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TERRESTRIAL ISOPODA FROM THE KRAKATAU ISLANDS, SOUTH SUMATRA AND WEST JAVA

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Abstract

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Seventeen species of terrestrial Isopoda are recorded from the Krakatau Islands, South Sumatra and West Java. Five species are described as new: *Burmoniscus orientalis, B. rakataensis, B. veliger, B. vaughani* and *B. thorntoni*. Four species are redescribed and illustrated: *Alloniscus pallidulus* Budde-Lund, 1885, *Pseudotyphloscia alba* (Dollfus, 1898) comb. nov., *Saidjahus guttatus* (Dollfus, 1898) and *"Spherillo" velutinus* (Dollfus, 1898). *Pseudotyphloscia pallida* Verhoeff, 1928 is considered to be a junior synonym of *P. alba*. Comments on the distributions of all the species are given.

Introduction

This paper deals with the Oniscidea collected during the Zoological Expeditions to the Krakataus by the Department of Zoology, La Trobe University, Bundoora, Victoria, Australia, in 1984, 1985 and 1986. The material was collected in the Krakatau Islands and surrounding areas of Sumatra and Java (see Thornton, 1985).

It is the first time that the Krakatau Archipelago has been investigated properly. In fact, only three species of terrestrial isopods were known from a single island (Krakatau I. = Rakata I.). They were collected by E. Jacobson in 1908, identified by the late G. Budde-Lund and published by Richardson Searle (1922), i.e. *Alloniscus brevis* Budde-Lund, 1885 (= *A. oahuensis* Budde-Lund, 1885), *Nagara cristata* [= *Nagurus cristatus* (Dollfus, 1889)] and *Cubaris murina* Brandt, 1833. According to Dammerman (1948: 510) other specimens were collected between 1919 and 1922, and in 1933, but no identifications were published.

Unfortunately the Oniscidea of both Sumatra and Java (and in general of all of the Oriental Region) are poorly known because of both lack of investigations and outmoded literature. This prevents any reliable zoogeographical comments. Only 29 species have been reported from Java and 23 from Sumatra (Budde-Lund, 1885, 1912a; Dollfus, 1898; Richardson Searle, 1922; Herold, 1931; Arcangeli, 1927, 1935, 1954; Schultz, 1985). These numbers certainly are far from their actual oniscidean populations.

In studying this material we came across numerous taxonomic problems due to the confused literature. In order to identify most of the specimens correctly it was necessary to re-examine much of the type material studied by previous authors (Dollfus, 1898; Richardson Searle, 1922; Verhoeff, 1928; Herold, 1931).

For names of the different Krakatau Islands and localities visited by the Zoological Expeditions to the Krakataus, see Thorton (1985).

Abbreviations. BM, British Museum (Natural History), London; MF, Museo Zoologico "La Specola" (Sezione del Museo di Storia Naturale) dell'Università, Firenze; MZB, Museum Zoologicum, Bogor; NHMB, Naturhistorisches Museum, Basel; NMV, Museum of Victoria, Melbourne; RMNH, Rijksmuseum van Natuurlijke Historie, Leiden; TM, Tasmanian Museum and Art Gallery, Hobart; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; ZMA, Zoölogisch Museum, Amsterdam; ZMB, Zoologisches Museum, Berlin; ZMH, Zoologisches Museum, Hamburg.

Scyphacidae

Alloniscus Dana, 1854

Alloniscus oahuensis Budde-Lund, 1885

Alloniscus brevis.—Richardson Searle, 1922: 1.
Alloniscus oahuensis.—Vandel, 1973a: 23.—1973b: 30.

Type material re-examined. "Indes": 1 male (Holotype of *Alloniscus brevis* Budde-Lund, 1885), leg. J. Ray (Budde-Lund Collection, BM).

Material examined. Krakatau Islands: 1 male juv., 1 female (MZB), 1 male juv., 1 female (NMV J16158), 1 male juv. (MF), Sertung, Spit, 7 Sep 1984.

Distribution. Littoral species widely distributed along the coasts of Indian and Pacific Oceans.

Remarks. Ferrara and Taiti (1985) tried to solve the entangled taxonomy of *Alloniscus* species. Some of them were revised but the authors were not able to clarify *A. brevis* Budde-Lund, 1885, and *A. pallidulus* Budde-Lund, 1885. We have re-examined the holotype of *A. brevis* deposited in the British Museum (Natural History). It is a male which lacks pereopods 7 and pleopod 1 exopods, so it is not sufficient to solve the identity of this species with certainty. However, the general shape of the body and pleopod 1 endopod are identical to those of *A. oahuensis*. Moreover, material from Krakatau Island (= Rakata I.) was identified by Budde-Lund (in Richardson Searle, 1922) as *A. brevis*. The specimens from Sertung Island examined here certainly belong to *A. oahuensis*. It appears from these facts that it is wise to support Jackson's (1933) opinion and consider *A. brevis* as a junior synonym of *A. oahuensis*. This will serve to avoid any future confusion about a species which otherwise is impossible to recognize.

