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MILLIPEDES FROM AUSTRALIA, 10: THREE INTERESTING NEW SPECIES AND A NEW GENUS (DIPLOPODA: SPHAEROTHERIIDA, SPIROBOLIDA, POLYDESMIDA)*)

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ABSTRACT

Description of *Cynotelopus notabilis* n.g., n.sp. (Sphaerotheriida). The genus belongs to the tribe Cyliosomatini of the family Sphaerotheriidae, and appears to be related most closely to the eastern Australian genus *Epicyliosoma* Silvestri (= *Cyliosoma* auct.). This constitutes the first record of a pill-millipede from Western Australia. *Spirobolellus philiporum* n.sp. (Spirobolida) is described from Philip Island (near Norfolk Island, Pacific Ocean). This probably endemic spirobolellid is the first millipede recorded from the island. *Atopogonus bucculentus* n.sp. (Polydesmida), from Queensland, is the first indubitably autochthonous species of the family Haplodesmidae, subfamily Atopogoninae, recorded from the Australian mainland.

INTRODUCTION

The millipedes described in this paper were discovered among material from various sources. In an unidentified collection received on loan from the South Australian Museum, Adelaide (SAM), three specimens of a pill-millipede were discovered, interesting because they represented a new genus and were taken in a locality in the southwestern region of Western Australia. Although quite a number of sphaerotheriids have been described from eastern Australia, the group was never before recorded from the western part of the continent.

From Miss Penelope Greenslade, Canberra, a small sample of millipedes was received for identification. The sample was taken on Philip Island, situated in the Pacific Ocean not far from Norfolk Island, in the course of ecological field work. The species is an apparently endemic spirobolellid. The type material is deposited in the National Insect Collection, Canberra (NICC).

Finally, a new haplodesmid, obtained by the author during his collecting trip through Queensland (Jeekel, 1981), represents the first unquestionable record of the group from Australia. The material is preserved in the Zoölogisch Museum, Amsterdam (ZMA).

In connection with the description of the new taxa, the taxonomy of related Australian forms is discussed.

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SPHAEROTHERIIDAE

Before treating the taxonomic status of the presently described new species, some remarks relating the classification and nomenclature of the Australian members of this family are to be made.

In chronological sequence the following generic and subgeneric names have been based on Australian sphaerotheriids:

Cyliosoma Pocock, 1895: 414. Type-species: *Sphaerotherium angulatum* Butler, 1878.

Epicyliosoma Silvestri, 1917: 68. Type-species: *Zephronia albertisii* Silvestri, 1895.

Procyliosoma Silvestri, 1917: 75. Type-species: *Procyliosoma leae* Silvestri, 1917.

Syncyliosoma Silvestri, 1917: 76. Type-species: *Procyliosoma aurivillii* Silvestri, 1917.

Cyliosomella Verhoeff, 1924: 43. Type-species: *Cyliosomella castanea* Verhoeff, 1924.

Paracyliosoma Verhoeff, 1928: 82. Type-species: *Cyliosoma penicilligerum* Verhoeff, 1928.

According to the work of Silvestri (1917) and Verhoeff (1924), two generic categories can be recognized: *Cyliosoma* sensu auct. and a genus which was called *Procyliosoma* by Silvestri and *Cyliosomella* by Verhoeff. Unfortunately, the status of *Cyliosoma*, the oldest name, is uncertain. The original diagnosis of the genus applies to all Australian sphaerotheriids, and the identity of the type-species is also dubious. Apparently, neither Silvestri nor Verhoeff studied the type-species of *Cyliosoma* and their choice, which of the two generic categories should bear the name *Cyliosoma* was purely arbitrary.

A possible indication towards the identity of *Sphaerotherium angulatum* may be that Pocock (1893: 130) when recording this species on account of material collected by the Challenger expedition, stated *angulatum* to be based on a female specimen and put *Sphaerotherium walesianum* Karsch, 1881, of which only the male has been described, into its synonymy. We thus may assume that the newly recorded material consisted of female as well as male specimens, the first showing the characters of *angulatum*, the second those of *walesianum*. Although Pocock's identification was probably incorrect as regards the identity of the two species, the male characters of *Cyliosoma* might be those of *walesianum* and as a consequence the use of the name *Cyliosoma* in the restricted sense of Silvestri, 1917, and subsequent authors would be erroneous, for the telopod drawings of *walesianum* given by Karsch, poor as they may be, clearly show that his species is referable to the genus named *Procyliosoma* by Silvestri, 1917, or *Cyliosomella* Verhoeff, 1924.

The status of *Cyliosoma* being uncertain, I prefer to drop the name for the time being and substitute it by *Epicyliosoma*. In doing so we avoid a further, probably erroneous use of *Cyliosoma* and diminish the confusion which would result from an eventual transnomination.

In order to obtain a clear picture of the taxonomy and nomenclature of the Australian pill-millipedes I give here a checklist.

Checklist of Australian Sphaerotheriidae

Epicyliosoma Silvestri

Cyliosoma; Brölemann, 1913: 77; Silvestri, 1917: 63; Verhoeff, 1924: 43; Verhoeff, 1928: 82.
Epicyliosoma Silvestri, 1917: 68.
Paracyliosoma Verhoeff, 1928: 82.

Range.—

Queensland, New South Wales.

Remarks.—

For an extensive diagnosis reference is made to the papers of Brölemann, Silvestri and Verhoeff under *Cyliosoma*. The males are easily distinguished from those of *Procyliosoma* by the structure of the anterior telopods. In these, the prefemur is comparatively large and mediodistally produced in a rather thick process. Femur and tibiotarsus are reduced, the first being laterodistally produced into a triangular process. In the females, the vulvae are comparatively small, covering only part of the hind surface of the coxae of the second pair of legs and not at all or scarcely projecting distad of their distal margin.

On account of the number of sensory cones of the antennae, Silvestri and Verhoeff independently divided this genus into two subgenera. However, in the present case this

character probably does not merit more than specific value, as it does not seem to correlate with any other particular feature.

Still, two subgenera may be distinguished on account of the relative length of the femoral process of the posterior telopods. This character seems to be correlated with a particular secondary sexual modification of the male pygidium. The two subgenera then may be distinguished as follows:

Epicyliosoma s.str.: Femoral process of posterior telopods of about the same length as the tibiotarsus. Pygidium of male without sexual modification, or with a rounded depression with some scattered hairs.

Paracyliosoma: Femoral process of posterior telopods of about half the length of the tibiotarsus. Posterior third of pygidium of male with a median longitudinal field of setiferous punctae.

Future studies must learn whether or not these male characters coincide with any particular difference in the females.

Subgenus *Epicyliosoma* Silvestri

E. (E.) albertisii (Silvestri, 1895): 635; Silvestri, 1917: 74 (Qld.: Somerset).
E. (E.) excavatum (Verhoeff, 1928): 81 (N.S.W.: Upper Richmond River).[1])
E. (E.) froggatti (Silvestri, 1917): 70 (N.S.W.: Richmond River).
E. (E.) penrithense (Brölemann, 1913): 85 (N.S.W.: Penrith, Cambewarra).[2])
E. (E.) sennae (Silvestri, 1898): 227; Silvestri, 1917: 72 (Qld.: Cairns).

