **(Girault)**

Tomocera pini Girault, 1925b:4; Dahms, 1986:412. Transferred to *Moranila* by Bouček, 1988a:357.

Distribution: Eastern Australia

• ***punctata* sp.n.**

Distribution: Eastern Australia

• ***striata* sp.n.**

Distribution: Eastern Australia

• ***strigaster* sp.n.**

Distribution: New Zealand

• ***viridivertex* (Girault)**

Tomocera viridivertex Girault, 1927:333-334; Dahms, 1986:645. Transferred to *Moranila* by Bouček, 1988a:357.

Distribution: Australia

11. Genus *Ophelosia*

Ophelosia Riley, 1890:249; Ashmead, 1904:328; Valentine, 1967:1129; Bouček, 1988a:353-354; Charles, 1989:226-227; Naumann, 1991:965. Type species *Ophelosia crawfordi* Riley; by monotypy.

Asaphomorphella Girault, 1913b:104-105. Type species *Asaphomorphella rousseaui* Girault; by original designation. Synonymised by Bouček, 1988a:354.

• ***australis* sp.n.**

Distribution: New Zealand

• ***biaki* sp.n.**

Distribution: Papua New Guinea

• ***bifasciata* Girault**

Ophelosia bifasciata Girault, 1916a:228; Dahms, 1983:136-137; Bouček, 1988a:354.
O. viridinotata Girault, 1916a:228; Dahms, 1986:639; Bouček, 1988a:354. **syn.n.**
Asaphomorphella rousseaui Girault, 1913b:104-105; Dahms, 1986:480. Transferred to *Ophelosia* by Bouček, 1988a:354. **syn.n.**
Distribution: Mainland Australia, Papua New Guinea, New Zealand

• ***brevisetosa* sp.n.**

Distribution: Mainland Australia

• ***charlesii* sp.n.**

Distribution: Mainland Australia, New Zealand

• ***crawfordi* Riley**

Ophelosia crawfordi Riley, 1890:249; Girault, 1916a:227; Wilson, 1963:4, 9; Smith and Compere, 1931:1109; Charles, 1989:226-227, 234; Bouček, 1988a:354 (Fig. 650).
Ophelosia sulcata Girault, 1925b:1; Dahms, 1986:571-572; Bouček, 1988a:354. **syn.n.**
Distribution: Mainland Australia, New Zealand, Java

• ***hypatia* Girault**

Ophelosia hypatia, 1916a:227; Dahms, 1984:705; Bouček, 1988a:354.
Ophelosia lucretii Girault, 1921:189; Dahms, 1984:777; Bouček, 1988a:354. **syn.n.**
Distribution: Australia; established in California

• ***indica* Farooqi**

Ophelosia indica Farooqi 1983:185 (Figs 1-6); (miscited in Bouček, 1988a:354).
Distribution: India

• ***josephinae* sp.n.**

Distribution: Mainland Australia

• ***keatsi* Girault**

Ophelosia keatsi Girault, 1927:334; Dahms, 1984:738; Bouček, 1988a:354.

Ophelosia horatii Girault, 1937:(2); Dahms, 1984:695; Bouček, 1988a:354. **syn.n.**

Distribution: Australia, Chatham Islands, New Zealand

• ***leai* Dodd**

Ophelosia leai Dodd, 1924:169.

Ophelosia aligherini Girault, 1927:334. **syn.n.**

Distribution: Australia, Lord Howe Island, Norfolk Island

• ***mcglashani* sp.n.**

Distribution: New Zealand

• ***missimi* sp.n.**

Distribution: Papua New Guinea

• ***odiosa* sp.n.**

Distribution: Western Australia

• ***rieki* sp.n.**

Distribution: Eastern Australia

• ***saintpierrei* Girault**

Ophelosia saintpierrei Girault, 1913a:315; Dahms, 1986:497; Bouček, 1988a:354.

Ophelosia pinguis Girault, 1913a:315; Dahms, 1986:411-412; Bouček, 1988a:354.

syn.n.

Distribution: Australia

• ***stenopteryx* sp.n.**

Distribution: New Zealand

• ***tasmaniensis* sp.n.**

Distribution: Tasmania

12. Genus *Tomicobiella*

Tomicobiella Girault, 1915b:211; Bouček, 1988a:355. Type species *Tomicobiella subcyanea* Girault; by monotypy.

• ***arsenei* sp.n.**

Distribution: Tasmania

• ***giraulti* sp.n.**

Distribution: Eastern Australia including Tasmania

• ***philiporum* sp.n.**

Distribution: Eastern Australia including Tasmania

• ***subcyanea* Girault**

Tomicobiella subcyanea Girault, 1915b:211; Dahms, 1986:567; Bouček, 1988a:355 (Figs 655-656).

Distribution: Eastern Australia

13. Genus *Tomicobomorpha*

Tomicobomorpha Girault, 1915b:207; Bouček, 1988a:357-358. Type species *Tomicobomorpha stellata* Girault; by original designation.

• ***stellata* Girault**

Tomicobomorpha stellata, 1915b:207; Dahms, 1986:562-563; Bouček, 1988a:358.

Distribution: Eastern Australia

• ***subplana*** **Bouček**

Tomicobomorpha subplana Bouček, 1988a:358 (Figs 665-666).

Distribution: Papua New Guinea

Appendix II
Character List

1.	Head	orange	0
		brown/black	1
2.	Face	1.2 to 1.5x broader than long	0
		1.4 to 1.7 x broader than long	1
		1.7 to 1.9x broader than long	2
3.	Dorsal margin of head	strongly concave	0
		weakly or not concave	1
4.	Occipital carina	strong	0
		weak	1
		absent	2
5.	Setae on vertex	long	0
		short	1
		absent	2
6.	Ocelli	removed from occiput by <1 OD	0
		removed from occiput by 1 OD	1
7.	OD	greater than or equal to OOL	0
		less than OOL	1
8.	Scrobes	carinate anteriorly	0
		not carinate anteriorly	1
		weakly carinate	2
9.	Scrobes	wholly sculptured	0
		partly sculptured or smooth	1
10.	♀ Antennae	> 1 torulus diameter above clypeus	0
		< 1 torulus diameter above clypeus	1
		about 1 td above clypeus	2
11.	♀ F1	transverse	0
		not transverse	1
12.	♀ F2	transverse	0
		not transverse	1
13.	Scutellum	with regular setation only	0
		with more than 2 pairs of setae	1
		with 2 pairs setae only	2

14.	♀ Club	≤ funicle in length	0
		> funicle in length	1
15.	Malar space	<eye	0
		=eye	1
		>eye	2
16.	Genal carina	present	0
		absent	1
17.	Malar groove	complete	0
		not complete	1
18.	Genal carina and clypeal margin	widely offset	0
		narrowly offset	1
		not offset	2
19.	Number of hind tibial spurs	2	0
		2, 1 rudimentary	1
		1	2
20.	Pronotal ring	absent	0
		less than 8	1
		8 to 14 incl	2
		over 14	3
21.	Setal bases on mesoscutum	reticulate	0
		not reticulate	1
		raised	2
		punctate	3
22.	Mesoscutum	with regular pilosity only	0
		with regular and paired pilosity	1
		with paired setae only	2
23.	Notauli	complete grooves	0
		shallow grooves	1
		wide grooves	2
		absent	3
24.	Thorax	flat in general facies	0
		moderately convex in general facies	1
		extremely convex in general facies	2
25.	Mesoscutum	sculptured	0
		not sculptured	1

26.	Scapulae	sculptured	0
		not sculptured	1
27.	Scutellum	longer than broad	0
		square	1
		broader than long	2
28.	Frenal area	not delimited	0
		delimited by change in sculpture	1
		delimited by line	2
		delimited by groove/punctations	3
29.	Scutellum	sculptured	0
		not sculptured	1
30.	Axillae	sculptured	0
		not sculptured	1
		foveate	2
31.	Dorsellum	sculptured	0
		smooth	1
32.	Metanotum furrow	sculptured	0
		smooth	1
33.	♀ Forewing	without definate infumate patch	0
		maculate	1
		bimaculate	2
		completely infumate	3
34.	♀ Marginal vein	≤ 0.5x length of stigmal vein	0
		0.5 to 0.9x length of stigmal vein	1
		from 1.3 to 2.4x length of stigmal vein	2
		from 2.4 to 3.4x length of stigmal vein	3
		from 3.4 to 4.6x length of stigmal vein	4
35.	♀ Postmarginal vein	≤ 0.5x length of stigmal vein	0
		0.5 to 0.9x length of stigmal vein	1
		=0.9 to =1.2x length of stigmal vein	2
		>1.2x length of stigmal vein	3
36.	♀ Stigmal area	setose	0
		bare	1
37.	♀ Costal cell	excised at apex	0
		slightly excised	1
		not excised at apex	2

38.	♀ Costal margin	with less than 10 setae	0
		with setae along <0.5x margin	1
		with setae along 0.5 to 0.9x margin	2
		with setae along 0.9 to entire margin	3
		without setae	4
39.	♀ Ventral setal row in costal cell	continuous	0
		interrupted	1
		absent	2
40.	♀ Basal hairline with	setal tuft	0
		setal strip	1
		setal line	2
		setae absent	3
		not demarcated	4
41.	♀ Basal cell	setose	0
		bare	1
42.	♀ Basal cell	margined by cubital row of setae	0
		partly margined	1
		not margined	2
43.	♀ Speculum and linea calva	no speculum or linea calva	0
		narrow speculum present	1
		wide speculum present	2
		speculum and linea calva present	3
		linea calva only present	4
44.	Hind tibial spur	less than 0.4x basitarsus	0
		0.4-0.8x basitarsus	1
		0.8-as long as basitarsus	2
		longer than basitarsus	3
45.	Dorsal crest of setae on coxae	present	0
		absent	1
46.	Lateral crest of setae on coxae	present	0
		absent	1
47.	Nucha	longer than broad	0
		square	1
		broader than long	2
		reduced	3

48.	♂ antennae inserted	>1td above clypeus	0
		<1td above clypeus	1
		about 1td above clypeus	2
49.	Median carina	complete	0
		incomplete	1
		absent	2
		developed as a tooth	3
50.	T1	with striations	0
		without striations	1
51.	T1	>0.9x length gaster	0
		between 0.6x and 0.9x length gaster	1
		< 0.6x length gaster	2
52.	Setal tuft at basal fovea	compact	0
		not compact	1
		sparse	2
		absent	3
53.	Setal tuft	confined to base	0
		extended along margin	1
		absent	2
54.	Mesepimeron	with dimple	0
		without dimple	1
55.	Mesepimeron	glabrous	0
		striate	1
56.	Male: Club	≤ 2x F1	0
		>2x F1	1
57.	Male: F1	<F2	0
		=F2	1
		>F2	2
58.	Forewing	complete	0
		reduced	1
		narrow	2
59.	Male antennae	filiform	0
		nodose	1
		strongly nodose	2
		branched	3

60.	♂ Forewing	without definate infumate patch	0
		maculate	1
		bimaculate	2
		completely infumate	3
61.	♂ Marginal vein	shorter than stigmal vein	0
		approx equal to stigmal vein	1
		from 1.2 to 3x as long as stigmal vein	2
		more than 3x length of stigmal vein	3
62.	♂ Costal margin	with less than 10 setae	0
		with setae along <0.5x margin	1
		with setae along 0.5x to 0.9x margin	2
		with setae along 0.9 to entire margin	3
63.	♂ Basal hairline with	setal tuft	0
		setal strip	1
		setal line	2
		setae absent	3
		not delimited	4
64.	♂ Basal cell	margined by cubital row of setae	0
		partly margined	1
		not margined	2
65.	♂ Head	orange	0
		brown/black	1
66.	♀ forewing	basal hairline infumate	0
		basal hairline not infumate	1
67.	♂ forewing	basal hairline infumate	0
		basal hairline not infumate	1
68.	♂ postmarginal vein	≥ stigmal vein	0
		< stigmal vein	1
69.	mandible	with 2 teeth, neither divided	0
		1 lower tooth, 1 upper tooth and a truncation	1
		1 lower tooth, 2 upper teeth	2
		1 lower tooth, 3 upper teeth	3
		reduced	4
70.	S1	surface entirely finely striate	0
		surface not finely striate	1
71.	S1	without setae	0
		with setae at base of sculpture	1

		with setae all over sculpture	2
72.	S1 medial horizontal ridge	absent	0
		present as an interruption	1
		present as a smooth ridge	2
		present as a sculptured ridge	3
73.	S1 anterior of collar	unsculptured	0
		alveolate	1
		concave	2
		foveate	3
		grooved	4
74.	S1 posterior of collar	unsculptured	0
		alveolate	1
		concave	2
		foveate	3
		grooved	4
75.	♂ club with	plate sensilla	0
		trichoid sensilla	1
76.	♂ antennae with setae	shorter than F2	0
		equal to F2	1
		longer than F2	2

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Tbl.arsenei          1012001112 1120010002 1120001201 1101102202 0021002021 1111012010 1220100121 133402
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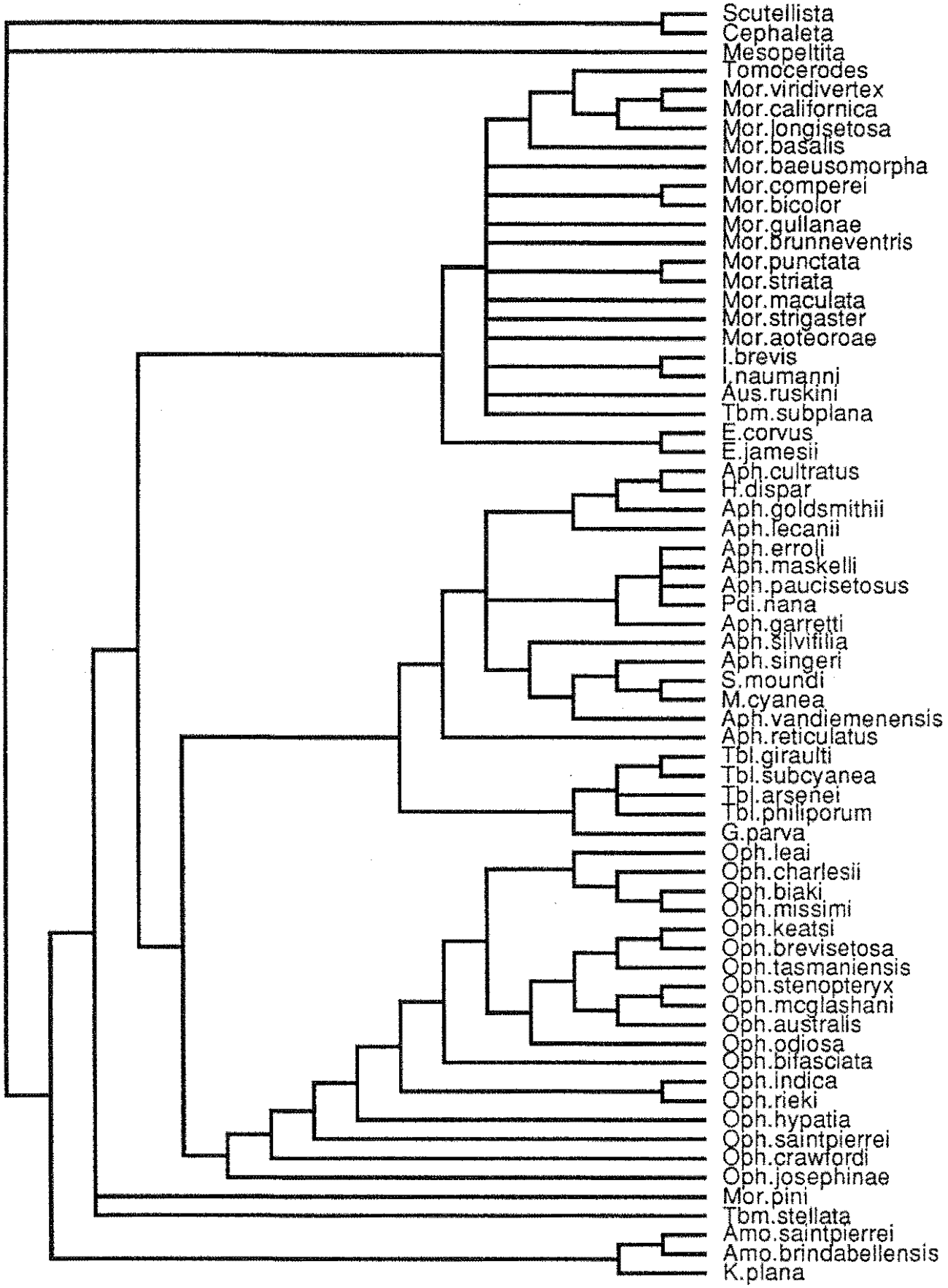
Appendix IV
Strict consensus of 309 minimum length trees.



Appendix V

List of taxon codes used for data matrix

No.	Taxon	Code
1	*Scutellista cyanea*	Scutellista
2	*Cephaleta* sp.	Cephaleta
3	*Mesopeltita truncatipennis*	Mesopeltita
4	*Tomocerodes americanus*	Tomocerodes
5	*Aphobetus cultratus*	Aph.cultratus
6	*Aphobetus erroli*	Aph.erroli
7	*Aphobetus garretti*	Aph.garretti
8	*Aphobetus goldsmithii*	Aph.goldsmithii
9	*Aphobetus lecanii*	Aph.lecanii
10	*Aphobetus maskelli*	Aph.maskelli
11	*Aphobetus paucisetosus*	Aph.paucisetosus
12	*Aphobetus reticulatus*	Aph.reticulatus
13	*Aphobetus silvifilia*	Aph.silvifilia
14	*Aphobetus singeri*	Aph.singeri
15	*Aphobetus vandiemenensis*	Aph.vandiemenensis
16	*Pidinka nana*	Pdi.nana
17	*Amoturella saintpierrei*	Amo.saintpierrei
18	*Amoturella brindabellensis*	Amo.brindabellensis
19	*Moranila viridivertex*	Mor.viridivertex
20	*Moranila californica*	Mor.californica
21	*Moranila baeusomorpha*	Mor.baeusomorpha
22	*Moranila comperei*	Mor.comperei
23	*Moranila gullanae*	Mor.gullanae
24	*Moranila brunneventris*	Mor.brunneventris
25	*Moranila basalis*	Mor.basalis
26	*Moranila punctata*	Mor.punctata
27	*Moranila maculata*	Mor.maculata
28	*Moranila bicolor*	Mor.bicolor

29	*Moranila longisetosa*	Mor.longisetosa
30	*Moranila striata*	Mor.striata
31	*Moranila pini*	Mor.pini
32	*Moranila strigaster*	Mor.strigaster
33	*Moranila aotearoae*	Mor.aotearoae
34	*Ophelosia leai*	Oph.leai
35	*Ophelosia bifasciata*	Oph.bifasciata
36	*Ophelosia crawfordi*	Oph.crawfordi
37	*Ophelosia keatsi*	Oph.keatsi
38	*Ophelosia stenopteryx*	Oph.stenopteryx
39	*Ophelosia hypatia*	Oph.hypatia P51
40	*Ophelosia indica*	Oph.indica
41	*Ophelosia rieki*	Oph.rieki
42	*Ophelosia saintpierrei*	Oph.saintpierrei
43	*Ophelosia odiosa*	Oph.odiosa
44	*Ophelosia josephinae*	Oph.josephinae
45	*Ophelosia tasmanensis*	Oph.tasmaniensis
46	*Ophelosia brevisetosa*	Oph.brevisetosa
47	*Ophelosia charlesii*	Oph.charlesii
48	*Ophelosia mcglashani*	Oph.mcglashani
49	*Ophelosia australis*	Oph.australis
50	*Ophelosia biaki*	Oph.biaki
51	*Ophelosia missimi*	Oph.missimi
52	*Tomicobiella giraulti*	Tbl.giraulti
53	*Tomicobiella arsenei*	Tbl.arsenei
54	*Tomicobiella philiporum*	Tbl.philiporum
55	*Tomicobiella subcyanea*	Tbl.subcyanea
56	*Kneva plana*	K.plana
57	*Ismaya brevis*	I.brevis
58	*Ismaya naumanni*	I.naumanni
59	*Hirtonila dispar*	H.dispar
60	*Eunotomyiia corvus*	E.corvus

61	*Eunotomyiia jamesii*	E.jamesii
62	*Australeunotus ruskini*	Aus.ruskini
63	*Strionila moundi*	Str.moundi
64	*Modronila cyanea*	Mod.cyanea
65	*Globonila parva*	G.parva
66	*Tomicobomorpha stellata*	Tbm.stellata
67	*Tomicobomorpha subplana*	Tbm.subplana

Appendix VI

Host: Parasitoid List

Aleyrodidae: Hemiptera

Trialeurodes vaporariorum (Westwood): *Moranila comperei* (Ashmead)

Aphelinidae: Hymenoptera

***Coccophagus* sp.** in *Eriococcus* sp.: *Aphobetus maskelli* Howard

Aphididae: Hemiptera

Eriosoma lanigerum (Hausmann): *Ophelosia bifasciata* Girault, *Moranila comperei*

Myzus persicae (Sulzer): *Moranila comperei*

Asterolecanidae: Hemiptera

***Asterolecanium* sp.**: *Moranila californica* (Howard)

Asterolecanium pustulans (Cockerell): *Moranila californica*

Braconidae: Hymenoptera

Aphidius colemani Viereck/ ***Myzus persicae*** (Sulzer): *Moranila comperei*

Aphidius salicis (Haliday)/ ***Cavariella aegopodii*** (Scopoli): *Moranila comperei*

Diaretiella rapae (McIntosh)/ ***Lipaphis erysimi*** (Kalt): *Moranila comperei*

Ephedrus persicae Froggatt/ ***Myzus persicae*** : *Moranila comperei*

Coccidae: Hemiptera

Ceroplastes sp.: *Moranila californica*

Ceroplastes ceriferus (Fab.): *Moranila californica*

Ceroplastes rubens Maskell: *Moranila californica*

Ceroplastes ruski (L.): *Moranila californica*

Ceroplastes sinensis (Del Guercio): *Moranila californica*

***Coccus* (=*Lecanium*)** sp.: *Moranila californica*, *Tomicobomorpha subplana* Boucek

Coccus hesperidum L.: *Moranila californica*

***Ctenochiton* sp.**: *Aphobetus erroli* sp.n., *Aphobetus nana* (Boucek)

Ctenochiton elaeocarpi Maskell: *Aphobetus nana*

Ctenochiton perforatus Maskell: *Aphobetus erroli*, *Aphobetus nana*

Ctenochiton piperis Maskell: *Aphobetus nana*

Ctenochiton viridis Maskell: *Aphobetus maskelli*, *Aphobetus nana*

?Inglisia leptospermi Maskell: *Aphobetus maskelli*

Saissetia coffeae (Walker): *Moranila californica*

Saissetia hemisphaerica (=S. coffeae): *Moranila californica*

Parasaissetia nigra (Nietner): *Moranila californica*

Saissetia oleae (Olivier): *Moranila californica*, *Moranila comperei*

Diaspididae: Hemiptera

***Leucaspis* sp.**: *Aphobetus maskelli*, *Aphobetus paucisetosus* sp.n.

Leucaspis mixta de Boer: *Aphobetus nana*

Eriococcidae: Hemiptera

Eriococcus sp.: *Aphobetus cultratus* sp.n., *Aphobetus cyanea* (Boucek), *Aphobetus maskelli*, *Aphobetus paucisetosus*, *Aphobetus singeri* sp.n., *Moranila gullanae* sp.n., *Moranila viridivertex* (Girault)

Eriococcus elaeocarpi (Hoy): *Aphobetus paucisetosus*

Eriococcus nitidulus Hoy: *Aphobetus cyanea*

Lachnodius eucalypti (Maskell): *Australeunotus ruskini* Girault

Margarodidae: Hemiptera

Icerya purchasi (Maskell): *Ophelosia crawfordi* Riley, *Ophelosia hypatia* Girault

Icerya seychellarum (Westwood): *Ophelosia crawfordi*

Pseudococcidae: Hemiptera

Chaetococcus (=Antonina) bambusae (Maskell): *Moranila californica*

Nipaecoccus sp.: *Ophelosia indica* Farooqi

Nipaecoccus aurilanatus (Maskell): *Aphobetus maskelli*, *Moranila comperei*, *Ophelosia bifasciata*

Phenacoccus graminicola Leonardi: *Ophelosia charlesii* sp.n., *Ophelosia keatsii* Girault

Plannococcus citri (Risso): *Ophelosia bifasciata, Ophelosia indica*

Pseudococcus affinis (Maskell) (=*P. obscurus* Essig): *Ophelosia charlesii, Ophelosia keatsii.*

Pseudococcus calceolariae (Maskell) (=*P. citrophilus* Clausen): *Ophelosia bifasciata, Ophelosia charlesii*

Pseudococcus longispinus (Targioni Tozzetti) (=*P. adonidum* (L.)): *Ophelosia bifasciata, Ophelosia charlesii, Ophelosia keatsii, Aphobetus nana*

Pseudoripersia turgipes Maskell: *Ophelosia bifasciata*

Trionymus (=Paraferrisia) podocarpi (Brittin): *Ophelosia charlesii*

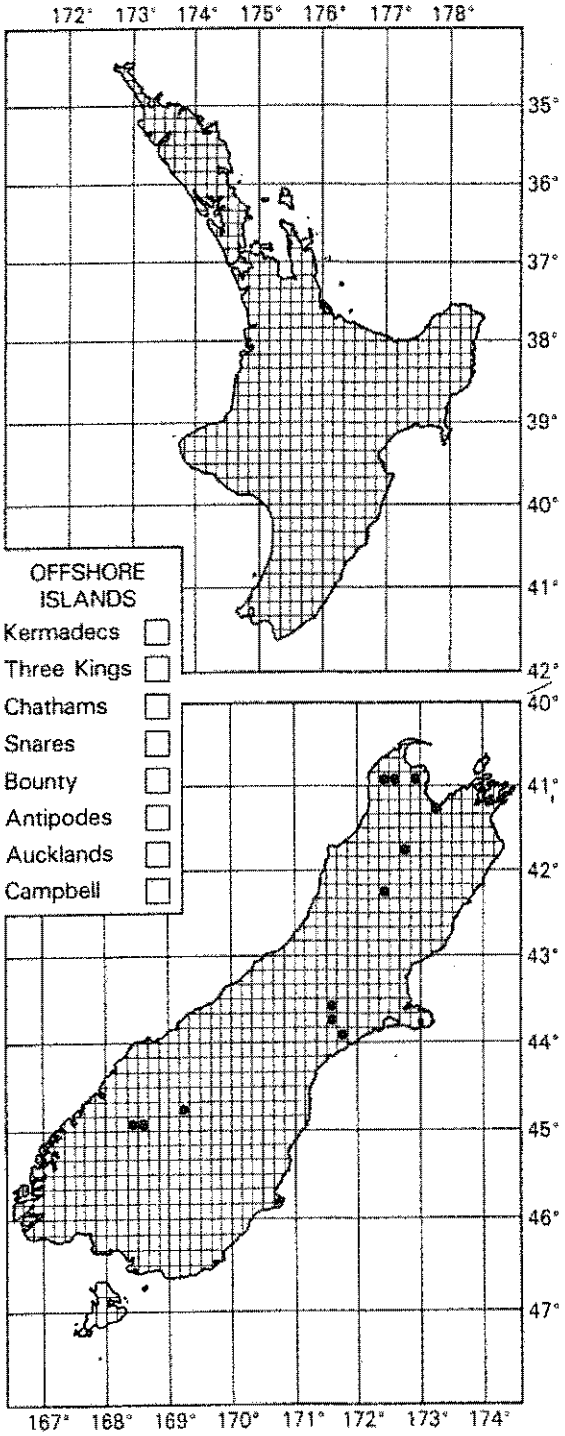
Psyllidae: Hemiptera

Ctenarytiana thysanura: *Moranila comperei*

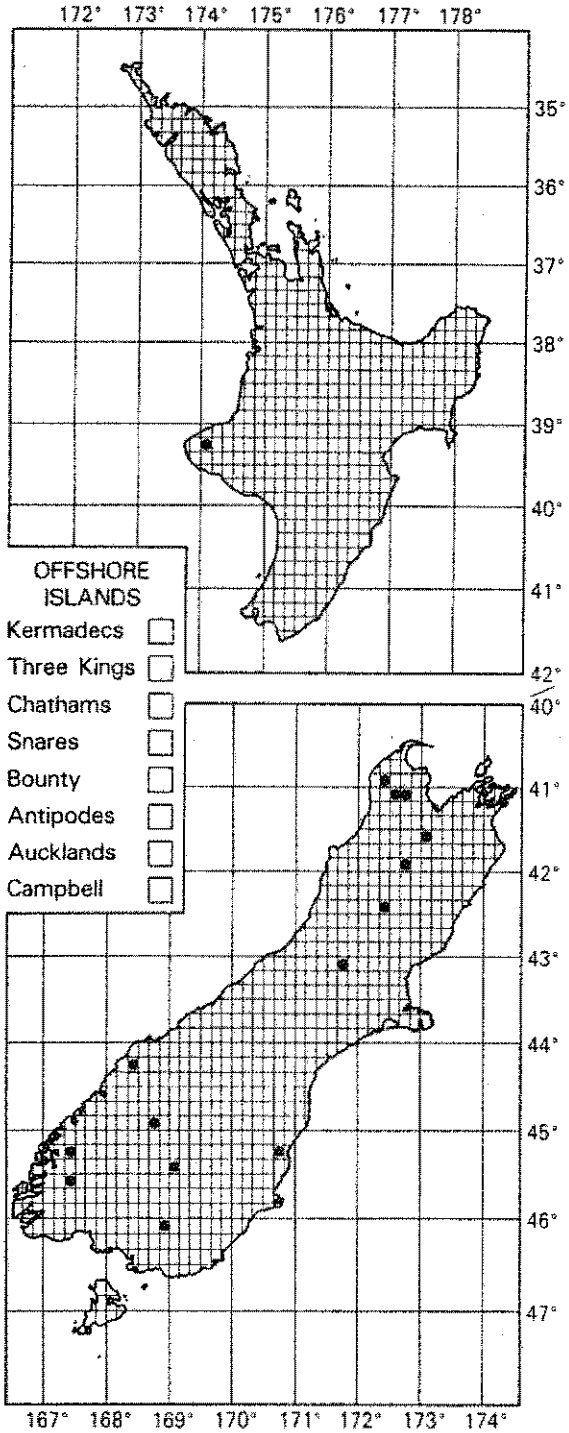
***Powellia* sp.**: *Aphobetus maskelli*

Phoridae: Diptera

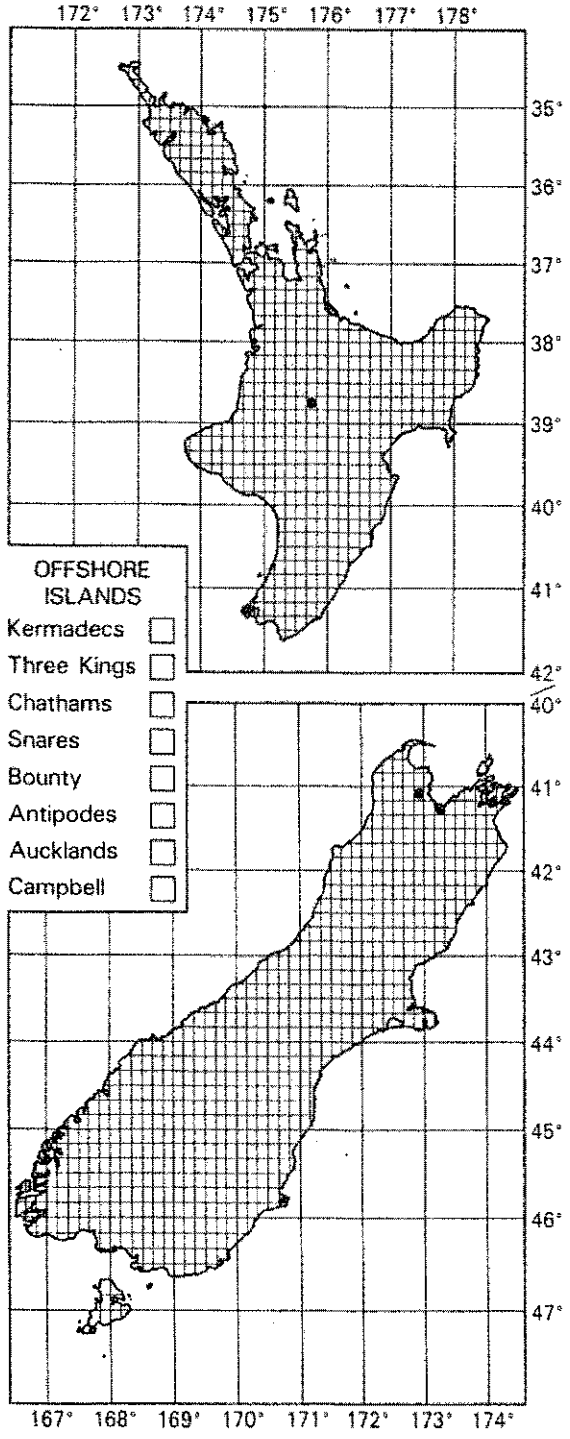
Megaselia sp.: *Kneva plana* Boucek



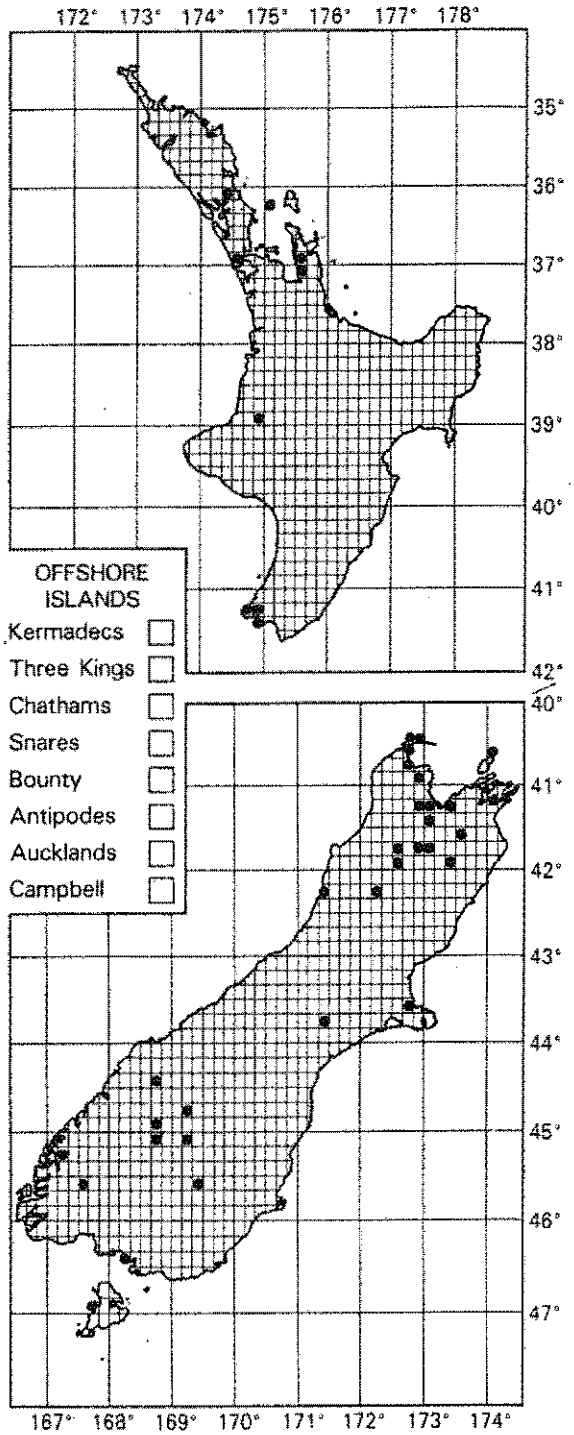
Map 1: *Aphobetus cultratus* sp.n.



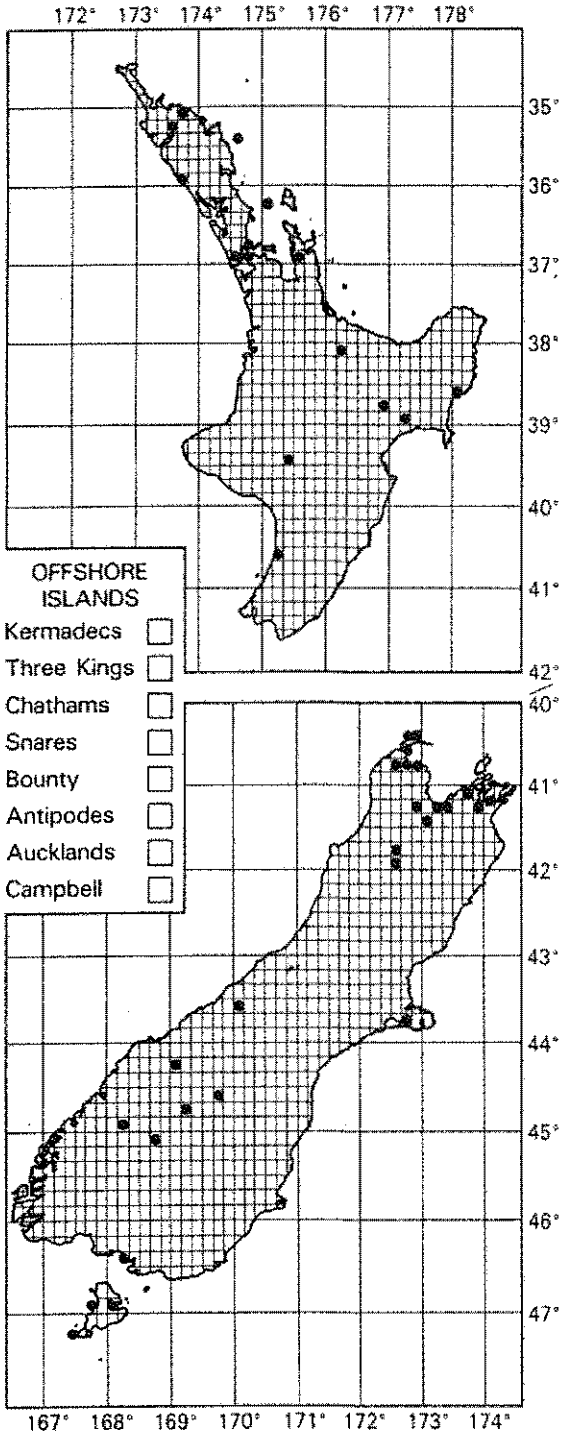
Map 2: *Aphobetus cyanea* (Boucek)



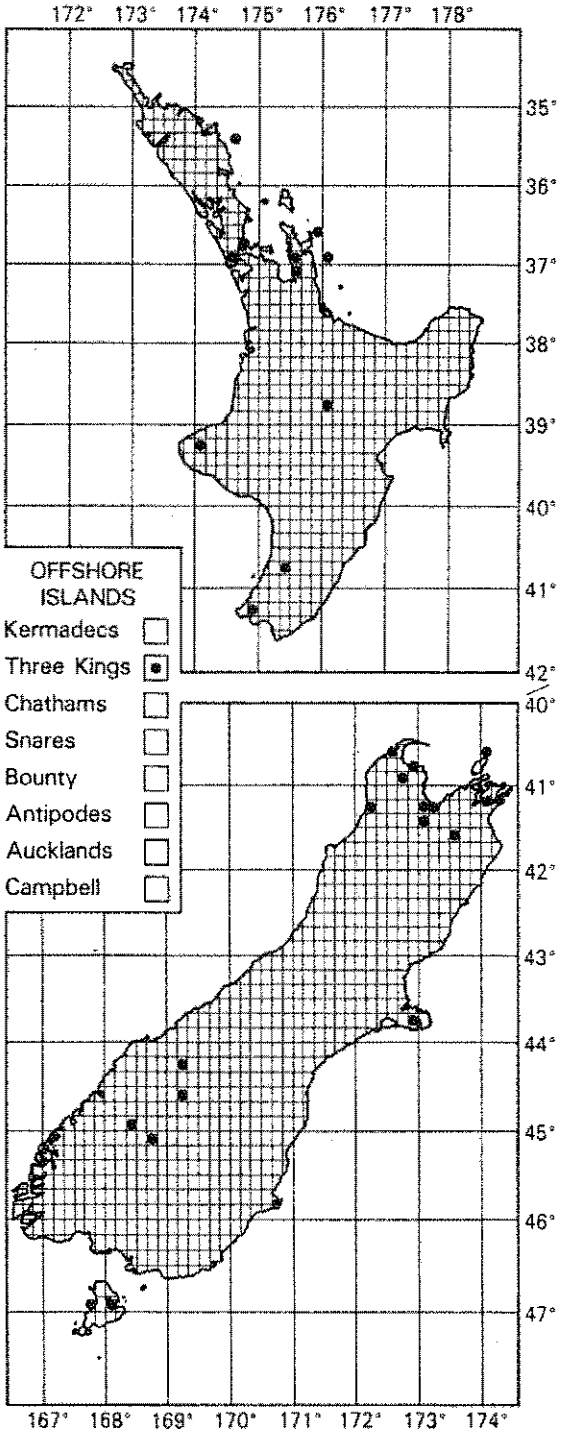
Map 3: *Aphobetus erroli* sp.n.



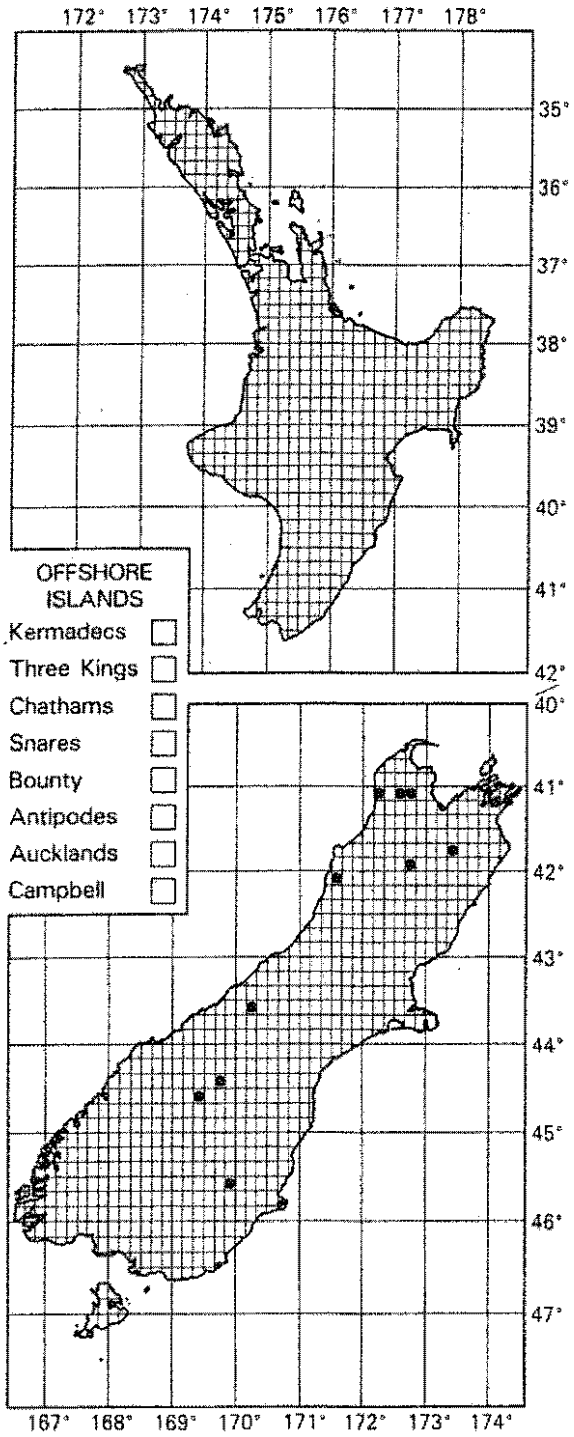
Map 4: *Aphobetus maskelli* Howard



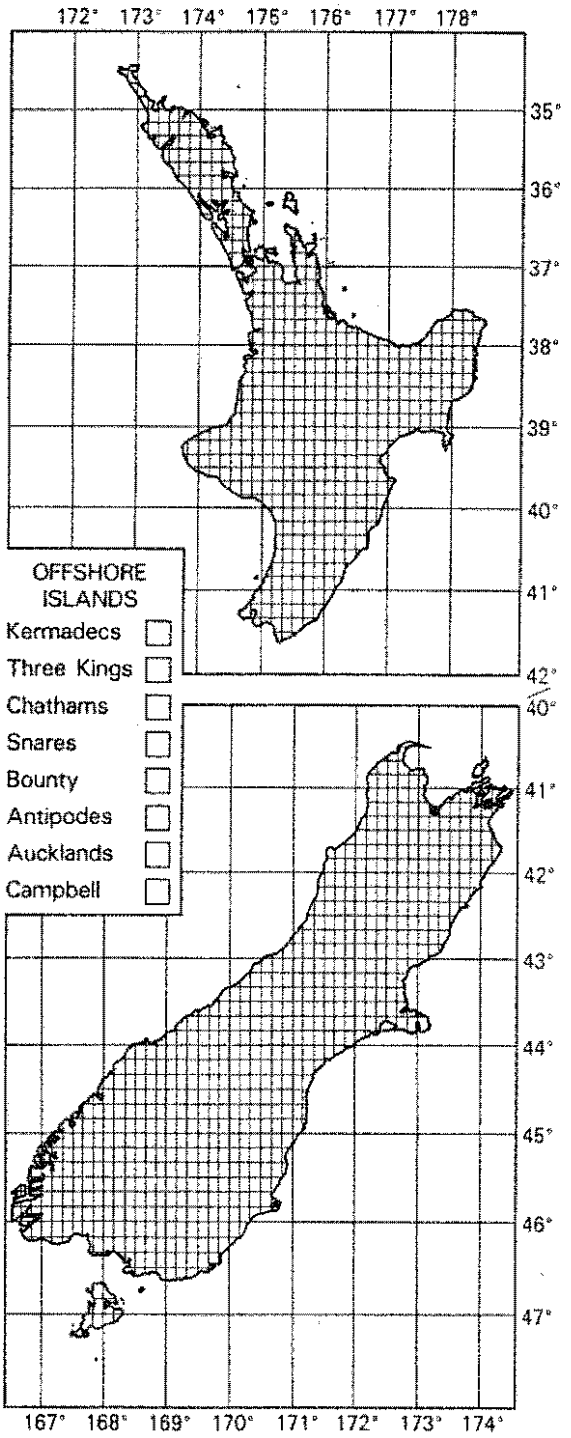
Map 5: *Aphobetus nana* (Boucek)



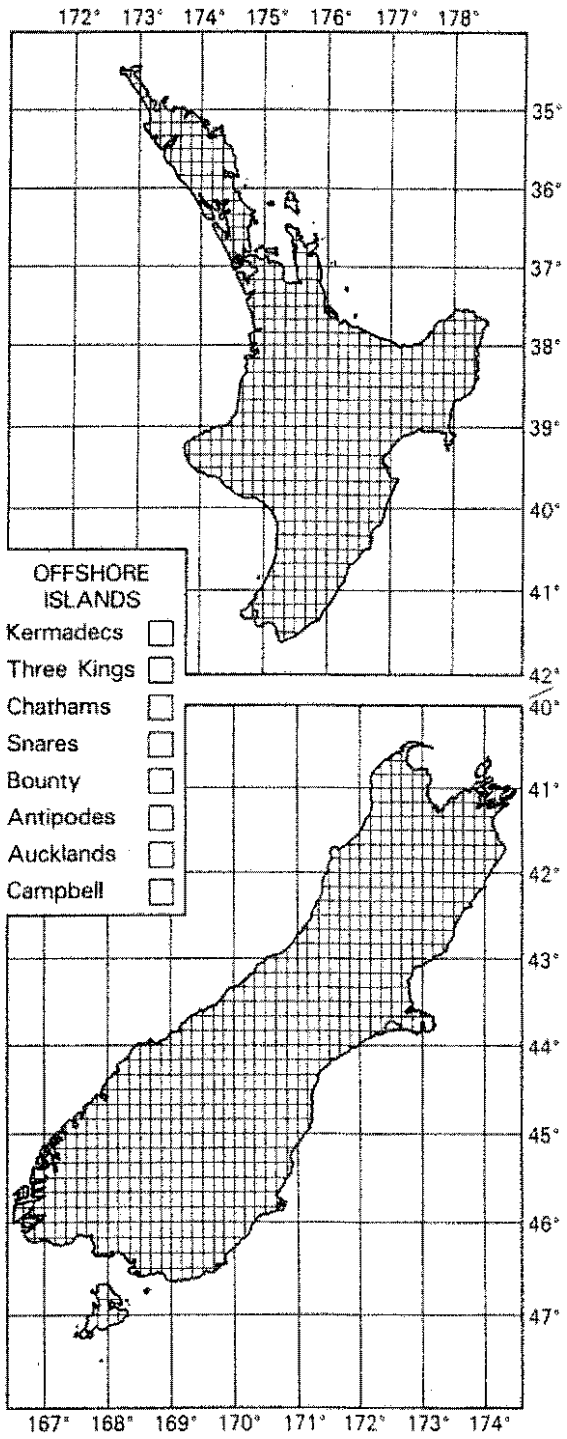
Map 6: *Aphobetus paucisetosus* sp.n.