Alloniscus pallidulus Budde-Lund, 1885

Figure 1

Material examined. Krakatau Islands: 1 male, 1 female (MZB), 1 male (NMV J16101), 1 male (MF), Sertung, Spit, 7 Sep 1984.

Description. Dimensions: male, 9.5 × 5 mm; female, 7.5 × 3 mm. Grey or brown, often with isolated chromatophores. Body convex with numerous tiny triangular scale-spines. Gland pores (7–15) along lateral margins of pereonites, more numerous on posterior ones. Eye with about 20 ommatidia. Cephalon with profrons slightly protruding frontwards; triangular lateral lobes with rounded apex; frontal line slightly visible, supra-antennal line clearly visible, straight. Pereonites 1–4 with posterior margin straight and postero-lateral corners rounded; pereonites 5–7 with posterior margin concave and postero-lateral corners acute. Pleonites 3–5 with epimera well developed, falciform. Telson with straight sides and truncated or broadly rounded apex, with a slight longitudinal impression on dorsal surface. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 6:4:7. Exopods of pleopods with respiratory areas typical of the genus. Uropod with protopod flattened and surpassing tip of telson; insertion of endopod proximal to that of exopod.

Male. Pereopods 1–5 with brushes of trifid spines on carpus and merus. Pereopod 7 ischium with a depression on the proximal half of sternal margin. Pleopod 1 exopod cordiform; endopod straight with apical part without modifications (sharply pointed and distinctly bent outwards in juvenile and subadult specimens). Pleopod 2 with endopod shorter than exopod.

Distribution. Pahang and Sabah (Malaysia) (dat. ined.), Krakatau Islands, Sulawesi (dat. ined.), Moluccas and Australia.

Remarks. These specimens are ascribed tentatively to *A. pallidulus*. This species was described by Budde-Lund (1885) on two specimens (probably females; see Arcangeli, 1960) from Amboina Island (Moluccas). The type specimens of *A. pallidulus* were to be deposited in the Zoologisches Museum, Berlin, but they seem to be no longer present (H.-E. Gruner, pers. comm.). No illustrations of *A. pallidulus* exist so a safe identification of this species is not possible. These specimens from Sertung Island correspond quite well to Budde-Lund's description. Moreover we have examined specimens pertaining to the same species from several other localities in the Sunda Archipelago area (Pahang, West Malaysia; Sabah, East Malaysia; Sulawesi). Thus the species has a wide distribution in the area from which *A. pallidulus* was originally described so the identification of these specimens with *A. pallidulus* is probable. Accepting this identification will also avoid the institution of another new species. Already the genus includes many species which are extremely close to each other and which can be identified only after examination of adult males. The new description of this species provided here is based on the specimens examined.

Budde-Lund (1908; 1912b; 1913) identified as *A. pallidulus* specimens from Madagascar and Australia. The specimens from Madagascar certainly belong to a different species, *A. nacreus*