Subgenus *Paracyliosoma* Verhoeff

E. (P.) denticulatum (Verhoeff, 1924): 47 (Qld.: Blackal Range).
E. (P.) mjoebergi (Verhoeff, 1924): 47 (Qld.: Colosseum).[3])
E. (P.) penicilligerum (Verhoeff, 1928): 83 (N.S.W.: North Dorrigo).
E. (P.) queenslandiae (Brölemann, 1913): 80 (Qld.: Gayndah).[4])
E. (P.) queenslandicum (Verhoeff, 1924): 45; Verhoeff, 1928: 84 (Qld.: Mt. Tambourine, Malanda, Herberton; N.S.W.: Upper Richmond River).[5])
E. (P.) targionii (Silvestri, 1898): 226; Silvestri, 1917: 69 (Qld.: Cairns).
E. (P.) unicolor (Silvestri, 1897): 16; Silvestri, 1917: 71 (Qld.: Gayndah).

Subgeneric status uncertain.

E. kurandanum (Chamberlin, 1920[b]): 85 (Qld.: Kuranda).
E. pachygon (Chamberlin, 1920[b]): 86 (Qld.: Cooktown).
E. sjoestedti (Silvestri, 1917): 73 (Qld.: Cardwell).

[1]) *E. excavatum* appears to be very similar to *E. froggatti*, which was described from about the same locality. The differences between the two, mentioned in the key below, may be a matter of interpretation or were perhaps caused by the state of preservation of the material studied by the two authors. Actual comparison of the types is necessary to clarify this point.

[2]) Silvestri (1917) has synonymized *E. penrithense* with *E. sennae*. The points of difference between the two descriptions, mentioned in the key below, seem to justify their being kept separate. Moreover, the two species were described from widely separated localities.

[3]) *E. mjoebergi* was described briefly as a subspecies of *E. queenslandicum*. However, the relationship of *mjoebergi* to *queenslandicum* is dubious, because the latter was probably based on material of more than one species. Rather *mjoebergi* seems related to, or perhaps even identical with *E. queenslandiae*.

[4]) *E. queenslandiae* was synonymized by Silvestri (1917) with *E. unicolor*. Indeed there seems to be an almost complete agreement in the characters of the two, and the fact that they were described from the same locality further supports synonymy. The very long prefemoral process of the anterior telopods described for *unicolor* is sufficient reason to keep the two separate for the time being.

[5]) *E. queenslandicum* may be identical with *E. targionii*. It seems likely, however, that Verhoeff mixed up two species under the name: one from northern Queensland and one from southern Queensland, subsequently reported also from northern New South Wales. A restudy of the type material, involving also the selection of a lectotype, is needed to clarify the point. It must be noted here, that the name *queenslandicum* is in fact a replacement name for *queenslandiae* and as such an objective synonym of the latter. It is doubtful that the material studied by Brölemann and Verhoeff belongs to one species. On that account the name *queenslandicum* is maintained here as a matter of convenience and in order not to complicate matters.

Key to the species

This and the following keys have been compiled exclusively from the available descriptions. Rather than intended to lead to a correct identification, they are meant to serve as a guide to the descriptions made partly in ignorance of each others work by Brölemann, Silvestri and Verhoeff.

Subgenus *Epicyliosoma*

1. Antennae with numerous sensory cones. Tergites smooth. Tarsi of ambulatory legs with nine ventral spines. ..... *albertisii*
-. Antennae with four sensory cones. 2
2. Tergites almost smooth, shiny; pygidium punctulate and wrinkled. 3
-. Tergites and pygidium not differently sculptured, smooth or leathery..... 4
3. Tergites more or less uniformly castaneous. Pygidium of male somewhat depressed above the caudal margin. Tarsi with 10 ventral spines..... *froggatti*
-. Tergites yellowish brown, the posterior borders dark brown. Pygidium of male with a rounded median depression with some scattered hairs at one third from the posterior border..... *excavatum*
4. Medial as well as lateral side of distal sclerite of vulva concave. Tergites smooth. Tarsi with 8 ventral spines. ..... *sennae*
-. Medial side of distal sclerite of vulva convex. Tergites leathery. Tarsi with 10 ventral spines..... *penrithense*

Subgenus *Paracyliosoma*

1. Antennae with 7 sensory cones. Pygidium of male with a deep horseshoe-shaped impression before the posterior border, in the middle of which protrudes from the dorsal side a densely setiferous crest. Prefemur of anterior telopods $1^1/_2$ times broader than long. Distal sclerite of vulva shorter than broad at its base. ..... *penicilligerum*
-. Antennae with 4 sensory cones. Pygidium of male without a horseshoe-shaped impression, but with a median area of setiferous punctae in the posterior third. Prefemur of anterior telopods about as long as broad. 2
2. Setiferous area on pygidium of male distinctly raised, at each side a depression. Tergites finely reticulate. Tarsi with 10 to 12 spines. Distal sclerite of vulva longer than broad at the base. ..... *targionii queenslandicum*
-. Setiferous area on pygidium of male not distinctly raised, without depression at both sides. 3
3. Setiferous area on male pygidium broad and rounded triangular. ..... *denticulatum*
-. Setiferous area on male pygidium narrow or rather narrow, longitudinal..... 4
4. Prefemoral process of anterior telopods projecting distad of femur and tibiotarsus. Tarsi with 8 to 10 ventral spines. Distal sclerite of vulva shorter than broad at the base. *unicolor*
-. Prefemoral process of anterior telopods not projecting distad of femur and tibiotarsus. 5
5. Male pygidium with a slight transverse depression before the setiferous area. *mjoebergi*
-. Male pygidium with a slight transverse depression behind the setiferous area. Tarsi with 10 ventral spines. Distal sclerite of vulva as long as broad at base. ..... *queenslandiae*

Procyliosoma Silvestri

? *Cyliosoma* Pocock, 1895: 414.
Procyliosoma Silvestri, 1917: 75.
Syncyliosoma Silvestri, 1917: 75.
Cyliosomella Verhoeff, 1924: 43; Verhoeff, 1928: 84.

Range.—

Queensland, New South Wales, Victoria (unpublished), Tasmania. (New Zealand).

Remarks.—

In this genus the anterior telopods of the male lack a prefemoral mediodistal production, whereas femur and tibiotarsus are more strongly developed. The femoral process arises here from the medial side. In the females the vulva is large, covering almost the entire posterior surface of the coxa and part of the prefemur of the 2nd leg.