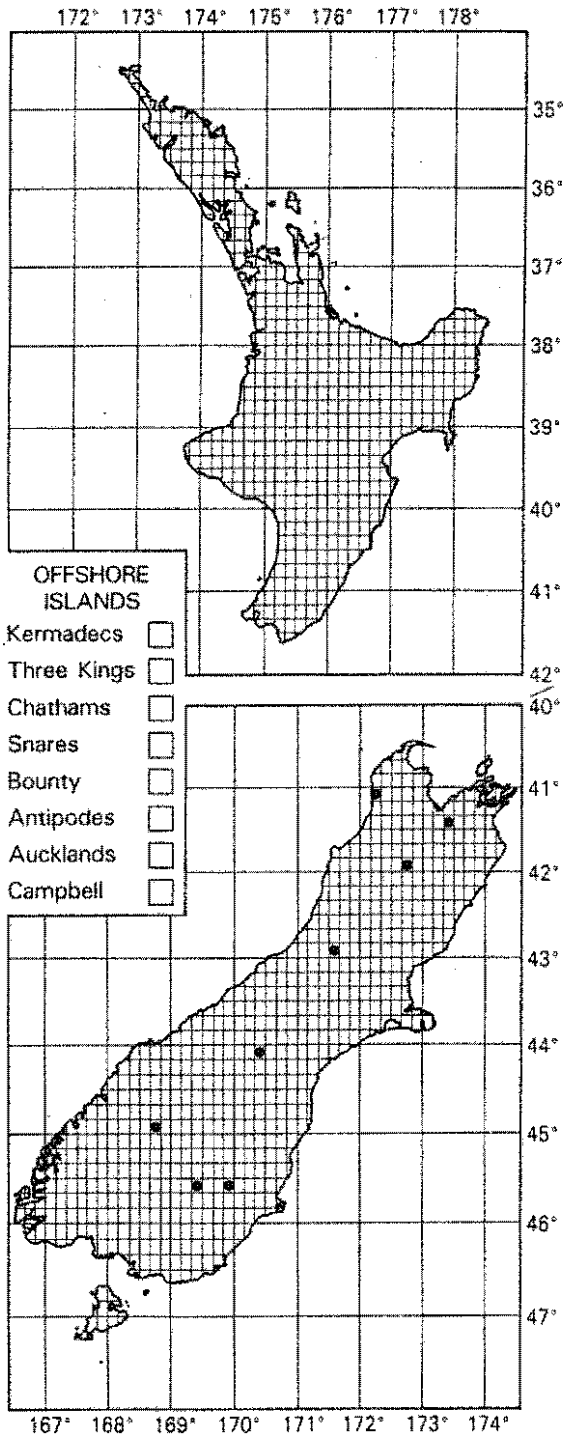
Map 7: *Moranila aoteoroae* sp.n.



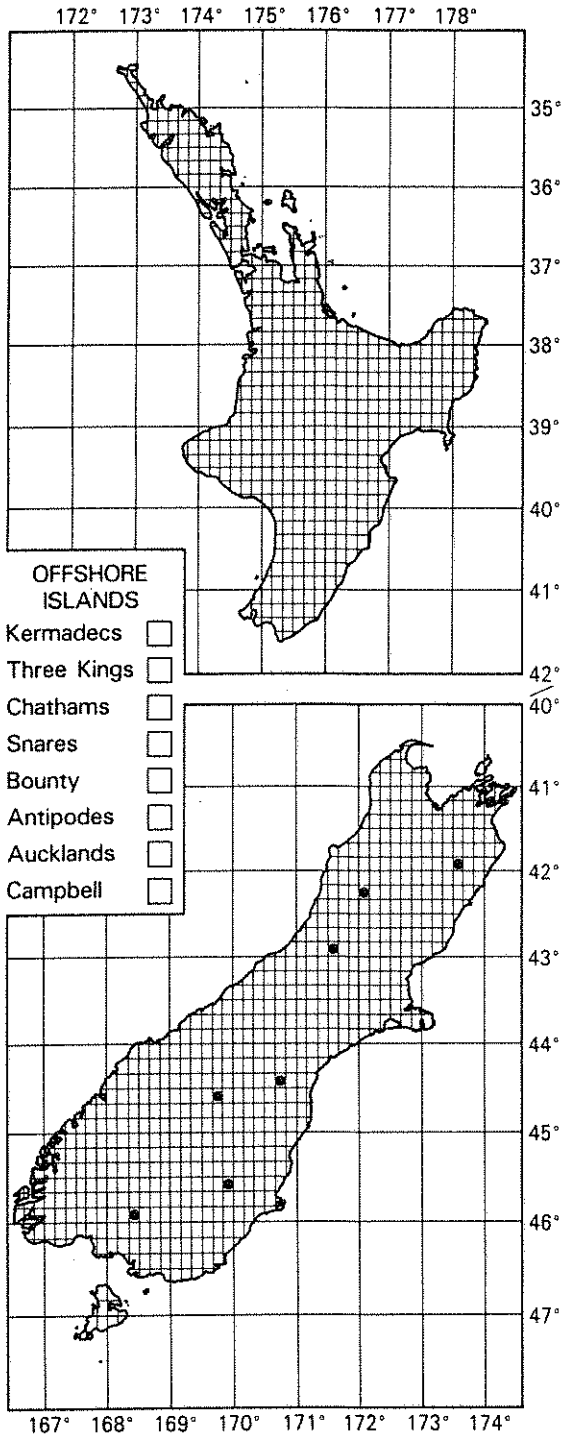
Map 8: *Moranila californica* (Howard)



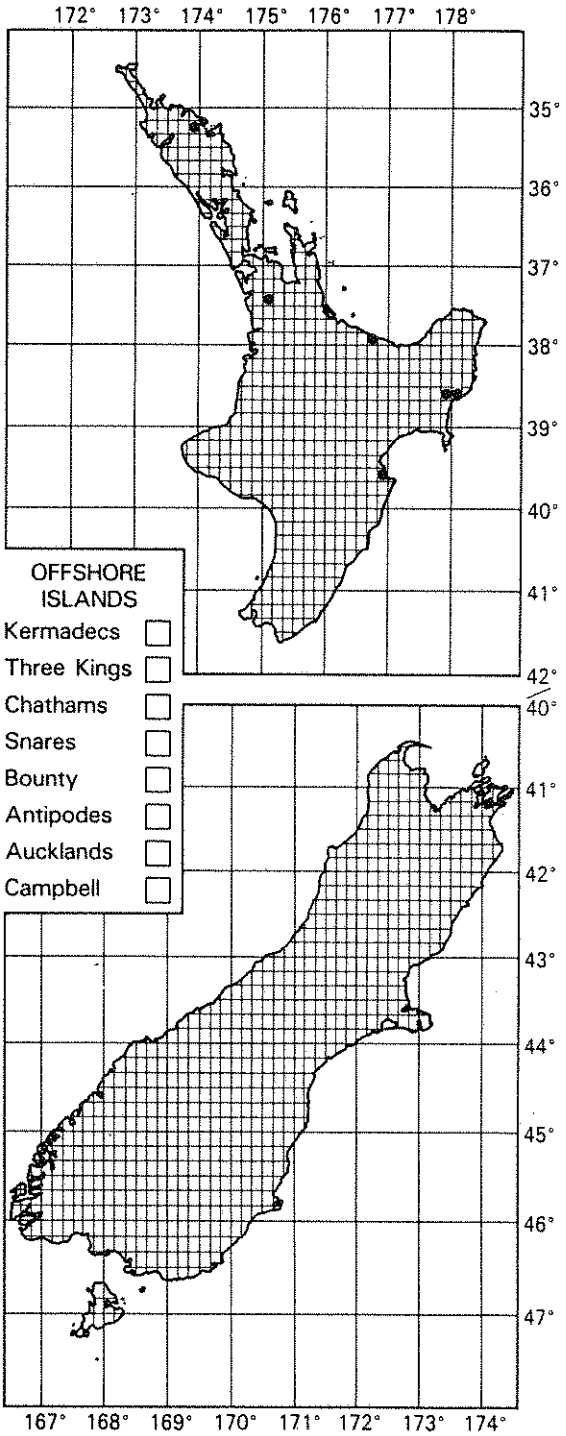
Map 9: *Moranila comperei* (Ashmead)



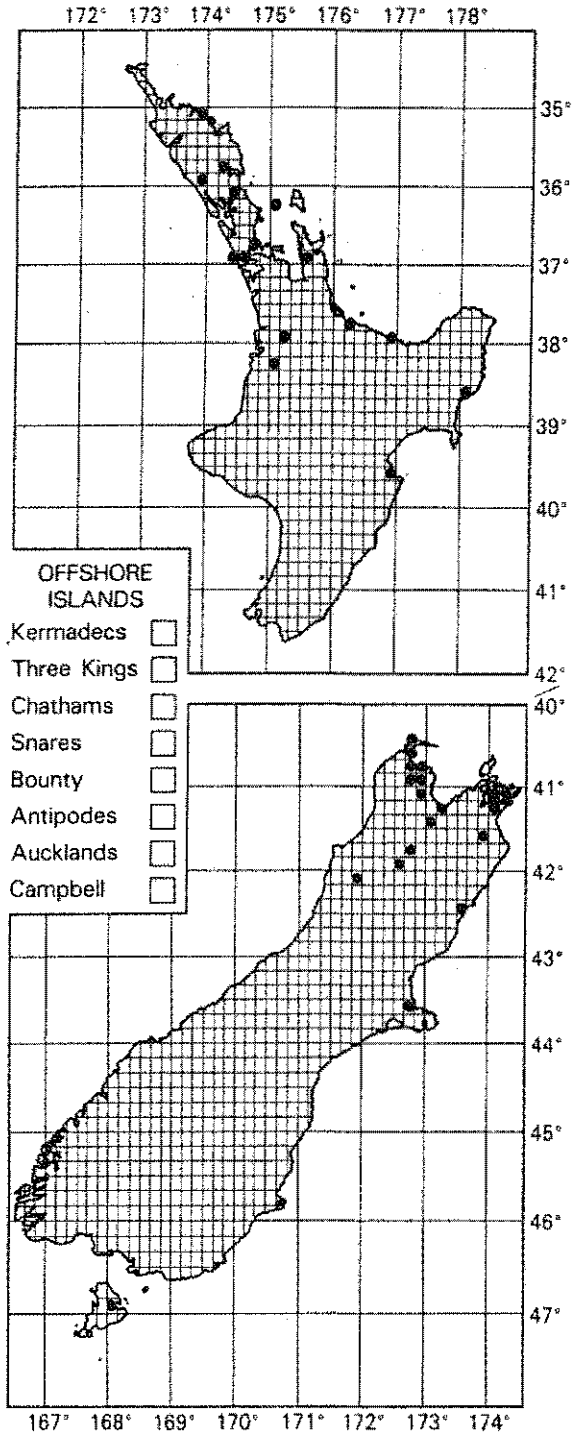
Map 10: *Moranila strigaster* sp.n.



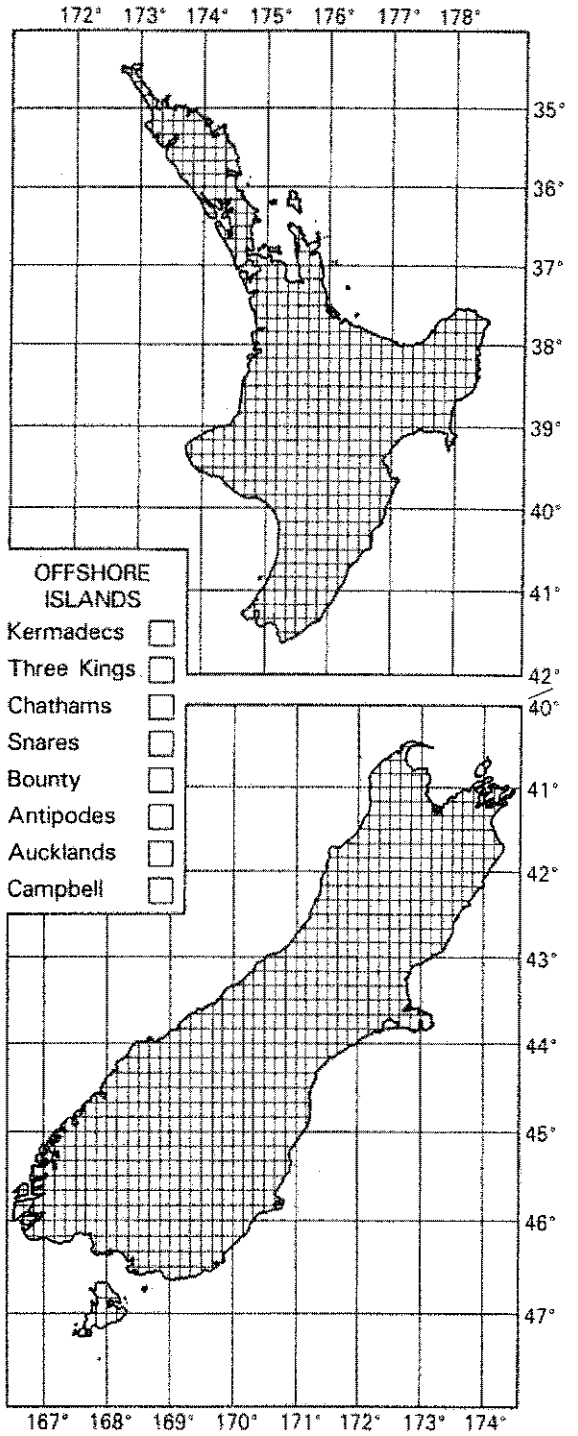
Map 11: *Ophelosia australis* sp.n.



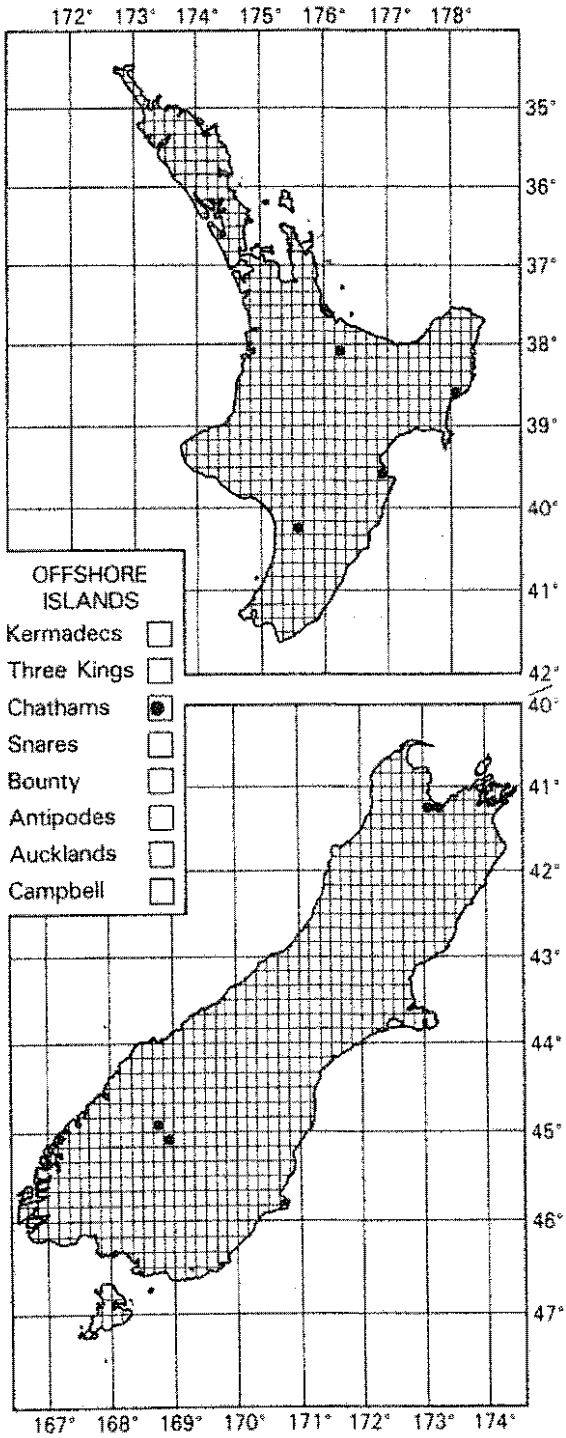
Map 12: *Ophelosia bifasciata* Girault



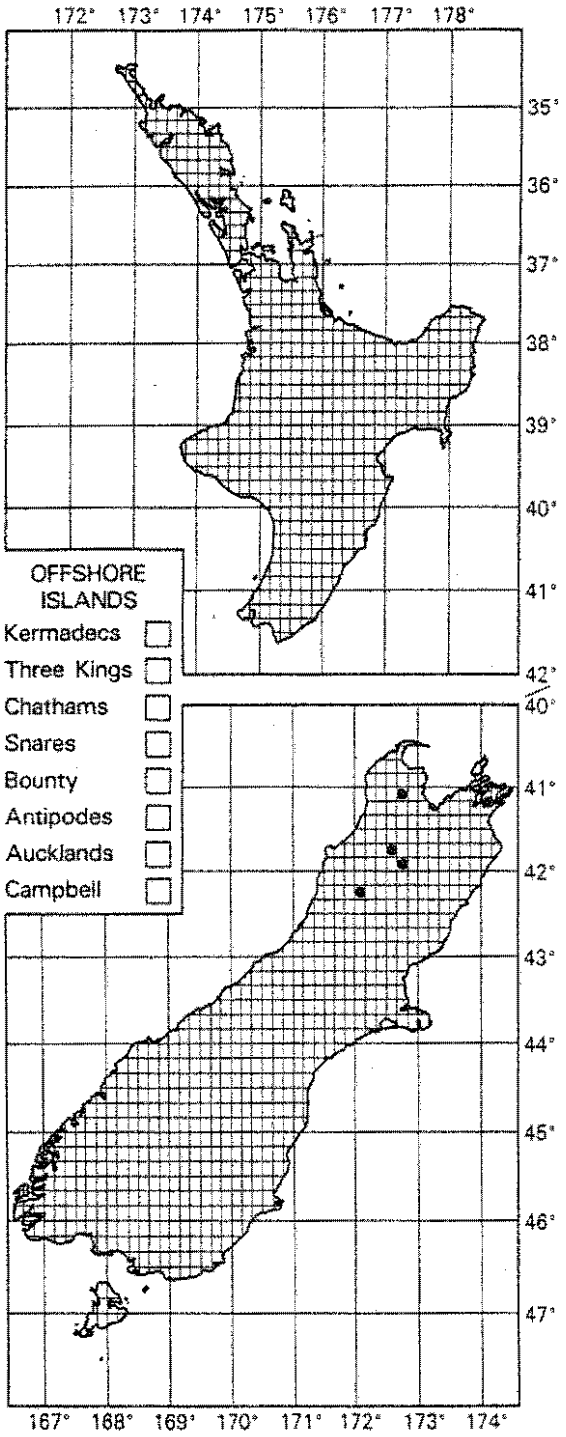
Map 13: *Ophelosia charlesii* sp.n.



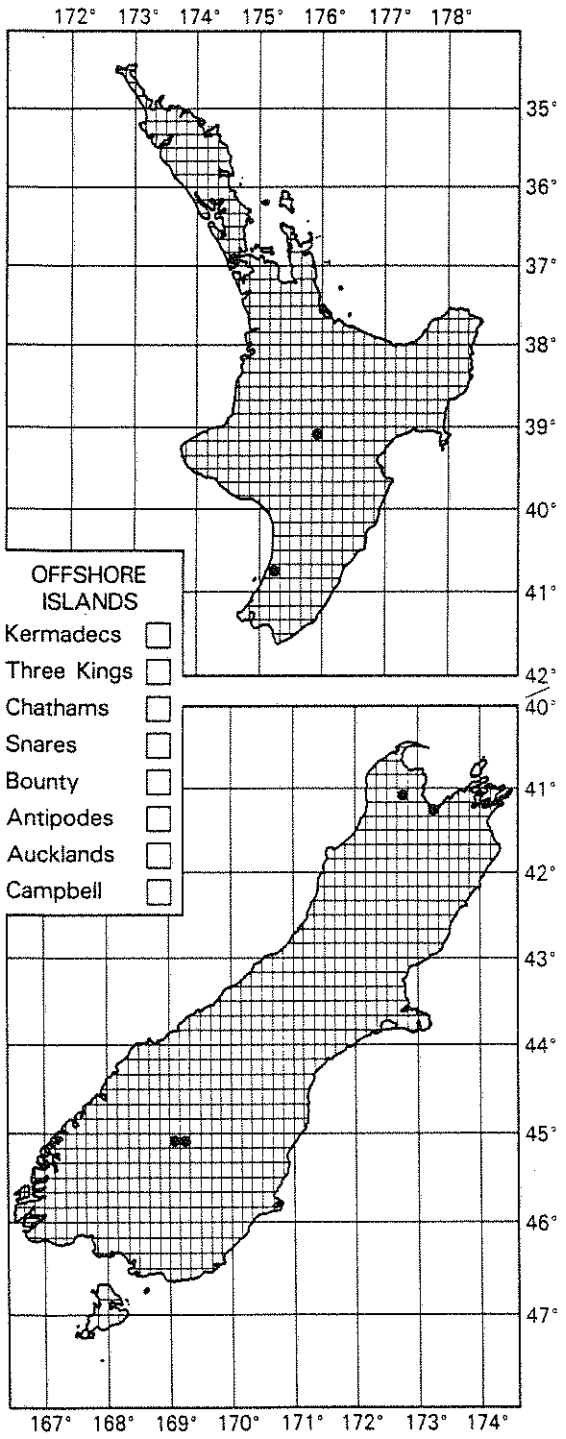
Map 14: *Ophelosia crawfordi* Riley



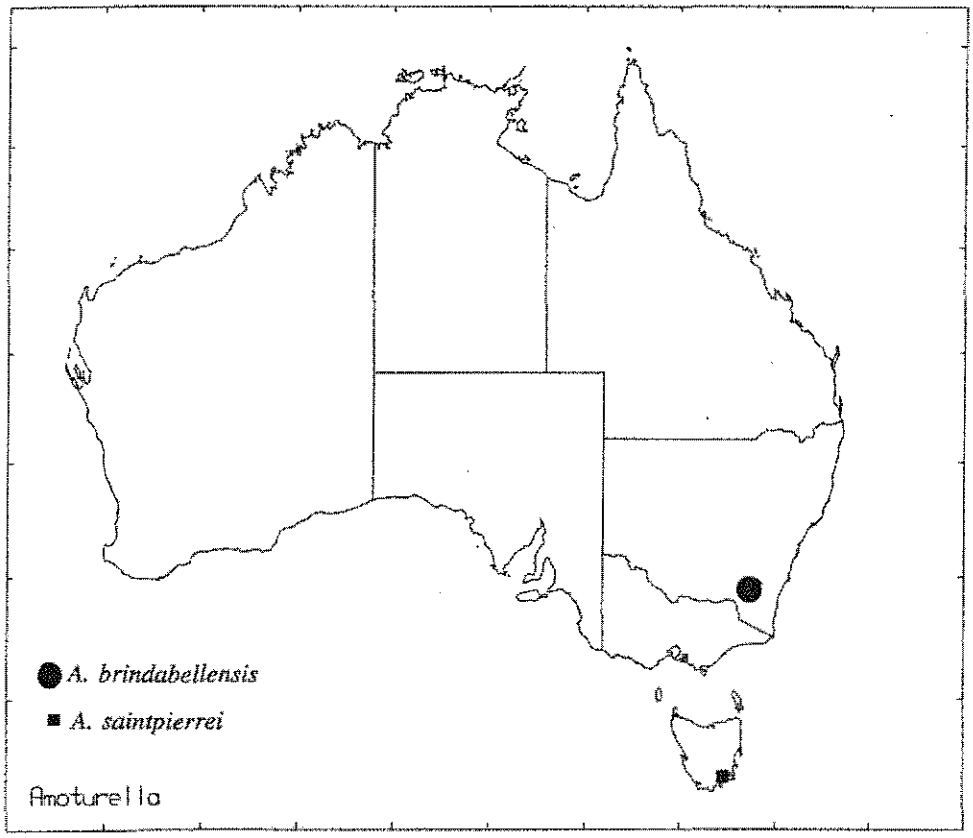
Map 15: *Ophelosia keatsi* Girault



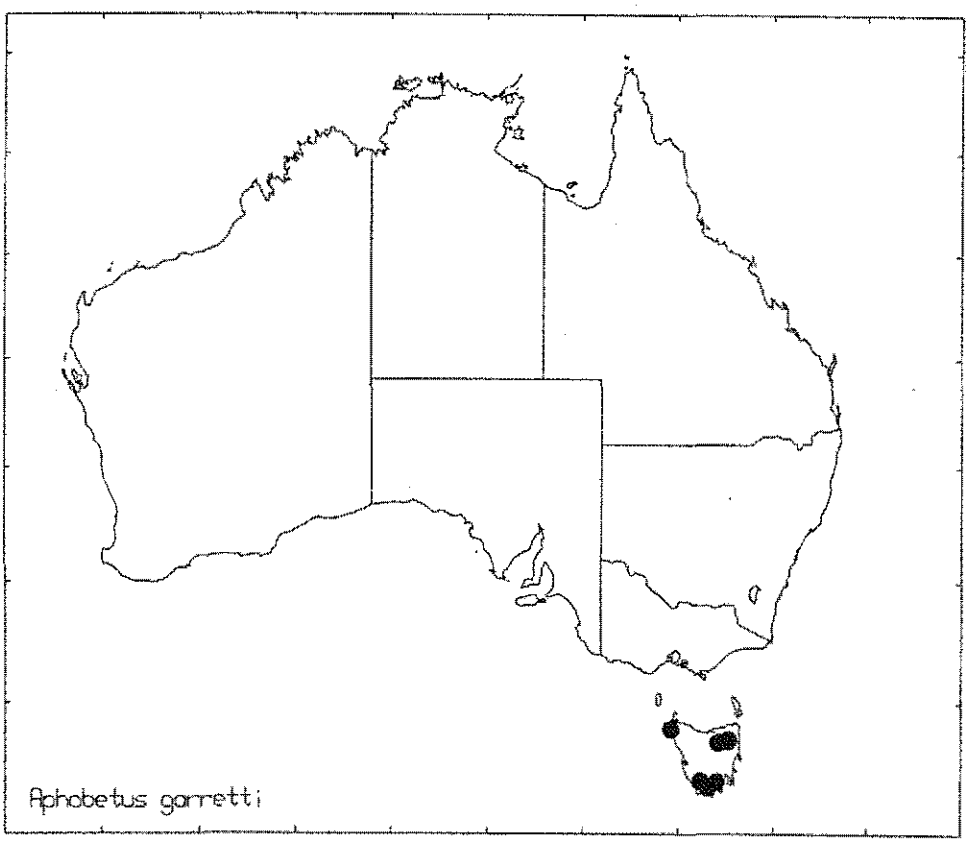
Map 16: *Ophelosia mcglashani* sp.n



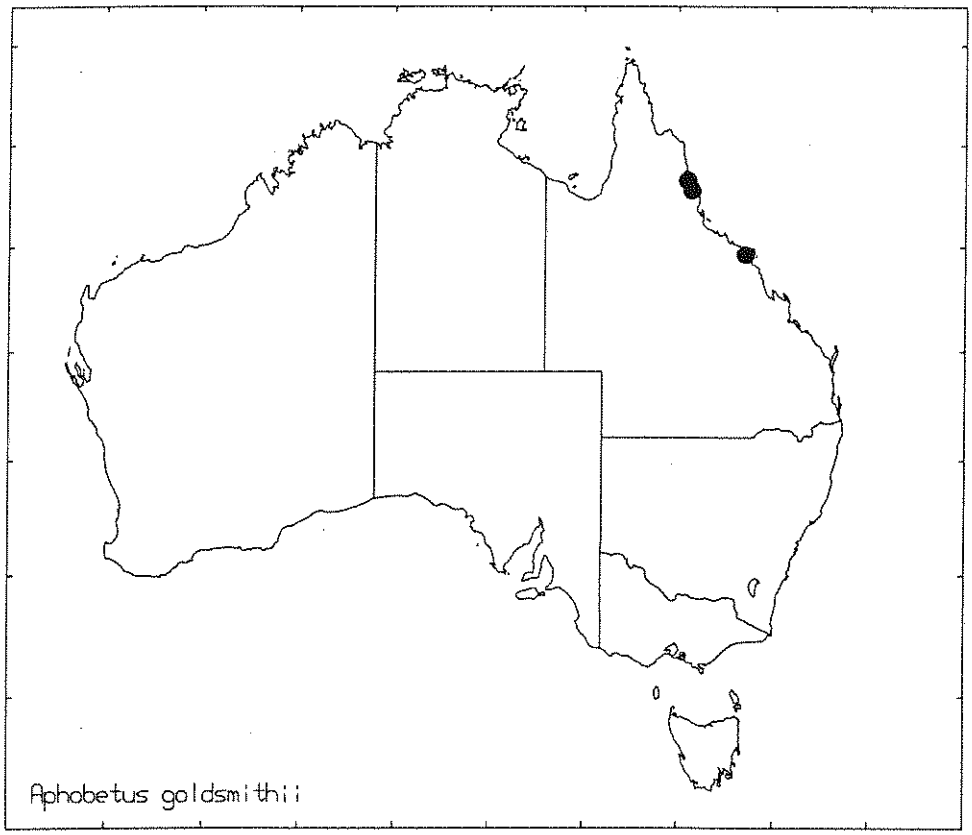
Map 17: *Ophelosia stenopteryx* sp.n.



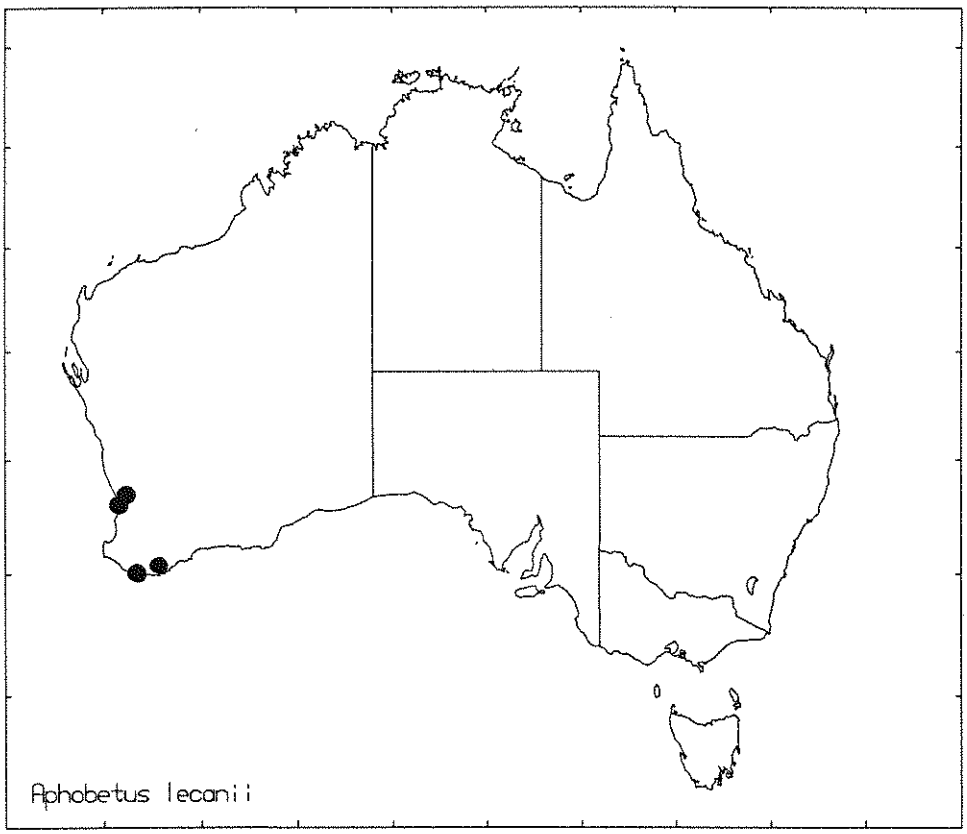
Map 18: *Amoturella* Girault



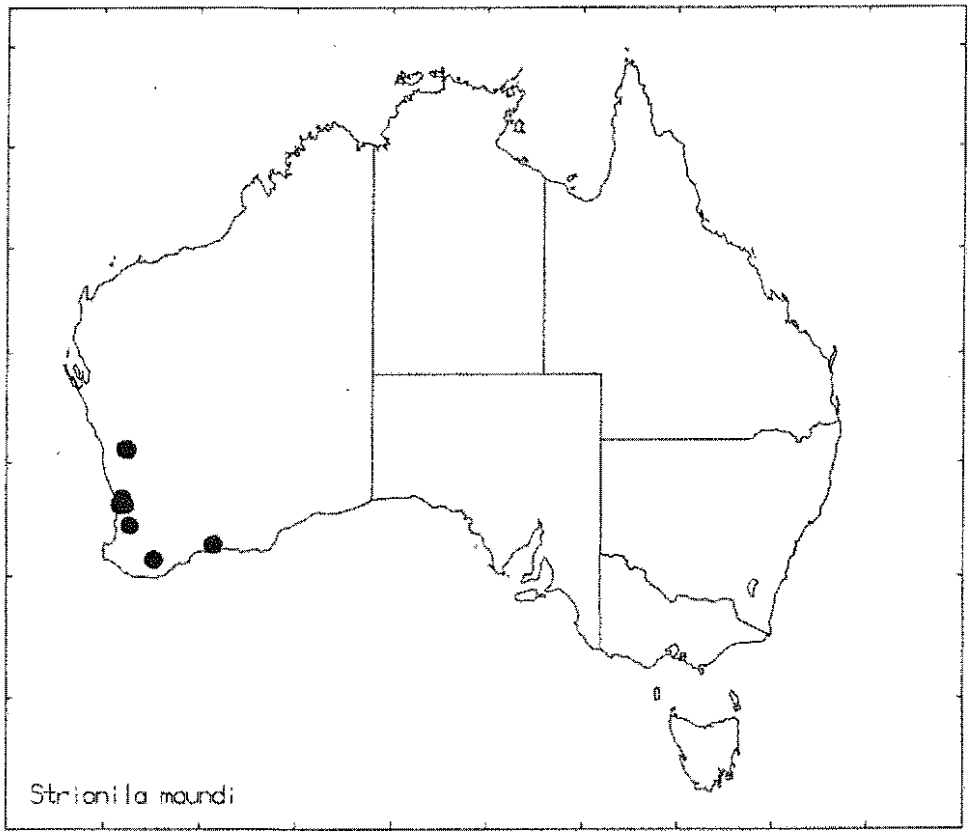
Map 19: *Aphobetus garretti* sp.n.



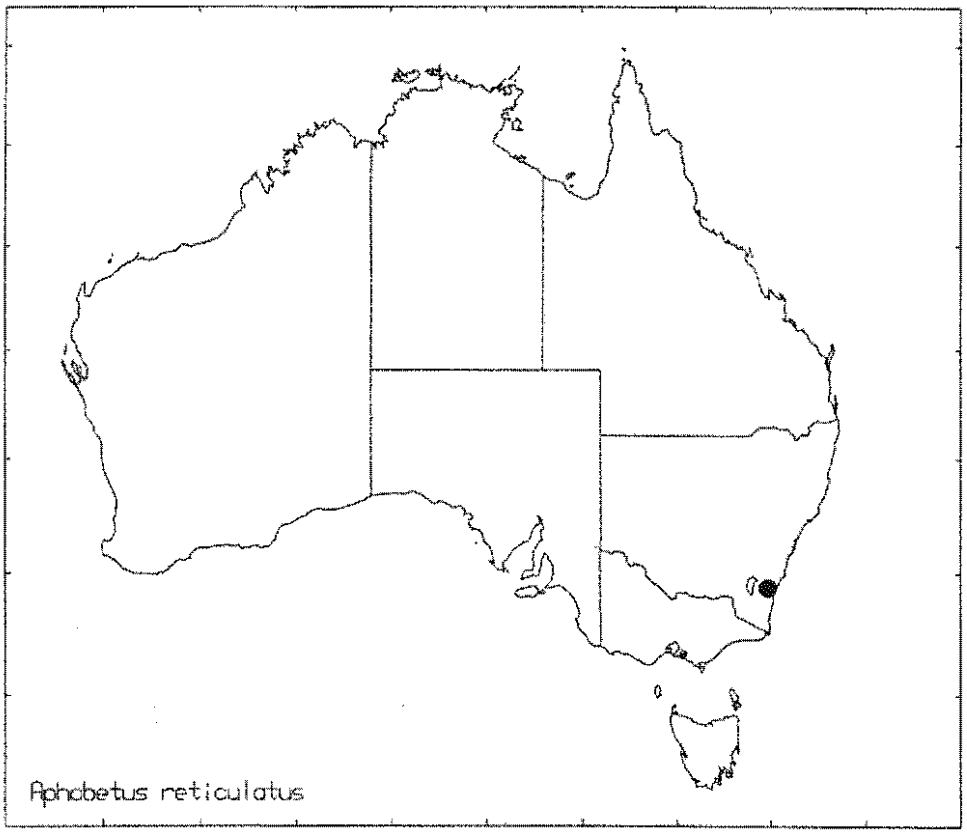
Map 20: *Aphobetus goldsmithii* Girault



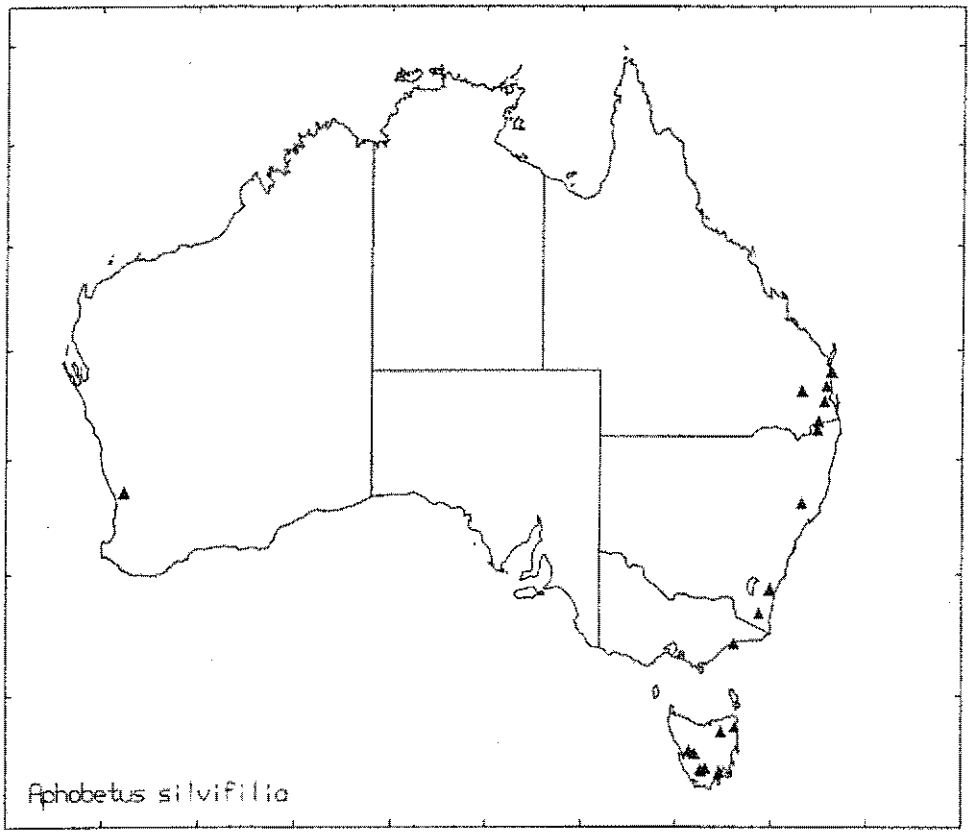
Map 21: *Aphobetus lecanii* Girault



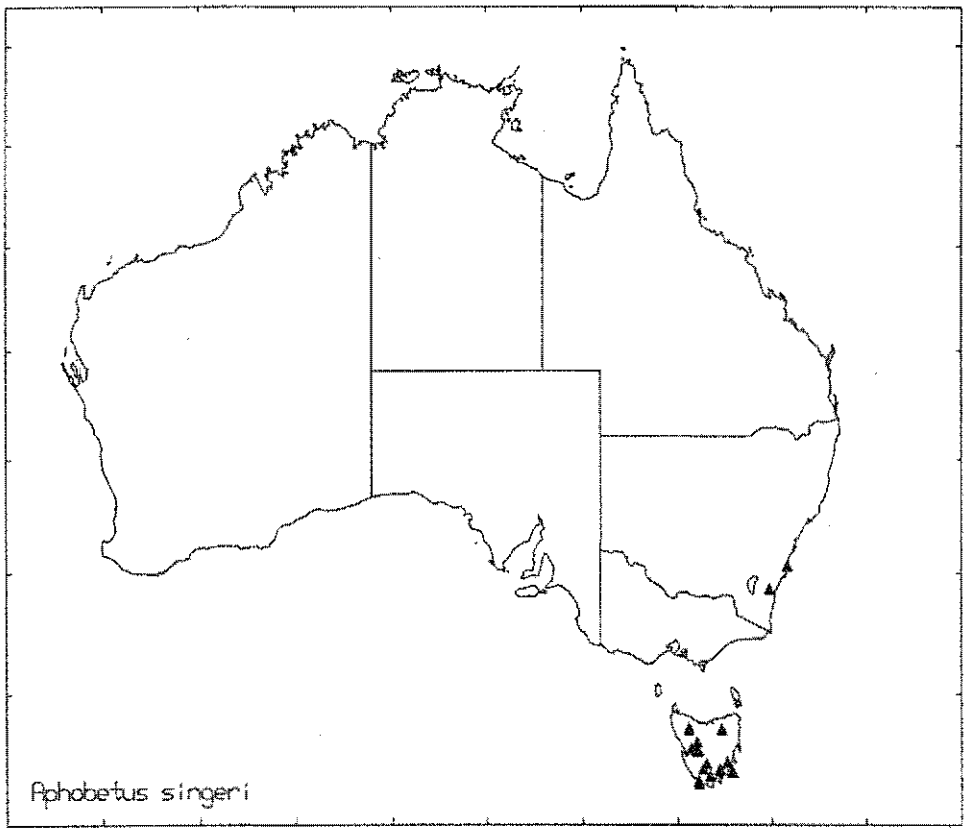
Map 22: *Aphobetus moundi* (Boucek)



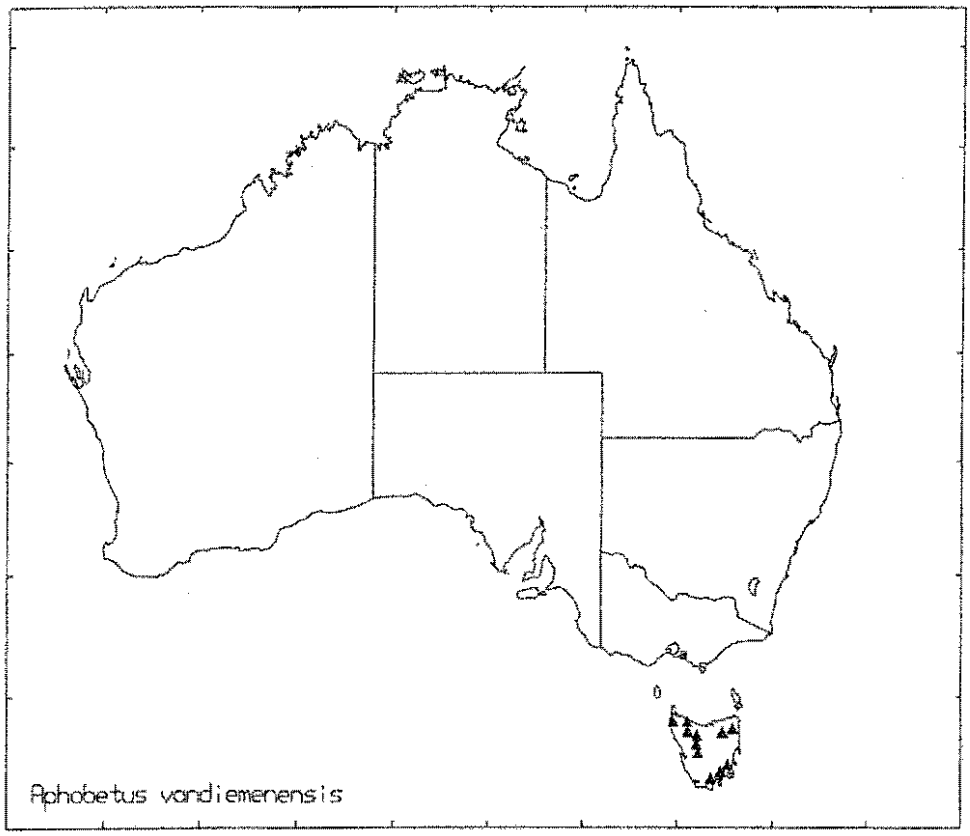
Map 23: *Aphobetus reticulatus* Girault



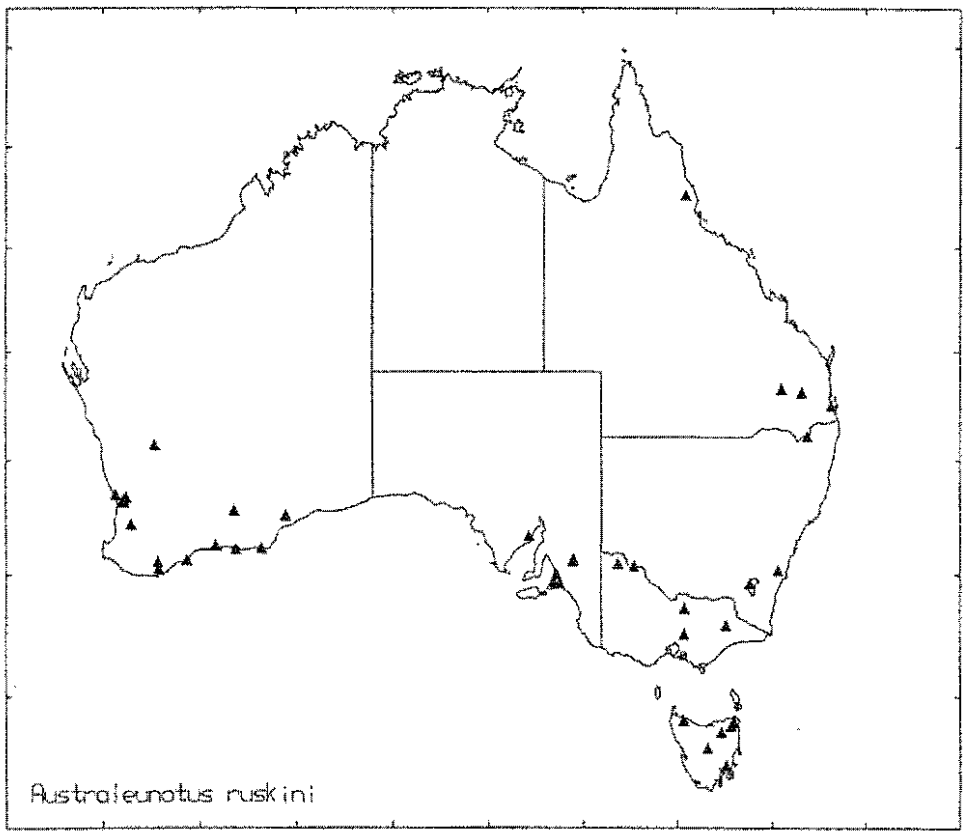
Map 24: *Aphobetus silvifilia* Girault



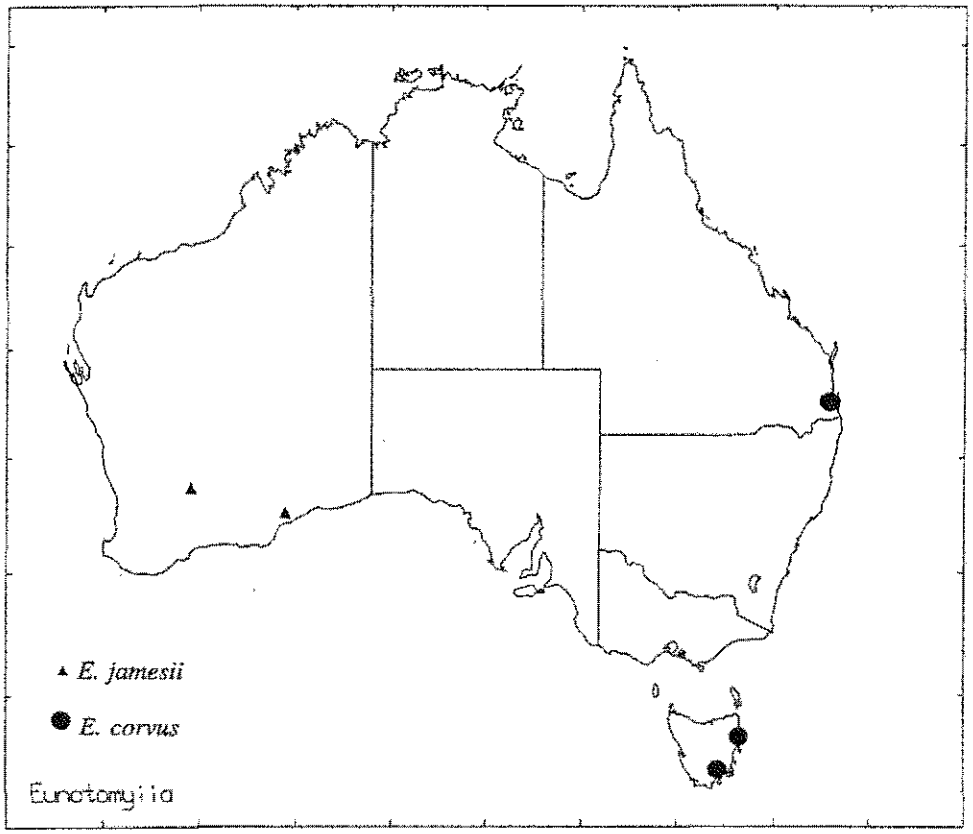
Map 25: *Aphobetus singeri* sp.n.