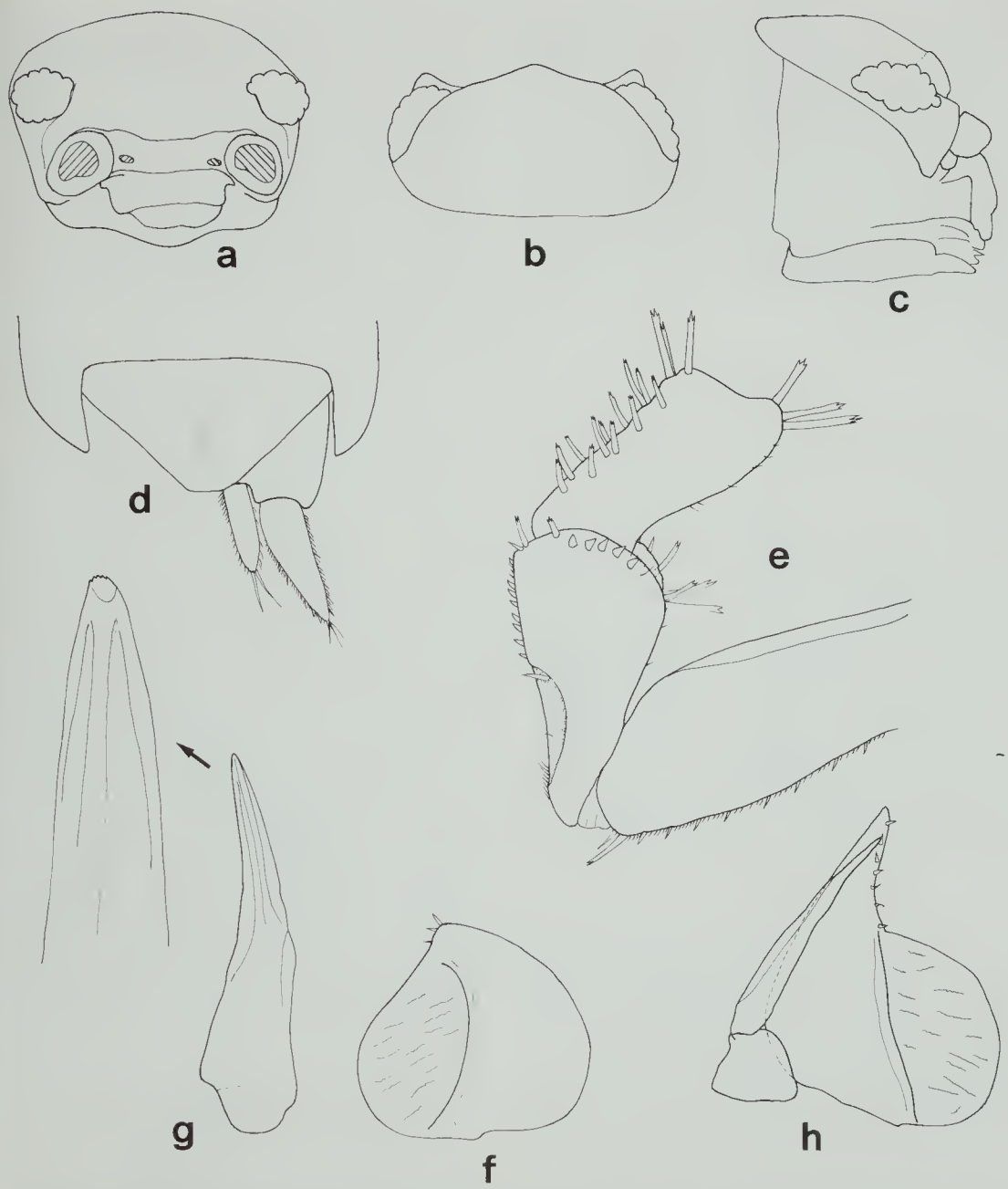

Figure 1. *Alloniscus pallidulus* Budde-Lund, 1885, male: a, cephalon in frontal view; b, cephalon in dorsal view; c, cephalon in lateral view; d, pleonite 5, telson and right uropod; e, pereopod 7; f, pleopod 1 exopod; g, pleopod 1 endopod; h, pleopod 2.

Collinge, 1922 (Ferrara and Taiti, 1985). Re-examination of the specimens from Denham, Western Australia (1 male, 2 females, ZMH), identified by Budde-Lund (1912b: 40) showed that the identification was correct.

We re-examined also specimens from Western Australia [Fremantle (1 male, 1 juv., ZMH) and Rottnest Island (2 males, 1 female, TM)] identified as *A. nicobaricus* Budde-Lund, 1885, by Budde-Lund (1912b: 40) and Bunn and Green

(1982: 149) respectively. These specimens proved to be identical to those from Denham and belong to *A. pallidulus*.

A. pallidulus is characterized by the cephalon with profrons slightly protruding frontwards, triangular lateral lobes with rounded apex, frontal line slightly visible; telson with truncated or broadly rounded apex; male pereopod 7 ischium with a depression on the proximal half of sternal margin; male pleopod 1 exopod cordiform, endopod straight with apical part without evident modifications.

Philosciidae

Pseudotyphloscia Verhoeff, 1928

Type species. Pseudotyphloscia pallida Verhoeff, 1928 (= *Philoscia alba* Dollfus, 1898).

Diagnosis. Sulcus marginalis and gland pores absent. Each pereonite with one nodulus lateralis per side; d/c co-ordinates with one evident peak on pereonite 4 and two smaller peaks on pereonites 2 and 7. Frontal line absent; supraantennal line present. Epimera of pleon reduced, adpressed, without posterior points visible in dorsal view. Molar penicil of mandible consisting of a single unbranched seta. Outer branch of maxillule with 4+5 (4 slightly incised) + 2 very small teeth; inner branch with two unequal penicils. Endite of maxilliped with a penicil. Exopods of pleopods without respiratory areas. Uropodal protopod grooved on outer margin; insertion of endopod proximal to that of exopod.

