

Taxonomy, Phylogeny and Zoogeography of the Subfamily Ceratomerinae of Australia (Diptera: Empidoidea)

BRADLEY J. SINCLAIR

Zoologisches Forschungsinstitut und Museum Alexander Koenig,
Adenauerallee 160, 53113 Bonn, Germany
b.sinclair.zfmk@uni-bonn.de

ABSTRACT. Nineteen endemic Australian species of the Gondwanan genus *Ceratomerus* Philippi are revised, including four described and 15 new species: *C. albistylus* Hardy, *C. athertonius* n.sp., *C. attenuatus* n.sp., *C. barringtonensis* n.sp., *C. bickeli* n.sp., *C. bulbosus* n.sp., *C. campbelli* (Paramonov), *C. falcatus* n.sp., *C. globosus* n.sp., *C. hibernatus* n.sp., *C. inflexus* Hardy, *C. lobatus* n.sp., *C. maculatus* n.sp., *C. malleolus* n.sp., *C. macalpinei* n.sp., *C. ordinatus* Hardy, *C. oreas* n.sp., *C. orientalis* n.sp., and *C. victoriae* n.sp. This is primarily an aquatic genus, restricted to cascading rocky rainforest streams of eastern Australia from the Tablelands near Cairns to Tasmania. Adults prey on flying aquatic insects and are collected on emergent rocks and riparian vegetation.

The Australian ceratomerine fauna comprises three species groups, with the *C. campbelli* group apparently most closely related to the *C. paradoxus* group of Chile. The *C. ordinatus* group appears closely related to species from New Zealand and Ecuador (high elevations). A key to all Australian species is included and zoogeography discussed.

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The aquatic Diptera of Australia are relatively poorly known, with the exception of economically important groups such as Tabanidae, Simuliidae and Culicidae. In the Empidoidea, two subfamilies dominate cascading streams in eastern Australia. Firstly, the Clinocerinae, include at least three genera (*Proagomyia* Collin, *Asymphyloptera* Collin and *Clinocera* Meigen). *Clinocera* includes seven species (Sinclair, 2000b), while there are some 6–8 spp. of *Asymphyloptera* and possibly as many *Proagomyia* (Sinclair, unpubl. data).

The second subfamily is the Ceratomerinae, which is particularly common on emergent rocks in mountainous streams of eastern Australia. Besides these taxa, other empidooids collected on emergent rocks include *Hilara* Meigen (but more often swarming and skimming pools), *Apalocnemis* Philippi, *Hydropeza* Sinclair (1999), and

several undescribed genera (e.g., “Genus No.3” Sinclair & Cumming, 2000). A number of dolichopodid species are also known to frequent river rocks as discussed by Bickel (1994). However, it is the Ceratomerinae that most often dominate this niche in Australia.

The Ceratomerinae are confined to wet forests of the former Gondwanan continents of Australia, New Zealand and South America. Despite its classic Trans-Antarctic distribution, these flies have received sparse attention from zoogeographers, because of the lack of knowledge at both the species and genus level and absence of published data on phylogenetic relationships within this subfamily.

Adults of Ceratomerinae are characterized by long, narrow wings and very elongate antennae, which strongly project forward as they run about. In Australia, the Ceratomerinae are represented by the single genus *Ceratomerus* Philippi, 1865,

first described from Chile. There are four described and 15 new Australian species described in this paper. In New Zealand, there are 13 named species (Plant, 1991), but more than twice this number remain undescribed (Sinclair, 1998).

Very little is known about the biology of this subfamily, the immature stages remain unknown but are presumed to be primarily aquatic. This is the second of a series of studies on the subfamily Ceratomerinae (see Sinclair, 1997), with the present study confined to the taxa of Australia.

Materials and methods

This study is based on some 1850 adult specimens of *Ceratomerus* borrowed from or deposited in the following institutions: Australian Museum, Sydney, Australia (AMS); Australian National Insect Collection, Canberra, Australia (ANIC); The Natural History Museum, London, England (BMNH); Bernice P. Bishop Museum, Honolulu, USA (BPBM); Canadian National Collection of Insects, Ottawa, Canada (CNC); Museum of Victoria, Melbourne, Australia (MVM); University of Queensland Insect Collection, Brisbane, Australia (UQIC); United States National Museum of Natural History, Washington, USA (USNM); N.E. Woodley Collection [private], Washington, USA (WOOC); Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany (ZFMK). Abbreviations given here are used throughout the text to indicate deposition of specimens.

Although the Hardy collection was donated to the Australian Museum (Chadwick, 1966), his type specimens of *Ceratomerus* could not be located. According to Daniels (1978) many types from this collection were found to be damaged or destroyed when it was received at AMS. The three species of *Ceratomerus* described by Hardy were not included in Daniels' (1978) list. A search of the ANIC, UQIC and Queensland Museum (Brisbane) proved unsuccessful, and consequently the types are presumed destroyed and lost.

Terms used for adult structures primarily follow those of J.F. McAlpine (1981), except male terminalia where terms of Cumming *et al.* (1995) and Sinclair (2000a), and antenna where terms of Stuckenberg (1999) are used. The apical portion of male abdomens were macerated in hot 85% lactic acid in order to examine and draw the terminalia. The following abbreviations were used in the descriptions: ad, anterodorsal; av, anteroventral; dc, dorsocentral bristle; npl, notopleural bristle; pal, postalar bristle; pd, posterodorsal; pprn, postpronotal bristle; presut spal, presutural supra-alar bristle; psut spal, postsutural supra-alar bristle; pv, posteroventral; S, sternite; sctl, scutellar bristle; T, tergite. The following additional abbreviations were used in recording the label data: BJS, B.J. Sinclair; ck, creek; DHC, D.H. Colless; DJB, D.J. Bickel; DKM, D.K. McAlpine; FIR, Flora Reserve; FR, Forest Reserve; MT, malaise trap; NP, National Park; nr, near; SF, State Forest; SP, State Park; str., stream; y.pans, yellow pan traps.

The term "bristle" is used for differentiated large setae on the head, mesonotum and legs bearing a particular name or one of a series with a particular name, e.g., notopleural bristle, dorsocentral bristle, anterodorsal bristle. Label data of holotypes are cited in full, with original spelling, punctuation and date. Lines are delimited by a slash mark(/), a semicolon separates data quoted from different labels, and author's remarks are given in square brackets.

A variety of sampling methods proved effective in collecting Ceratomerinae, especially when used in combination. The

traditional methods of sweeping and aspirating adults directly off emergent rocks lying in cool, cascading streams proved very successful. Wading up streams and watching the flies dart about on the rocks assisted in locating specimens. This proved especially effective for species of the *C. campbelli* group, which were observed to fly close to the water surface and dart beneath emergent rock. From here the specimens were aspirated.

Shallow, yellow, plastic pan traps, filled with water and a few drops of detergent to break the surface tension were also highly effective in attracting and capturing specimens of Ceratomerinae. These methods are also very productive for other Empidoidea (see Pollet & Grootaert, 1987; Bickel, 1994; Sinclair & Cumming, 2000). The yellow pans (simply small cereal bowls) were spread beside and along streams and rivers, or placed on emergent rocks, especially at small cascades. Many of the large series and some rare Tasmanian species were collected using yellow pans. Pans were left out for a maximum of 24 hours then collected and redistributed at other localities.

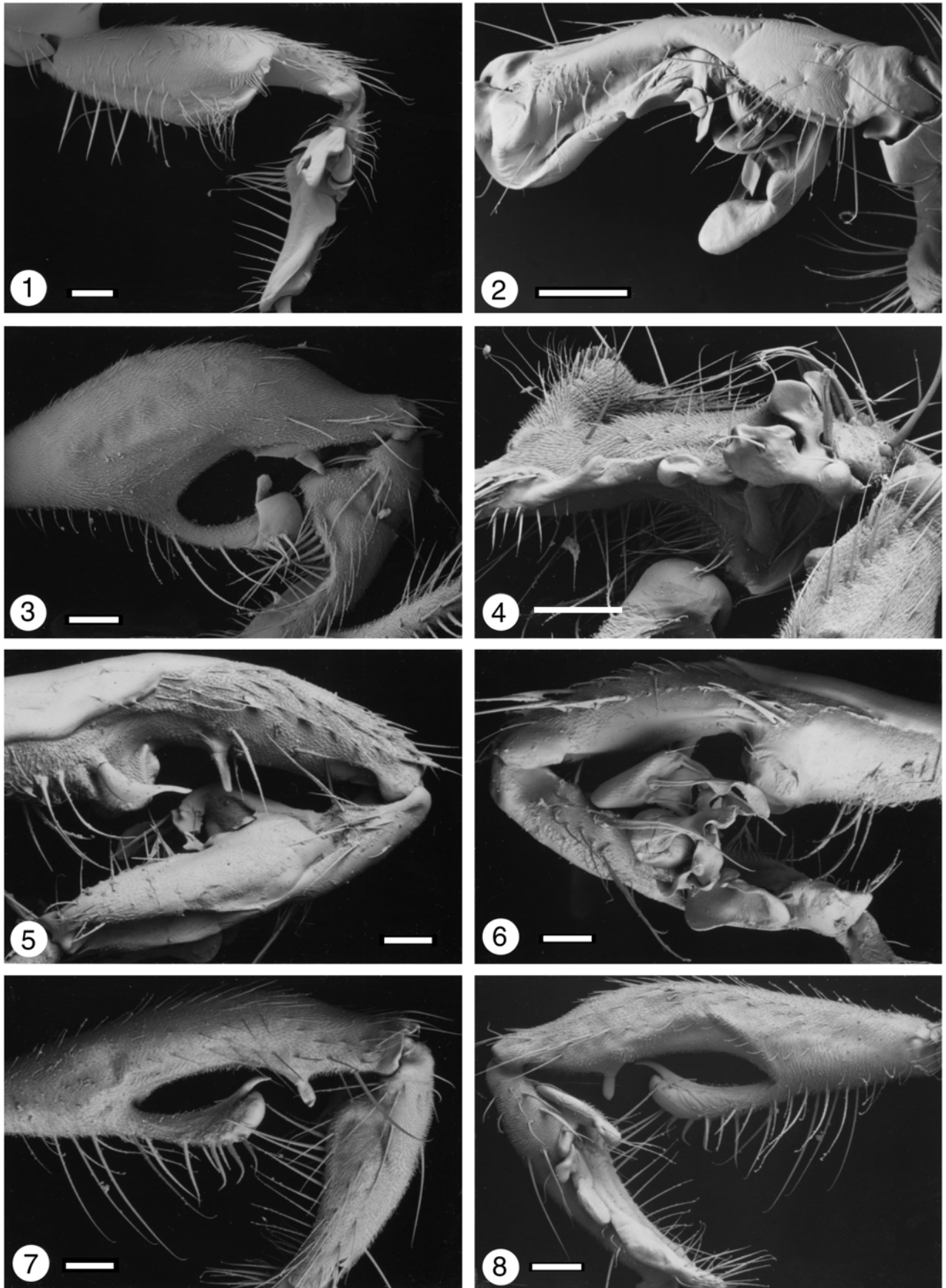
Morphology

Antenna. The most characteristic defining feature of the Ceratomerinae is the presence of a conus or thumb-like condyle arising from the apex of the pedicel (or second antennal segment), which is inserted into the postpedicel (or first flagellomere) (Figs. 58–60). In the majority of Empidoidea, the conus is absent and the base of the postpedicel is narrowed and inserted into an apical invagination of the pedicel. The conus is inserted on the median side (laterally) of the postpedicel in all Ceratomerinae. A similar condition also occurs in some genera of the Sympycninae (Dolichopodidae), including *Syntormon* Loew and *Parasyntormon* Wheeler (Bickel, 1999 and pers. comm.). In Dolichopodinae, a similar conus is present, but it is inserted medially into the postpedicel. This latter form of conus also occurs in Cyclorrhapha, except Platypezidae and Opetiidae (Cumming *et al.*, 1995). On the basis of many conflicting characters and the differences in insertion, it is assumed that the presence of the conus is derived independently among all the above groups.

Wing venation. The Ceratomerinae, exclusive of *Glyphidopeza* Sinclair are also characterized by distinct wing venation. The wing is greatly narrowed with the anal lobe not developed, R_1 terminating in the costa prior to the mid-length of the wing, and the cell *cup* (or anal cell) is absent (Figs. 10, 16, 51, 87). The dm cell is usually narrow, rectangular and parallel-sided (except where secondarily modified in some males), emitting two veins (M_{1+2} and CuA_1). The basal cells lack a clear separating vein, with cell bm only weakly outlined by a faint line and some colour differentiation within the cell.

Male secondary sexual characters. Many species of Ceratomerinae have species-specific male secondary sexual characters. These include modifications of the antenna, labrum and labium, modifications of wing veins, posterior margin of the wing, fore and/or midlegs, occasionally hindlegs, and pleura region of some New Zealand species. The male midleg can be grotesquely modified as seen in the *C. campbelli* group (Figs. 1–8). These modifications are presumably used in courtship and evolved through sexual selection by female choice.

Male terminalia. The male terminalia of Ceratomerinae, particularly *Ceratomerus*, have not been adequately



Figs. 1–8. Scanning electron micrographs of male midlegs of *Ceratomerus*. 1–2, *C. athertonius*: 1, midleg, anterior view; 2, mid tibia, dorsal view. 3–4, *C. barringtonensis*: 3, midleg, posterior view; 4, tibia, anterior view. 5–6, *C. campbelli*: 5, posterior view; 6, anterior view. 7–8, *C. victoriae*: 7, posterior view; 8, anterior view. Scale bars = 0.1 mm.

described. Collin (1933) provided an excellent illustration of *C. mediocris* Collin, but the components were unlabelled. The illustration of the same species in Chvála (1983, figs. 128–131) has several inaccuracies, which lead to misinterpretations of homologies. The homologies of the male terminalia proposed by Chvála (1983) are rejected here in favour of those of Cumming *et al.* (1995). In addition, this Chilean species is particularly complex and not an appropriate example of this genus.

Generally the terminalia are somewhat arched dorsally over the abdomen with tergite 7 weakly sclerotized medially and tergite 8 greatly narrowed dorsally. The hypandrium is cup-shaped and elongate, often with the posterior margin projecting as a long, thin extension (Figs. 23, 103, 111, 115). This projection may function as some sort of phallic brace. A pair of distinct gonocoxal apodemes project anteriorly from the anterodorsal margin of the hypandrium. Postgonites are paired processes located near the phallus and are homologous to similar structures in the Cyclorhapha (Sinclair, 2000a). They appear as arched, articulated processes arising at the base of the phallus, just above the ejaculatory apodeme. They are usually sickle-shaped (Fig. 115), or nearly straight (Fig. 121) and occasionally divided into two pairs (Fig. 77).

The two epandrial lamellae are not connected dorsally (Fig. 113) as observed in the ground plan of the Empidoidea. The lamellae are held rigid by narrow anteroventral extensions to the hypandrium and internally by the bacilliform sclerites and subepandrial plate. The epandrial lamellae are sometimes greatly inflated in some Australian species, particularly of the *C. inflexus* group (Fig. 45). Epandrial lobes are sometimes developed (Figs. 30, 120) often closely associated with the surstylus. Large lateral spine-like setae are also present in some species (e.g., *C. barringtonensis* n.sp., Fig. 19).

The phallus is a narrow, tapered tube projecting from the posterior half of the hypandrium. In some species the phallus appears as a pair of apical processes or as sickle-shaped processes (Fig. 121). The base of the phallus extends anteriorly to the subepandrial sclerite + hypandrium point of junction (point y). The ejaculatory apodeme is a large vertically orientated plate, fused to the base of the phallus (Fig. 114). This configuration also occurs in the Trichopezinae and Brachystomatinae.

The cercus is normally well sclerotized posteriorly and it is this face that extends ventrally to articulate with the subepandrial sclerite or bacilliform sclerite. The anterior face of the cercus is mostly membranous, lightly pigmented with numerous setae especially long and stout surrounding the anus (Figs. 17, 19, 110, 113, 120). The form of the cercus can be species-specific and uniquely modified in some species (e.g., *C. macalpinei* n.sp. [Fig. 69] and *C. oreas* n.sp. [Fig. 72]).

The subepandrial sclerite is a narrow transverse plate with lateral extensions posteriorly or what are termed bacilliform sclerites, which form the inner walls of the surstylus apically. The surstyli are highly variable, ranging from poorly differentiated lobes in some species (e.g., *C. maculatus* n.sp., Fig. 102), to long, slender, unarticulated lobes (e.g., *C. campbelli* (Paramonov), Fig. 22), or strongly articulated lobes (e.g., *C. albistylus* Hardy, Fig. 110).

The most noticeable difference between the Australian and New Zealand *Ceratomerus* fauna is the great morphological variability of the male terminalia in the former. The Australian species are easily identified on the

basis of genitalia alone, while identification among New Zealand species is more reliant on external features, such as male secondary sexual characters. It is likely that male secondary sexual characters are used during complex courtship behaviour in many New Zealand species. Several Australian species are clearly closely related on the basis of the configuration of the male genitalia. For example, (*C. inflexus* n.sp., *C. bulbosus* n.sp., *C. bickeli* n.sp.) and (*C. malleolus* n.sp., *C. macalpinei* n.sp.).

Ceratomerinae

Ceratomerinae Collin, 1928: 3. Type genus *Ceratomerus* Philippi, 1865.

This subfamily includes the following genera: *Ceratomerus* Philippi, *Glyphidopeza* Sinclair, and *Icasma* Collin.

Diagnosis. Dichoptic in both sexes, usually lacking ommatrichia. Long projecting antennae generally inserted high on head; first antennal segment (scape) more than twice as long as the second segment (pedicel), bearing long dorsal and ventral setae; pedicel with finger-like condyle or conus on which postpedicel is inserted laterally; postpedicel (first flagellomere) elongate, often strap-like. Proboscis long and projected, longer than length of head; pseudotracheae lacking, except *Glyphidopeza*; lacinia freely projected, except fused to labium in *Glyphidopeza*.

Scutum with restricted rows of bristles, sometimes reduced in number and size. Dorsal mesepimeral pocket present; laterotergite bare.

Wing narrow, lacking anal lobe; Sc complete, or incomplete in *Icasma*; R₄₊₅ branched or unbranched; cell cup absent, except *Glyphidopeza*; 2 veins usually emitted from cell dm, or M₁₊₂ petiolate, except *Glyphidopeza* with 3 veins.

Male terminalia arched dorsally; ejaculatory apodeme plate-like, narrowly fused to base of phallus; epandrial lamellae not connected anterodorsally; surstyli usually weakly articulated with epandrium. Female terminalia truncate withdrawn into segment 7; sclerites of segment 8 articulated anterolaterally; anterior margin of tergite 8 with median or pair of flattened plates or none; tergite 10 (acanthophorites) arched dorsally, bearing spines or stout setae; cercus heavily sclerotized, projecting dorsally; spermatheca with single spherical receptacle.

Historical review of the classification of the Ceratomerinae

The genus *Ceratomerus* was described by Philippi (1865) for a highly modified male species from Chile which has a large protuberance or horn on the mid femur. Melander (1928) tentatively included *Ceratomerus* in the subfamily Clinocerinae because its slender legs and shortened front coxa are similar to that of the latter. In his revision of New Zealand Empididae, Collin (1928) erected a new subfamily Ceratomerinae for this genus, and has been followed ever since. In this revision, four new species of *Ceratomerus* and a new monotypic genus *Icasma* were described. Collin (1933) later described two species of *Ceratomerus* from southern Chile. In Australia, Hardy (1930) and Paramonov (1961) described four and one new species, respectively. No additional species of this subfamily were described until Plant (1990, 1991) described one and seven new species of *Icasma* and *Ceratomerus*, respectively.

Most recently, Sinclair (1997) described five new species of *Icasma* and two new species of a new genus *Glyphidopeza*, all endemic to New Zealand. In an ongoing revision of this subfamily, many new species remain to be described from New Zealand and there are at least two undescribed genera from South America (Sinclair, 1998).

Chvála (1983) assigned the subfamily as the sister group to the Clinocerinae, but provided little evidence for such an arrangement, except for general resemblance of the male terminalia with that of the Clinocerinae. Ceratomerinae was considered the sister group to Hemerodromiinae + (Brachystomatinae + Clinocerinae) by Wiegmann *et al.* (1993), but these relationships are weakly supported as discussed by Sinclair (1995: 671, 719). Presently, the Ceratomerinae is considered most closely related to the Trichopezinae and Brachystomatinae because of unique similarities of the female terminalia and form of the male ejaculatory apodeme (Sinclair, 1995; Cumming *et al.*, 1995; Cumming & Sinclair, 2000). These three subfamilies comprise a probable new family group within the Empidoidea (Cumming & Sinclair, 2000).

In contrast to its phylogenetic position within the Empidoidea, the monophyly of the Ceratomerinae has never been questioned. A number of characters are derived in comparison to the Trichopezinae and Brachystomatinae including: a small conus projecting from the second antennal segment into the postpedicel, scape 2–3 times longer than pedicel, inner face of base of scape flattened, males dichoptic, R_1 terminates proximally to mid-length of wing, and dorsal bridge of epandrial lamellae lacking.

Bionomics

The Ceratomerinae of Australia are confined to the area immediately within and along rocky, cascading streams of the eastern ranges. These streams are surrounded by a range of rainforest vegetation types that have been classified into numerous floral systems, comprehensively appraised by Adam (1992). Rainforest is discontinuously distributed in eastern Australia, and represent remnants of a widespread wet vegetation that predominated in the Late Paleocene and Early Eocene (White, 1994; Bickel, 1994). Since this time, the progressive drying phases which accelerated during the Miocene have fragmented the rainforest into disjunct refugia. However, many of these pockets of rainforest are not completely isolated, but are connected through “gallery” or gully forests—a mixture of sclerophyll-rainforest vegetation along streams (Adam, 1992; Bickel, 1994). These strips of rainforest along watercourses may extend well beyond lower rainfall regions and provide continuity and pathways among major stands. This is especially true around Sydney, which is surrounded by dry sclerophyll and heathlands, with narrow strips or patches of rainforests with closed overhead canopies growing along streams flowing through narrow valleys. It is in these habitats that a number of fairly widespread species of Ceratomerinae were collected, especially in the coastal lowlands around Sydney (e.g., Bola, Couranga and Waterfall Creeks).

The Australian species of Ceratomerinae are both stenothermic and eurythermic, some being found in a variety of stream temperatures. For example, *C. victoriae* n.sp. is known only from heavily shaded, cool streams cascading through temperate rainforests usually dominated by *Nothofagus*. In Victoria, these habitats are now confined to small patches,

predominantly in deep ravines and consequently the populations of *C. victoriae* n.sp. are rather isolated (Fig. 28). In contrast, *C. orientalis* n.sp. is tolerant of a wide range of stream temperatures. This tolerance has facilitated its widespread distribution, and it is the most commonly collected species of Ceratomerinae in Australia.

Most Australian species are found primarily in streams, running about on emergent rocks (especially *C. ordinatus* group) with their antennae outstretched. Only one species, *C. albistylus* is most commonly collected more distantly from streams. A large number of specimens of *C. victoriae* n.sp. were collected by sweeping fronds of tree ferns that were overhanging streams.

Although several distinct larval empidoid types have been identified from stream and river surveys, the larval and pupal stages of Ceratomerinae remain unknown. In addition, the mating habits have not been observed. Attempts were made to identify the immature stages by collecting live females and inducing oviposition by decapitation (see Cumming & Cooper, 1993), but these attempts failed. Since adults of most species of Australian *Ceratomerus* are present nearly year round, prediction of the emergence period(s) is difficult. In collections examined, some female specimens collected in October and November appeared to have swollen abdomens indicating a gravid condition. This is possibly the most appropriate period for attempts at either collection of immature stages of this subfamily or decapitation of gravid females.

Adults are believed to be predacious (except probably the *C. virgatus* group from New Zealand). Adults of *C. ordinatus* Hardy were observed feeding on conspecific flies that were squashed on emergent rocks. Numerous adults of this species were observed running about on emergent rocks in the Franklin River (Tasmania). They easily and quickly found the squashed corpses and extended their long proboscises obliquely while feeding. The morphology of the labrum (i.e., presence of apical epipharyngeal blades) supports predacious habits. Chvála (1983: 78) hypothesized that adults of Ceratomerinae were flower visitors on the basis of their long *Empis*-like proboscis, but only specimens of the *C. virgatus* group from New Zealand have been collected on flowers.

Ceratomerus Philippi

Ceratomerus Philippi, 1865: 765. Type-species *Ceratomerus paradoxus* Philippi (monotypy).

Tomia Paramonov, 1961: 100 nec Martynov (1936: 1262). Type-species *Tomia campbelli* Paramonov (original designation) (Colless & D.K. McAlpine, 1991: 760).

Notes on synonymy. *Tomia* Paramonov was erected for the highly autapomorphic species *C. campbelli*, but the extreme morphological features are not unusual for the genus *Ceratomerus*, and Colless & D.K. McAlpine (1991) were justified in this synonymy. In addition, *Tomia* Paramonov is a junior homonym of *Tomia* Martynov (1936), a fossil Paraplecopteran of the family Tomiidae (Rohdendorf, 1991).

Diagnosis. This genus is distinguished from other Ceratomerinae by the following combination of characters: posterior ocelli usually widely separated with ocellar bristles inserted anteriorly, postpedicel lengthened and tapered apically, acrostichal setulae present, 3–5 dorsocentral bristles present, Sc complete, R_{4+5} branched, cell dm emitting 2 veins (M_{1+2} and CuA_1), cell cup absent, presence of

distinct bristles on tibiae, scutum not highly polished, and abdominal sclerites not heavily sclerotized and punctate.

Description. Male. Head. Dichoptic, bare; face parallel-sided; frons slightly narrowed above antennae; posterior ocelli usually widely separated with ocellar bristles inserted anteriorly. Antenna with scape at least 2 times length of pedicel; pedicel normally ovate, sometimes slightly to greatly lengthened; postpedicel with quadrate base, attenuated and strongly prolonged apically; occasionally apical segments (8–10) fused to postpedicel. Proboscis long, slender; labrum long, stout, with pair of apical epipharyngeal blades; lacinia free, blade-like; pseudotracheae absent.

Thorax. Anteprepronotum usually with stout pair of setae; scutum generally completely clothed in fine, pale pruinescence; acrostichal setulae uniserial or biserial, rarely absent; 3–5 dc; 1–2 npl, 1–2 pairs sctl; laterotergite bare.

Wing long and narrow; stigma absent or present at apex of R_1 or apex of cell r_1 ; Sc complete; C circumambient; R_{4+5} branched; cell dm emitting 2 veins (M_{1+2} and CuA_1); cell cup absent.

Abdomen. Sclerites usually not heavily sclerotized; lacking punctate appearance.

Terminalia. Hypandrium narrow with pair of divergent postgonites, gonocoxal apodemes short and slender, somewhat projected beyond hypandrium. Phallus short with

plate-like ejaculatory apodeme fused to base of phallus. Epandrial lamellae separated, lacking dorsal bridge ventral to cercus; surstylus weakly to strongly articulated. Cercus membranous to strongly sclerotized, often with long apical setae and long setae surrounding anus.

Female. Terminalia. Posterior margin of T7 with row of setae. T8 articulated anterolaterally with S8; anterior margin with pair of flattened plates, single, rounded median plate, or margin straight (plates absent); posterior margin with median membranous cleft; medially with transverse row of setae. S8 with slender ventral setae, membranous posteriorly. T10 with 1 or more posterior rows of acanthophorite spines of various sizes. Cercus held upright, slightly arched, bearing apically numerous spine-like bristles similar to acanthophorite spines on T10, posterior margin with long, slender setae. Spermathecal receptacle spherical, darkly pigmented on long, unpigmented duct.

Remarks. This genus is recorded from Australia, New Zealand and South America. There are 19, nearly 40, and five species known from Australia, New Zealand and South America, respectively. The above generic concept of *Ceratomerus* is based on the examination of all known species of Ceratomerinae, which is the preliminary result of an ongoing phylogenetic analysis reported by Sinclair (1998).

Key to males of the Australian species of *Ceratomerus**

Ceratomerus can be distinguished from all other Australian empidoidea by the following features: cell cup absent, first flagellomere very large with pedicel inserted thumb-like on inner side at base, proboscis long and slender, arising from front of mouth-opening and slightly recurved. Although males are unknown for *C. hibernatus*, it is included in the key based on characters that are independent of the sex of the specimen.

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|---|--|---|
| 1 | Stigma absent (Figs. 80–84); second antennal segment (pedicel) long, at least one-fourth length of first segment (Figs. 59, 60); acrostichal setae directed posteriorly (<i>C. ordinatus</i> group) | 2 |
| — | Stigma present (Figs. 9, 16, 87); second antennal segment (pedicel) short, globular, less than one-fourth length of first segment (Figs. 25, 58); acrostichal setae usually directed anteriorly | 5 |
| 2 | Auxiliary crossvein present between R_{2+3} and R_4 (Figs. 80, 83) or wing highly modified (Fig. 82); median fork usually distal to radial fork | 3 |
| — | Auxiliary crossvein absent, wing unmodified (Figs. 81, 84); median fork proximal to radial fork | 4 |
| 3 | Veins on wing wavy, highly modified, membrane with dark patches; cell dm distally emitting 3 veins (Fig. 82) | <i>C. maculatus</i> n.sp. |
| — | Veins on wing straight, not modified; cell dm distally emitting 2 veins, median vein petiolate (Fig. 80) | <i>C. falcatus</i> n.sp. |
| | | (An undescribed specimen from Philip Is. [Norfolk group] may also key to this species). |
| 4 | Median fork separated from radial fork by less than length of crossvein dm-cu (Fig. 84); apical third of hind tibia with row of 4–5 anterodorsal bristles (Fig. 94) | <i>C. ordinatus</i> Hardy |
| — | Median fork separated from radial fork by more than length of crossvein dm-cu (Fig. 81); apical third of hind tibia with 2 anterodorsal bristles | <i>C. hibernatus</i> n.sp. |

* Ceratomerinae can be identified from other empidoidea using the key to the major lineages of Australian Empidoidea in Sinclair & Cumming (2000).

- 5 Male midleg not highly modified, with dense ventrobasal setae on femur only (Figs. 38, 41); tibia cylindrical 6
 — Male midleg highly modified, with lobes, modified setae and strongly attenuated forming pockets (Figs. 1–8, 39, 93, 97) 13
- 6 R₂₊₃ distinctly deflected around stigma (Figs. 53–56); in doubtful cases epandrial lamellae nearly spherical and inflated (*C. inflexus* group) 7
 — R₂₊₃ not distinctly deflected around stigma (Figs. 16, 87); epandrial lamellae not inflated 12
- 7 Epandrial lamellae strongly inflated, nearly spherical, much wider than abdomen (Figs. 44–46); cercus variable 8
 — Epandrial lamellae not highly inflated, simply convex, less than width of middle of abdomen; cercus short, broad, with inner stout setae (Fig. 72) *C. oreas* n.sp.
- 8 Hypandrium with pair of long, slender, posterior processes, longer than width of epandrium (Fig. 44) *C. bickeli* n.sp.
 — Hypandrial processes short, projecting only slightly beyond epandrium (Figs. 46, 63, 66) 9
- 9 Tergites 4–6 with heavily sclerotized, dark ventrolateral ridges (Fig. 68); cercus anvil-shaped, clothed with dense macrotrichia, lacking stout setae; base of cercus with pair of long processes (Figs. 66, 69) 10
 — Tergites 4–6 lacking ridges; cercus gradually expanded apically with tufts of stout, apical setae; base of cercus lacking long processes (Figs. 46, 63) 11
- 10 Anepisternum with pale streak across lower half; lobe beneath the cercus roundly expanded apically; posterior tip of cercus tapered (Fig. 69) *C. macalpinei* n.sp.
 — Anepisternum uniformly brown, lacking pale zone on lower half; lobe beneath the cercus tapered, apex setose; posterior tip of cercus round (Fig. 66) *C. malleolus* n.sp.
- 11 Anterior hypandrial process truncate; posterior hypandrial process broad (Fig. 63) *C. inflexus* Hardy
 — Anterior hypandrial process bilobed; posterior hypandrial process narrow (Fig. 46) *C. bulbosus* n.sp.
- 12 Apical portion of postpedicel shorter than rectangular basal portion; stylus (segments 8–10) subequal to or longer than postpedicel; cercus very slender and long, with short lateral setulae (Fig. 34) *C. attenuatus* n.sp.
 — Apical portion of postpedicel longer than rectangular basal portion; stylus (segments 8–10) shorter than postpedicel; cercus hooked posteriorly, expanded basally (Fig. 120) *C. orientalis* n.sp.
- 13 Scutum with 3 dorsocentral bristles, prescutellar bristles short and inconspicuous; male postpedicel greatly lengthened, gradually tapered, stylus greatly shortened (Fig. 61); femora and halter yellow *C. albistylus* Hardy
 — Scutum with 4 dorsocentral bristles, prescutellar bristles short and slender; male postpedicel not lengthened, strongly tapered, stylus longer than one-half length of postpedicel; femora distinctly darker apically; halter dark 14
- 14 Stigma short, not extending proximally to radial fork (Fig. 86); pleura bright yellow; mid femur with 3 flattened anterior setae on basal third *C. lobatus* n.sp.

