

## SCOLOPENDROMORPH AND GEOPHILOMORPH CENTIPEDES FROM THE KRAKATAU ISLANDS AND ADJACENT REGIONS, INDONESIA

BY J. G. E. LEWIS

Taunton School, Taunton, Somerset, TA2 6AD, UK

### Abstract

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Nine species of scolopendromorph and three species of geophilomorph centipedes are recorded from the Krakatau Islands and adjacent regions. None is new to science but some are poorly known and are here described in detail.

### Introduction

The Krakatau Islands lie midway between Java and Sumatra in the Sunda Strait. All life on them was destroyed by an enormous volcanic eruption in 1883. The history of the archipelago, its present environment and details of previous surveys were given by Thornton and Rosengren (1988). There are currently four islands, Rakata, Sertung, Panyang and Anak Krakatau.

The first reference to the centipedes of the Krakatau Islands was made by Jacobson (1909). According to him the main island teemed with *Scolopendra subspinipes* which reached a length of 15 cm. Jacobson recorded a second unidentified scolopendrid from Rakata and an unidentified phosphorescent species of "Geophilidae" was seen on the summit of the island.

Dammerman (1948) reported on the collections of 1921 and 1933. On Rakata *Scolopendra subspinipes* was still fairly plentiful in 1921 but by 1933 it had noticeably decreased in numbers. A slender species of the "Geophilidae" with a depressed rectangular head was found on Krakatau and Sertung, known to Dammerman as Verlaten Island, in 1921 and 1933. Dammerman sent material to R.V. Chamberlin but (Dammerman, 1948) received no information from him about the collection. Chamberlin had, in fact, published in 1944, listing *S. subspinipes* from Krakatau and *Mecistocephalus krakatauensis* Chamberlin from Krakatau and Batavia, Java. Chamberlin deposited the material in the Academy of Natural Sciences of Philadelphia.

Details are here presented of centipedes collected from the Krakatau Islands, Sumatra and Java by the La Trobe University Zoological Expeditions in 1984 and 1985 and from Krakatau by Dr Seiki Yamana of Kagoshima University in 1982. Of the 38 specimens in the collec-

tion, 21 are from the Krakatau Islands, 15 from Liwa, Sumatra and two from Gunung Payung, Java. Twelve species were collected, five from the Krakatau Islands.

The collections contained no species new to science but some are poorly known so detailed descriptions and illustrations of the material are given where appropriate.

The specimens were kindly loaned by Professor I.W.B. Thornton and have been lodged in the Museum Zoologicum Bogoriense, Bogor, Indonesia (MZB) and the Museum of Victoria, Melbourne, Australia (NMV).

Full synonymies have been given for the Geophilomorpha by Attems (1929) and for the Scolopendromorpha by Attems (1930a). The colour of specimens was described using the names given in Kornerup and Wanscher's (1967) Methuen handbook of colour.

### Order Scolopendromorpha

#### Scolopendridae

#### Scolopendrinae

#### *Scolopendra subspinipes subspinipes* Leach

*Scolopendra subspinipes* Leach, 1815: 383.

*Scolopendra subspinipes subspinipes*.—Attems, 1930a: 29–30, fig. 43.

*Material examined.* Rakata, Zwarte Hoek, Krakatau Islands (6°09'S, 105°25'E), 15 Sep 1984, in tent, MZB (1 specimen, 35 mm). Rakata, Owl Bay, Krakatau Islands, 22 Sep 1984, NMV (1 specimen, 22 mm). Rakata, summit, 777 m, Krakatau Islands, 18–19 Sep 1984, NMV (1 specimen, 38 mm). Sertung, Forest 1, Krakatau Islands, (6°05'S, 105°23'E) 18 Aug 1985, sweep, NMV (1 specimen, 23 mm). Rakata, Krakatau Islands, 18 Jul 1982, S. Yamane (1 specimen, 22 mm). Sertung, Krakatau Islands, 5 Jul 1982, from a tunnel made on tree trunk by termites, S. Yamane, NMV (1

specimen, 42 mm). Sertung, Krakatau Islands, 6 Jul 1982, forest, S. Yamane, MZB (1 specimen, 21 mm). Rakata, Krakatau Islands, 15–18 Jun 1982, 10–50 m, MZB (2 specimens, 115 mm and 118 mm).

*Diagnosis.* Tergite 1 without ring suture. Tergites with complete paramedian sutures. Prefemur of leg 20 without dorsal spines. Coxopleural process cone-like, usually with 2 end spines. End leg prefemur 2.5 times as long as wide, with 1–3 (4) not exceptionally long spines ventrally. End leg without tarsal spine.

*Remarks.* The specimens are typical. The species is widely distributed in the Indo-Australian region and the West Indies. It was collected on Rakata by both Jacobson (1909) and Dammerman (1948).

### Otostigma Porat

#### Otostigma (O.) metallicus Haase

Figures 1–3

*Otostigma metallicum* Haase, 1887: 70.

*Otostigma metallicus*.—Kraepelin, 1903: 121, fig. 58.

*Otostigma metallicus*.—Attems, 1930a: 140.

*Material examined.* Forest, Liwa, Sumatra, 16 Sep 1984, MZB and NMV (4 specimens: 1, 20 mm; 2, 18 mm; 3, 12 mm and 4, in Hoyer's mountant, 10 mm).

*Diagnosis.* Antennae with 17–21 segments, basal 2–2 $\frac{3}{4}$  glabrous. Tergites marginate at least from 17, without keels or spines. Sternites without tubercles or spines. Each forcipular coxosternal tooth plate with 3–4 teeth. Coxopleural process without dorsal spine. Leg 21 prefemur with corner spine. A few anterior legs with 2 tarsal spines.

*Description.* Colour of preserved specimens: greyish brown. Antennae: with 17–21 segments, the basal 2 $\frac{1}{2}$ –2 $\frac{3}{4}$  segments glabrous dorsally. Tergites: with complete paramedian sutures from 5 or 6 and marginate from 6 or 7 in specimens 1 and 2, (not determined in specimens 3 and 4). Laterally corrugate from 6 or 7 in specimens 1 and 2, lacking spines and keels but with slight median ridge. Tergite 21 without median longitudinal suture but posterior median depression present. Sternites: with very short paramedian sutures in anterior segments, extending to two-thirds of length of sternite posteriorly (Fig. 1). Sternite 21 with sides converging posteriorly and posterior border concave or straight (Fig. 2). Forcipular coxosternal tooth plates: each with 3 main teeth, the first and third

often with small subsidiary tooth (Fig. 3). End legs: coxopleural process short (Fig. 2) with 2 end and 1 lateral spine, without dorsal spine. Telopodites present in specimens 2 and 4 only. Prefemur with 4 ventrolateral, 2 ventromedial, 1 or 2 medial, 1 or 2 dorsomedial spines and a corner spine. Trunk legs: first with or without prefemoral spine but with 1 tibial and 2 tarsal spines. Legs 2 or 3 to 19 or 20 with 1 tarsal spine.

*Remarks.* This species has been recorded from Sri Lanka, Bali and Flores, Sumatra, Sangir Island (N. Moluccas) and Sarawak. The material closely resembles the population described from Sarawak by Lewis (1982) but differs in that only the first one or two pairs of legs bear two tarsal spines (the first three or four pairs do in the Sarawak material) and that the twenty-first and sometimes the twentieth pairs lack tarsal spines. They are present in Sarawak material. Sarawak specimens have very short sternal paramedian sutures. In the type specimen (coll. no. 105, Sangereiland, Indische Archipel) in the Rijksmuseum, Leiden, Netherlands which I have examined, only the basal two antennal segments are glabrous, sternal paramedian sutures are absent and the first three or four pairs of legs have two tarsal spines. Such differences are to be expected in a widely distributed species.

#### Otostigma (O.) oweni Pocock

Figures 4–7

*Otostigma oweni* Pocock, 1892: 319.