Remarks. Pseudotyphloscia was erected by Verhoeff (1928) to accommodate the new species *P. pallida* from Formosa. Re-examination of the type material of this species (see below) allowed us to redefine the genus according to modern criteria. The genus appears to be very close to *Burmoniscus* Collinge, 1914, from which it differs only in the maxillular teeth [4+5 (4 slightly incised) + 2 small accessory teeth instead of 5+6 (5 deeply cleft)]. The absence of gland pores and insertion of uropodal endopod proximal to that of exopod are characters present also in some species of *Burmoniscus*. With only one known species, we are not able to judge the importance of this distinctive character. Waiting for a better knowledge of the philosciids from the Oriental Region, we keep *Pseudotyphloscia* as a valid genus.

Pseudotyphloscia alba (Dollfus, 1898) comb. nov.

Figures 2, 3

Type material re-examined. Sulawesi: 1 male, 2 females (syntypes of *Philoscia alba* Dollfus), Tomshou, leg. F. and P. Sarasin (Dollfus Collection, NHMB).

Taiwan: 1 male, 2 females (syntypes of *Pseudotyphloscia pallida* Verhoeff), Takao, leg. H. Sauter (Verhoeff Collection, ZMB).

Material examined. West Java: 4 males, 2 females (MZB), 1 male, 6 females (NMV J16135), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Krakatau Islands: 2 males, 2 females (MF), Sertung, Spit, 18 Aug 1985; 1 male (TM), Anak Krakatau, 10 Sep 1984.

Description. Maximum length: male, 4 mm; female 6 mm. Body elongated and colourless. Eye with 4 or 5 ommatidia (in the largest specimens). Co-ordinates of noduli laterales as in Fig. 2a. Pereonite 7 with postero-lateral corner almost a right angle. Telson triangular, with sides almost straight, apex obtuse. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 3 and 2 aesthetases respectively.

Male. Antenna with fifth joint of peduncle distinctly swollen. Pereopods without sexually dimorphic modifications. Pleopod 1 exopod cordiform with rounded apex; endopod with apical part slightly bent outwards, narrowed before apex. Pleopod 2 as in Fig. 3d.

Distribution. Sulawesi, Java, Krakatau Islands, Bali (dat. ined.) and Taiwan.

Remarks. Comparison with type materials has shown that the specimens from the Krakataus and West Java correspond with certainty to *Philoscia alba* Dollfus, 1898, from Celebes and to *Pseudotyphloscia pallida* Verhoeff, 1928, from Formosa. *P. pallida* is a junior synonym of *P. alba* which must be transferred to the genus *Pseudotyphloscia*.

Anchiphiloscia Stebbing, 1908

Anchiphiloscia pilosa (Budde-Lund, 1913)

Material examined. Krakatau Islands: 9 males, 21 females (MZB), Panjang, 14 Sep 1984; 3 males, 1 female (NMV J16133), same locality, 27 Aug 1985; 3 males, 4 females (MF), Rakata, Zwarte Hoek, 1 Sep 1984; 5 males, 4 females (TM), same locality, 12 Sep 1984; 4 females, 2 juvs (MZB), same locality, 15 Sep 1984; 1 female (MZB), Rakata, 280 m, 14 Sep 1984; 1 female (MZB), Rakata, West Ridge, 259 m, 14 Sep 1984; 4 males, 1 juv. (NMV J16132), 1 female (MZB), Sertung, 18 Aug 1985; 3 females, 1 juv. (MZB), same locality, 19 Aug 1985; 1 male (MZB), Sertung, Spit, 16 Aug 1985; 2 males, 2 females (NMV J16134), same locality, 18 Aug 1985.