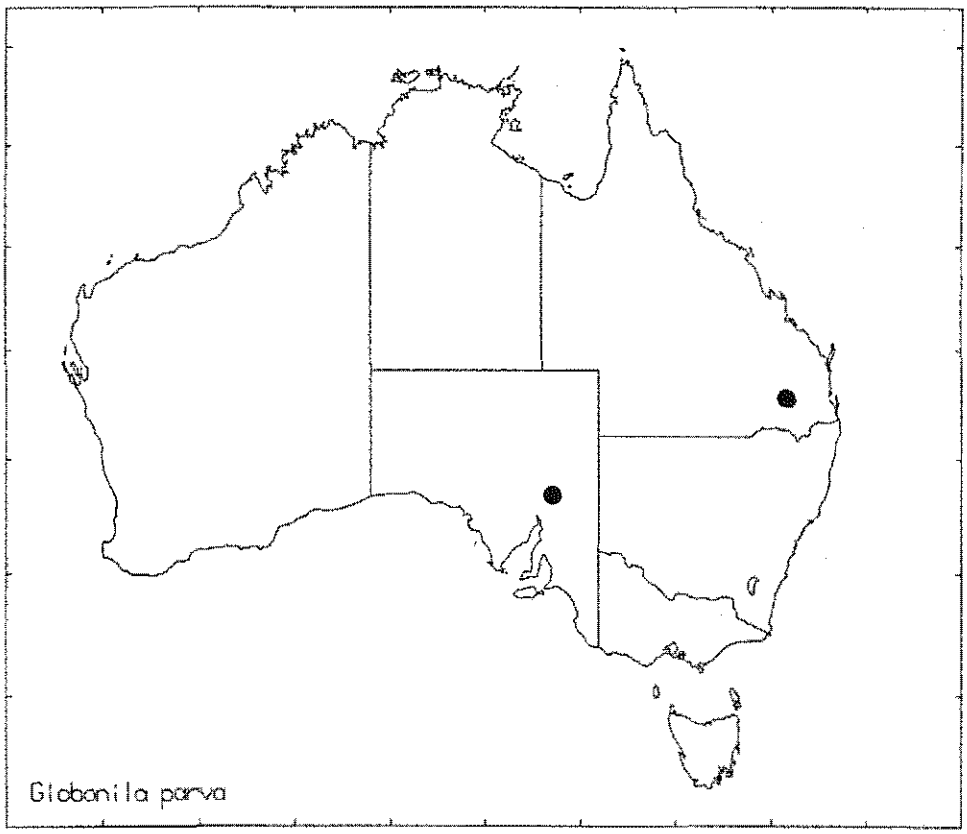
Map 26: *Aphobetus vandiemenensis* sp.n.



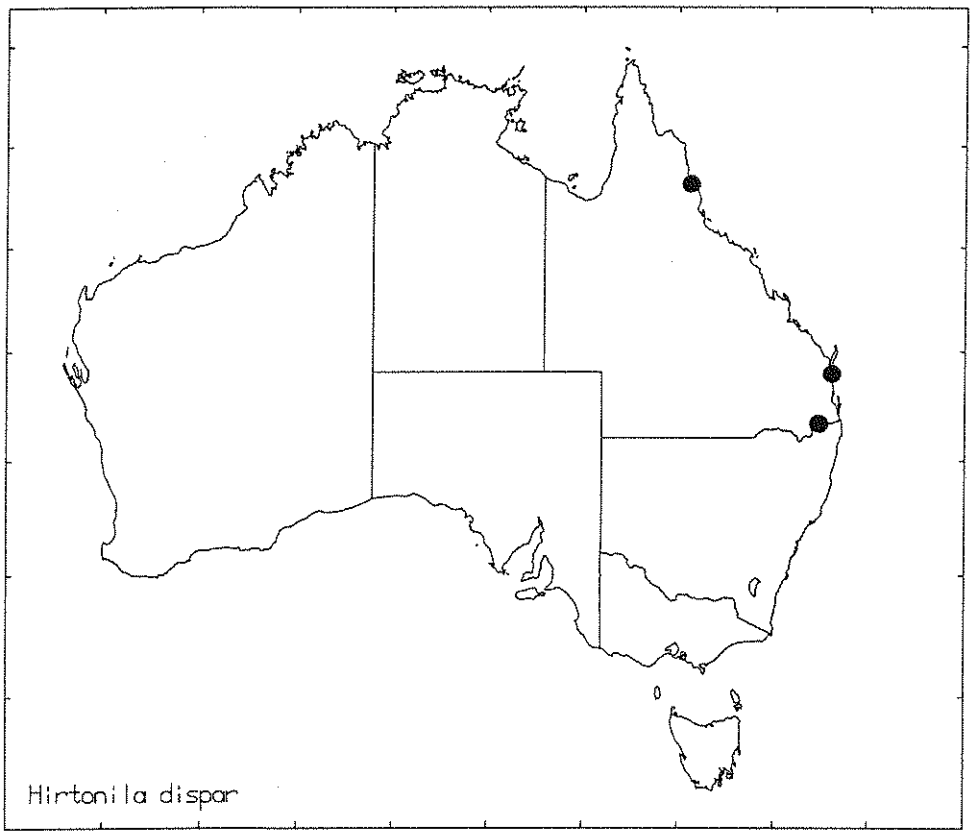
Map 27: *Australeunotus ruskini* Girault



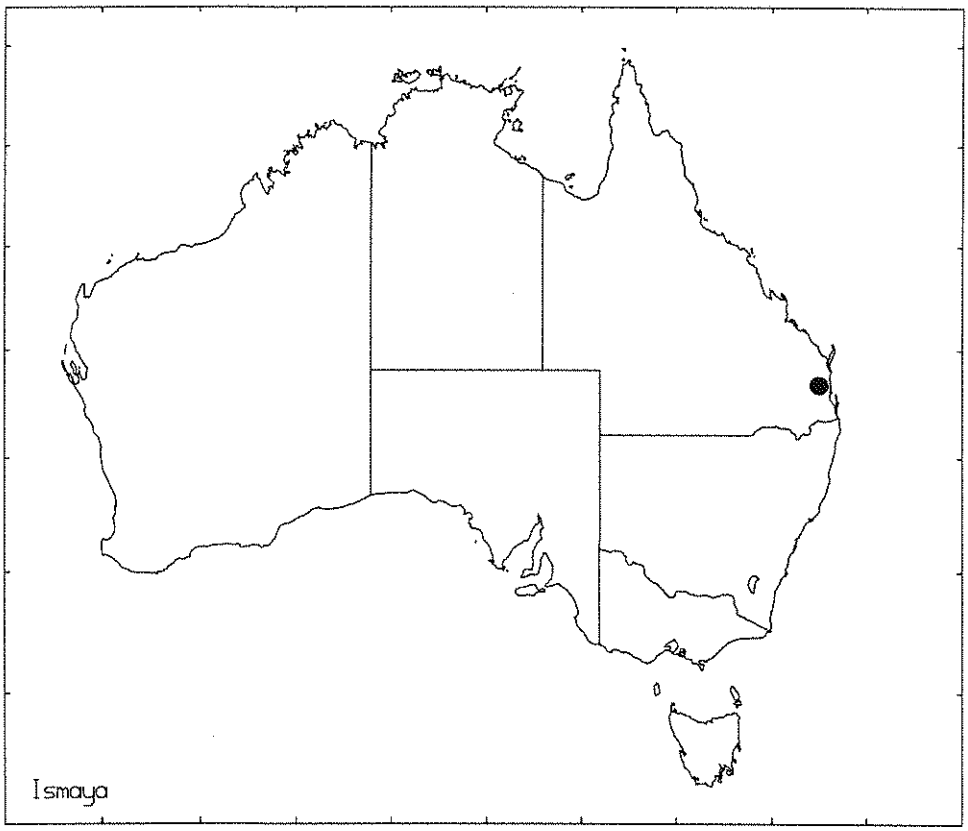
Map 28: *Eunotomyiia* Girault



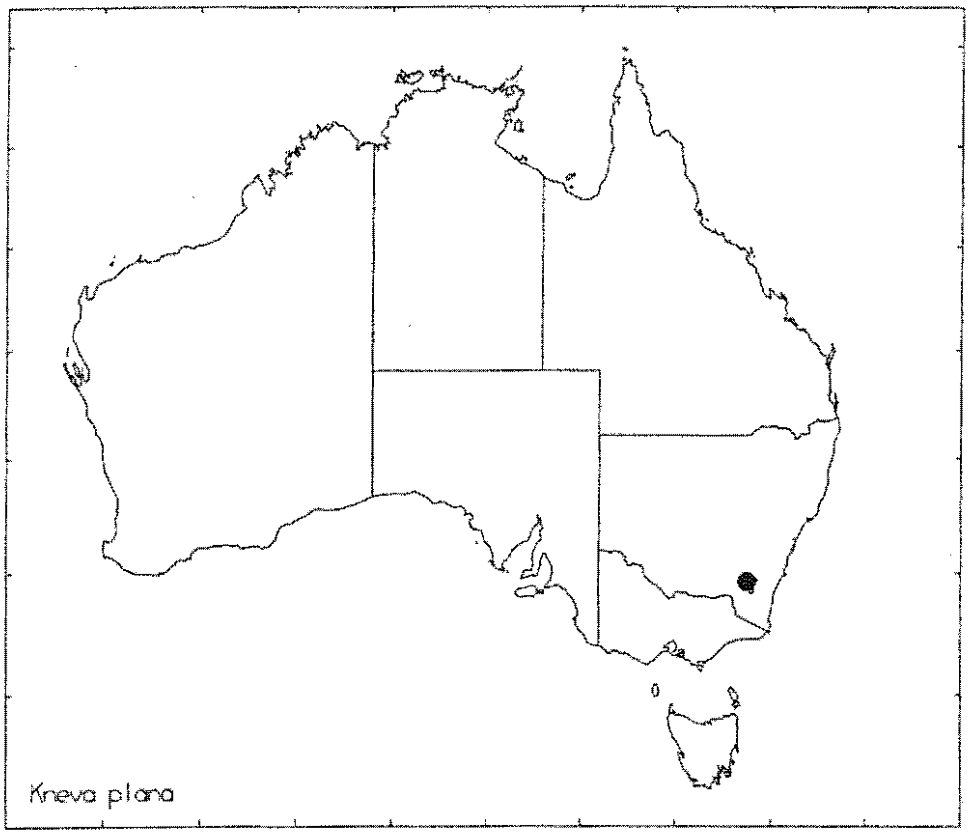
Map 29: *Globonila parva* Boucek



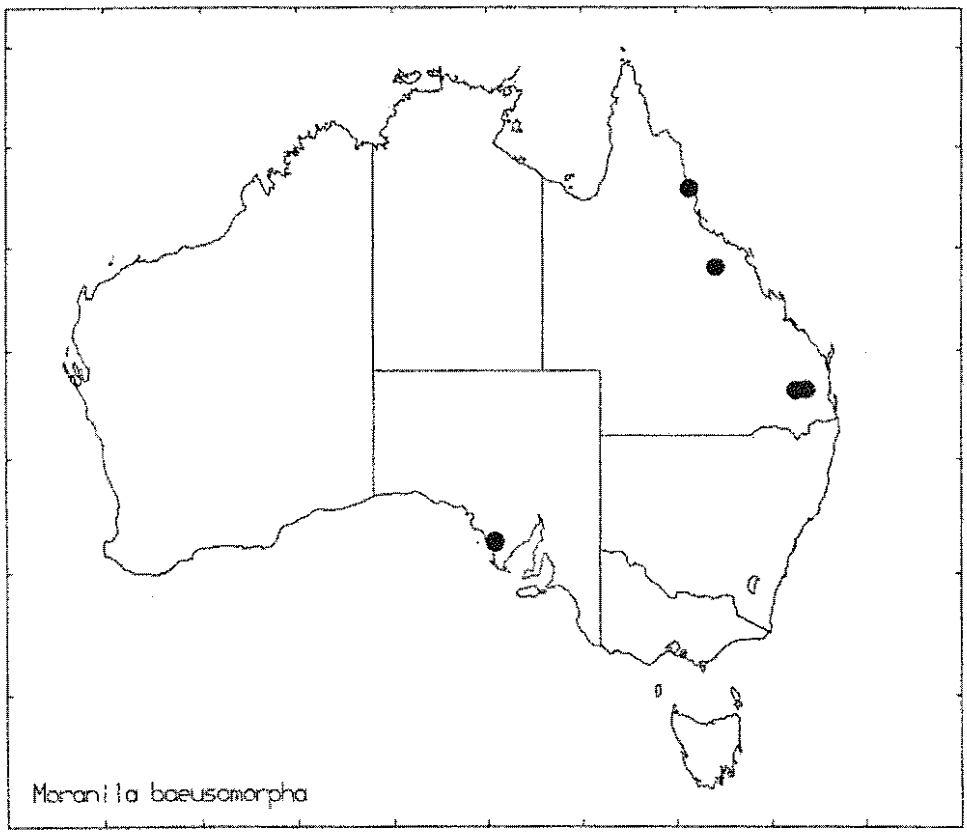
Map 30: *Hirtonila dispar* Boucek



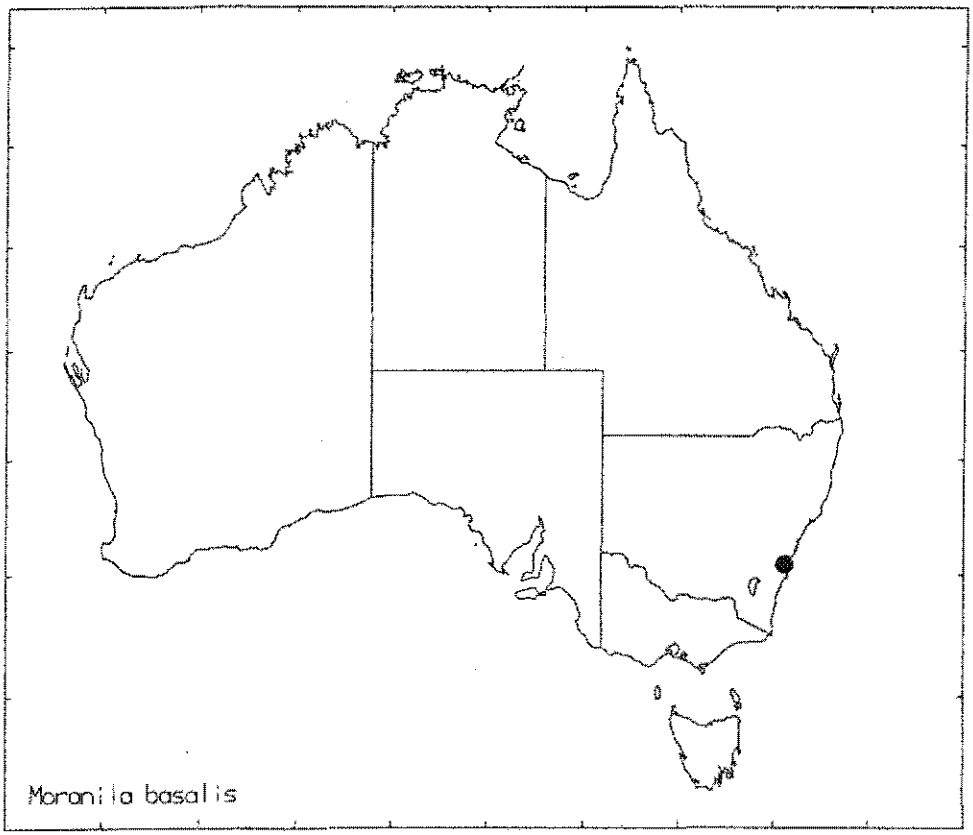
Map 31: *Ismaya* Boucek



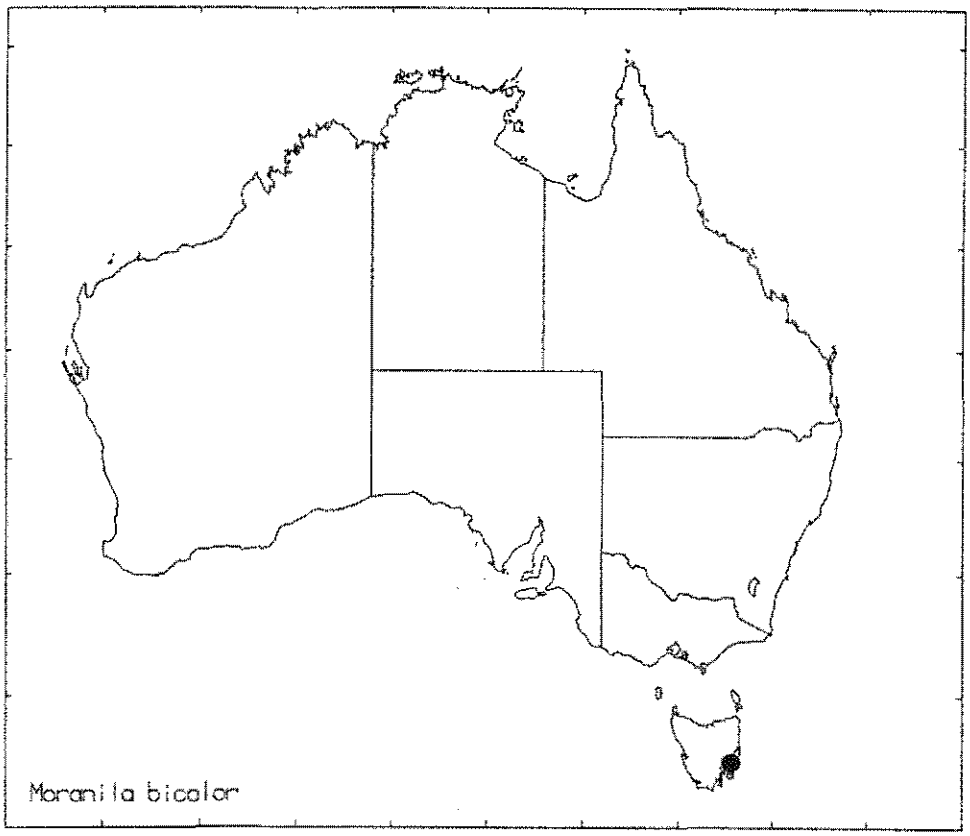
Map 32: *Kneva plana* Boucek



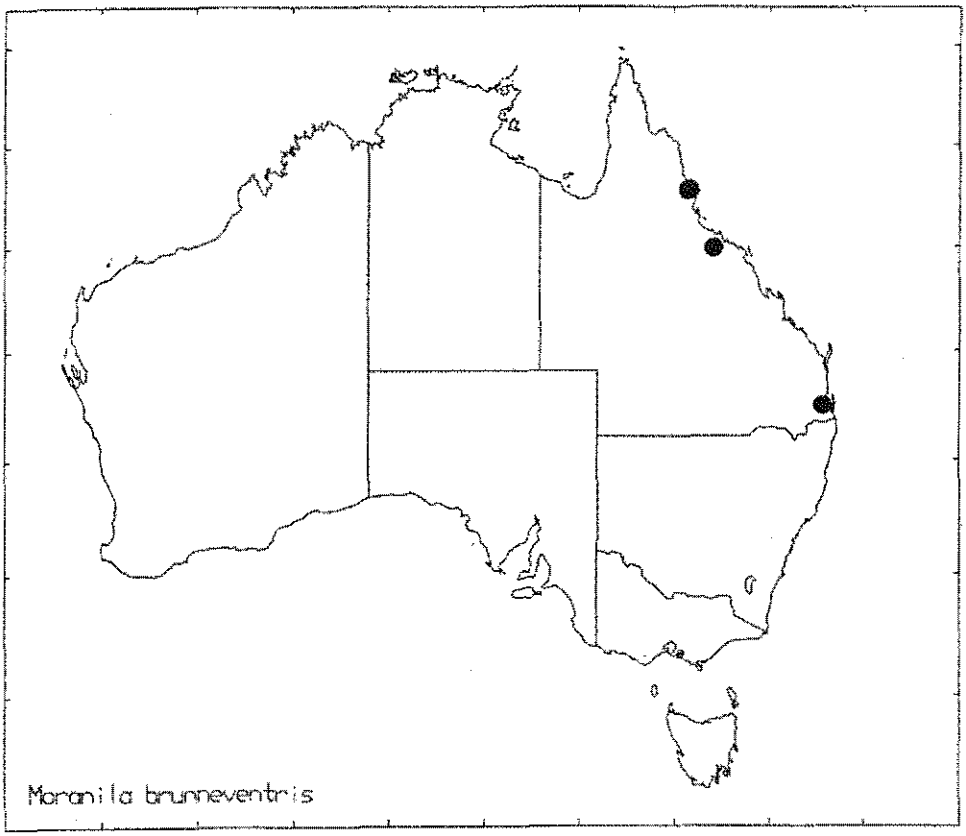
Map 33: *Moranila baeusomorpha* (Girault)



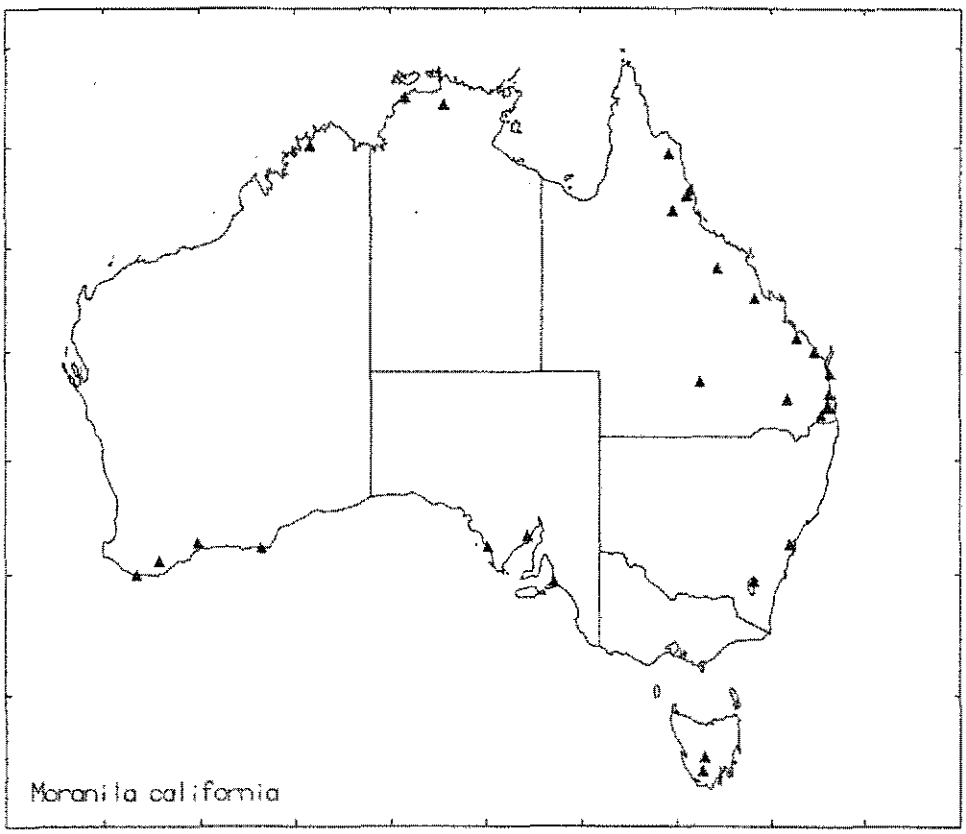
Map 34: *Moranila basalis* sp.n.



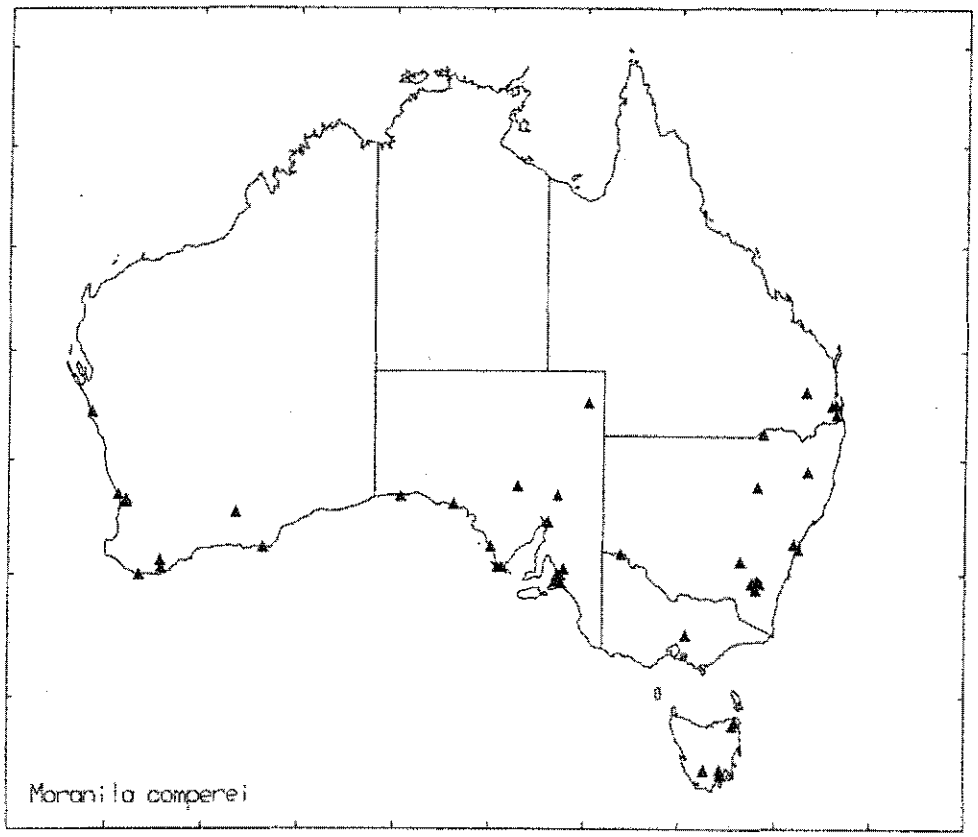
Map 35: *Moranila bicolor* sp.n.



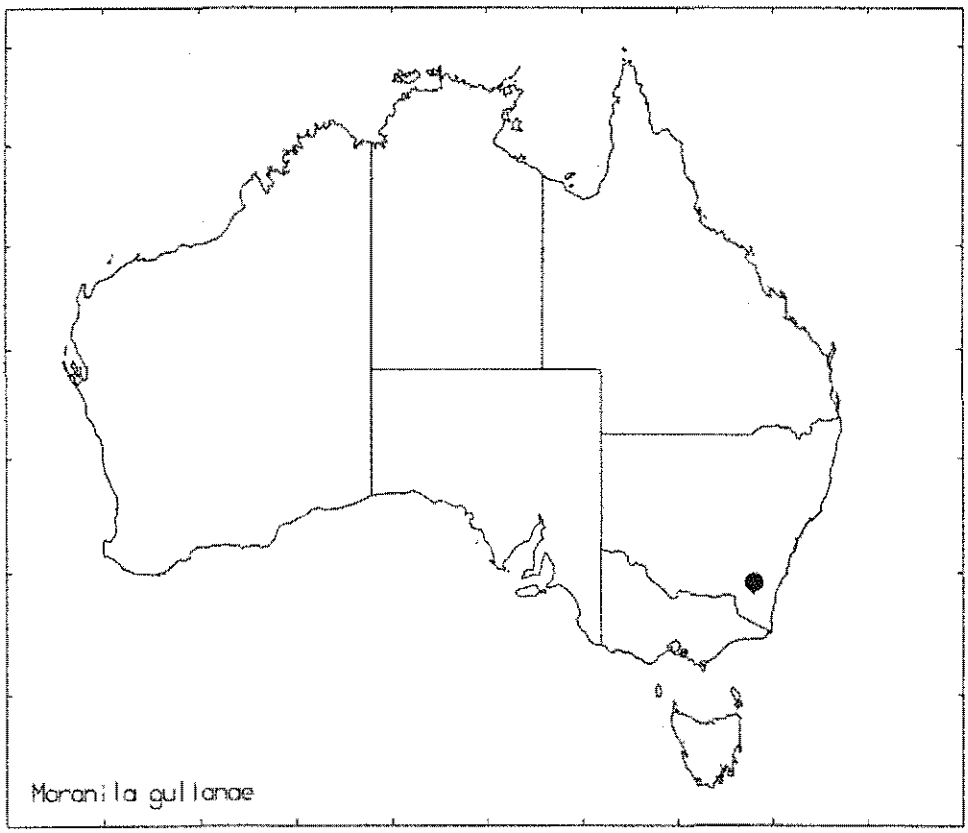
Map 36: *Moranila brunneventris* (Girault)



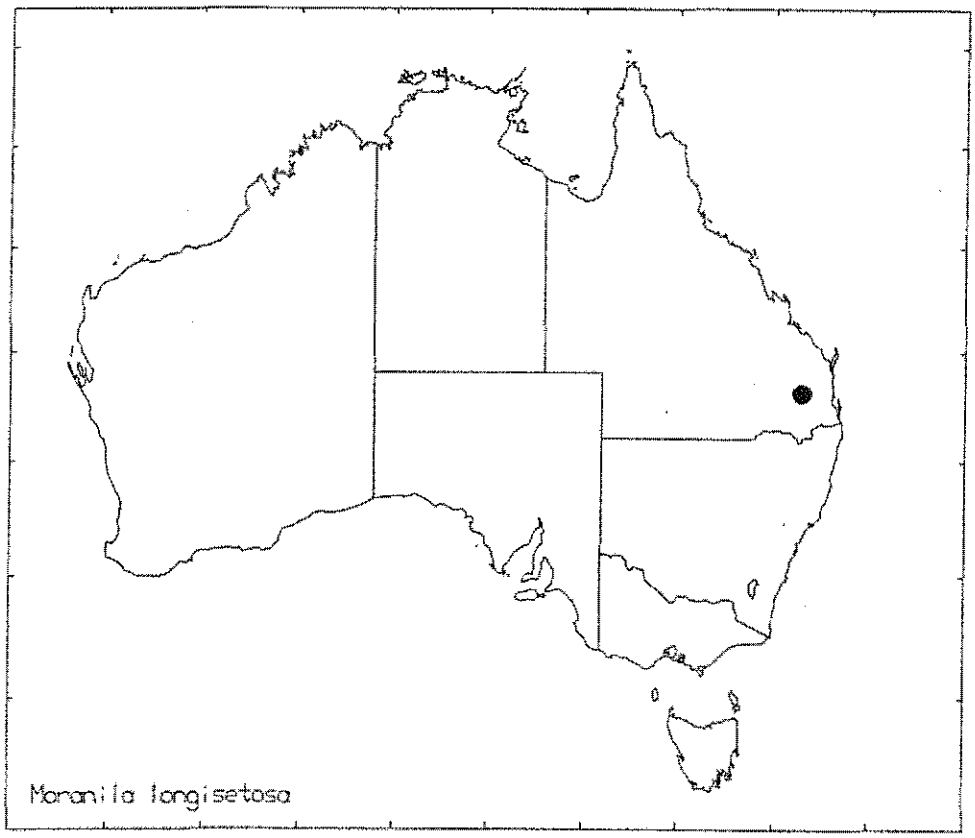
Map 37: *Moranila californica* (Howard)



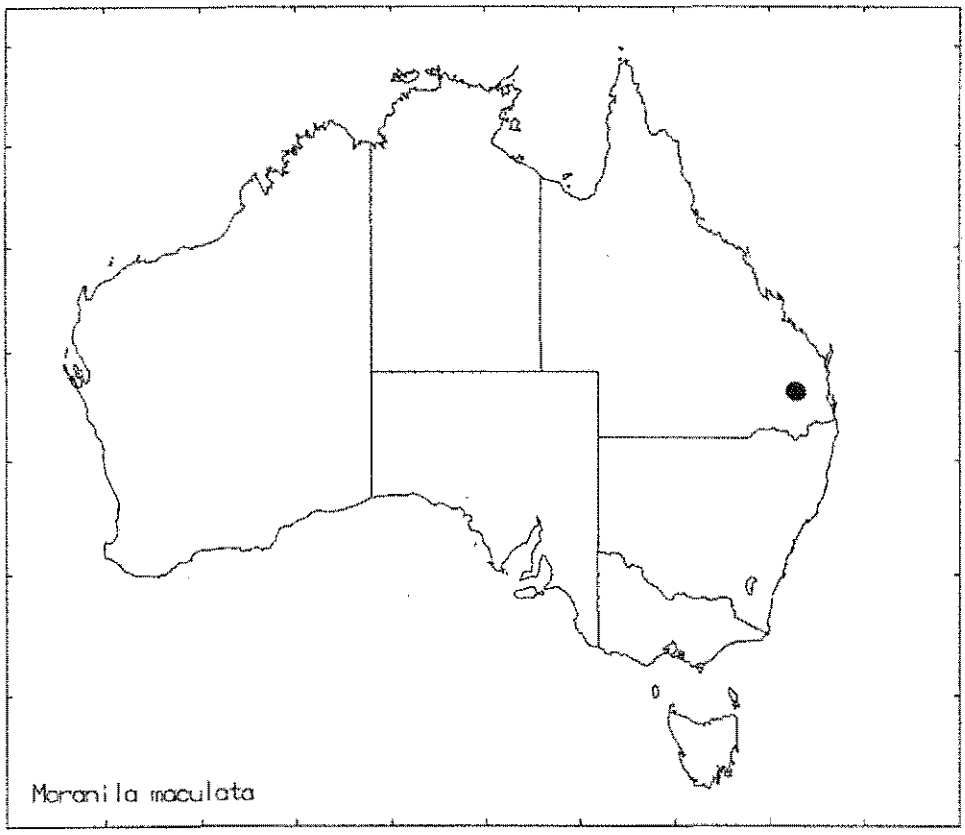
Map 38: *Moranila comperei* (Ashmead)



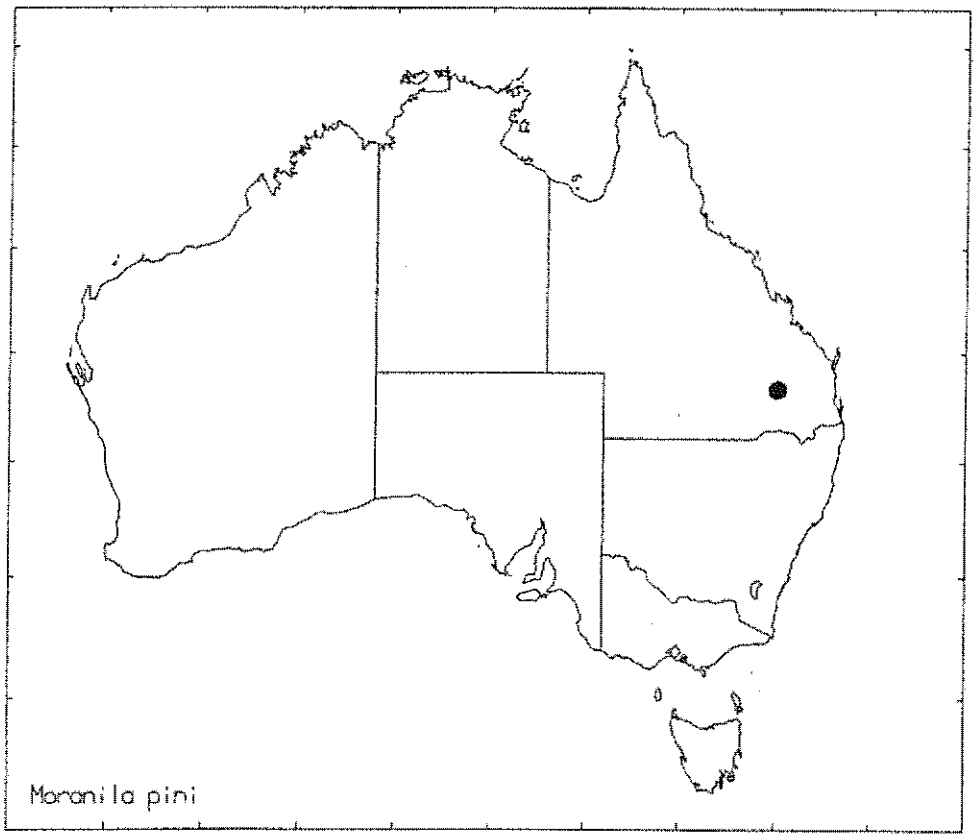
Map 39: *Moranila gullanae* sp.n.



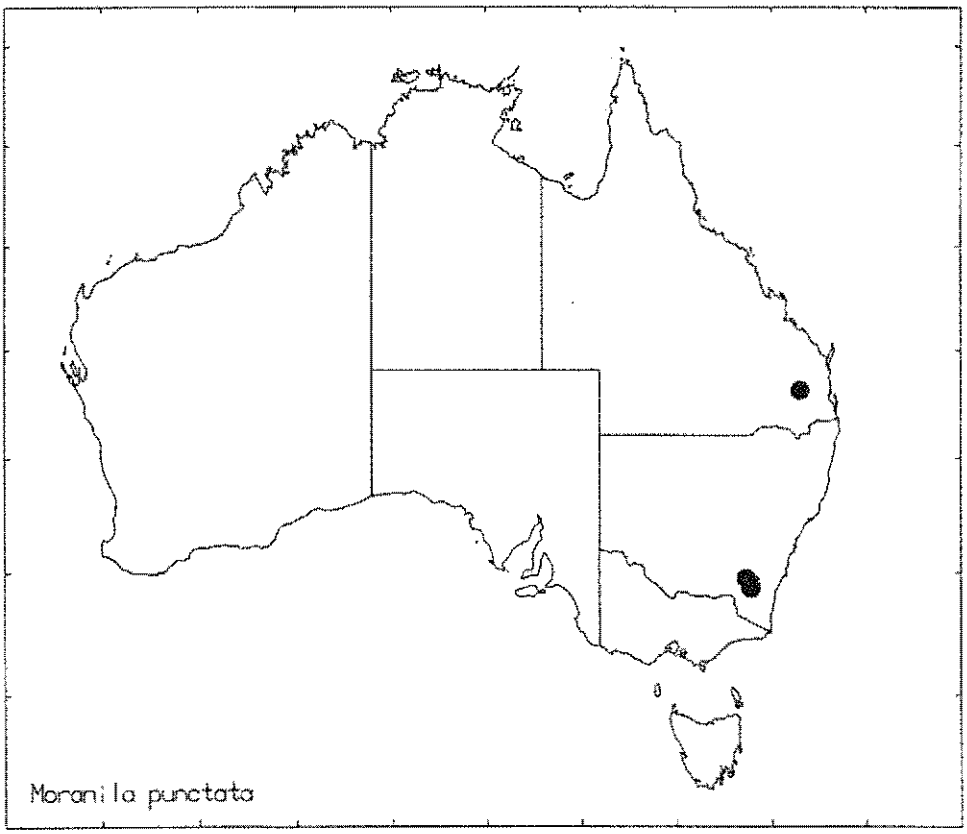
Map 40: *Moranila longisetosa* sp.n.



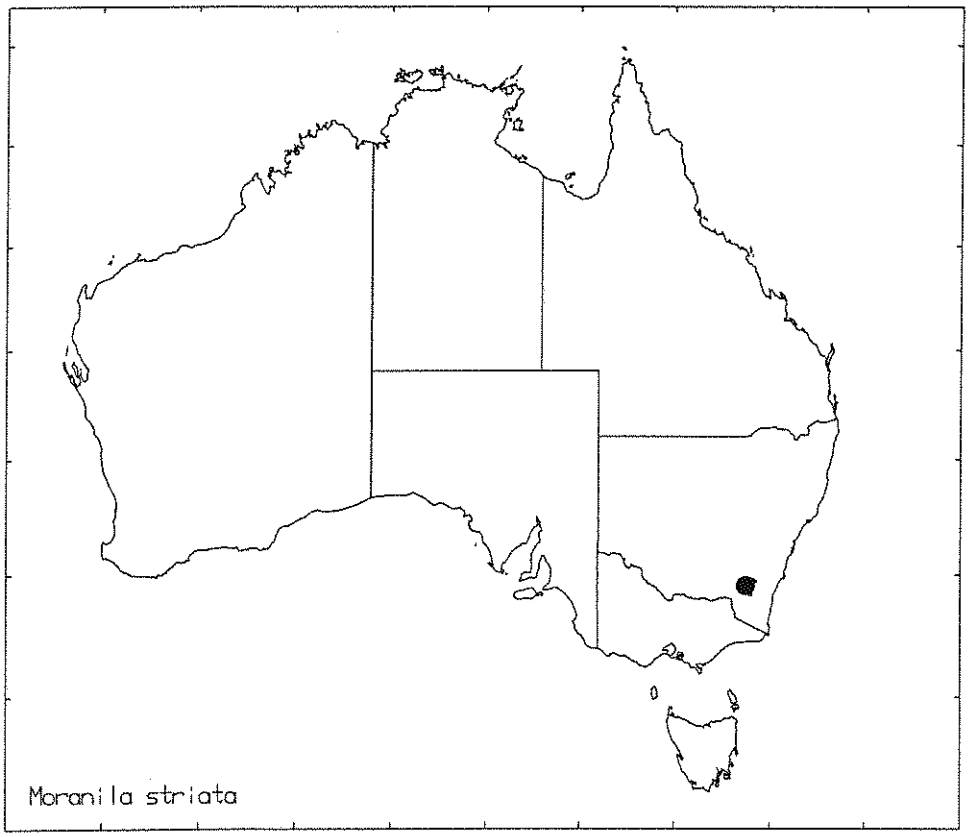
Map 41: *Moranila maculata* sp.n.



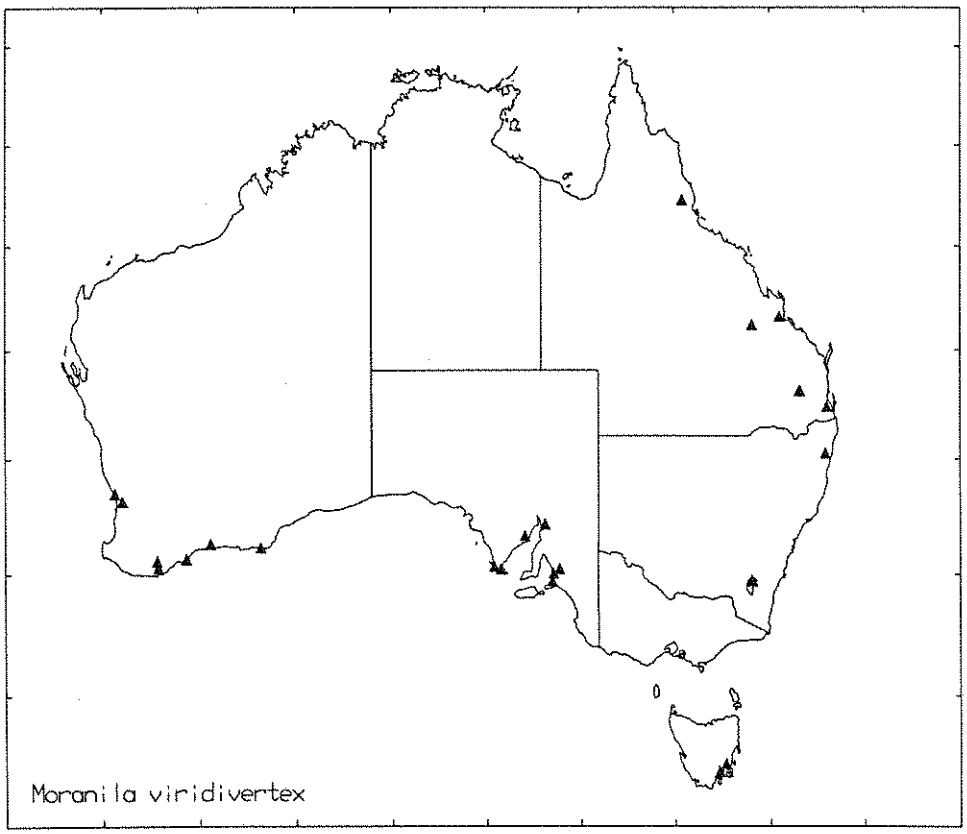
Map 42: *Moranila pini* sp.n.