—	Stigma extending proximally to radial fork (Fig. 51); in doubtful cases pleura dark; mid femur lacking flattened anterior setae	15
15	Anal lobe of wing produced, bearing long slender processes or long setae (Figs. 9, 12); epandrium not enclosing hypandrium; pleura yellow to pale brown (<i>C. campbelli</i> group)	16
—	Anal lobe of wing not produced, lacking processes and long setae (Fig. 51); epandrium completely enclosing hypandrium (Fig. 48); pleura dark brown	<i>C. globosus</i> n.sp.
16	Anal lobe of male wing with 3 long, slender processes (Figs. 9, 11, 13); costal margin lacking long, dorsal setae; mid femur lacking long ventral lobe	17
—	Anal lobe of male wing with long setae, lacking slender processes (Figs. 12, 14); costal margin with long, dorsal setae; mid femur with long ventral lobe	18
17	Acrostichal setulae absent; pleura with at least laterotergite and meron dark; hind femur lacking long, flattened posteroventral setae	<i>C. athertonius</i> n.sp.
—	Acrostichal setulae present; pleura usually with only laterotergite dark; hind femur with long, flattened posteroventral setae	<i>C. campbelli</i> (Paramonov)
18	Pleura yellow with brown smudges; mid femur greatly swollen (Fig. 3); anal lobe of wing truncate, with long, wavy, slender setae (Fig. 12)	<i>C. barringtonensis</i> n.sp.
—	Pleura yellow, lacking brown smudges; mid femur not greatly swollen (Fig. 7); anal lobe of wing acutely produced, with stout setae (Fig. 14)	<i>C. victoriae</i> n.sp.

Key to Females of the Australian species of *Ceratomerus*

Females of *Ceratomerus bickeli* are unknown.

1	Stigma absent (Fig. 81); second antennal segment (pedicel) long, at least one-fourth length of first segment (Fig. 89); acrostichal setae directed posteriorly (<i>C. ordinatus</i> group)	2
—	Stigma present (Fig. 15); second antennal segment (pedicel) short, globular, less than one-fourth length of first segment (Fig. 62); acrostichal setae usually directed anteriorly	4
2	Auxiliary crossvein present between R_{2+3} and R_4 (Fig. 83); median fork distal to radial fork	<i>C. maculatus</i> n.sp. / <i>C. falcatus</i> n.sp. (An undescribed female specimen from Philip Is. [Norfolk group] will also key to these species).
—	Auxiliary crossvein absent, wing unmodified; median fork proximal to radial fork (Fig. 81)	3
3	Median fork separated from radial fork by less than length of crossvein dm-cu (Fig. 84); apical third of hind tibia with row of 4–5 anterodorsal bristles	<i>C. ordinatus</i> Hardy
—	Median fork separated from radial fork by more than length of crossvein dm-cu (Fig. 81); apical third of hind tibia with 2 anterodorsal bristles	<i>C. hibernatus</i> n.sp.
4	Scutum with 3 dorsocentral bristles; stylus white	<i>C. albistylus</i> Hardy
—	Scutum with 4 dorsocentral bristles, with prescutellar bristles short and slender; stylus usually dark	5
5	Stigma long, nearly length of cell r_4 (Fig. 15); medial fork branching very near apex of cell dm, stem less than length of crossvein dm-cu	6

- Stigma short, distinctly shorter than length of cell r_4 (Fig. 52);
medial fork branching more distant from apex of cell dm, stem
greater than length of crossvein dm-cu 7
- 6 Pleura pale brown..... *C. barringtonensis* n.sp.
— Pleura yellow, especially on anterior half..... *C. victoriae* n.sp.
- 7 Acrostichal setulae absent *C. athertonius* n.sp.
— Acrostichal setulae present 8
- 8 Pleura nearly entirely bright yellow, or at least either with a broad
yellow band or lower half of pleura yellow 9
— Pleura mostly light to dark brown, at most proepisternum yellow
above fore coxa 12
- 9 R_{2+3} distinctly arched or deflected around stigma (Fig. 55) 10
— R_{2+3} nearly straight, not deflected around stigma 11
- 10 R_{2+3} very strongly deflected around stigma; yellow pleural band
broad and long, extending to katepisternum *C. inflexus* Hardy / *C. bulbosus* n.sp.
— R_{2+3} not strongly deflected around stigma; yellow pleural band
narrow and short, not extending to katepisternum *C. macalpinei* n.sp.
- 11 Tip of stylus dark; scutum dark *C. lobatus* n.sp.
— Tip of stylus pale; scutum with pale vittae between postsutural
supra-alars and dorsocentral bristle *C. campbelli* (Paramonov)
- 12 Stylus (segments 8–10) shorter than postpedicel *C. globosus* n.sp.
— Stylus (segments 8–10) subequal to or longer than postpedicel 13
- 13 R_{2+3} nearly straight, sometimes only slightly deflected around
stigma 14
— R_{2+3} distinctly arched or deflected around stigma *C. malleolus* n.sp. / *C. oreas* n.sp.
- 14 Fore coxa nearly white, in strong contrast to thorax; wing and
cell r_1 very narrow; dorsolateral margin of sternite 7 straight *C. orientalis* n.sp.
— Fore coxa pale but not strikingly bright; wing and cell r_1 not
obviously narrowed; dorsolateral margin of sternite 7 concave,
with posterodorsal corner extended sharply upright (Fig. 37) *C. attenuatus* n.sp.

Ceratomerus campbelli species-group

This unique species group is characterized by either a long comb of setae or three long spatulate processes on the anal lobe of the male wing, and the highly contorted and modified male midleg. Four species are included in this group, and together appear to be most closely related to the *C. paradoxus* group of southern Chile.

Ceratomerus athertonius n.sp.

Figs. 1, 2, 9–11, 17, 18, 28, 124

Type material. HOLOTYPE ♂, “AUST: N.QLD[Northern Queensland] 31.6 km up Mt. Lewis Rd., 1000 m/ 16.iv.1994, cascading/ creek, B.J. Sinclair/ 16°36'S 145°16'E”; “HOLOTYPE/ *Ceratomerus/ athertonius/* Sinclair [red label]” AMS K175239. PARATYPES: **Queensland:** 2♂♂, 8♀♀, same data as holotype (AMS, CNC); 3♀♀, same locality as holotype, 21–22.iv.1994 (ZFMK); 2♂♂, 3♀♀, 4 km up Mt. Edith Rd, 800 m, Danbulla SF, 17°05'S 145°33'E, Ck, 22.iv.1994, BJS; 2.4 km up Mt. Edith Rd, 700 m, Danbulla SF, 27.iv.1994, 17°05'S 145°33'E, sandy str., BJS (AMS); 2♂♂, 11♀♀, 4 km up Mt. Edith Rd, 800 m, Danbulla SF, 17°05'S 145°33'E, MT across Ck, 22–27.iv.1994, BJS (ANIC, AMS, CNC); 3♀♀, Mt. Edith, 4–7 m off Danbulla Rd, 27.iv.1967, DHC (ANIC).

Diagnosis. Males readily recognized by the highly modified midlegs and long spatulate processes projecting from the anal lobe of the wing. Females are separated by lacking acrostichals, dark stylus, and pale to dark coloured pleura with at least the laterotergite and meron darkened.

Description. Wing length 3.2–3.4 mm.

Male. *Head* dark brown, face with white pruinescence, lacking setulae; ocellar triangle with 2 long, divergent bristles, inserted between ocelli; postocellar bristle short, one-half length of ocellar bristle; 3 pairs of long vertical bristles, shorter than ocellar bristles; postocular bristles very short, slender, overlapping less than one-fifth of eye. Antenna long, with scape subequal to height of eye; pedicel oval with posterior fringe of setae; scape sparsely covered by setulae, with 2 long, dorsal setae and 1 long, ventral seta. Postpedicel 1.3× longer than scape, covered by long, dense pruinescence, basal half rectangular; apical half strongly differentiated from base, tapered to short three-segmented stylus, one-third length of postpedicel; segment 8 not longer than wide; stylus concolorous with remaining antenna. Base of labrum lacking dorsal process; palpus

yellow, long and slender, one-fourth length of labrum, with lateral row of short, dark setae and stout, subapical seta; prementum with short setae only.

Thorax. Mesonotum, postnotum, laterotergite, and meron dark; remaining pleura, lateral margin of scutum, postpronotal lobe, and postalar yellowish-brown. Acrostichals absent; 4 dc, first and fourth bristles short and slender; 1 pprn; 1 presut spal; 1 npl; 2 psut spal, upper short and slender; 1 slender, short pal; 2 sctl; numerous setulae scattered on scutum, particularly among dc. Anteprenotum with 2 long, lateral setae.

Wing (Fig. 9). Posterior margin with strongly sclerotized, triangular prolongation, lined with long setulae; projection bearing 3 long, narrow processes, with dilated or spatulate tips (Fig. 11); wing stem with long, stout setae. Stigma at apex of cell r_1 broad, dark, remainder of wing infuscate; single long costal seta; costal margin with unmodified setulae. R_{4+5} acutely forked; auxiliary crossvein between R_{2+3} and R_4 lacking; cell dm trapezoidal; medial fork petiolate, proximal to radial fork by slightly less than length of R_4 . Halter with dark knob and white shaft.

Legs. Coxae yellow, concolorous with pleura; fore femur yellow, apex of mid and hind femur dark; tibiae with yellow dorsal margin; remaining segments dark. Fore coxa more than twice length of mid and hind coxae combined; apical third concave with inner tuft of stout setae and pair of long, wavy, sclerotized processes. Fore trochanter not lengthened, bearing row of 3–4 long, inner setae. Fore femur with pv row of very long, stout setae, more than twice width of femur; basal half with 5 widely spaced av setae, basal seta projecting obliquely; mid-length with irregular row of long anterior setae, becoming more stout apically. Fore tibia shorter than femur, apex not dilated with anteroapical comb; pv margin with row of long erect setae, length nearly twice width of tibia. First tarsomere slightly shorter than fore tibia, with 2 long ventrobasal setae; distal 4 tarsomeres longer than first tarsomere; fifth tarsomere dorsoventrally flattened.

Mid coxa with stout anterior seta. Basal two-thirds of mid femur strongly swollen, with pv tooth; av and pv margins with long stout setae, less than basal width of femur; basal third with anterior, spine-like seta; apical third of femur narrow, with long anterior setae (Fig. 1). Mid tibia shorter than femur, with concave ventral margin; apical half expanded; pv margin with row of stout setae, slightly longer than width of tibia, and short basal hooked process; base with long projecting lobe, base of lobe surrounded by series of short, convoluted lobes (Fig. 2). First tarsomere thin, longer than femur and tibia combined; apex with pair of ventral bristles; fifth tarsomere somewhat flattened.

Hind coxa bearing unmodified setae. Hind femur less than twice length of fore femur; base with pv oval zone, devoid of setae, with fringe of 7 long setae; mid-length with row of slender, ventral setae; lacking preapical dorsal bristle. Hind tibia longer than femur, apex dilated, bearing posteroapical comb; 4 ad bristles and 2 dorsal bristles on apical half. Hind tarsomeres longer than tibia; first tarsomere with 1 erect, ventral seta near base; pv margin with erect setae.

Abdomen. T1 pale brown; T2–6 dark brown, with long slender setae, especially on posterior margin; S1–6 yellow; T7 light brown, posterior margin membranous, lacking long posterior setae; S7 slightly longer than preceding sternite, anterolateral margin produced anteriorly, fused to S8; T8 one-fifth length of sternite, expanded laterally bearing long setae.

Terminalia (Fig. 17). Hypandrium with posterior flap-like process; paired articulated, curved postgonites projecting obliquely near apex of phallus. Apex of phallus with pair of sickle-shaped appendages arching posteriorly between postgonites. Epandrium with 1 very long stout seta on ventrolateral margin; epandrial lobe long, tapered, bearing 4 broad, peg-like lateral setae. Bacilliform sclerite broad, separate from epandrium. Surstylus short, round, projected posteriorly, little longer than wide, bearing marginal setulae. Cercus short, fleshy, apex acute, expanded laterally around anus; posterior surface well sclerotized.

Female. Similar to male except as follows: postpedicel slightly longer than scape; segment 8 1.5× longer than wide; palpus brown; mesonotal bristles long and stout; occasionally pleura entirely brown; wing (Fig. 10) lacking posterior projection and appendages, venation unmodified; cell dm rectangular; medial fork with short petiole, basal to radial fork by nearly length of R_4 . Legs lacking modified appendages and setae; apex of fore tibia not expanded. Mid tibia with 1 long ventral, 1 ad and 1 pd apical bristle; 1 ventral and 1 ad bristle at mid-length; basal third with 1 ad and 1 pd bristle. Apical segments retracted into segment 7; posterior margin of T7 with narrow, yellowish-brown extension, bearing posterior fringe of setae; lateral margin of S7 straight. Terminalia (Fig. 18): posterior margin of T8 membranous, with dense fringe of long setae along lateral margin; pair of flat lateral sclerites extend into segment 7 from anterior margin of T8; S8 with ventral setulae; posterior margin invaginated, forming internal plate. T10 split medially into pair of rectangular sclerites, bearing double row of spine-like setae along posterior margin. Cercus bearing row of similar setae, with short, slender marginal setae. Spermathecal receptacle oval, with short, wide neck.

Distribution. This species is known only from the Atherton Tableland and Mt. Lewis of northern Queensland from 800 to at least 1000 m (Figs. 28, 124).

Etymology. Named in reference to the Atherton Tablelands where the first specimens of this species were taken by Dr D.H. Colless.

Ceratomerus barringtonensis n.sp.

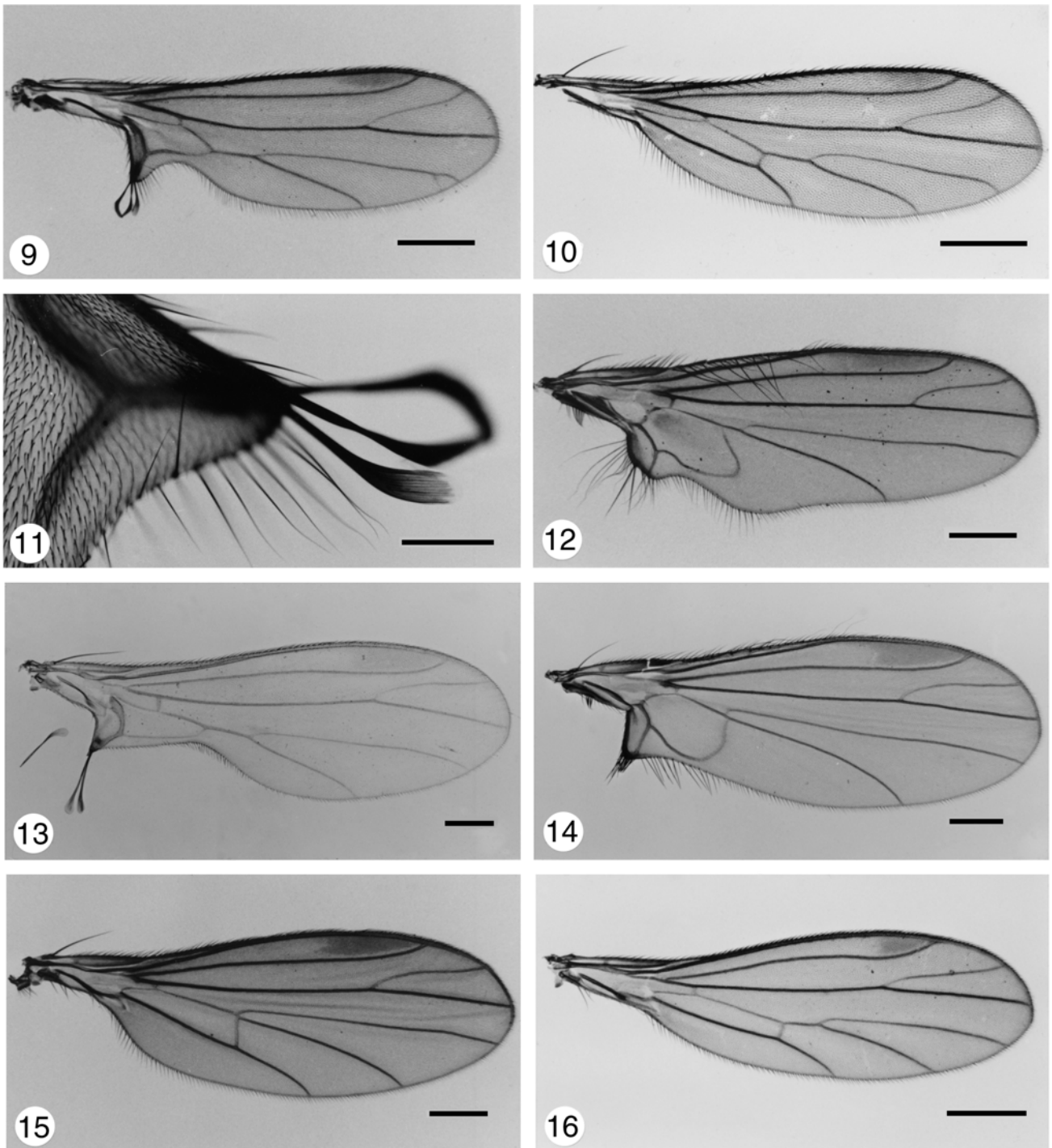
Figs. 3, 4, 12, 19–21, 28

Type material. HOLOTYPE ♂, "AUST: NSW [New South Wales]: Barrington/ Tops NP, Williams R./ 21.i.1995, 480 m/ rainfor., BJ Sinclair"; "HOLOTYPE/ *Ceratomerus/ barringtonensis/* Sinclair [red label]" AMS K175240. PARATYPES: **New South Wales:** 3♂♂, 1♀, same data as holotype (AMS, ZFMK); 4♂♂, same locality as holotype, 19.xii.1993 (CNC, ZFMK); 1♀, Gloucester Tops, *Nothofagus*, 1280 m, MT, 4–30.xii.1988, DJB (AMS).

Diagnosis. Males are readily recognized by the greatly swollen mid femur and truncate anal lobe of the wing, bearing long, wavy, slender setae. Females are distinguished by the long stigma, short base of the medial fork, yellow-coloured pleura, with brown smudges and dark-tipped stylus.

Description. Wing length 3.5–3.8 mm, similar to *C. athertonius* except as follows:

Male. Head. Postocellar bristles one-third length of ocellar bristles; postocular bristles short, slender, overlapping less than one-third of eye. Antenna long, with scape slightly



Figs. 9–16. Wings of *Ceratomerus*. 9–11, *C. athertonius*: 9, male; 10, female; 11, spatulate wing setae, male. 12, *C. barringtonensis*, male. 13, *C. campbelli*. 14–15, *C. victoriae*: 14, male; 15, female. 16, *C. attenuatus*, male. Scale bars = 0.5 mm, except Fig. 11 where scale bar = 0.2 mm.

longer than height of eye; scape with many dorsal setulae; three-segmented stylus one-half length of postpedicel; segment 8 not longer than wide; apical two-thirds of stylus dark. Palpus brown, short and slender, with several long, dark setae; prementum with 2 pairs of long, erect setae.

Thorax. Mesonotum and postnotum dark, lacking dorsal stripes; postpronotal lobe yellowish-brown, pleura yellow with brown smudges on lower margins of sclerites. Acrostichals in alternating single row of short setulae to prescutellar depression, posterior half directed anteriorly; 4 dc, posterior dc short and slender; lower psut spal near wing base.

Wing (Fig. 12). Anal lobe truncate, bearing pair of long, stout setae, and 6–12 pairs of long, wavy lateral setae longer than costal seta; posterior margin lacking incision, with 5–6 stout setae on wing stem. C with 16 closely spaced, long dorsal setae on upper surface between tip of Sc and R₁, shorter than costal seta. Cell dm oval; medial fork with petiole lacking or very short, proximal to radial fork by more than length of R₄. Halter with dark knob.

Legs. Coxae concolorous with pleura, hind coxae somewhat darker; ventral margin of femora yellowish brown, upper surface light brown; remaining leg segments

dark. Inner margin of fore coxa concave, with anterior row of long setae near mid-length; basal third with transverse band of fine, wavy setae. Fore trochanter unmodified. Fore femur somewhat inflated, slightly sinuous, inner margin flat lacking setae; posterior margin with single row of short setae along entire length; 1 long stout seta at base, length twice width of femur; av row of setae sinuous, apically increasing in length to greater than width of femur; basal third with biserial row of pv setae, outer row longer than width of femur; 1 long, erect preapical dorsal seta; apical fourth with ad patch of long setae. Fore tibia shorter than femur, cylindrical, with partial subapical constriction; basal half with long av and ad setae, longer than width of tibia; distal third with short, dense setae; anteroapical comb on apex of anteriorly deflected tip. First tarsomere three-quarters length of fore tibia, cylindrical; long ventral setae, longer than width of tarsus; 1 erect ventral seta at base.

Mid coxa with slender setae. Mid femur greatly swollen, strongly arched, with large curved, ventral tubercle; tubercle with 2–3 long ventral setae and 3 stout subapical setae, terminating in round, subapical finger-like process; basal third with short setae; apical fourth with short, tapered, black pv appendage (Fig. 3). Mid tibia two-thirds length of femur, laterally expanded, with deep concave ventral surface; pv margin with row of long setae, longer than width of tibia; anteroapical margin with broad lobe extending beyond base of tarsomere, lateral margin with row of more than 10 short, curved setae; av margin of basal half with several short, convoluted lobes, pair of erect, stout setae, and comb of short setae; 1 long, erect pd apical seta (Fig. 4). First tarsomere sinuous, nearly twice length of tibia; subbasal lobe densely clothed in microtrichia; anterior and posterior margins with long, curved setae, longer than twice width of tarsus, longest at mid-length; first tarsomere shorter than remaining 4 tarsomeres.

Hind femur bow-legged, nearly twice length of fore femur, bearing long av and pd setae on apical third; 1 erect, subapical dorsal seta. Hind tibia with ad and av row of long, erect setae, nearly 3× width of tibia; basal fourth with long, erect dorsal seta. Hind tarsomeres longer than tibia; tarsomeres 1–3 clothed in long erect setae; fifth tarsomere dorsoventrally flattened.

Abdomen. Sclerites paler than thorax, with long, stout setae along posterior margin of T1–6; posterior margin of T7 with broad U-shaped membranous region; T8 very slender, one-sixth length of sternite, lateral margin expanded.

Terminalia (Fig. 19). Hypandrium with posterior broad flap, folded anteriorly, bearing crown of long setae; paired articulated postgonites flanking phallus, project dorsally, apex attenuated. Phallus flattened, apex truncate with lateroapical sickle-shaped extensions curving around anterior margin of postgonites. Epandrium with 1 very long and 3–4 shorter, stout setae on ventrolateral margin; pair of round lobes flanking base of surstylus: anterior lobe with apical setulae, posterior lobe with crown of very stout, flattened setae. Bacilliform sclerite broad, fused to epandrium near base of cercus; small lobe from bacilliform sclerite at base of anterior epandrial lobe. Surstylus fin-shaped, tapered, bearing lateral setulae; base with 4 long setae. Cercus short, fleshy, apex acute, expanded laterally around anus; posterior surface well sclerotized.

Female. Similar to male and female of *C. athertonius* except as follows: postpedicel short, subequal in length to scape;

wing lacking posterior modification and setae; cell dm rectangular; medial fork with short petiole, basal to radial fork by more than length of R₄. Legs lacking modified appendages and setae; apex of fore tibia slightly expanded. Mid tibia with 1 ventral bristle at mid-length. Hind tibia with 3 ad bristles and 1 dorsal bristle. Terminalia (Fig. 21): median region of T8 with deep U-shaped weakly sclerotized zone; fringe of long setae. S8 subtriangular in lateral view. Spermathecal receptacle spherical, with short neck; base of spermathecal duct pigmented (Fig. 20).

Distribution. This species is known only from two localities in Barrington Tops National Park (Fig. 28).

Biology. Most adult specimens were collected from the underside of somewhat flattened emergent rocks in the Williams River located at Rocky Crossing. This river valley is surrounded by subtropical rainforest. A single specimen was collected at 1280 m in *Nothofagus* forest.

Etymology. Named in reference to type locality.

Ceratomerus campbelli (Paramonov)

Figs. 5, 6, 13, 22–24, 28, 88

Tomia campbelli Paramonov, 1961: 101.

Type material. HOLOTYPE ♂, “Interview R. area/ N of Pieman R., Tasm./ 31 Dec. 1953/ T.G. Campbell”; “*Tomia campbelli*/ Paramonov/ HOLOTYPE ♂ [red label]”; “Paramonov det./ *Tomia campbelli*/ gen et sp. nov./ Typus ♂ [hand written]” (ANIC).

Additional material. Tasmania: 1 ♀, nr Candle Mtn, Pencil Pine Ck, 800 m, high woodland, pans, 30.i.1989; 2 ♂♂, 4 ♀♀, Hartz Mtns NP, nr Keogh Falls, 23.i.1989, rock seep.; 1 ♀, Frodshams Pass nr Mt. Wedge, 4–5.ii.1989, rainfor., y.pans; 1 ♂, Mt. Bobs Range, Pine Lk., 680 m, W. Hartz Mtns, 23.i.1989, wet heath (AMS); 1 ♀, Hellyer Gorge, 2.ii.1967 (ANIC); 3 ♂♂, 1 ♀, Mt. Bobs Range, nr Pine Lk., 700 m, 23.i.1989, rainfor., y.pans (AMS, CNC, ZFMK).

Diagnosis. This is the largest sized species in Tasmania, with males readily recognized by the long highly modified midlegs and processes projecting from the anal lobe of the wing. Females are separated by pale-coloured pleura and white-tipped stylus.

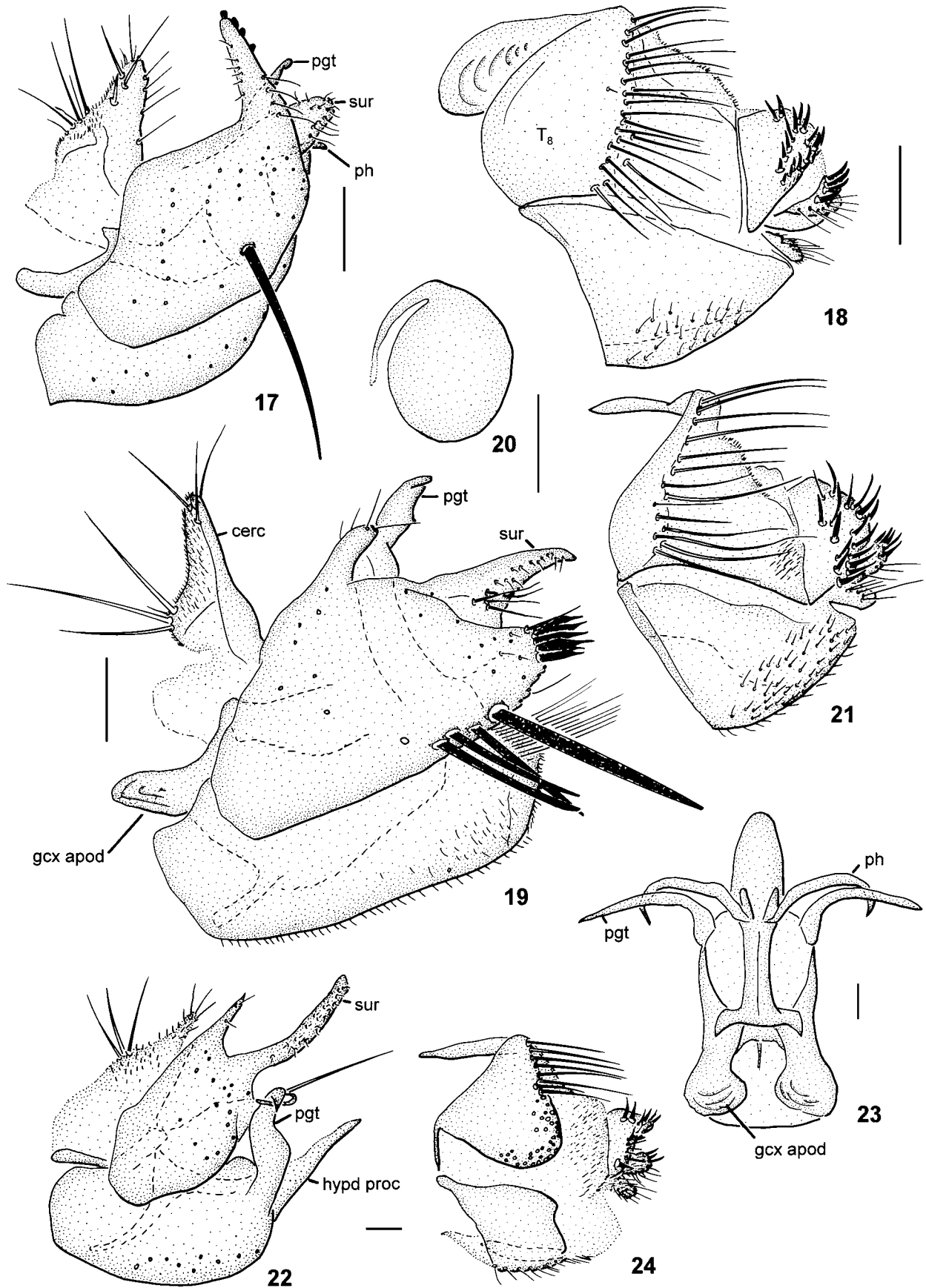
Description. Wing length 4.7–5 mm, similar to *C. athertonius* except as follows:

Male. Head. Postocellar bristles short, one-third length of ocellar bristles; postocular bristles short, slender, overlapping less than one-third of eye. Antenna long, with scape subequal to half length of labrum; three-segmented stylus subequal to half length of postpedicel; segment 8 4–5× longer than wide; apical two-thirds of stylus white. Palpus brown, one-third length of labrum, with several long, dark setae.

Thorax. Mesonotum and postnotum dark, with 2 wide, reddish-brown stripes on either side of dc; pleura, postpronotal lobe pale. Two long anterior acrostichals, followed by alternating single row of short setulae to prescutellar depression, directed anteriorly; 4 dc, posterior dc short and slender; 2 psut spal, lower near wing base; numerous setulae scattered on scutum, particularly on ppm, among dc and npl.

Wing (Fig. 13). Wing stem with long, undifferentiated setae; cell dm triangular. Halter with dark knob.