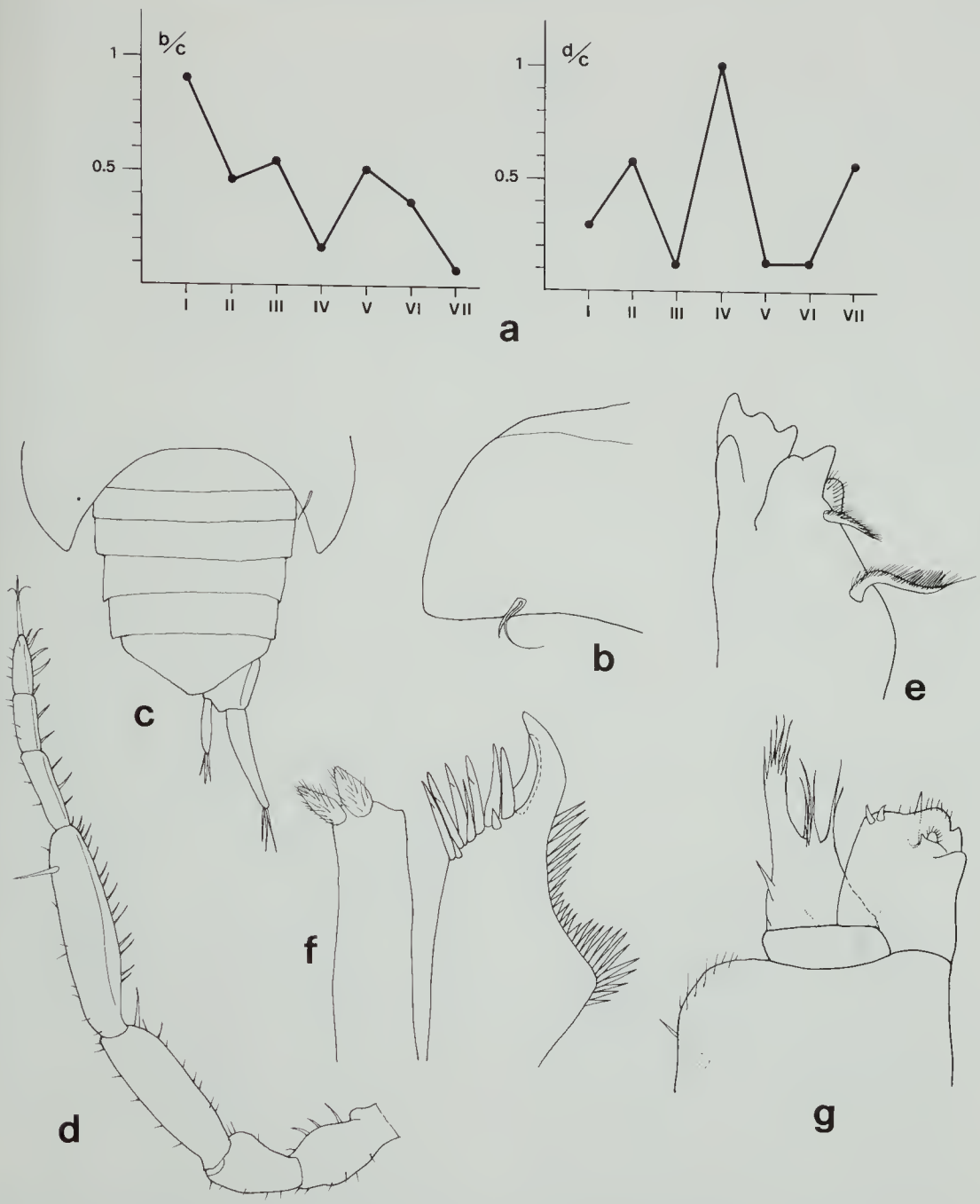

Figure 2. *Pseudotyphloscia alba* (Dollfus, 1898), male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pereonite 7, pleon, telson and right uropod; d, antenna; e, mandible; f, maxillule; g, maxilliped.

Distribution. Chagos Archipelago, West Malaysia (dat. ined.), Java, Bali (dat. ined.), Krakatau and Hawaiian Islands (dat. ined.).

Remarks. A. pilosa has been redescribed recently and given its correct taxonomic position (Ferrara and Taiti, 1986).