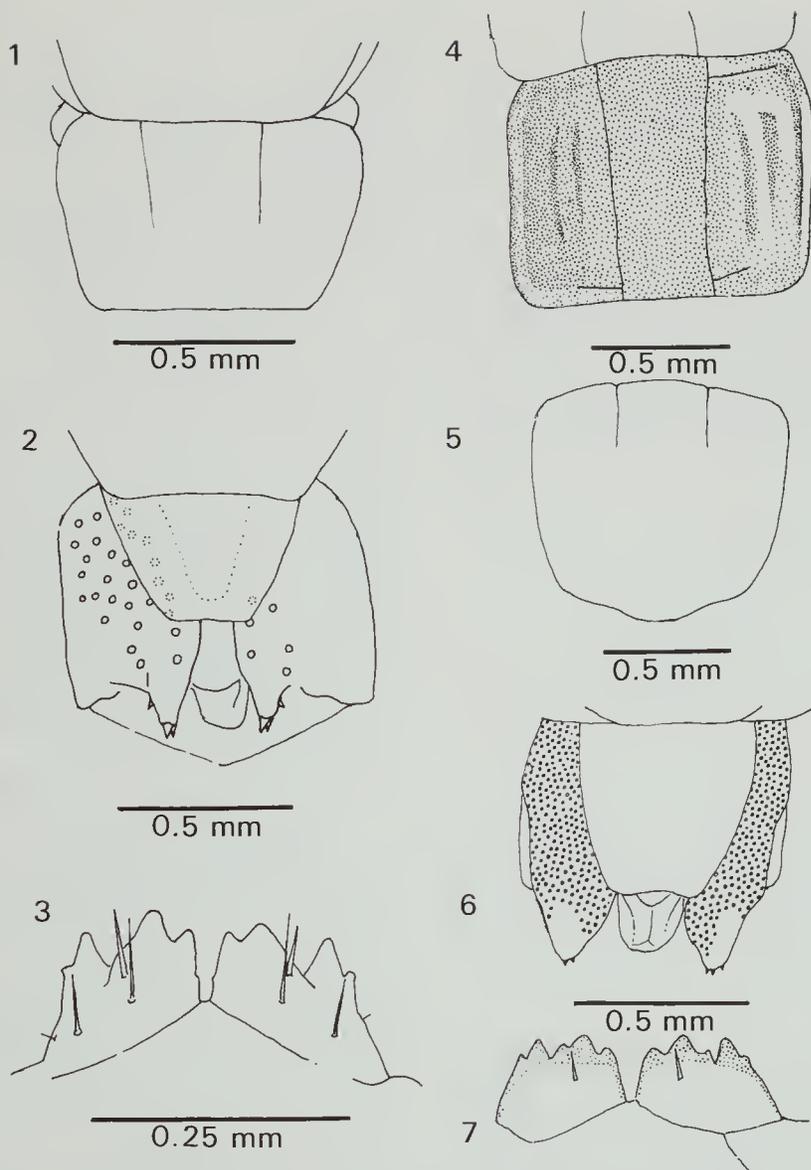
*Otostigma oweni*.—Kraepelin, 1903: 116.

*Otostigma oweni*.—Attems, 1930a: 152.

*Material examined.* Disturbed forest, Liwa, Sumatra, 5–7 Sep 1984, pitfalls, MZB (1 specimen, 27.5 mm).

*Diagnosis.* Antennae with 18–23 segments, basal 2 $\frac{2}{3}$  glabrous. Tergites marginate at least from 17, without keels or spines. Sternites without tubercles or spines. Each coxosternal tooth plate with 5 teeth. Coxopleural process with 2–3 end spines, 0–1 dorsal spines. Legs 1–18 with 2 tarsal spines.

*Description.* Colour of preserved specimen: bluish grey. Antennae with 22–23 segments, the basal 2 $\frac{2}{3}$  glabrous dorsally. Tergites: with paramedian sutures complete from 6, marginate from 5, lateral corrugations present from 5, and without ridges or spines (Fig. 4). Tergite 21, with posterior median depression occupying about a third of its length. Sternites: with anterior para-



Figures 1-7. *Otostigmus metallicus* and *Otostigmus oweni*.

*Otostigmus metallicus*. Fig. 1, sternite 17, specimen 2. Fig. 2, ventral view of terminal segments, specimen 4. Fig. 3, forcipular coxosternal tooth plates, specimen 4.

*Otostigmus oweni*. Fig. 4, tergite 12. Fig. 5, sternite 16. Fig. 6, ventral view of terminal segments. Fig. 7, forcipular coxosternal tooth plates.

median sutures occupying about one-quarter to one-third their length, without pits or tubercles (Fig. 5). Sternite 21 with sides converging posteriorly, with slightly concave posterior margin (Fig. 6). Forcipule: median prefemoral process with 2 very low teeth or knobs. Each coxosternal

tooth plate with 5 teeth consisting of inner group of 3 and outer group of 2. (Fig. 7). End legs: coxopleural process conical and rounded with 2-3 end spines, 0-1 lateral spines and 0-1 dorsal spines. Telopodites wanting. Trunk legs: first with 1 tarsal spine, legs 2 and 3 wanting, legs 4-

18 with 1 tibial and 2 tarsal spines, 19 and 20 with no tibial and 1 tarsal spine.

*Remarks.* This species was hitherto known from a single specimen from Owens Island, Mergui Archipelago in the Andaman Sea off the east coast of the most southerly part of Burma. The Sumatra specimen is very similar to the type specimen in The Natural History Museum, London (1891.10.15.8) which I have examined, but there are some minor inaccuracies in Pocock's description. He described *O. oweni* as having the basal three antennal segments glabrous, in fact the basal 2½ are, and as having four sharp prehensorial coxosternal teeth; a small fifth tooth is present. I have little doubt that Pocock's specimen and the Sumatra specimen are conspecific.

### *Otostigmus (O.) multidentis* Haase

Figures 8–10

*Otostigma multidentis* Haase, 1887: 75.

*Otostigmus multidentis*.—Kraepelin, 1903: 121, fig. 59.

*Otostigmus multidentis*.—Attems, 1930a: 141, fig. 172.

*Material examined.* Rakata, Krakatau Islands, Sep 1985, under logs, bark, litter, MZB (1 specimen, 34 mm).

*Diagnosis.* Antennae 20–22 segmented, basal 2¼–2½ glabrous. Tergites marginate at least from 17, without keels or spines. Sternites without tubercles or spines. Each coxosternal tooth plate with 6–10 teeth. Coxopleural process without dorsal spine. First 14–20 pairs of legs with 2 tarsal spines.

*Description.* Colour of preserved specimen: dark green. Antennae: incomplete, basal 2¼ segments glabrous dorsally. Tergites: with complete paramedian sutures from 6, weakly marginate from 14, lacking ridges or spines. Tergite 21 with a longitudinal median depression occupying posterior two-thirds of tergite. Sternites: with paramedian sutures occupying anterior one-third of anterior sternites and anterior half of posterior sternites, without pits or tubercles. Sternite 21 with sides converging posteriorly, posterior border slightly concave (Fig. 8). Foreciple: coxosternal toothplates each with 6 teeth (Fig. 9), median prefemoral process with 3 low teeth (Fig. 10). End legs: coxopleural process of moderate length with elongated ventral poreless strip (Fig. 8), with 2 end spines and 1 lateral spine, dorsal spines lacking. Telopodites missing. Trunk legs: many missing. 1 tibial spine and 2

tarsal spines present from leg 2 to at least 18. Leg 20 lacks tarsal spines.

*Remarks.* *Otostigmus multidentis* is a common species recorded from Java, Sumatra, Celebes, Sarawak, New Guinea, Mentaway Island and Tawarin Island. The species is similar to *O. oweni* from which it differs in having more forcipular coxopleural teeth and the characteristics of the coxopleural process of segment 21.

### *Otostigmus (O.) spinosus* Porat

Figures 11–14

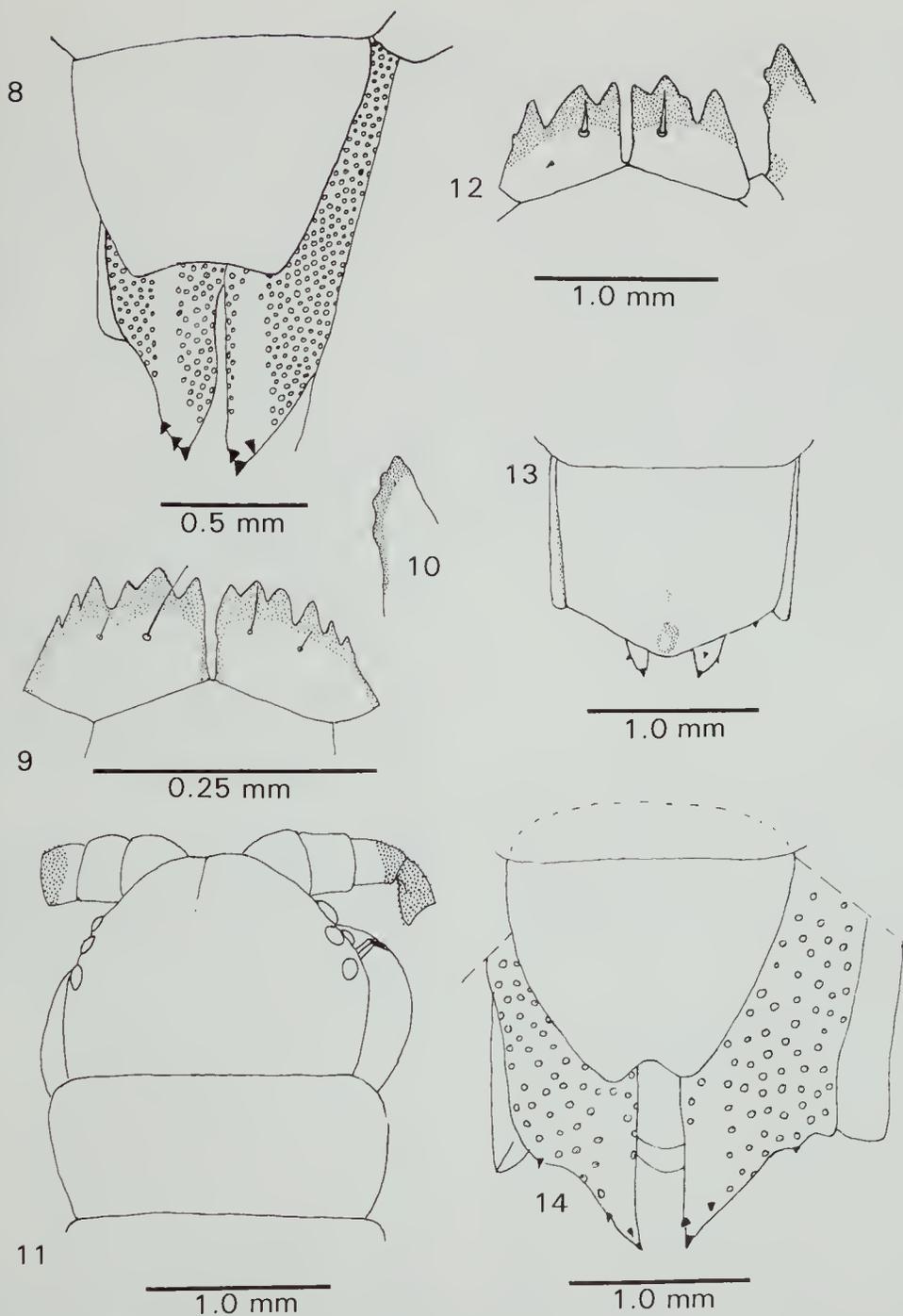
*Otostigmus spinosus* Porat, 1876: 22.