Legs. Coxae concolorous with pleura. Fore coxa armed on inner margin one-third before apex with tuft of stout setae and pair of long, sclerotized processes similar to a collapsed sac (Fig. 88); distal to process, inner surface deeply concave. Fore



Figs. 17–24. Terminalia of *Ceratomerus*. 17–18, *C. athertonius*: 17, male, lateral view; 18, female, lateral view. 19–21, *C. barringtonensis*: 19, male, lateral view; 20, spermatheca, 21, female, lateral view. 22–24, *C. campbelli*: 22, male, lateral view; 23, hypandrium and phallus, dorsal view; 24, female, lateral view. Scale bars = 0.1 mm. Abbreviations: *cerc*, cercus; *gcx apod*, gonocoxal apodeme; *hypd proc*, hypandrial process; *pgt*, postgonite; *ph*, phallus; *sur*, surstylus; *T*, tergite.

trochanter equal to one-third of fore coxa, bearing row of 4–5 short setae. Fore femur with very long, stout basal seta; mid-length of anterior region with patch of long, erect setae; pv region with row of stout setae, increasing in length apically. Fore tibia equal in length to femur + trochanter, apex dilated covered with rows of short setae and bearing anteroapical comb; basal half of anterior region with row of long, erect setae; pv region with row of stout setae, increasing in length apically. First tarsomere slightly shorter than fore tibia, with pd apical row of 5–6 stout setae.

Mid coxa with stout lateral seta and transverse row of setae on anterior face. Basal half of mid femur strongly thickened, with large av tubercle; ventral region of basal half armed with 2 long, stout setae and wide, flattened, curved seta; apical half with ad row of stout setae; ventral region of apical half with 2 long setae and short, flattened, finger-like process (Figs. 5, 6). Mid tibia shorter than femur extremely modified by series of variously ornamented processes and setae. First tarsomere longer than remaining 4 tarsomeres.

Hind coxa with transverse row of setae on anterior face. Hind femur twice length of fore femur, bearing row of 7–9 long, flattened pv setae near mid-length; preapical seta, long, stout, projecting perpendicular to posterior surface. Hind tibia longer than femur, apex dilated, bearing posteroapical comb; subapical posterior region with shallow notch; ad region with 1 subapical seta and 2 setae on basal half; 1 erect dorsal seta near mid-length.

Abdomen brown, with long, stout setae along posterior margin of T1–6; T7 membranous.

Terminalia (Figs. 22, 23). Hypandrium with posterior flap-like process; paired articulated, curved postgonites projecting laterally near apex of phallus. Apex of phallus with laterally projecting sickle-shaped appendages which arch anteriorly beneath postgonites. Epandrium with short pointed lobe projected anterior to surstylus. Surstylus slender, arched dorsally, parallel-sided with rounded apex, bearing setulae. Cercus short, fleshy, apex acute, expanded laterally around anus.

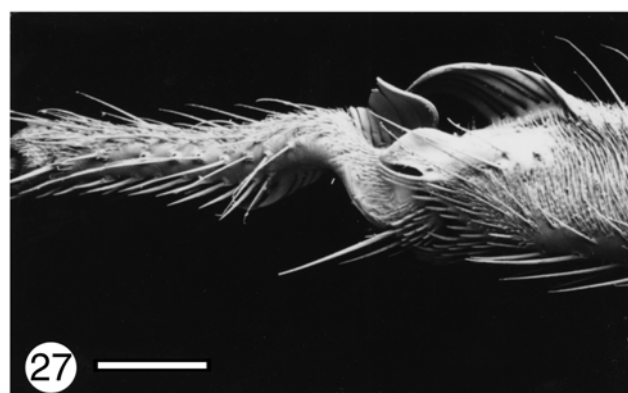
Female. Similar to male and female of *C. athertonius* except as follows: wing lacking posterior incision and appendage; medial fork with short petiole, basal to radial fork by slightly more than half length of R_4 . Apex of fore tibia slightly expanded. Posterior fringe of setae on T7 restricted to lateral margins. Terminalia (Fig. 24): T8 largely membranous, with dense fringe of setae along lateral margins; S8 with median stripe of setae. T10 bearing short, spine-like setae; cercus short with small apical spine-like setae. Spermathecal receptacle slightly oval, with duct attached directly, lacking pigmented ridge or neck-like extension.

Distribution. This species is restricted to the moist, higher elevations of the western half of Tasmania (Fig. 28).

Ceratomerus victoriae n.sp.

Figs. 7, 8, 14, 15, 25–28, 30–33

Type material. HOLOTYPE ♂, "AUST: VIC[tor]ia: 9 km N/ Warburton, Cement Ck./ 1–3.xii.1994/ B.J. Sinclair/ ex. *Nothofagus* for.": "HOLOTYPE/ *Ceratomerus/ victoriae/* Sinclair [red label]" AMS K175241. PARATYPES: **Victoria:** 15♂♂, 10♀♀, same data as holotype (AMS, ANIC, CNC, ZFMK); 2♂♂, 3♀♀, Acheron Ck, 29 km from Warburton, 1–3.xii.1994, y.pans, BJS, DJB; 4♂♂, Cement Ck, 800 m, rainfor., y.pans, 1–3.xii.1994, DJB; 2♀♀, Errinundra Plateau, Result Ck, & Gap Rd, 920 m, rainfor., y.pans, 6.xii.1994, DJB; 1♂, 3♀♀, Otway Ra., SE Beech For., Beauchamp Falls, y.pans, 350 m, 4–5.xii.1994, DJB



Figs. 25–27. Scanning electron micrographs of male *Ceratomerus victoriae*: 25, head, lateral view; 26, fore femur, anterior view; 27, fore first tarsomere and apex of tibia, posterior view. Scale bars = 0.1 mm.

(AMS); 1♀, Acheron Gap, 15 km NNE Warburton, MT, 830 m, 6–12.xii.1990, D. Pollock, L. Reichert; 1♂, Cement Ck, 27.x.1961, DHC; 1♀, Cement Ck, 670 m, *N. cunninghamii*, 10–17.i.1980, A. Newton, M. Thayer (ANIC); 1♂, Cement Ck, 27.iii.1972, A. Neboiss (MVM); 4♂♂, 2♀♀, Errinundra Plateau, Gap Rd, Result Ck Falls, 6–7.xii.1994, BJS (MVM, ZFMK); 3♂♂, 2♀♀, Otway Ra., Beauchamp Falls, *Nothofagus*, 3.xii.1994, BJS (ZFMK); 2♂♂, 4♀♀, Otway Ra., Melba Gully SP, temperate rainfor., ck, 4.xii.1994, BJS (CNC).

Diagnosis. Males are readily recognized by highly modified midlegs and anal lobe of the wing acutely produced, bearing many stout setae. Females are separated by the yellow-coloured pleura, short base of the medial fork, and dark-tipped stylus.

Description. Wing length 4.2–4.5 mm, similar to *C. athertonius* except as follows:

Male. Head. Postocellar bristles one-third length of ocellar bristles; vertical bristles somewhat shorter than ocellar bristles; postocular bristles short, slender, overlapping one-third of eye.

Antenna long, with scape slightly longer than height of eye (Fig. 25). Postpedicel 1.6× longer than scape; palpus yellow, short and slender, one-fourth length of proboscis, with several long, dark setae; prementum with 1 pair of erect setae.

Thorax. Mesonotum and postnotum dark, lacking dorsal stripes; postpronotal lobe brown, pleura yellow. Acrostichals in alternating single row of short setulae to prescutellar depression, directed anteriorly; 4 dc, posterior dc short and slender; 2 psut spal, lower near wing base; numerous setulae scattered on scutum, particularly around presut spal and dc.

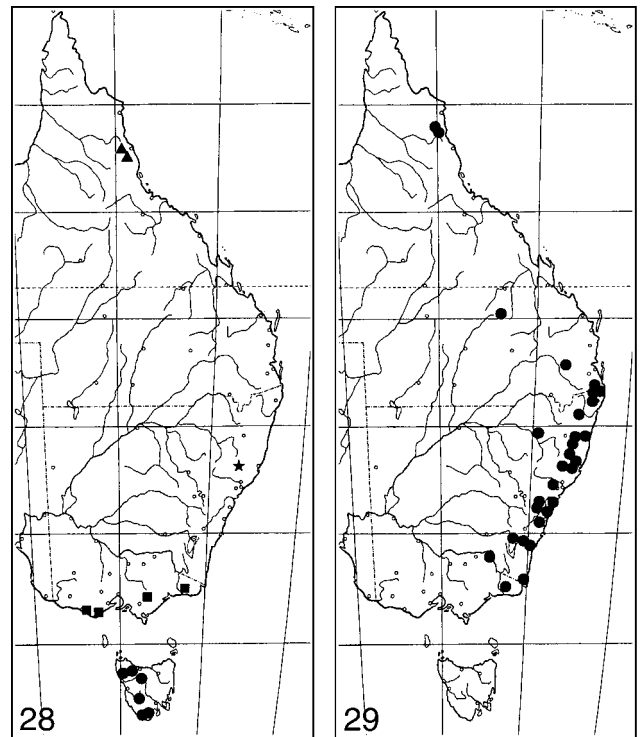
Wing (Fig. 14). Anal lobe acutely produced, bearing more than 15 short, stout setae; posterior margin lacking incision, with 3 stout, flattened setae on wing stem. C with 12 widely spaced, long dorsal setae on upper surface between tip of Sc and R₁, longer than costal seta. Cell dm oval; medial fork proximal to radial fork by more than length of R₄, usually with very short petiole or stem. Halter with dark knob.

Legs. Coxae concolorous with pleura, hind coxa somewhat darker; base and inner margin of femora yellowish brown, dark apically; remaining leg segments dark. Inner margin of fore coxa gradually tapered, parallel-sided, with anterior row of long setae on apical half and inner subapical patch of fine setae; apical third with long stout seta, half length of coxa on near inner ventral margin. Fore trochanter unmodified. Fore femur swollen, inner margin concave on basal two-thirds; upper edge of depression with row of 7 long, ventrally directed setae, longer than width of femur (Fig. 26); av margin with row of stout, black setae, decreasing in length apically, longest on apex of ventral swelling; apical fourth with ventral swelling with av fringe of long setae and 1 ventral, near horizontal projecting stout seta. Fore tibia longer than femur + trochanter, with mid-length constriction or weakening; distal half with anterior and posterior surfaces concave, clothed in short appressed setae; apex with pd comb of tightly appressed, arched, stout setae; anteroapical comb present. First tarsomere less than half length of fore tibia, with deep basal notch; short, arched comb opposing tibial comb (Fig. 27); 1 erect, ventral seta at base; distal 4 tarsomeres nearly twice length of first tarsomere.

Mid coxa with slender setae. Mid femur thickened, strongly arched, with large curved, ventral tubercle; tubercle lined with long ventral setae, terminating in pointed, subapical finger-like process; basal third with long av and pv setae, longer than width of femur; apical fourth with short, slender, black pv appendage (Figs. 7, 8). Mid tibia two-thirds length of femur, laterally expanded, with deep concave ventral surface; pv margin with row of long setae, longer than width of tibia; anteroapical margin with broad lobe extending beyond base of tarsomere; av margin with several short, rounded lobes; 2 long, erect ad setae. First tarsomere 1.3× longer than tibia; base with pv row of 3 stout setae; apical half with anterior row of stout, curved, flattened setae; basal half with long, anterior and ad setae, longer than width of tibia; first tarsomere nearly subequal in length to remaining 4 tarsomeres.

Hind femur less than twice length of fore femur, bearing av patch of curled, golden setulae; basal third with row of 3–5 long, erect setae; 1 erect, subapical dorsal seta. Hind tibia longer than femur, apex not dilated, bearing posteroapical comb; 4 erect ad setae and 2 erect dorsal setae on apical half. Fifth tarsomere not strongly flattened.

Abdomen. Tergites concolorous with thorax, with long, stout setae along posterior margin of T1–6; sternites pale



Figs. 28–29. Known distribution of species of *Ceratomerus* (eastern Australia). 28, *C. athertonius* ▲, *C. barringtonensis* ★, *C. campbelli* ●, *C. victoriae* ■. 29, *C. orientalis*.

brown; T8 very slender, one-sixth length of sternite, lateral margin expanded.

Terminalia (Figs. 30, 31). Hypandrium with posterior broad flap, folded anteriorly, bearing crown of long setae; paired articulated postgonites flanking phallus, projecting dorsally, apex forked. Phallus flattened, apex truncate with lateroapical sickle-shaped extensions curving around anterior margin of postgonites. Epandrium with 1 very long, stout seta on ventrolateral margin; pair of round setose lobes flanking surstylus, with anterior lobe bearing radiating crown of thickened setae, posterior lobe bearing crown of very stout, flattened setae. Bacilliform sclerite broad, fused to epandrium near base of cercus; small, round lobe from bacilliform sclerite near anterior epandrial lobe. Surstylus fin-shaped, tapered, bearing lateral setulae; base with pair of long setae. Cercus short, fleshy, apex acute, expanded laterally around anus; posterior surface well sclerotized.

Female. Similar to male and female of *C. athertonius* except as follows: postpedicel short, subequal in length to scape; palpus dark. Medial fork with very short petiole, basal to radial fork by more than length of R₄ (Fig. 15). Apex of fore tibia slightly expanded. Mid tibia with long, erect ventroapical seta; 1 erect ventral seta at mid-length; basal third with ad and pd seta. Posterior margin of T7 with complete fringe of golden setulae. Terminalia (Fig. 32): S8 subtriangular in lateral view. Spermathecal receptacle oval, flattened, with distinct wide neck (Fig. 33).

Distribution. This species is known from several isolated remnant patches of *Nothofagus* rainforest in Victoria (Fig. 28). These localities are often in deep, cool ravines, well shaded and consequently the stream temperatures are also fairly cool.

Biology. Relatively large numbers were swept above Cement Creek from the overhanging frons of tree ferns.

Adults were also aspirated from the under side of emergent rocks that had formed small, dark enclaves above the water surface. Adults appeared to seek these hiding spots, which was identical to behaviour observed for *C. barringtonensis*.

Etymology. Refers to the state where the material for this species was collected.

Ceratomerus inflexus species-group

This Australian species group is characterized by laterally inflated male terminalia, where the epandrial lamellae are normally highly convex, R_{2+3} is slightly to strongly deflected and arched around the stigma, and antennal segment 8 (second flagellomere) is much longer than wide. The relationship of this group remains doubtful, although appearing to be the sister group to all remaining Australian species exclusive of the *C. ordinatus* group.

Ceratomerus attenuatus n.sp.

Figs. 16, 35–38, 43

Type material. HOLOTYPE ♂, "AUST[ralia]: NSW[New South Wales]: Dorrigo NP/ Wonga Walk, 700 m/ Crystal Shower Falls/ 2.iv.1995/ B.J. Sinclair"; "HOLOTYPE/ *Ceratomerus/ attenuatus/* Sinclair [red label]" AMS K175242. PARATYPES: **Australian Capital Territory:** 4♂♂, 1♀, Blundells Ck, 35°22'S 148°50'E, iii., vi.1987, v.1988, DHC (ANIC). **New South Wales:** ♂, same data as holotype (AMS); 4♂♂, 3♀♀, Border Ranges NP, Brindle Ck, 1000 m, rainfor., y.pans, 25–26.i.1995, BJS (CNC, ZFMK); 1♂, Dorrigo NP, Rosewood Ck, 23.i.1995, BJS; 5♂♂, 4♀♀, Gloucester Tops, 1280 m, *Nothofagus*, MT, 19.xi–4.xii.1988, DJB; 1♀, Styx River SF, George's Ck For. Res., Cunnawarra Ck, 31.iii.1995, BJS (AMS); 1♂, 2♀♀, nr Gloucester Tops, 1290 m, *Nothofagus*, 14–19.xi.1988, DJB (AMS, ANIC); 1♀, Monga SF, 19–24.i.1984, L. Masner (CNC). **Queensland:** ♀, Lamington NP, Green Mtns, Elabana Falls, Canungra Ck, 6.v.1994, BJS (AMS). **Victoria:** 9♂♂, 1♀, Acheron Ck, 29 km from Warburton; y.pans, rainfor. ck, 400 m, 1–3.xii.1994, DJB; 5♂♂, Burrowa-Pine Mtn NP, Bluff Ck Falls, 400 m, riverine for., y.pans, 29.xi.1994, DJB; 2♂♂, 1♀, same locality, swept over pools, 29.xi.1994, DJB; 1♂, Cement Ck, rainfor., 800 m, y.pans, 1–3.xii.1994, DJB; 6♂♂, 3♀♀, Errinundra Plateau; Bonang Ck, y.pan, 1.iv.1990, DJB; 2♂♂, 4♀♀, same locality, Result Ck; 1♂, 1♀, Errinundra Plat., Result Ck + Gap Rd., 900 m, cool rainfor., y.pans, 6.xii.1994, DJB (AMS); 5♂♂, 1♀, same locality, Cudgewa Bluff Falls, 400 m, rainfor., 30.xi.1994, BJS (CNC, ZFMK).

Diagnosis. Recognized by the very slight inflexion of R_{2+3} around the stigma, dorsolateral margin of female sternite 7 concave with posterior corner extended dorsally, and distinctive capsule-like male hypopygium with long slender cerci.

Description. Wing length 2.8–3.5 mm.

Male. *Head* dark brown, dull; upper half of face pale brown, lacking setae; lower half of face with dense white pruinescence; ocellar triangle with 2 widely spaced, long, divergent bristles, inserted anterior to lateral ocelli; postocellar bristles short, one-half length of ocellar bristles; 3 pairs of vertical bristles, shorter than ocellar bristles; postocular bristles short, slender, overlapping less than one-third of eye. Antenna with length of scape slightly more than half height of eye, with 2 dorsal setae, several lateral setulae and 1 long ventral seta; pedicel globular, with setae confined to apical fringe. Postpedicel covered by long, dense pruinescence, length slightly longer than height of head; base rectangular; apical half strongly tapered, subequal in length to base; three-segmented stylus subequal in length to postpedicel; segment 8 long, 4–5× longer than width; stylus concolorous with remaining segments. Base of

labrum lacking dorsal process; palpus brown, slender, one-fourth length of labrum, with several dark setae; prementum with short setae only.

Thorax. Scutum and postnotum dark brown; pleura brown; postpronotal lobe pale; pale streak extending ventrally along proepisternum and anterior margin of anepimeron; scutum lacking vitta of pruinescence. Alternating row of short acrostichals to prescutellar depression, directed anteriorly; 4 dc, fourth dc short and slender; 1 pprn; 1 presut spal; 1 npl; 2 psut spal; 1 pal, short; 2 sct; additional setulae lacking. Anteprepronotum with pair of long setae.

Wing (Fig. 16) infusate, stigma distinct, short somewhat triangular in shape at apex of cell r_1 ; 1 long costal seta; costal margin with unmodified setulae; posterior margin lacking incision; posterior setal margin complete, with 3 long setae on wing stem. R_1 reaching costa before middle of wing; R_{2+3} running parallel and close to costa, slightly arched around stigma; medial fork proximal to radial fork; cell dm rectangular, slender; auxiliary crossvein between R_{2+3} and R_4 lacking. Halter with dark knob.

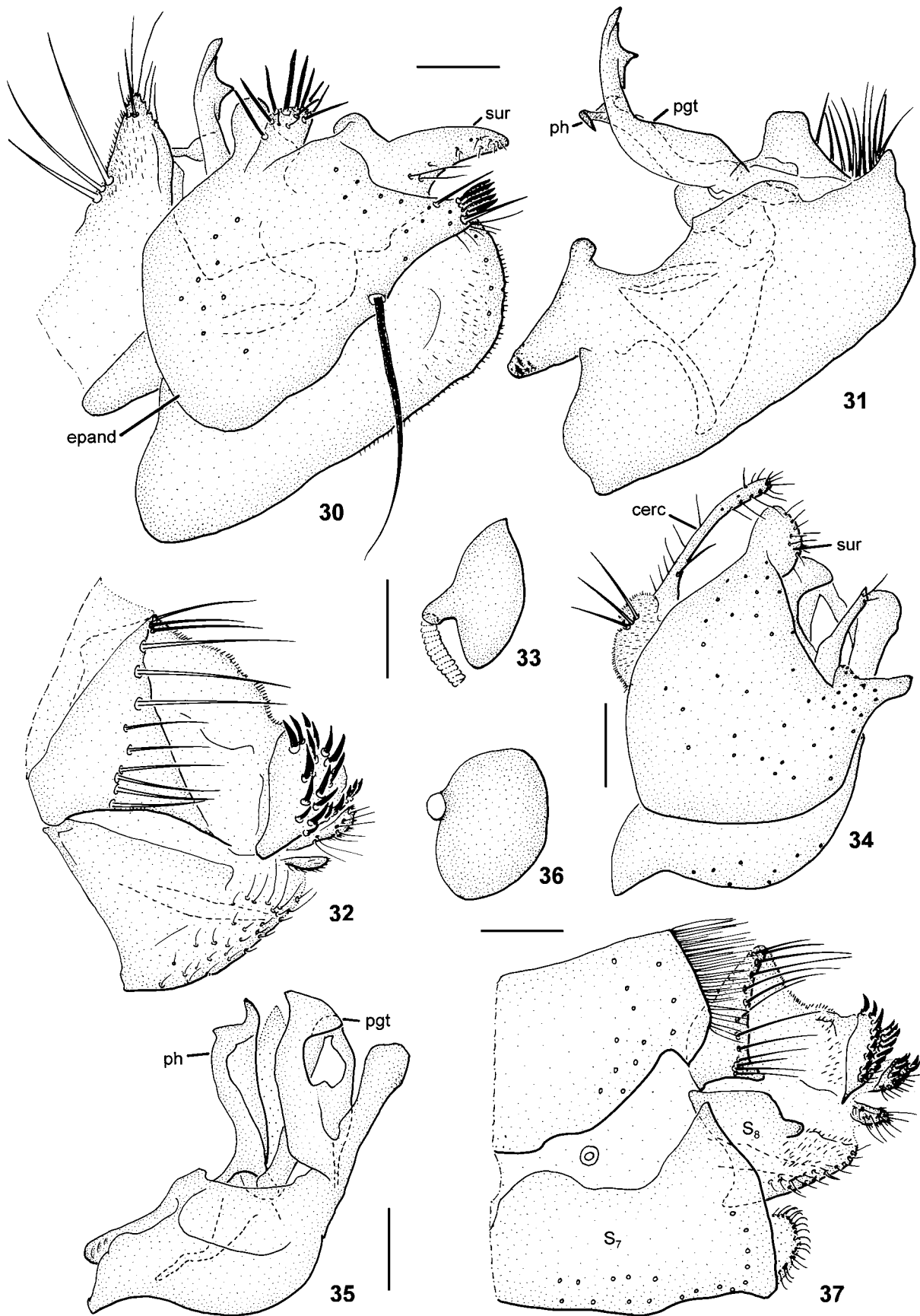
Legs. Fore and mid coxae yellow, hind coxa yellowish-brown; base of femora, especially inner margin yellow, becoming dark brown towards tip. Fore coxa slightly less than twice length of mid coxa, lacking modified setae. Fore trochanter lacking modified setae. Fore femur slightly swollen, with av row of fine setae, decreasing in length apically; 1 preapical dorsal seta. Fore tibia slightly shorter than femur; apex with anteroapical comb, not dilated. First tarsomere nearly two-thirds length of fore tibia, lacking modified setae; all tarsomeres slender.

Mid coxa lacking modified seta. Mid femur partially swollen, with pv row of short, dark setae along middle two-thirds; base with long erect pv seta; basal third with av biserial row of short dark setae (Fig. 38). Mid tibia not swollen at mid-length, with av row of short setae; pv surface with row of slender setae, shorter than width of tibia; 1 dorsal seta on basal third and 1 pd seta near mid-length. First tarsomere subequal in length to remaining 4 tarsomeres, with many erect pv setae, including long basal seta; tarsomere 5 not noticeably more flattened than on other legs.

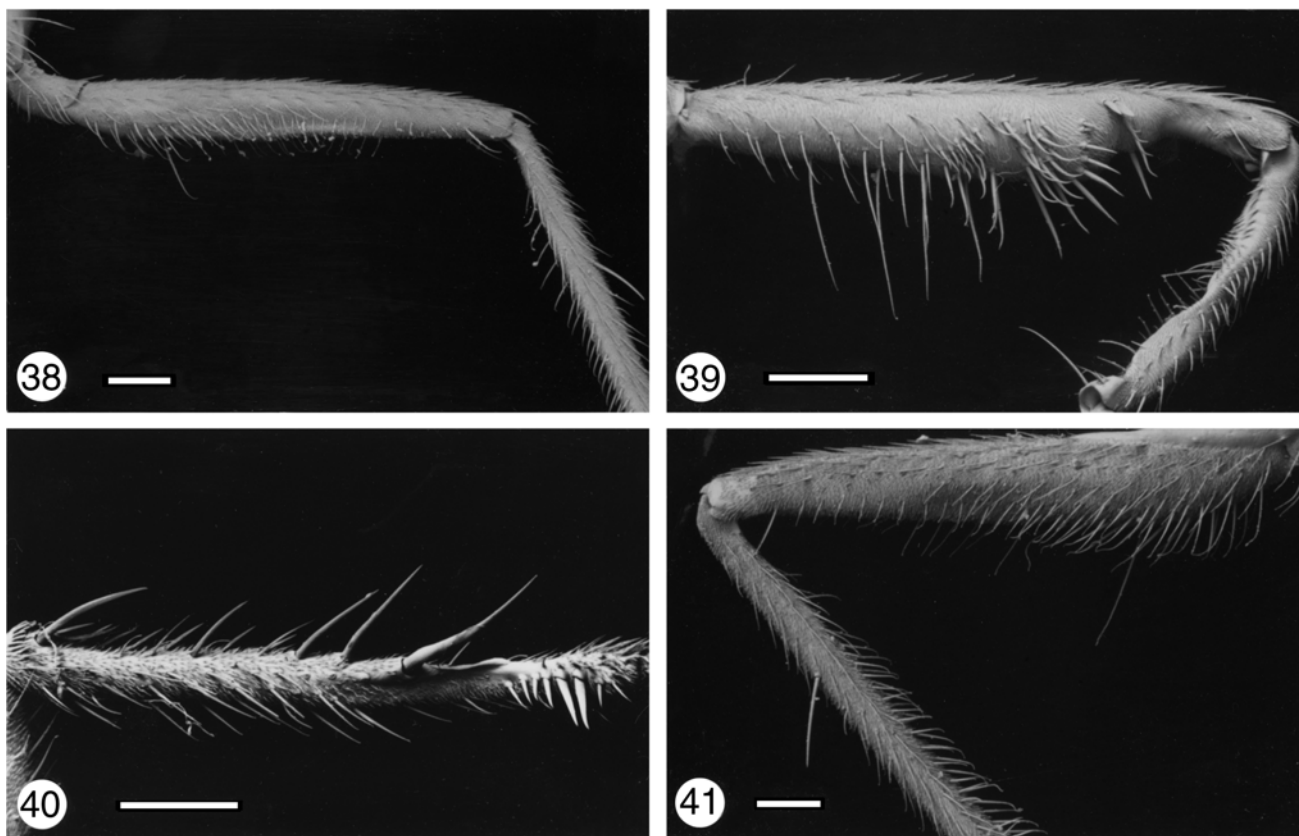
Hind coxa with unmodified setae. Hind femur straight with 1 preapical ad seta; ventral surface lacking distinct row of setae beneath. Hind tibia straight, shorter than femur, apex partially dilated, bearing posteroapical comb; pv surface lacking setae; 3 erect ad setae on apical two-thirds; dorsal margin with 2 erect setae on distal half. Hind tarsomeres longer than tibia; first tarsomere with 1 long, erect ventral seta near base.

Abdomen brown, concolorous with thorax, sclerites of segment 1–6 well sclerotized; posteromarginal setae increasing in length apically, longest on T6, where setae half width of abdomen; sternites and tergites lacking modified setae and ridges; T7 thinly sclerotized medially, lacking long posteromarginal setae; S7 only slightly longer than preceding sternite, anterolateral margin produced anteriorly; T8 bow-tie shaped.

Terminalia (Figs. 34, 35). Hypandrium convex, posterior margin produced into pair of long processes, expanded apically, nearly subequal in length to postgonites; gonocoxal apodemes developed, not projected beyond anterior margin; postgonites upright, gently arched posteriorly, fused anteriorly with pair of lateral processes (phallic), and concave median process; phallus upright, gently arched with subapical hook and arched apex. Epandrial lamella nearly circular in lateral view, forming



Figs. 30–37. Terminalia of *Ceratomerus*. 30–33, *C. victoriae*: 30, male, lateral view; 31, hyandrium and phallus, lateral view; 32, female, lateral view; 33, spermatheca. 34–37, *C. attenuatus*: 34, male, lateral view; 35, hyandrium and phallus, lateral view; 36, spermatheca, 37, female, lateral view. Scale bars = 0.1 mm. Abbreviations: *cerc*, cercus; *epand*, epandrium; *pgt*, postgonite; *ph*, phallus; *S*, sternite; *sur*, surstylus.



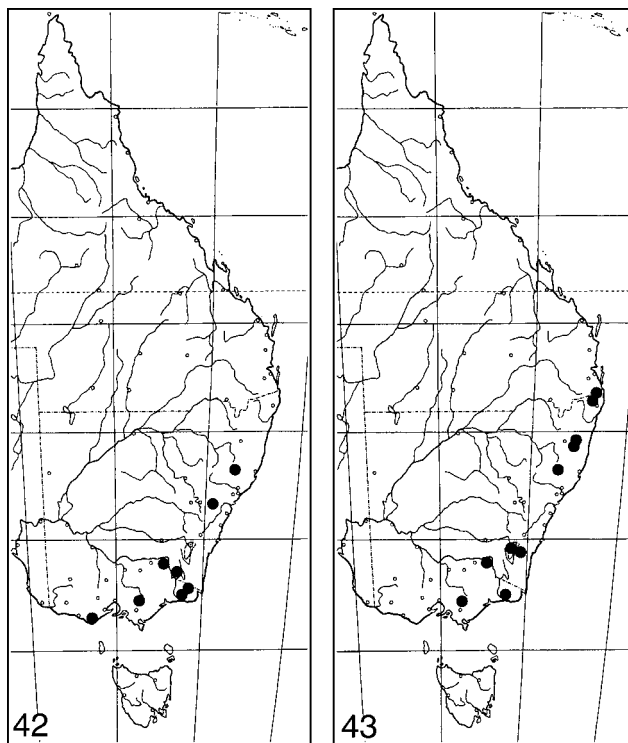
Figs. 38–41. Scanning electron micrographs of male legs of *Ceratomerus*. 38, *C. attenuatus*, midleg, anterior view. 39–40, *C. globosus*: 39, midleg, anterior view; 40, fore first tarsomere, ventral view. 41, *C. malleolus*, midleg, anterior view. Scale bars = 0.1 mm.

a partial capsule fused ventrally to hypandrium; bearing short, oblique, finger-like, posterior epandrial lobe. Surstylus short, thumb-like; inner margin with dense mat of short, stout setae; lateral margin with row of setae. Subepandrial plate narrow, extending laterally to epandrial margin; apex bearing slender process projected beyond epandrium; base of process secondarily fused to epandrium. Cercus very long and slender, sparsely clothed in setae.

Female. Similar to male except as follows: av row of setae of fore and hind femora short; mid femur slender; lacking rows of ventral setae on mid femur and tibia; mid tibia with long, erect, ad and pv apical seta; erect pv seta at mid-length. Apical segments retracted into segment 7; apical margins of segment 7 not folded inwards; posterior margin of T7 entire, with fringe of golden setulae; lateral margin of S7 concave, with pd corner extended sharply dorsally. Terminalia (Fig. 37): median region of T8 with deep U-shaped weakly sclerotized zone; fringe of long setae anterior to membranous region; anterior margin with flattened, internal, median plate. S8 triangular in lateral view, with short, rounded process; posterior margin invaginated, forming internal plate. T10 split medially into pair of rectangular sclerites, bearing double row of spine-like setae along posterior margin. Cercus bearing biserial row of spine-like setae, with short, slender marginal setae. Spermathecal receptacle oval, flattened with duct attached to broad asymmetrical neck (Fig. 36).