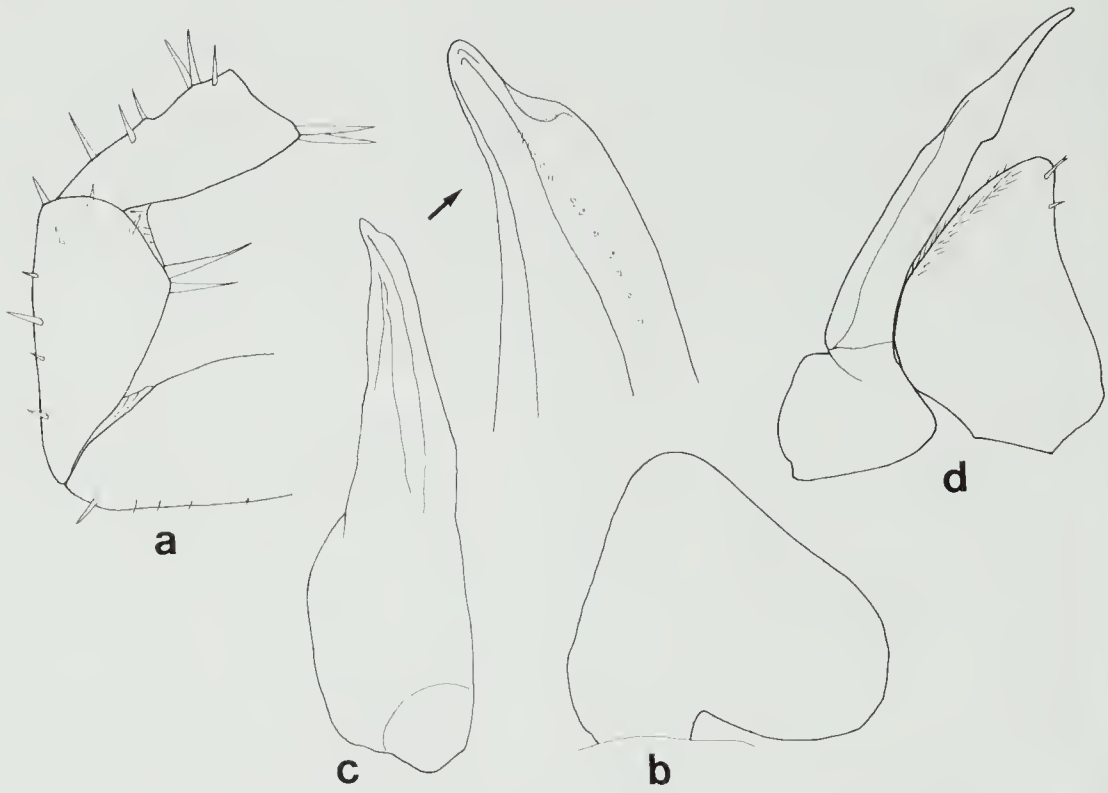

Figure 3. *Pseudotyphloscia alba* (Dollfus, 1898), male: a, pereopod 7; b, pleopod 1 exopod; e, pleopod 1 endopod; d, pleopod 2.

Burmoniscus Collinge, 1914

Burmoniscus orientalis sp. nov.

Figures 4, 5

Material examined. Holotype: Krakatau Islands: male (MZB), Rakata, Zwarte Hoek, 12 Sep 1984.

Paratypes: Krakatau Islands: 10 males, 30 females (MZB), Rakata, Zwarte Hoek, 12 Sep 1984; 1 male, 1 female (NMV J61126), same loeality, 1 Sep 1984; 3 males, 1 female (NMV J16127), same loeality, 31 Aug–4 Sep 1984; 2 males, 1 female (NMV J16128), same loeality, 15 Sep 1984; 1 female (MZB), 1 male (MZB), Rakata, West Ridge, 5 Sep 1984; 2 males, 5 females (MF), same loeality, 19 Sep 1984; 1 male, 3 females (MZB), same locality, 22 Sep 1984; 3 females (MZB), same loeality, 14 Sep 1984; 3 males, 2 females (TM), Rakata, summit, 18–19 Sep 1984; 3 males, 1 female (MF), same loeality, 22 Sep 1984; 1 female (MZB), same loeality, 24 Aug 1985; 1 male (NMV J16131), same loeality, 23 Aug 1985; 5 females (MZB), Rakata, South Faee, 24 Aug 1985; 5 males, 5 females (NMV J16137), Rakata, Owl Bay, 26 Aug 1985; 7 males, 19 females (MF), Rakata, 259 m, 19 Sep 1984; 19 males, 47 females (TM), Panjang, 14 Sep 1984; 2 males, 2 females (NMV J16130), same loeality, 17 Aug 1985.

West Java: 1 male, 1 female (MZB), 1 male, 3 females (NMV J16129), Ujung Kulon, Pulau Peueang, 19 Sep 1984.

Description. Maximum length: male and female, 7 mm. Brown with yellowish muscle spots; an oval pale spot at the base of each pereonal epimeron. Many gland pores along the whole lateral margin of pereonal epimera. Noduli laterales with b/c and d/c co-ordinates as in Fig. 4a. Eye with about 16 ommatidia. Cephalon with distinct supra-antennal line; frontal line absent. Pereonite 7 with postero-lateral corner right angled. Pleonal epimera reduced, adpressed, without posterior points visible in dorsal view. Telson with concave sides and apical part consisting of a small point. Antenna with fifth joint of peduncle slightly longer than flagellum; ratio of flagellar joints 7:4:4; flagellar joints 2 and 3 with 3 and 2 aesthetases respectively. Mandible with molar penicil consisting of a single unbranched seta. Maxillular outer branch with 4 + 6 (5 cleft) teeth; inner branch with two unequal penicils and a small posterior point. Endite of maxilliped with a penicil. Uropodal protopod