*Otostigmus spinosus*.—Attems, 1930a: 152, fig. 182.

*Material examined.* Panjang central, Krakatau Islands, 17 Aug 1985, MZB (1 specimen, 30 mm). Panjang, Krakatau Islands, litter, secondary rainforest, 14 Sep 1984, NMV (3 specimens, 26 mm, 26 mm, 24 mm). Rakata, Owl Bay, Krakatau Islands, 25 Aug 1985, NMV (1 specimen, 45 mm). Rakata, Krakatau Islands, under logs, bark, litter, Aug 1985, NMV (1 specimen, 29 mm). Rakata Camp, Krakatau Islands, 18 Jul 1982, S. Yamane, MZB (1 specimen, 22 mm). 1 km S of Panjang, Sumatra, under rocks, 3 Sep 1984, MZB (1 specimen, 38 mm).

*Diagnosis.* Antennae with 17–21 segments, basal 2½–3 glabrous. Tergites marginate at least from 17, without keels, with or without spines. Sternites without tubercles or spines, with short paramedian sutures. Coxopleural process with dorsal spine. Prefemur of leg 20 with dorsal end spine.

*Description.* Colour of preserved specimens: violet grey or turquoise grey with greyish blue legs. Antennae: with 17–21 segments, with basal 2½–2¾ glabrous dorsally (Fig. 11). Tergites: with complete paramedian sutures from 5 or 6, margination beginning from 9 to 15, without keels, spines or lateral furrows. Tergite 21 as in Fig. 13. Sternites without spines, tubercles or pits, except for the specimen from Owl Bay, Rakata which has 3 faint depressions on sternites 15 and 16, with short anterior paramedian sutures on anterior sternites. Sternite 21 with sides converging posteriorly, posterior border concave (Fig. 14). Foreciple: coxosternal toothplates: each with 4 or 5 teeth (Fig. 12). End legs: coxopleural process slender, (whether it be termed long or short is a very subjective matter), with 2 or 3 end spines, 1 or 2 lateral spines and 1 or 2 dorsal spines but never more than 5 spines in all. Lateral spines very near to or far from end spines. Terminal prefemur with ventrolateral



Figures 8–14. *Otostigma multidens* and *Otostigma spinosus*.

*Otostigma multidens*. Fig. 8, ventral view of terminal segments. Fig. 9, forcipular coxosternal toothplates. Fig. 10, left forcipular prefemoral process.

*Otostigma spinosus*, 24 mm specimen, Panjang Is. Fig. 11, dorsal view of head capsule. Fig. 12, forcipular coxosternal toothplates and left prefemoral process. Fig. 13, tergite 21. Fig. 14, ventral view of terminal segments.

row of 5, or, in one case 4 spines, ventromedially with 2, 3 or 4, medially with 3, 4 or 5 and dorsomedially with 1 or 2 plus corner spine. Telopodites missing in some specimens. Trunk legs: leg 1 with or without prefemoral spine, legs 1 or 1 and 2 or 1, 2 and 3 with tibial spine. Legs 1 to 3, 4 or 5 with 2 tarsal spines, succeeding legs to 18, 19, 20 or 21 with 1 tarsal spine, remainder without. Prefemur of leg 20 with typical distal dorsal spine, this not seen in 2 specimens from Panjang which lacked twentieth pair of legs.

*Remarks.* *Otostigmus spinosus* is a common species which has been recorded from Burma, Java, Sumatra, Borneo and New Guinea. The Krakatau specimens lack tergal spines and lateral tergal corrugations. Lewis (1982) suggested that tergal spines, present in some specimens from Sarawak were a female secondary sexual character. The figures for the number of prefemoral spines are similar to those given by Attems (1930a) but slightly more than those given by Lewis (1982) for Sarawak specimens.

#### *Otostigmus* (*O.*) *politus* Karsch

Figures 15–20

*Otostigma politum* Karsch, 1881: 62.

*Otostigmus politus*.—Attems, 1930a: 149–151.

*Material examined.* Sertung Forest II, Krakatau Islands, near spring (6°05'S, 105°23'E), 9 Aug 1985, MZB (1 specimen, 40 mm).

*Diagnosis.* Antennae with 17–19 segments, basal 3 glabrous. Tergites marginate, at least from 17, without keels or spines. Sternites without tubercles or spines, paramedian sutures almost complete. Tarsal spines present.

*Description.* Colour of preserved specimen: dark blue, head brownish, legs light blue. Antennae: damaged, basal 3 segments virtually glabrous dorsally (Fig. 15). Tergites: with paramedian sutures complete from 5, marginate from 8. Last tergite with slight median terminal depression (Fig. 17). Sternites: with short paramedian sutures (Fig. 18) on anterior segments, increasing in length in midbody region, with median pit or depression from tergites 5–18 and small pits marking termination of paramedian sutures (Fig. 19). Forcipules: each coxosternal toothplate with 3 teeth (Fig. 16) prefemoral process virtually without teeth. End legs: coxopleural complex (Fig. 20) with 2 end spines, 2 or 3 lateral spines and 2 or 3 dorsal spines. Telopodites wanting. Trunk legs: leg 1 with 1 tibial spine, 1 and 2 with 2 tarsal spines, 3–19 with 1 tarsal spine.

*Remarks.* The species is known from China, Burma, Sumatra, New Guinea, East Sumba, New Britain and Australia. The Krakatau specimen has fewer coxosternal teeth and more coxopleural spines than described in Attem's (1930a) monograph but is clearly referable to *O. politus*. A number of subspecies of *O. politus* have been described but their status is unclear. The problem requires a detailed study.

#### *Otostiomus* sp.

Figures 21–25

*Material examined.* Forest, Liwa, Sumatra, 1 Sep 1984, MZB (1 specimen, 12 mm).

*Description.* Antennae: with 17 segments, basal 2½ glabrous (Fig. 21). Tergites: with paramedian sutures complete from 5, pronounced longitudinal corrugations from 5 and median ridge but no spines or lateral ridges. Only tergite 21 marginate (Fig. 24) but this may be a juvenile character. Sternites: with complete paramedian sutures and anterior and posterior pits (Fig. 23), without spines or tubercles. Forcipules: coxopleural tooth plates each with 4 teeth (Fig. 22), prefemoral process with 1 tooth. End legs: coxopleural complex short (Fig. 25), with 2 end spines but no lateral or dorsal spines. Prefemur with 3 ventrolateral, 2 ventromedial, 2 medial, 2 dorsomedial and a corner spine. Trunk legs: 1–19 with 1 tarsal spine, 20 and 21 without.

*Remarks.* This specimen is immature and I am unable to assign it to a species but it is described here since there is little information about *Otostiomus*. The specimen resembles *O. metallicus* but has complete sternal paramedian sutures and ventral pits. It is unlikely that these are juvenile characters.