Distribution. This species is recorded sporadically from streams in subtropical rainforests of northern NSW and southern Queensland to gallery rainforests of Victoria (Fig. 43).

Etymology. The specific name is from the Latin *attenuatus* (drawn out or thin), referring to slender, thread-like male cercus.



Figs. 42–43. Known distribution of species of *Ceratomerus* (eastern Australia). 42, *C. globosus*. 43, *C. attenuatus*.

Ceratomerus bickeli n.sp.

Figs. 44, 100

Type material. HOLOTYPE ♂, "TAS[mania, Australia]: Frodshams Pass/nr.Mt. Wedge;4-5.ii./ -1989; rainforest/ D.Bickel;yellowpan"; "HOLOTYPE/ *Ceratomerus/ bickeli*/ Sinclair [red label]" AMS K175243.

Diagnosis. Recognized by the strong inflexion of R₂₊₃ around the stigma and the very long, slender posterior hypandrial processes and cerci.

Description. Wing length 3.7 mm, similar to *C. attenuatus* except as follows:

Male. Head. Four pairs of vertical setae, shorter than ocellar bristles; postocular bristles short, overlapping less than one-third of eye. Antenna with length of scape slightly less than height of eye; postpedicel length less than height of head; three-segmented stylus longer than postpedicel; segment 8 elongate, 4× as long as wide. Palpus brown, slender, one-sixth length of labrum.

Thorax. Upper margin of pleura brown, remaining pale brown; postpronotal lobe pale.

Wing. R₂₊₃ running parallel and close to costa, strongly deflected around stigma.

Legs. Fore and mid coxae and ventral of femora pale yellow, remaining leg segments brown, darker towards tip. Fore femur slightly swollen, with av row of fine setae, decreasing in length apically; basal setae nearly subequal in length to width of femur. First tarsomere greater than half length of fore tibia.

Mid femur more strongly swollen than fore femur, with pv row of short, dark setae and 1-2 long basal setae; basal half with av brush of short dark setae, increasing in length medially. Mid tibia very slightly swollen at mid-length, with av row of short setae; pv surface with row of slender setae, longer than width of tibia; ventroapically with row of short erect setae on apical sixth; 1 ad seta on proximal half. First tarsomere 4/5 length of remaining 4 tarsomeres, with many erect pv setae.

Hind femur straight with 1 preapical dorsal and 1 ad seta; ventral surface with av row of fine setae, shorter than width of femur. Hind tibia straight, shorter than femur, apex partially dilated, bearing posteroapical comb; 2 erect ad setae at mid-length and 1 subapical ad seta; apical two-thirds with row of long, erect dorsal setae. Hind tarsomeres slightly longer than tibia.

Abdomen pale brown, concolorous with thorax, sclerites weakly sclerotized; T8 not examined.

Terminalia (based on undissected specimen) (Fig. 44). Hypandrium with pair of long, slender posterior processes, partially twisted; 1 pair of short anterior, hooked, articulated processes arched posteriorly near surstyli; postgonites arched anteriorly, flanking pair of phallic processes. Epandrial lamella greatly inflated laterally, round; fused ventrally to lateral wall of hypandrium. Surstylus finger-shaped, shorter than cercus. Cercus with broad base, with long, heavily sclerotized lateral process, similar to posterior hypandrial process.

Female. Unknown.

Distribution. This species is restricted to Tasmania (Fig. 100).

Etymology. The specific name honours Dr D.J. Bickel, who collected the holotype of this species and many other rare species from Tasmania.

Ceratomerus bulbosus n.sp.

Figs. 45, 46, 100

Type material. HOLOTYPE ♂, "TAS[mania, Australia]: nr Cradle Mtn./ Pencil Pine Ck; 800 m/ 30-i-1989; D.Bickel/ high woodlands;pans"; "HOLOTYPE/ *Ceratomerus/ bulbosus/* Sinclair [red label]" (AMS K175244). PARATYPES: **Tasmania:** 1♂, 1♀, same data as holotype (AMS).

Diagnosis. Recognized by the strong inflexion of R₂₊₃ around the stigma, heavily sclerotized and broad male cerci, and short, narrow posterior and bilobed anterior hypandrial processes. Females can also be partially identified on the basis of a broad, yellow pleural band extending to the katepisternum.

Description. Wing length 3-3.3 mm, similar to *C. attenuatus* except as follows:

Male. Head. Antenna with length of scape slightly less than height of eye; postpedicel length less than height of head; three-segmented stylus longer than postpedicel; segment 8 elongate, 4× as long as wide. Palpus brown, slender, one-sixth length of labrum.

Thorax. Scutum and postnotum dark brown; upper margin of pleura brown, remaining pale brown; postpronotal lobe pale; long, broad yellow pleural band extending to katepisternum; scutum lacking vitta of pruinescence.

Wing as in *C. attenuatus*.

Legs. Fore and mid coxae and ventral margin of femora pale yellow, remaining leg segments brown, darker towards tip. First tarsomere greater than half length of fore tibia.

Mid femur slender with pv row of long, dark setae; proximal half with av row of dark setae, increasing in length basally, biserial at base. Mid tibia very slightly swollen at mid-length, with 4 stout av; pv surface with row of slender setae, longer than width of tibia; ventroapically with row of short erect setae on apical fourth; 1 ad seta on proximal half. First tarsomere 4/5 length of remaining 4 tarsomeres, with 4 erect pv setae.

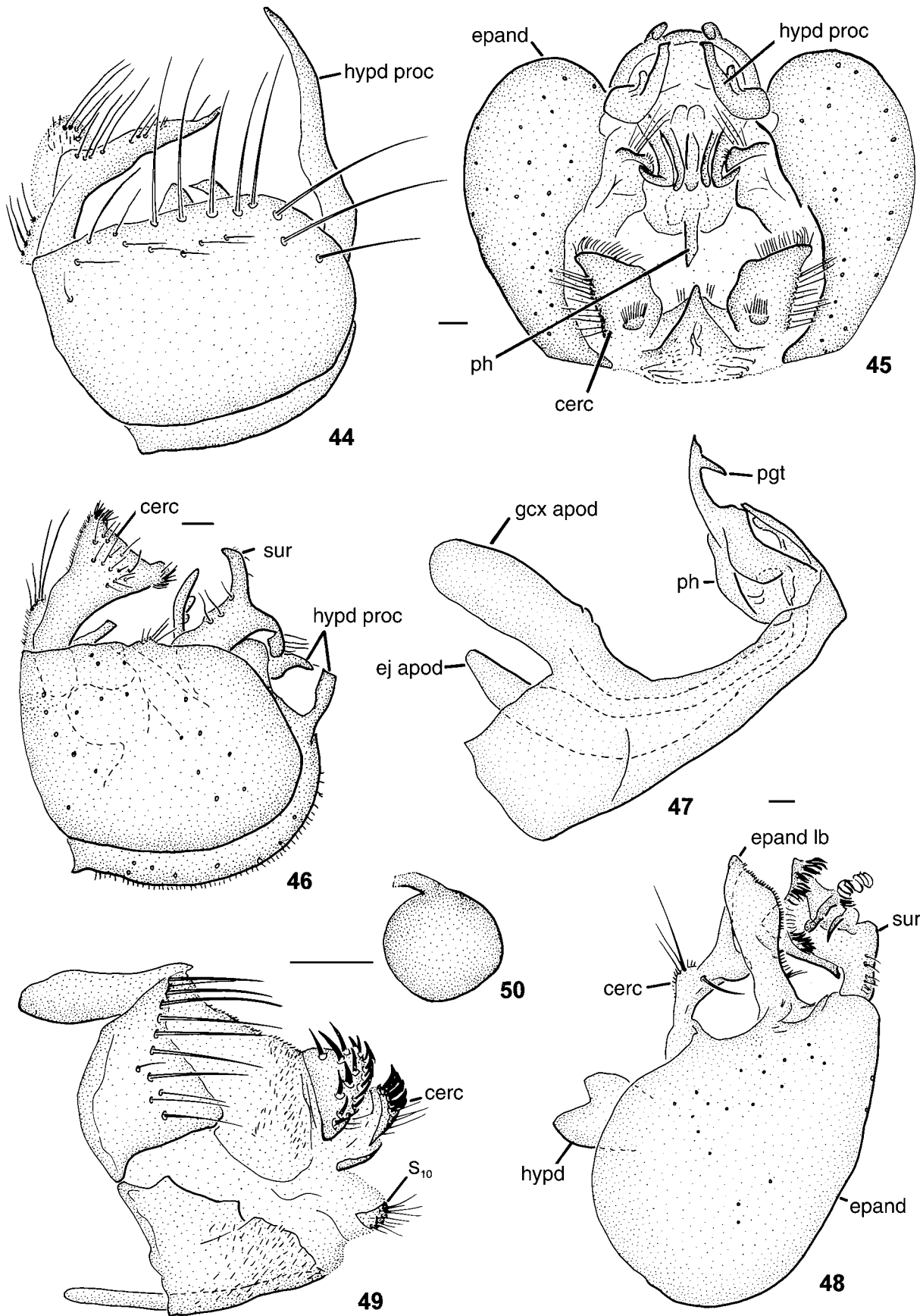
Hind femur straight with 1 preapical dorsal and 1 ad seta; ventral surface with av row of fine setae, shorter than width of femur. Hind tibia with 2 erect dorsal setae on apical half; 4 erect ad setae. Hind tarsomeres slightly longer than tibia.

Abdomen pale brown, concolorous with thorax, sclerites thinly sclerotized; T8 bow-tie shaped, with very short ventral process.

Terminalia (Figs. 45, 46). Hypandrium with pair of short, slender posterior processes; 1 pair of short anterior, bilobed, hooked, articulated processes arched posteriorly near surstyli; postgonites arched anteriorly, flanking pair of phallic processes; stout, blade-like, median phallic process arched anteriorly, distant from postgonites and posterior phallic processes. Epandrial lamella greatly inflated laterally, round; fused ventrally to lateral wall of hypandrium. Surstylus hammer-shaped, shorter than cercus. Subepandrial plate subrectangular, heavily sclerotized; more than half length of cercus. Cercus heavily sclerotized, long and broad in posterior view; apex expanded with fringe of subapical setae; strong setae clustered along anterior and posterior margins.

Female. Similar to male and female of *C. attenuatus* except as follows: Terminalia (based on undissected specimen): T10 bearing stout setae; cercus bearing similar modified setae.

Distribution. This species is restricted to Tasmania (Fig. 100).



Figs. 44–50. Terminalia of *Ceratomerus*. 44, *C. bickeli*, male, lateral view. 45–46, *C. bulbosus*: 45, male, dorsal view; 46, male, lateral view. 47–50, *C. globosus*: 47, hypanthium and phallus, lateral view; 48, male, lateral view; 49, female, lateral view; 50, spermatheca. Scale bars = 0.1 mm. Abbreviations: *cerc*, cercus; *gcox apod*, gonocoxal apodeme; *ej apod*, ejaculatory apodeme; *epand*, epandrium; *epand lb*, epandrial lobe; *hypd*, hypandrium; *hypd proc*, hypandrial process; *pgt*, postgonite; *ph*, phallus; *S*, sternite; *sur*, surstylus.

Etymology. The specific name is from the Latin *bulbosus* (swollen), referring to the greatly swollen or inflated male hypopygium.

***Ceratomerus globosus* n.sp.**

Figs. 39, 40, 42, 47–52, 57

Type material. HOLOTYPE ♂, “AUST[ralia]: NSW[New South Wales]: Kosciusko/ NP, nr. Swamp Plain/ 28.ix.1994, 500 m/ B.J. Sinclair/ ex. Bogong Ck.”; “HOLOTYPE/ *Ceratomerus/ globosus/* Sinclair [red label]” AMS K175245. PARATYPES: **New South Wales:** 3♂♂, 3♀♀, same data as holotype (AMS, CNC); 1♂, 1♀, Barrington Tops NP, upper Gloucester R. + Falls, 1200 m, 20–21.xii.1993. BJS (CNC); 1♀, Barrington Tops NP, Williams R., subtrop. rainfor., 480 m, 19.xii.1993, BJS; 1♀, Blue Mtns NP, Valley of the Waters, Vera Falls, 23.x.1994, BJS; 1♂, 1♀, Blue Mtns NP, Wentworth Falls, Jamison Ck, 10.xi.1993, 23.x.1994, BJS (ZFMK); 1♂, Jonolan, 12.x.1950 (UQIC); 2♂♂, 1♀, Kosciusko NP, Leatherbarrel Ck, 1000 m, 28.xi.1994, BJS, DJB (AMS). **Victoria:** 5♂♂, 5♀♀, Burrowa-Pine Mtn NP, Bluff Ck Falls, 400 m, riverine for., y.pans, 29.xi.1994, DJB (ANIC, AMS); 1♀, Delgate R. & Goonmirk Rd, 960 m, 16.i.1991, DJB; 2♀♀, Otway Ra., SE Beech For., Beauchamp Falls, y.pans, mixed forest, 4–5.xii.1994, DJB; 1♀, Otway Ra., Beauchamp Falls, *Nothofagus*, 3.xii.1994, BJS (AMS); 3♂♂, 1♀, 45 km N Orbost, Bonang Hwy, Martins Ck, rainfor., 200 m, 6.xii.1994, BJS (CNC); 1♂, 29.5 km N Warburton, Acheron Way, rainfor., Acheron R., 1.xii.1994, BJS (ZFMK).

Additional material. New South Wales: 1♀, Styx R. SF, E Jeogla, Wattle Flat, wet scler. for., pans, 1000 m, 7.xii.1992, DJB (AMS). This specimen is possibly conspecific because the ratio of the length of the style to postpedicel is similar, but an associated male specimen is required for confirmation.

Diagnosis. Recognized by the style shorter than the postpedicel, slight inflexion of R_{2+3} around the stigma, dark brown pleura, tufts of stout setae on the lateral margin of male sternites 3–4 and tergite 6, encapsulated male terminalia, and scape 1.25 times longer than height of head.

Description. Wing length 3.5–4 mm, similar to *C. attenuatus* except as follows:

Male. Head. Face pale brown. Antenna with length of scape 1.25× height of eye (Fig. 57); postpedicel apical half 1.25× length of base; three-segmented stylus one-third length of postpedicel; segment 8 short, slightly longer than width. Palpus yellow, slender, one-fifth length of labrum.

Thorax. Scutum, postnotum and pleura dark brown; postpronotal lobe pale; pale streak extending ventrally along proepisternum.

Wing (Fig. 51) as in *C. attenuatus*.

Legs. Base of femora, especially inner margin yellow, becoming dark brown towards tip. Fore femur slightly swollen, lacking ventral setae. First tarsomere greater than half length of fore tibia, with large notch on apical third; base of notch with twisted spur-like seta (Fig. 40).

Mid femur more strongly swollen than fore femur, apical fourth strongly constricted; mid-length bearing pv row of 3 setae, longer than width of femur; apical half of swollen portion with 4 transverse rows of stout setae; base with long erect pv seta (Fig. 39). Mid tibia about half as long as femur, somewhat flattened and twisted, with subapical av notch; lateral margins with av and pv rows of setae, latter row increasing in length apically; lacking erect ad setae. First tarsomere longer than remaining 4 tarsomeres, with many erect pv setae.

Hind femur straight with ventral surface bearing av row of short, dark setae. Hind tibia with 2 erect dorsal setae on

apical half; ad margin with row of 3 long, erect setae. Hind tarsomeres slightly longer than tibia.

Abdomen. S3–4 and T6 with dense cluster of short, stout, lateral setae; T8 broad, subrectangular, about half as long as sternite.

Terminalia (Figs. 47, 48). Hypandrium laterally flattened, enclosed within epandrial lamellae; apex produced into slender posterior flap-like process; gonocoxal apodemes well developed; postgonites upright, gently arched posteriorly with subapical hooked process; phallus with pair of articulated processes, flanked by postgonites. Epandrial lamella oval forming distinct capsule fused ventrally to hypandrium; bearing subapical epandrial lobe, apically tapered, with dense mat of microtrichia. Surstylus complex, twisted, strongly bent, bearing whip-like setae; anterior margin with fringe of stout setae. Subepandrial plate narrow; lacking processes from hypoproct. Apical half of cercus well sclerotized, very narrow with apex bearing many stout setae; long stout seta on lateral margin of basal half.

Female. Similar to male and female of *C. attenuatus* except as follows: apical half of palpus brown. Wing similar to male (Fig. 52). S7 lacking transverse weakening. Terminalia (Fig. 49): cercus bearing row of spine-like setae, with long slender marginal setae. Spermatheca receptacle spherical, with short, pigmented neck (Fig. 50).

Distribution. This species is recorded from isolated communities at least as far north as Barrington Tops (NSW) south to the Otway Ranges of Victoria (Fig. 42).

Biology. This species appears to prefer cool temperate rainforest regions and is more rarely collected along gallery rainforests.

Etymology. The specific name is from the Latin *globosus* (round as a ball), referring to the rounded, encapsulated hypopygium.

***Ceratomerus inflexus* Hardy**

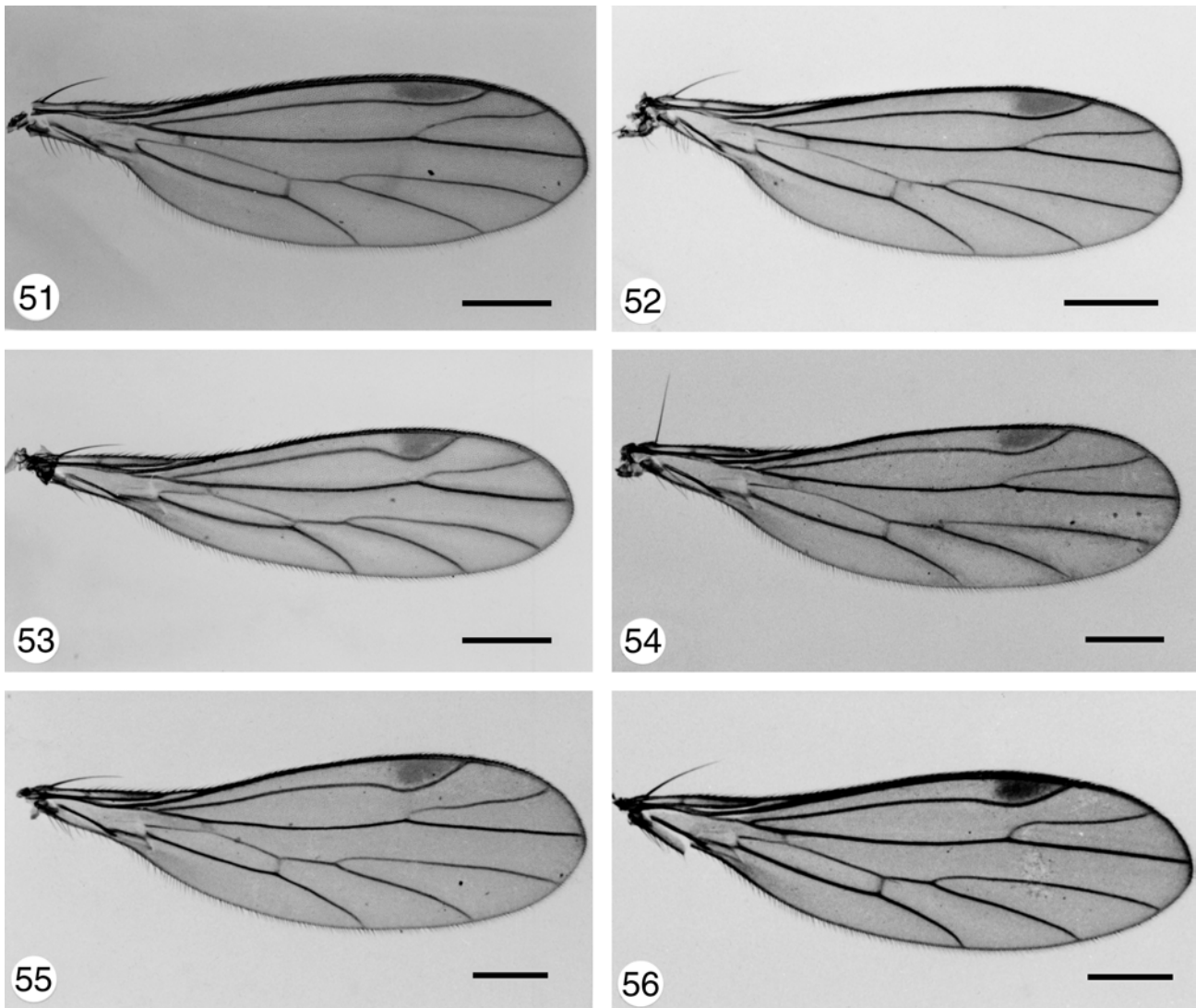
Figs. 53, 63, 71

Ceratomerus inflexus Hardy, 1930: 247.

Type material. NEOTYPE (here designated) ♂, “TAS[mania, Australia]: Sandy Bay [Hobart]/ creek, U[niversity of] Tas. campus/ 18–21-1-1993; pans/ wet scler; D. Bickel”; “NEOTYPE/ *Ceratomerus/ inflexus* Hardy/ des. B.J. Sinclair 2000 [red label]” AMS K175253.

As discussed in “Materials and methods”, all Hardy type series have been lost, and this species, *C. inflexus*, was not mentioned in the list of damaged Hardy types by Daniels (1978). But it was possible to associate this species on the basis of wing venation. In addition, the original type material was collected from Mount Nelson (Hardy, 1930), which is a suburb near Sandy Bay (Hobart) and the University campus where the Neotype was collected. The description by Hardy (1930) of the hypopygium as “rather small” is considered incorrect and was likely confused with *C. ordinatus*. Given the inaccuracies of the original description which may lead to future misidentifications, the designation of a neotype was deemed necessary.

Additional material. Australian Capital Territory: 1♂, 2♀♀, Blundells Ck, 35°22'S 148°50'E, vi, viii.1987 (ANIC). **Tasmania:** 1♀, same data as neotype (AMS). **Victoria:** 2♂♂, 1♀, Alexandra, 27.v.1953 (ANIC, MVM); 1♂, Burrowa-Pine Mtn NP, Bluff Ck, picnic area, 400 m, rainfor., y.pans, 29.xi.1994 (AMS).



Figs. 51–56. Wings of *Ceratomerus*. 51–52, *C. globosus*: 51, male; 52, female. 53, *C. inflexus*, male. 54–55, *C. malleolus*: 54, male; 55, female. 56, *C. oreas*, male. Scale bars = 0.5 mm.

Diagnosis. Recognized by the strong inflexion of R_{2+3} around the stigma, inflated male terminalia, stout male cerci, and short, broad posterior and truncate anterior hypandrial processes.

Description. Wing length 3–3.4 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocular bristles short, erect shorter than one-third of eye. Antenna with length of scape slightly less than height of eye, with 3 dorsal setae; postpedicel length less than height of head; three-segmented stylus longer than postpedicel; segment 8 elongate, 4× as long as wide. Palpus brown, slender, one-sixth length of labrum.

Thorax. Scutum and postnotum dark brown; upper margin of pleura brown, remaining pale brown; postpronotal lobe pale.

Wing (Fig. 53). R_{2+3} running parallel and close to costa, strongly deflected around stigma.

Legs. Fore and mid coxae and ventral margin of femora pale yellow, remaining leg segments brown, darker towards tip. First tarsomere greater than half length of fore.

Mid femur slender with pv row of long, dark setae; base with long erect pv seta; proximal half with av row of dark

setae, increasing in length basally, biserial at base. Mid tibia slightly swollen at mid-length, bearing 2–3 stout av setae; pv surface with row of slender setae, longer than width of tibia; av surface with row of setae, decreasing in length apically; apical 4–5 av setae, shorter than width of tibia, held erect, perpendicular to tibia; 2 ad setae on proximal half. First tarsomere $\frac{3}{5}$ length of remaining 4 tarsomeres, with 4 erect pv setae.

Hind femur straight with 1 preapical dorsal and 1 ad seta; ventral surface with av row of fine setae, shorter than width of femur. Hind tibia with 2 erect dorsal setae on apical half; 4 erect ad setae. Hind tarsomeres slightly longer than tibia.

Abdomen pale brown, concolorous with thorax, sclerites thinly sclerotized; T8 bow-tie shaped, with short ventral process.

Terminalia (Fig. 63). Hypandrium with pair of short posterior processes; 1 pair of short, anterior, hooked articulated processes arched posteriorly near surstyli, with truncate apex; postgonites arched anteriorly, flanking pair of phallic processes; stout, blade-like, median phallic process arched anteriorly, distant from postgonites and posterior phallic processes. Epandrial lamella greatly inflated laterally, spherical; fused ventrally to lateral wall of hypandrium. Surstylus finger-shaped, shorter than cercus.

Subepandrial plate trapezoidal, heavily sclerotized; more than half length of cercus. Cercus heavily sclerotized, long and broad in posterior view; apex expanded with fringe of subapical setae; strong setae clustered along anterior and posterior margin.

Female. Similar to male and female of *C. attenuatus* except as follows: Terminalia (based on undissected specimen): T10 bearing stout setae; cercus bearing similar modified setae.

Distribution. This species is known from Tasmania, Victoria and the Australian Capital Territory (Fig. 71).

Remarks. The mainland population differs somewhat from the neotype in having more pronounced setae on the inner margin of the surstylus.

Ceratomerus malleolus n.sp.

Figs. 41, 54, 55, 58, 64–68, 71

Type material. HOLOTYPE ♂, “VIC[toria, Australia]: Acheron Creek; 29 km/ from Warburton; pans/ rainforest/creek; 400 m/ 1–3.xii.1994; D. Bickel”; “HOLOTYPE/ *Ceratomerus/ malleolus/* Sinclair [red label]” AMS K175246. PARATYPES: **New South Wales:** 1 ♂, Kosciusko NP, Pipers Ck, Guthega Rd, 1320 m, subalpine, 1.i.1991, DJB (AMS). **Victoria:** 1 ♀, same data as holotype, BJS (ZFMK); 13 ♂♂, 6 ♀♀, same data as holotype (AMS, CNC, ZFMK); 1 ♂, Otway NP, Blanket Bay; rocky ck above falls, 10 m, 4–5.xii.1994, y.pans, DJB (AMS).

Diagnosis. Recognized by the slight inflexion of R_{2+3} around the stigma, heavily sclerotized male tergites 4–6 and anvil-shaped male cercus. This species can be distinguished from its sister species, *C. macalpinei*, by the narrow setose lobe beneath the cercus. Females can be partially identified by the brown pleura and long style.

Description. Wing length 3–3.5 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocellar bristles one-third length of ocellar bristles. Antenna with length of scape slightly less than height of eye (Fig. 58); postpedicel length less than height of head; three-segmented stylus longer than postpedicel; segment 8 elongate, 4× as long as wide. Palpus one-fifth length of labrum.

Thorax. Pale streak occasionally extending ventrally along proepisternum.

Wing (Fig. 54) as in *C. attenuatus*.

Legs. Fore and mid coxae pale and ventral margin of femora yellowish-brown, remaining leg segments brown, darker towards tip. Fore femur slightly swollen, with av row of fine setae, decreasing in length apically; basal setae longer than width of femur. First tarsomere greater than half length of fore tibia.

Mid femur with pv row of short, dark setae; base with long erect pv seta; basal half with av brush of short dark setae, increasing in length medially (Fig. 41). Mid tibia not swollen at mid-length, with av row of short setae; pv surface with row of slender setae, longer than width of tibia; ventroapically with row of short erect setae on apical sixth; 1 ad seta on proximal half. First tarsomere subequal in length to remaining 4 tarsomeres, with many erect pv setae.

Hind femur straight with 1 preapical dorsal and 1 av seta; ventral surface with av row of short, fine setulae. Hind tibia with 2 erect ad setae on apical half; dorsal margin with row of 4 long, erect setae. Hind tarsomeres slightly longer than tibia.

Abdomen pale brown, concolorous with thorax, sclerites of segment 1–3 weakly sclerotized; T4–6 heavily sclerotized, lateral margin extending ventrally, most pronounced in T4, where stout, rounded ridge formed (Fig. 68); S7 produced laterally, overlapping T7; T8 bow-tie shaped, lacking ventral process.

Terminalia (Figs. 66, 67). Hypandrium with pair of short, slender posterior processes; 1 pair of short anterior, hooked, articulated processes arched posteriorly near surstyli; postgonites arched anteriorly, flanking pair of phallic processes; stout, blade-like, median phallic process arched anteriorly, with hooked apex. Epandrial lamella greatly inflated laterally, spherical; fused ventrally to lateral wall of hypandrium. Surstylus curved, finger-like, shorter than cercus. Subepandrial plate subrectangular, heavily sclerotized; more than half length of cercus. Hypoproct with large, lateral process, curving out from beneath cercus; apex round. Cercus heavily sclerotized, with narrow neck and laterally expanded, hammer-shaped apex; clothed in fine setulae, lacking long setae; base of cercus with slender setose lobe.

Female. Similar to male and female of *C. attenuatus* except as follows: wing similar to male, although often R_{2+3} more strongly deflected below stigma (Fig. 55). S7 with transverse weakening, providing flexibility. Terminalia (Fig. 64): anterior margin of T8 with flattened, internal, median plate, strongly arched ventrally. S8 subdivided into small trapezoidal sclerite and small, oval dome-shaped sclerite; posterior margin invaginated, forming broad internal plate. T10 bearing stout setae along posterior margin. Cercus bearing similar modified setae. Spermathecal receptacle oval, flattened, with distinct wide neck (Fig. 65).

Distribution. This species is known from Victoria and New South Wales (Fig. 71), in subalpine to coastal habitats.

Etymology. The specific name is from the Latin *malleolus* (hammer), referring to the shape of the male cercus.

Ceratomerus macalpinei n.sp.