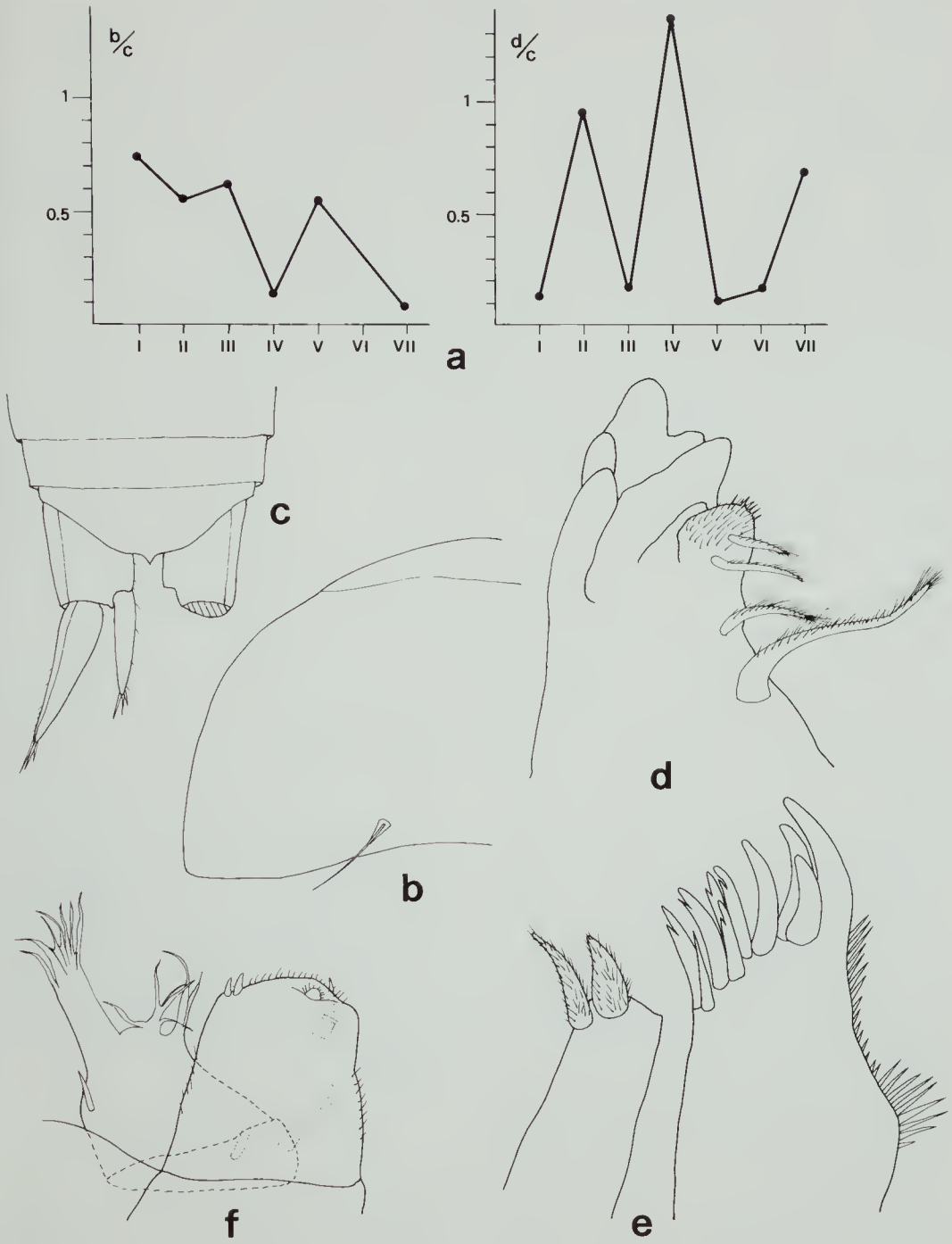

Figure 4. *Burmoniscus orientalis* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonites 4–5, telson and uropods; d, mandible; e, maxillule; f, maxilliped.