As in the foregoing genus, Silvestri distinguished two subgenera on account of the number of antennal sensory cones. As a higher number than 4 cones cannot be regarded as having more than specific value in the present group, this

subgenus, *Syncyliosoma*, is not recognized here.
P. andersoni (Verhoeff, 1928): 85 (N.S.W.: Upper Richmond River).
P. aurivillii Silvestri, 1917: 85 (Qld.: Cape York).
P. castaneum (Verhoeff, 1924): 48 (Qld.: Herberton).
P. dorrigense (Verhoeff, 1928): 86 (N.S.W.: North Dorrigo).[6])
P. leae Silvestri, 1917: 77 (Tas.: Hobart).
P. tasmanicum Silvestri, 1917: 78 (Tas.: Hobart).
P. walesianum (Karsch, 1881): 31 (N.S.W.: Sydney).[7])

Key to the species of *Procyliosoma* (excluding *walesianum*)

1. Antennae with numerous sensory cones. Distal sclerite of vulva subtriangular. Width up to 16 mm..... *aurivillii*
-. Antennae with 4 sensory cones. Distal sclerite of vulva short, the distal margin rounded.2
2. Black carina of lateral internal side of pygidium long. Tergites minutely reticulate. Legs with 10 to 12 ventral tarsal spines and one ventral tibial spine. Pygidium of male medially with a suboval tubercle above the posterior border. Width up to 10 mm. 3
-. Black carina of lateral internal side of pygidium short. Width up to 16.5 mm. 4
3. Pygidium of male behind the tubercle with an impression. Distal sclerite of vulvae evenly rounded..... *tasmanicum*
-. Pygidium of male not impressed behind the tubercle. Distal sclerite of vulva more narrowly rounded at medial side..... *leae*
4. Tergites with coarse punctation. Male pygidium without particular modifications. *dorrigense*
-. Tergites without coarse punctation, minutely reticulate and finely punctulate..... 5
5. Pygidium of male with an elongate tubercle before the posterior third. Tibiotarsus of posterior telopods without stridulation knobs. Pygidium weakly punctulate..... *castaneum*
-. Pygidium of male without a tubercle, but with a shallow pit, which, together with the area around it, is densely set with short setae. Tibiotarsus of posterior telopods with a series of stridulation knobs. Pygidium of male densely punctulate. ..... *andersoni*

Australian Sphaerotheriidae of uncertain generic status

Sphaerotherium angulatum Butler, 1878: 299; Pocock, 1893: 130; *Cyliosoma angulatum*; Pocock, 1895: 414 (Qld.: Rockhampton).
Sphaerotherium convexum C.L. Koch, 1847: 100; 1863: 31 ("Neuholland").
Sphaerotherium fraternum Butler, 1872: 359; 1873: 177 (Victoria).
Zephronia glaberrima Attems, 1898: 510 (Qld.: Cooktown).
Zephronia larvalis Butler, 1878: 301 (Qld.: Torres Straits).
Sphaerotherium marginepunctatum Karsch, 1881: 31 (Qld.: Rockhampton).

Cynotelopus n.g.

Diagnosis.
Agreeing in general with *Epicyliosoma* Silvestri (= *Cyliosoma* auct.), but differing mainly in the structure of the posterior telopods of the male. Syncoxite narrowly elongate; the coxal horns distally split. Femur broad at base; the femoral process widely curving distad, gradually tapering towards the narrowly rounded apex. Tibiotarsus in basal half with a large rounded lateral inflation, the apical half narrowed and with a truncate apex, not distinctly produced distad of femoral process. Anterior telopods with the femur only weakly mediodistally produced. Pygidium of male with caudal surface widely and deeply concave, and with a rounded median knob. Female with sclerites of vulva covering only part of coxa of 2nd leg.

[6]) *P. dorrigense* was originally described as a subspecies of *P. andersoni*. The characters used for distinguishing the two forms seem sufficient reason to give each the status of a separate species.

[7]) Although the reference to *Procyliosoma* is undoubtedly correct, the available description of *walesianum* is entirely insufficient for its recognition.

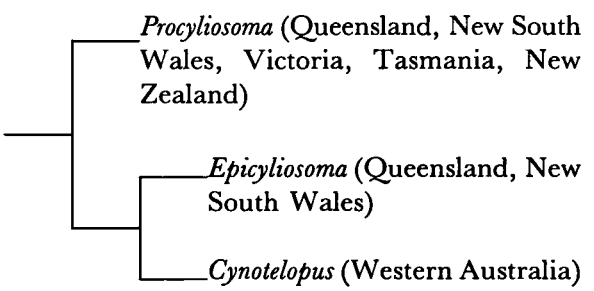
Type-species.

Cynotelopus notabilis n.sp.

Remarks.

The excavation of the male pygidium in the type-species of this genus is a secondary sexual feature which, as far as could be ascertained is quite unique in the order Sphaerotheriida. The same applies to the characteristic shape of the tibiotarsus of the posterior telopods of the male. Obviously we are dealing here with a very specialized form.

Rather than to *Procyliosoma, Cynotelopus* is closely related to *Epicyliosoma* as shown by the similarity in the structure of the anterior telopods of the male and of the vulvae of the female. It seems likely that *Procyliosoma* has some obviously primitive features, especially in the male telopods. There can be little doubt, therefore, that the phylogenetic interrelationship of the three genera of Australian Sphaerotheriidae is as expressed in the following diagram:



The genera may be distinguished with the aid of the following key:

1. Anterior and posterior telopods dissimilar. Prefemur of anterior telopods large, usually medially produced into a rounded process; femur and tibiotarsus small, condensed; the femur usually laterally produced into a process, the tibiotarsus attached to its medial side. Female with vulva small, covering only part of the coxa of the 2nd pair of legs..... 2
-. Anterior and posterior telopods of similar structure. Prefemur of anterior telopods usually smaller than femur and tibiotarsus together; femur and tibiotarsus pincerlike; femur with a medial process, the tibiotarsus attached to the lateral side. Vulva of female large, covering the coxa of the 2nd pair of legs almost entirely and moreover a part of the prefemur..... *Procyliosoma*
2. Posterior telopods of male with tibiotarsus not inflated and not truncate; the posterior telopods pincerlike. Male pygidium usually with sexual modifications, but never deeply concave..... *Epicyliosoma*
-. Posterior telopods of male with tibiotarsus laterobasally stronly inflated, its apex broadly truncate. Male pygidium deeply concave. ..... *Cynotelopus*

Cynotelopus notabilis n.sp.

Type locality.

Western Australia, Nornalup.

Material.

♂ holotype; 2 ♀ paratypes (with eggs), from the above locality (S.A.M.); 1927, E. Ashby leg.

Description.

Colour: In general greenish black. Head with oral margin yellowish brown, headplate otherwise dark, areolated with paler colour in the clypeal-frontal region; three pale spots lying on an imaginary arched line between antennal sockets. Antennae of same greenish black colour, the antennomeres distally narrowly annulated with brown. Collum dark, areolated with pale colour; the margins narrowly brownish. Tergites dark, also vaguely areolated; the caudal and lateral margins narrowly brown. Legs variegated with brown and greenish black, the tarsi darkest. Pygidium dull yellowish brown, the upper half a little darker, olivaceous grayish brown.

Width: ♂: 6.3 mm, ♀: 7.2-7.6 mm.