#### *Rhysida* H. C. Wood

##### *Rhysida immarginata* (Porat)

Figures 26–30

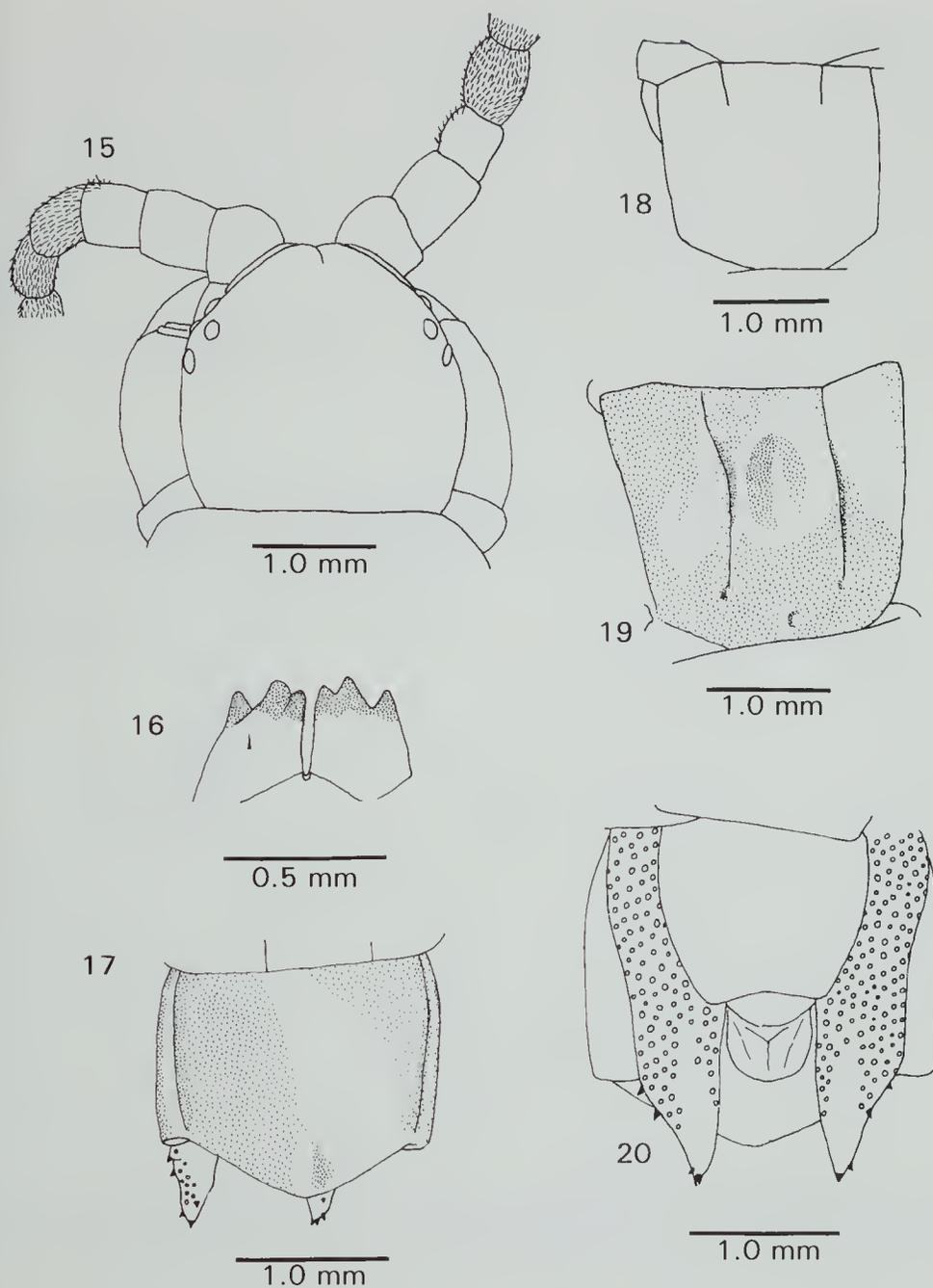
*Branchiostoma immarginata* Porat, 1876: 24.

*Rhysida nuda immarginata*.—Attems, 1930a: 190.

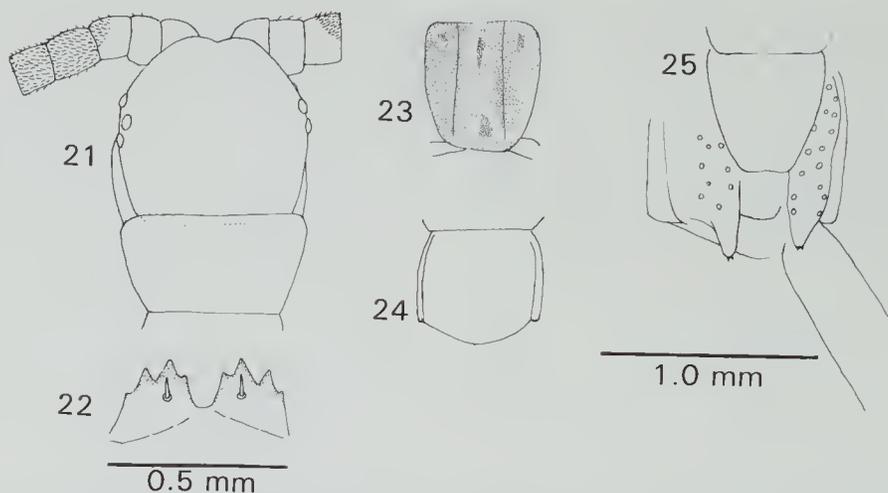
*Rhysida immarginata*.—L.E. Koch, 1986: 212.

*Material examined.* Sertung, Krakatau Islands, 16 Sep 1984, A. Saim, MZB (specimen 1, 44 mm). Sertung Forest, Krakatau Islands, (6°05'S, 105°23'E), 18 Sep 1986, under log, Sertung Spring Valley, NMV (specimen 2, 47 mm, lacks end legs).

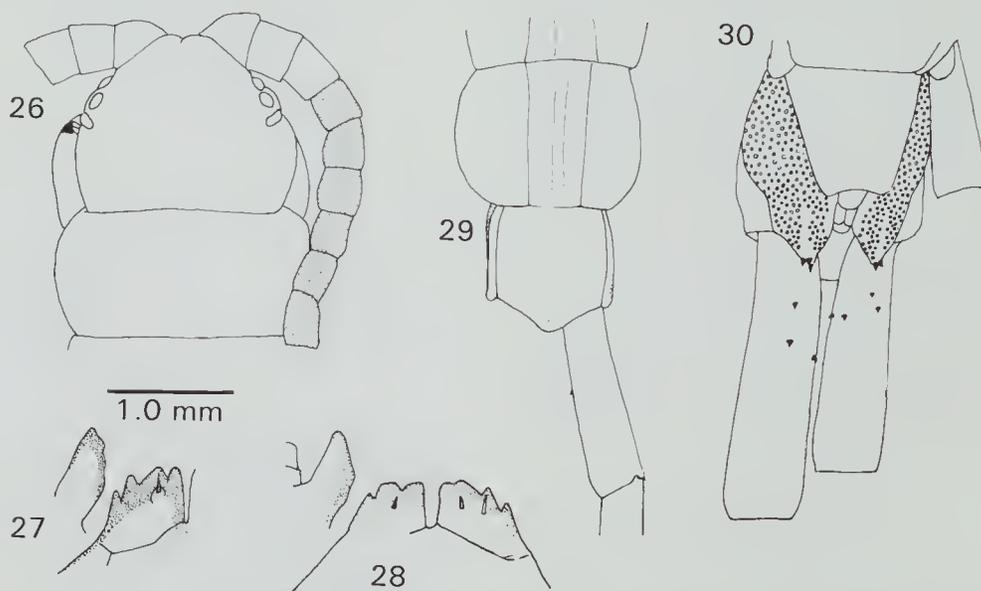
*Diagnosis.* Most tergites with complete paramedian sutures, only tergite 21 marginate. First 15–18 pairs of legs with 2 tarsal spines. Coxopleural process with 3 end spines.



Figures 15–20. *Otostigmus politus*. Fig. 15, dorsal view of head capsule and basal antennal segments. Fig. 16, forcipular coxosternal tooth plates. Fig. 17, tergite 21. Fig. 18, sternite 3. Fig. 19, sternite 9. Fig. 20, ventral view of terminal segments.



Figures 21–25. *Orostigmus* sp. Fig. 21, dorsal view of head capsule and tergite 1. Fig. 22, forcipular coxosternal tooth plates. Fig. 23, sternite 11. Fig. 24, tergite 21. Fig. 25, ventral view of terminal segments.



Figures 26–30. *Rhysida immarginata*. Fig. 26, dorsal view of head capsule and tergite 1 specimen 1. Fig. 27, forcipular coxosternal toothplate and prefemoral process specimen 1. Fig. 28, forcipular coxopleural tooth plates and prefemoral process specimen 2. Fig. 29, tergites 20 and 21 and prefemur of right terminal leg. Fig. 30, ventral view of terminal segments and prefemora of the terminal legs.