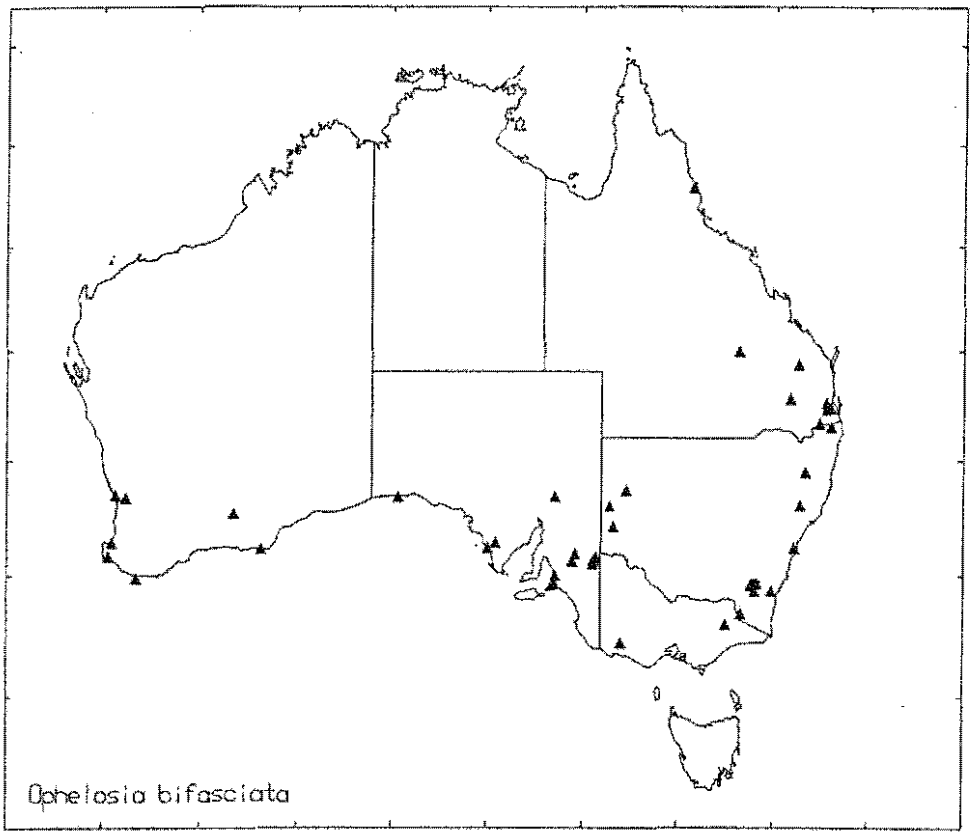
Map 43: *Moranila punctata* sp.n.



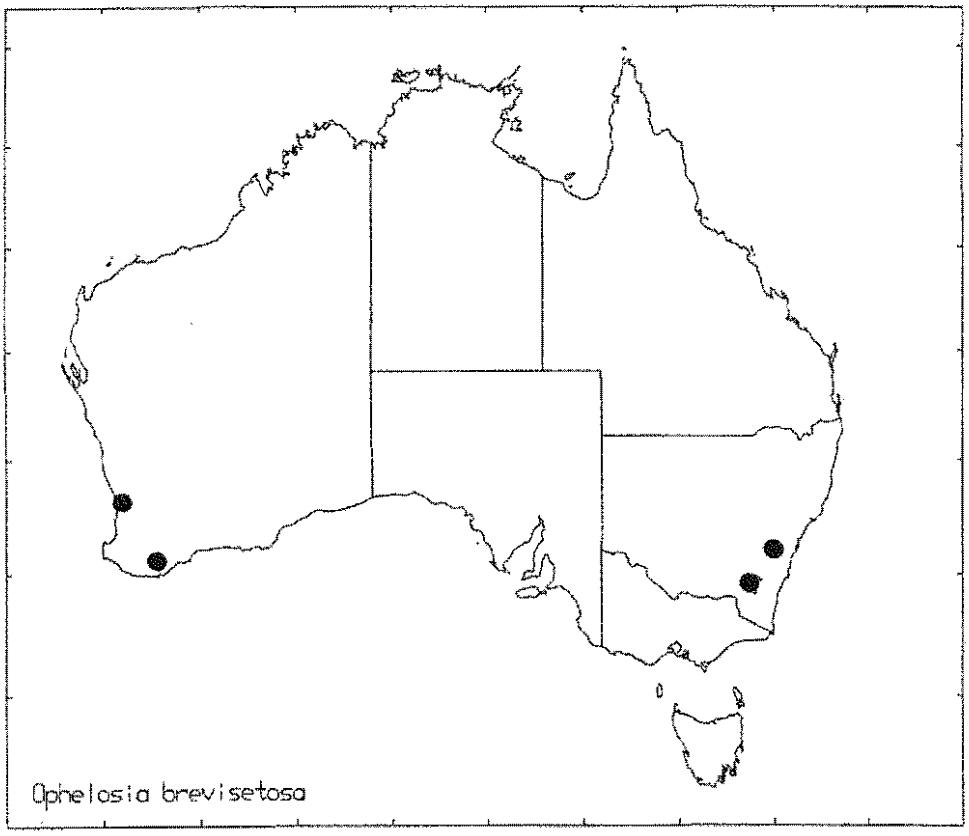
Map 44: *Moranila striata* sp.n.



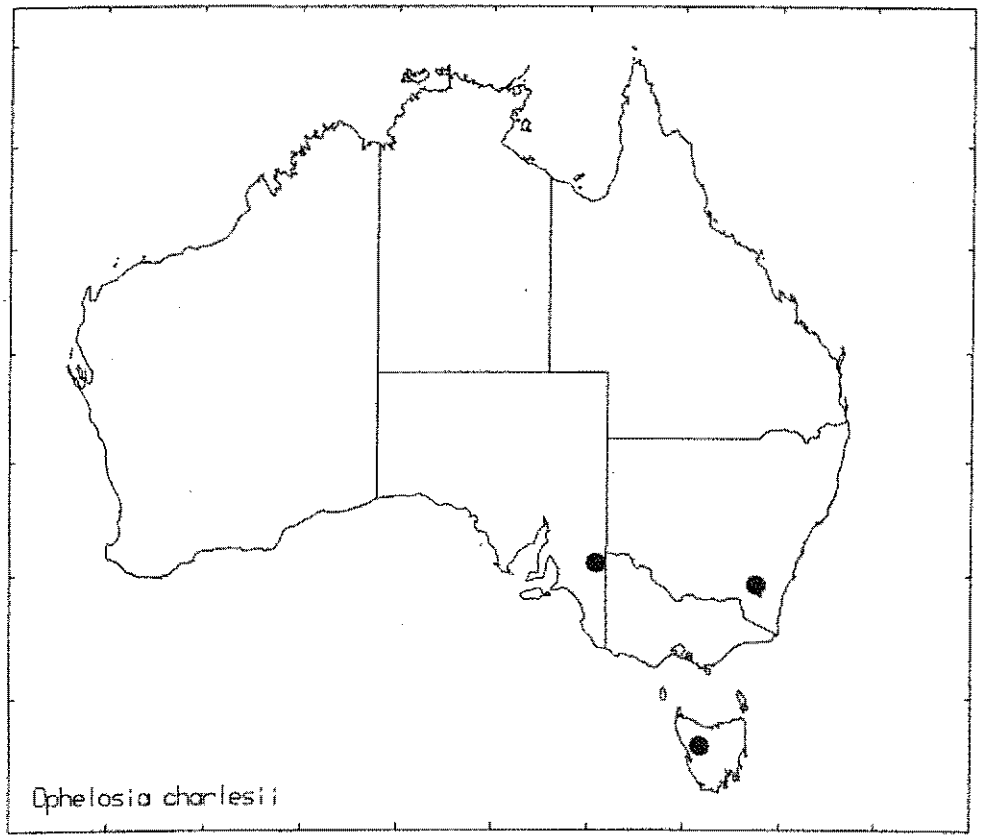
Map 45: *Moranila viridivertex* (Girault)



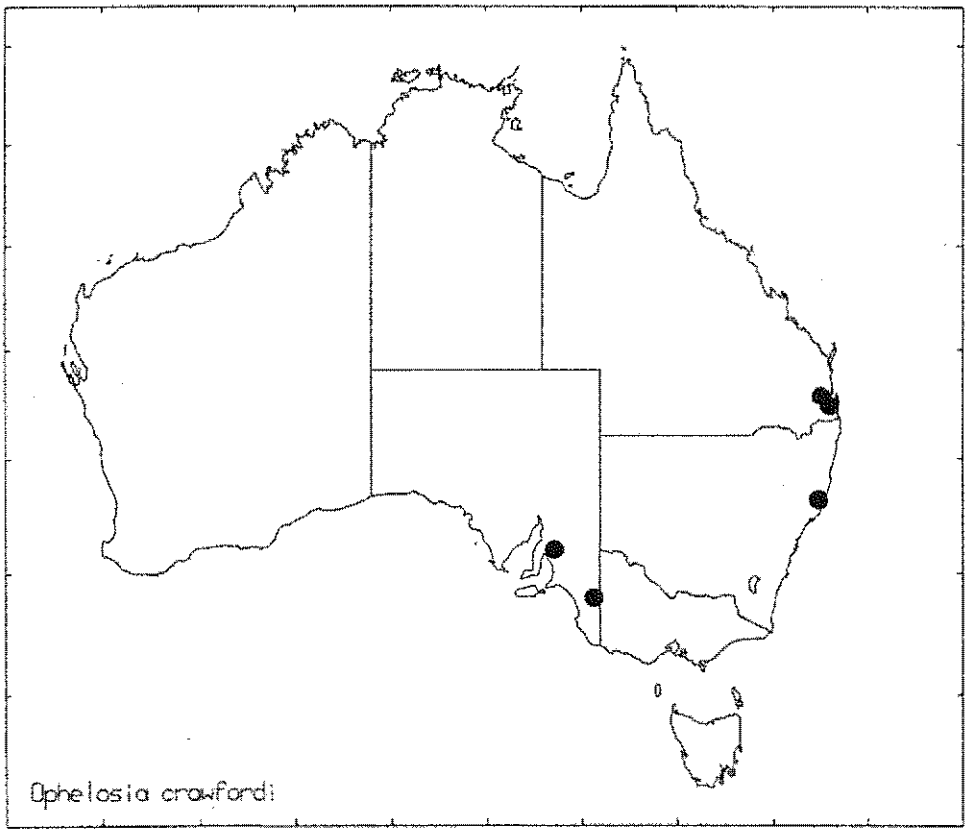
Map 46: *Ophelosia bifasciata* Girault



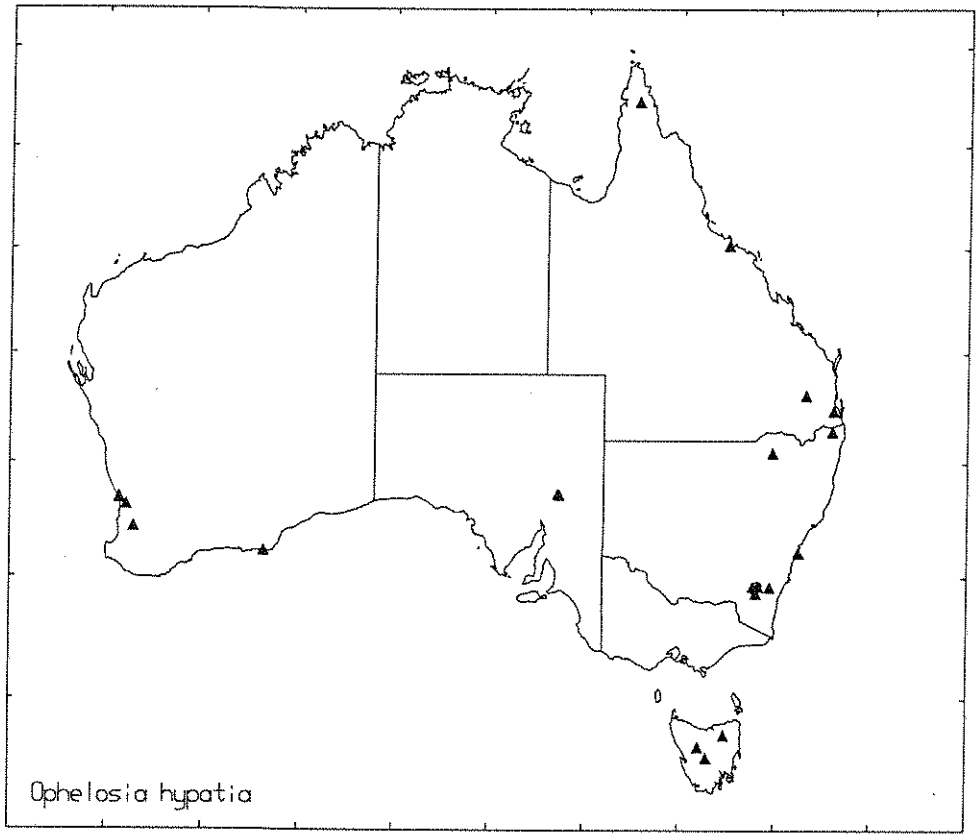
Map 47: *Ophelosia brevisetosa* sp.n.



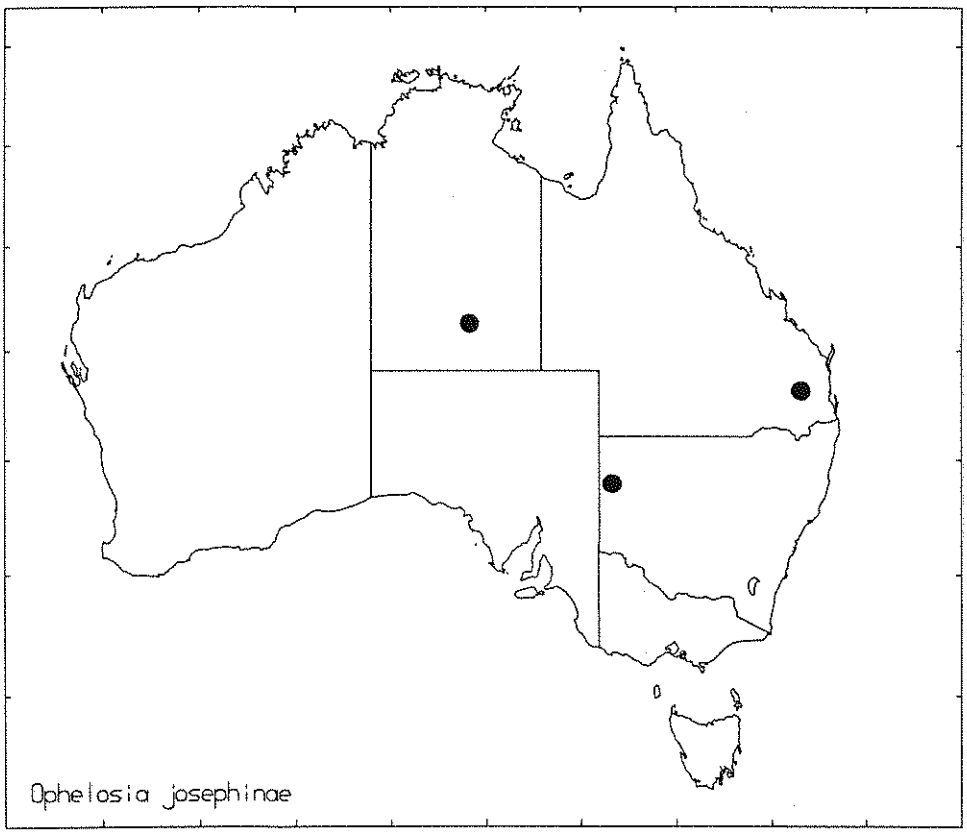
Map 48: *Ophelosia charlesii* sp.n.



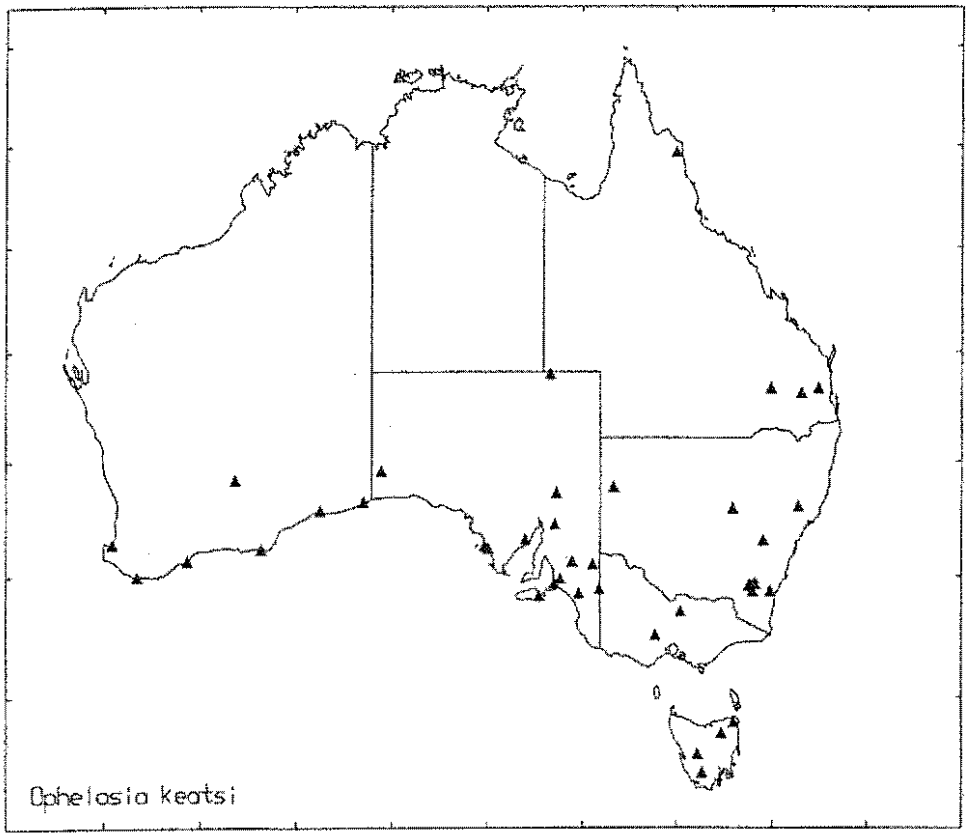
Map 49: *Ophelosia crawfordi* Riley



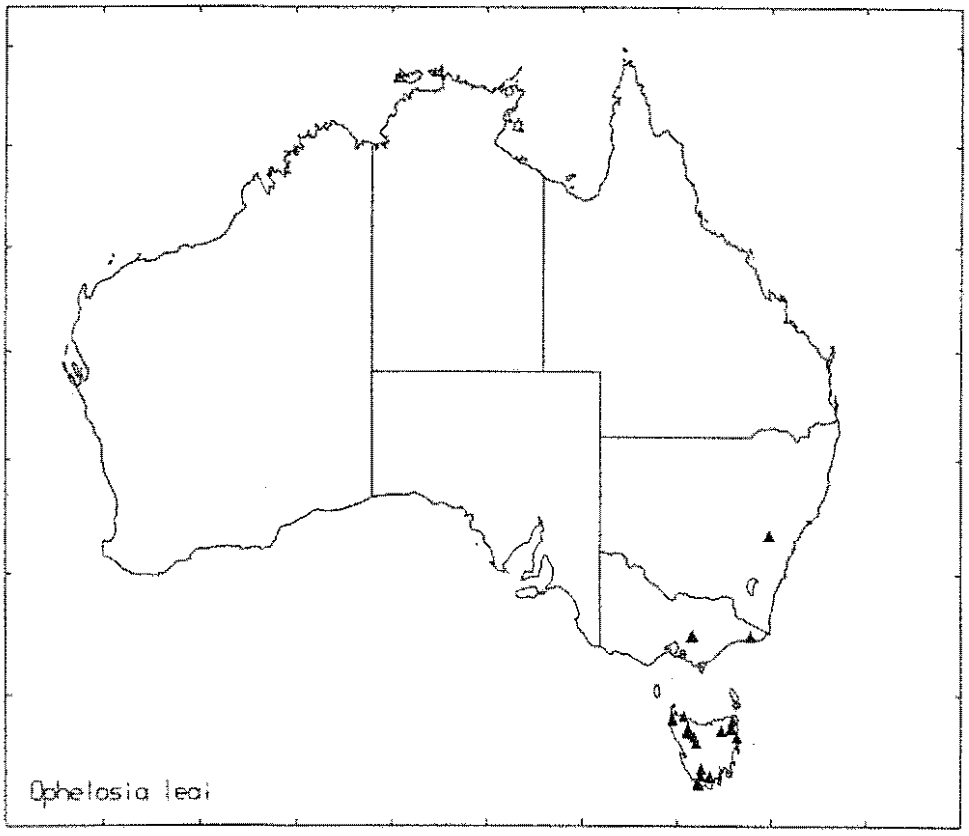
Map 50: *Ophelosia hypatia* Girault



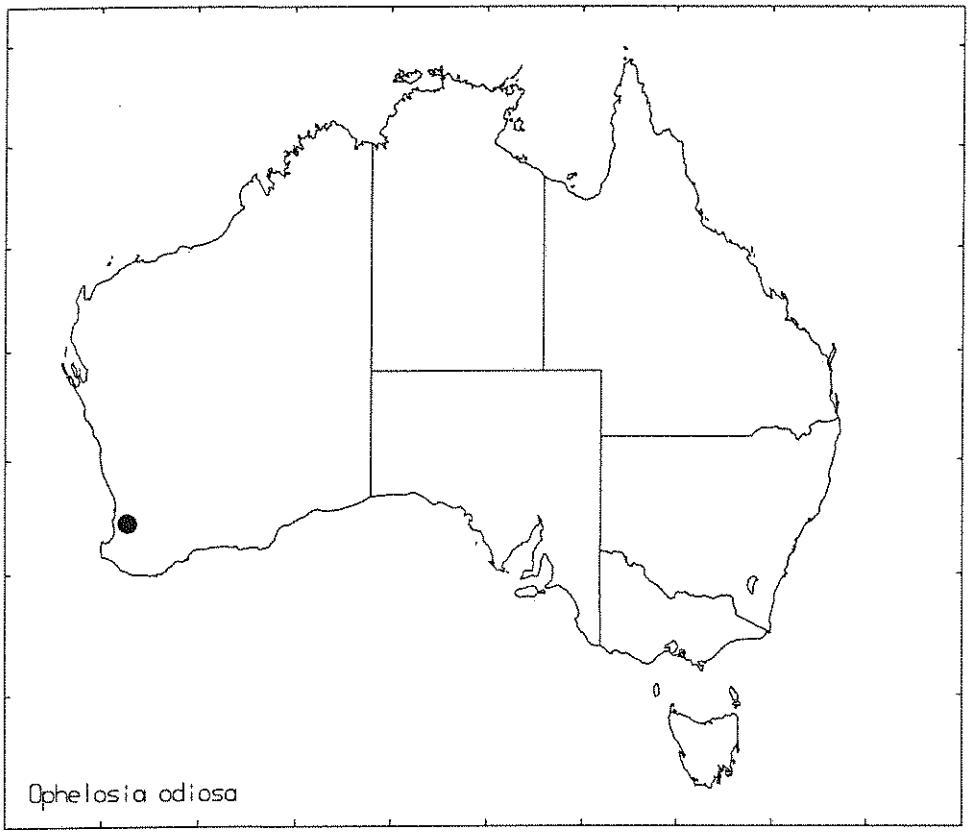
Map 51: *Ophelosia josephinae* sp.n.



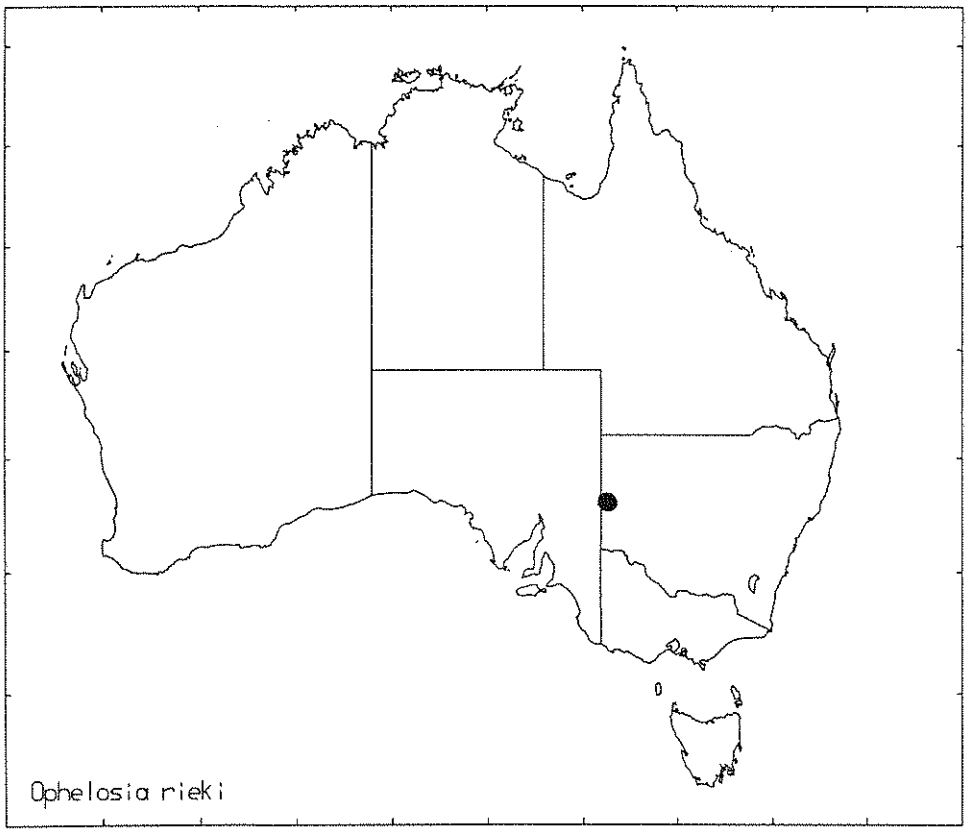
Map 52: *Ophelosia keatsi* Girault



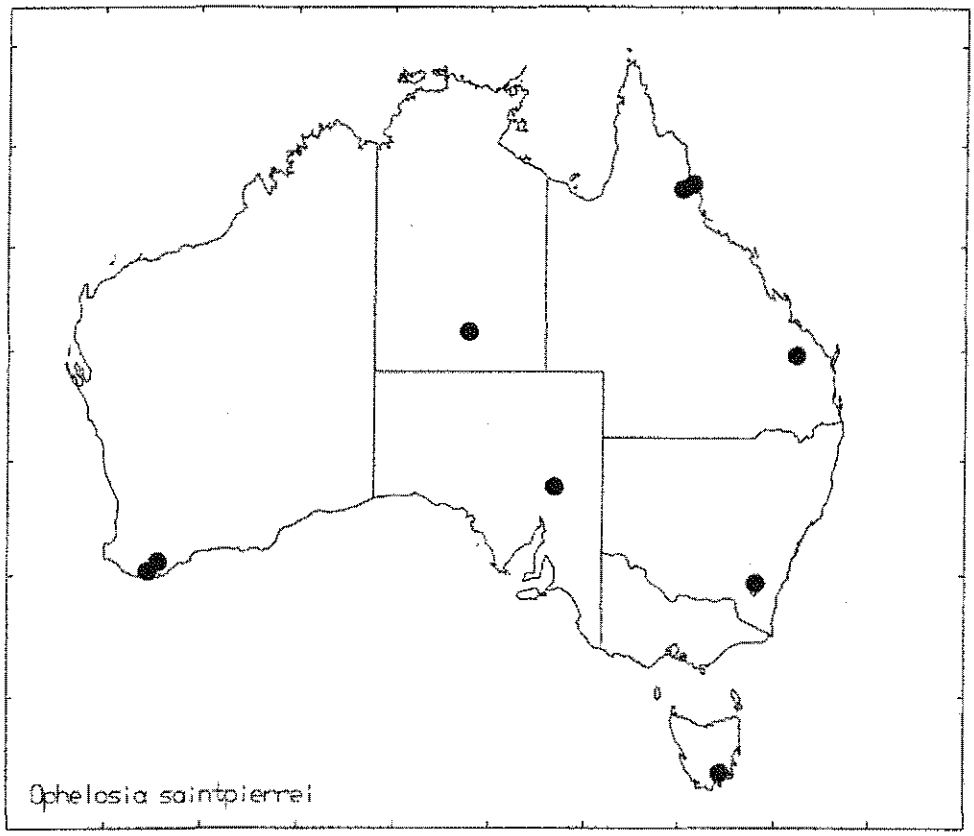
Map 53: *Ophelosia leai* Dodd



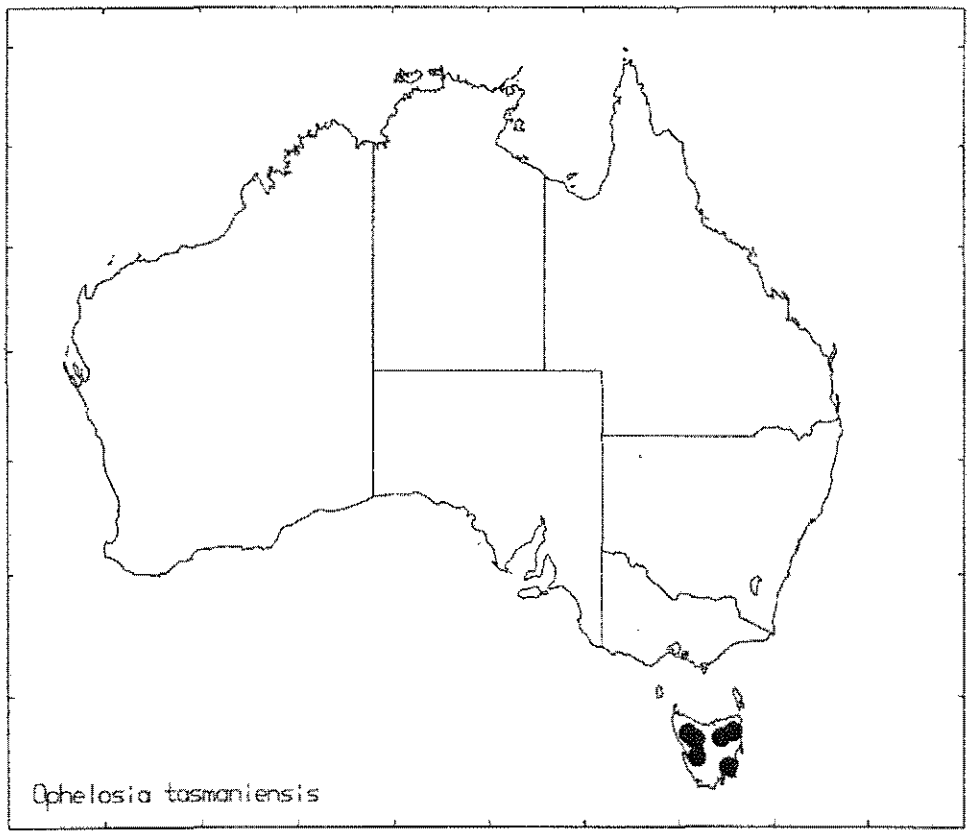
Map 54: *Ophelosia odiosa* sp.n.



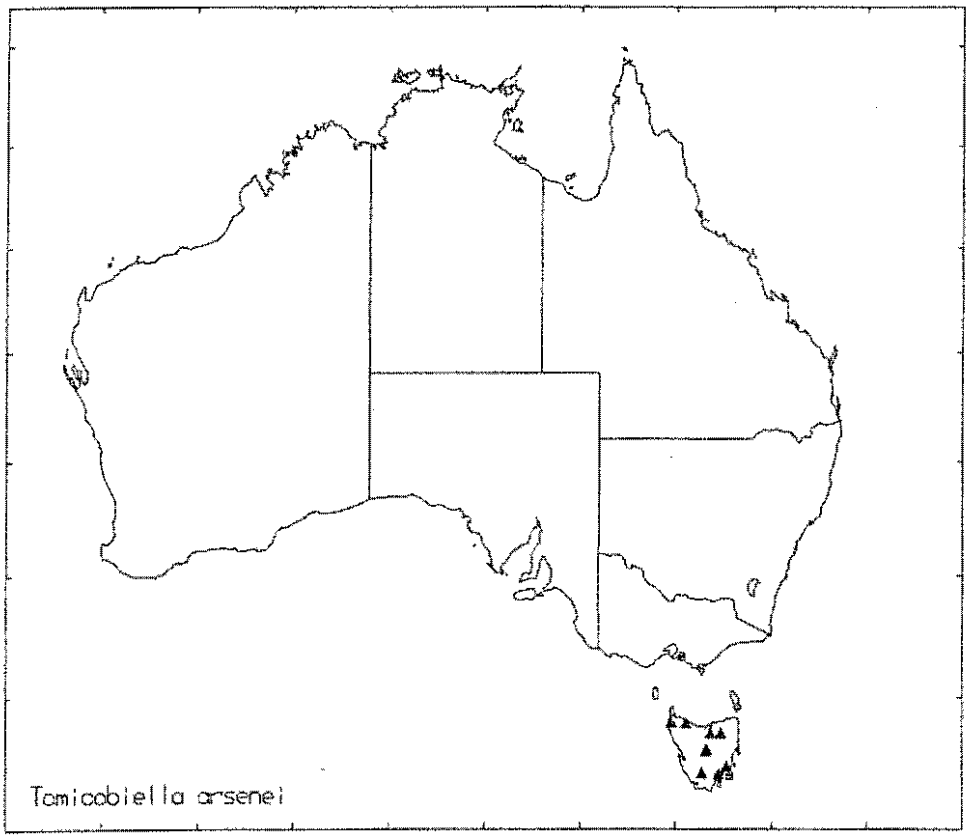
Map 55: *Ophelosia rieki* sp.n.



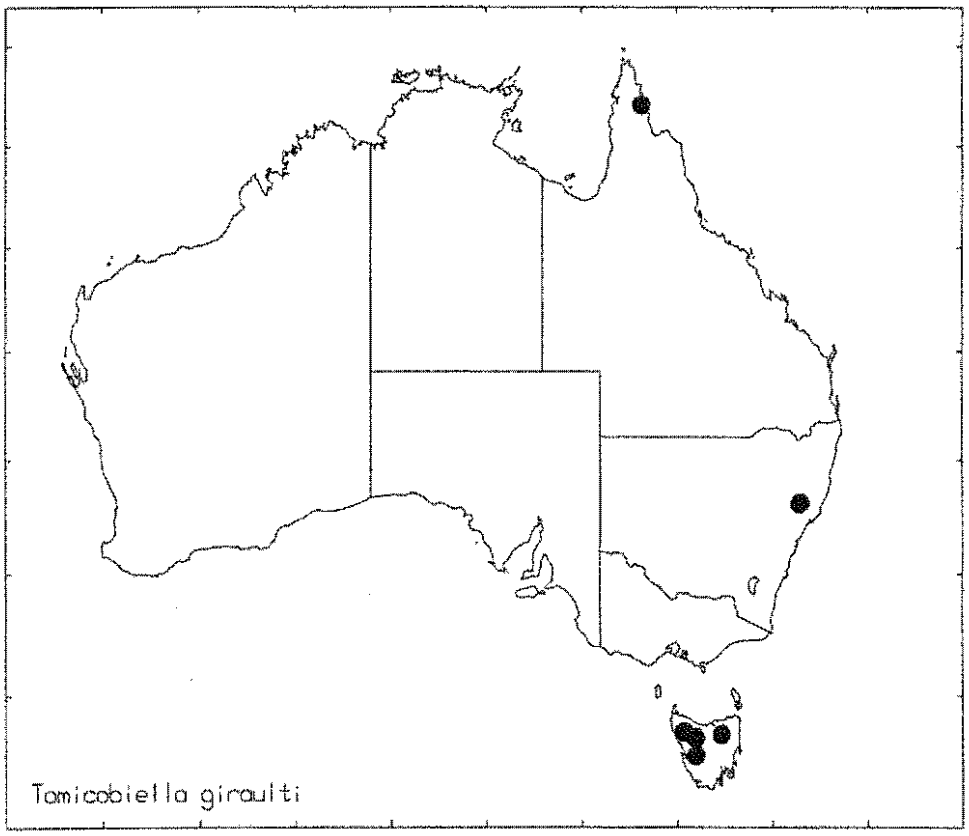
Map 56: *Ophelosia saintpierrei* Girault



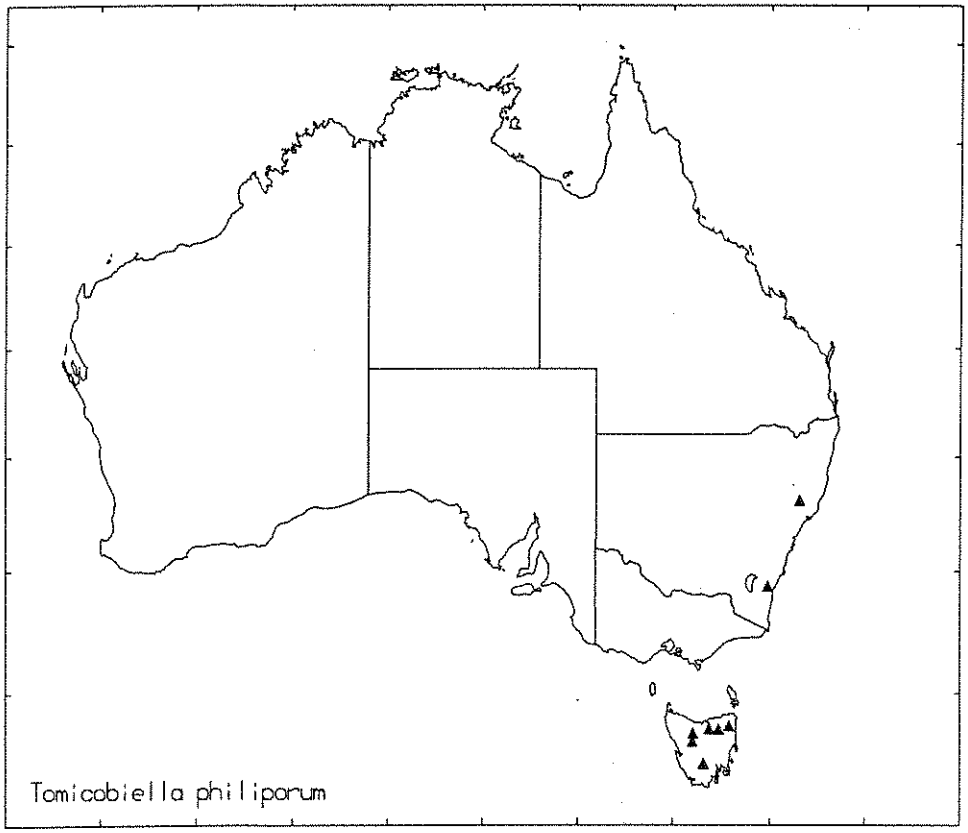
Map 57: *Ophelosia tasmanensis* sp.n.



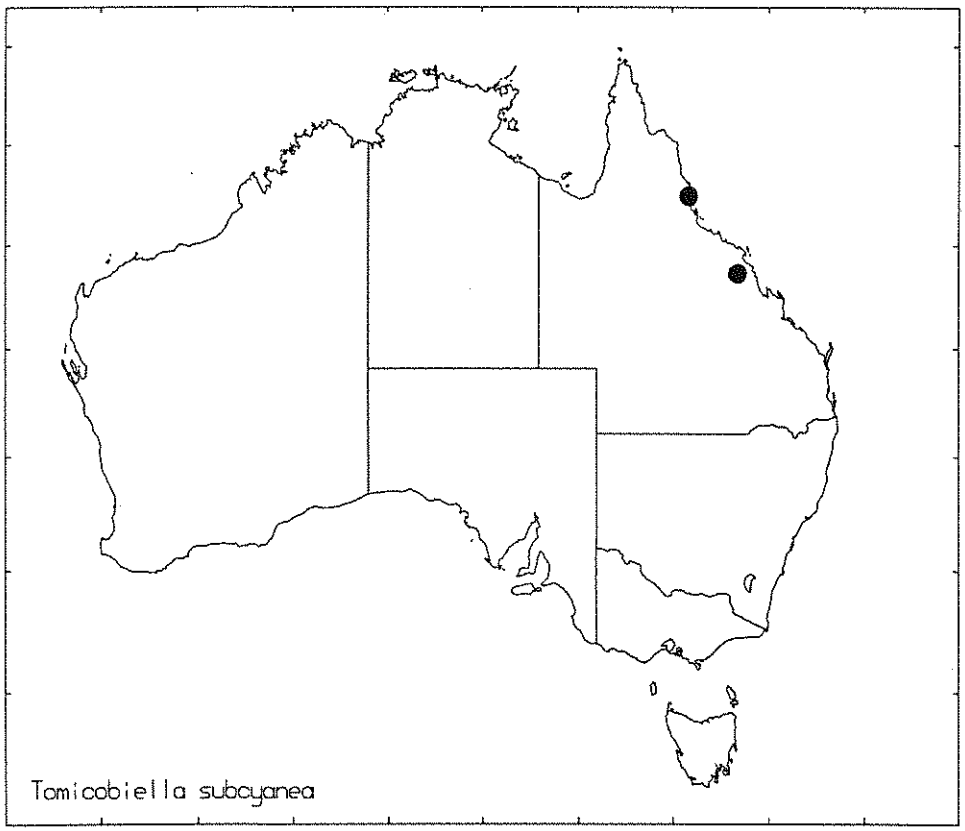
Map 58: *Tomicobiella arsenei* sp.n.



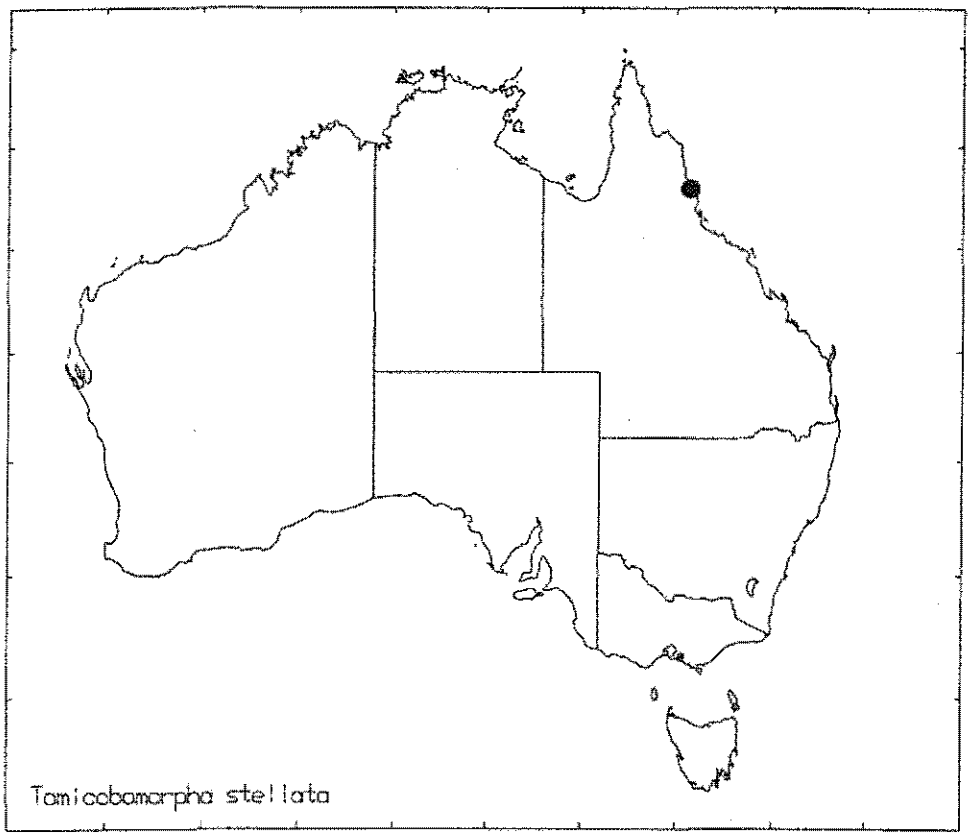
Map 59: *Tomicobiella giraulti* sp.n.



Map 60: *Tomicobiella philiporum* sp.n.



Map 61: *Tomicobiella subcyanea* Girault



Map 62: *Tomicobomorpha stellata* Girault

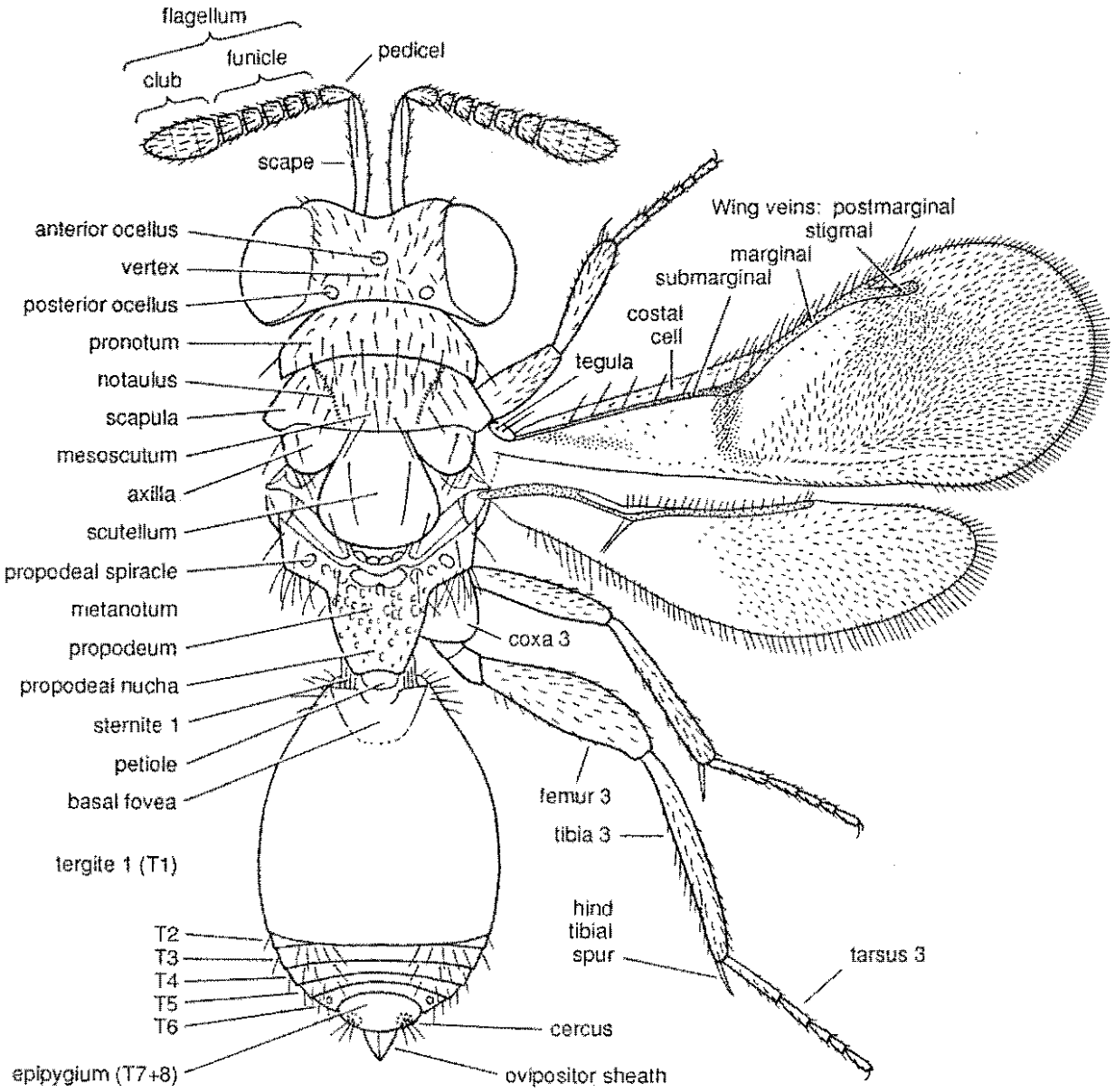


Fig. 2.1 ***Ophelosia charlesii*, sp.n.** Drawing by Desmond Helmore, Manaaki Whenua - Landcare Research.