Head and antennae: Labrum widely but rather weakly emarginate, medially notched and with one labral tooth. Headplate trapezoidal in frontal aspect, widest above, 1.7 times broader than greatest length. Surface longitudinally widely and evenly arched, transversely flat. Tegument shiny, with moderately dispersed coarse pits, which are setiferous in the clypeal area, and with minute punctulation and striolation under high magnification. Antennal bases retracted in a funnel, in frontal aspect concealed by a widely concave bridge. Eyes consisting of numerous (about

40) distinct, rather convex ocelli. Hind margin of vertex medially emarginate; hind part of vertex with a moderately deep, semioval impression caudally marked by a transverse furrow. Antennae short, narrowing slightly from base to apex, antennomeres 2 to 5 broader than long, the 6th longer than wide, its sides faintly convex. Setation rather dense. Four apical sensory cones.

Collum: 2.7 times wider than long. Anterior border medially produced into a wide triangle, laterally widely and almost evenly emarginate. Anterior border finely rimmed, the rim widest medially. Tegument shiny, under high magnification with minute punctulae and striae; in each lateral corner a long hair.

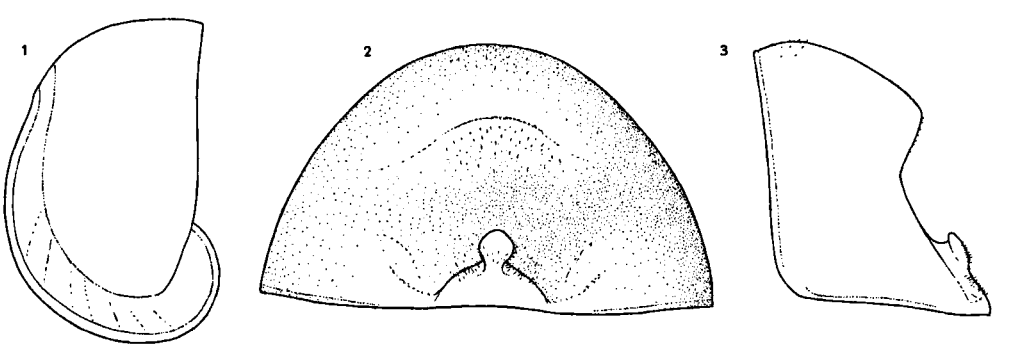
Shield: (fig. 1) Tegument shiny, with same sculpture as collum; no setation. Surface longitudinally rather strongly convex, anteriorly strongly declivous. Middle field laterally relatively broad, not curving backward, but its lateroposterior demarcation bent a little cephaled. Lateral demarcation of middle field rather widely rounded. Declivity anteriorly well developed, laterally with about 7 feeble carinae. Marginal rim well developed, moderately broad laterally, narrower along posterior lobe; the premarginal furrow percurrent along anterior border. Caudal lobe of brim moderately produced caudad, rather widely and evenly rounded.

Tergites 3 to 12: Same tegumental sculpture as preceding tergites; only declivous part of lateral lappets with setiferous pits. Anterior (concealed) margin with a minutely crenulate premarginal ridge. Underside of caudal margin without submarginal setation, but with a narrow, heavily pigmented transverse zone with a series of minute pits, into which fits the crenulation of the anterior margin of the next tergite (lock and key structure). Underside of lateral lappets with a black crest.

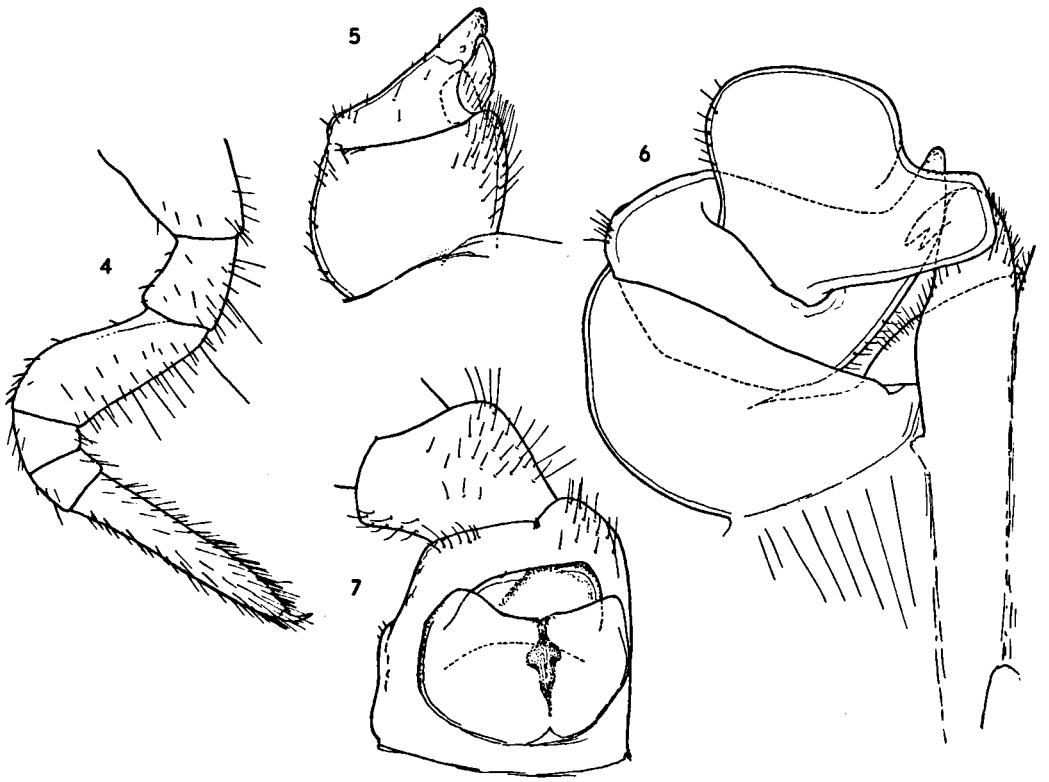
Pygidium: (figs. 2-3) Tegument as in preceding tergites, but with moderately dispersed small setiferous pits; the setae short and unapparent (and probably partly rubbed off). Caudal surface deeply and widely concave. The concavity rather densely minutely punctate (and setiferous ?). From the mediocaudal margin protrudes a triangular elevation ending dorsally in a rounded knob. Whole triangular area and knob rather densely to densely covered with setiferous pits (possibly a large part of the setation is rubbed off). Anterior part of ventral margin with a weak premarginal furrow. Inner side of pygidium laterally with a long black crest, about 4.5 times longer than the corresponding crest of the preceding tergite. Dorsad of the crest a rounded wall, soon flattening caudad.

Legs: (fig. 4) Coxae laterally widely and weakly convex, without lateral lobe. Tarsi rather slender, about 6 times longer than wide, with six ventral and one supra-apical spines. Apex of tarsi gradually tapering, claw widely curved. Setation of legs moderate, becoming rather dense at tarsal apex; some setae at ventral side of prefemur and femur long.

Telopods: Anterior telopods (fig. 5) with prefemur mediodistally produced into a rounded, rather densely setiferous lobe. Femur



Figs. 1-3. *Cynotelopus notabilis* n.g., n.sp., ♂ holotype. 1, left side of shield, lateral aspect. 2, pygidium, caudal aspect 3, left side of same, lateral aspect.