*Description.* Colour of preserved specimens: dark blue or dark green with yellowish white legs. Antennae with 19 segments, basal 3 glabrous. Head capsule as in Fig. 26. Forcípules: coxopleural tooth plates each with 3 or 4 teeth (Figs 27, 28), median prefemoral process with 2

slight teeth. Tergites: with complete paramedian sutures from 4 or 6, without lateral corrugations, spines or keels. Only tergite 21 marginate (Fig. 29), lacking median suture and virtually without median posterior depression. Sternites: with short anterior paramedian sutures occupying

quarter of their length, without pits or tubercles. Last sternite with sides converging posteriorly, with slightly concave posterior margin (Fig. 30). End legs: coxopleural process stout, with 3–2 end spines and 0–1 lateral spines in specimen 1 and 3–3 end spines in specimen 2. Dorsal spines absent. Right prefemur of first specimen (Fig. 30) with 2 ventromedial and 1 medial spine, left (which is regenerated) with 3 ventrolateral, 1 ventromedial and 1 medial. Without dorso-medial spines or corner spines. Trunk legs: leg 1 with 0 or 1 prefemoral spines and 1 or 2 tarsal spines. tibial spines present on legs 1 and 2. Legs 2–18 (specimen 1) or 1–15 (specimen 2) with 2 tarsal spines, 1 tarsal spine on 19 or on 16–18, 19 with or without, 20 and 21 without tarsal spines.

*Remarks.* The species has been recorded from Sudan, India, Burma, Brunei, Philippines, Venezuela and Guatemala. It is possibly even more widely distributed as Koch (1985) suggested that the name *Rhysida immarginata* may be applicable to some or even most of the non-Australian forms previously recorded as *R. nuda* (Newport).

### Cryptopodidae

#### Cryptops Leach

#### Cryptops sp.

*Material examined.* Gunung Pajung, summit, 12–13 Sep 1984, beating (1 specimen, 9.5 mm, in Hoyer's Mountant).

*Description.* Colour: yellowish grey, specimen may be newly moulted. Antennae: of 17 segments. Head capsule: without sutures. Clypeus: with 5 rows of 2, 1, 2, 2 and 8 setae, last immediately in front of the labrum. Labral side pieces not notched. Second maxillae: hooked apical claw of telopodite with rounded lobe at its base. Forcípules: anterior margin of coxosternum virtually straight with 3 setae on each side, fourth large seta on each side just behind anterior margin. Tergites: first overlying posterior border of head capsule, lacking ring or other sutures. Trunk tergites without paramedian or other sutures. Tergite 21 semicircular, without median longitudinal suture, overlapped by pleural region. Sternites without paramedian sutures but with median longitudinal sulcus, not seen after prepared in Hoyer's Mountant. No transverse suture but weak transverse skeletal thickening between coxae. Sternite 21 posteriorly rounded, wider than long (1.5:1). End legs: coxae each with 10 gland pores in anterior two-thirds

of coxa. About 6 setae in pore-field. Telopodites missing. Trunk legs: tarsi of legs 1–19 not divided, those of leg 20 clearly so.

*Remarks.* In Attems' (1930a) key the specimen runs down to the region of *C. modiglianii* Silvestri from Sumatra, *C. audax* Attems from South Africa and *C. patagonicus* Meinert from Argentina. It appears to be related to the poorly described *C. stabilis* Chamberlin from Gunung Malabar, Java but as the specimen lacks the terminal legs it cannot at this stage be assigned to a definite species. Two further specimens of *Cryptops* in poor condition were collected in litter in forest at Liwa, Sumatra, on 6 Sep 1984.

### Order Geophilomorpha

#### Mecistocephalidae

#### Mecistocephalus Newport

#### *Mecistocephalus* (M.) *verrucosus* Verhoeff

#### Figures 31–41

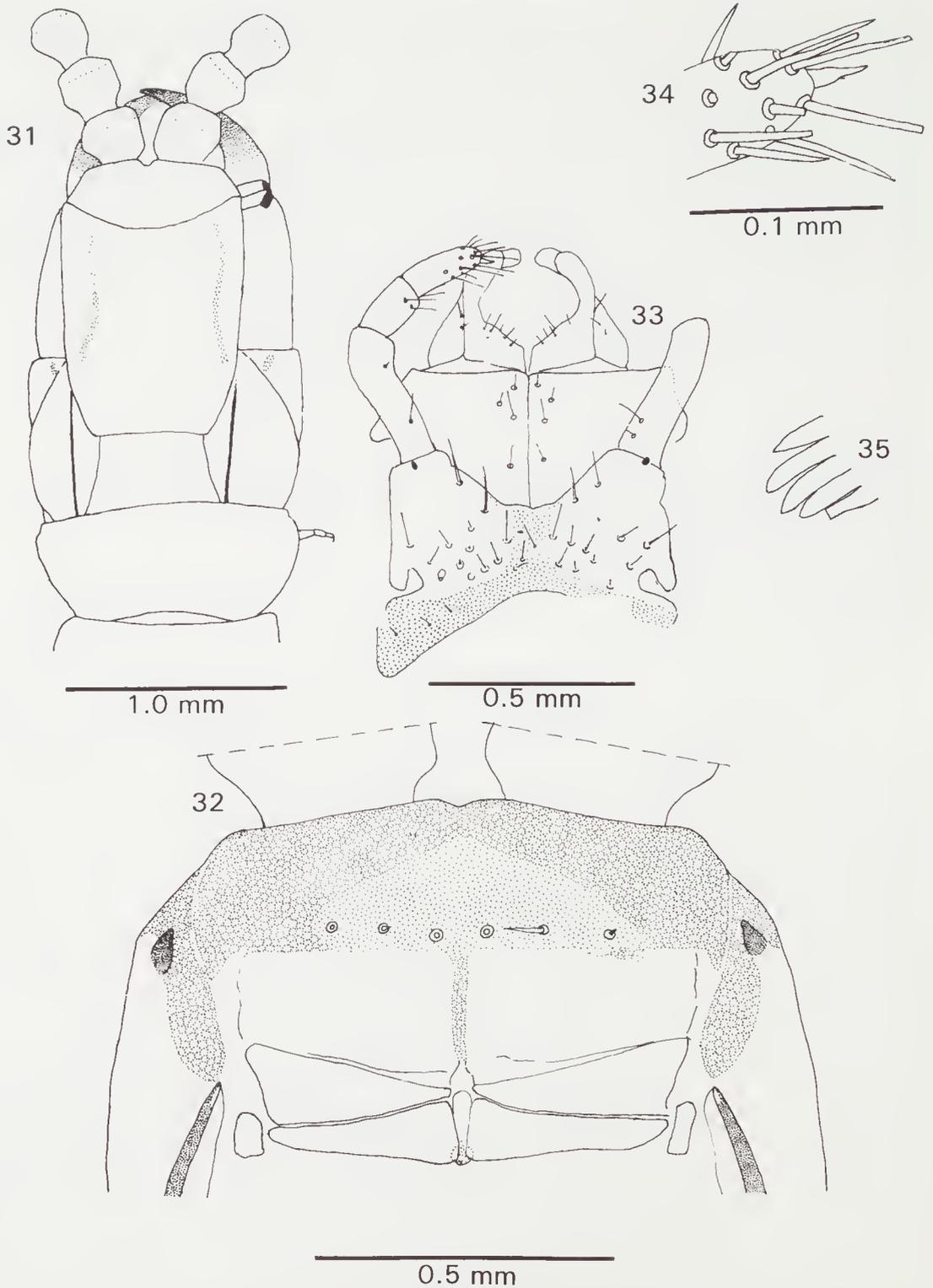
*Mecistocephalus verrucosus* Verhoeff, 1937: 231, figs 32–33.

*Mecistocephalus* (*Mecistocephalus*) *verrucosus*.—Attems, 1947: 101.