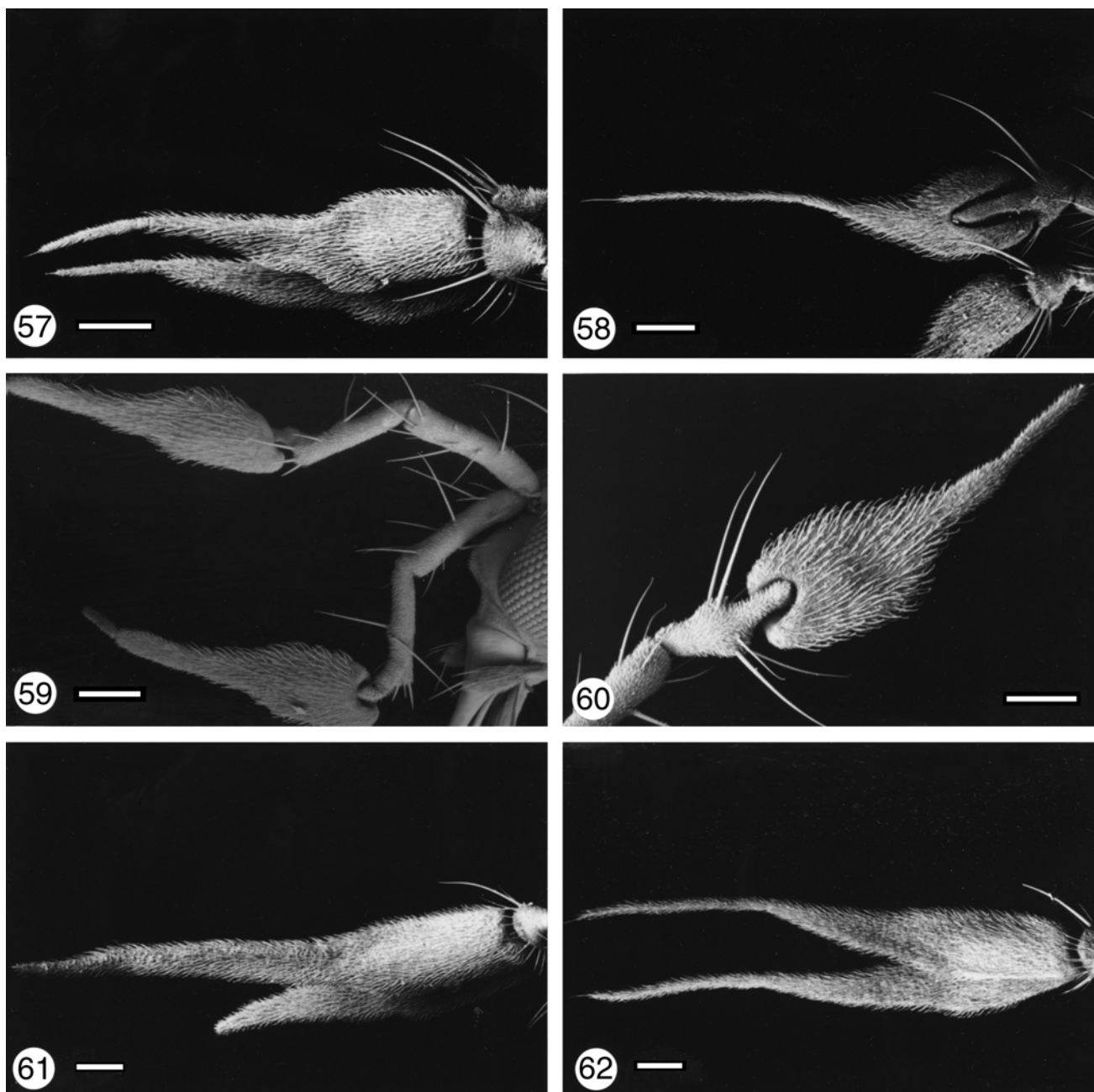
Figs. 69, 71

Type material. HOLOTYPE ♂, “[Aust: NSW]/ Blue Mts. NP, Mt. Wilson, / Waterfall CK, / 12–13.Dec.1998/ YPans, B.J. Sinclair”; “HOLOTYPE/ *Ceratomerus/ macalpinei/* Sinclair [red label]” AMS K175247. PARATYPES: **New South Wales:** 1 ♂, 3 ♀♀, same data as holotype; 1 ♂, same locality, 21.xi.1993 (CNC, ZFMK); 1 ♂, 1 ♀, Katoomba, 26.x., 18.xi.1955, G.H. Hardy; 1 ♂, 1 ♀, Blue Mtns NP, Mt. Wilson, 19.xii.1986, DKM, B.J. Day, R. de Keyzer; 2 ♂♂, Morton NP, nr Milton, Cooyoyo Ck, 500 m, 35°17'S 150°11'E, 6.xi.1997, A. Leask (AMS); 1 ♀, Mt. Wilson, 19.xi.1921, A. Tonnoir (ANIC).

Diagnosis. Recognized by the slight inflexion of R_{2+3} around the stigma, broad, yellow pleural band broad extending to katopisternum, heavily sclerotized male tergites 4–6 and anvil-shaped male cercus. This species can be distinguished from *C. malleolus* by the narrow lobe beneath the cercus, which is roundly expanded apically and tapered posterior tip of the cercus.

Description. Wing length 3.3–3.5 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocellar bristles short, one-third length of ocellar bristles. Antenna with length of scape slightly less than height of eye; postpedicel length less than height of head; three-segmented stylus longer than postpedicel;



Figs. 57–62. Scanning electron micrographs of antennae of *Ceratomerus*. 57, *C. globosus*, male, outer view. 58, *C. malleolus*, male, inner view. 59, *C. maculatus*, male. 60, *C. ordinatus*, female, inner view. 61–62, *C. albistylus*: 61, male, outer view; 62, female, outer view. Scale bars = 0.1 mm.

segment 8 elongate, 4× as long as wide. Palpus one-fifth length of labrum.

Thorax. Pale streak extending ventrally from proepisternum across pleura.

Wing as in *C. attenuatus*.

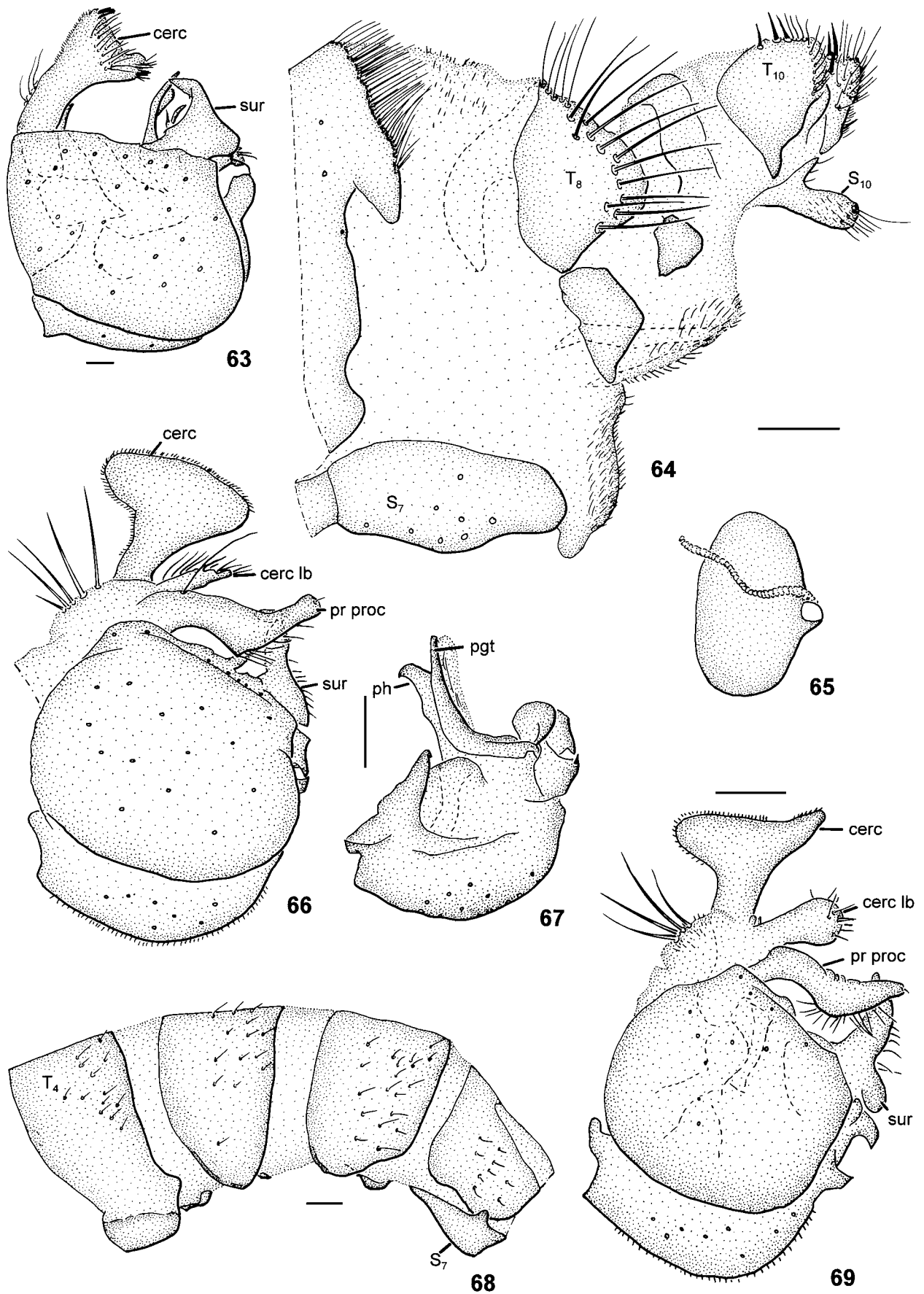
Legs. Fore and mid coxae and ventral margin of femora yellow, remaining leg segments brown, darker towards tip. Fore femur slightly swollen, with av row of fine setae, decreasing in length apically; basal setae longer than width of femur. First tarsomere greater than half length of fore tibia.

Mid femur more strongly swollen than fore femur, with pv row of short, dark setae; base with long erect pv seta; basal half with av brush of short dark setae, increasing in length medially. Mid tibia with pv row of slender setae, longer than width of tibia; ventroapically with row of short erect setae on apical sixth; 1 ad seta near mid-length.

Hind femur straight with 1 preapical dorsal and 1 av seta; ventral surface with av row of short, fine setulae. Hind tibia with 2 erect ad setae on apical half; dorsal margin with row of 3 long, erect setae. Hind tarsomeres slightly longer than tibia.

Abdomen brown, concolorous with thorax, sclerites of segment 1–3 more thinly sclerotized than remaining segments; T4–6 heavily sclerotized, lateral margin extending ventrally, most pronounced on T4, where stout, rounded ridge formed; S7 produced laterally, overlapping T7; T8 bow-tie shaped, lacking ventral process.

Terminalia (Fig. 69). Hypandrium with pair of short, slender posterior processes; 1 pair of short anterior, hooked, articulated processes arched posteriorly near surstyli; postgonites arched anteriorly, flanking pair of phallic processes; stout, blade-like, median phallic process arched



Figs. 63–69. Terminalia and posterior abdomen of *Ceratomerus*. 63, *C. inflexus*, male, lateral view. 64–68, *C. malleolus*: 64, female, lateral view; 65, spermatheca; 66, male, lateral view; 67, hypandrium and phallus, lateral view; 68, male abdomen, lateral view. 69, *C. macalpinei*, male, lateral view. Scale bars = 0.1 mm, except Fig. 68 where scale bar = 0.05 mm. Abbreviations: *cerc*, cercus; *cerc lb*, cercal lobe; *pgt*, postgonite; *ph*, phallus; *pr proc*, proctiger process; *S*, sternite; *sur*, surstylus; *T*, tergite.

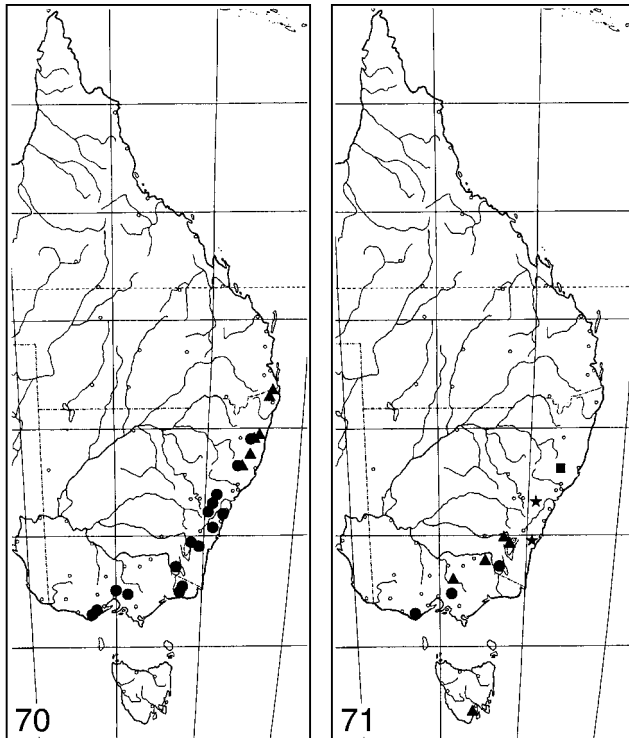
anteriorly. Epandrial lamella greatly inflated laterally, spherical; fused ventrally to lateral wall of hypandrium. Surstylus curved, finger-like, shorter than cercus. Subepandrial plate subrectangular, heavily sclerotized; more than half length of cercus. Hypoproct with large, lateral process, curving out from beneath cercus; apex round. Cercus heavily sclerotized, with narrow neck and laterally expanded, hammer-shaped apex; posterior tip tapered; cercus clothed in fine setulae, lacking long setae; base of cercus with narrow lobe; apex roundly expanded apically.

Female. Similar to male and female of *C. attenuatus* except as follows: S7 with transverse weakening, providing flexibility. Terminalia: anterior margin of T8 with flattened, internal, median plate, slightly arched ventrally. S8 subdivided into small trapezoidal sclerite and small, oval dome-shaped sclerite; posterior margin invaginated, forming broad, sclerotized internal plate. T10 bearing stout setae along posterior margin. Cercus broad laterally bearing similar modified setae. Spermathecal receptacle oval, sides parallel-sided, flattened, with short wide neck.

Distribution. The greatest number of specimens of this species have been collected from the Mt. Wilson region of the Blue Mountains (Fig. 71).

Biology. All specimens at Mt. Wilson were collected along a narrow, cascading stream. This locality is a small remnant rainforest growing in rich basaltic soils, and near the stream is a large grove of tree ferns (*Dicksonia antarctica*), known as the "cathedral of ferns".

Etymology. The specific name honours Dr D.K. McAlpine, who collected several of the type specimens of this species and first introduced the author to the type locality.



Figs. 70–71. Known distribution of species of *Ceratomerus* (eastern Australia). 70, *C. falcatus* ▲, *C. maculatus* ●, 71, *C. inflexus* ▲, *C. malleolus* ●, *C. macalpinei* ★, *C. oreas* ■.

Ceratomerus oreas n.sp.

Figs. 56, 71–75

Type material. HOLOTYPE ♂, "NSW[New South Wales, Australia]: Gloucester Tops/ e1.1280; 19-xi-4-xii/ -1988; D.Bickel; mal-/ aise; *Nothofagus* for."; "HOLOTYPE/ *Ceratomerus/ oreas/ Sinclair* [red label]" AMS K175248. PARATYPES: New South Wales: 7 ♂♂, 4 ♀♀, same data as holotype; 1 ♀, same locality as holotype, 14–19.xi.1988 (AMS); 3 ♂♂, same locality as holotype, 4–30.xii.1988; 1 ♂, Barrington Tops NP, Gloucester Tops, *Nothofagus*, str., 1200 m, 21.xii.1993, BJS (ZFMK); 5 ♂♂, 1 ♀, nr Gloucester Tops, 1290 m, *Nothofagus*, 14–19.xi.1988, DJB (AMS, CNC).

Diagnosis. Recognized by the distinct inflexion of R_{2+3} around the stigma, dark pleura, long style and males have distinctive inflated, round epandrial lamellae, and broad, bilobed cercus.

Description. Wing length 3.3–3.6 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocellar bristles, short, one-third length of ocellar bristles. Antenna with length of scape one-fourth less than height of eye; postpedicel length less than height of head; three-segmented stylus longer than postpedicel; segment 8 elongate, 4× as long as wide.

Thorax. Pleura light brown.

Wing (Fig. 56). R_{2+3} running parallel and close to costa, strongly deflected around stigma.

Legs. Fore and mid coxae and ventral margin of femora pale yellow, remaining leg segments brown, darker towards tip. Fore femur slightly swollen, with av row of fine setae on basal half. First tarsomere two-thirds length of fore tibia.

Mid femur swollen similar to fore femur, with pv row of short, dark setae; basal half with av brush of short dark setae, increasing in length medially. Mid tibia slender with pv row of slender setae, longer than width of tibia; basal half with av row of short setae; ventroapically with row of short erect setae on apical fourth; 1 ad seta on basal third. First tarsomere $\frac{4}{5}$ length of remaining 4 tarsomeres.

Hind femur with av row of fine setae, shorter than width of femur. Hind tibia with 2 erect dorsal setae on apical half; 3 erect ad setae.

Abdomen. S7 with transverse weakening on anterior third; posterior margin of S7 broadly membranous, with well sclerotized posterolateral margin, extending to S8; T8 bow-tie shaped, lacking ventral process.

Terminalia (Figs. 72, 73). Hypandrium with pair of bilobed posterior processes; anterior lobe hooked posteriorly; postgonites erect, with broad base, strongly tapered to slender slightly curved tip; phallic processes absent; stout, blade-like, median phallic process somewhat arched anteriorly. Epandrial lamella greatly inflated laterally, round; fused ventrally to lateral wall of hypandrium. Surstylus with long, slender finger-shaped lobe. Subepandrial plate subrectangular, heavily sclerotized; more than half length of cercus. Cercus heavily sclerotized, short, broad, with bilobed apex; inner margin of anterior lobe with short, stout setae; posterior lobe with dense cluster of long stout setae, longer than width of lobe.

Female. Similar to male and female of *C. attenuatus* except as follows: Terminalia (Fig. 75): T10 bearing single row of spine-like setae along posterior margin. Cercus broad, bearing spine-like setae, with short, slender marginal setae. Spermathecal receptacle oval, flattened, with short wide neck (Fig. 74).

Distribution. This species is restricted to the type locality, an isolated patch of cool temperate rainforest dominated by *Nothofagus* (Fig. 71).

Biology. All specimens were collected from or near cool, shaded mossy streams. The upper plateau of Gloucester Tops supports snow gum and grassland communities, while the gullies and saddles immediately below the plateau support stands of *Nothofagus*. It is in these sheltered wet forests where several species of *Ceratomerus* abide.

Etymology. The specific name is from the Latin *oreas* (mountain-nymph), referring to the high elevation of the type locality.

Ceratomerus ordinatus species-group

This Australian species group of *Ceratomerus* is characterized by a lengthened pedicel (second antennal segment), stigma absent, long postocular bristles overlapping eye, widely spaced ocellar bristles, third dorsocentral bristle shorter than others, and posterior fringe of female tergite 7 lacking. In addition, a number of species have a short, dorsomedian projection from the apex of the fifth tarsomere. Several of the above characters are also present in undescribed species from New Zealand and Ecuador and possibly indicates close phylogenetic relationships among all these taxa.

Species of this group were observed to be quite active runners over rocks in and along the banks of creeks. Upon alighting on a rock, they often immediately run about, in contrast to taxa of other species groups which appear to be much less active and reclusive.

Ceratomerus falcatus n.sp.

Figs. 70, 76, 77, 80, 91, 92

Type material. HOLOTYPE ♂, "AUST[ralia]: QLD [Queensland]: Lamington/ N.P., Green Mtns./ 6.v.1994, Elabana Falls/ B.J. Sinclair/ ex. Canungra Ck.": "HOLOTYPE/ *Ceratomerus/ falcatus/* Sinclair [red label]" AMS K175249. PARATYPES: **New South Wales:** 1 ♂, Barrington Tops NP, Gloucester Tops, 1200 m, *Nothofagus*, str., 21.xii.1993, BJS (ZFMK); 1 ♂, Barrington Tops NP, Williams R., subtrop. rainfor., 19–20.xii.1993, DJB (AMS); 38 ♂♂, 2 ♀♀, Barrington Tops NP, Williams R., subtrop. rainfor., 480 m, 19.xii.1993, 21.i.1995, BJS (AMS, CNC); 7 ♂♂, 3 ♀♀, 23 km WNW Bellangry, Cockerawombeeba Ck, warm temp. rainfor., 730 m, 8.xii.1986, 14–15.i.1988, DJB (AMS); 26 ♂♂, Border Ranges NP, Brindle Ck, 1000 m, rainfor., 25–26.i.1995, BJS (ANIC, CNC, ZFMK); 2 ♂♂, Chichester SF, Allyn R., 22.i.1995, BJS; 1 ♀, Dorriggo NP, 2–15.x.1984, MT, I. Naumann, J. Cardale (ANIC); 5 ♂♂, 1 ♀, Dorriggo NP, Rosewood Ck, 23.i.1995, BJS (CNC); 5 ♂♂, 1 ♀, Dorriggo NP, Sassafras Ck 700 m, Callicoma Falls, subtrop. rainfor., 1.iv.1995, BJS (ZFMK); 3 ♂♂, Mt. Hyland NP, Obeloe Ck, 1030 m, 30°10'S 152°27'E, y.pans, warm temp rainfor., 25–27.i.1996, DJB; 1 ♂, Werrikimbe NP, N. Plateau Beech For., y.pans, 28.xii.1993, DJB; 5 ♂♂, 9 ♀♀, Upper Allyn R., nr Eccleston, 4.v.1967, DKM (AMS). Queensland: 10 ♂♂, 1 ♀, same data as holotype (AMS, CNC).

Additional material (in alc.). New South Wales: 1 ♂, 3 ♀♀, New England NP, Point Lookout, 30°29'S 152°25'E, 12.ii.1984, I.D. Naumann (ANIC).

Diagnosis. Distinguished from other members of this species group by the simple male wings, with straight veins and lacking spots, and the auxiliary crossvein is present in both sexes. Females are generally difficult to separate from *C. maculatus*, but sometimes distinguished by their more lightly infuscate wings and the radial fork is generally proximal to cell dm.

Description. Wing length 2.1–2.3 mm.

Male. Head (Fig. 91) dark brown, dull; face pale brown, lacking setae; ocellar triangle with 2 widely spaced, divergent bristles, inserted anterior to lateral ocelli; postocellar bristle long, two-thirds to subequal to length of ocellar bristle; 2 pairs of long vertical bristles; postocular bristles long, overlapping one-third of eye. Antenna with scape two-thirds height of eye, with 3–4 dorsal setae and 1 long ventral seta; pedicel cylindrical, slightly greater than half length of scape; setae confined to apical fringe. Postpedicel covered by long, dense pruinescence, less than 1.5× height of head; basal half rectangular; apical half narrow, nearly parallel-sided, not strongly tapered; three-segmented stylus one-fourth length of postpedicel; segment 8 short, width subequal to length; stylus concolorous with remaining segments. Base of labrum lacking dorsal process; palpus yellowish-brown, slender, one-sixth length of labrum, with several dark setae; prementum with short setae only.

Thorax. Scutum and postnotum dark brown; pleura brown, darker along dorsal margin; postpronotal lobe brown; scutum lacking vitta of pruinescence. Alternating row of short acrostichals to prescutellar depression, subequal in length, directed posteriorly; 4 dc, third dc short and slender; 1 pprn; 1 presut spal; 2 npl, lower weak; 2 psut spal; 1 pal; 4 sclt, outer pair short, slender; additional setulae lacking. Anteprepronotum lacking setulae.

Wing (Fig. 80) infuscate, stigma lacking; single short costal seta; costal margin with unmodified setulae; posterior margin lacking incision; posterior setal margin complete, unmodified. R₂₊₃ gradually arched to C, not deflected; radial fork bell-shaped; medial fork distal to radial fork; cell dm rectangular, slender; auxiliary crossvein between R₂₊₃ and R₄ (occasionally absent on one wing). Halter with pale brown knob.

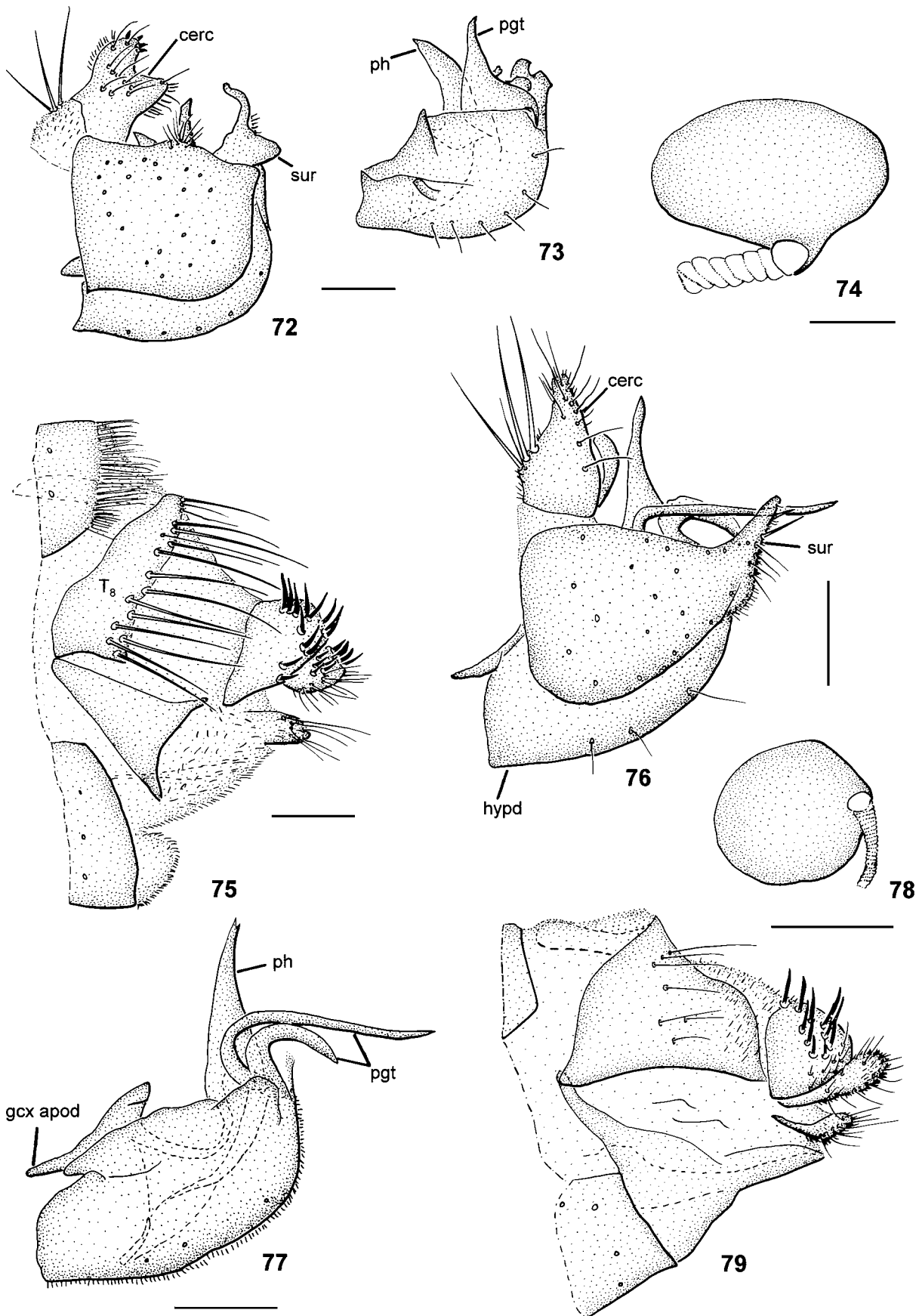
Legs. Coxae yellowish brown, remaining leg segments brown, darker towards tip. Fore coxa about twice length of mid coxa, with long dark anterior setae. Fore trochanter lacking modified setae. Fore femora slightly swollen, with av row of dark setulae; pv region with 2 basal setulae. Fore tibia slightly shorter than femur; apex with anteroapical comb, not dilated. First tarsomere greater than half length of fore tibia; tarsomeres 1–3 slender, tarsomeres 4 and 5 dorsoventrally flattened.

Mid coxa lacking modified seta. Mid femur slender with unmodified setae. Mid tibia subequal in length to femur; lacking erect setae. First tarsomere equal in length to remaining 4 tarsomeres; tarsomere 5 dorsoventrally flattened.

Hind coxa with unmodified setae. Hind femur straight with 1 preapical dorsal seta. Hind tibia straight, shorter than femur, apex dilated, bearing posteroapical comb; pv surface lacking setae. Hind tarsomeres longer than tibia; first tarsomere with 1 short, erect ventral seta near base; tarsomere 5 dorsoventrally flattened.

Abdomen pale brown, sclerites thinly sclerotized, posteromarginal setae short, longest on T6; sclerites lacking ridges and modified setae; central region of T7 membranous; S7 slightly longer than preceding sclerite, lacking posterolateral extension; T8 slender, with broad rectangular posterior membranous zone.

Terminalia (Figs. 76, 77, 92). Hypandrium with short posterior flap-like process; 2 pairs of sickle-shaped, articulated postgonites flanking phallus, outer pair shorter, strongly recurved, inner pair long, slender. Phallus comprises single, straight, pointed median process. Apical corner of epandrial lamella narrow; posterior margin with long setae along inner posterior margin. Surstylus weakly



Figs. 72–79. Terminalia of *Ceratomerus*. 72–75, *C. oreas*: 72, male, lateral view; 73, hyandrium and phallus; 74, spermatheca; 75, female, lateral view. 76–77, *C. falcatus*: 76, male, lateral view; 77, hyandrium and phallus, lateral view. 78–79, *C. hibernus*: 78, spermatheca; 79, female, lateral view. Scale bars = 0.1 mm, except Figs. 76–77 where scale bar = 0.05 mm. Abbreviations: *cerc*, cercus; *gcx apod*, gonocoxal apodeme; *hypd*, hyandrium; *pgt*, postgonite; *ph*, phallus; *sur*, surstylus; *T*, tergite.

developed, with only partial subapical weakening on epandrium. Cercus thinly sclerotized, short, apex blunt, expanded laterally around anus.

Female. Similar to male except as follows: pedicel slightly greater than half length of scape; palpus brown; setae and modifications of legs lacking; pleura brown. Apical segments retracted into segment 7; apical margin of segment 7 not folded inwards; T7 lacking posterior fringe of setae; lateral margin of S7 straight. Terminalia: central region of T8 with deep U-shaped weakly sclerotized zone; fringe of long setae along lateral ridge; anterior margin with broad, flattened, median process, extending beneath T7 when segment retracted; S8 the posterior margin invaginated, forming internal flooring. T10 split medially into pair of rectangular sclerites; anterior margin with stout, straight, spine-like setae; cercus with terminal cluster of 4–5 spine-like setae, similar to T10. Spermathecal receptacle spherical, with short neck where duct attached.

Distribution. This species is distributed from the Border Ranges at the New South Wales and Queensland border, south to Barrington Tops at elevations generally above 400 m (Fig. 70).

Etymology. The specific name is from the Latin *falcatus* (sickle-shaped), referring to the shape of the male postgonites.

Ceratomerus hibernus n.sp.

Figs. 78, 79, 81, 100

Type material. HOLOTYPE ♀, “AUST[ralia]: TAS[mania]: Pelion Hut/ 3 km S Mt. Oakleigh/ 41°50'S 146°03'E, 860 m/ June 1990; I.D. Naumann”; “HOLOTYPE/ *Ceratomerus/ hibernus/* Sinclair [red label]” (ANIC). PARATYPES: **Tasmania:** 6 ♀ ♀, same data as holotype (ANIC); 6 ♀ ♀, 28 km SSW Mole Ck, 570 m, MAP 8114 355.752, 15.x.1985, L. Hill (AMS, ZFMK).

Diagnosis. Distinguished from other species in this group by the short postocellar setae, long pedicel (three-fifths length of scape) and median fork separated from radial fork by more than the length of crossvein dm-cu.

Description. Wing length 3–3.3 mm, similar to *C. falcatus* except as follows:

Female. *Head* dark brown; postocellar bristle slender, less than half length of ocellar bristle; 3 pairs of long vertical bristles, third pair distant from others; postocular bristles long, overlapping at least one-third of eye. Antenna with scape equal to height of eye, with 2–3 long, dorsal setae and 1 long ventral seta; pedicel with short basal section, three-fifths length of scape, with posterior fringe of long setae; postpedicel apical half strongly tapered, extending parallel-sided to short, stout, three-segmented stylus, subequal to one-third length of postpedicel. Palpus light brown, slender, one-fifth length of labrum.

Thorax. Mesonotum, pleura and postnotum brown; 1 slender, short pal. Anteprenotum with 2 short setulae.

Wing (Fig. 81). Medial fork proximal to radial fork by more than length of crossvein dm-cu. Halter with dark knob.

Legs. Coxae and basal half of femora yellowish-brown, remaining leg segments brown, gradually darkening towards tip. Fore coxa lacking modified setae. Fore femur slightly swollen, lacking modified ventral setae. Fore tibia nearly equal

in length to femur; apex with undilated anteroapical comb. First tarsomere slightly longer than half length of fore tibia; distal 4 tarsomeres slender, longer than first tarsomere.

Mid tibia slightly shorter than femur with dorsal and ventral apical seta. First tarsomere shorter than remaining 4 tarsomeres.

Hind tibia with 3–4 erect ad setae on apical half; lacking dorsal setae.

Abdomen as in female *C. falcatus*.

Terminalia (Fig. 79). Anterior margin of T10 bearing biserial row of stout, straight spine-like setae; cercus with slender setae, lacking spine-like setae. Spermathecal receptacle spherical, with very short neck where duct attached (Fig. 78).

Male. Unknown.

Distribution. This species is known only from the northwestern highlands of Tasmania (Fig. 100) and is possibly restricted to the cooler months (June, October).