Figs. 4-7. *Cynotelopus notabilis* n.g., n.sp. 4, leg of ♂ holotype. 5, right anterior telopod of ♂ holotype, anterior aspect 6, right posterior telopod of ♂ holotype, anterior aspect. 7, right vulva of ♀ paratype.

laterobasally with a small knob. Apex mediodistally with an area with minute tubercles. Tibiotarsus curving distad. Posterior telopods (fig. 6) with syncoxite narrow and strongly elongate; the coxal horns curving caudad and proximad a little, their apex deeply split into two acuminate prongs. Femur broad at base and laterally with a small setiferous area; the process tapering towards apex, the apex itself with some fine tubercles. Tibiotarsus strongly laterally inflated, beyond inflation at caudal side an excavation to accomodate the femoral process. Apex of tibiotarsus broadly truncate, its lateroposterior margin finely crenulate.

Female: Pygidium in profile widely arched, without excavation; tegument rather densely minutely punctulate. In place of the tubercle of the male there is a low and somewhat shiny medial swelling. The premarginal furrow percurrent along caudal margin. No apparent setation. Hypoproct rather widely parabolically rounded, without stridulatory mechanism. Vulvae (fig. 7) with lateral basal sclerite larger than the medial one; distal sclerite short, broadly obliquely truncate.

SPIROBOLELLIDAE

Although the new species presently described does not come from the mainland, it may be worthwhile to review the Australian species of the family, partly to explain the generic status of the new species, partly to facilitate further studies.

Eleven species have been described, and these have been referred to not less than seven genera:

Spirobolellus Pocock, 1894: 398. Type-species: *Spirobolellus chrysodirus* Pocock, 1894.

Strophobolus Chamberlin, 1920a: 37. Type-species: *Strophobolus immigrans* Chamberlin, 1920.

Queenslandobolus Verhoeff, 1924: 100. Type-species: *Queenslandobolus sjoestedti* Verhoeff, 1924.
Attemsobolus Verhoeff, 1924: 100. Type-species: *Attemsobolus bivittatus* Verhoeff, 1924.
Poratobolus Verhoeff, 1924: 100. Type-species: *Poratobolus mjoebergi* Verhoef, 1924.
Walesbolus Verhoeff, 1928: 105. Type-species: *Walesbolus lobatus* Verhoeff, 1928.
Howeobolus Verhoeff, 1928: 105. Type-species: *Howeobolus insularum* Verhoeff, 1928.

With regard to the recognition of genera there is a considerable confusion in literature. Obviously this is caused by the fact that the male characters of the Sumatran type-species of *Spirobolellus* are unknown, and that there is no consensus among authors on which characters are to be regarded as of generic importance. Some writers, e.g. Verhoeff, adopted a narrow concept, others adhered to a broad concept for the genus *Spirobolellus*. The different treatment by various authors has resulted in a very unbalanced taxonomy of the family. In his studies on Australian millipedes Verhoeff has introduced five monotypical genera. Hoffman (1980), in his classification, reduced this number by synonymizing *Queenslandobolus* and *Poratobolus* with *Spirobolellus*. But he still maintained *Attemsobolus, Howeobolus, Strophobolus* and *Walesbolus*.

For the time being even this approach may be too cautious. After scrutiny of the existing specific descriptions, and particularly the structure of the gonopods, I guess that in the Australian fauna only *Walesbolus* deserves a separate status, being distinguishable from the other Australian spirobolellids by the location of the pores on the metasomites. Other generic categories should be disregarded until the discovery of additional species may throw more light on the existence of particular distinguishable groups of species.

Under the present circumstances, using the genus *Spirobolellus* as a temporary accomodation for most species, I come to the following checklist.

Checklist of Australian Spirobolellidae

Spirobolellus:
S. bivittatus (Verhoeff, 1924): 101 (Qld.: Blackal Range).
S. immigrans (Chamberlin, 1920a): 38 (U.S.A., imported from Australia).
S. insularum (Verhoeff, 1928): 107 (Lord Howe Island).
S. mjoebergi (Verhoeff, 1924): 104 (Qld.: Christmas Creek).
S. sjoestedti Verhoeff, 1924): 102 (Qld.: Colosseum).

Walesbolus:
W. lobatus Verhoeff, 1928: 106 (N.S.W.: Port Stephens, Fingal's Bay).
W. rainbowi (Brölemann, 1913): 119 (N.S.W.: Mount Sassafras).

Male characters unknown, but possibly referable to *Spirobolellus*:
Strophobolus australianus Chamberlin, 1920a: 38 (N.S.W.: Sutherland).
Attemsobolus dorsovittatus Verhoeff, 1928: 109 (N.S.W.: Upper Richmond River).
Spirobolellus kurandanus Chamberlin, 1920b: 214 (Qld.: Kuranda).
Spirobolus lugubris L. Koch, 1867: 887 (N.S.W.: Wollongong).

The following key to the Australian spirobolellids has been compiled from the dispersed descriptions, and henceforth has a limited value.

Key to the Australian Spirobolellidae

1. Unicolourous species: black with at most the margins of the somites pale. Diameter of somites up to 4.5 mm. (here also *lugubris*). 2
-. Longitudinally banded species: orange to yellowish stripes separated by black stripes. Diameter up to 2.8 mm. (here also *australianus, kurandanus* and *dorsovittatus*)..... 5
2. Pores situated near the transverse sulcus. 3
-. Pores situated on metasomites remote from the transverse sulcus..... 4
3. Sternite of anterior gonopods distally with a small median incision. Eyes with 19-27 ocelli. 44-47 somites. ..... *rainbowi*
-. Sternite of anterior gonopods without median incision. Eyes with 17 ocelli. 48-51 somites. ..... *lobatus*

4. Sternite of anterior gonopods with a small median incision. Anal somite without tail. .... *sjoestedti*
-. Sternite of anterior gonopods with apex triangular, without median incision. Anal somite with a small tail. ..... *mjoebergi*
5. Sternite of anterior gonopods subtrapezoidal in outline, the distal margin widely rounded. Eyes with 23 ocelli. ..... *bivittatus*
-. Sternite of anterior gonopods subtriangular, the apex narrowly rounded. 6
6. Eyes with 35 ocelli. Sometimes with a distinct transverse suture. ..... *immigrans*
-. Eyes with 20 ocelli. Suture of somites almost obliterated ..... *insularum*

Spirobolellus philiporum n.sp.

Type locality.

Philip Island, Dykes, Flax soil cores, 1.IV.1984.

Material.

♂ holotype, from the above locality. 1 ♂ paratype, Philip Island, Dykes, Flax leaf litter, 28.III.1984. 1 ♀, 1 juv ♂ paratypes, Philip Island, above Stool, Moo-oo leaf litter, 1.IV.1984. All leg. P. Greenslade (N.I.C.C.).

Description.