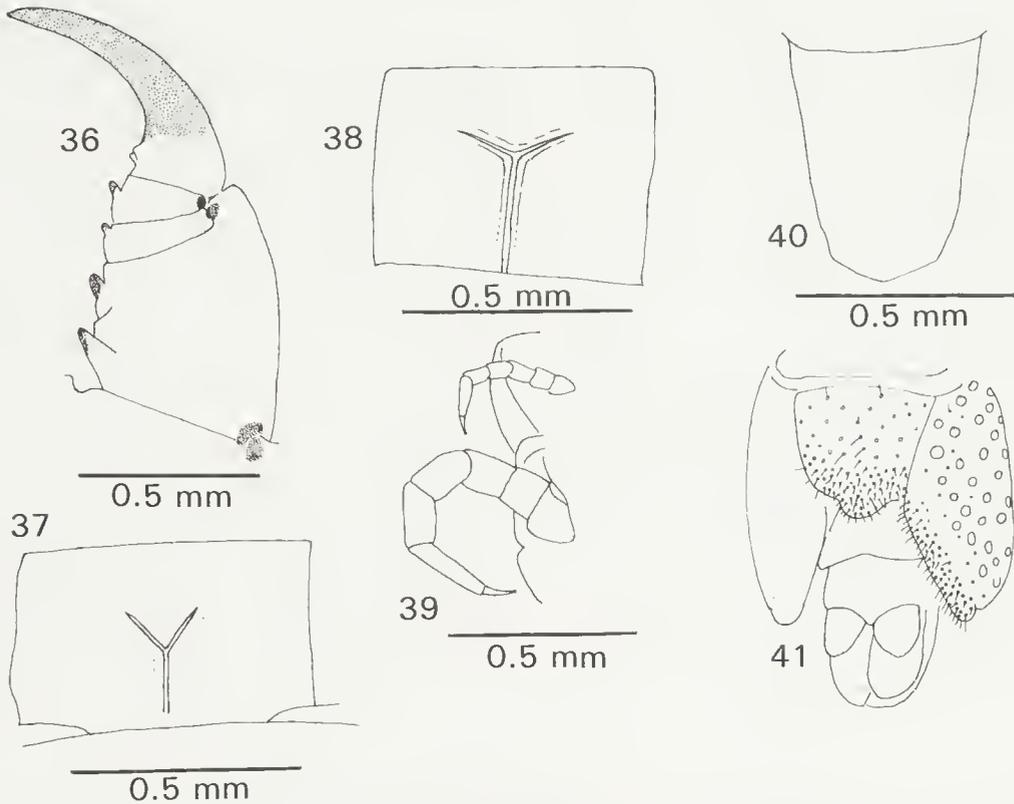
*Material examined.* Disturbed forest, Liwa, Sumatra, 5 Sep 1984, litter, MZB (specimen 1, female, 31 mm, head removed, 1st and 2nd maxillae in Hoyer's Mountant). Forest, Liwa, Sumatra, 6 Sep 1984, litter, NMV (specimen 2, female, 33 mm, head removed, 1st and 2nd maxillae in Hoyer's Mountant). Liwa, Sumatra, as above, (specimen 3, adolescents 1, about 10 mm).

*Diagnosis.* 49 pairs of legs. Anterior sternites with obtusely angled Y-shaped median thickenings. Arcolate region of clypeus without smooth areas. Midpart of labrum very narrow, mandibular tooth plates with teeth of approximately equal size. Posterior half of head pleurite setose. Leg 1 about half length of leg 2.

*Description of specimens 1 and 2.* Colour: Head capsule and forcípular segment brown red, trunk dull yellow, without pigment flecks. Pairs of legs: 49. Antennae: with sparse large setae on basal segments increasing in number and becoming shorter on segments 8 and 9, densely setose from segment 10. Segments relatively short, sharply incurved at their bases. Head capsule: ratio of length to width 1.6:1 in specimen 1, 1.52:1 in specimen 2. Widest in anterior third, tapering slightly posteriorly (Fig. 31). Frontal suture well marked. Clypeal region: paraclypeal sutures complete. Head pleurite arcolate anterior to buccal spiculum (tooth), posterior region



Figures 31–35. *Mecistocephalus verrucosus* specimen 1. Fig. 31, dorsal view of head capsule and tergite 1. Fig. 32, clypeus and labrum. Fig. 33, first and second maxillae. Fig. 34, claw of second maxilla. Fig. 35, a mandibular tooth plate.



Figures 36–41. *Mecistocephalus verrucosus*. Fig. 36, right forcipule, specimen 2. Fig. 37, sternite 2, specimen 1. Fig. 38, sternite 7, specimen 1. Fig. 39, left legs 1 and 2, specimen 2. Fig. 40, last tergite specimen 2. Fig. 41, ventral view of terminal segments, specimen 1.

smooth (Fig. 32). Buccal spiculum pointed and incurved. Anterior part of head pleurite (bucca) glabrous, posterior half with strong setae. Clypeus: anterior areolate region (fore-clypeus) with broad based triangle of more finely areolate cuticle adjacent to hind clypeus (clypeal plagula). Setae 3+3. Anterior border of hind clypeus straight. Ratio of fore- to hind-clypeus about 1:1. Labrum: midpiece not projecting beyond side pieces but overlapped by them in its posterior half (Fig. 32). Posterior border of side pieces smooth and not notched. First maxilla: coxosternum with prominent midlongitudinal suture (Fig. 33) with anterior margin more or less straight, without blunt projection at outer corner or curved suture behind corner. Median lobes of more or less equal length, each inner lobe with 5 or 6 setae, each outer with 3. Coxosternum with 4+4 setae. Second maxilla: without median suture, median areolate strip with 3 or 5 setae (Fig. 33). Terminal claw of telopodite spine-like with minute lateral spicule (Fig. 34). Metameric pores lateral. Mandible: obscured in preparation of specimen 1, partly visible in specimen 2; with about 6 tooth plates each with 6–12 more or less

equal-sized teeth (Fig. 35); general appearance much as in *M. insularis*. Forcípules: coxosternum (prosternum) without chitin lines; with 2 prominent median anterior teeth in specimen 1, these obscured in specimen 2. Telopodite reaching in front of head (Fig. 31); basal article with 2 large teeth, femuroid and tibioid each with large tooth; claw not serrate and without noticeable basal tooth (Fig. 36). Basal plate: without median groove, setae not set in pale areas of cuticle. Tergites: with thin longitudinal strips of areolate cuticle from 2 in position normally occupied by paramedian sutures. Sternites: with Y-shaped median thickenings (rhachides) from 2 to 31 or 32. Obtuse: 80° on tergite 2 (Fig. 37), 130° on tergite 7 (Fig. 38); simple on tergites 32 and 33 in specimen 1. First pair of legs: about half length of second pair (Fig. 39). Last leg-bearing segment: tergite with sides converging posteriorly (Fig. 40) with hind border more or less rounded. Ratio of length to width 1.61:1. Sternite with converging sides and strongly setose semicircular bulge on posterior border but not divided into anterior and posterior regions (Fig. 41). Ventromedial edge of coxopleu-

ron raised, swollen and densely setose. Coxal pores large and evenly distributed. Female gonopods: 1-segmented and widely separated (Fig. 41). Anal gland pores apparently absent.

*Specimen 3:* (Presumed to be *M. verrucosus*.) Differs from other specimens in: Head capsule relatively shorter (ratio of length to width 1.38:1). Posterior region of head pleurite with relatively few setae. Triangular area of finely areolate cuticle not developed on fore-clypeus. Tergital paramedian sutures not visible. Ratio of length to width of tergite of last leg-bearing segment 0.95:1, sides barely converging, hind border obtusely angled. Sternite virtually triangular, less setose than in adult as are raised edges of coxopleura. Coxopleura without gland pores but well developed anal glands and pores present. (Clypeus, labrum and mouthparts not examined in detail.)

*Remarks.* Crabill's (1959) terminology has been adopted for a number of characters.

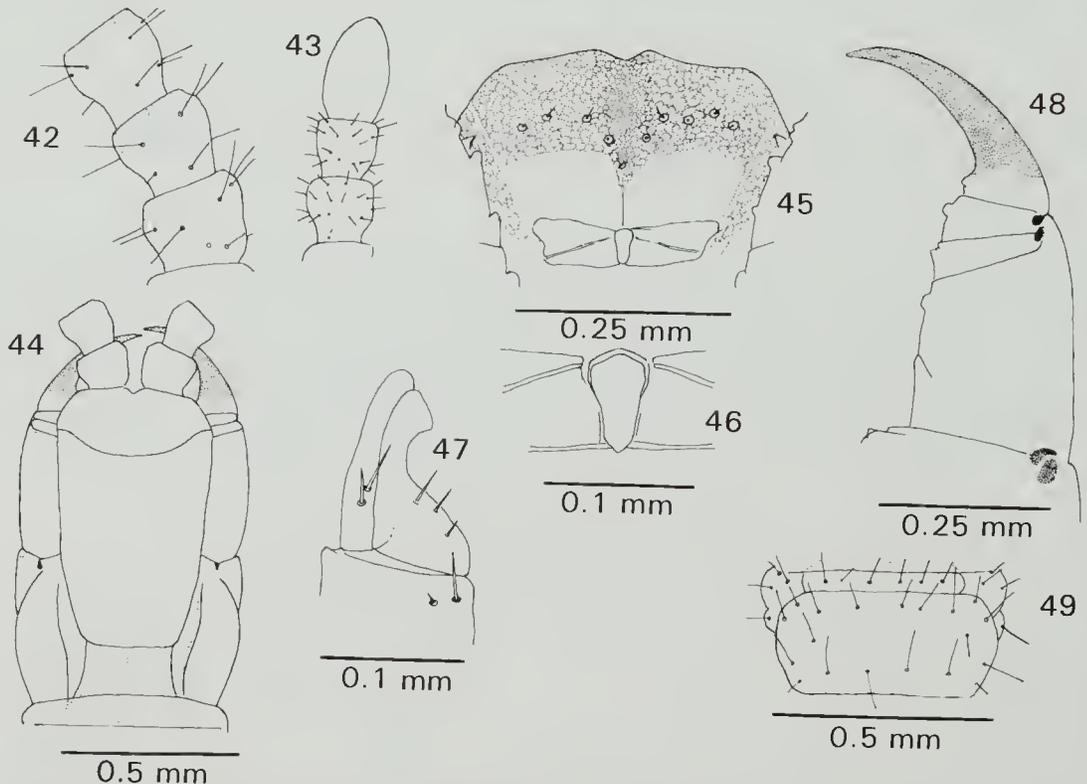
Verhoeff described *M. verrucosus* on the basis of a single male from Kuala Legap, Plus Valley, Perak, Malaya. He gave some characters in the description, others in a key to related species. He described the triangular fore-clypeus as having thick wart-like structure with two pairs of setae. I presume that this is the finely areolate region of the Liwa specimens. Although the description is brief, I have little doubt that the two females here described are of the same species.