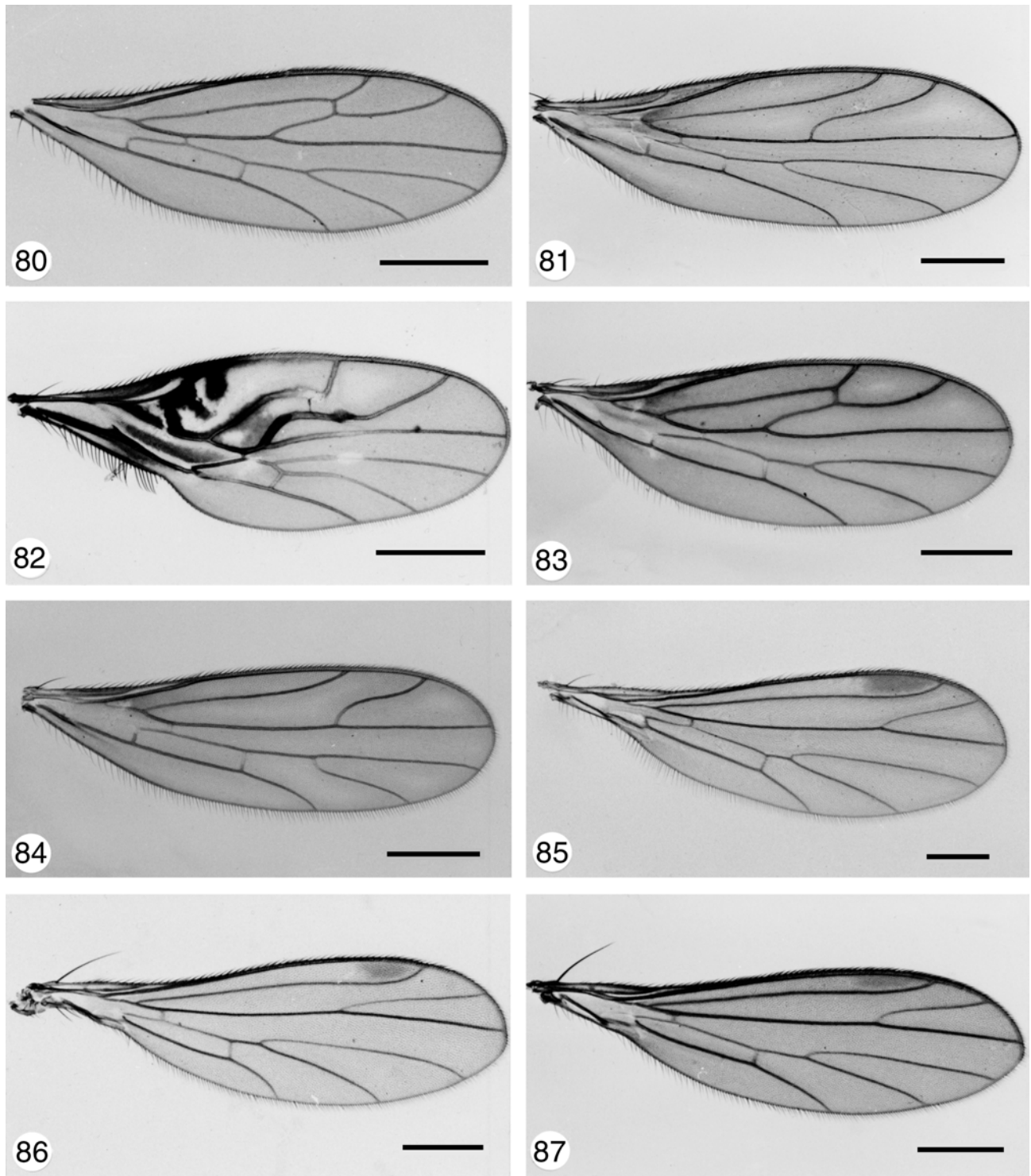
Etymology. The specific name is from the Latin *hibernus* (of winter), referring to the probable seasonality of this species.

Remarks. It is normally not recommended to describe a new species on the basis of female specimens alone. But given the long series of specimens and its apparent differences with *C. ordinatus* (the only other species of the *C. ordinatus* group in Tasmania), it was considered best to describe this species to encourage “off season collecting” in the hope that conspecific males may someday be obtained.

Ceratomerus maculatus n.sp.

Figs. 59, 70, 82, 83, 90, 102–105

Type material. HOLOTYPE ♂, “AUST[ralia]: NSW[New South Wales]: 7 km E/ Robertson, Macquarie Pass/ N.P., 23.xi.1993, cascading/ stream, B.J. Sinclair”; “HOLOTYPE/ *Ceratomerus/ maculatus/* Sinclair [red label]” AMS K175250. PARATYPES: **Australian Capital Territory:** 1 ♂, 2 ♀ ♀, Black Mtn, MT, xii.1987, M. Irwin; 1 ♂, Blundells Ck, 3 km E Piccadilly Circus, 35°22'S 148°50'E, 850 m, x.1985, Weir, Lawrence, Johnson; 1 ♀, same locality, v.1988, DHC (ANIC); 5 ♂ ♂, 1 ♀, Gibraltar Falls, 35°29'S 148°56'E, 8.xii.1993, BJS (ZFMK). **New South Wales:** 5 ♂ ♂, 3 ♀ ♀, same data as holotype; 9 ♂ ♂, 7 ♀ ♀, Kosciusko NP, Leatherbarrel Ck, 1000 m, 28.xi.1994, BJS, DJB (AMS, ZFMK); 6 ♂ ♂, 2 ♀ ♀, Barrington Tops NP, upper Gloucester R./Falls, 1200 m, 20–21.xii.1993, BJS (CNC, ZFMK); 2 ♂ ♂, Barrington Tops NP, Gloucester Tops, 1200 m, *Nothofagus*, str., 21.xii.1993, BJS; 1 ♂, Blue Mtns NP, Blackheath, Rim Tr. at falls, 1000 m, 12.xii.1998, BJS; 7 ♂ ♂, 1 ♀, Blue Mtns NP, Grand Canyon, Greaves Ck, 27.iii.1994, 4.iv.1994, 18.vii.1994, BJS; 1 ♂, Belmore Falls, 2.x.1938, A.L. Tonnoir; 1 ♂, 5 mi S Monga, tree fern gully, leaf mould, 8.v.1968, DHC & Z. Liepa (ANIC); 4 ♂ ♂, Blue Mtns NP, Blackheath, Govett's Ck below falls, 1.xii.1993, 25.xii.1993, 18.vii.1994, BJS; 2 ♂ ♂, Blue Mtns NP, Wentworth Falls, 23.x.1994, 10.vii.1994, BJS; 2 ♂ ♂, 27 ♀ ♀, Gloucester Tops, 1280 m, *Nothofagus*, MT, 19.xi–4.xii.1988, DJB; 1 ♀, Kanangra-Boyd NP, Boyd R. Cpgd, 1200 m, dry scler. veg., y.pans, 26.xi.1994, DJB; 8 ♂ ♂, 12 ♀ ♀, Kosciusko NP, upper Pipers Ck, 1600 m, 28–29.xi.1994, 7.xii.1994, BJS; 1 ♂, Oberon, Silent Ck, 34°6'S 149°45'E, 3.xi.1998, J. Potts; 1 ♂, Royal NP, Couranga Tr., 19.iii.1995, BJS; 1 ♂, Katoomba, 28.ix.1955, G.H. Hardy (AMS); 4 ♂ ♂, 1 ♀, Blue Mtns NP, Valley-of-the-Waters, below Vera Falls, 10.vii.1994, 23.x.1994, 9.iv.1995, BJS (AMS, CNC); 2 ♀ ♀, Kosciusko NP, nr Swamp Plain, Bogong Ck, 28.xi.1994, BJS; 2 ♂ ♂, Monga SF, 19–24.i.1984, L. Masner; 1 ♂, Royal NP, Uloola Falls, 17.xii.1993, BJS (CNC); 4 ♂ ♂, 8 ♀ ♀, Styx R. SF, George's Ck F.Res., Cunnawarra Ck, 3.iii.1995, BJS (USNM); 1 ♀, Styx R. SP, Wattle Flat, Styx R., 1200 m, 1.iv.1995, BJS (ZFMK). **Victoria:** 1 ♂, Errinundra Plateau, y.pans, Bonang Ck, 1.iv.1990, DJB; 2 ♂ ♂, 9 ♀ ♀, Errinundra Plateau, Gap Rd, Result Ck Falls, y.pans, 6–7.xii.1994, BJS, DJB; 3 ♂ ♂, 5 ♀ ♀, 45 km N Orbost, Bonang Hwy, Martins Ck, 200 m, rainfor., 6.xii.1994, BJS; 1 ♀, Otway NP, Maits Rest, rainfor., y.pans, 350 m, 4–5.xii.1994, DJB; 1 ♂, 7 ♀ ♀, 9 km N Warburton, *Nothofagus*, Cement Ck, 1–3.xii.1994, BJS, DJB (AMS); 1 ♂, Fern Tree Gully NP, 20.viii.1967, T. Weir (UQIC); 4 ♂ ♂, 7 ♀ ♀, Otway Ra., *Nothofagus*, Beauchamp Falls, 350 m, 3–5.xii.1994, BJS, DJB (AMS, CNC); 1 ♀,



Figs. 80–87. Wings of *Ceratomerus*. 80, *C. falcatus*, male. 81, *C. hibernus*, female. 82–83, *C. maculatus*: 82, male; 83, female. 84, *C. ordinatus*, male. 85, *C. albistylus*, male. 86, *C. lobatus*, male. 87, *C. orientalis*, male. Scale bars = 0.5 mm.

Sassafras, 22.x.1922, A. Tonnoir; 3♂♂, 1♀, Warburton, Cement Ck, 670 m, *Nothofagus*, 10–17.i.1980, A. Newton & M. Thayer (ANIC); 6♂♂, 6♀♀, 29 km N Warburton, Acheron Way, Acheron R., rainforest, y.pans, 1–3.xii.1994, BJS, DJB (AMS, CNC); 1♂, Warburton Rd to Mt. Donna Buang, roadcut seep, 3.xii.1994, BJS (CNC).

Additional material (in alc.). **Australian Capital Territory:** 11♂♂, 30♀♀, Blundells Ck, 3 km E Piccadilly Circus, 35°22'S 148°50'E, 850 m, iii–iv.1984, vi.1985, Weir, Lawrence, Johnson; 4♂♂, Wombat Ck, 6 km NE Piccadilly Circus, 35°19'S 148°51'E, 750 m, iv.1984, Weir, Lawrence, Johnson. **New South Wales:** 1♂, 6♀♀, New England NP, Toms Cabin, 30°30'S 152°24'E, 12–22.ii.1984, MT, I.D. Naumann (all ANIC).

Diagnosis. Distinguished by the unique and distinctly bizarre male wing and inwardly bowed hindlegs. Females are generally larger in size than *C. falcatus* with darker wings, however they can be only confidently identified in association with males.

Description. Wing length 2.6–2.9 mm, similar to *C. falcatus* except as follows:

Male. Head. Face yellowish-brown; postocellar bristle long, subequal in length to ocellar bristle. Antenna with (Fig. 59)

pedicel nearly equal in length to scape, bearing pair of dorsal setae on distal half; 1 ventral seta and apical fringe of long setae; postpedicel 1.5× height of head; apical three-fifths narrow, nearly parallel-sided, not strongly tapered; three-segmented stylus one-fifth length of postpedicel. Palpus yellow.

Thorax. Pleura yellow, dorsal margin yellowish-brown; postpronotal lobe yellowish-brown.

Wing (Fig. 82) with posterior margin of stem bearing fringe of long dark setae; anal lobe with fringe of minute setulae. Wing venation highly modified: R_1 ending in costa before middle of wing; R_{2+3} and R_4 thickened, highly undulated; base of R_4 thickened; auxiliary cross-vein between R_{2+3} and R_4 absent; 3 veins arising from cell dm; Cu thickened. Costal cell darkly infuscate; cell r_1 with dark spots along margin of R_1 ; cell br with median streak.

Legs. Coxae and femora yellow, hind femora darker towards tip; tibiae and tarsi brown. Fore femur swollen, with av row of dark setae; pv region with 3 basal setae. Fore tibia equal in length to femur. First tarsomere half length of fore tibia; distal 4 tarsomeres dorsoventrally flattened, ventral margin with bare pale surface.

Mid femur swollen, similar to fore femur, with av row of short setae, longer at base. Mid tibia with triangular lobe subapically, with shallow ventral excavation; apex with tuft of ventral setae. First tarsomere slightly bent subbasally, with stout ventral basal seta; shorter than remaining 4 tarsomeres; fourth and fifth tarsomeres dorsoventrally flattened.

Hind femur bow-legged, with 1 preapical dorsal seta. Hind tibia bent and slightly twisted, compressed near mid-length (Fig. 90); shorter than femur, apex dilated, bearing posteroapical comb; pv surface lacking setae. Hind tarsomeres shorter than tibia, slender.

Abdomen as in *C. falcatus*.

Terminalia (Figs. 102, 103). Hypandrium with short posterior flap-like process; 1 pair of long, sickle-shaped, articulated postgonites flanking phallus. Phallus comprising pair of long, straight, slender processes, overlapping apically. Apical corner of epandrium narrow; posterior margin with long setae along inner posterior margin. Surstylus weakly developed, with only partial subapical weakening on epandrium with row of marginal setae. Cercus thinly sclerotized, short, apex acute, expanded laterally around anus.

Female. Similar to male and female of *C. falcatus* except as follows: wing (Fig. 83) lacking modified venation; darkly infuscate, with pale median streak in cells r_1 , r_{2+3} and r_4 ; medial fork distal to radial fork; cell dm rectangular, slender; auxiliary crossvein between R_{2+3} and R_4 (occasionally absent on one wing). Terminalia (Fig. 104): T10 with anterior margin bearing stout, straight, spine-like setae; cercus with terminal cluster of 4–5 spine-like setae, similar to T10. Spermathecal receptacle spherical (Fig. 105).

Distribution. This species is confined to the southeastern corner of Australia (i.e., southern NSW and Victoria), and overlaps with its sister species, *C. falcatus*, at Barrington Tops National Park and Styx River region in central NSW (Fig. 70). It is found at both high and low altitudes south of Sydney, but restricted to above 1000 m north of this latitude.

Biology. A teneral specimen from the region of Monga was collected among leaf mould in a tree fern gallery. This may indicate that this species (and possibly others of this group) breed in damp soils associated with streams and is thus not truly aquatic.

Etymology. The species name is derived from the Latin *maculatus* (spotted, stained) in reference to the spotted and patterned male wing.

Ceratomerus ordinatus Hardy

Figs. 60, 84, 89, 94, 101, 106–109

Ceratomerus ordinatus Hardy, 1930: 247.

Ceratomerus ordinarius Hardy, 1930: 245.

Type material. NEOTYPE (here designated) ♂, “AUST [ralia]: TAS[mania]: Lyell/Hwy. Franklin/Gordon/ Wild Rivers N.P./ 20.ii.1994, Nelson R./ B.J. Sinclair” AMS K175254. My neotype label “NEOTYPE/ *Ceratomerus/ ordinatus* Hardy/ des. B.J. Sinclair 2000 [red label]” has been attached to this specimen.

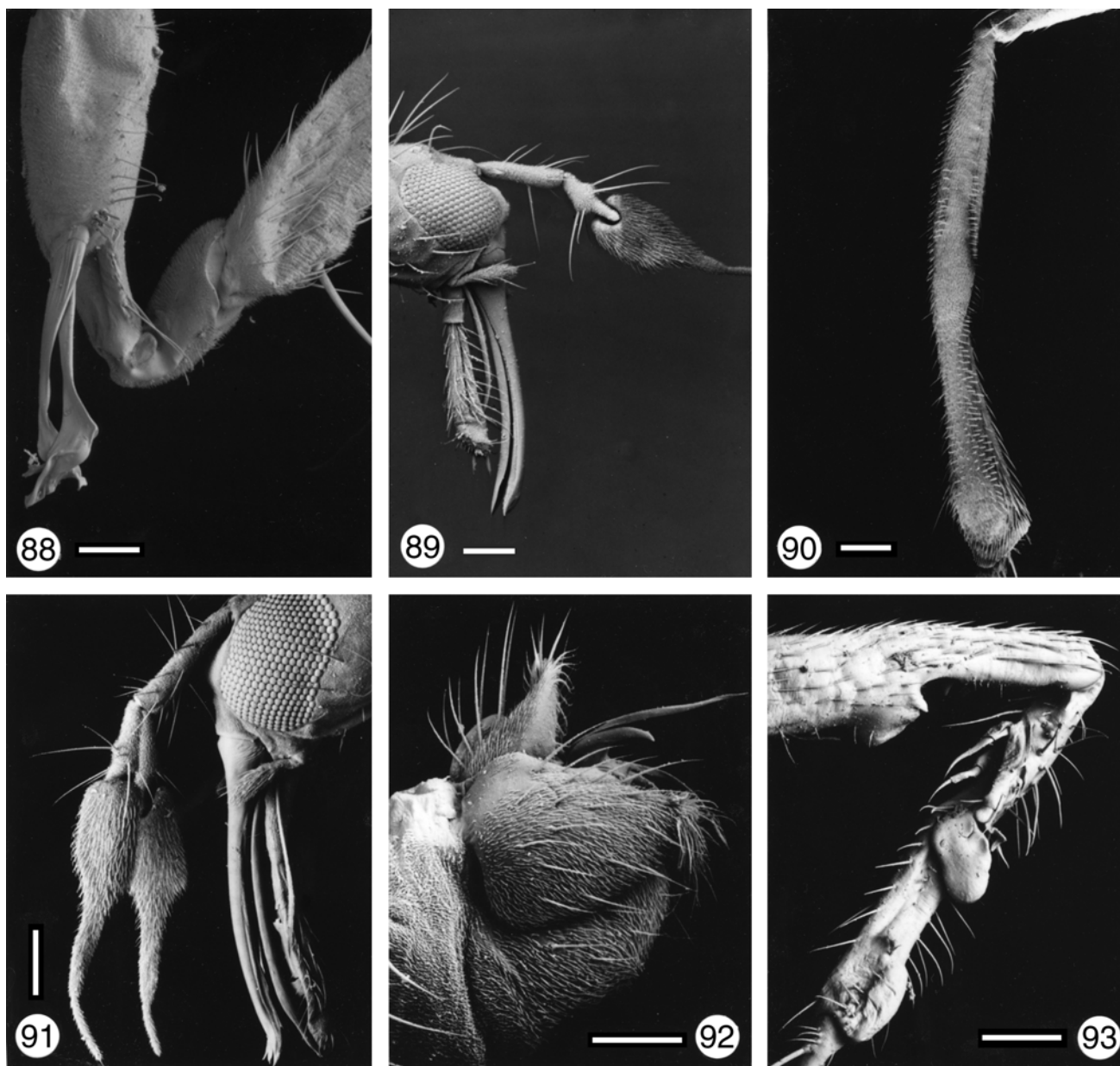
The holotype is lost as discussed previously for all Hardy species of Ceratomerinae and *C. ordinatus* was not mentioned in the list of damaged hardy types by Daniels (1978). The association of all additional material is based on the original description of the wing venation, where the radial and medial veins fork nearly in parallel. The description by Hardy (1930) of the hypopygium as “very large” is considered incorrect and likely confused with *C. inflexus*. In order to avoid misidentifications with other closely related species in Tasmania (e.g., *C. hibernus*), and given the inaccuracies of the original description which may lead to future misidentifications, the designation of a neotype was deemed necessary.

Notes on spelling. This species was first spelt as *ordinarius* in the key to species of *Ceratomerus* (Hardy, 1930), but was subsequently spelt *ordinatus* in the description of the species, Zoological Record, and Smith (1989). As first reviser (I.C.Z.N. 1999, Sec. 24.2.3), I have chosen to accept the second spelling (*ordinatus*) to maintain stability.

Additional material. Tasmania: 8♂♂, 8♀♀, same data as neotype (AMS, ZFMK); 6♂♂, 1♀, Adventure Bay, 30.xii.1922; 1♂, 1♀, Cradle Mtn, 23.v.1923; 2♂♂, 1♀, Cradle Val., 23.i.1923; 1♂, Interview R., N. of Pieman R., 31.xii.1953; 2♂♂, 8♀♀, Pelion Hut, 3 km S Mt. Oakleigh, 860 m, 41°50'S 146°03'E, 8.i., 6–11.iii., 9.iv–6.vi.1991; 1♂, 15♀♀, Pelion Plains, 1.iii., 15.v., 7.vi., 7.xi.1990 (ANIC); 1♀, Arve R., nr Hartz Mtn Rd, y.pans, river rocks, 22–23.i.1989; 30♂♂, 8♀♀, nr Cradle Mtn, Pencil Pine Ck, 800 m, high woodlands, 30.i.1989, y.pans; 1♂, Franklin R., Irenabyss Camp, 11.iii.1989, y.pans; 1♀, Picton Rd, Farmhouse Ck, *E. obliqua* for., y.pans, 43°15'S 146°38'E, 22–23.i.1989 (AMS); 1♂, St. Colomba Falls, Pyengana, 21.ii.1971 (MVM); 1♂, Tahune FR, Huon R., 17.ii.1994 (AMS); 8♂♂, 5♀♀, Cradle Mtn. NP, Pencil Pine Ck, 800 m, 20–22.ii.1994; 4♂♂, 13♀♀, Lyell Hwy, Franklin/Gordon Wild Rivers NP, Franklin R., 19.ii.1994; 4♂♂, 2♀♀, same locality, Surprise R. 19.ii.1994; 1♂, 2♀♀, Mt. Field NP, Lady Barron Falls, 17.ii.1994; 3♂♂, 6♀♀, Rd.C405, 12 km N of C401, 23.ii.1994, small ck (CNC); 4♂♂, 2♀♀, Cradle Mtn. NP, Overland/Dove Lk. Tr., 900–1100 m, 21.ii.1994; 2♂♂, 7♀♀, Mt. Field NP, Russell & Horseshoe Falls, 200 m, 18.ii.1983; 1♂, 2♀♀, same locality, Lk. Dobson, small str. inflow, 1020 m, 18.ii.1984 (ZFMK); 1♂, 20 km SW Derwent Bridge, Franklin, 11.ii.1971 (MVM); 1♂, 1♀, Franklin R., 42°13'S 146°01'E, 22.i.1983, at light (ANIC-alc.); 1♂, 15 km W Geeveston, Keoghs Ck, 17.ii.1994 (USNM); 5♂♂, 5♀♀, Hellyer Gorge, 2.ii.1967, 9.ii.1971 (ANIC, MVM); 7♂♂, 2♀♀, Myrtle Bank, St. Patricks R., 22.ii.1994 (CNC, ZFMK).

Diagnosis. Distinguished from others in this group by a shortened pedicel (one-fourth length of scape) and median fork separated from radial fork by less than the length of crossvein dm-cu.

Description. Wing length 2.5–2.8 mm, similar to *C. falcatus* except as follows:



Figs. 88–93. Scanning electron micrographs of *Ceratomerus*. 88, *C. campbelli*, male fore coxa, inner view. 89, *C. ordinatus*, female head, lateral view. 90, *C. maculatus*, male hind tibia, posterior view. 91–92, *C. falcatus*: 91, male head, lateral view; 92, male terminalia, lateral view. 93, *C. albistylus*, male midleg, anteroventral view. Scale bars = 0.1 mm, except Fig. 92 where scale bar = 0.05 mm.

Male. Head (Fig. 89) including face dark brown; postocellar bristle slightly shorter than ocellar bristles; 3 pairs of long vertical bristles. Antenna with scape equal to height of eye, with 2–3 long, dorsal setae and 1 long ventral seta (Fig. 60); pedicel with short basal section, one-fourth length of scape, with posterior fringe of long setae. Postpedicel with apical half strongly tapered to short, stout, three-segmented stylus, subequal to one-third length of postpedicel.

Thorax. Mesonotum, pleura and postnotum dark brown. Anteprepronotum with 2 short setulae.

Wing (Fig. 84). Medial fork branching nearly opposite radial fork, separated by less than length of crossvein dm-cu.

Legs. Coxae and basal half of femora yellowish-brown, remaining leg segments brown, gradually darkening towards tip. Fore femur slightly swollen, lacking modified ventral setae; bearing 1 erect, preapical dorsal seta. Fore tibia nearly equal in length to femur. First tarsomere slightly longer than half length of fore tibia; distal 4 tarsomeres slender, longer

than first tarsomere.

Basal half of mid femur with biserial row of short setae beneath; bearing, 1 erect preapical dorsal seta. Mid tibia slightly shorter than femur lacking modified setae; bearing 1 preapical ad seta. First tarsomere shorter than remaining 4 tarsomeres, with several erect stout setae beneath.

Hind tibia longer than femur; apical half with 4–5 erect ad and 2–3 dorsal setae (Fig. 94).

Abdomen as in *C. falcatus*.

Terminalia (Figs. 106, 107). Hypandrium with short posterior flap-like process; gonocoxal apodemes slender, not projecting beyond base of hypandrium; 2 pairs of articulated postgonites arching in opposite directions. Phallus comprises 1 pair of long, slender, nearly straight processes and thinly sclerotized, ragged-edge median process. Apical corner of epandrium narrow; posterior margin with long setae and short, stout spine-like setae along inner posterior margin. Surstylus weakly developed, with only partial subapical lateral

weakening on epandrium. Cercus thinly sclerotized, short, fleshy; apex acute, expanded laterally around anus.

Female. Similar to male and female of *C. falcatus* except as follows: Terminalia (Fig. 108): anterior margin with broad, flattened, median process, extending beneath T7 when segment retracted (Fig. 109). Anterior margin of T10 bearing biserial row of stout, straight spine-like setae; cercus with terminal cluster of 4–5 spine-like setae, similar to T10. Spermathecal receptacle spherical, with short ridge where duct attached.

Distribution. This species is endemic to Tasmania, with adults commonly collected throughout both eastern and western areas of the island (Fig. 101) from November to May.

Ceratomerus sp. (undescribed)

Material examined. ♀, **Philip Island** (nr. Norfolk Is.) 29°07'S 167°57'E, Upper Long Valley, 26.iii–2.iv.1984, MT, D.C.F. Rentz (ANIC).

Diagnosis. This female specimen is in very poor condition and consequently not described. It appears to be most closely related to *C. falcatus* and *C. maculatus* on the basis of wing venation and lengthened pedicel.

Diagnosis. Female with wing length 2.5 mm. Pedicel cylindrical, slightly greater than half length of scape; radial fork proximal to medial fork; cell dm rectangular, slender; auxiliary crossvein between R_{2+3} and R_4 present.

Biology. This specimen was collected on Philip Island, which lies about 6 km south of Norfolk Island (Rentz, 1989). This island is ecologically devastated, primarily the result of the introduction of rabbits which striped the island of vegetation and caused widespread erosion (Rentz, 1989, figs. 4–9). This species of *Ceratomerus* has surprisingly survived the changes to this island in narrow damp valleys protected by low shrubs. As discussed in “Biology” under *C. maculatus*, it is hypothesized that this species group breeds in damp soil near streams. Thus the breeding habitat of this species has remained protected in the narrow sheltered valleys.

Unplaced Australian species

Although the following species are considered to be most closely related to other Australian species, they could not be confidently assigned to a particular Australian species group. They remain problematic, especially *C. albistylus* which differs greatly from all other Australian species.

Ceratomerus albistylus Hardy

Figs. 61, 62, 85, 93, 95, 96, 110–112, 118

Ceratomerus albistylus Hardy, 1930: 246; Smith, 1989: 387.
C. albistylus Hardy, 1930: 245, 246 (mis-spelling).
C. tuberculus Hardy, 1930: 247; Smith, 1989: 387.

Notes on spelling and synonymy. *Ceratomerus albistylus* was spelt originally as such by Hardy (1930) in both his key and description, but was spelt *albistylus* when compared to another species (*C. ordinatus*) taken at the same locality. This species was subsequently spelt *albistylus* in the Zoological Record and Smith (1989). As first reviser (I.C.Z.N. 1999, Sec. 24.2.3),

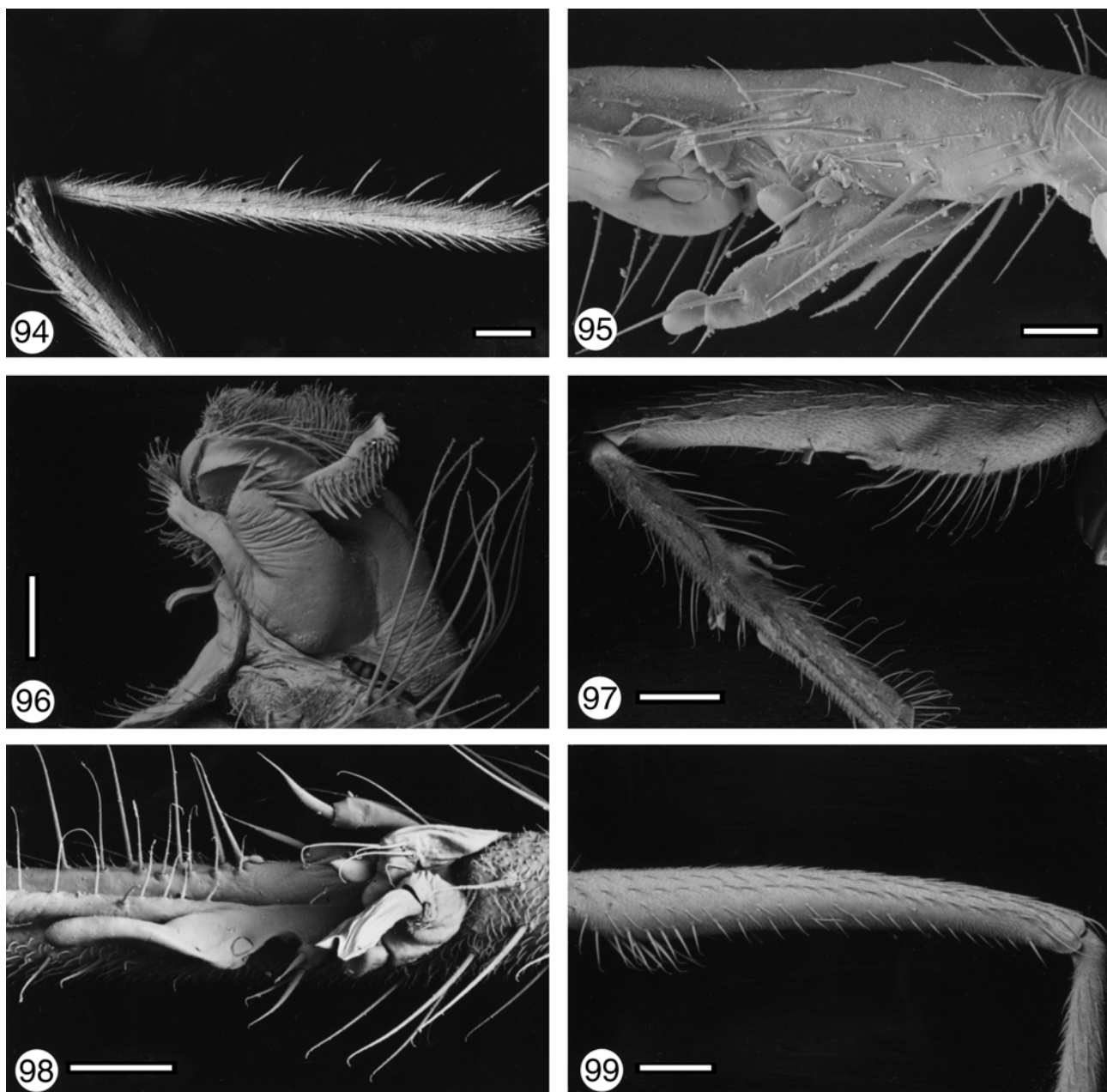
I have chosen to maintain the spelling as used by Smith (1989) in order to avoid further confusion.