Fig. 3.3: Width vs length of face in females of Ophelosia bifasciata

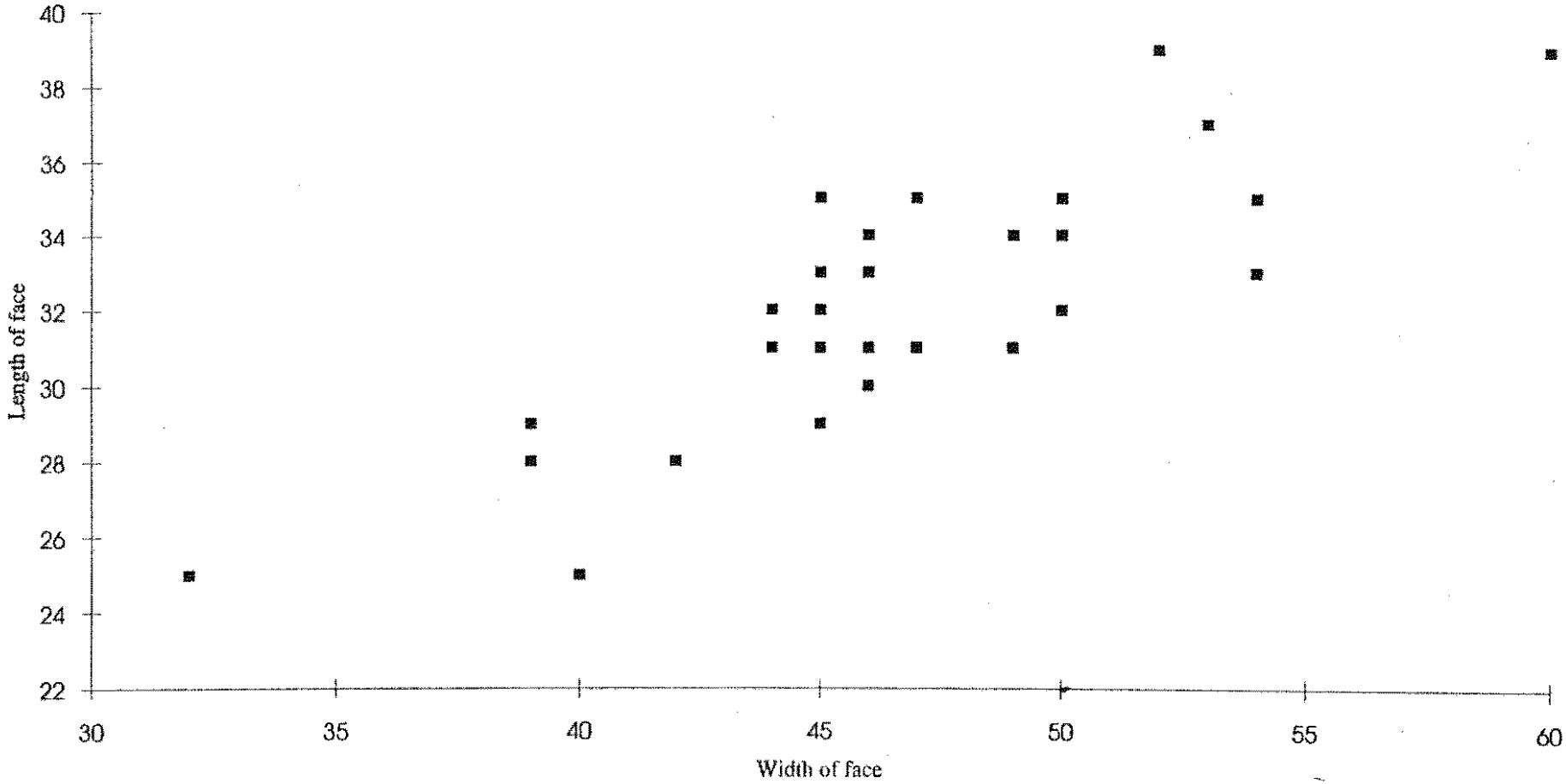


Fig. 3.4: Width vs length of face in males of Ophelosia bifasciata

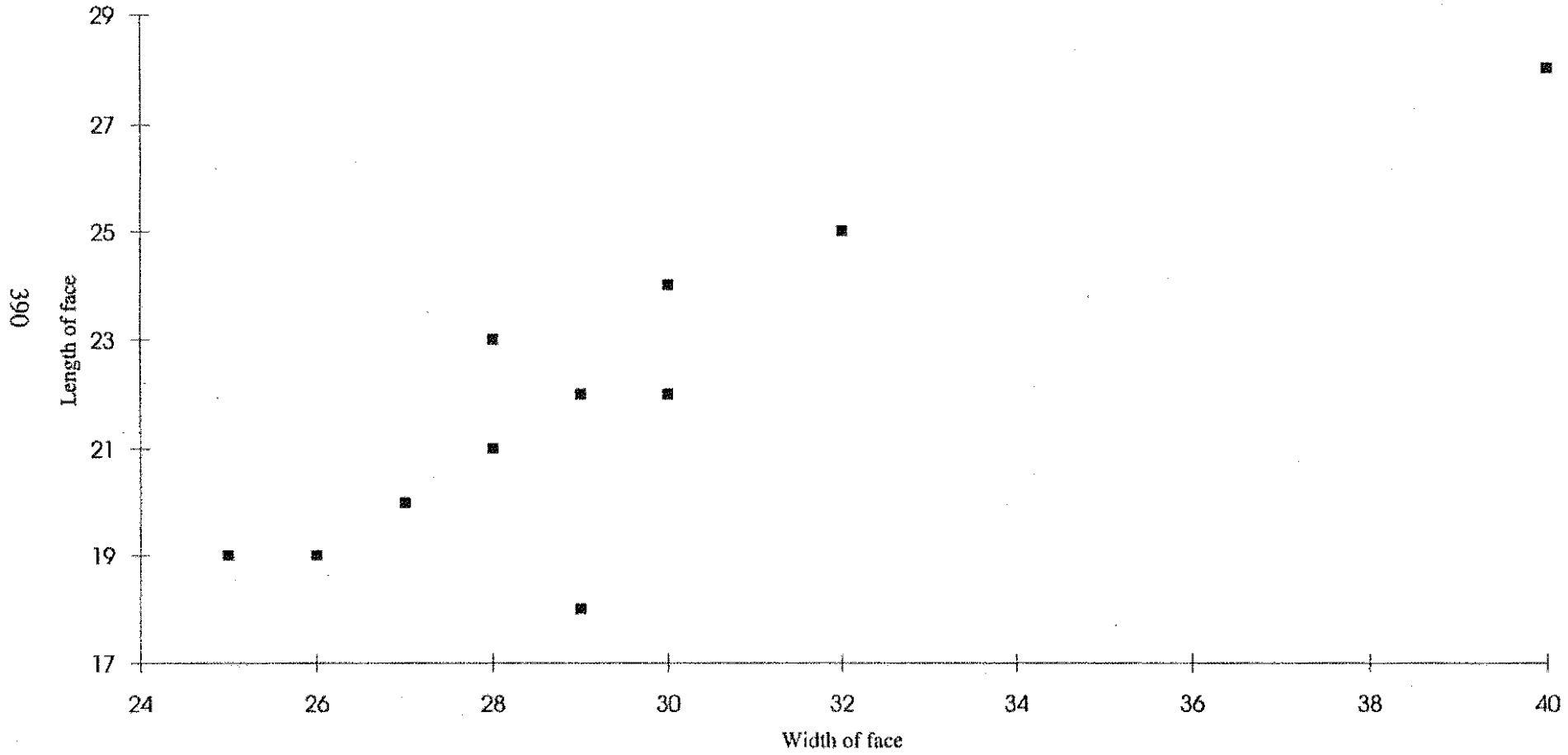


Fig. 3.5: Width of face vs ratio of width:length for females of Ophelosia bifasciata

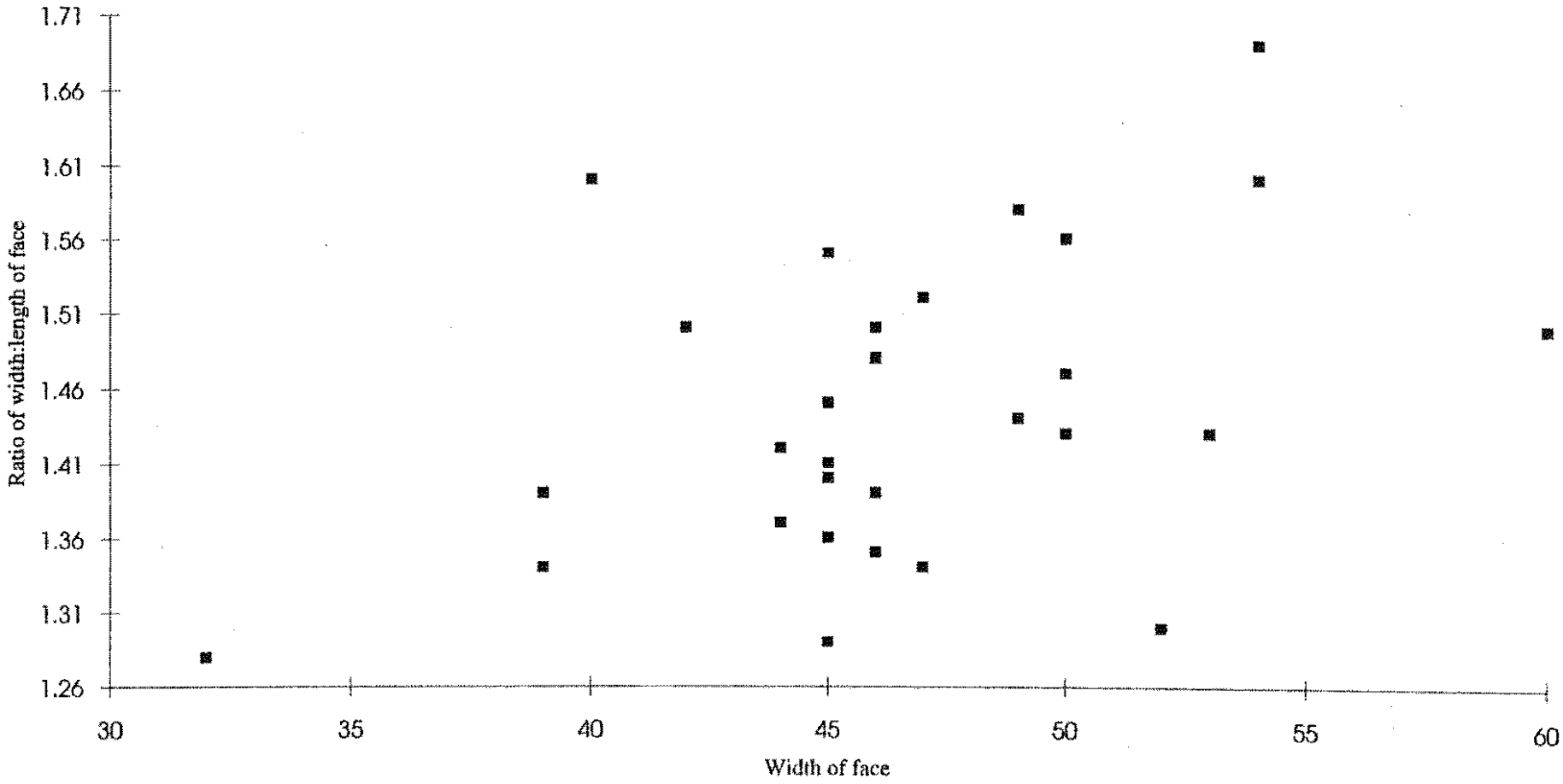


Fig. 3.6: Width of face vs ratio of width:length for males of Ophelosia bifasciata

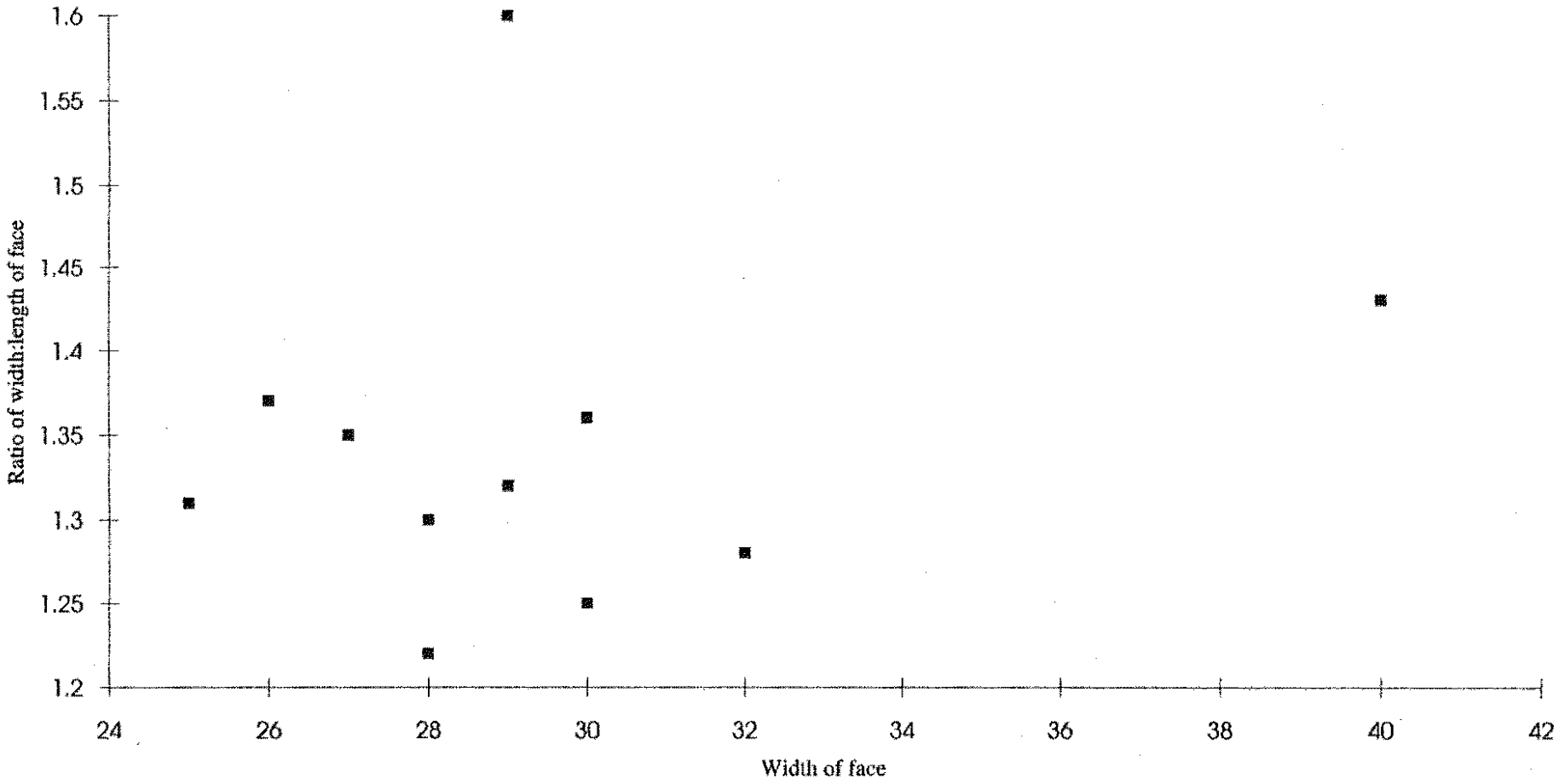


Fig. 3.7: Length of marginal vein vs ratio of width:length of face in females of Ophelosia bifasciata

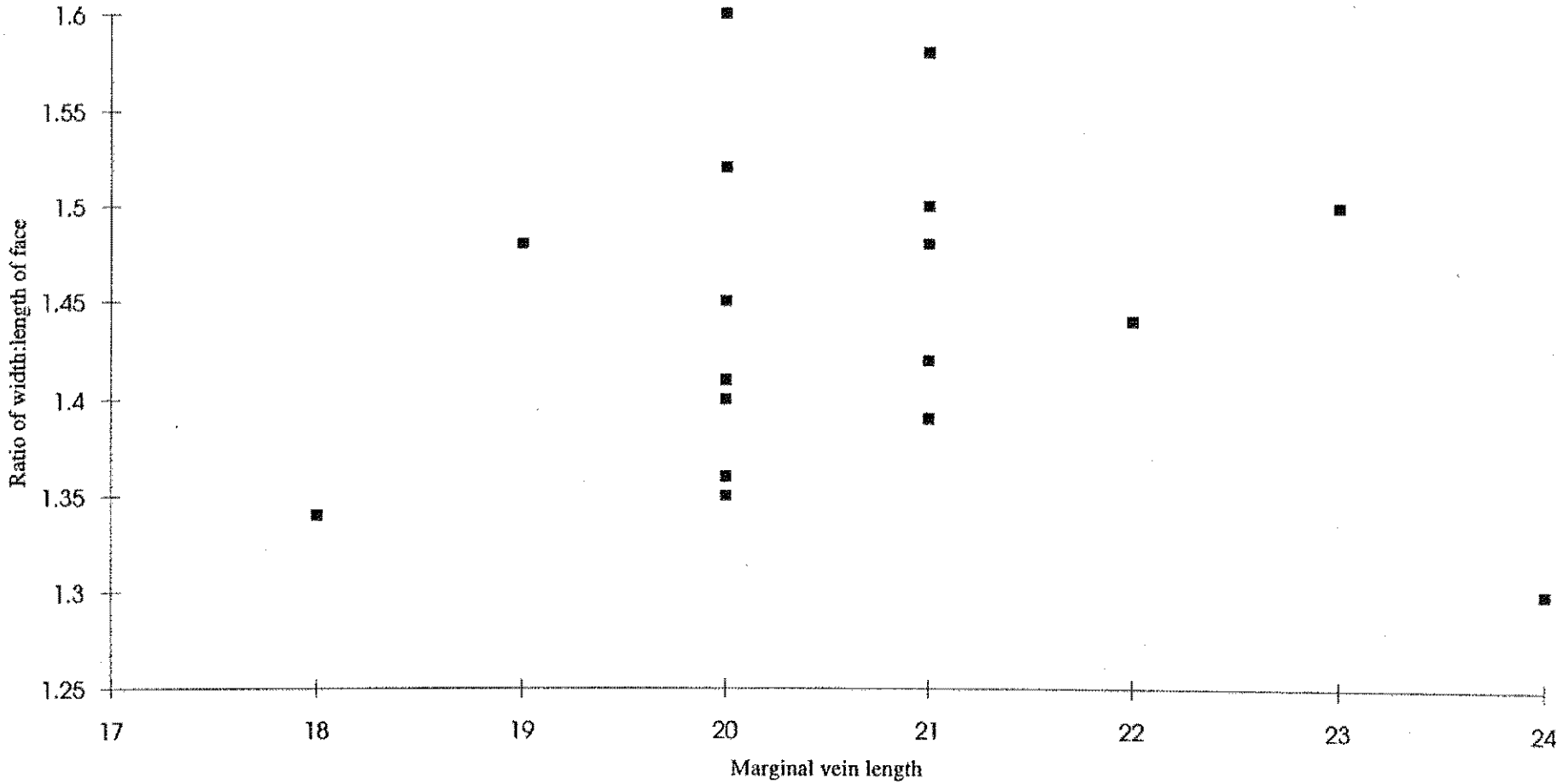


Fig. 3.8: Ratio of face width:length for all species of Moranilini

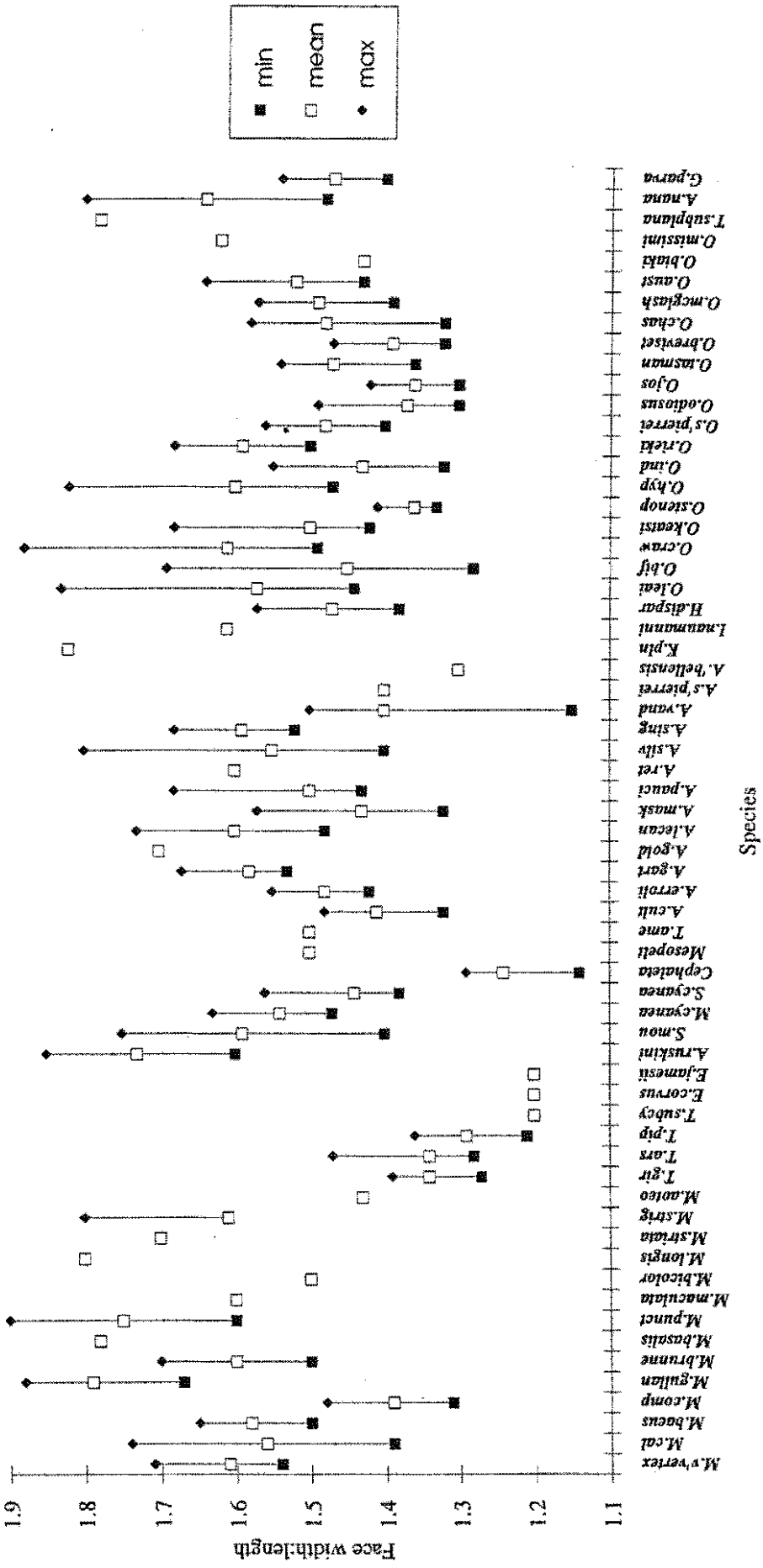


Fig. 3.9: Ratio of club:funicle length (females) in all species of Eunotinae

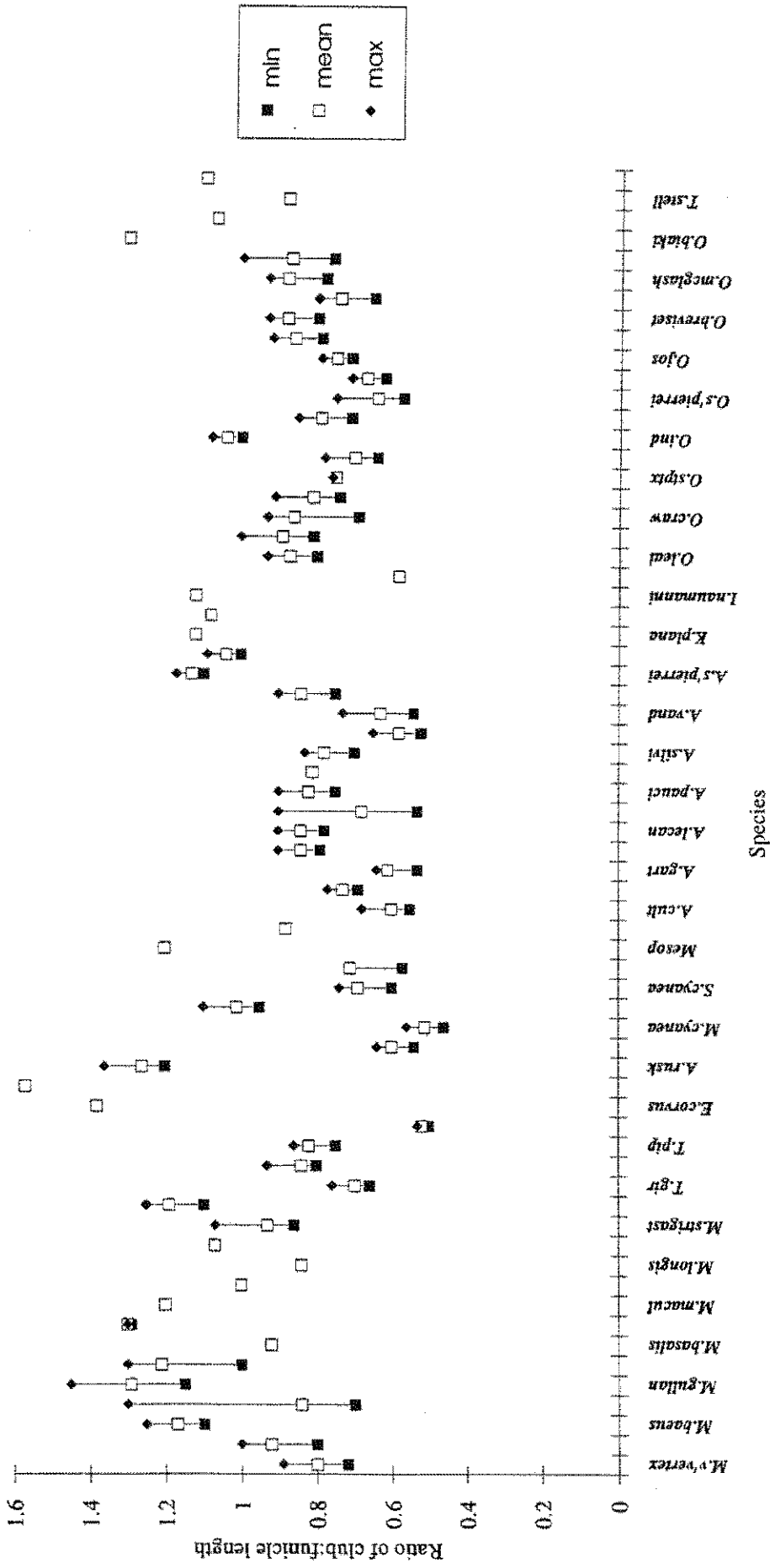


Fig. 3.10: Ratio of club:F1 length (males) in all species of Eunotinae

Fig. 3.11: Marginal vein length vs stigmal vein length in females of Ophelosia hypatia

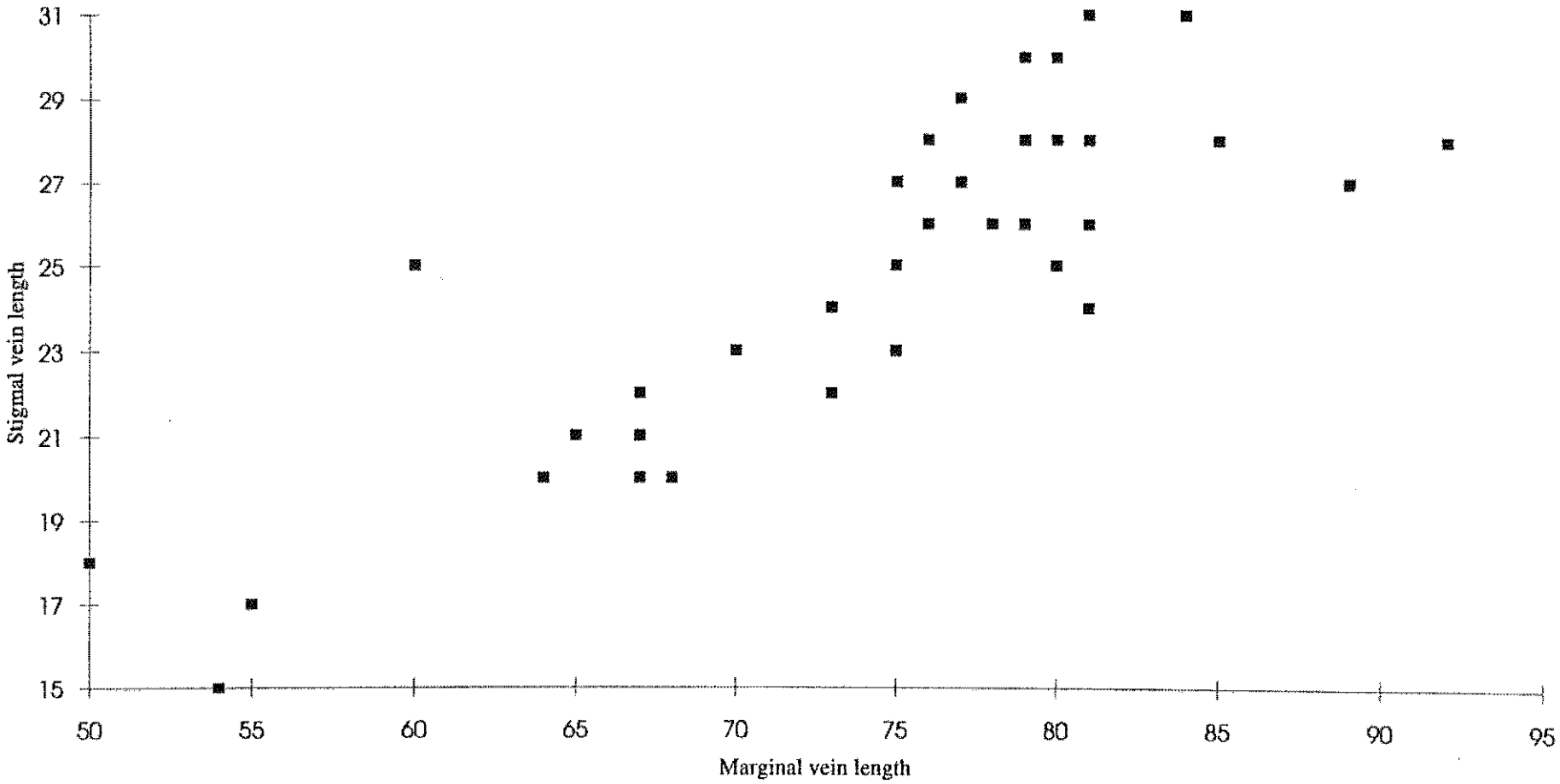


Fig. 3.12: Marginal vein length vs stigmal vein length in males of Ophelosia hypatia

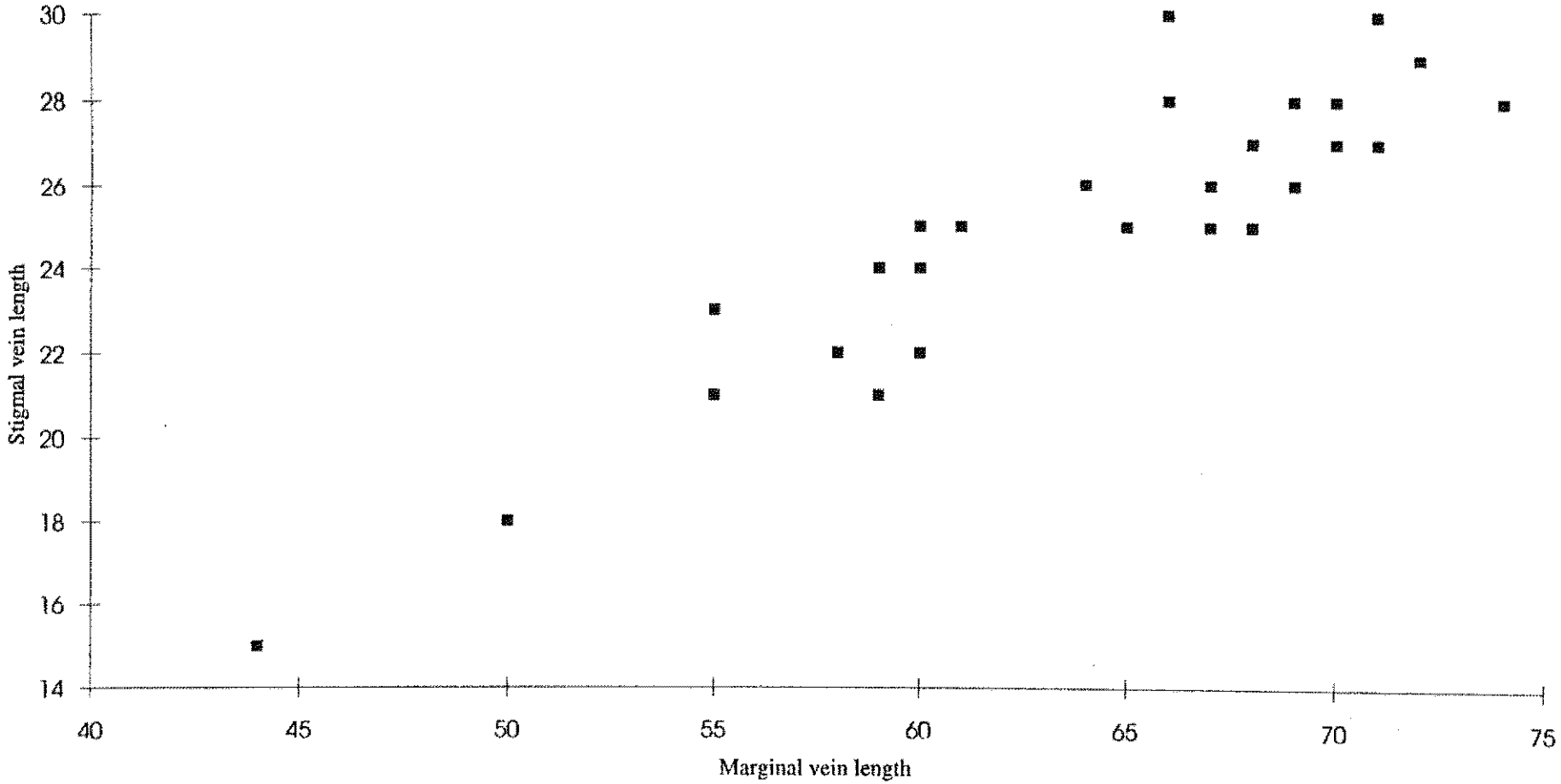


Fig. 3.13: Length of marginal vein vs ratio of marginal:stigmal veins in females of Ophelosia hypatia

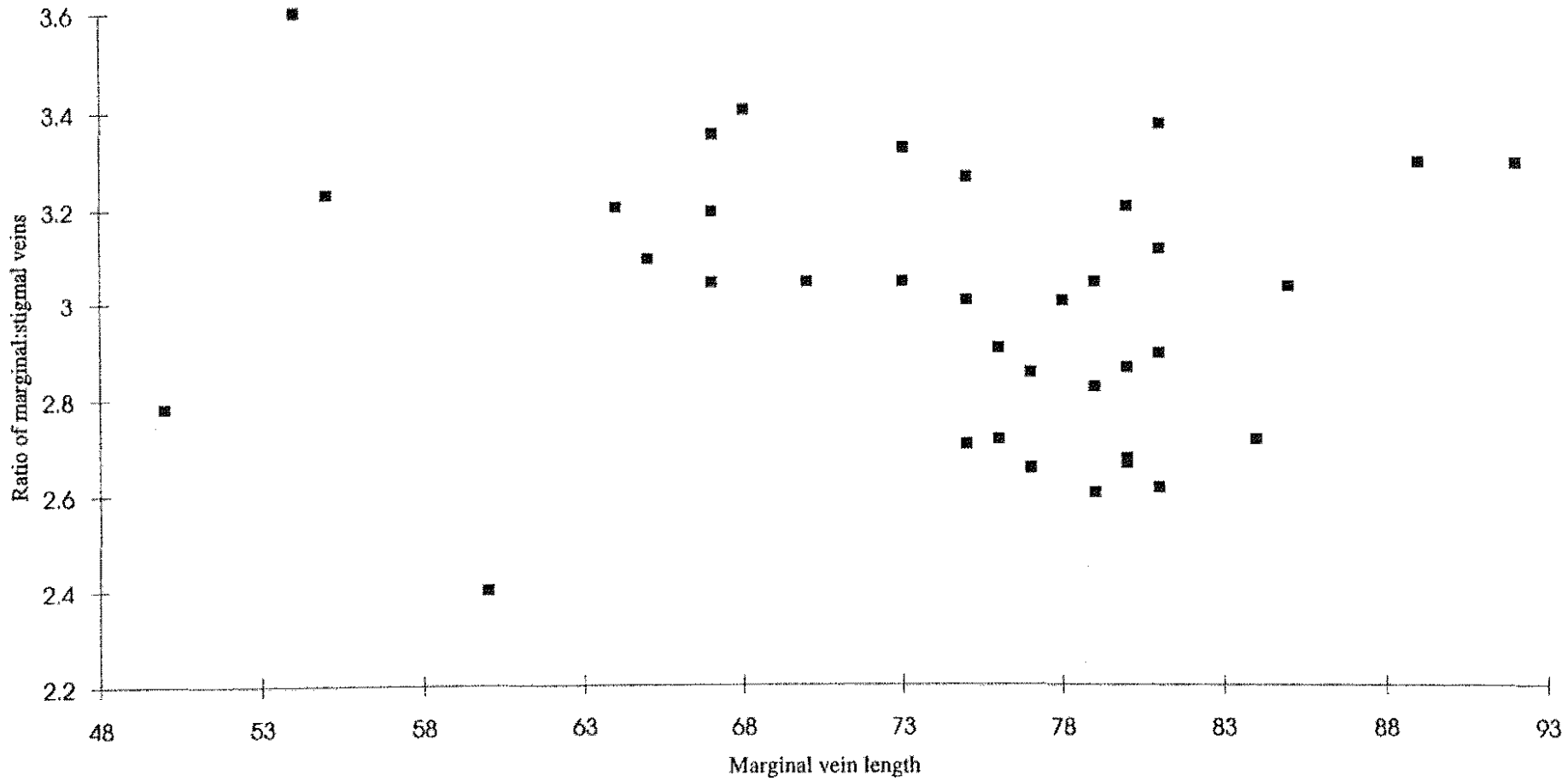


Fig. 3.14: Length of marginal vein vs ratio of marginal:stigmal veins in males of Ophelosia hypatia

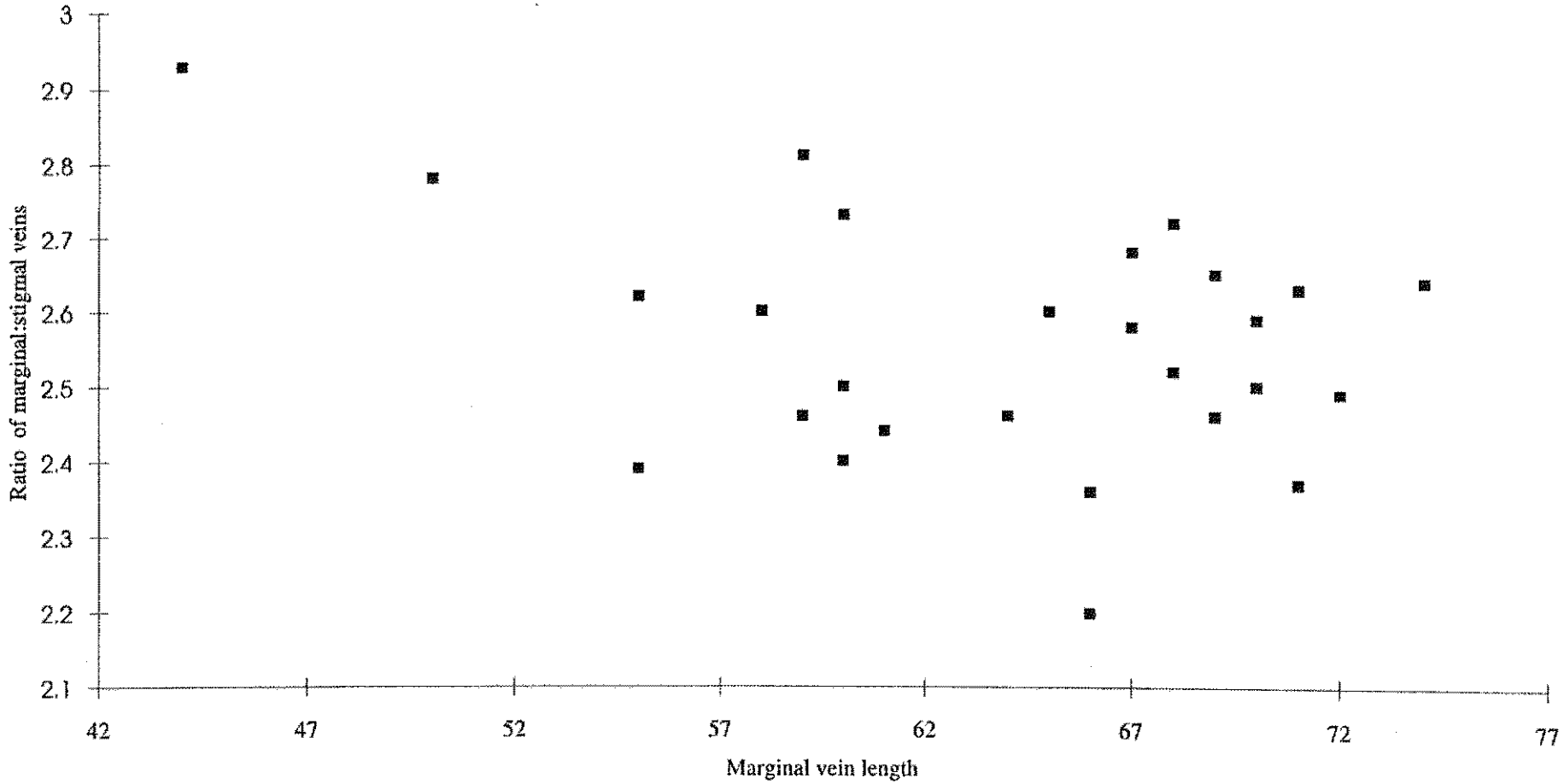


Fig. 3.15: Marginal vein length vs stigmal vein length in females of Ophelosia charlesii

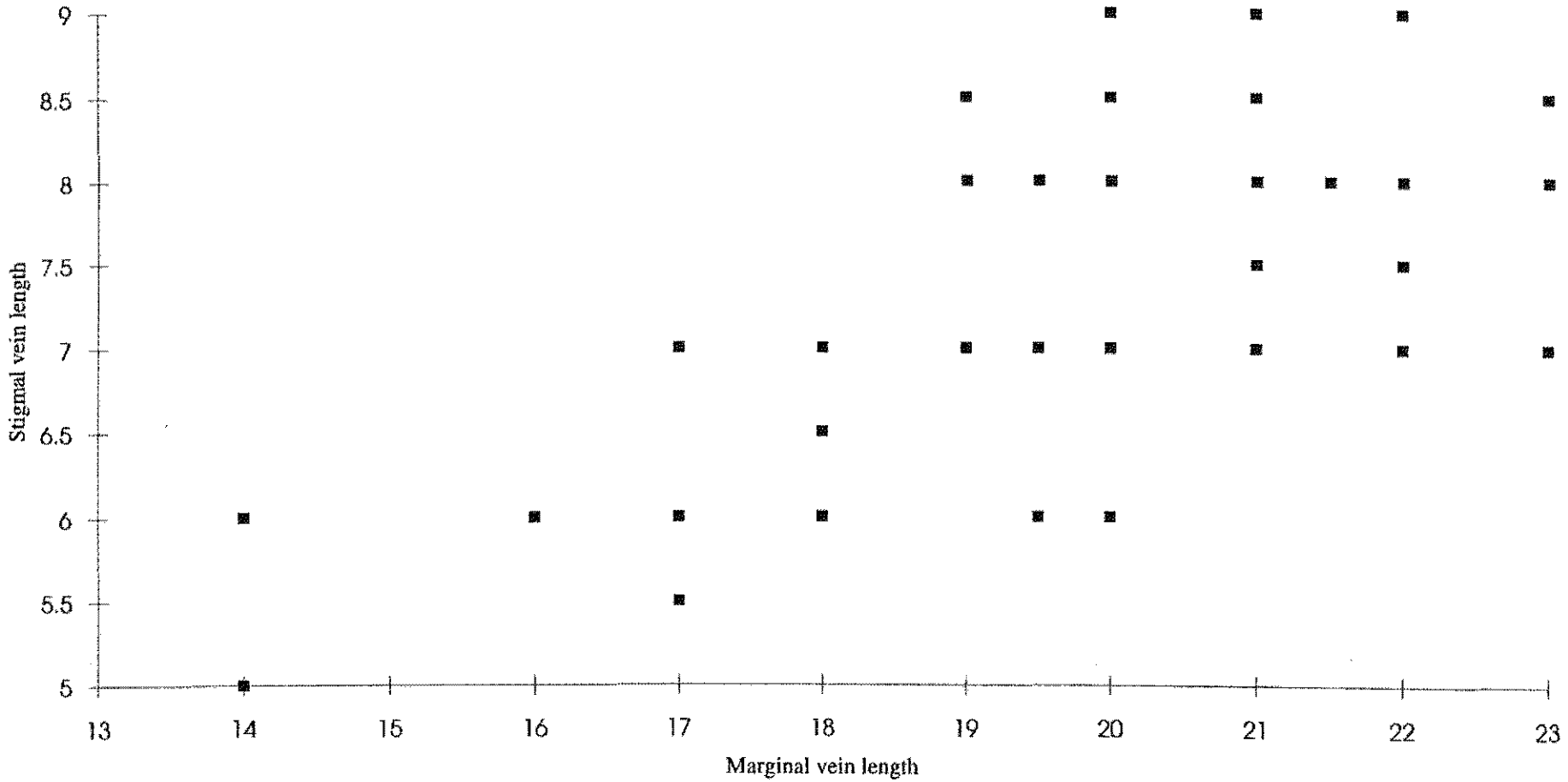


Fig. 3.16: Marginal vein length vs stigmal vein length in males of Ophelosia charlesii