#### *Mecistocephalus* (M.) cf. *conspicuus* Attems

*Mecistocephalus conspicuus* Attems, 1938: 327, figs 287-292.

*Material examined.* West Java, Gunung Payung, 300 m, 13 Sep 1984, MZB (1 specimen, immature female, 17 mm).

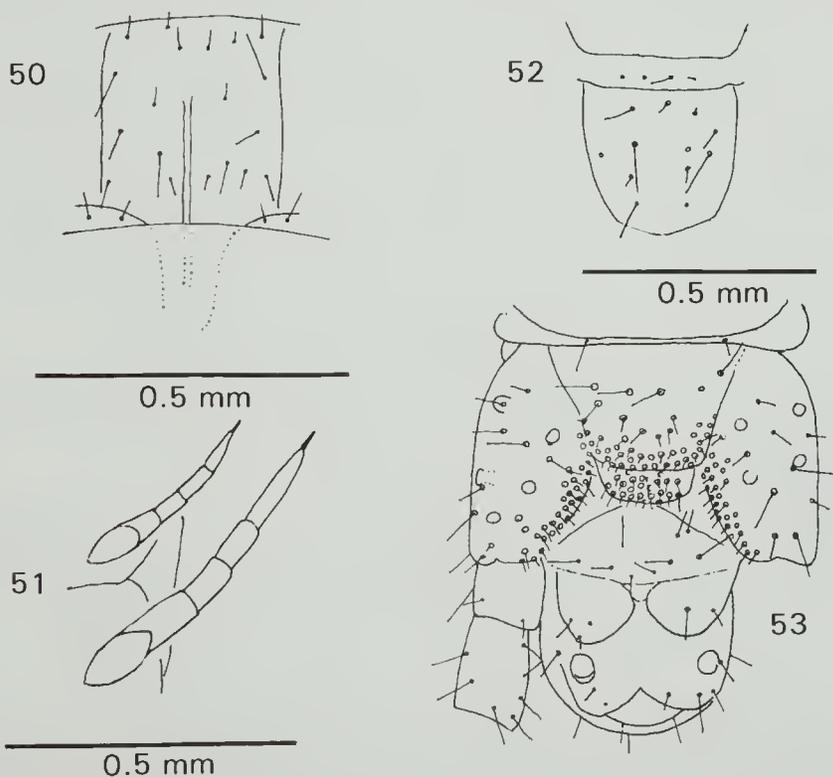
*Description.* Colour: head capsule and forcipular segment dark brown (tan), antennae yellowish brown, trunk greyish orange with brown pigment (fat body?) seen through cuticle on either



Figures 42-49. *Mecistocephalus* cf. *conspicuus*. Fig. 42, basal three segments of right antenna. Fig. 43, terminal three segments of right antenna, setae of terminal segment omitted. Fig. 44, dorsal view of head capsule. Fig. 45, clypeus and labrum. Fig. 46, midpiece of labrum. Fig. 47, left side of first maxilla. Fig. 48, right forcipule. Fig. 49, tergite 3.

side of midline. Pairs of legs: 49. Antennae: with sparse large setae on basal segments, increasing in number and becoming shorter and more dense distally (Figs 42, 43). Segments relatively short, not sharply incurved at bases. Head capsule: ratio of length to width 1.67:1. Widest in anterior eighth, tapering slightly posteriorly (Fig. 44). Frontal suture well marked. Clypeal region: paraclypeal sutures complete. Buccal spiculum pointed, inward pointing and not well sclerotised (Fig. 45). Clypeus: with anterior areolate region with longitudinal median strip of more finely areolate cuticle with 3+4 fine setae posterior to which is pair of posterior geminate setae (Fig. 45). Ratio of anteroposterior length of fore- to hind-clypeus about 1:1. Labrum: broad midpiece (Fig. 46) not projecting beyond side pieces but its posterior half overlapped by them. Posterior border of side pieces smooth, not notched. First maxilla: coxosternum with prominent midlongitudinal suture (Fig. 47) with anterior margin more or less straight, without blunt projection at outer corner or curved suture behind corner. Telopodites and median lobes of more or less equal length, latter crotchet-like.

Telopodites with 3 setae, median lobes with 1 or 2, coxosternum with 2+2 setae. Second maxilla: without median suture, median areolate strip with 2 or 3 setae. Metameric pores not observed. Mandible: not seen as this sole specimen was not dissected. Forcipules: coxosternum (prosternum) without chitin lines with 2 small nipple-like projections on midanterior border. Telopodite reaching in front of head (Fig. 44), basal article with anterior wart-like tooth, second posterior tooth barely present. Femuroid with small tooth, tibioid with large wart-like tooth (Fig. 48). Claw not serrate and with small basal tooth. Basal plate: without median groove: setae not set in pale areas of cuticle (Fig. 44). Tergites without paramedian sutures, with long setae (Fig. 49). Sternites with long setae and with simple median longitudinal sternal thickening (rhachides) from sternite 1 (obscured by tergite 2) to 21 (Fig. 50). First pair of legs: about half length of second pair (Fig. 51). Last leg-bearing segment: tergite as in Fig. 52 with hind border more or less rounded. Ratio of length to width 1.1:1. Sternite with converging sides and semi-circular bulge on posterior border which is



Figures 50–53. *Mecistocephalus* cf. *conspicuus*. Fig. 50, sternite 7. Fig. 51, right legs 1 and 2. Fig. 52, tergite of last leg-bearing segment. Fig. 53, ventral view of terminal segments.

strongly setose and divided into anterior and posterior regions (Fig. 53). Ventromedial edge of coxopleuron raised, swollen and densely setose. Coxal pores 4–5. Female gonopods: 1-segmented and widely separated (Fig. 53). Anal gland pores present.

*Remarks.* *M. conspicuus* was described from Poulo Dama Isles, Gulf of Vietnam. The immature specimen here described runs down to *M. parvidentatus* Verhoeff from Mauritius in Attems' (1947) key. It is, however, not this species which has a very narrow labral middle piece and much smaller buccal spicula. It appears to be similar to *M. monticolens* Chamberlin from Java, *M. rubriceps* H. C. Wood from Japan and the Lesser Sunda Islands, *M. modestus* Silvestri from West Sumba and West Flores, Java, New Guinea and Ethiopia, *M. apator* Chamberlin from Celebes and *M. mossambicus* Lawrence from Mozambique and Zimbabwe. I think it is most likely an immature *M. conspicuus*. These

species are poorly characterised and Attems (1930b) regarded *M. modestus* as an immature *M. rubriceps* and did not distinguish *M. modestus* from *M. apator* in his 1947 key.

### Schendylidae

#### Ballophilinae

#### *Ballophilus* Cook

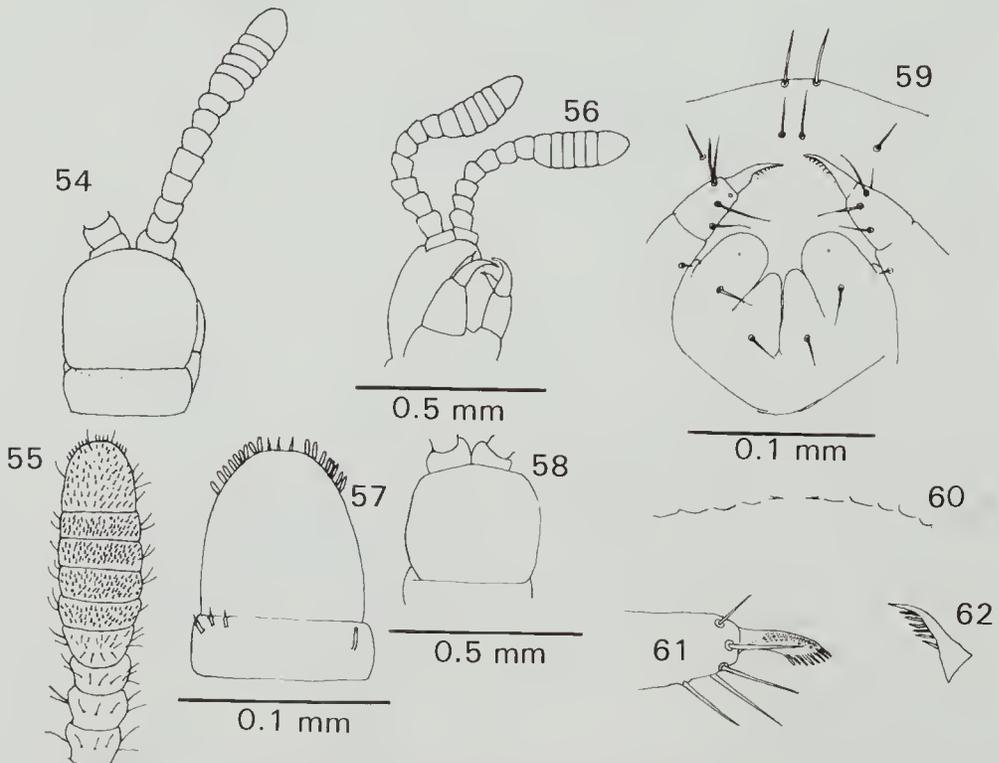
#### *Ballophilus pedadanus* Chamberlin

Figures 54–68

*Ballophilus pedadanus* Chamberlin, 1944: 5, fig. 1.