The description of *C. albistylus* was based only on female specimens and *C. tuberculus* on males. On the basis of similar colour patterns Smith (1989) synonymized these two species and I can confirm this nomenclatural change.

Type material. NEOTYPE (here designated) ♂, “Mt. Wellington/ Tas[mania, Australia]/ 12 Feb. 1963/ D.H. Colless”; “Wet forest/ (lower slopes) [dissected]” (ANIC). My neotype label “NEOTYPE/ *Ceratomerus/ albistylus* Hardy/ des. B.J. Sinclair 2000 [red label]” has been attached to this specimen.

The syntypes of *C. albistylus* (type localities: Mt. Wellington, Strahan and Cradle Mountain) and *C. tuberculus* (type locality: Mt. Wellington) were not located and are presumed destroyed as discussed under *C. inflexus*. No specimens of these species were mentioned in the list of damaged Hardy types by Daniels (1978). The male specimen selected as neotype agrees with the original description and is from the same locality as the original material described by Hardy. The designation of a neotype clearly establishes the identity of this species.

Additional material. Australian Capital Territory: 2♀♀, Blundell's, 13.xi.1938 (ANIC). **New South Wales:** 2♂♂, 2♀♀, Belmore Falls, 23.i.1963; 8♂♂, 8♀♀, Brown Mt., Rutherford Ck, 10.iii., 11.xi.1961; 2♀♀, Bulli, Cataract Ck, 2.xi.1960; 2♂♂, 1♀, Clyde Mt., Landslip, 22.ii.1965; 1♂, Fitzroy Falls, 22–27.xi.1937; 2♂♂, 1♀, Kangaroo Valley, west slope, 23.xi.1960; 1♂, 2♀♀, Macquarie Falls, 14.xi.1960, 13.x.1986; 3♀♀, New England NP, Point Lookout, 30°29'S 152°25'E 12.ii.1984 (ANIC); 5♂♂, 1♀, Blue Mtns NP, Blackheath, Popes Glen, dry scler. for., 31.x.1994; 2♂♂, 1♀, Blue Mtns NP, Grand Canyon, rainfor., 25.xii.1993 (ZFMK); 1♀, Blue Mtns NP, below Govett's Leap, 7.xii.1956; 1♂, 1♀, Gloucester Tops, *Nothofagus*, 1290 m, 14.xi–4.xii.1988; 2♂♂, 3♀♀, Minnamurra Falls, 7.i., 20.x.1961; 1♂, Mt. Dromedary, summit, 800 m, rainfor., 9.xi.1985; 1♂, Nadgee SF, Maxwell's Ck, warm temp. rainfor., 400 m, 13–19.ii.1987; 2♂♂, New England NP, Thungutti Rest A., *Nothofagus*, 20–22.xii.1994; 1♀, New England NP, Wright's Lookout, 1.iv.1961; 2♂♂, Werrikimbe NP, Cobcroft Ck, 1110 m, 6.xii.1986 (AMS); 5♂♂, 19♀♀, Blue Mtns NP, Mt. Wilson, rainfor., Waterfall Ck, 19.xi.1921, 5.xii.1956, 28.xi., 11.xii.1959, 30.xii.1960, 5.xi.1977, 23.xi.1982, 8.xii.1986, 10.xi.1990, 22.xi.1993, 12–13.xii.1998 (AMS, ANIC, CNC, ZFMK); 1♀, New England NP, Toms Cabin, 30°30'S 152°24'E, 12–22.ii.1984 (ANIC-alc.); 3♂♂, Wentworth Falls, Jamison Ck, 4.xii.1956, 10.xi.1993 (AMS, CNC). **Tasmania:** 6♀♀, same data as neotype; 2♀♀, Adventure Bay, 18, 20.xii.1922; 1♂, 2♀♀, Cradle Valley, 12–16.ii.1923; 4♀♀, 9 km WSW Derwent Bridge, 42°10'S 146°08'E, 21.i.1983; 2♀♀, King River, 4.ii.1923; 1♀, Mt. Field NP, Russell Falls, 23.ii.1967; 2♀♀, National Park, 15–16.xii.1922; 4♂♂, 5♀♀, 5 km ESE Redpa, 42°57'S 144°49'E, 18.i.1983; 1♀, Lk. Margaret, 3.ii.1923; 2♂♂, 2♀♀, 10 mi E Strahan, 7.ii.1967 (ANIC); 1♀, Arthur Plains, 3.ii.1965; 1♀, Sir John Falls, Cataract Ck, trib. Gordon R., 9.i.1977; 2♀♀, Tasman Peninsula, Pirates Ck, 2.5 km SW Eaglehawk, 13.ii.1990 (MVM); 10♀♀, Arve R. nr Geeveston, 20.i.1960; 6♀♀, Arve R. nr Hartz Mtn Rd., river rocks, 22–23.i.1989, y.pans; 1♂, 1♀, Corinna, 8.i.1960; 1♀, 16 mi NE Cradle Mtn, 2200 ft, 5.i.1960; 2♀♀, Ferntree nr Hobart, 12.i.1960; 1♀, June Cave, nr Maydena, 13.i.1960; 1♀, Lyell Hwy, Double-Barrel Ck, rainfor., y.pans, 27.i.1989; 1♂, 6♀♀, Lyell Hwy, Franklin R. Crossing, 16.i.1960; 8♀♀, Marakooopa Caves, nr Mole Ck, 10.i.1960; 6♀♀, Mt. Barrow, 25–3000 ft, 24–25.i.1960; 4♀♀, Mt. Field NP, Lady Barron Ck, 900 m, y.pans, subalpine, 25.i.1989; 1♀, 2 mi S Oonah, Waratah Hwy, 7.i.1960; 1♀, Scotts Peak Dam Rd & Clear Ck, wet scler., MT, 4–5.ii.1989; 1♀, Tasman Peninsula, Long Bay Ck, wet scler., y.pans, 7–9.ii.1989; 3♀♀, Zeehan-Renison Bell SR, N. Zeehan, rainfor., 28.i.1989 (AMS); 7♀♀, Eaglehawk Neck, 17–22.xi.1922, 17.i.1960; 8♀♀, Hellyer R. Gorge, S. Wynyard, rainfor., 2–3.ii.1967, 29.i.1989 (AMS, ANIC); 4♀♀, Lyell Hwy, Franklin/Gordon Wild Rivers NP, Surprise R. 19.ii.1994 (CNC); 15♀♀, Pelion Hut, 3 km S Mt. Oakleigh, 860 m, 41°50'S 146°03'E, 5–10.ii.1990, 8.i.–12.ii.1991, 6–11.iii.1991 (ANIC); 2♀♀, Rd C405, 12 km N of C401, small ck, 23.ii.1994 (ZFMK); 1♀, Rosebery, ii.1977 (BPBM); 1♀, 4 km E Rosebery, 41°47'S 145°35'E, MT, 16.i.–



Figs. 94–99. Scanning electron micrographs of male *Ceratomerus*. 94, *C. ordinatus*, hind tibia, anterior view. 95–96, *C. albistylus*: 95, mid tibia, anterior view; 96, terminalia, lateral view. 97–98, *C. lobatus*: 97, midleg, oblique posterior view; 98, mid tibia, ventral view. 99, *C. orientalis*, mid femur, anterior view. Scale bars = 0.1 mm, except for Figs. 95, 98 where scale bars = 0.05 mm.

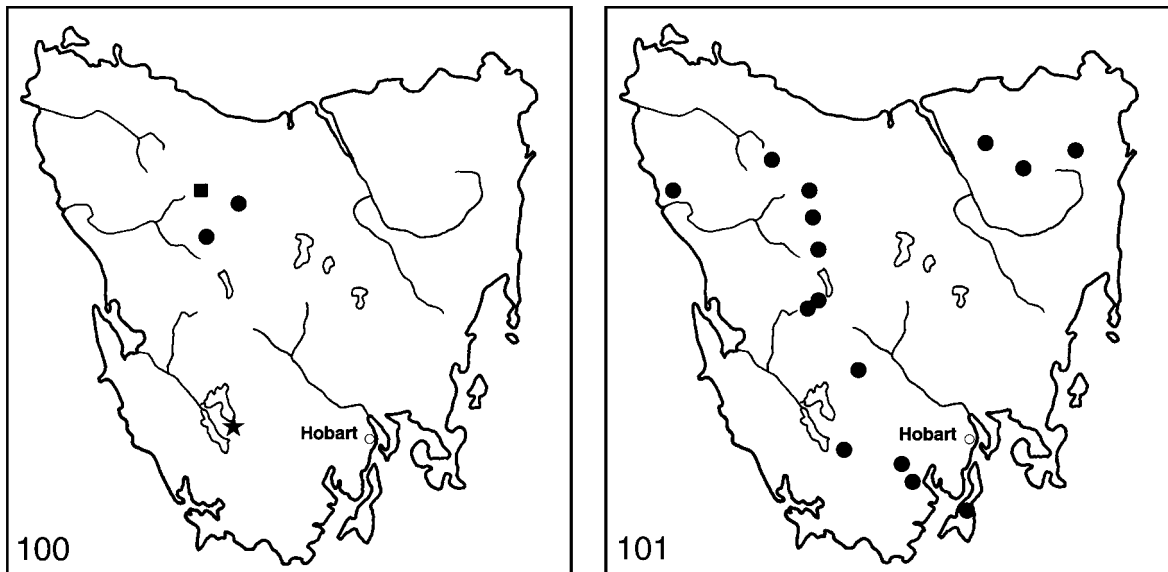
1.ii.1983; 1 ♀, 42°43'S 145°49'E, rainfor, 3.ii.1978 (ANIC-alc.). **Victoria:** 9 ♂♂, 5 ♀♀, Acheron Ck, 29 km from Warburton, y.pans, 400 m, 1–3.xii.1994 (AMS, ZFMK); 1 ♀, 10 mi E Beech Forest, 1.i.1967; 1 ♂, Cabbage Tree Ck, 18.xi.1964; 2 ♂♂, Nowa Nowa, 28.x.1961; 1 ♂, Spring Hill Junction, 9 mi N Dargo, 4000 ft, 13.ii.1965 (ANIC); 1 ♂, Belgrave, 20.i.1930; 1 ♀, 8 km SSW Gellibrand, Upper Carlisle R., 27.i.1982; 1 ♂, Noorinbee, 12.xi.1969 (MVM); 1 ♂, Donna Buang Rd, 15.xii.1970 (ANIC-slide); 14 ♂♂, 5 ♀♀, Errinundra Plateau, Result Ck Falls & Gap Rd, 900 m, 6–7.xii.1994 (AMS, CNC, ZFMK); 1 ♀, Grampians NP, Delley's Dell, 4 km SSW Halls Gap, 37°11'S 142°31'E, 30.xi.1992; 1 ♀, Result Ck & Gap Rd, 920 m, cool rainfor., y.pans, 17.i.1991 (AMS); 2 ♀♀, NNE Melbourne, 20.xii.1960 (BPBM); 2 ♂♂, 5 ♀♀, Otway NP, Mait's Rest, temp. rainfor, ck, 4–5.xii.1994 (AMS, ZFMK); 1 ♀, Otway Ra., Beauchamp Falls, *Nothofagus*, 3.xii.1994; 3 ♂♂, Otway Ra., Melba Gully SP, temp. rainfor., ck, 4.xii.1994 (CNC); 5 ♂♂, 2 ♀♀, 9 km N Warburton, Cement Ck, 27.x.1961, 7.iv.1963, 1–3.xii.1994 (AMS, ANIC, CNC).

Diagnosis. Recognized by its dark, shiny abdomen, bright yellow legs, white tipped female stylus and greatly lengthened male antennae, with inconspicuous stylus.

Description. Wing length 3.7–4.2 mm, similar to *C. attenuatus* except as follows:

Male. *Head* dark brown, shiny, with white pruinescence; ocellar triangle with 2 closely spaced, divergent bristles, inserted between lateral ocelli; postocular bristles very short and fine. Antenna with scape two-thirds height of eye, with many short dorsal setae and 1 long ventral seta (Fig. 61); pedicel with 1 long dorsal seta. Postpedicel greatly lengthened to 3× height of head, gradually tapered; apical stylus very short, inconspicuous. Palpus yellow, slender, one-sixth length of labrum, with several dark setae.

Thorax. Mesonotum and postnotum dark brown, shiny; pleura shiny, proepisternum, anterior portion of anepisternum, and postpronotal lobe yellow; scutum with median vitta of pruinescence; lateral margin of scutum, prescutellar depression and postnotum with patch of pruinescence.



Figs. 100–101. Known distribution of species of *Ceratomerus* (Tasmania). 100, *Ceratomerus bickeli* ★, *C. bulbosus* ■, *C. hibernus* ●. 101, *Ceratomerus ordinatus*.

Alternating row of short acrostichals to prescutellar depression, directed posteriorly; 4 dc, third dc stout and long, with setulae intermixed; 4 sclt, outer pair short, slender. Anteprepronotum with 2 short setulae.

Wing (Fig. 85). Single short costal seta. R_{2+3} not deflected around stigma; radial fork bell-shaped; stem of median fork sometimes nearly twice length of crossvein dm-cu; medial fork proximal to radial fork by less than length of R_4 . Halter with yellow knob.

Legs. Coxae, femora and tibiae bright yellow, hind femur darker towards tip; tarsi becoming dark towards tip. Fore coxa less than twice length of mid coxa. Fore femur slender, with av row of dark slender setae. Fore tibia nearly equal in length to femur. First tarsomere subequal in length of fore tibia; distal 4 tarsomeres slender, subequal in length to first tarsomere.

Apical third of mid femur strongly constricted with posterior projecting lip; 1 long av and 2 long pv setae near mid-length. Mid tibia with projecting appendage corresponding to constriction on femur; appendage with spherical apex and subapical seta (Fig. 95); pad-like swelling at mid-length and apex of tibia (Fig. 93). First tarsomere longer than remaining 4 tarsomeres, with long curved ventral seta at base.

Hind femur often with long preapical av setae. Hind tibia longer than femur, apex slightly dilated, bearing postero-apical comb; apical half with several erect ad setae; long, slender erect setae often present beneath.

Abdomen shiny, dark brown, T1–5 with short postero-marginal setae; T6 with long postero-marginal setae; T7 pale; S7 slightly longer than preceding sternite; T8 with narrow, posterior incision; postero-marginal of S8 with long, stout setae, often extending beyond terminalia.

Terminalia (Figs. 96, 110, 111). Hypandrium with long posterior flap-like process; postgonites sickle-shaped, with twisted, hooked tips; postero-marginal with fringe of long setae, often stout. Phallus with pair of strongly arched processes, curving around flanking postgonites. Postero-apical margin of epandrium with patch of spine-like setae; epandrial lobe slender, with sparse setal fringe and dense

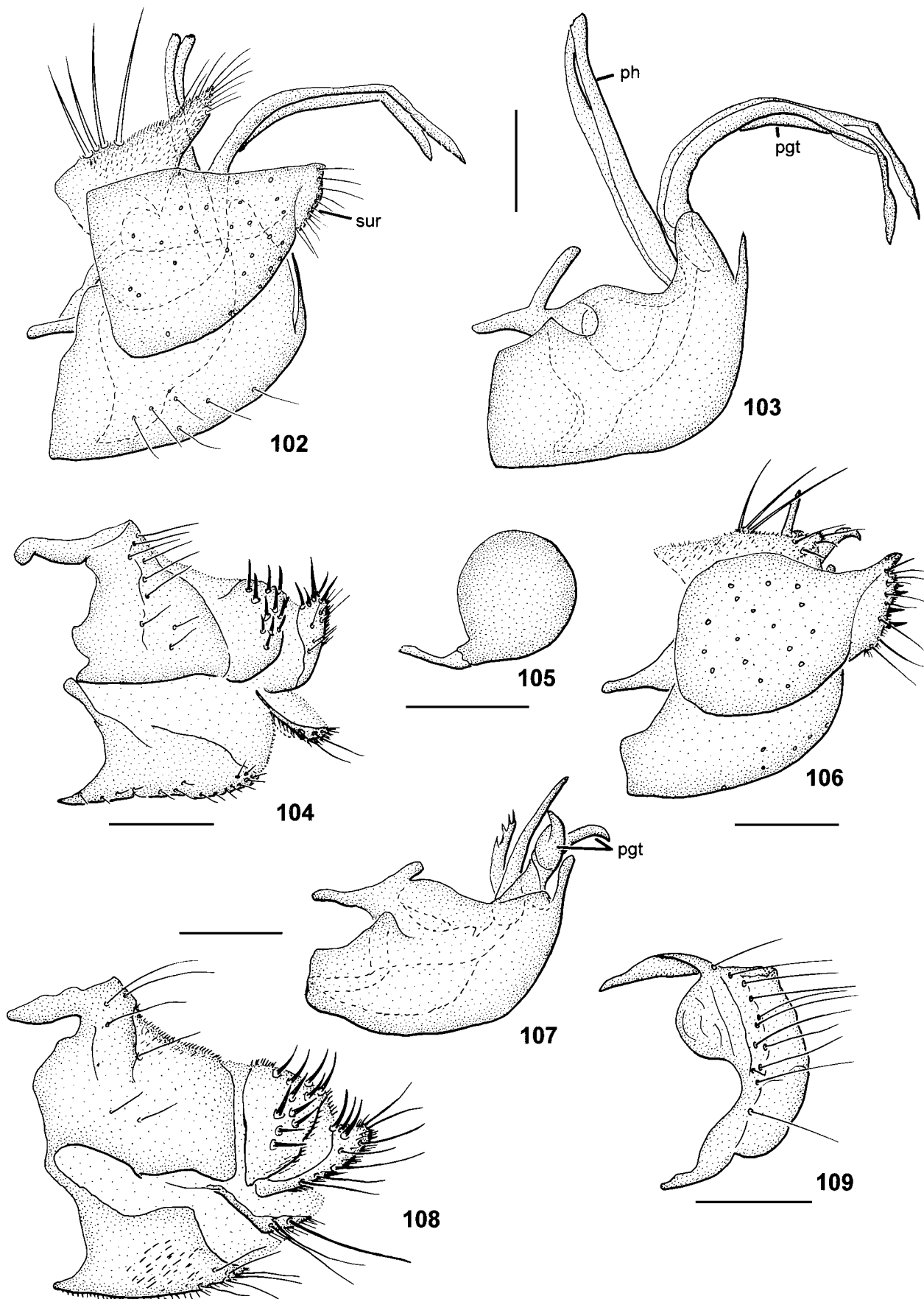
crown of setae. Surstylus long and slender, with posterior fringe of dark, stout setae. Cercus thinly sclerotized, short, apex acute, expanded laterally around anus; posterior margin thickly sclerotized.

Female. Similar to male and female of *C. attenuatus* except as follows: palpus brown. Postpedicel more strongly attenuated (Fig. 62), with apical fourth white. Halter dark. Lateral margin of S7 straight. Terminalia (Fig. 112): anterior half of T10 with several rows of stout, curved spine-like setae; cercus with row of short spine-like setae, similar to T10. Spermathecal receptacle spherical, with short ridge-like neck where duct attached.

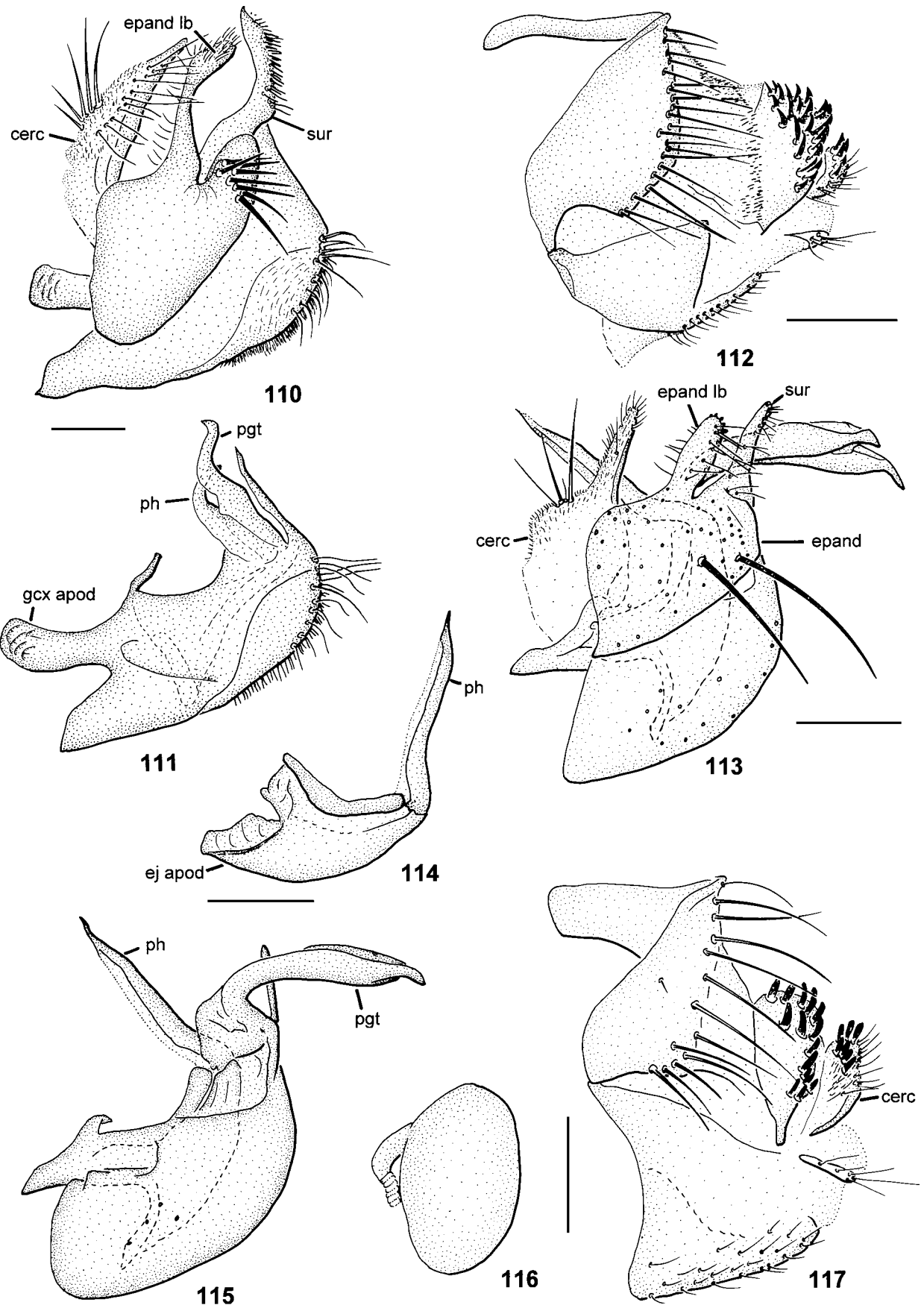
Distribution. Widespread in southeastern Australia, this species is known from throughout Tasmania, westward to the Grampians in Victoria and north to New England National Park in northern New South Wales (Fig. 118). Most common at southern latitudes, and confined to higher elevations north of Sydney.

Biology. This species is commonly collected by sweeping riparian vegetation and rarely swept from emergent rocks in streams. Occasionally specimens are found quite distant from running water.

Remarks. Three differing morphological forms can be somewhat identified. Populations in Victoria (Warburton/Cement Creek region and Otway Ra.), can be distinguished by the absence of a postero-marginal fringe of setae on the hypandrium, and presence of long, slender setae on the apical fourth of the male hind femur and ventral region of the male hind tibia. A northern population is also distinguishable, ranging from Gloucester Tops north. This population is distinguished by the very stout setal fringe on the hypandrium, and the hindlegs also possess long erect setae as in the form known from Victoria. The typical form (widespread, ranging from Tasmania, Victoria and southern NSW), possesses a long setal fringe on the hypandrium and lacks long, slender setae on the male hindlegs.



Figs. 102–109. Terminalia of *Ceratomerus*. 102–105, *C. maculatus*: 102, male, lateral view; 103, hypandrium and phallus; 104, female, lateral view; 105, spermatheca. 106–109, *C. ordinatus*: 106, male, lateral view; 107, hypandrium and phallus, lateral view; 108, female, lateral view; 109, female tergite 8, oblique dorsal view. Scale bars = 0.05 mm, except Fig. 105 where scale bar = 0.1 mm. Abbreviations: *pgt*, postgonite; *ph*, phallus; *sur*, surstylus.

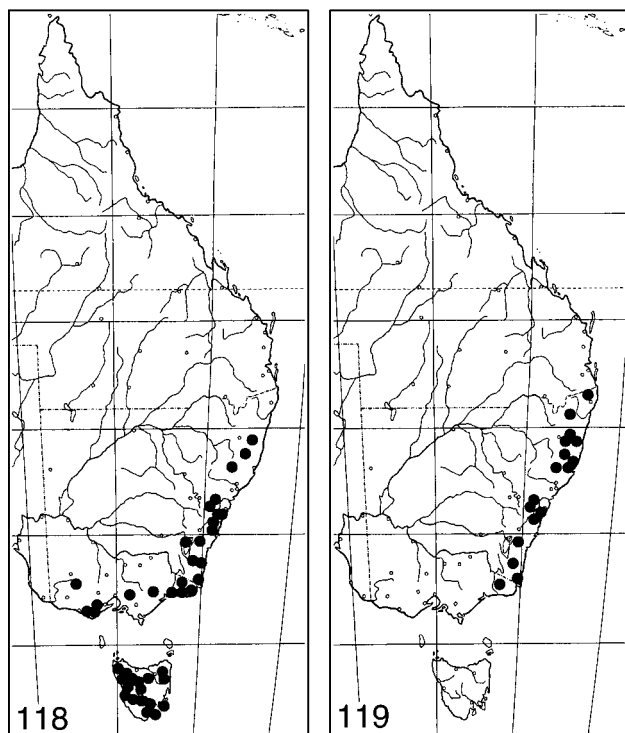


Figs. 110–117. Terminalia of *Ceratomerus*. 110–112, *C. albistylus*: 110, male, lateral view; 111, hypandrium and phallus, lateral view; 112, female, lateral view. 113–117, *C. lobatus*: 113, male, lateral view; 114, phallus, lateral view; 115, hypandrium and phallus, lateral view; 116, spermatheca; 117, female, lateral view. Scale bars = 0.1 mm. Abbreviations: *cerc*, cercus; *ej apod*, ejaculatory apodeme; *epand*, epandrium; *epand lb*, epandrial lobe; *gcx apod*, gonocoxal apodeme; *pgt*, postgonite; *ph*, phallus; *sur*, surstylus.

Ceratomerus lobatus n.sp.

Figs. 86, 97, 98, 113–117, 119

Type material. HOLOTYPE ♂, "AUST[ralia]: NSW[New South Wales]: Blue Mtns/ N.P. Grand Canyon/ 27.iii.1994/ B.J. Sinclair/ ex. Greaves Ck."; "HOLOTYPE/ *Ceratomerus/ lobatus/ Sinclair [red label]*" AMS K175251. PARATYPES: **New South Wales:** 6♂♂, 4♀♀, same data as holotype (AMS); 4♂♂, 3♀♀, Blue Mtns, NP, Grand Canyon, Greaves Ck, 25.xii.1993, 4.iv.1994, 18.vii.1994, BJS (CNC, ZFMK); 3♂♂, 4♀♀, Blue Mtns NP, Mt. Wilson, 19.xii.1986, DKM, B.J. Day, R. de Keyzer (AMS), 19.viii.1961, DHC (ANIC), Waterfall Ck, 22.xi.1993, BJS; 1♂, 1♀, Blue Mtns NP, Wentworth Falls, Jamison Ck, 10.xi.1993, BJS; 1♂, Border Ranges NP, Brindle Ck, rainfor., 1000 m, 25.i.1995, BJS; 6♂♂, Bruxner Pk FIR, nr Coffs Harbour, Bucca Bucca Ck, 100 m, subtrop. rainfor., 1.iv.1995, BJS; 2♂♂, Royal NP, Wallumarra Tr., Bola Ck, 7.xi.1993, BJS (CNC); 1♂, Blue Mtns NP, Valley of the Waters, Vera Falls, 320 m, y.pans, 9.iv.1995, BJS; 1♂, Dorrigo NP, Rosewood Ck, rainfor., y.pans, 23.i.1995, BJS; 3♂♂, Macquarie Pass NP, 7 km E Robertson, subtrop.for., 23.xi.1993, BJS; 6♂♂, Royal NP, below National Falls, subtrop.for., 29.v.1994, BJS; 3♂♂, Styx R. SF, George's Ck FR, Cunnawarra Ck, 31.iii.1995, BJS; 2♂♂, Royal NP, Couranga Tr., 23.iv.1995, BJS (ZFMK); 3♂♂, 1♀, Brown Mtn, Rutherford Ck, 15.iii.1961, 17.vii.1963, DHC; 7♂♂, 6♀♀, 4 mi S Monga, 8.v.1968, DHC & Liepa (ANIC); 4♂♂, 2♀♀, Carrai SF, Coachwood Ck nr Kookaburra Camp, y.pans, 8–9.ii.1997, DJB; 3♂♂, Dingo Tops For. Pk, NW Wingham, 950 m, rainfor., MT, 20.ii–23.iii.1993, G. Williams; 3♂♂, 2♀♀, Dorrigo NP, Never Never area, Sassafras Ck, temp. rainfor., 750 m, y.pans, 1–2.iv.1995, DJB; 1♀, Ebor, Point Lookout, 5000 ft, 31.iii.1960, DKM; 1♂, 2♀♀, Gloucester Tops, 1280 m, *Nothofagus*, MT, 19.xi–4.xii.1988, DJB; 4♂♂, 2♀♀, Lansdowne SF, Newby's Cave, 24 km N Taree, 300 m, warm temp. rainfor., 20.v.1993, G.&T. Williams; 1♀, Mt. Gibraltar NP, 64 mi W Grafton, 24.ii.1965, DKM; 1♂, Mt. Hyland NP, Obeloe Ck, 1030 m, 30°10'S 152°27'E, warm temp. rainfor., 25–27.i.1996, DJB; 1♀, Nadgee NP, Bruce's Ck wet scler. for., 18–19.ii.1987, DJB; 8♂♂, 2♀♀, Nadgee NR nr Eden, wet scler. for./Nadgee R., 14–15.ii.1986, 15.ii.1987, DJB; 6♂♂, 7♀♀, Royal NP, Bola Ck, 28.iv.1956, 1.vi.1963, 24.vi.1961, 6.vii.1966, 10.viii.1957, 19.xi.1960, DKM; 1♂, 2♀♀, Washpool NP, Coombadjah Ck, 780 m, warm temp. rainfor., 6.xii.1992, DJB; 4♂♂, Werrikimbe NP, Cobcroft Ck nr Walcha, temp. rainfor., 23.iii.1985, 1–5.xii.1997 DJB (AMS). **Victoria:** 28♂♂, 15♀♀, Errinundra Plateau, Bonang Ck, y.pans, 1.iv.1990, DJB (AMS).



Figs. 118–119. Known distribution of species of *Ceratomerus* (eastern Australia). 118, *C. albistylus*. 119, *C. lobatus*.

Diagnosis. Recognized by the short, distinct stigma, bright yellow-coloured pleura and sculptured mid tibiae with pectinate setae of the male midleg.

Description. Wing length 2.8–3.5 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocellar bristles one-third length of ocellar bristles. Antenna with length of scape subequal to height of eye; postpedicel apical two-thirds strongly tapered; three-segmented stylus one-third length of postpedicel; length of segment 8 twice width. Palpus pale, slender, one-fourth length of labrum, with several dark setae.

Thorax. Scutum and postnotum dark brown; pleura bright yellow, except brown laterotergite; postpronotal lobe pale brown.

Wing (Fig. 86). R_{2+3} running parallel and close to costa, smoothly arched around stigma.

Legs. Fore and mid coxae yellow, hind coxa yellowish-brown; base of femora, especially inner margin yellow, becoming dark brown towards tip. Fore coxa nearly twice length of mid coxa. Fore femur slightly swollen, with biserial av row of fine setae, mostly longer than width of femur; 1 weak preapical dorsal seta.