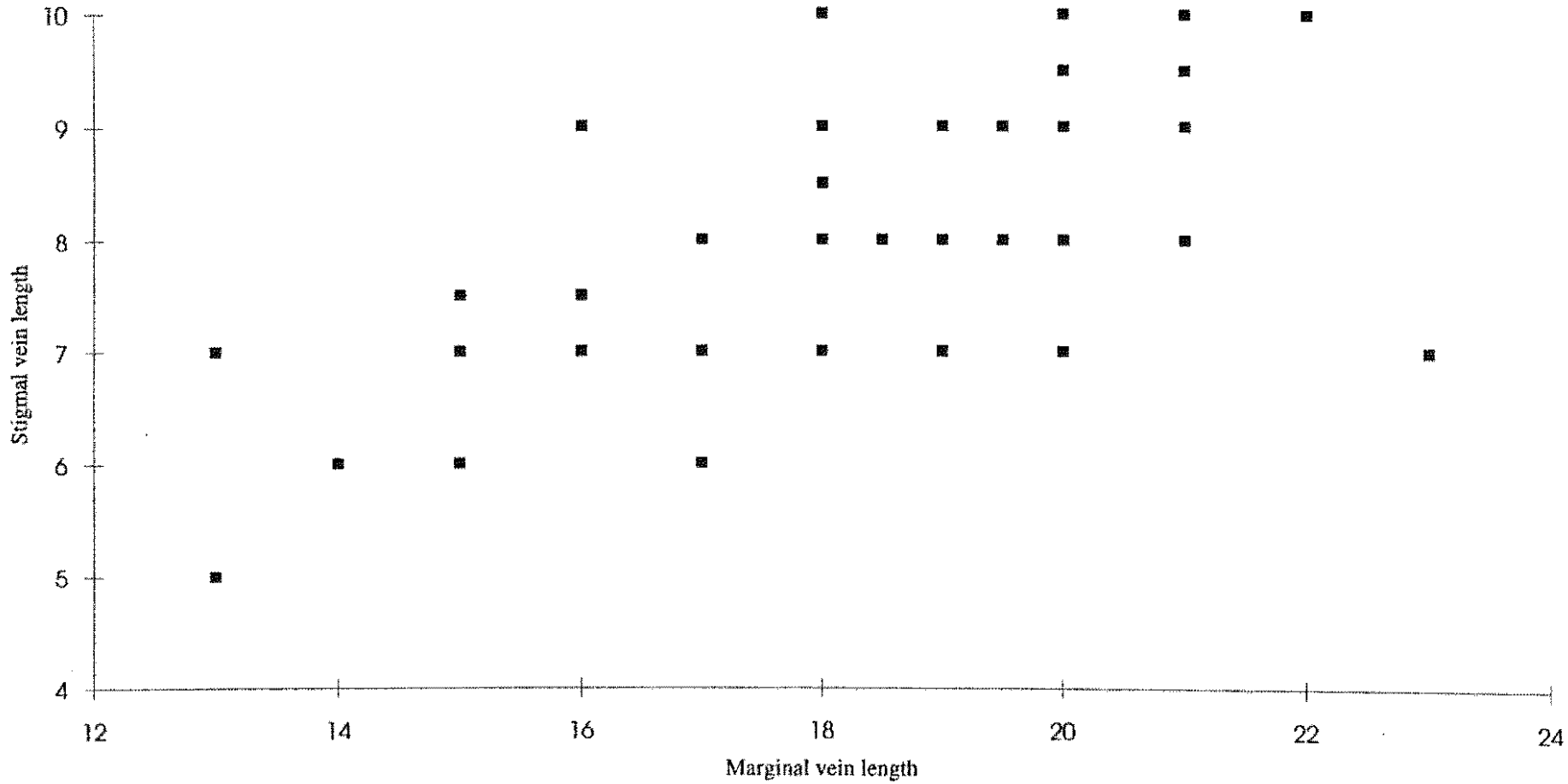


Fig. 3.17: Length of marginal vein vs ratio of marginal:stigmal vein in females of Ophelosia charlesii

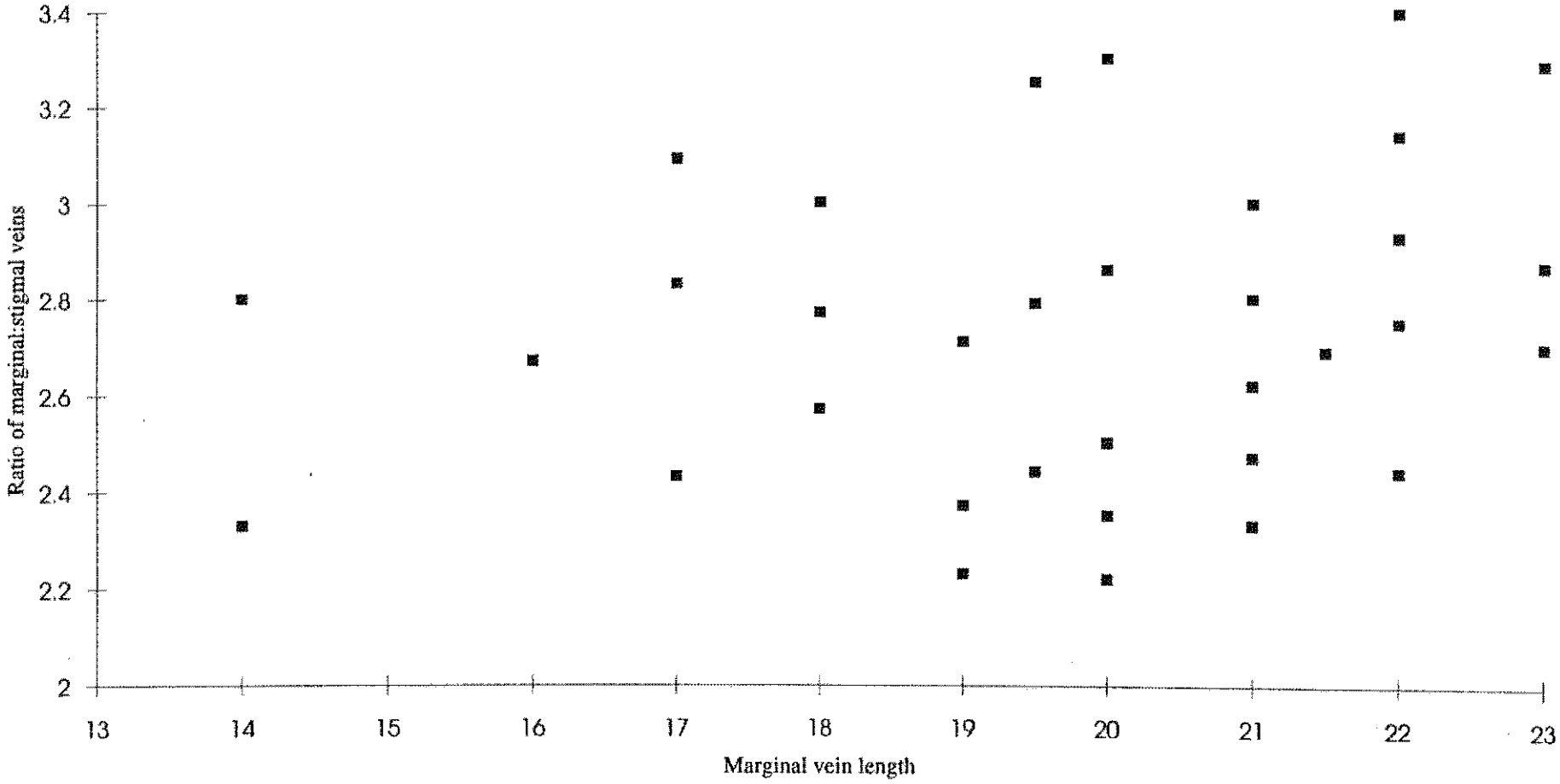


Fig. 3.18: Length of marginal vein vs ratio of marginal:stigmal vein in males of Ophelosia charlesii

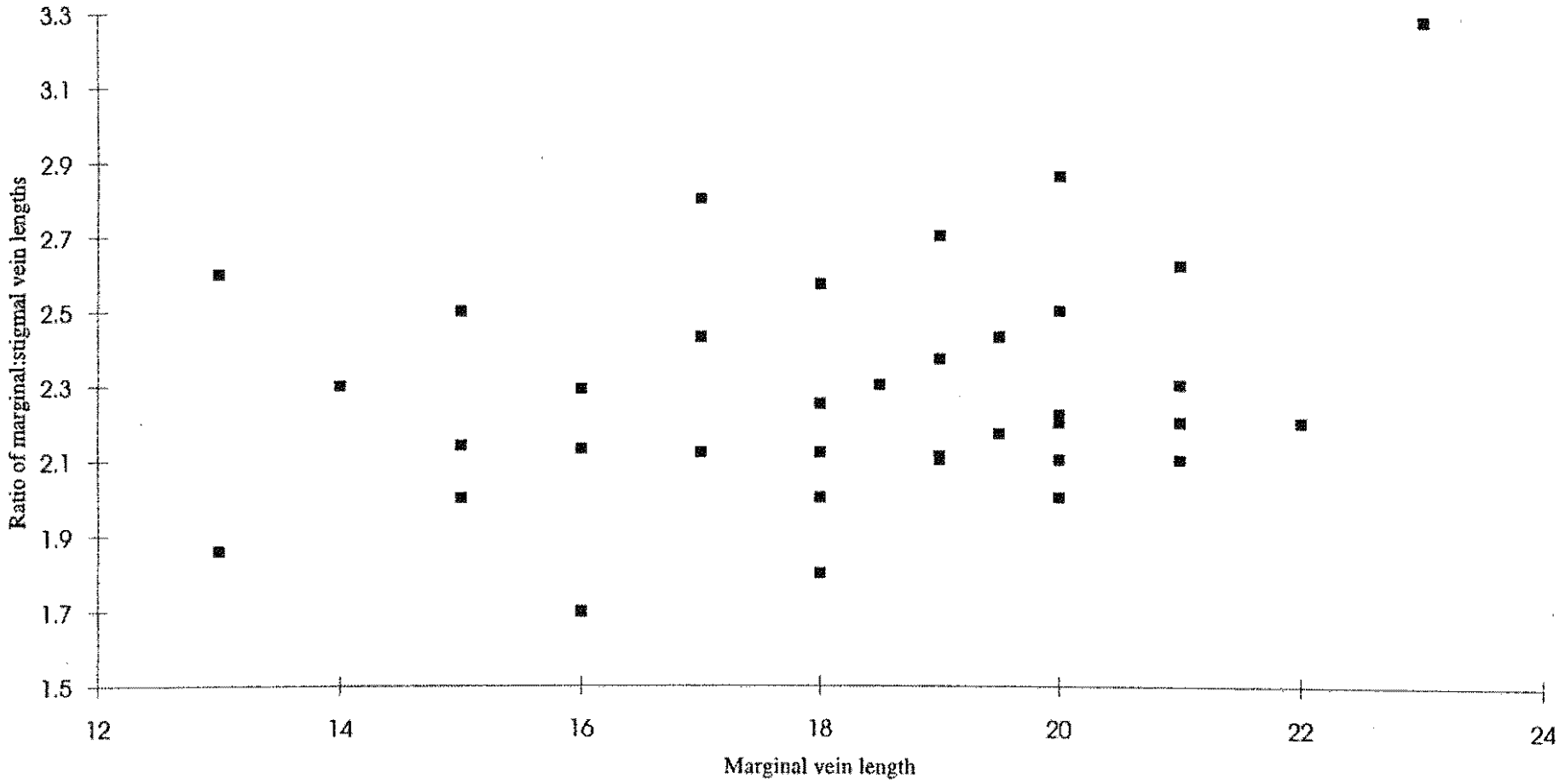


Fig. 3.19: Length of scutellum vs ratio of marginal:stigmal vein in males of Ophelosia charlesii

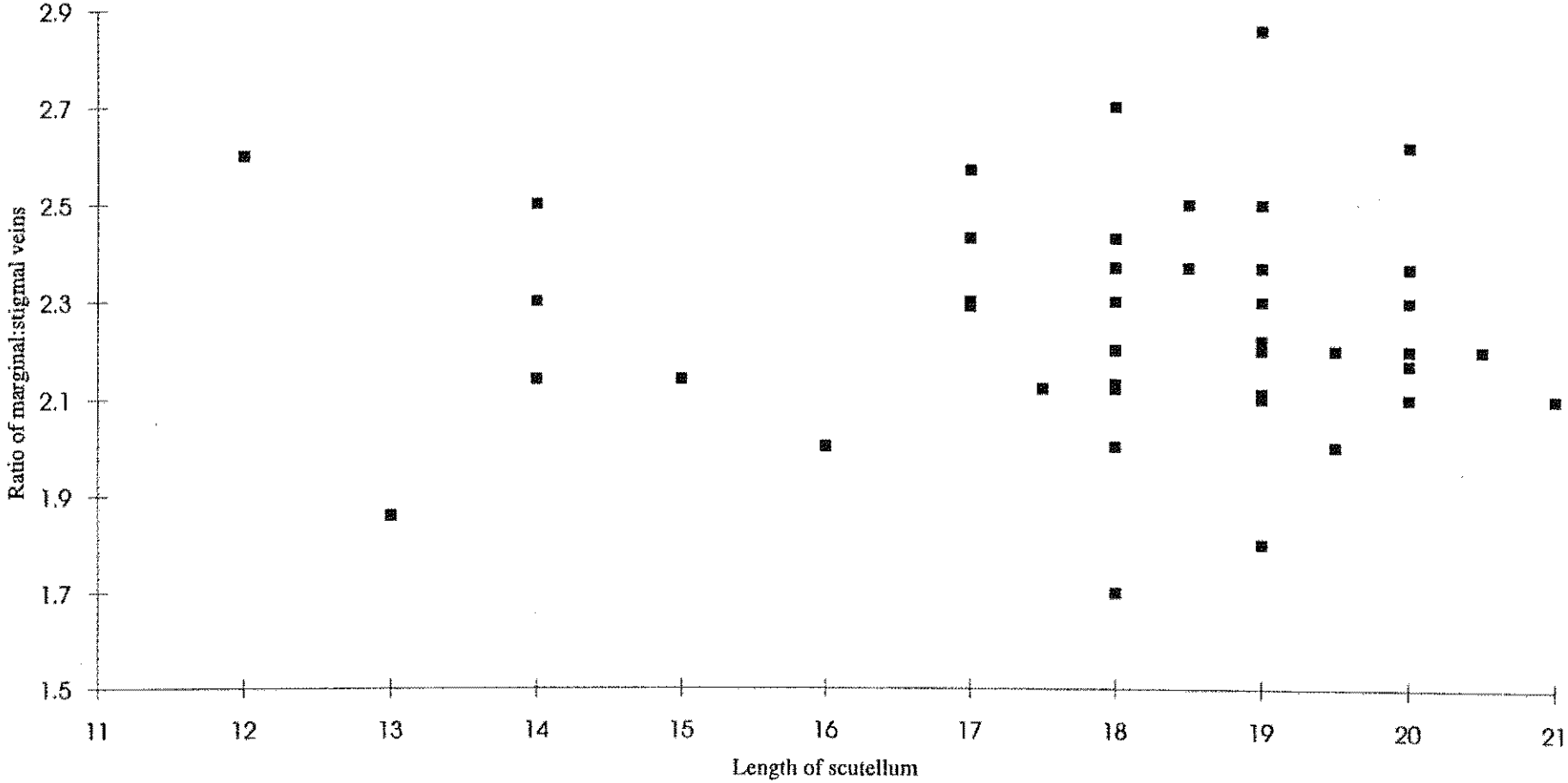


Fig. 3.20: Ratio of marginal:stigmal vein lengths (females) in all species of Moranilini

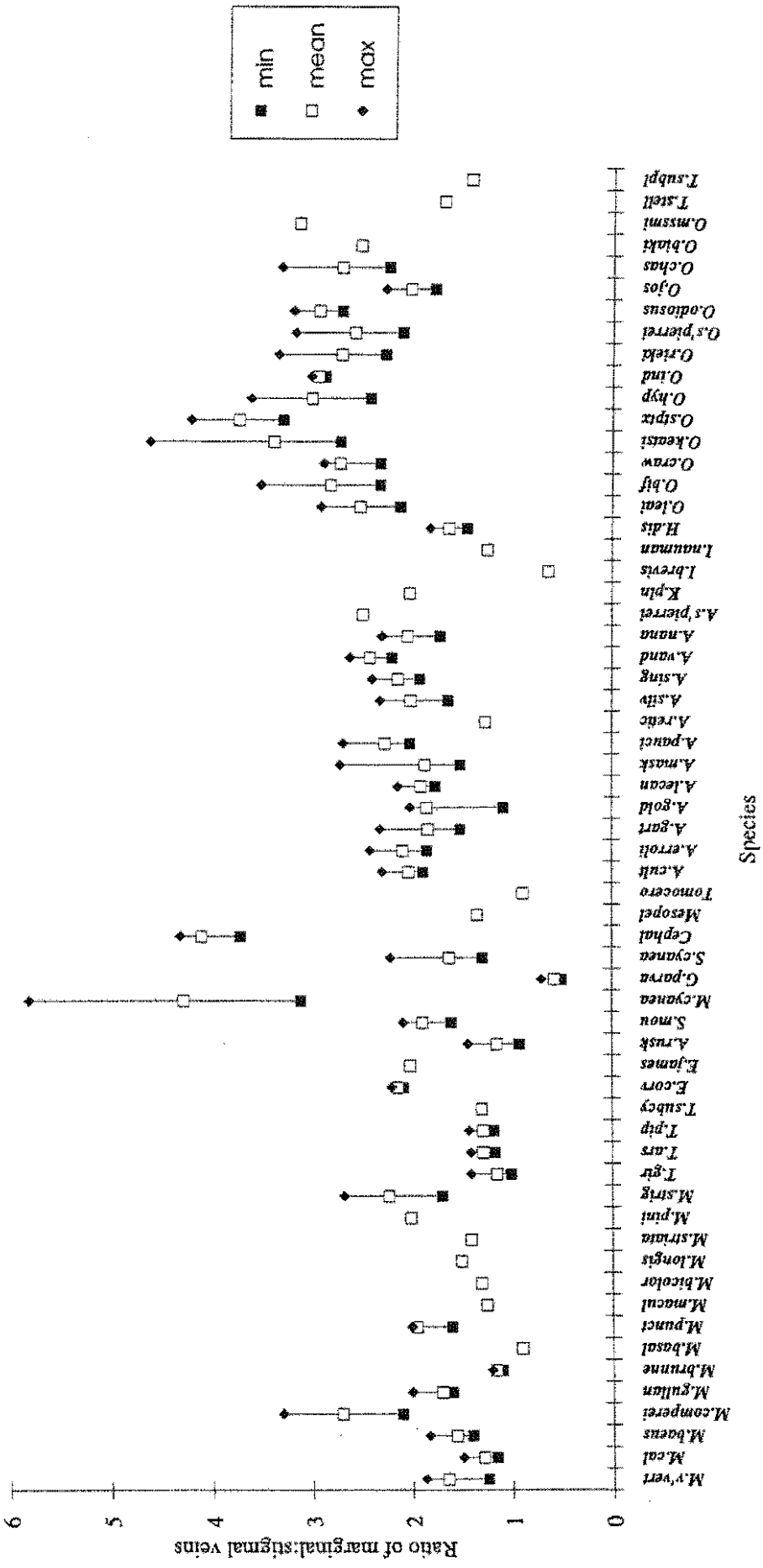


Fig. 3.21: Ratio of marginal:stigmal vein lengths (male) for all species of Moranilini

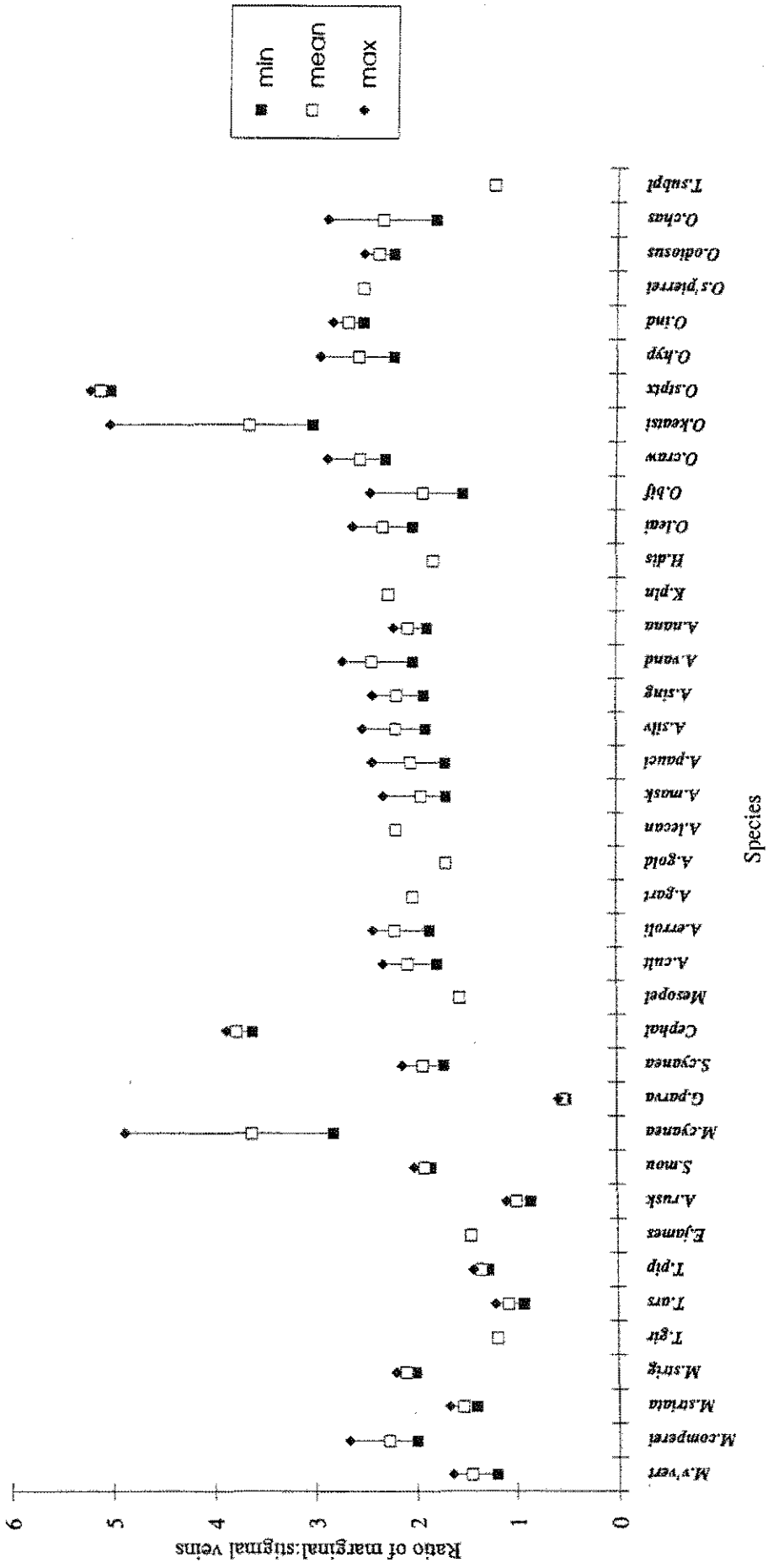


Fig. 3.22: Marginal vein length vs number of setae on costal margin in females of Ophelosia charlesii

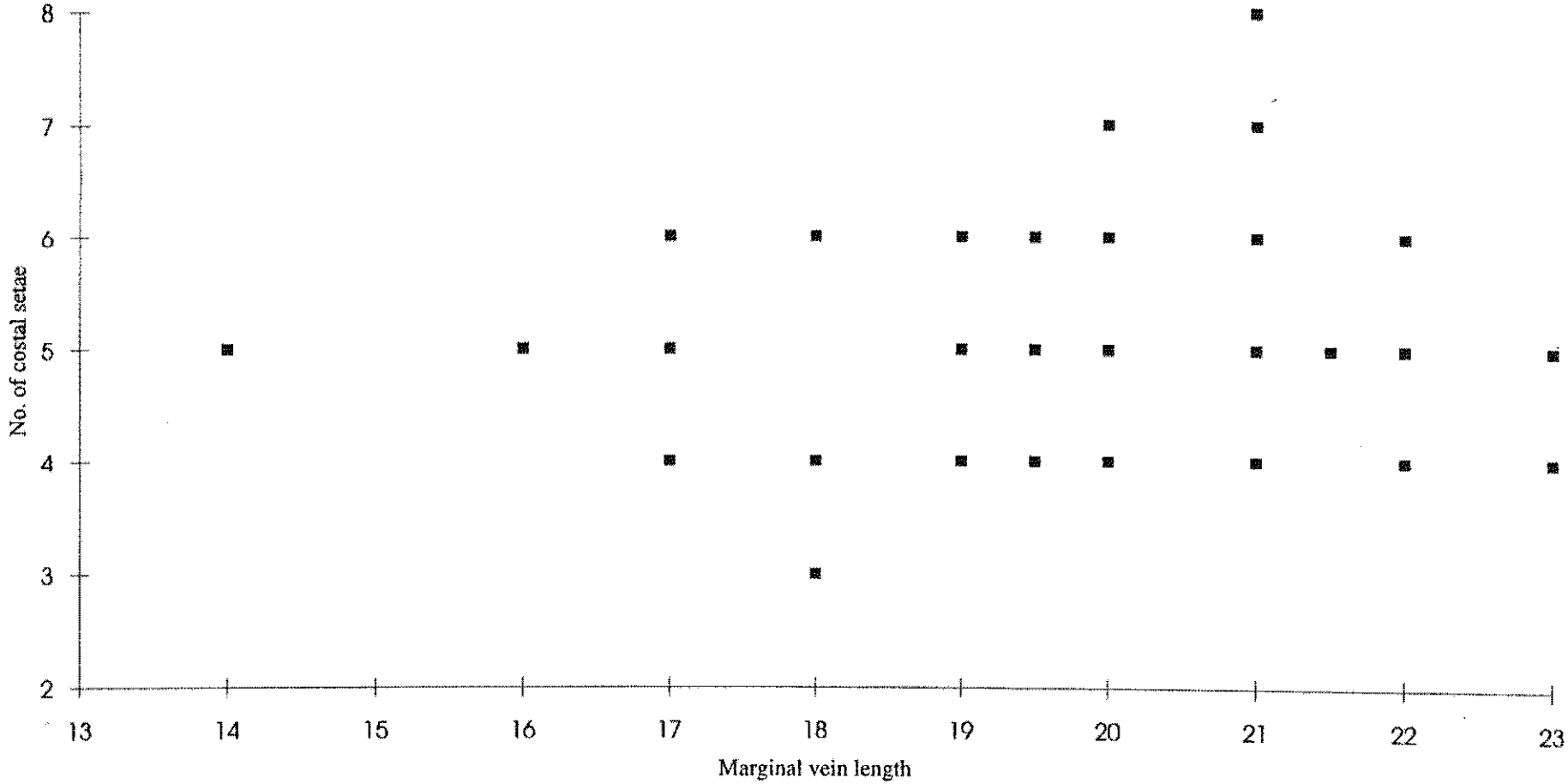


Fig. 3.23: Length of marginal vein vs no. of setae in wing tuft in females of Ophelosia hypatia

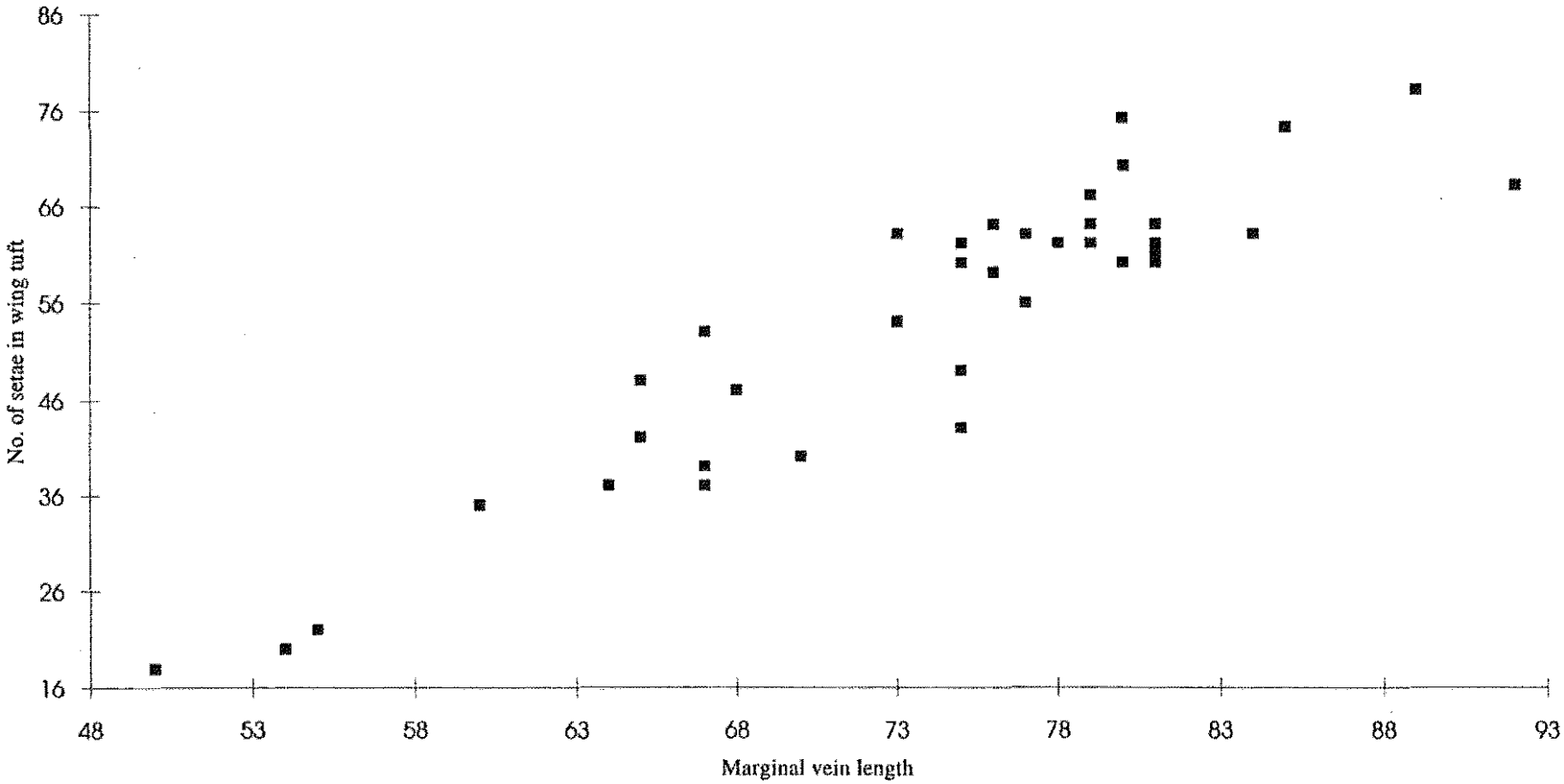
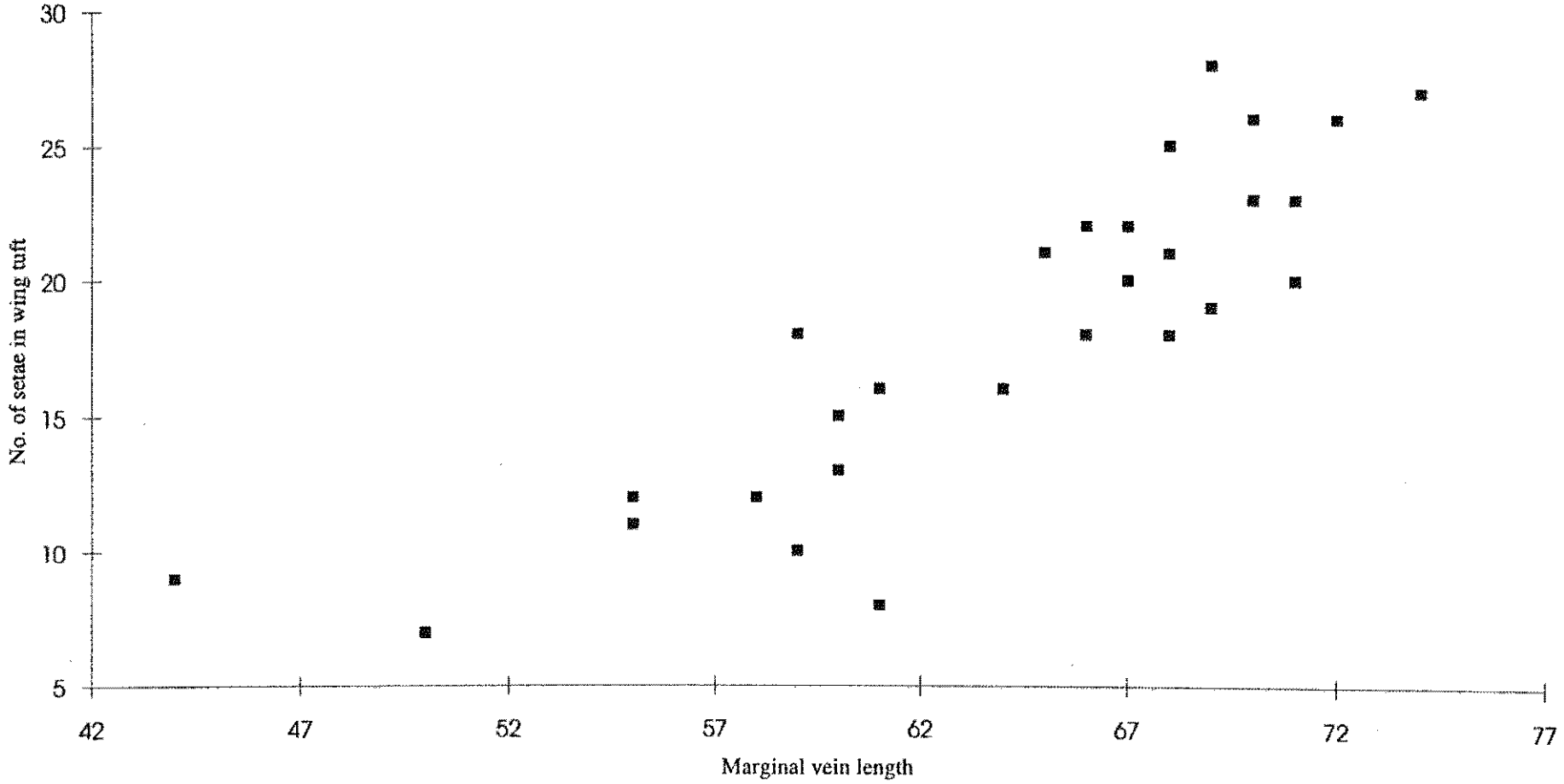
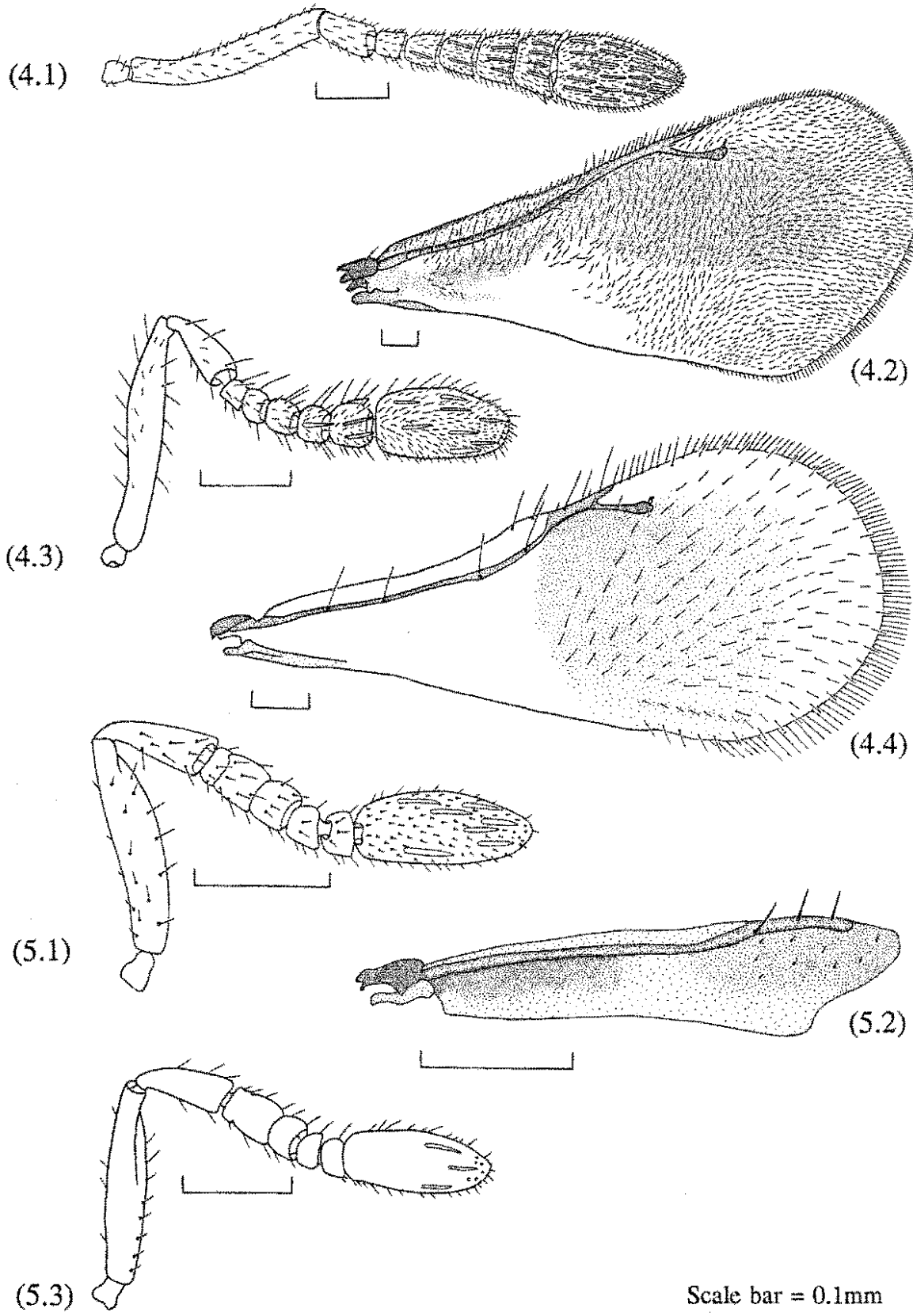


Fig. 3.24: Length of marginal vein vs no. of setae in wing tuft in males of Ophelosia hypatia





Figures 4.1, 4.2 *Scutellista cyanea*, female: (4.1) antenna; (4.2) forewing. **Figures 4.3, 4.4** *Tomocerodes americanus* female: (4.3) antenna; (4.4) forewing. **Figures 5.1, 5.2** *Amoturella brindabellensis* female: (5.1) antenna; (5.2) forewing. **Figure 5.3** *Amoturella saintpierrei*: female holotype antenna.

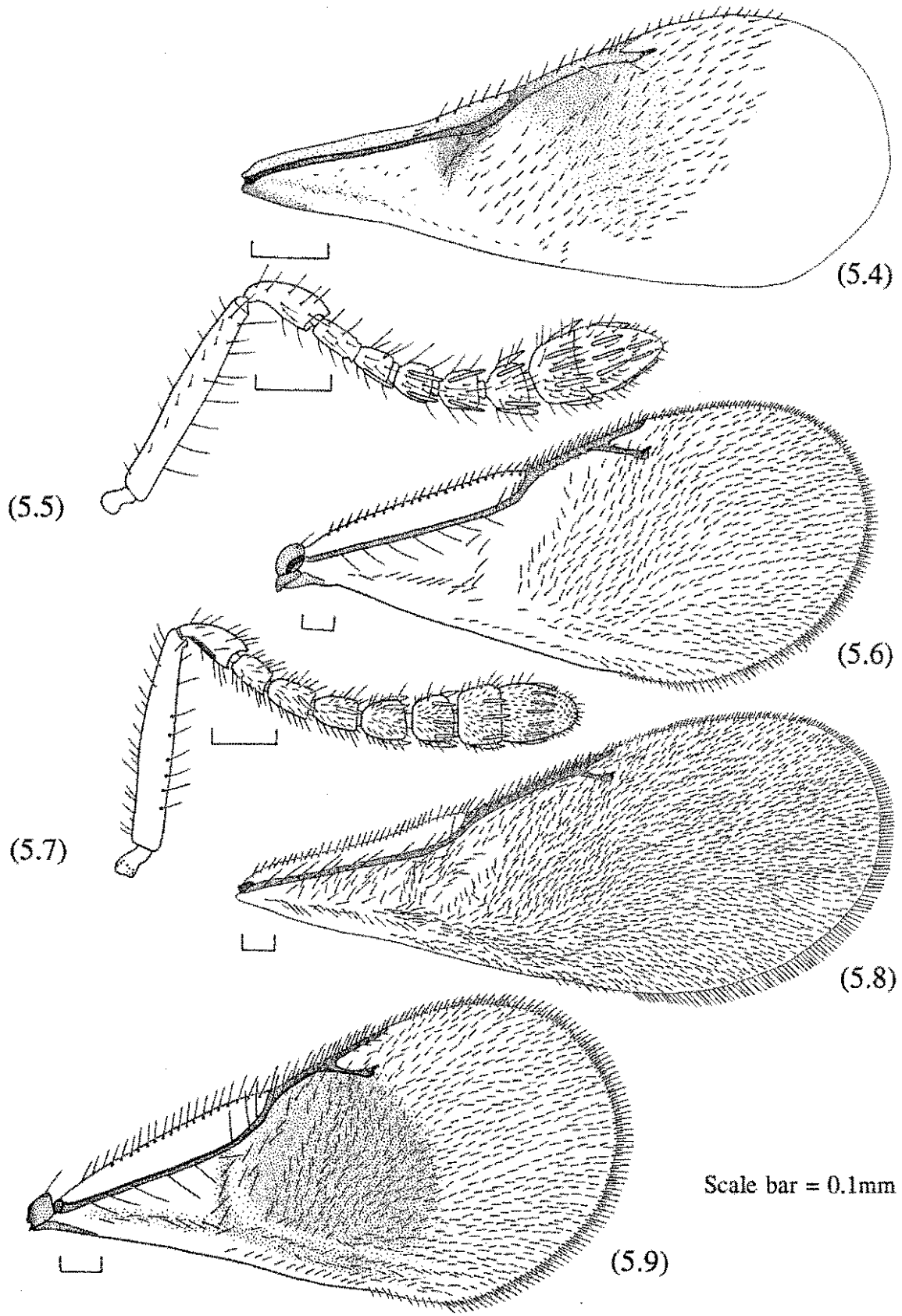
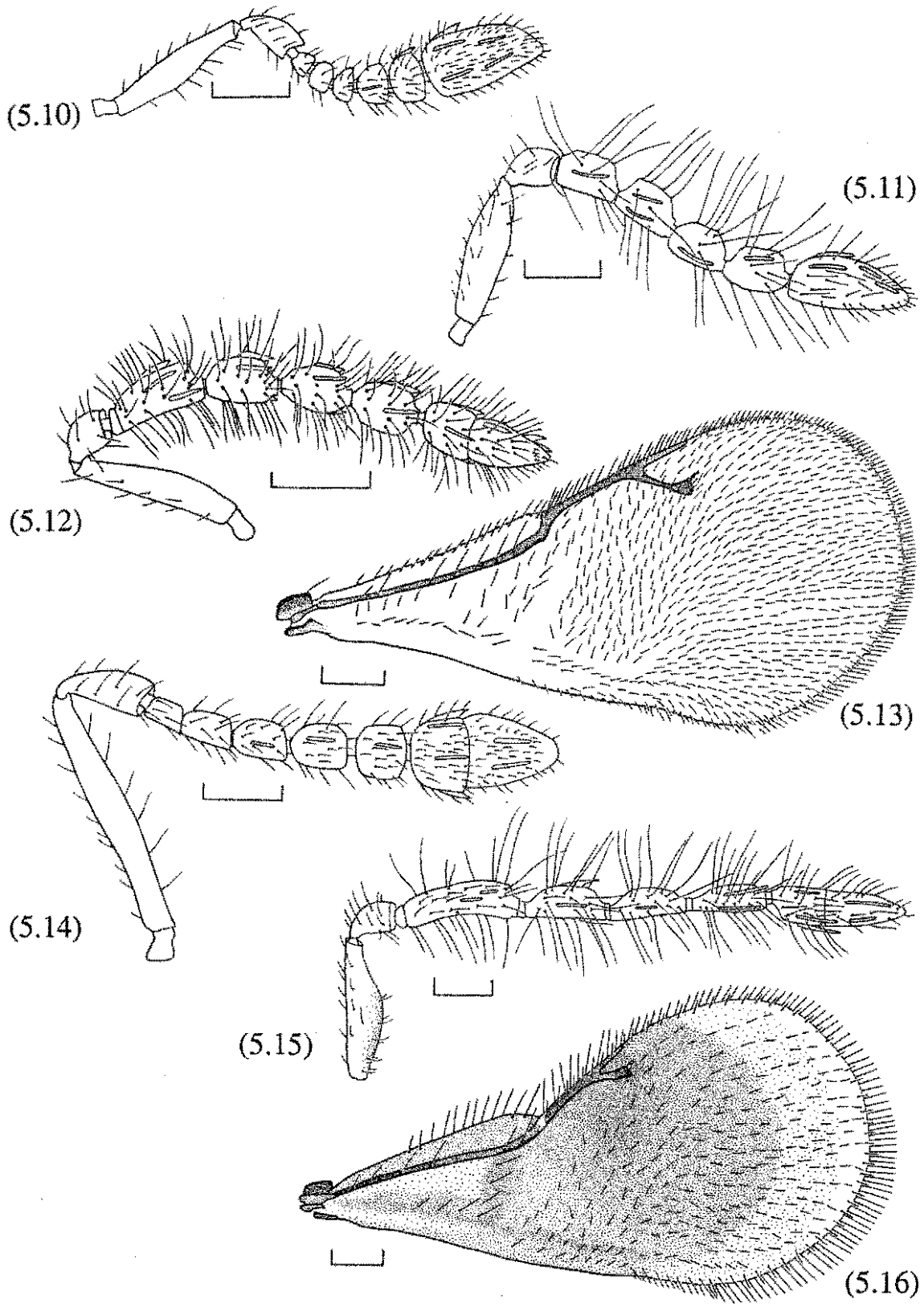
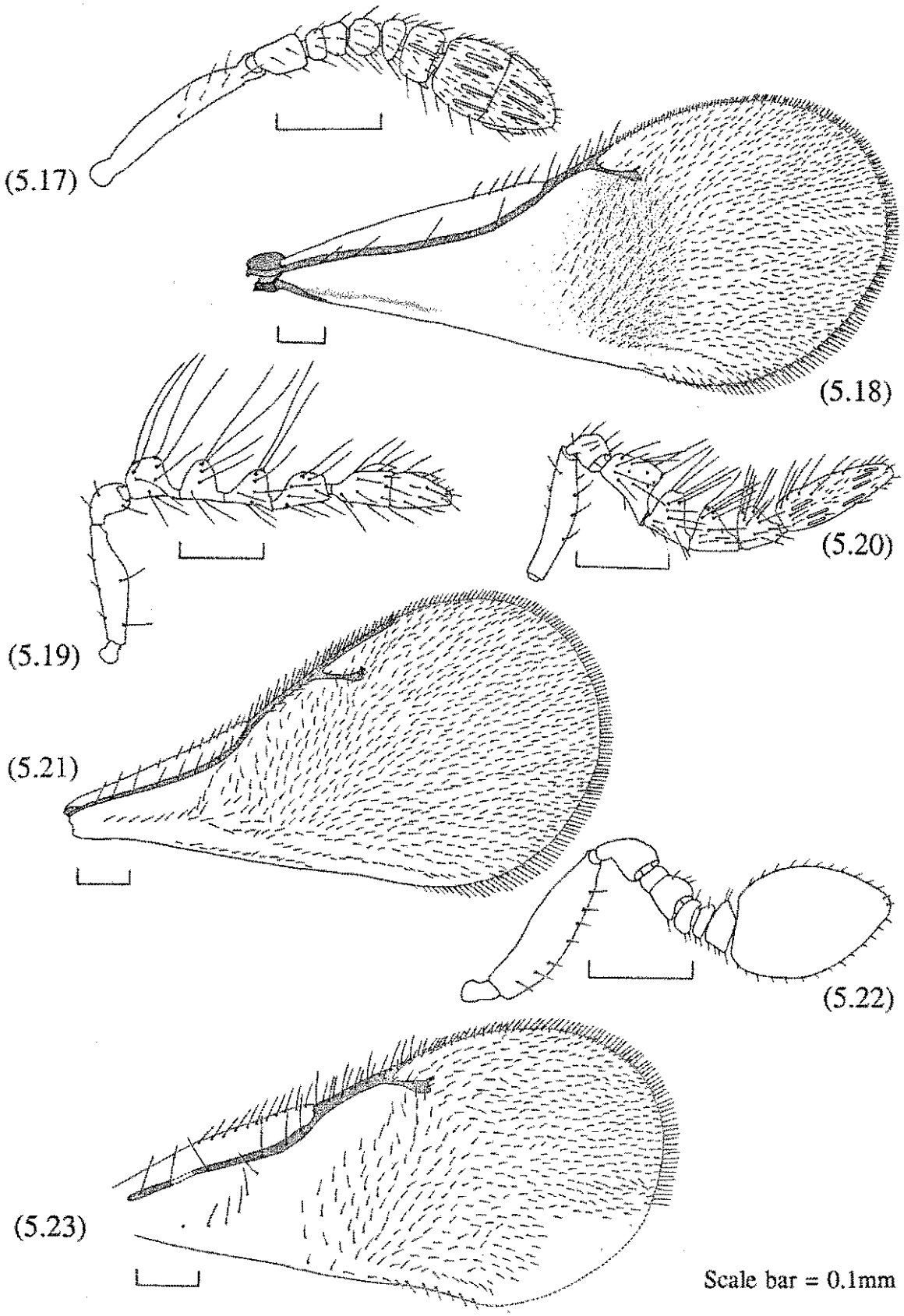


Figure 5.4 *Amoturella saintpierrei* female holotype forewing. **Figures 5.5, 5.6** *Aphobetus cultratus* female: (5.5) antenna; (5.6) forewing. **Figures 5.7, 5.8** *Aphobetus cyanea* female: (5.7) antenna; (5.8) forewing. **Fig.5.9** *Aphobetus garretti* female forewing.