*Material examined.* Disturbed forest, Liwa, Sumatra, 5 Sep 1984, litter, NMV (specimen 1, male, 13 mm). Forest, Liwa, Sumatra, 6 Sep 1984, litter, MZB (specimen 2, male, 14 mm and specimen 3, female, 12 mm).

*Diagnosis.* 47–51 pairs of legs. Last antennal segment conically narrowed. Claw of second max-

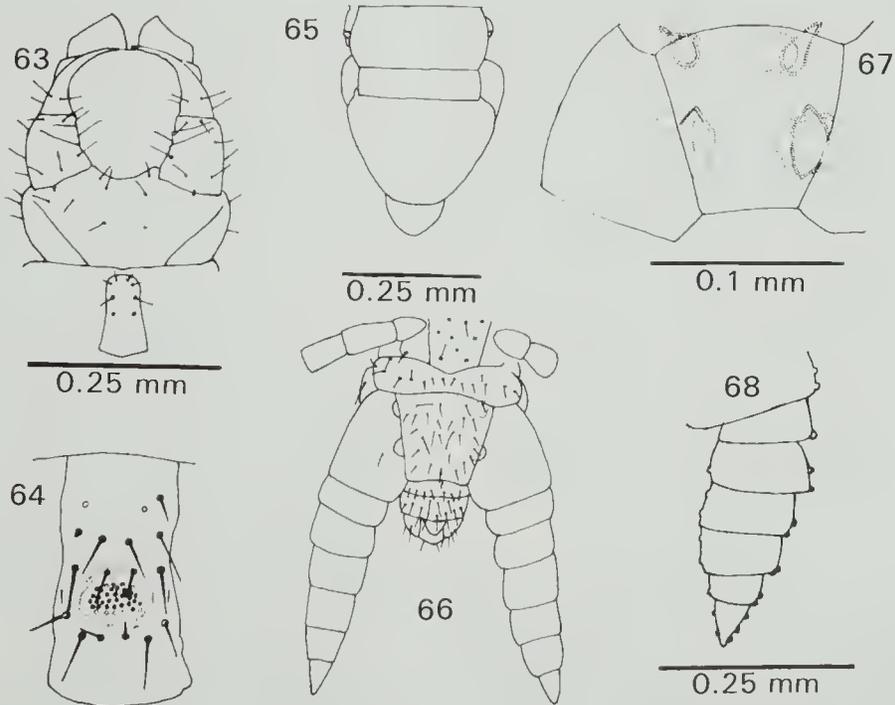


Figures 54–62. *Ballophilus pedadanus*. Fig. 54, head and forcipular tergite specimen 2. Fig. 55, ventral view of distal 9 antennal segments, specimen 2. Fig. 56, ventrolateral view of head, specimen 2. Fig. 57, dorsal view of segments 13 and 14 of right antenna, specimen 2. Fig. 58, dorsal view of head capsule, specimen 1. Fig. 59, clypeus and parts of first and second maxillae, specimen 2. Fig. 60, labrum, specimen 2. Fig. 61, part of terminal segment and claw of second maxillary telopodite, specimen 1, viewed obliquely. Fig. 62, claw of second maxillary telopodite, specimen 2.

illa pectinate along both edges. Pore fields on all sternites except first and last four. Tergites not granulate. Coxopleuron of end leg with 2 pores.

*Description.* Body anteriorly attenuate, narrowest between segments 3–6. Colour of specimen 2: trunk brownish orange, head reddish brown, ventral glands greyish magenta, this colour disappearing after clearing in 60% lactic acid. Antennae: clavate (Fig. 54), last 6 segments expanded and very densely setose ventrally (Fig. 55); not strongly geniculate (Fig. 56). Specimens 1 and 2 with numerous thin-walled basiconic sensilla anterolaterally on segment 14 and a few spine-like sensilla distally (Fig. 57). On other segments sensilla dorsal. Segment 13 with 2 or 3 thick-walled basiconic sensilla anteroexternally and 1–3 brown sensilla anterointernally. On segment 9, 1 or 2 thick-walled basiconic sensilla and 2 or 3 brown sensilla. In specimen 1 very few antennal sensilla (this may be a sexual difference but distal antennal segments have most setae missing and absence of sensilla could be related to this). Head capsule: about as long as wide (Fig. 54) or wider than long (Fig. 58), posterior border

covered by forcipular tergite. No discernible frontal suture. Clypeus: paraclypeal sutures not discernible. Row of 4 setae behind 2 anterooclypeal setae (Fig. 61). Labrum: midpiece apparently atrophied, side pieces with 4 or 5 low teeth and medially directed seta (Fig. 60). First maxillae: median lobes small, far exceeded by telopodites (Fig. 61). Small telopodal lappet present, larger in specimen 3 than in specimen 2. Second maxillae: with robust telopodite with broad spoon-shaped claw, finely pectinate along inner and outer borders (Figs 61, 62). Forcipules: not extending beyond anterior border of head capsule (Fig. 63). Without teeth. Poison calyx small, cordiform, situated in tibia/tarsus. Chitin lines (pleurograms) absent. Tergites: not granulate and without paramedian sutures. Sternites: much wider than long, posterocentrally with elliptically transverse raised pore field (Fig. 64) on all tergites except first and last 4. Last leg-bearing segment: pretergite distinct from pleurites (Fig. 65), tergite wider than long (ratio 1.4:1 in specimen 1) with sides converging posteriorly and hind border rounded. Presternite constricted centrally but not obviously divided.



Figures 63–68. *Ballophilus pedadanus*. Fig. 63, ventral view of head capsule and forecipular tergite, specimen 2. Fig. 64, sternite 4, specimen 2. Fig. 65, dorsal view of terminal segments, specimen 1. Fig. 66, ventral view of terminal segments, specimen 1. Fig. 67, ventral view of sternite and right coxopleuron of last leg-bearing segment, specimen 3. Fig. 68, lateral view of end leg, specimen 2. Setae are not shown.

Sternite about as wide as long (Fig. 66) with sides converging posteriorly and hind border more or less straight. Coxopleuron with 2 pores, round and equal in specimen 1 (Fig. 66) but anterior pore smaller in specimens 2 and 3 and pores somewhat compressed and elliptical (Fig. 67). End legs inflated, tarsus double, large setigerous alveoli as in Fig. 68. Postpedal segments: male (Fig. 66) and female gonopods 1-segmented. No discernible anal gland pores.

*Remarks.* Chamberlin (1944) gave a very brief description of *B. pedadanus* based on a single specimen from Lampongs, Sumatra. It is very similar to *B. sabesinus* Chamberlin from Sebesi Island in the Sunda Strait from which it differs in having antennae that are not truly geniculate with the terminal segment more conically narrowed distally. The specimens may prove to be conspecific. The Liwa specimens are provisionally allocated to *B. pedadanus*. A revision of the genus is clearly necessary.

### Discussion

Of the twelve species, nine scolopendromorphs and three geophilomorphs here recorded, five, all scolopendromorphs, are from the Krakatau Islands. *Scolopendra subspinipes subspinipes* which has previously been recorded from the islands is widely distributed in the Indo-Australian region and the West Indies. Lewis (1988) noted that it seems to be a wandering species and that its behaviour favours distribution through trading. *Otostigmus multidentis*, *O. spinosus* and *O. politus* are widely distributed in the far east and *Rhysida immarginata* is found in central and south America, Africa, India and the far east. The geophilomorph *Mecistocephalus (M.) krakataunus* Chamberlin recorded from Rakata, Krakatau Islands and Batavia, Java (Chamberlin, 1944) was incompletely described. It has 47 pairs of legs and a simple median longitudinal sternal thickening. It is not represented in the present collection.

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