Mid femur more strongly swollen than fore femur, with deep attenuation at mid-length; basal half with cluster of 3 flattened anterior setae and group of basal setae, some nearly subequal in length to width of femur; apical half with short, pointed stud-like process; 1 stout, erect ad seta at apical fourth (Fig. 97). Mid tibia with shallow excavation at mid-length; anterior margin of notch with flattened lobe; basal half with erect, anterior and posterior setae, longer than width of tibia; base of notch with bilobed process, bearing broad flattened seta; ventral margin of notch with 3 cylindrical lobes, bearing stout, wavy seta (Fig. 98); apical half with pv row of setae, shorter than width of tibia; apex with cluster of subapical, anterior setae. First tarsomere longer than remaining 4 tarsomeres (one-third longer than tibia), with many erect pv setae.

Hind femur with av row of short setae.

Abdomen dark brown, concolorous with mesonotum; S7 only slightly longer than preceding sternite, anterolateral margin produced anteriorly; T8 narrow, expanded laterally.

Terminalia (Figs. 113, 115). Hypandrium convex, posterior margin extended as long, flat, median process, reaching beyond postgonites; gonocoxal apodemes developed, just projecting beyond anterior margin; postgonites articulated at base of phallus, strongly recurved posteriorly; phallus upright, straight, tapered to sharp apex (Fig. 114). Epandrium with 2 very long, stout setae arising posterolaterally; epandrial lamellae small, not greatly inflated, fused ventrally to hypandrium at av corner; epandrial lobe anterior to surstylus short and broad, bearing stout, blunt inner apical setae. Surstylus slender, longer than epandrial lobe, with row of marginal setulae; subepandrial plate narrow, lacking extensions and lobes. Cercus slender, fleshy, posterior margin more thickly sclerotized.

Female. Similar to male and female of *C. attenuatus* except as follows: lacking av row of setae of fore femur; mid tibia with 2 erect ad and 1 pd seta on basal half. Posterodorsal corner of anepisternum with more expansive dark colouration. Lateral margin of S7 straight. Terminalia (Fig. 117): T10 bearing row of blunt-tipped, spine-like setae along posterior margin. Cercus bearing row of blunt-tipped, spine-

like setae, with slender marginal setae. Spermathecal receptacle somewhat flattened, oval, with short neck (Fig. 116).

Distribution. This species is restricted almost exclusively to New South Wales, with additional records from northeastern Victoria (Fig. 119). It is widespread in both high and lower altitudes.

Biology. In mountainous regions, this species is found year round. In the streams of gallery rainforests which thread through broad sclerophyll forests around Sydney (e.g., Bola Creek, Royal NP), this species is found primarily in the cooler months, with records from April to November.

Etymology. The specific name is from the Latin *lobus* (an elongated projection), referring to a slender lobe on the male mid tibia.

Ceratomerus orientalis n.sp.

Figs. 29, 87, 99, 120–124

Type material. HOLOTYPE ♂, "AUST[ralia]: NSW[New South Wales]: Royal/ N.P., Bola Creek/ 3.iv.1994/ B.J. Sinclair"; "HOLOTYPE/ Ceratomerus/ orientalis/ Sinclair [red label]" AMS K175252. PARATYPES: **New South Wales:** 1 ♀, same data as holotype; 5 ♂♂, 3 ♀♀, Barrington Tops NP, 350 m, lower Gloucester R., 2.xii.1988, 21.xii.1993, DJB; 1 ♂, same locality, Upper Williams R., 550 m, 26.i.1987, DJB; 4 ♂♂, 2 ♀♀, same locality, Gloucester Tops, 1280–1290 m, *Nothofagus*, 14.xi–30.xii.1988, DJB; 1 ♂, Blue Mtns NP, Burralow Swamp, 9.xii.1986, G.A. Holloway; 10 ♂♂, 6 ♀♀, Blue Mtns NP, Valley of the Waters, Vera Falls, 10.vii.1994, 23.x.1994, 9.iv.1995, BJS; 5 ♂♂, Carrai SF, Coachwood Ck nr Kookaburra Camp, 8–9.ii.1997, DJB; 7 ♂♂, 2 ♀♀, Chichester SF, Upper Allyn R., 400 m, subtrop. rainfor., 19–20.xii.1993, DJB, nr Eccleston, 4.v.1967, DKM; 33 ♂♂, 8 ♀♀, Cockerawombeeba Ck, 23 km WNW Bellangry, warm temp. rainfor., 8.xii.1986, 14–15.i.1988, DJB; 5 ♂♂, 1 ♀, Comboyne-Wingham Rd, 10 km SSW Comboyne, rainfor., y.pans, 19.ii.1993, DJB; 1 ♂, Cooranbong, Gap Ck FIR, 3–4.ii.1986, B.J. Day, DKM; 2 ♂♂, 1 ♀, Dingo Tops For. Pk, NW Wingham, rainfor., 950 m, y.pans, 19.ii.1993, DJB; 11 ♂♂, 4 ♀♀, "Lorien", 3 km N Lansdowne, nr Taree, rainfor./wet scler. for., 6.i.1988, 4–10.v.1987, 16–30.viii.1992, 20–26.ix.1992, DJB, G. Williams; 2 ♂♂, Lyons Ck, 8 km NW Nelligen, riv. for., y.pans, 2.i.1991, DJB; 1 ♂, 1 ♀, Mooney Mooney Ck nr Gosford, 26.i.1984, B. Duckworth, B. Day, DKM, 3.xii.1985, DJB; 2 ♂♂, Mt. Hyland NP, Obeloe Ck, 1030 m, 30°10'S 152°27'E, warm temp. rainfor., 25–27.i.1996, DJB; 3 ♂♂, 6 ♀♀, Mt. Kaputar NP, nr Green Ck, 950 m, y.pans, 18.xi.1990, DJB, ck at Road, 750 m, 18.xi.1990, DJB; 1 ♂, 2 ♀♀, Mt. Warning NP, 24.xi.1985, DJB & G. Cassis; 3 ♂♂, 2 ♀♀, Nadgee NP, Merrika R./Nadgee R., dry scler. for., 1.ii.1987, 13–19.ii.1987, DJB; 2 ♂♂, 1 ♀, Nadgee NP, nr Eden, 14–15.ii.1986, DJB; 7 ♂♂, 1 ♀, Royal NP, Wallumarra Tr., Bola Ck, subtrop. rainfor., y.pans, 7.xi.1993, BJS; 1 ♀, Royal NP, E. Waterfall, rainfor., 8.iii.1991, DJB; 4 ♂♂, 6 ♀♀, Tooloom Scrub For. Res., Legume Rd nr Urbenville, 10–11.i.1988, DJB; 5 ♂♂, 3 ♀♀, Washpool NP, Coombadjah Ck, warm temp. rainfor., 780 m, 6.xii.1992, DJB; 4 ♂♂, 2 ♀♀, Werrikimbe NP, 23.iii.1985, DJB & B. Day, Cobcroft Ck, warm temp. rainfor., 27.xii.1993, 1–5.xii.1997, DJB; 3 ♂♂, 3 ♀♀, Wilson R. Res. nr Bellangry, subtrop. for. y.pans, 5.xii.1988, DJB, 27.i.1983, DKM & K.C. Khoo; 2 ♀♀, National Park, 6.xii.1958, DKM; 2 ♂♂, Nightcap NP, Googarna Rd, NE Nimbin, 14–15.xi.1988, DJB; 4 ♂♂, Nightcap NP, Terania Ck, N. Lismore, 15–16.xi.1988, DJB; 2 ♂♂, Nightcap NP, Googarna Rd, NE Nimbin, 14–15.xi.1988, DJB; 4 ♂♂, Nightcap NP, Terania Ck, N. Lismore, 15–16.xi.1988, DJB (AMS); 18 ♂♂, 2 ♀♀, Barrington Tops NP, Williams R., subtrop. rainfor., 480 m, y.pans, 19–20.xii.1993, BJS, DJB (AMS, CNC); 11 ♂♂, 4 ♀♀, Blue Mtns NP, Mt. Wilson, 19.xii.1986, DKM, B.J. Day, R. de Keyser (AMS), Waterfall Ck, 22.xi.1993, 12–13.xii.1998, BJS; 22 ♂♂, 4 ♀♀, Border Ranges NP, Brindle Ck, 800–1000 m, rainfor., y.pans, 25–26.i.1995, BJS (CNC); 5 ♂♂, 4 ♀♀, Blue Mtns NP, Wentworth Falls, Jamison Ck, 23.x.1994, 10.xi.1993, BJS (AMS, ZFMK); 2 ♂♂, Bruxner Pk FIR nr Coffs Harbour, Bucca Bucca Ck, subtrop. rainfor., 100 m, 1.iv.1995, BJS (ZFMK); 26 ♂♂, 5 ♀♀, Dorrigo NP, 12.x.1962, DHC (ANIC), 22–23.x.1980, subtrop. rainfor., DJB (ANIC, WOOC), Rosewood Ck, y.pans, 23.i.1995, BJS (CNC), Wonga Walk, 700 m, Crystal Shower Falls,

2.iv.1995, BJS (ZFMK); 1 ♂, 1 ♀, Fitzroy Falls, 23.i.1963, DHC (ANIC); 20 ♂♂, 8 ♀♀, Ku-ring-gal Chase NP, Gibberagong Tr., trib. Gully Ck, 20.xi.1993, BJS (ZFMK), McCarrs Ck, 28.i.1985, DJB (AMS), Cicada Ck nr Church Pt, 11.xi.1990, 28.xii.1992, DJB (AMS); 26 ♂♂, 12 ♀♀, 7 km E Robertson, Macquarie Pass NP, subtrop. rainfor., 23.xi.1993, BJS (CNC), 30.iii.1986, 27.ii.1991, DJB (AMS); 16 ♂♂, 16 ♀♀, Minnamurra Falls, 31.i.1962, 28.v.1963, 4.x.1965, DHC (ANIC), 7.i.1961, 20.x.1961, DKM (AMS), iii.1983, B.Day, K.C. Khoo (AMS); 30 ♂♂, 27 ♀♀, Royal NP, Otford, 31.xii.1962, DHC (ANIC), 6.xii.1958, 10.ii., 3.iii.1962, DKM (AMS); 15.ii.1957, W.W. Wirth (USNM); 6 ♂♂, 5 ♀♀, Royal NP, Bola Ck, subtrop. rainfor., 29.xii.1993, BJS (ZFMK), 12.ii.1985, DKM (AMS); 9 ♂♂, Royal NP, Couranga Tr., dry scler. for., 19.iii.1995, 23.iv.1995, 29.v.1994, BJS (CNC, ZFMK); 2 ♂♂, Royal NP, National Falls, 29.v.1994, BJS (ZFMK). **Queensland:** 8 ♂♂, 22 ♀♀, Bunya Mtns NP, Saddleback Ck, rainfor., 950 m, y.pans, 25–26.xi.1992, DJB, y.pans/MT, 4–6.xii.1985, DJB & G. Cassis; 1 ♂, 2 ♀♀, Horse Gully Ck, base Bunya Mtns, dry scler. 500 m, y.pans, 26.xi.1992, DJB; 10 ♂♂, Mt. Spurgeon, 16°26'S 145°12'E, 1250 m, wet sclero. for. & ck, y.pans, 18–19.iv.1994, DJB; 5 ♂♂, 1 ♀, Teviot Ra., Rd to Boonah below Wilsons Pk, 24.i.1995, BJS (AMS); 5 ♂♂, 1 ♀, Mt. Windsor Tableland, 16°26'S 145°12'E, 1000 m, ck, 16.iv.1994, BJS (ZFMK). **Victoria:** 13 ♂♂, 4 ♀♀, Burrowa-Pine Mtn NP, Bluff Ck Picnic A., 400 m, riverine for. y.pans, 29.xi.1994, DJB; 1 ♂, Errinundra Plateau, Bonang Ck, y.pans, 1.iv.1990, DJB (AMS).

Additional material (in alc.). **Australian Capital Territory:** 2 ♂♂, Wombat Ck, 6 km NE Piccadilly Circus, 35°19'S 148°51'E, 750 m, iv.1984, Weir, Lawrence, Johnson (ANIC).

Diagnosis. Recognized by the dark-coloured pleura, distinct iridescent pruinescence on katepisternum, distinct brush of setae at base of the male mid femur, and the tri-lobed epandrial process.

Description. Wing length 2.5–3.1 mm, similar to *C. attenuatus* except as follows:

Male. Head. Postocellar bristles one-third length of ocellar bristles. Antenna with length of scape less than height of eye; postpedicel apical two-thirds strongly tapered; three-segmented stylus one-fourth length of postpedicel; length of segment 8 subequal to width.

Thorax. Scutum, postnotum and pleura dark brown (pleura paler in northern populations); postpronotal lobe pale brown, with pale streak extending to base of fore coxa; scutum lacking vitta of pruinescence.

Wing (Fig. 87). Stigma faint. R_{2+3} running parallel and close to costa, smoothly arched around stigma.

Legs. Fore and mid coxae yellow, hind coxa yellowish-brown; base of femora, especially inner margin yellow, becoming dark brown towards tip. Fore femur slightly swollen, with av row of fine setae, less than half width of femur.

Mid femur slightly swollen with pv row of short, dark setae along basal two-thirds; base with long erect pv seta; base with av cluster of long stout setae, nearly equal in length to width of femur; av margin with row of short, pale setae along entire length (Fig. 99). Mid tibia slightly arched, not swollen at mid-length, with pv row of fine setae; apex with av cluster of short, erect setae; 1 erect dorsal seta near mid-length and 1 erect ad setae on basal third.

Hind femur with av row of very short setae.

Abdomen dark brown, concolorous with mesonotum; intersegmental membrane between S 6–7 often with pair of lateral patches of dark, dense microtrichia; S7 one-half longer than preceding sternite, anterolateral margin produced anteriorly, articulated with S8; T8 broad, rectangular, one-third length of sternite.

Terminalia (Figs. 120, 121). Hypandrium convex, posterior margin with flap-like extension; gonocoxal apodemes developed, slightly projected beyond anterior

margin; anterior margin of hypandrium with wing-like lateral wall upon which epandrium articulates; postgonites articulated at base of phallus, erect, slightly arched with hooked tips; phallus with pair of strongly recurved, posteriorly directed sickle-shaped processes. Epandrium lacking very long, stout setae; epandrial process forming trilobed complex: anterior lobes with rounded apex, apex of posterior lobe flattened with long dense setae; inner base of lobes with short, spine-like process; inner margin connected to internal sclerite formed from lateral expansion of bacilliform and subepandrial sclerites. Surstylus expanded apically with crown of short, stout setae; longer than epandrial process, with long marginal setulae. Cercus slender, thickly sclerotized posteriorly, with inner, apical, dense stout setae.

Female. Similar to male and female of *C. attenuatus* except as follows: apical half of postpedicel subequal to base; segment 8 of stylus nearly 4× longer than width; lacking a row of setae of fore femur; mid tibia with 2 erect ad and 1 pd seta on basal half. Posterodorsal corner of anepisternum with more expansive dark colouration. Terminalia (Fig. 122): T10 bearing biserial row of spine-like setae along posterior margin. Cercus bearing spine-like setae, with slender marginal setae. Spermathecal receptacle oval, somewhat flattened with short neck (Fig. 123).

Distribution. This is the most widespread species of

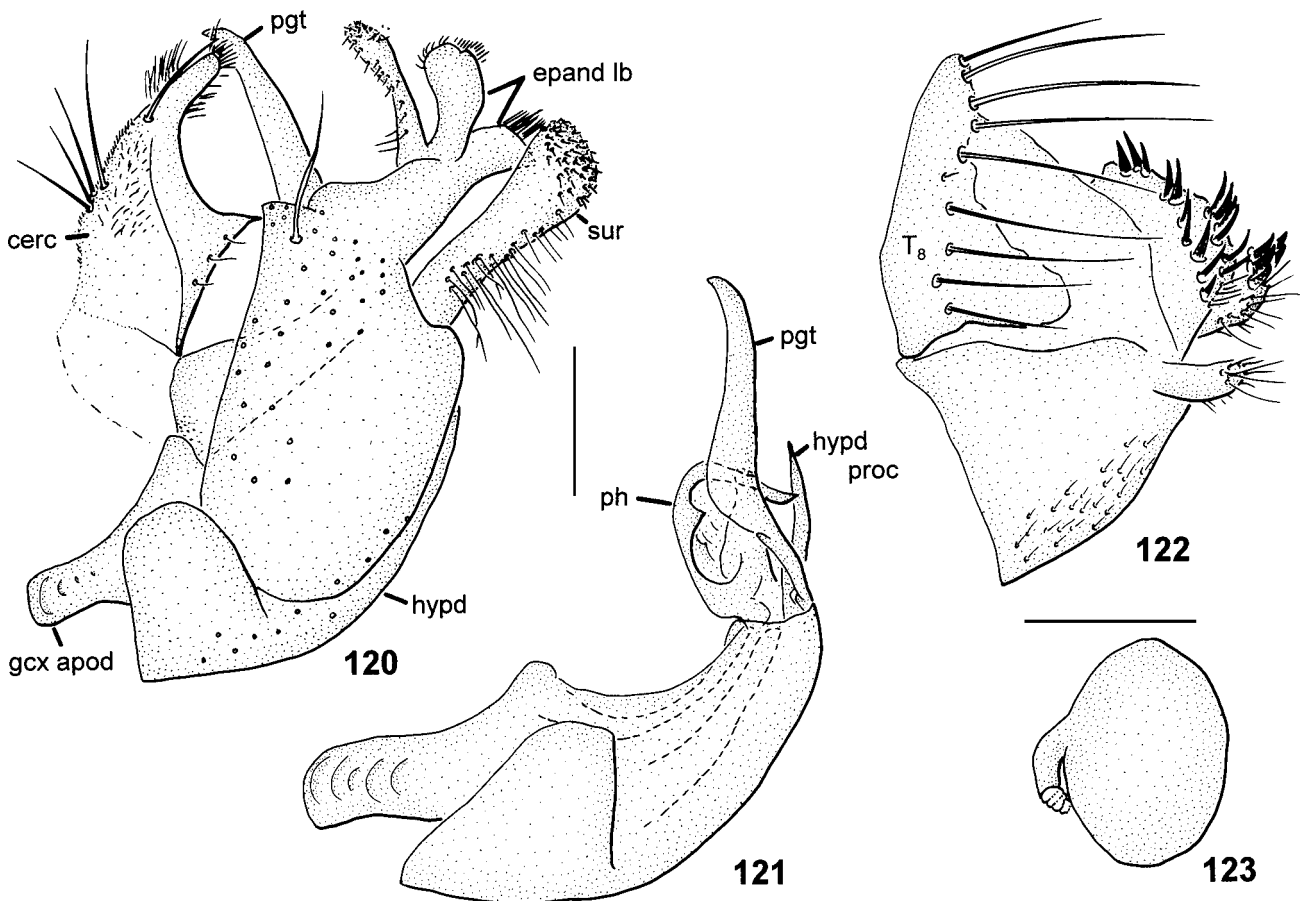
Ceratomerus in Australia, known from the Atherton Tablelands of northern Queensland to Victoria (Figs. 29, 124). The northern populations generally appear more pale in colouration.

It is also known from the upper Carnarvon Creek of Carnarvon NP (outlying western locality in southeastern Queensland, Fig. 29). The permanent waters of this montane region in southeastern Queensland are considered an oasis in an area of low and seasonal rainfall (Watson & Theischinger, 1984). Several endemic aquatic taxa are known from this region, or represent distinct populations, separate from the coastal populations.

Biology. This species is readily collected by sweeping emergent rocks in streams from a wide variety of forests, including warm and cool temperate, subtropical, and gallery rainforests. Records indicate that adults can be found year round at most localities.

In southern Queensland, this species inhabits widely disjunct watersheds. During periods of reduced rainfall, the streams occasionally are reduced to large pools, yet *C. orientalis* remains active. It is this adaptability that has enabled this species to inhabit a range of habitats, resulting in its widespread distribution.

Etymology. The specific name is from the Latin *orientalis* (of the east), referring to distribution of this species throughout the eastern margin of Australia.



Figs. 120–123. Terminalia of *Ceratomerus orientalis*, 120, male, lateral view; 121, hypandrium and phallus, lateral view; 122, female, lateral view; 123, spermatheca. Scale bars = 0.1 mm. Abbreviations: *cerc*, cercus; *epand lb*, epandrial lobe; *gcx apod*, gonocoxal apodeme; *hypd*, hypandrium; *hypd proc*, hypandrial process; *pgt*, postgonite; *ph*, phallus; *sur*, surstylus; *T*, tergite.

Zoogeography

Faunal subregion

The Ceratomerinae of Australia are presently confined to a narrow eastern zone defined by the Great Dividing Range, extending south into Tasmania. Although there are no records of this subfamily from southwestern Australia, it is clearly another example of a Bassian faunal element (Spencer, 1896), with a discontinuous northern extension along the temperate tablelands rising from the tropical and subtropical lowlands of northern Queensland (Mackerras, 1970; Nix, 1991). The distribution of Australian Ceratomerinae could also be termed an element of the Kosciuskan subregion as reviewed by Heatwole (1987) or what Bickel (1994) termed the "Eastern Forest". However, these two subregions do not include Tasmania. Other Empidoidea with a similar distribution to that of Australian Ceratomerinae, include the Clinocerinae and *Hydropeza* (Sinclair, 1999, 2000b). While *Apterodromia* Oldroyd has a similar distribution, it is also known from southwestern Australia (Sinclair & Cumming, 2000).

Regional patterns

The diversity of Ceratomerinae in Australia is greatest in the southeast, as for many aquatic groups. Although the Border Ranges of northern New South Wales include four species, all represent widespread taxa and no endemic species have been found in this region.

Northern Queensland-Tasmania disjuncts. In the *C. campbelli* group, there is an example of a widely disjunct sister-species pairing. *Ceratomerus campbelli* (Tasmania) is clearly most closely related to *C. athertonius* from the Northern Tablelands on the basis of similar secondary sexual modifications of the male wing. A similar disjunct sister-species pair is known also in the aquatic genus *Clinocera* (Sinclair, 2000b).

Areas of endemism. Five of seven species of *Ceratomerus* are known only from Tasmania (71% endemism). In other aquatic taxa, high Tasmanian species-level endemism is also reported in Blephariceridae (100%), Plecoptera (nr 90%), and Trichoptera (74%) (Zwick, 1977; Hynes & Hynes, 1982; Williams & Campbell, 1987; Neboiss, 1991). In Odonata, two endemic cold-water genera are known, suggesting long isolation of stream faunas (Watson & O'Farrell, 1991). Although Tasmania was connected to the mainland during the Pleistocene, the land bridges were primarily low plains, and mostly unfavourable to cool-adapted species (Hynes & Hynes, 1982; White, 1994). Among other Empidoidea, Tasmanian endemics are also known in terrestrial *Apterodromia* (100%) and the aquatic genera *Hydropeza* (100%) and *Clinocera* (33%) (Sinclair & Cumming, 2000; Sinclair, 2000b). Bickel (1998) estimates that there may be more than 100 Tasmanian species of Hilarini, including an endemic genus, *Cunomyia* Bickel.

The remarkable diversity of *Ceratomerus* in Barrington Tops National Park is a reflection of the range in altitude and resulting floral changes found there. Nine species are reported with two species currently endemic, or known only from the Park. *Ceratomerus barringtonensis* is known from both 480 m and 1280 m, while *C. oreas* is known only from the *Nothofagus* region above 1200 m. The southern species, *C. maculatus* and its northern sister species, *C. falcatus* are both found here, but the former is recorded only from 1200

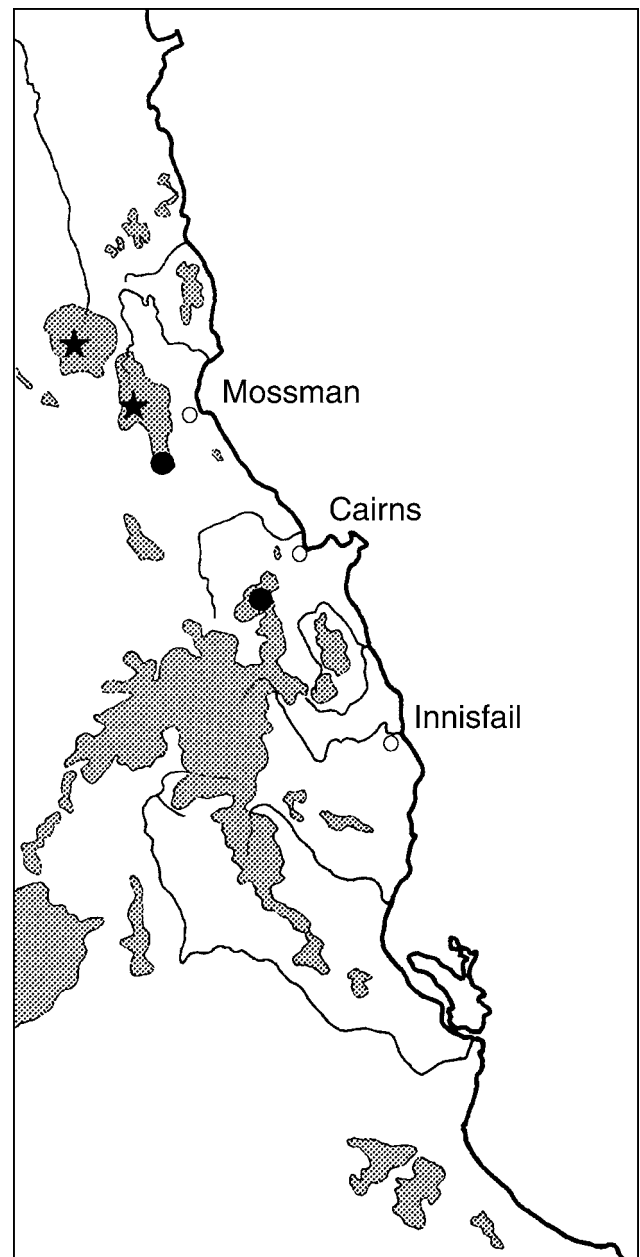


Fig. 124. Known distribution of species of *Ceratomerus* (northern Queensland). *Ceratomerus athertonius* ●, *C. orientalis* ★. Shaded areas indicate land above 700 m in altitude.

m and the latter from the subtropical area at 480 m. The widespread *C. orientalis* is found from 380 to above 1200 m and the southern species, *C. albistylus* is found only at higher elevations.

Widespread species patterns. *Ceratomerus orientalis* is the most widespread species, ranging from northern Victoria to southern Queensland (including Carnarvon NP), with an isolated population in the Tablelands west of Cairns. Most widespread species such as *C. orientalis* are found in both remnant and gallery rainforests. The latter are surrounded by sclerophyll forests (e.g., Royal National Park south of Sydney). In contrast, although *C. albistylus* is the second most widespread species ranging from Tasmania to New England National Park, it is recorded mostly from cool, wet rainforests. All species of *Ceratomerus* with very restricted ranges are confined to remnant rainforests and have not been recorded from gallery rainforests.

Two widespread species in the southeast (*C. albistylus* and *C. maculatus*) are common at both higher and lower altitudes as far north as Sydney. While populations north of Sydney are confined to areas above 1000 m. In addition, *C. lobatus* appears to be an example of a Bassian element with coastal populations present primarily in the cooler months. This pattern was discussed by Mackerras (1950).

Norfolk Island. Norfolk Is. is volcanic in origin, located in the southwestern Pacific, between New Caledonia and New Zealand and some 1400 km east of the coast of Australia (Rentz, 1989). There are three main islands in the Norfolk group, of which the ecologically devastated Philip Is. is 6 km south of Norfolk. It is estimated that the islands are 2.8–3 million years old and the biota could not have existed until after the late Pliocene (Rentz, 1989).

The present fauna arrived via transoceanic dispersal during the past two million years. During lower sea-level periods associated with Pleistocene glaciation (lowered approx. 100 m), the islands would have still been as isolated as today, although several small stepping stone islands probably existed that aided dispersal (Holloway, 1977; Rentz, 1989).

There has been no detailed study of the empidoids of Norfolk Is. Bickel (1994, 1996) reported three non-endemic species of Sciapodinae (Dolichopodidae) from Norfolk Is., of which two were probably accidentally introduced. All species also occur in Australia. The single species of *Ceratomerus* recorded from Philip Is. is clearly of the *C. ordinatus* group and thus of Australian origin. This species group is not known from New Zealand and no ceratomerines have yet been discovered from New Caledonia (Sinclair, unpubl. data) and the highlands of New Guinea. Additional material, especially males are required to determine the status of this species from Philip Is.

Affinities

The Southern Hemisphere distribution of the Ceratomerinae has long been noted, with the first species described from the early decades of the twentieth century. Paramonov (1959) and Hennig (1960) included the Ceratomerinae as possible examples of Trans-Antarctic (Southern) or Gondwanan elements, but lacked knowledge of relationships for discussion of this geographic distribution.

The two major Australian species-groups display contrasting zoogeographic relationships. The *C. ordinatus* group share apparent derived characters with several species from New Zealand and South America, while the *C. campbelli* group are clearly most closely related to the *C. paradoxus* group of southern South America (see "Phylogenetic affinities" for further details). Together with remaining Australian species (*C. inflexus* group and unassigned species), the latter two species groups constitute the sister group to a lineage of closely related New Zealand species.

Phylogenetic affinities

As stated above, the Australian species of *Ceratomerus* can be divided clearly into two monophyletic units, but they are not monophyletic as an entire group. The monophyly of the *C. ordinatus* group in comparison to other Australian species is supported on the basis of the following synapomorphies: lengthened pedicel (second antennal segment), stigma absent, long postocular bristles overlapping eye, and third dorsocentral bristle shorter than others. On the basis of an unpublished preliminary cladistic analysis (Sinclair, 1998), the *C. ordinatus* group is possibly most closely related to several New Zealand and Ecuadoran (high altitude) species. Within this species-group, *C. maculatus* appears to be the sister species of *C. falcatus* on the basis of an auxiliary crossvein and sickle-shaped postgonites (Figs. 77, 80, 83, 103).

The monophyly of all remaining Australian species is supported on the following synapomorphies: pair of long, bristle-like anteprenotal setae, one notopleural bristle, acrostichal setulae directed anteriorly (except *C. albistylus*), prescutellar pair of dorsocentral bristles shorter than others, stigma positioned at apex of cell r_1 and proximal end truncate, and single basoventral seta on hind first tarsomere. Within this group, the *C. campbelli* group alone is most closely related to the *C. paradoxus* group from Chile (Sinclair, 1998). This relationship is supported on the basis of the following synapomorphies: inner apical margin of the male fore coxa concave, not evenly tapered and greatly distorted male midlegs bearing tubercles, extra lobes, and modified setae. Within the *C. campbelli* group, *C. athertonius* and *C. campbelli* are sister species (see under Zoogeography) on the basis of long spatulate setae at the basal margin of the male wing (Fig. 11). The other two species of this group, *C. barringtonensis* and *C. victoriae* also form a sister species pairing on the basis of stout setae on the margin of the anal lobe of the male wing (Figs. 12, 14) and the large thumb-like ventral lobe of the male mid femur (Figs. 3, 7).

In the *C. inflexus* group, *C. macalpinei* and *C. malleolus* are very closely related sister species on the basis of male terminalia, especially the form the cercus, proctiger lobe, and surstylus (Figs. 66, 69). Also in this group, the male cercus of *C. bulbosus*, *C. inflexus* and *C. oreas* is unique in its shape and setation (Figs. 46, 63, 72). These five species, plus *C. bickeli* are closely related on the basis of spherical epandrial lamellae, which may often be greatly inflated more broadly than the width of the abdomen.

Further refinement of the relationships of Australian species of *Ceratomerus* could not be resolved through traditional morphological methods. It is possible that molecular phylogenetic techniques may improve the resolution and certainly could be used to test the relationships proposed in this study.

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