Scale bar = 0.1mm

Figures 5.10, 5.11 *Aphobetus goldsmithii*: (5.10) female antenna; (5.11) male antenna. **Figures 5.12, 5.13** *Aphobetus moundi*, male: (5.12) antenna; (5.13) forewing. **Figure 5.14** *Aphobetus singeri*: female antenna. **Figure 5.15** *Aphobetus vandiemenensis*: male antenna. **Figure 5.16** *Aphobetus nana*: female forewing



Figures 5.17, 5.18, 5.19 *Australeunotus ruskini*: (5.17) female antenna; (5.18) female forewing; (5.19) male antenna. **Figures 5.20, 5.21** *Australurios longispina*, male: (5.20) holotype antenna; (5.21) holotype forewing. **Figures 5.22, 5.23** *Eunotomyiia corvus*, female: (5.22) holotype antenna; (5.23) holotype forewing.

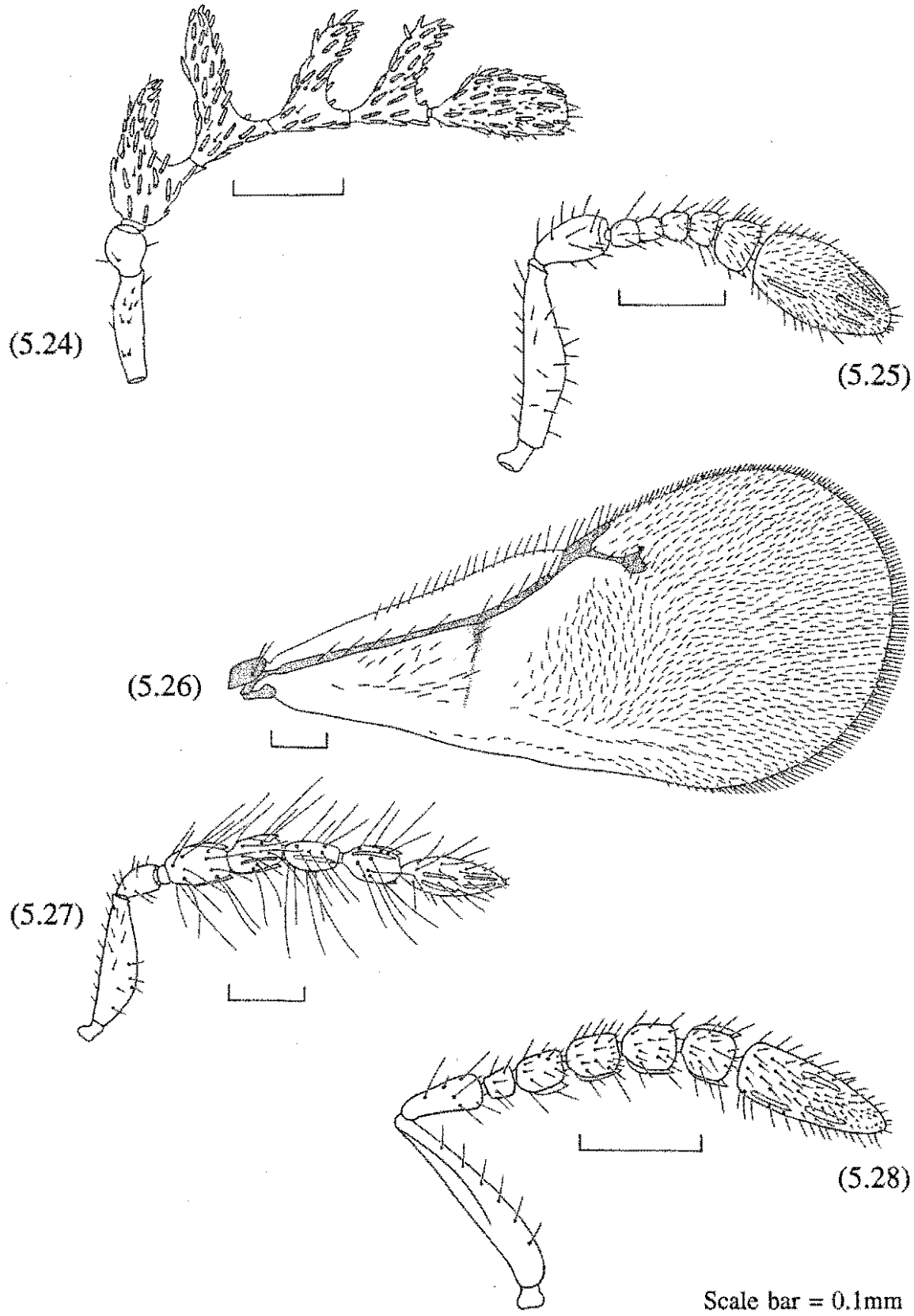


Figure 5.24 *Eunotomyiia jamesii*: male antenna. **Figures 5.25, 5.26, 5.27** *Globonila parva*: (5.25) female antenna; (5.26) female forewing; (5.27) male antenna. **Figure 5.28** *Hirtonila dispar*: female antenna.

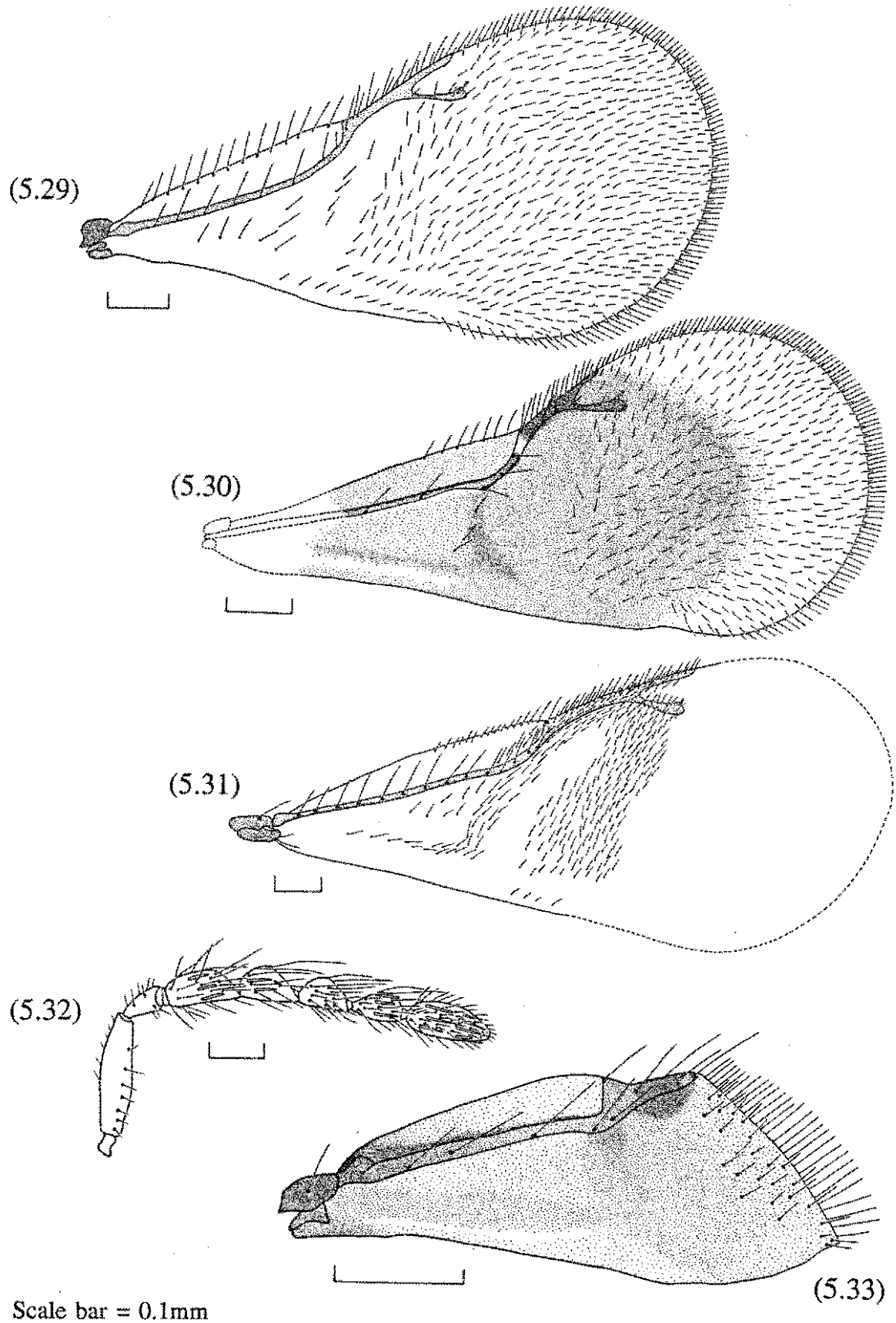
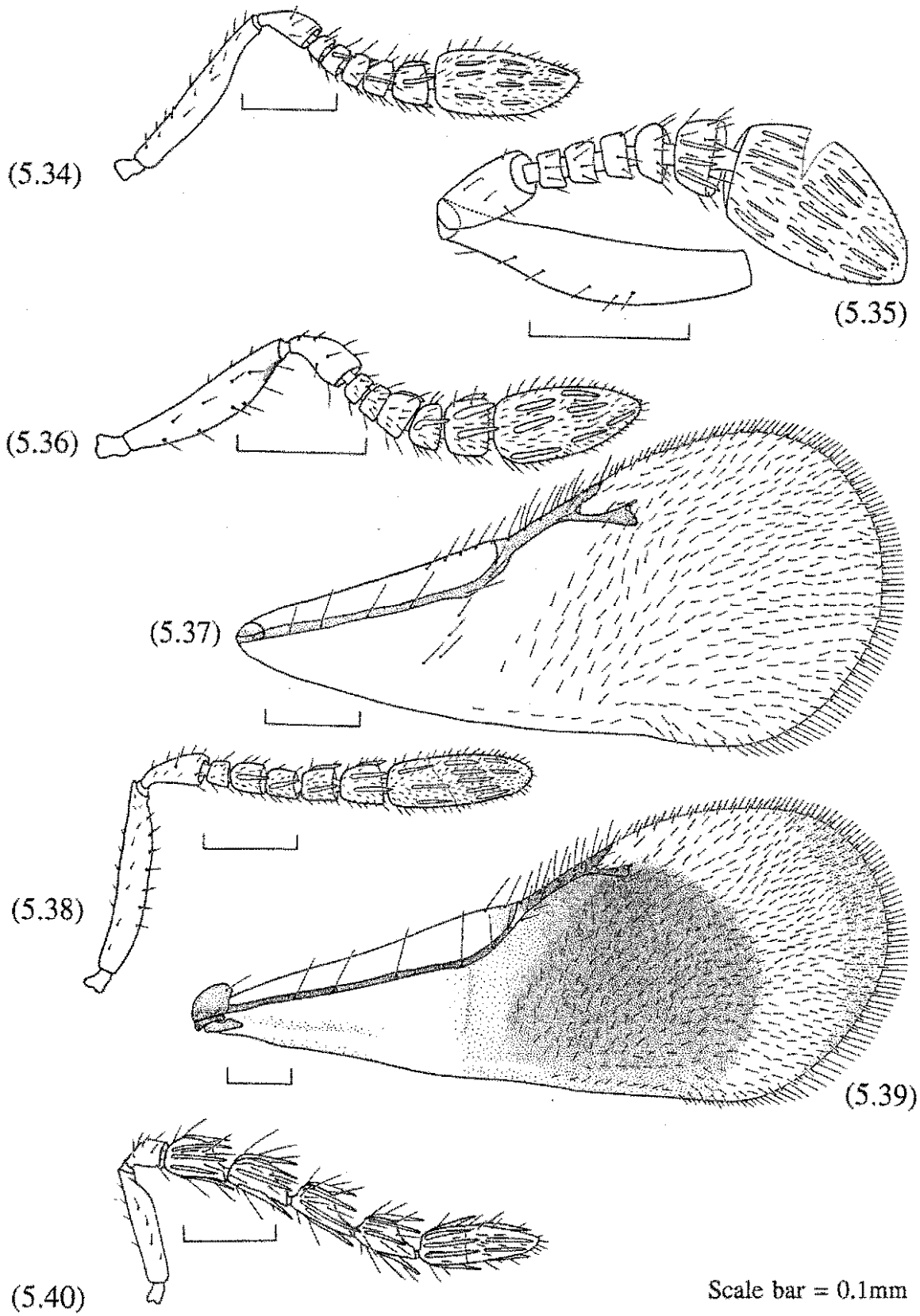
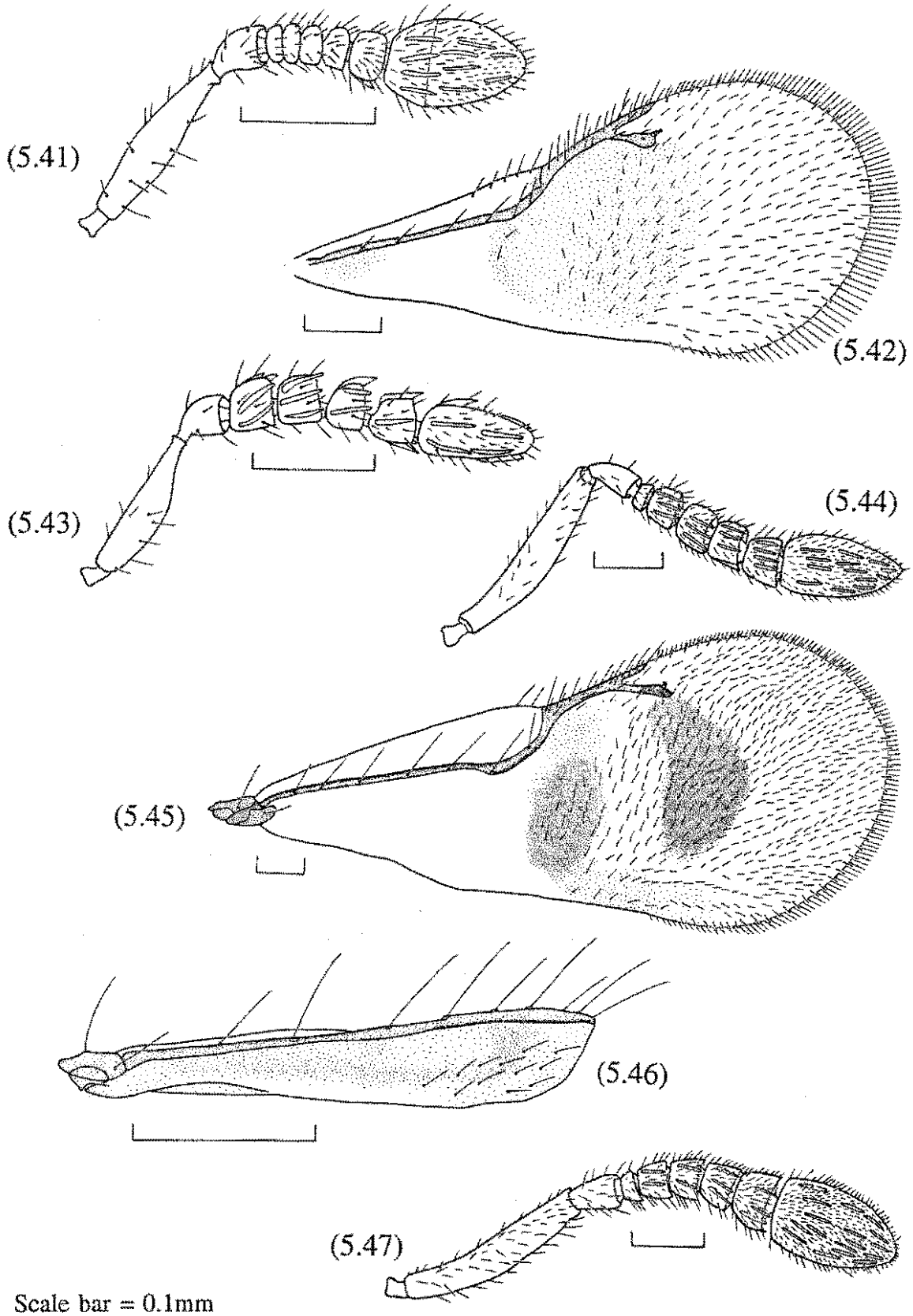


Figure 5.29 *Hirtonila dispar*: female forewing. **Figure 5.30** *Ismaya naumanni*: female forewing. **Figures 5.31, 5.32** *Kneva plana*: (5.31) female forewing; (5.32) male antenna. **Figure 5.33** *Moranila aoteoroae*: female forewing.



Figures 5.34, 5.35 *Moranila baeusomorpha*, female: (5.34) antenna; (5.35) holotype antenna. **Figures 5.36, 5.37** *Moranila brunneventris*, female: (5.36) antenna; (5.37) forewing. **Figures 5.38, 5.39, 5.40** *Moranila comperei*: (5.38) female antenna; (5.39) female forewing; (5.40) male antenna.



Figures 5.41, 5.42, 5.43 *Moranila gullanae*: (5.41) female antenna; (5.42) female forewing; (5.43) male antenna. **Figures 5.44, 5.45** *Moranila viridivertex*, female: (5.44) antenna; (5.45) forewing. **Figure 5.46** *Ophelosia australis*: female forewing. **Figure 5.47** *Ophelosia bifasciata*: female antenna.

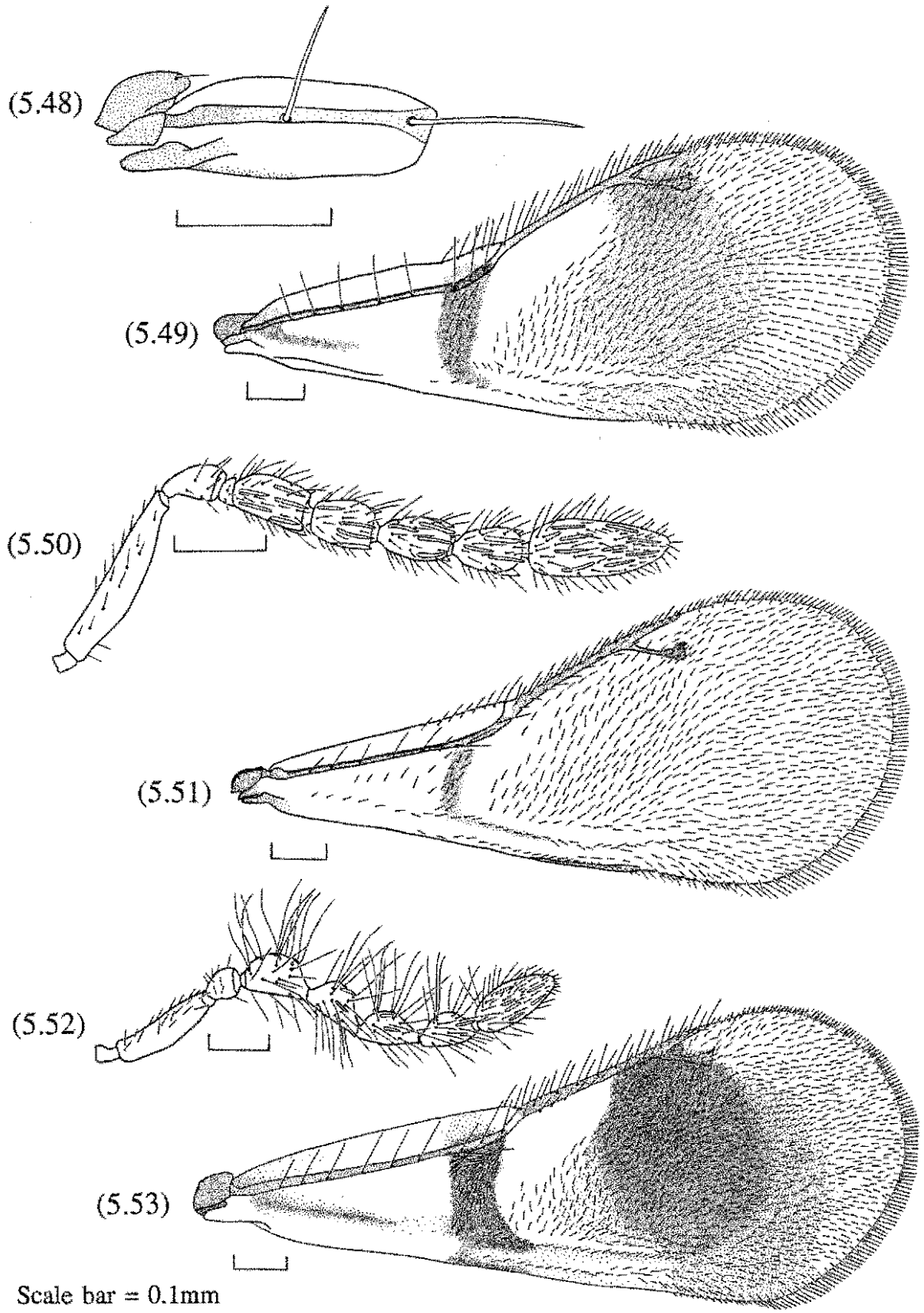


Figure 5.48 *Ophelosia brevisetosa*: female forewing. **Figures 5.49, 5.50, 5.51** *Ophelosia charlesii*: (5.49) female forewing; (5.50) male antenna; (5.51) male forewing. **Figure 5.52** *Ophelosia crawfordi*: male antenna. **Figure 5.53** *Ophelosia hypatia*: female forewing.

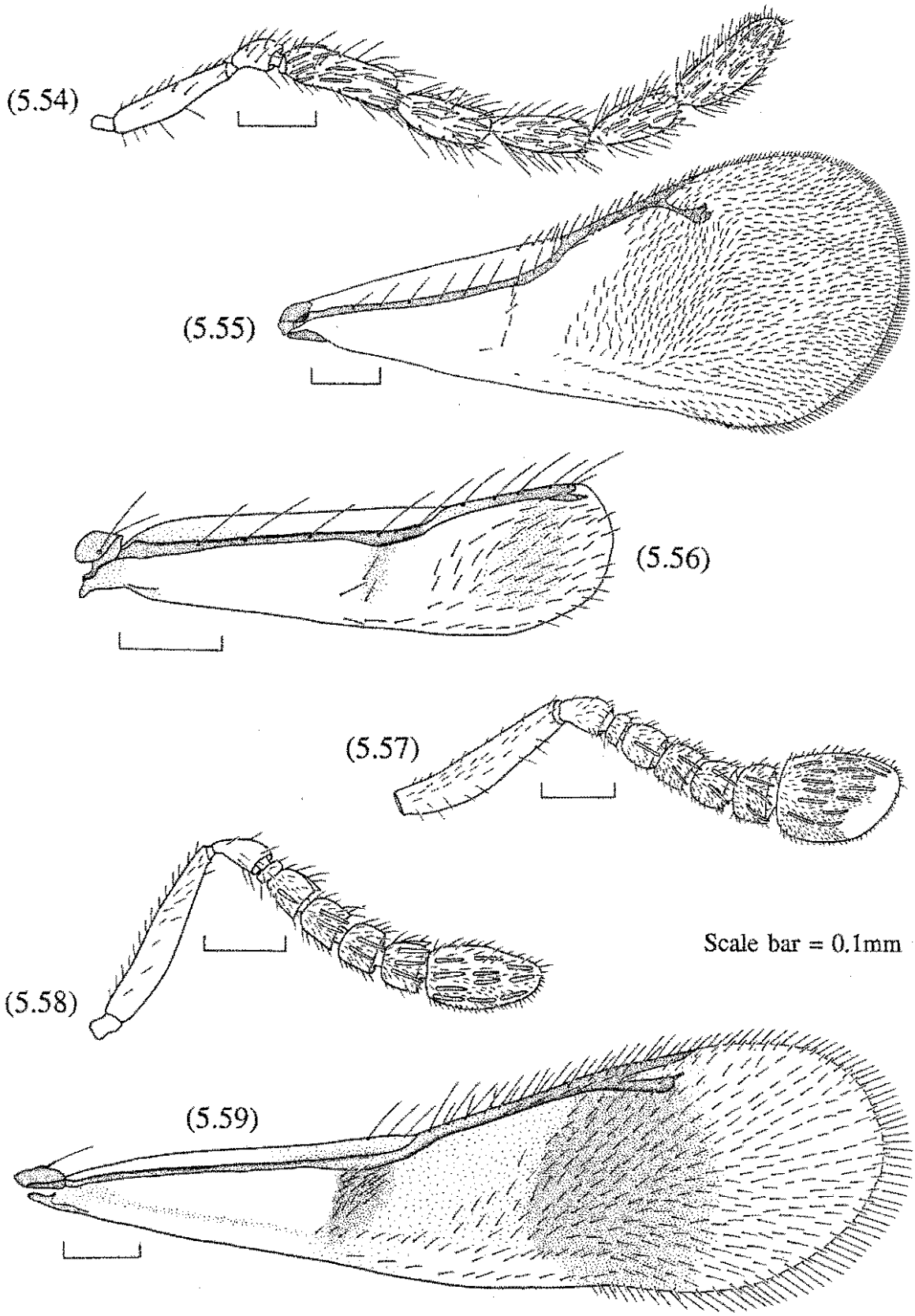
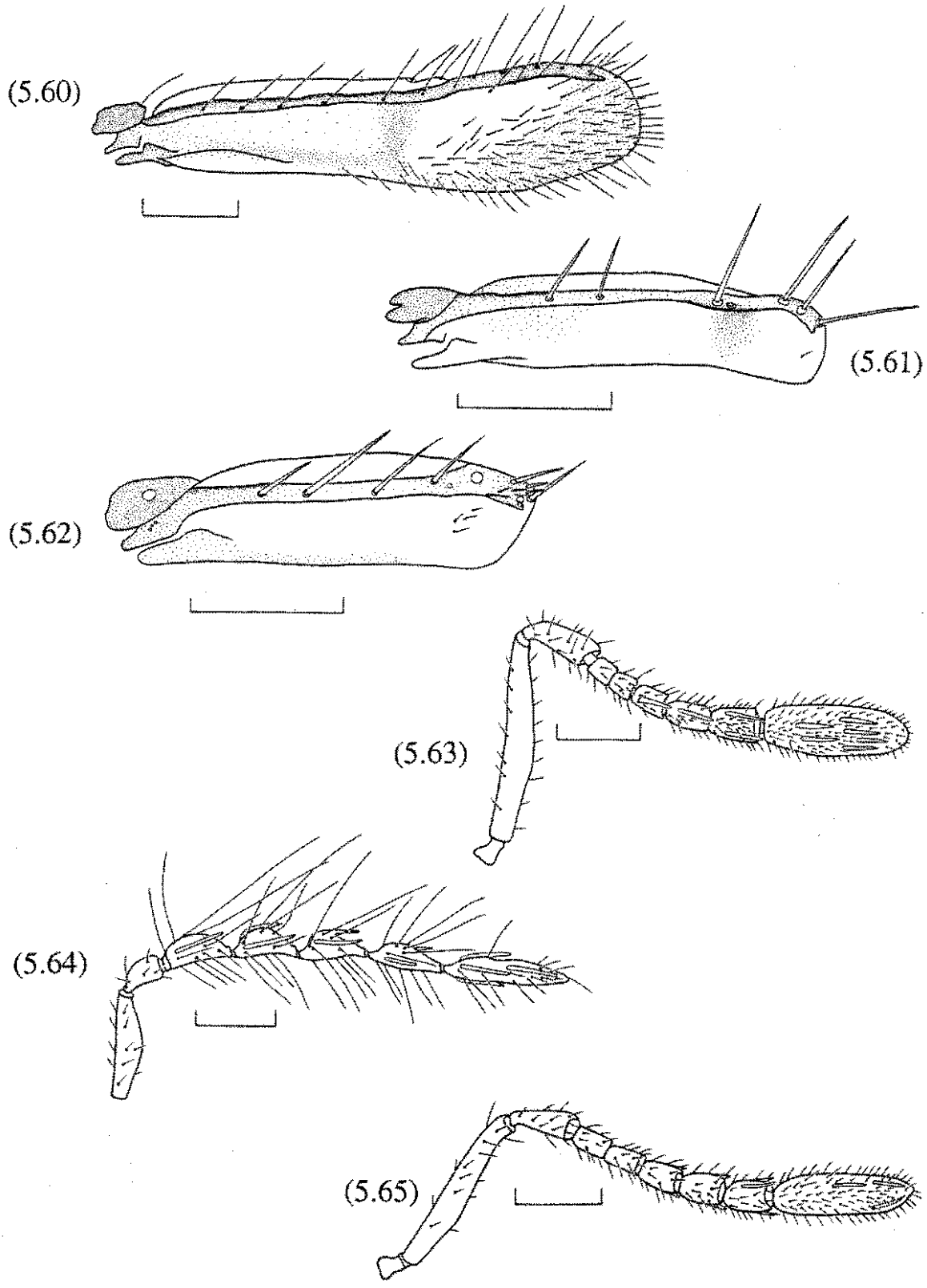
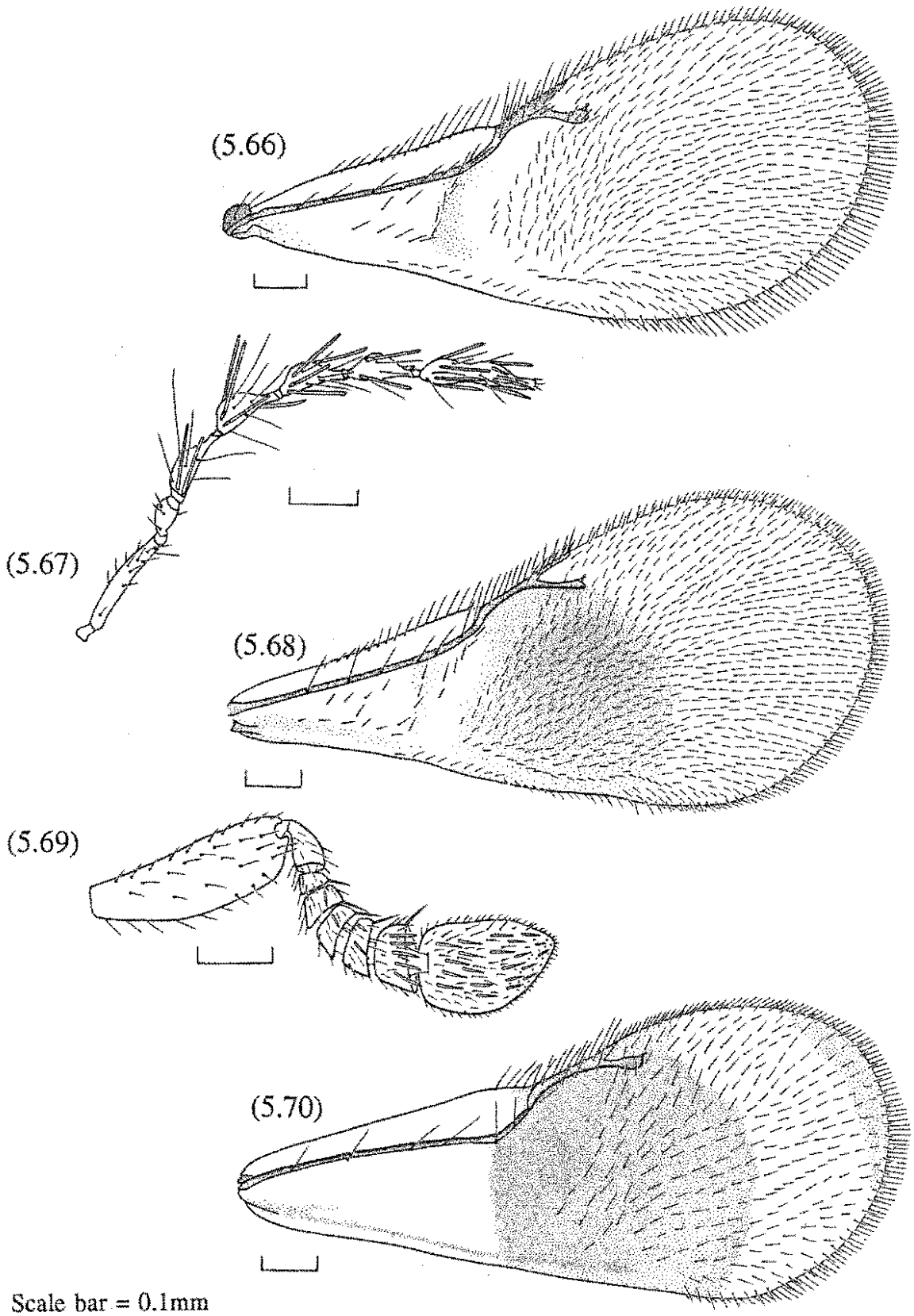


Figure 5.54 *Ophelosia hypatia*: male antenna. **Figure 5.55** *Ophelosia josephinae*: female forewing. **Figure 5.56** *Ophelosia mcglashani*: female forewing. **Figure 5.57** *Ophelosia rieki*: female antenna. **Figure 5.58** *Ophelosia saintpierrei*: female antenna. **Figure 5.59** *Ophelosia stenopteryx*: female forewing.



Scale bar = 0.1mm

Figure 5.60 *Ophelosia tasmaniensis*: female forewing. **Figures 5.61, 5.62** Intermediate wing forms: female forewings. **Figures 5.63, 5.64** *Tomicobiella arsenei*: (5.63) female antenna; (5.64) male antenna. **Figure 5.65** *Tomicobiella girault*i: female antenna.



Figures 5.66, 5.67 *Tomicobiella girault*i: (5.66) female forewing; (5.67) male antenna. **Figure 5.68** *Tomicobiella philiporum*: female forewing. **Figures 5.69, 5.70** *Tomicobomorpha stellata*, female: (5.69) holotype antenna; (5.70) holotype forewing.