Colour: In general blackish brown above with two rather broad dirty yellowish white longitudinal bands running from the hind margin of the collum to the front margin of the anal somite. Head blackish brown from the frontal region upward, for a large part rather indistinctly areolated with slightly paler colour. Labrum and clypeus up the the lower margin of the antennal sockets dirty pale yellowish. Antennae dirty whitish. Collum dark, with at the caudal margin a pair of vaguely demarcated light spots extending cephalad over one third of length of collum. Subsequent somites also dark with two light paramedian bands: the median dark stripe almost as wide as one quarter of body width, the yellow and median stripes together just over two thirds of body width. Lower half of somites mostly pale, the pale colour on metasomites extending along the caudal margin to about level of pores. Dark parts of somites vaguely areolated. Legs pale dirty yellowish. Anal somite dark above, with vague indications of two paramedian light spots at anterior margin. Paraprocts paler brownish black, hypoproct pale brownish.

Number of somites and width: ♂ holotype 37(-4) somites, 1.6. mm; ♂ 38(-4) somites, 1.6 mm; ♀ 38(-4) somites, 2.1 mm; juv. ♂ 31(-5) somites, 1.4 mm.

Head and antennae: Labrum moderately deeply and widely emarginate. Clypeus abruptly and rather strongly impressed towards labrum. 4 + 4 supralabral foveolae rather indistinct, the four medial ones located on the slant part of the clypeus. Headplate shiny, without apparent sculpture. Clypeus and frons up to between the antennal sockets with a fine median furrow. Antennal sockets widely separated, scarcely closer to each other than the eyes. Eyes subtriangular, pointing towards median line, separated by about two times the largest diameter of one eye. Each eye consisting of 22 to 24 moderately convex ocelli arranged, from collum to antennal sockets, in four transverse rows (holotype left 9,7,5,3, right 7,7,5.3; ♀ paratype both sides 8,7,6,3). Postantennal groove moderately deep, not sharply demarcated towards eyes. Upper part of vertex with a fine median furrow. Antennae (fig. 8) short, clavate. Second antennomere as long as 0.3 times distance between antennal sockets. Pubescence of antennomeres sparse to moderate. Four apical sensory cones.

Collum: Anterior border faintly convex at eye level, straight or faintly concave downward. Lateral border almost evenly and moderately widely rounded. Caudal border widely convex. A sharply impressed premarginal furrow runs from mid-eye level down to the caudal end of the lateral rounding. Surface of collum shiny, with minute and rather inconspicuous cellular structure. Sides mostly perpendicular, only faintly incurved below.

Somites: Prosomites somewhat dullish, the covered part with a pronounced, transversely elongate, cellular structure, but without transverse lines. Pro- and metasomites separated by a wide and well-impressed sulcus. Dorsally in the impression, and extending onto the adjacent part of the prosomites, a series of relatively

large circular to horseshoe-shaped markings. Below pore level these markings become lines curving obliquely upward on prosomites. These lines become longer and more oblique lower down the sides, extending ventrally also onto the metasomites. Metasomites smooth, shiny, with same cellular structure as collum. Pores minute, present from the 6th somite onwards, situated just in front of the middle of the metasomites. Sometimes a very weak, short, longitudinal stria running from pore caudad. Metasomites with longitudinal striae on lower side, in anterior somites up to about, but not above, the pore level. Ventral side of metasomites rather deeply emarginate behind sternite.

Sternite and legs: Sternites with roughly eight irregular transverse striae. Legs rather short and stout, sparsely setiferous. Coxa in 3rd pair (fig. 9) mediodistally produced into a rounded lobe. In 4th pair the lobe is shorter, more widely rounded, whereas in the 5th pair it is almost obsolete. No tarsal pads.

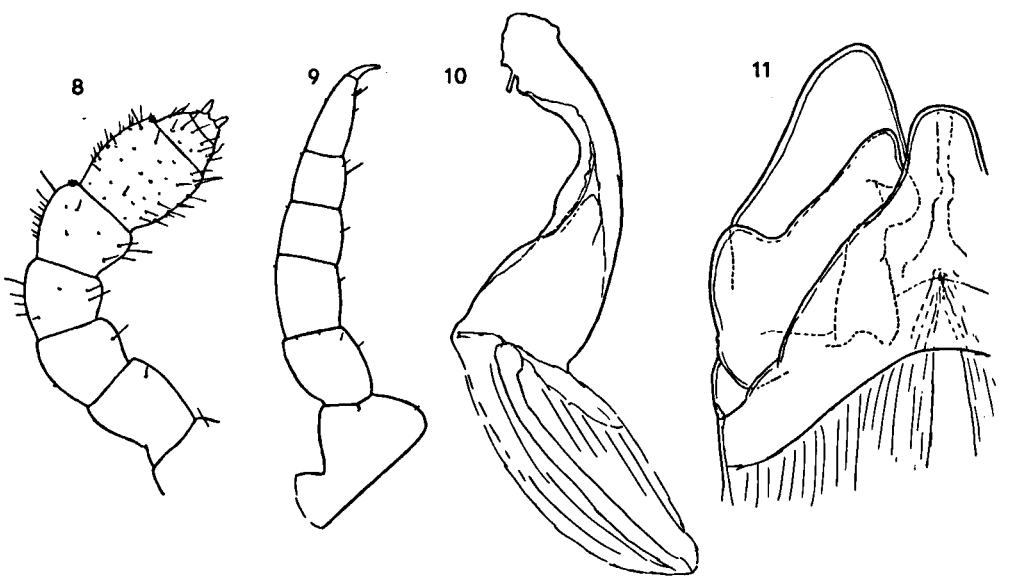
Anal somite: smooth, shiny, with same cellular structure as collum and metasomites. Epiproctal lappet rather short, in profile only slightly raised above paraprocts, broad triangular from above, with sides straight, apical angle about 120°, rather narrowly rounded. Paraprocts globose, almost evenly rounded in profile. Medial margin rounded, without premarginal furrow or marginal ridge. Hypoproct broadly triangular, with sides straight, apical angle wide (about 135°) and widely rounded.

Gonopods: Anterior pair (fig. 11) with sternite triangular, its sides weakly convex, but emarginate towards the apex, which is moderately widely rounded. Sternite exceeding coxite in length; the latter distally rather narrowly rounded, on its medial side a rounded lobe. Telopodite projecting well distad of sternite, distally rather narrowly rounded; its medial side halfway with two rounded lobes. Posterior gonopods (fig. 10) evenly curved, narrowing towards middle of length, and widening again towards apex. Distal end rounded, lamellar, with a tiny lappet pointing proximad.

Female: Lacking the modifications of the anterior legs.

Remarks.