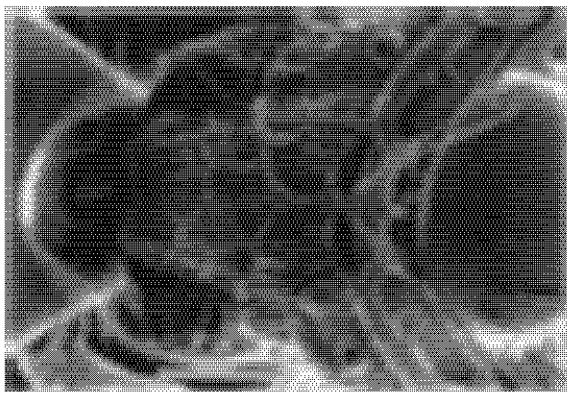


Fig.3.1 *Ophelosia charlesii*, ♂ propodeum
Scale bar=100μm

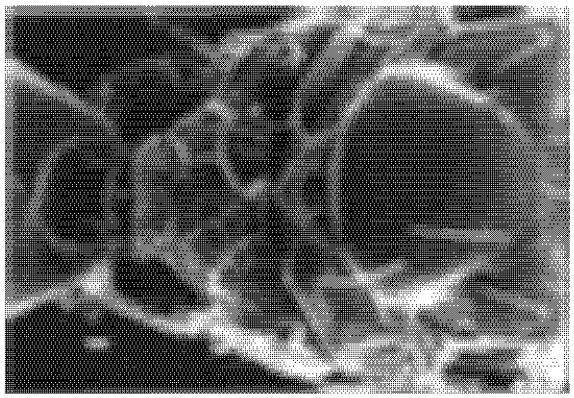


Fig.3.2 *Ophelosia charlesii*, ♂ propodeum
Scale bar=10μm

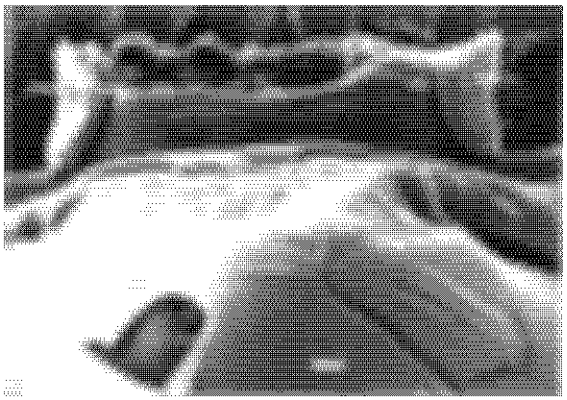


Fig.4.5 *Cephaleta* sp., sternite 1
Scale bar=10μm

Fig.4.6 *Mesopeltita truncatipennis*, sternite 1
Scale bar=100μm

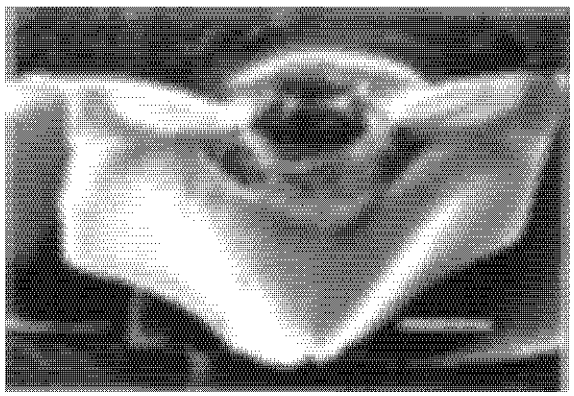


Fig.4.7 *Scutellista cyanea*, sternite 1
Scale bar=100μm

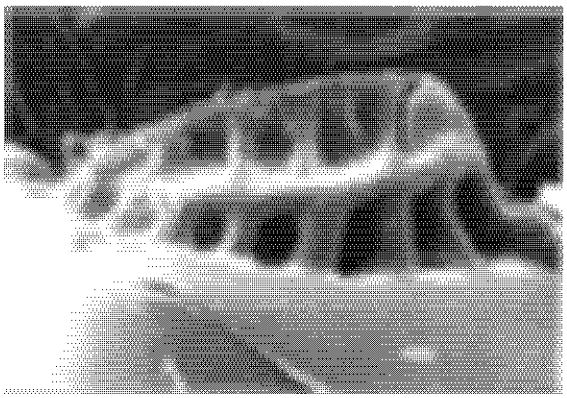


Fig.4.8 *Tomocera americanus*, sternite 1
Scale bar=10μm

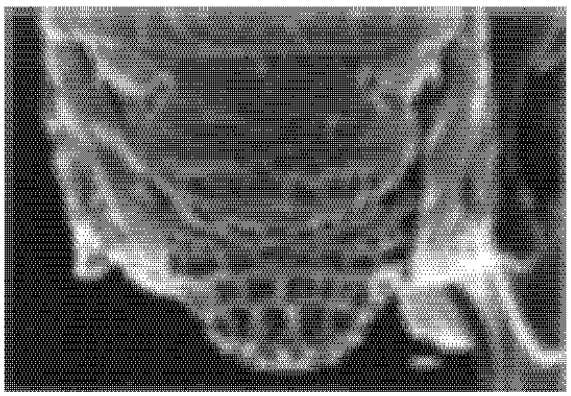


Fig.5.71 *Amoturella brindabellensis*, thorax
Scale bar=10μm

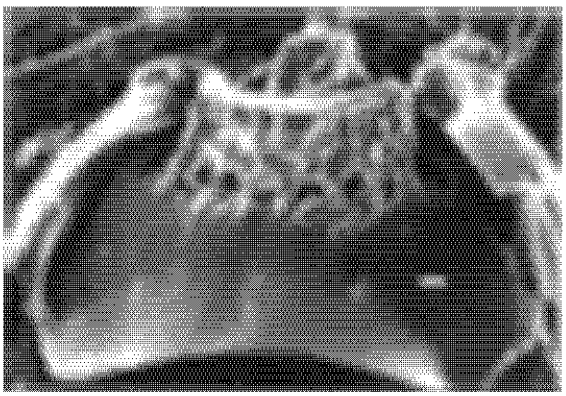


Fig.5.72 *Amoturella brindabellensis*, sternite 1
Scale bar=10μm

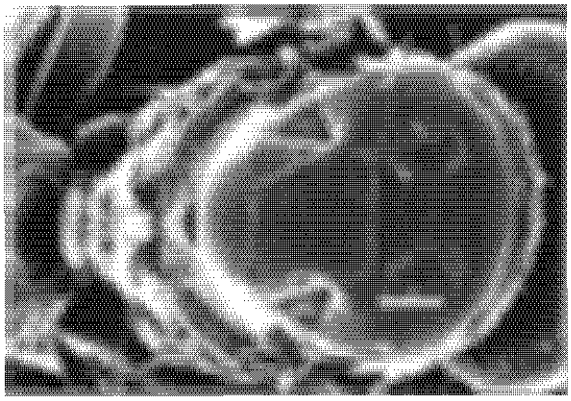


Fig.5.73 *Aphobetus cultratus*, thorax and propodeum
Scale bar=100μm

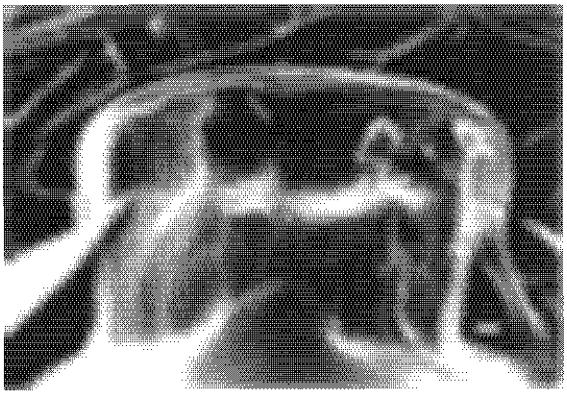


Fig.5.74 *Aphobetus cultratus*, sternite 1
Scale bar=10μm

Fig.5.75 *Aphobetus cyanea*, thorax and propodeum
Scale bar=100μm

Fig.5.76 *Aphobetus cyanea*, propodeum
Scale bar=100μm

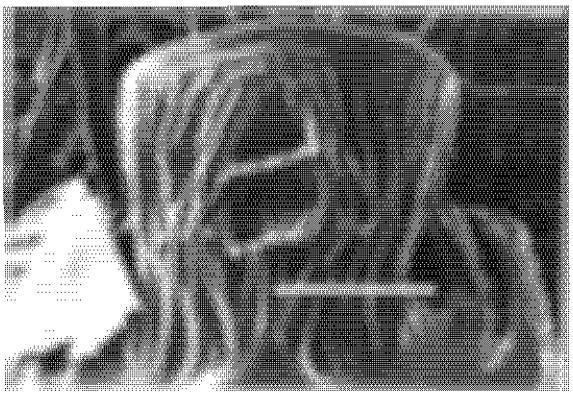


Fig.5.77 *Aphobetus cyanea*, sternite 1
Scale bar=100μm

Fig.5.78 *Aphobetus cyanea*, sternite 1
Scale bar=100μm

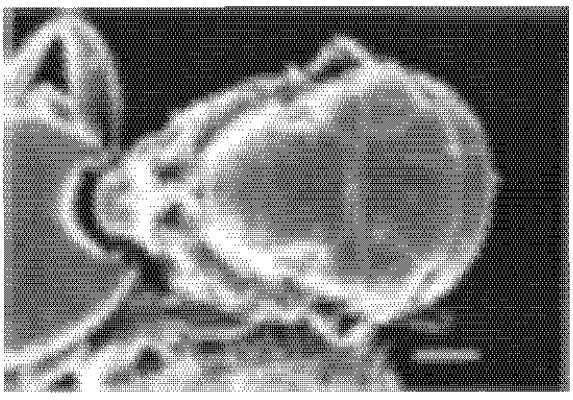


Fig.5.79 *Aphobetus erroli*, thorax and propodeum
Scale bar=100μm

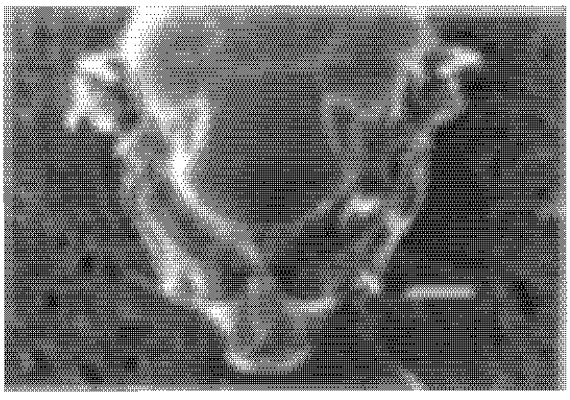


Fig.5.80 *Aphobetus erroli*, scutellum and propodeum
Scale bar=100μm

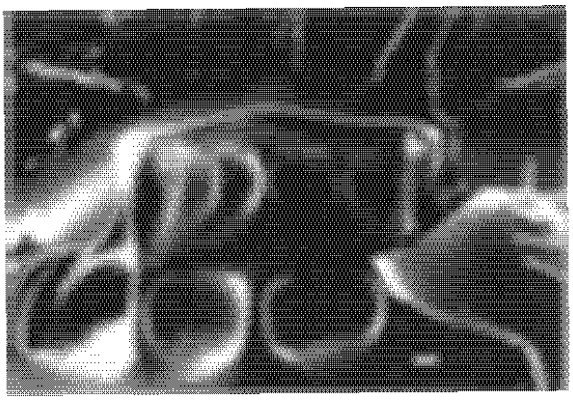


Fig.5.81 *Aphobetus erroli*, sternite 1
Scale bar=10μm

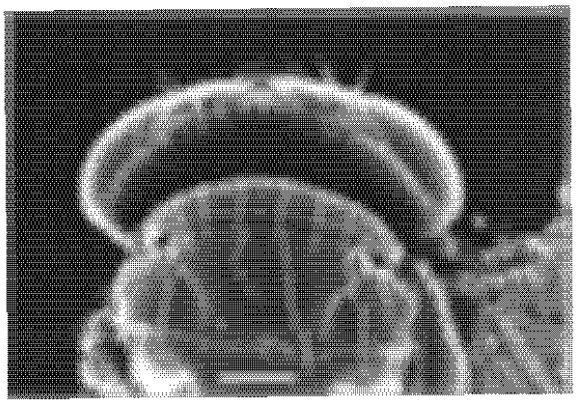


Fig.5.82 *Aphobetus garretti*, occipital carina
Scale bar=100μm

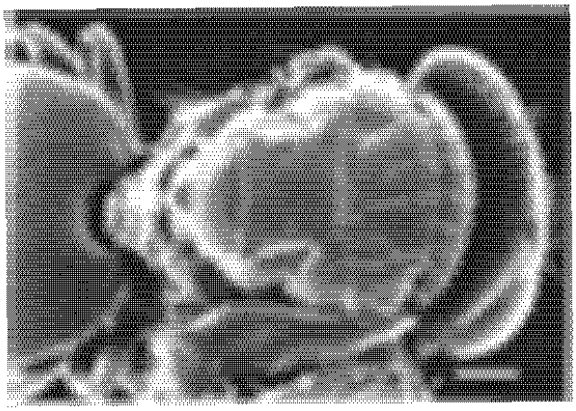


Fig.5.83 *Aphobetus garretti*, thorax and gaster
Scale bar=100μm

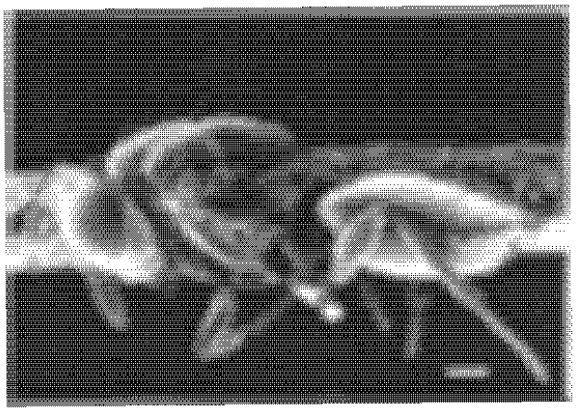


Fig.5.84 *Aphobetus garretti*, lateral view
Scale bar=100μm

Fig.5.85 *Aphobetus garretti*, propodeum
Scale bar=10μm

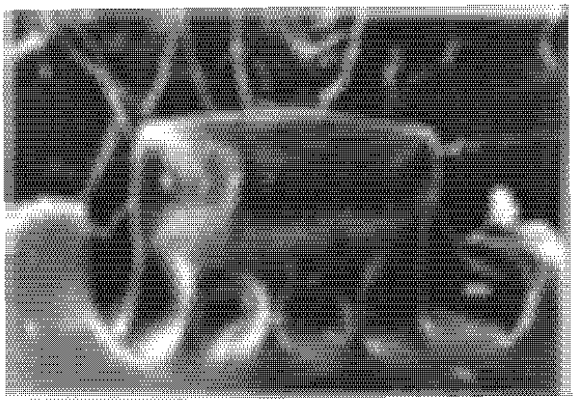


Fig.5.86 *Aphobetus garretti*, sternite 1
Scale bar=10μm

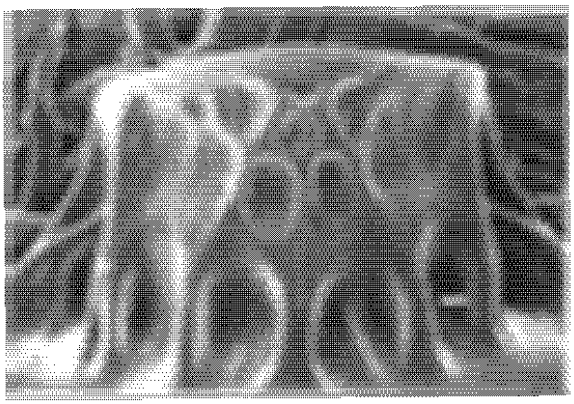


Fig.5.87 *Aphobetus lecanii*, sternite 1
Scale bar=10μm

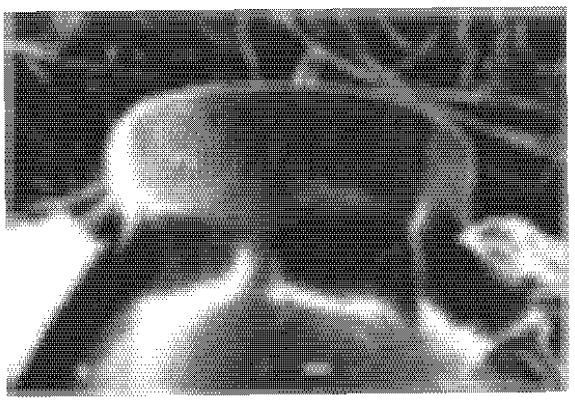


Fig.5.88 *Aphobetus maskelli*, sternite 1
Scale bar=10μm

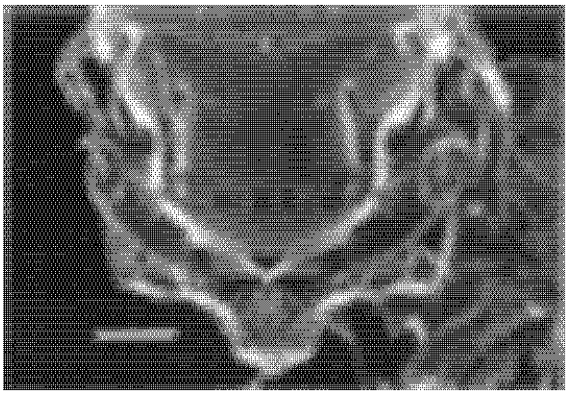


Fig.5.89 *Aphobetus moundi*, scutellum and propodeum
Scale bar=100μm

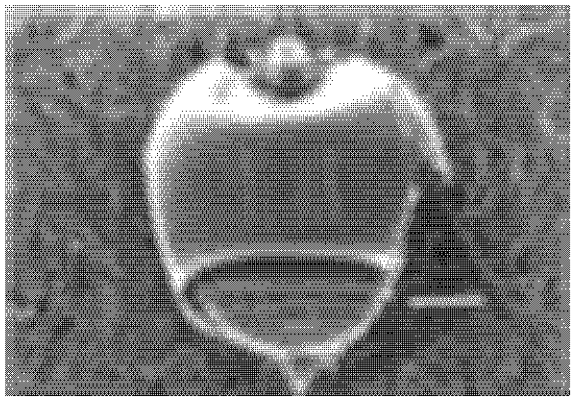


Fig.5.90 *Aphobetus moundi*, T1 of gaster
Scale bar=100μm

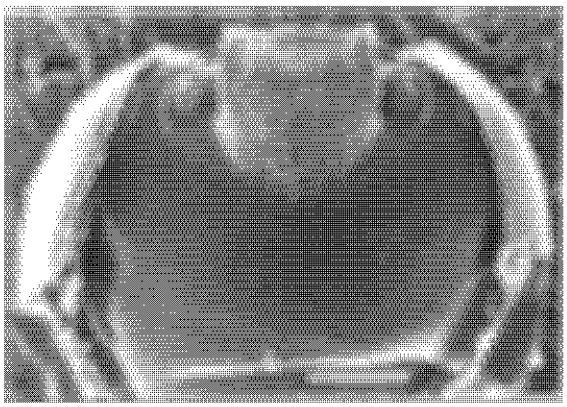


Fig.5.91 *Aphobetus moundi*, sternite 1
Scale bar=100μm

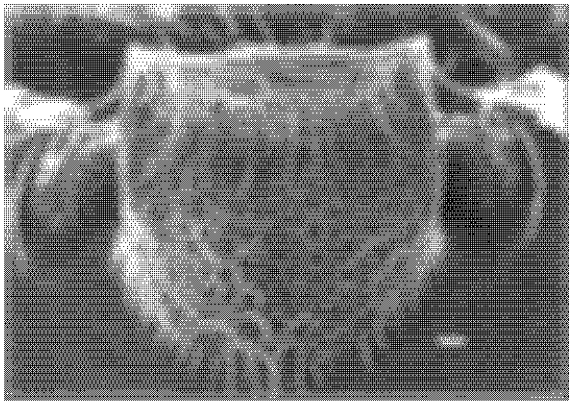


Fig.5.92 *Aphobetus moundi*, sternite 1
Scale bar=10μm

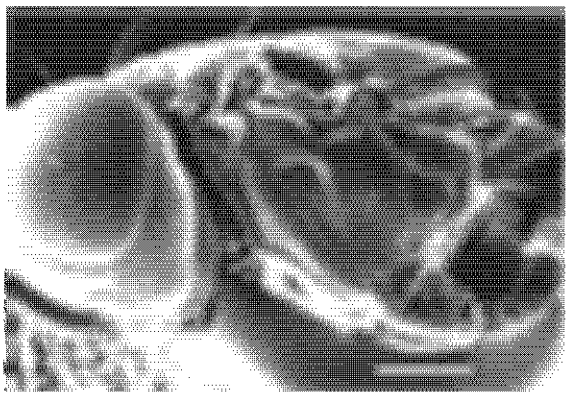


Fig.5.93 *Aphobetus paucisetosus*, lateral view
Scale bar=100μm

Fig.5.94 *Aphobetus paucisetosus*, sternite 1
Scale bar=100μm

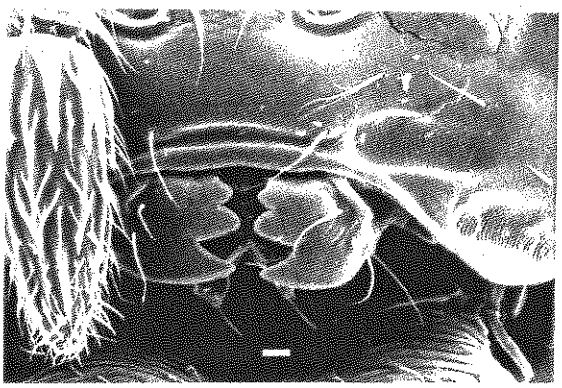


Fig.5.95 *Aphobetus silvifilia*, malar groove
Scale bar=10μm

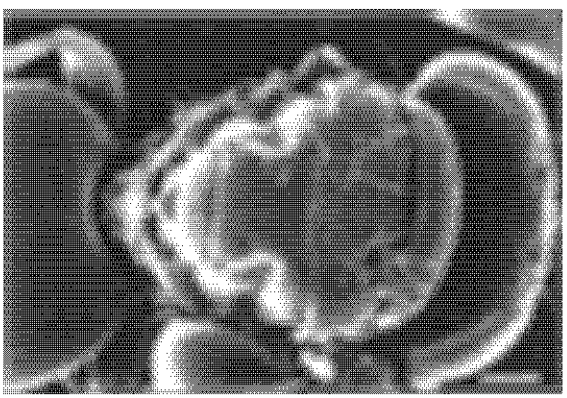


Fig.5.96 *Aphobetus silvifilia*, thorax and propodeum
Scale bar=100μm

Fig.5.97 *Aphobetus silvifilia*, lateral view
Scale bar=100μm

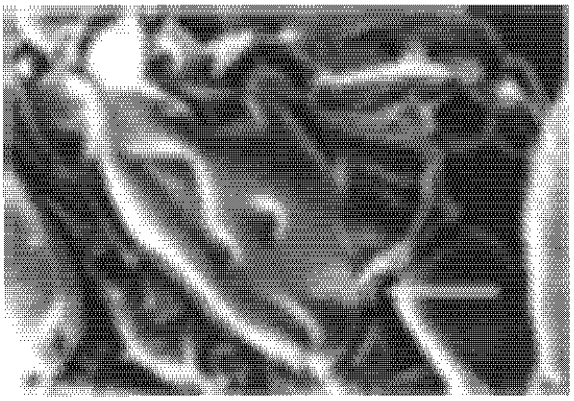


Fig.5.98 *Aphobetus silvifilia*, lateral thorax
Scale bar=100μm

Fig.5.99 *Aphobetus silvifilia*, propodeum
Scale bar=10μm

Fig.5.100 *Aphobetus silvifilia*, sternite 1
Scale bar=10μm

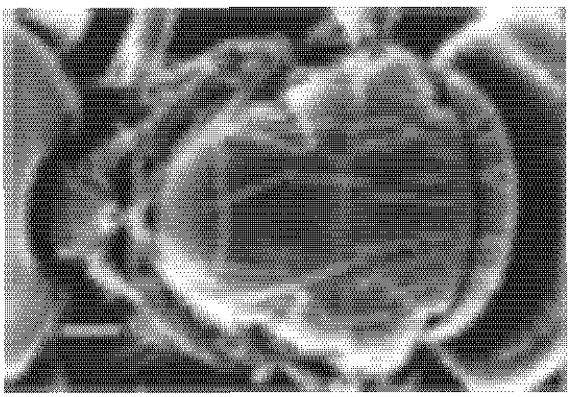


Fig.5.101 *Aphobetus singeri*, dorsal thorax
Scale bar=100μm

Fig.5.102 *Aphobetus singeri*, lateral thorax
Scale bar=100μm

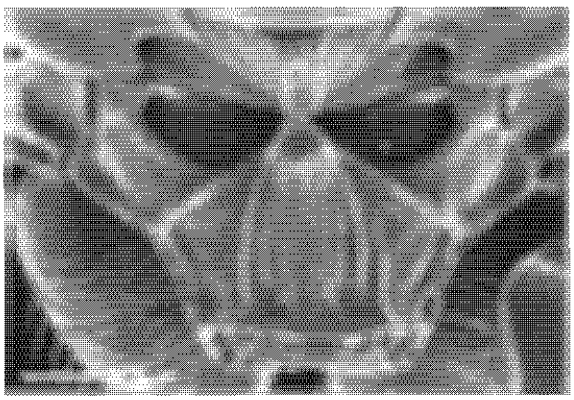


Fig.5.103 *Aphobetus singeri*, propodeum
Scale bar=100μm

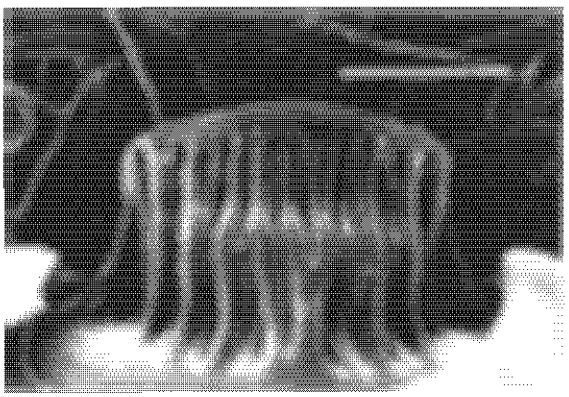


Fig.5.104 *Aphobetus singeri*, sternite 1
Scale bar=100μm

Fig.5.105 *Aphobetus vandiemenensis*, occipital carina
Scale bar=100μm

Fig.5.106 *Aphobetus vandiemenensis*, thorax
Scale bar=100μm

Fig.5.107 *Aphobetus vandiemenensis*, lateral thorax
Scale bar=100μm

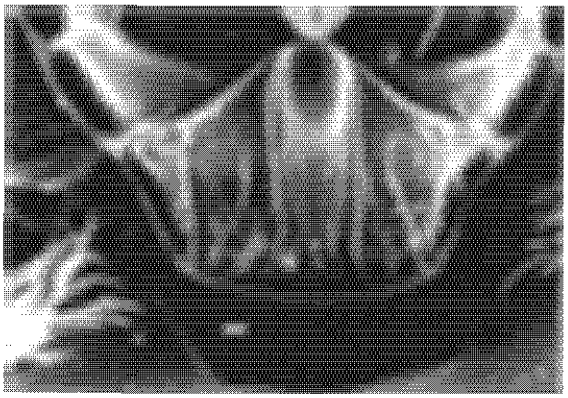


Fig.5.108 *Aphobetus vandiemenensis*, propodeum
Scale bar=10μm

Fig.5.109 *Aphobetus vandiemenensis*, sternite 1
Scale bar=10μm

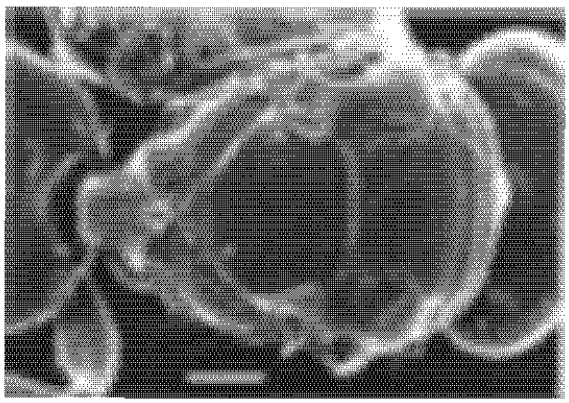


Fig.5.110 *Aphobetus nana*, dorsal thorax
Scale bar=100μm

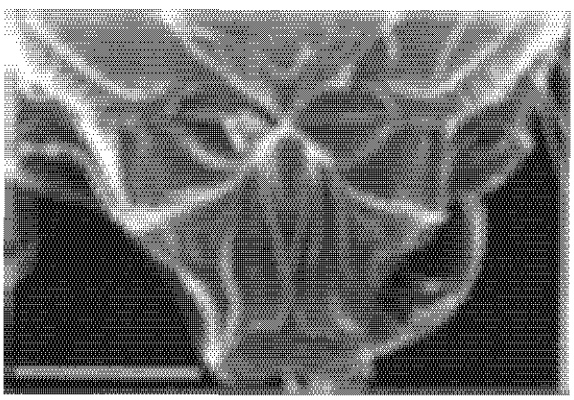


Fig.5.111 *Aphobetus nana*, propodeum
Scale bar=100μm

Fig.5.112 *Aphobetus nana*, sternite 1
Scale bar=10μm

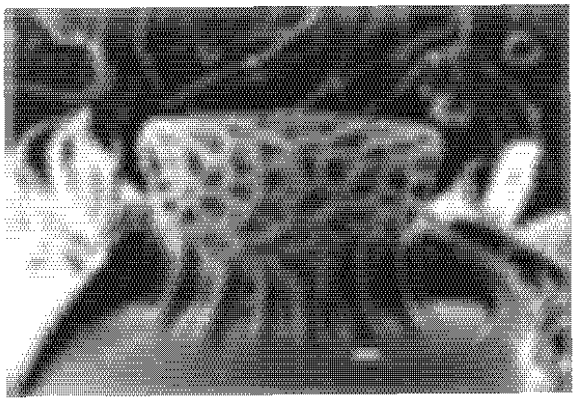


Fig.5.113 *Aphobetus ruskini*, sternite 1
Scale bar=10μm

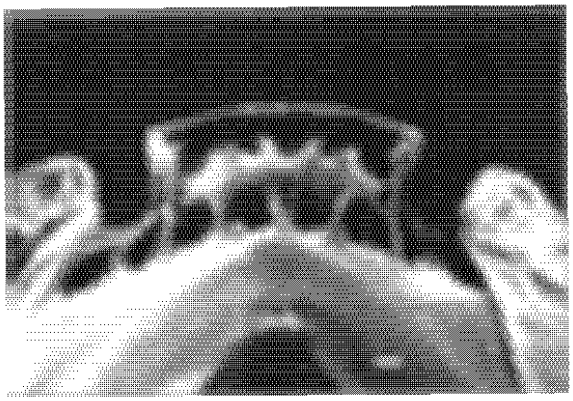


Fig.5.114 *Globonila parva*, sternite 1
Scale bar=10μm

Fig.5.115 *Moranila aoteoroae*, sternite 1
Scale bar=10μm

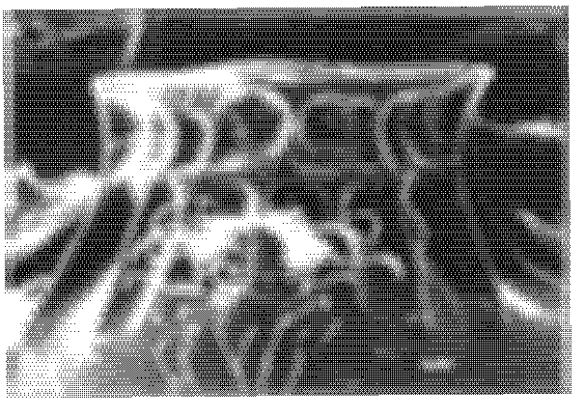


Fig.5.116 *Moranila baeusomorpha*, sternite 1
Scale bar=10μm

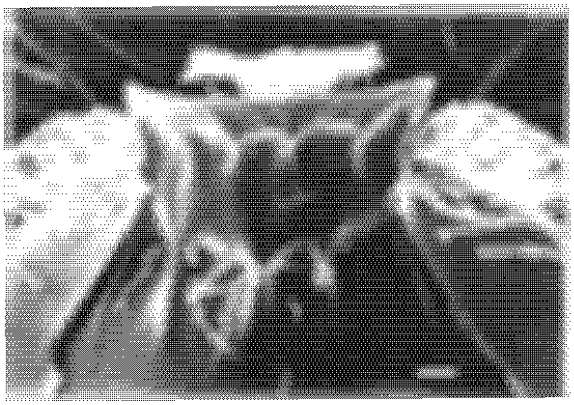


Fig.5.117 *Moranila brunneventris*, sternite 1
Scale bar=10μm

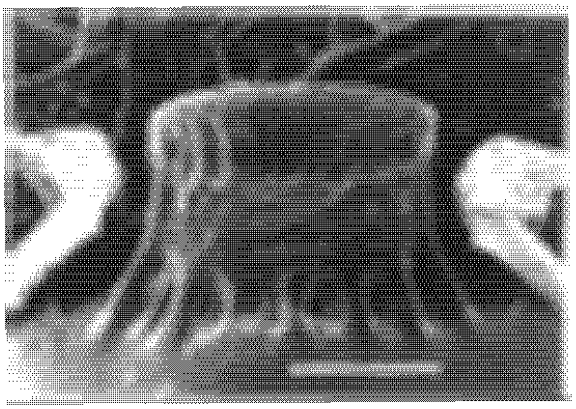


Fig.5.118 *Moranila californica*, sternite 1
Scale bar=100μm

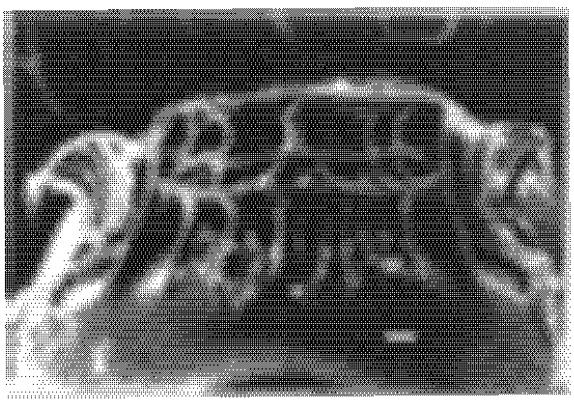


Fig.5.119 *Moranila comperei*, ♀ sternite 1
Scale bar=10μm

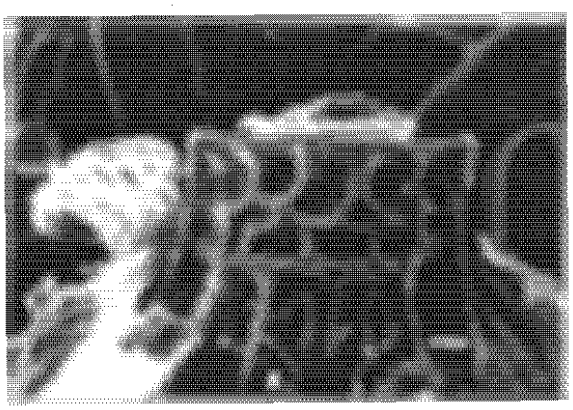


Fig.5.120 *Moranila comperei*, ♂ sternite 1
Scale bar=10μm

Fig.5.121 *Moranila gullanae*, sternite 1
Scale bar=10μm

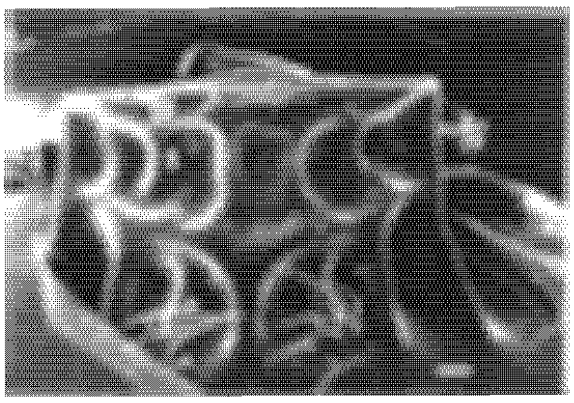


Fig.5.122 *Moranila punctata*, sternite 1
Scale bar=10μm

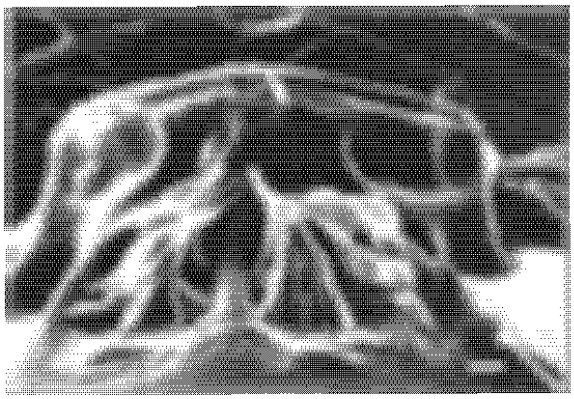


Fig.5.123 *Moranila strigaster*, sternite 1
Scale bar=10μm

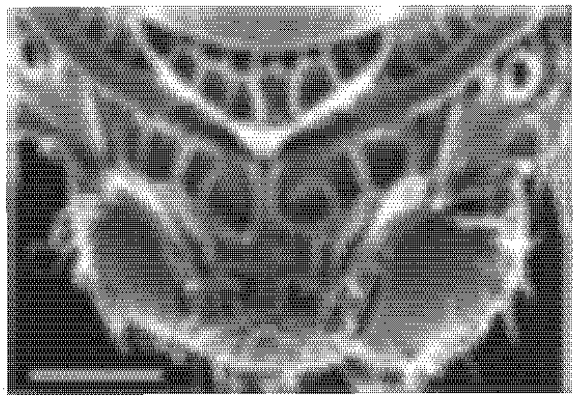


Fig.5.124 *Moranila viridivertex*, propodeum
Scale bar=100μm

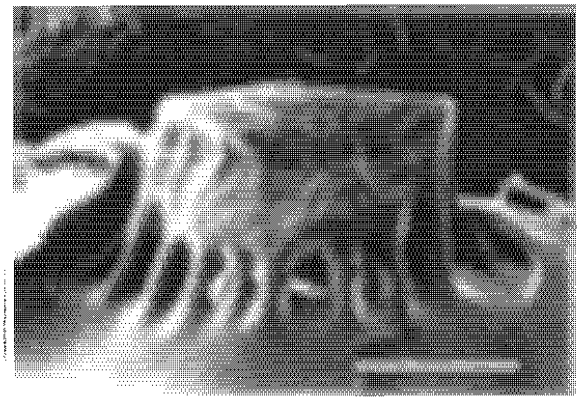


Fig.5.125 *Moranila viridivertex*, sternite 1
Scale bar=100μm

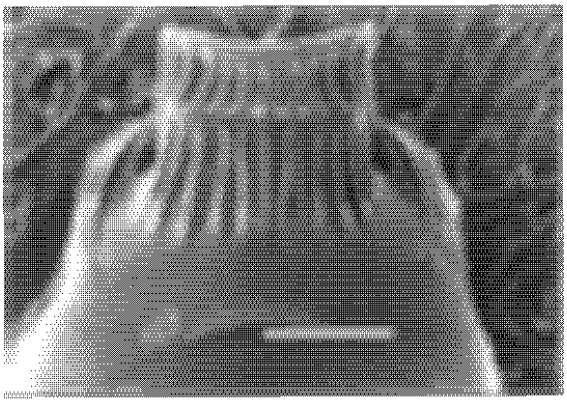


Fig.5.126 *Ophelosia australis*, sternite 1
Scale bar=100μm

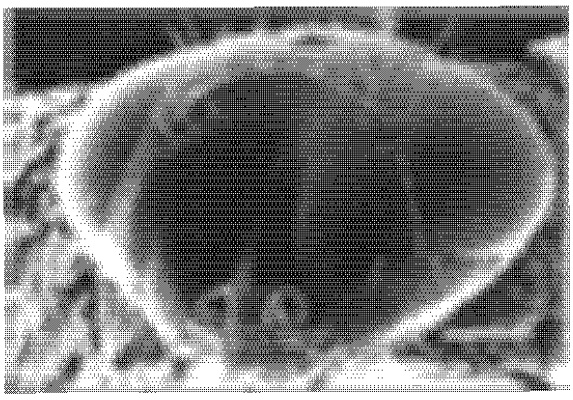


Fig.5.127 *Ophelosia bifasciata*, ♀ face
Scale bar=100μm

Fig.5.128 *Ophelosia bifasciata*, oral margin
Scale bar=10μm

Fig.5.129 Scale bar=100μm
Ophelosia bifasciata, scutellum and propodeum

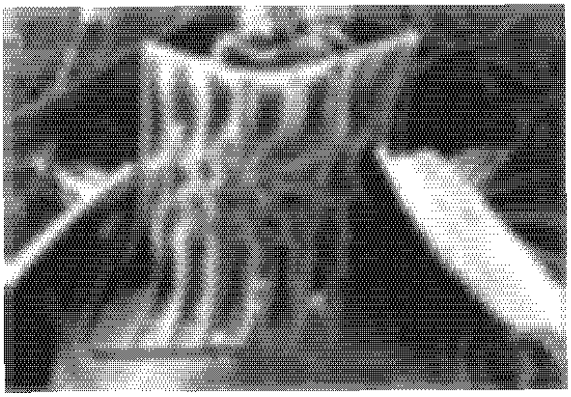


Fig.5.130 *Ophelosia bifasciata*, sternite 1
Scale bar=100μm

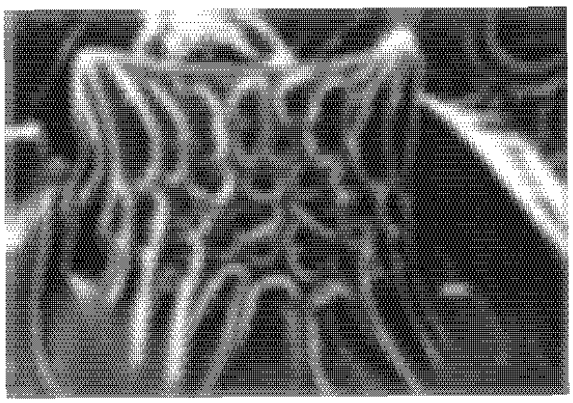


Fig.5.131 *Ophelosia brevisetosa*, sternite 1
Scale bar=10μm

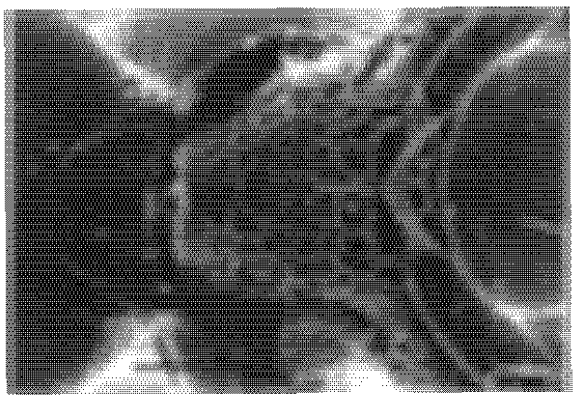


Fig.5.132 *Ophelosia charlesii*, propodeum
Scale bar=100μm

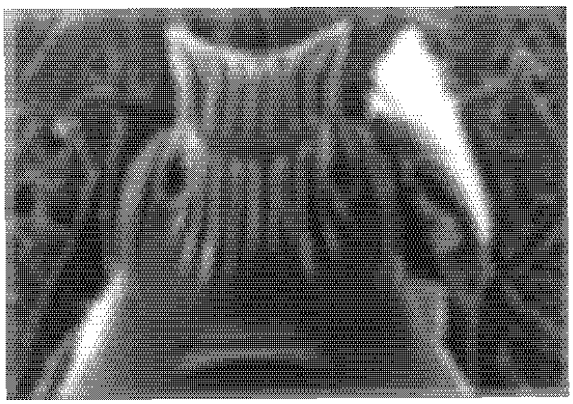


Fig.5.133 *Ophelosia charlesii*, sternite 1
Scale bar=100μm

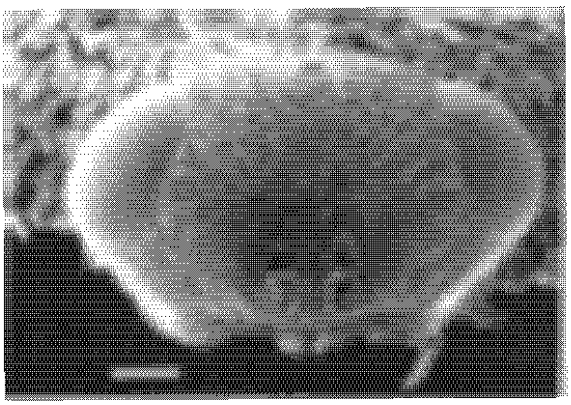


Fig.5.134 *Ophelosia crawfordi*, ♀ face
Scale bar=100μm

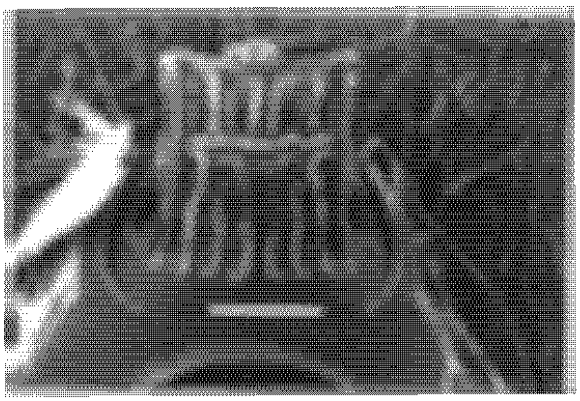


Fig.5.135 *Ophelosia crawfordi*, sternite 1
Scale bar=100μm

Fig.5.136 *Ophelosia hypatia*, oral margin
Scale bar=10μm

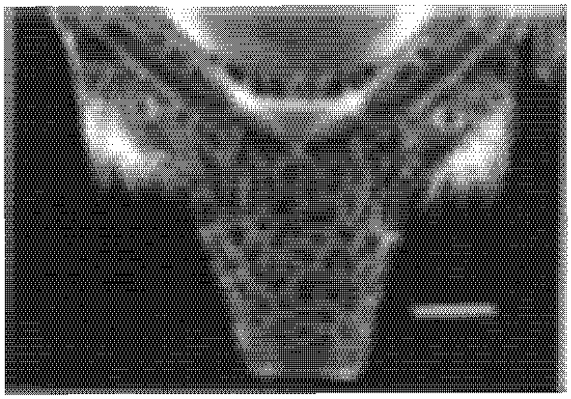


Fig.5.137 *Ophelosia hypatia*, propodeum
Scale bar=100μm

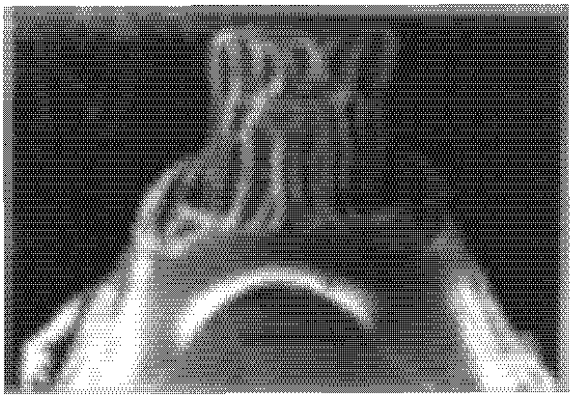


Fig.5.138 *Ophelosia hypatia*, sternite 1
Scale bar=100μm

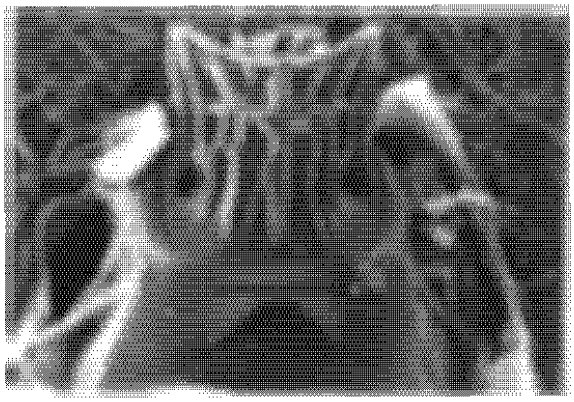


Fig.5.139 *Ophelosia josephinae*, sternite 1
Scale bar=100μm

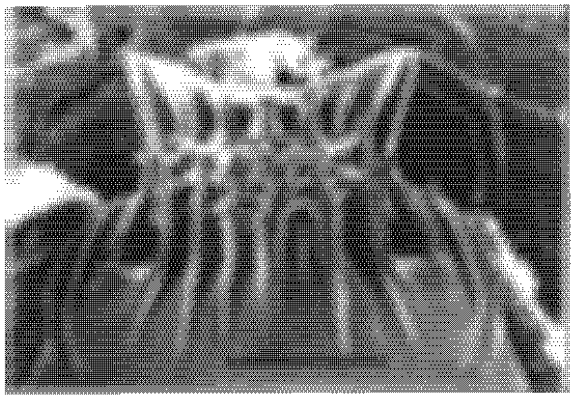


Fig.5.140 *Ophelosia keatsi*, sternite 1
Scale bar=100μm

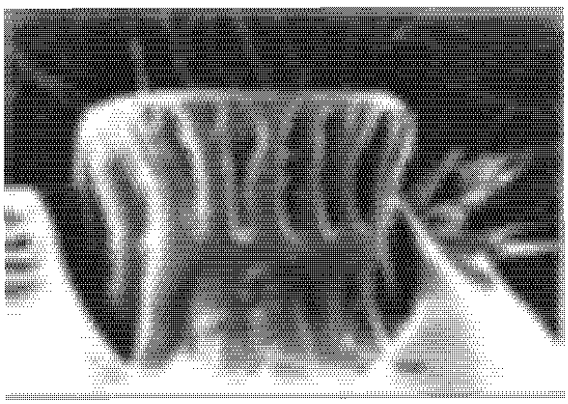


Fig.5.141 *Ophelosia keatsi*, sternite 1
Scale bar=10μm

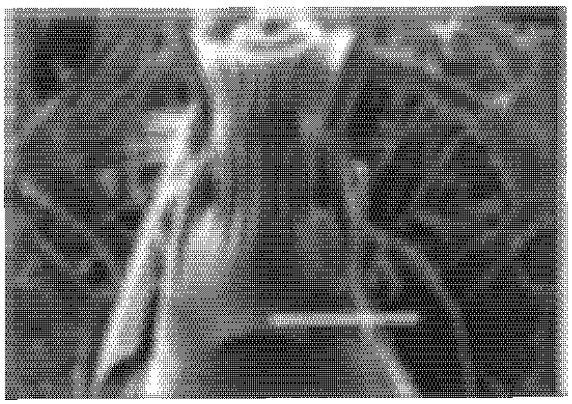


Fig.5.142 *Ophelosia leai*, sternite 1
Scale bar=100μm

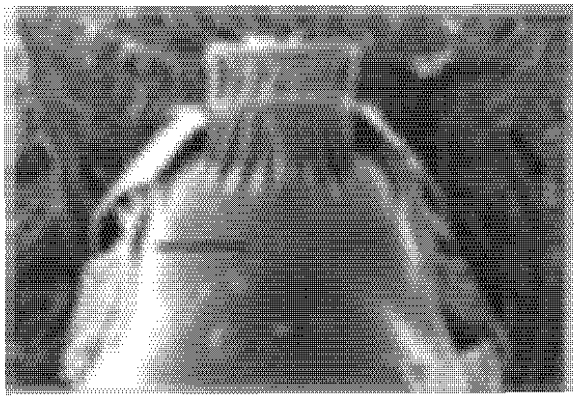


Fig.5.143 *Ophelosia mcglashani*, sternite 1
Scale bar=100μm

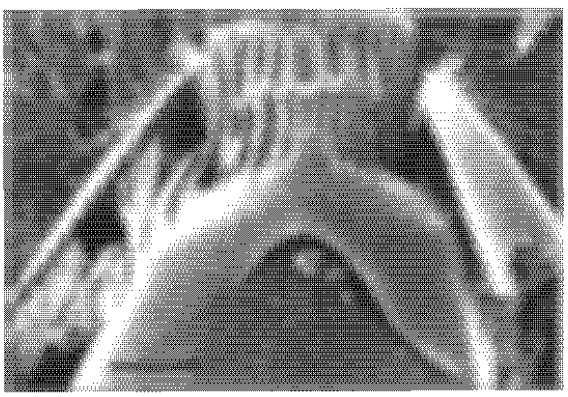


Fig.5.144 *Ophelosia odiosa*, sternite 1
Scale bar=100μm

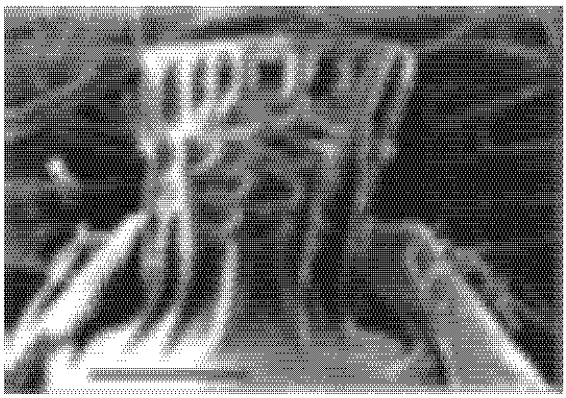


Fig.5.145 *Ophelosia rieki*, sternite 1
Scale bar=100μm

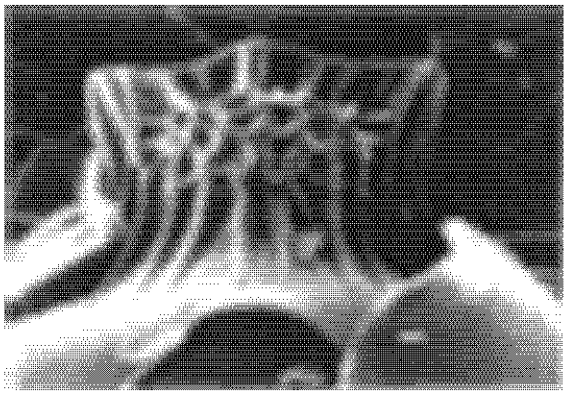


Fig.5.146 *Ophelosia saintpierrei*, sternite 1
Scale bar=10μm

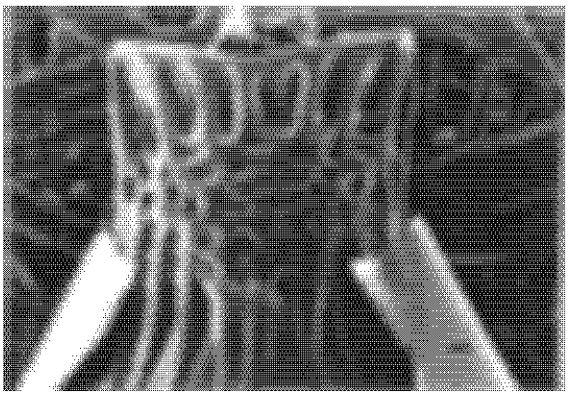


Fig.5.147 *Ophelosia stenopteryx*, sternite 1
Scale bar=10μm

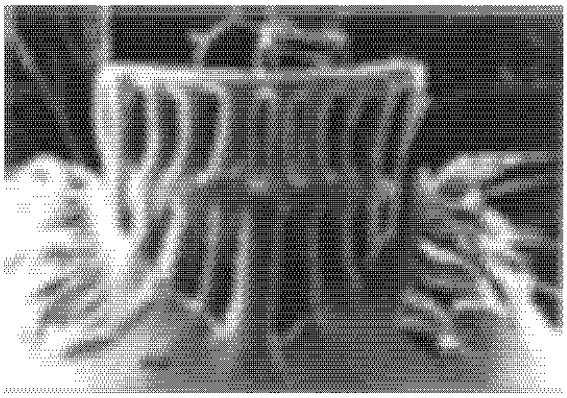


Fig.5.148 *Ophelosia tasmaniensis*, sternite 1
Scale bar=10μm

Fig.5.149 *Tomicobiella girault*i, propodeum
Scale bar=100μm

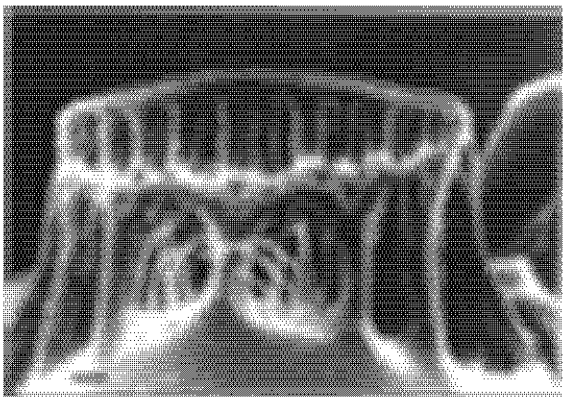


Fig.5.150 *Tomicobiella girault*i, sternite 1
Scale bar=10μm

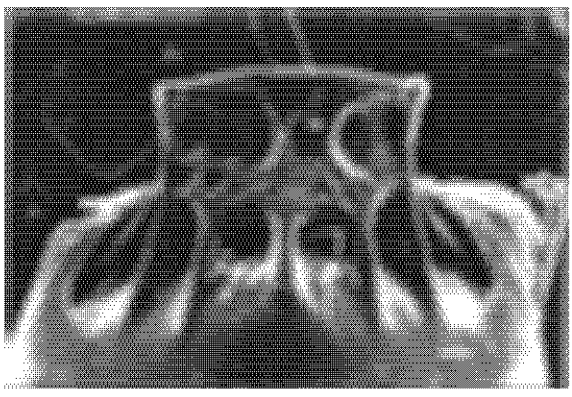


Fig.5.151 *Tomicobiella arsenei*, sternite 1
Scale bar=10μm

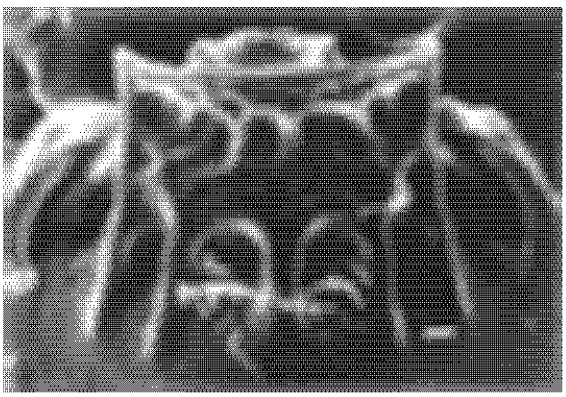


Fig.5.152 *Tomicobiella philiporum*, sternite 1
Scale bar=10μm