Although it is evident from the development of the gonopods that the specimens are adult, the number of apodous terminal somites indicates that the material examined is not entirely



Figs. 8-11. *Spirobolellus philiporum* n.sp., ♂ holotype. 8, antenna. 9, 3rd leg. 10, posterior gonopod. 11, right anterior gonopod, anterior aspect.

fullgrown, and the specimens had the potential of undergoing one or two additional moulds. As the studies on New Caledonian spirobolellids by Carl (1926) and Brölemann (1931) have shown the anterior gonopods in specimens which are not fullgrown may be somewhat different from those of fullgrown specimens. In New Caledonian species, for instance, it was shown that not fully developed anterior gonopods lack the laterodistal projection of the telopodite. Therefore, the characters of the anterior gonopods of the described specimens may be atypical for fullgrown specimens of *philoporum*

In the key to the Australian spirobolellids given above, this species comes next to *Spirobolellus immigrans* (Chamberlin) and *S. insularum* (Verhoeff). From the first it is distinct by a considerable lower number of ocelli, from the second by the presence of a distinct transverse sulcus of the somites. From the first mentioned species *philiporum* is distinct also in the lower number of somites and smaller size. From the second it is at least different in the structure of the posterior gonopods as a comparison of the pertinent drawings will reveal.

The new species differs from the two known New Zealand spirobolellids, *Spirobolellus drymophilus* Chamberlin, 1920b, and *Desmocricellus reischeki* Attems, 1953, in its small size and different colour pattern, from the latter species also by the structure of the gonopods.

Miss Greenslade (pers. comm.) kindly gave me the following additional information with regard to the Philip Island localities. Dykes: grid reference 065, 09; (Cliff) above Stool = bottom of Red Road Valley: grid reference 076, 082.5. Plant names: Moo-oo = *Cyperus haematodes* (Cyperaceae); Flax = *Phormium tenax* (Liliaceae).

HAPLODESMIDAE

The presence of this family in the Australian fauna was discussed in two previous papers (Jeekel, 1984, 1985). In the meantime, Dr. P. M. Johns, Christchurch, New Zealand (pers. comm.) assured me that in his opinion *Asphalidesmus* Silvestri is a member of the family Dalodesmidae rather than a haplodesmid. This leaves only *Atopodesmus* Chamberlin and *Agathodesmus* Silvestri as potential Australian Haplodesmidae. Unfortunately, the male characters of these two genera are unknown, so that as yet no certainty can be obtained.

Anyhow, the occurrence of Haplodesmidae in Australia can be confirmed now by the discovery among diplopods collected in Queensland (Jeekel, 1981) of a species of *Atopogonus* Carl, a genus hitherto formally recorded only from New Caledonia.

Atopogonus Carl

? *Inodesmus* Cook, 1896: 25.
Atopogonus Carl, 1926: 386; Attems, 1940: 477.
Inodesmus; Loomis, 1969: 144.

Remarks.

This genus and its type-species, *A. baccatus* Carl, 1926, were well characterized by Carl. Yet, the validity of the generic name is threatened by at least three older names: *Agathodesmus* and *Atopodesmus*, mentioned earlier, and *Inodesmus* Cook.

The latter genus was based by Cook on a species found in a Jamaican cave, *Inodesmus jamaicensis* Cook, 1896. In 1969, Loomis thought to have rediscovered this enigmatic species among freshly collected material and gave an extension of the fragmentary original description. However, the only apparent indication that Loomis's material belonged to the species described by Cook, was the fact that it was obtained in caves in Jamaica. There is no evidence that Loomis compared his material with Cook's types, which so far have not been traced in the collection at Washington, where they are supposed to have been deposited.

Anyhow, it is quite obvious that *Inodesmus jamaicensis* sensu Loomis, 1969, is a species congeneric with *Atopogonus baccatus* and the presently described new species. However, this does not imply that *Atopogonus* is a synonym of *Inodesmus*.

With the discovery of a species of *Atopogonus* in what seems to be a perfectly natural habitat in Queensland it becomes likely that the genus in essence is a continental Australian taxon. Prob-

ably the occurrence of the other species on widely remote islands is at least partly the result of anthropochorus dispersal.

Atopogonus bucculentus n.sp.

Type locality.

Queensland, Eungella National Park, 5 km W of Netherdale, along Broken Hill track in rainforest, under logs, 18.X.1980.

Material.

♂ holotype; 1 ♂, 1 juv. ♂ paratypes, from the above locality (Z.M.A.). C. A. W. & A. M.Jeekel leg.

Description.

Colour: dirty whitish, with a slightly brownish tinge.

Width: ♂: 0.8 mm, juv. ♂ (19 somites): 0.75 mm.

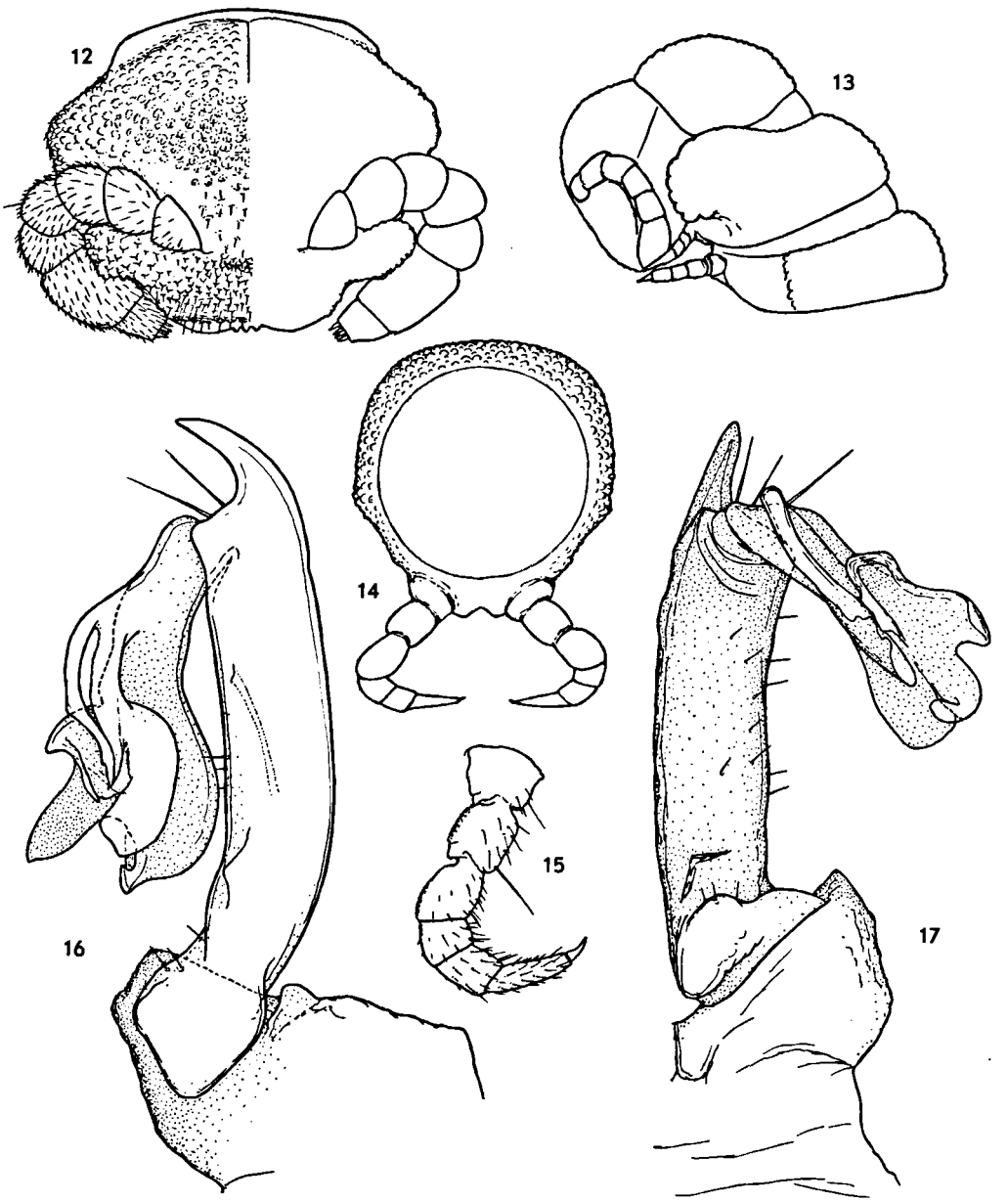
Head and antennae: (fig. 12) Labral emargination of moderate width and depth. Clypeus moderately convex, moderately impressed towards labrum; its lateral margin widely convex, with at caudal end a rather deep incision. Headplate densely granular; the granules subconical to flattened, mostly setiferous, with setae of moderate length to short. Antennal sockets separated by about 1.8 times the length of the 2nd antennomere. Postantennal groove deep to accommodate part of the antennae, and sharply demarcated; the wall in front ("cheeks") prominent. Frons demarcated from clypeus by a distinct transverse impression. Vertex transversely widely and about evenly convex, longitudinally rather strongly convex, especially in anterior part. Vertigial sulcus distinctly impressed, present only in caudal part of vertex. Antennae short, more or less moniliform; the antennomores bell-shaped, the 6th the longest and thickest, barrel-shaped. Pubescence moderate, dense in distal antennomeres.

Collum: Anterior border faintly convex, almost straight; caudal border straight in middle, widely convex towards the lateral sides, which are narrowly rounded. Surface densely covered by shortly setiferous granules, longitudinally about evenly convex, transversely with a relatively deep median furrowlike impression, each lateral half rather strongly convex dorsally, weakly convex and steeply declivous laterally.

Somites: (figs. 13-14) Constriction rather strong, especially towards metatergites. Waist of moderate width, weakly demarcated from prosomites, but sharply so from metasomites, dullish, but without sculpture. Prosomites with conspicuous cellular structure. Metatergites sharply declivous towards waist, longitudinally rather convex, a little declivous towards caudal margin. Surface transversely flattened a little in the middle, up to about 4th somite particularly flat medially and strongly convex laterally. Surface densely covered with minutely setiferous granules of unequal size. No transverse furrow. Sides with minute granules, in second half of body smooth. Pleural keels represented by a series of larger granules forming a crenulate crest up to about the 10th somite.

Paranota: (figs. 13-14) of 2nd somite rather strongly developed, perpendicular, thrust forward so as to partly cover sides of collum and head; the margin weakly scalloped. Paranota of subsequent somites absent, indicated only by a longitudinal series of somewhat larger tubercles, situated distinctly below the middle of the lateral surface of the somites. Poreformula normal: 5, 7, 9-10, 12-13, 15-19. Pores minute, situated in the middle of a small smooth area just below the middle of lateral surface of the metasomites, and about halfway of length of metasomites.

Sternites and legs: Sternites of middle somites about 4.3 times longer than wide between the anterior coxae. Cross impressions well developed, the median impression a deep furrow, the transverse impression slightly less deep than the longitudinal. Setation moderate, unapparent. Sternite of 6th somite modified: the posterior coxal sockets more widely separated than in other somites, and the sternite in between rather deeply concave. Sternite of 7th somite with gonopod aperture large, transversely oval, anteriorly not extending on prosomite, surrounded by a rim, which laterally is rather strongly raised and thick. Sternite of 2nd pair of legs narrow as in subsequent somites, medially furrowed. Legs (fig. 15) short and rather stout, the prefemur and femur both dorsally rather convex and finely granular.



Figs. 12-17. *Atopogonus bucculentus* n.sp. 12, head of ♂ paratype, dorsoanterior aspect (sculpture of left side omitted). 13, head and first two somites of ♂ holotype, left side, lateral aspect (sculpture omitted). 14, 7th somite of ♂ paratype, caudal aspect. 15, leg of 7th somite of ♂ paratype. 16, right gonopod of ♂ paratype, medial aspect. 17, left gonopod of ♂ paratype, caudal aspect.

Podomeres short, the tarsus exceeding the other podomeres in length. Setation moderate.

Anal somite: Dorsal side in profile rather strongly convex, with epiproct steeply declivous. Epiproct short, broad at base, sides strongly converging, apex narrowly truncate. Anal somite densely covered with setiferous granules. Paraprocts weakly convex, each only with two setiferous granules, medially without distinct marginal rim. Hypoproct short, broadly

triangular to widely rounded, two minute setiferous granules projecting weakly caudad of margin.

Gonopods: (figs. 16-17) Coxae medially solidly connected, broad, short, hairless, rather strongly narrowing towards apex. Base of prefemur attached to medial side of coxal apex, in lateral aspect concealed by coxa. Prefemur long, rather stout, widely and almost evenly curving caudad, bearing on laterocaudal side some short and unapparent setae. No coxal horn and no trace of spermal channel. Prefemur near basis with a low triangular lobe on caudal side, and more distad with the aperture of what appears to be a glandular tube. Apex of prefemur anteriorly produced in a long triangular process pointing distad and a little caudad; laterad of this process two or three long setae. Acropodite very complicated, attached to laterocaudal side of apex of prefemur, bent abruptly proximad. Acropodite an extremely complicated lamellar structure, apparently consisting of two processes: a smaller slender process on caudal side, ending in an irregular very thin lamella, and the larger part of the acropodite which appears to consist essentially of a four-lobate, complicated thin lamella.

Remarks.

The new species agrees with the type of the genus in the number of somites. It differs in its considerably smaller size: the female of *A. baccatus* has a width of 2 mm. Judging from Carl's drawing the paranota of his species are a little more prominent.

When comparing the drawing of the gonopods it must be realized that Carl reversed the legends of his figs. 26 and 27: in reality fig. 26 gives a caudal aspect, and fig. 27 an anterior aspect. The gonopods of *A. baccatus* differ rather conspicuously from those of *A. bucculentus*, in particular when we compare Carl's fig. 28 (obviously representing a laterocaudal aspect instead of the alleged lateral aspect) with fig. 17 of the present paper. The shape of the acropodite is quite different, it is apparently more widely split into the two main branches, and the apex of a number of lobes is finely fringed.

Inodesmus jamaicensis Cook, as redescribed by Loomis, is distinct by a sexually different number of somites: 19 in the male, 20 in the female. Loomis describes the enlarged paranota of the 2nd somite, but does not mention the scalloped margin. *I. jamaicensis* is described as having scattered long erect setae, arising from distinct shining subconic tubercles. The telopodite of the gonopods seems to agree, more than *A. baccatus*, with *A. bucculentus*, in particular when one realizes that a slightly different position of the gonopod may change the outline of the complicated acropodite considerably.

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