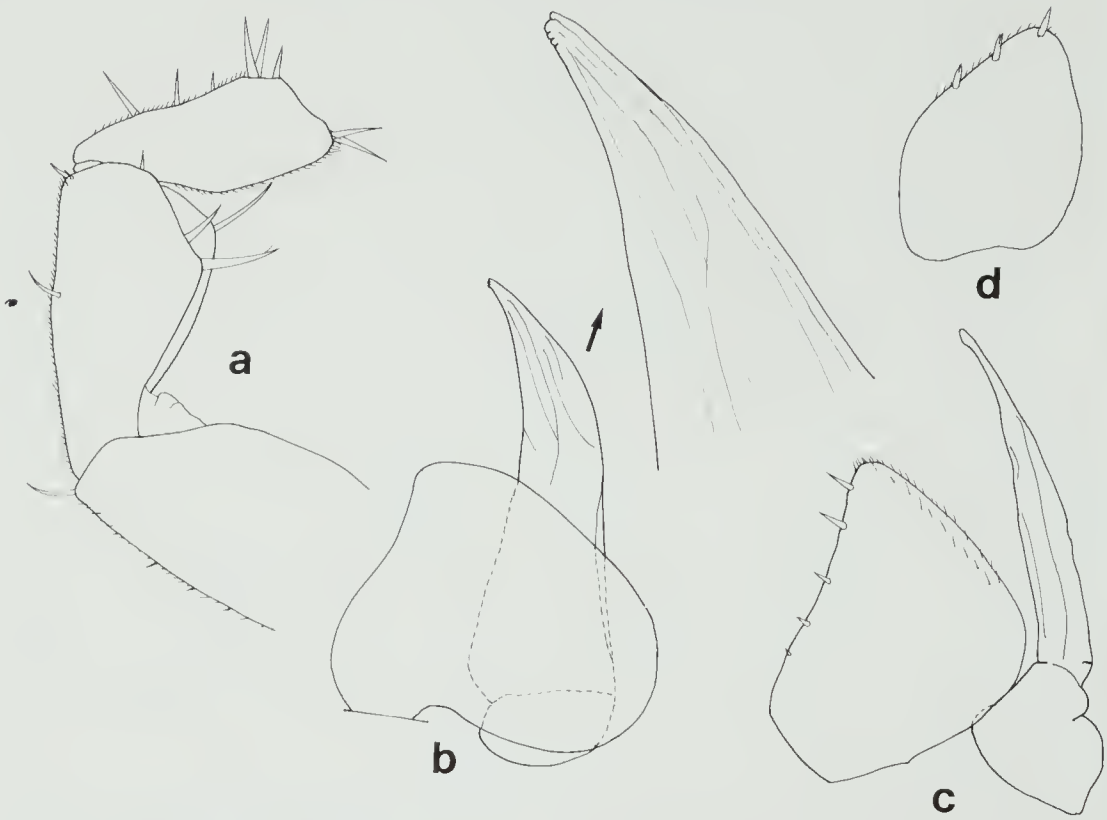

Figure 5. *Burmoniscus orientalis* sp. nov., male: a, pereopod 7; b, pleopod 1; c, pleopod 2; d, pleopod 5 exopod.

grooved on outer margin; insertion of endo- and exopods almost at the same level.

Male. Pereopods without evident sexually dimorphic modifications. Pleopod 1 exopod with outer margin slightly sinuous, apex rounded; endopod with distal third stout and bent outwards, apex without evident modifications. Pleopod 2 endopod longer than exopod; exopod with some short spines on outer margin. Pleopod 5 exopod as in Fig. 5d.

Distribution. South Thailand (dat. ined.), West Malaysia (dat. ined.), Java, Krakataus and Bali (dat. ined.).

Etymology. L. *orientalis* = oriental. The name refers to the wide distribution of this species in the Oriental Region.

Remarks. In the shape of the telson, *B. orientalis* is very similar to *B. comtus* (Budde-Lund, 1895) from Burma, *B. mucronatus* (Vandel, 1973) and *B. micropunctatus* Taiti and Manicastri, 1988. It differs from *B. comtus* in the male pereopod 7 without modifications; from *B. mucronatus* in the fifth joint of the antennal peduncle not swollen and from both *B. mucronatus* and *B. micropunctatus* in the shape of the male pleopod 1. Another species of philosciid, *"Philoscia" tenuissima* Collinge, 1915, from Madras, India, has the same shape of telson but a real comparison is impossible due to its uncertain description and taxonomic status (Taiti and Manicastri, 1988: 62).

Burmoniscus rakataensis sp. nov.

Figure 6

Material examined. Holotype: Krakatau Islands: male (MZB), Rakata, West Ridge, 707 m, 5 Sep 1984.

Paratypes: Krakatau Islands: 1 male (MF), 1 female (NMV J16136), Rakata, summit, 24 Aug 1985; 1 female (MZB), same locality, summit, 813 m, 4 Sep 1984; 1 female (NMV J16125), same locality, 259 m, 19 Sep 1984.

Description. Maximum length: male and female, 4 mm. Colourless body. Gland pores not visible.

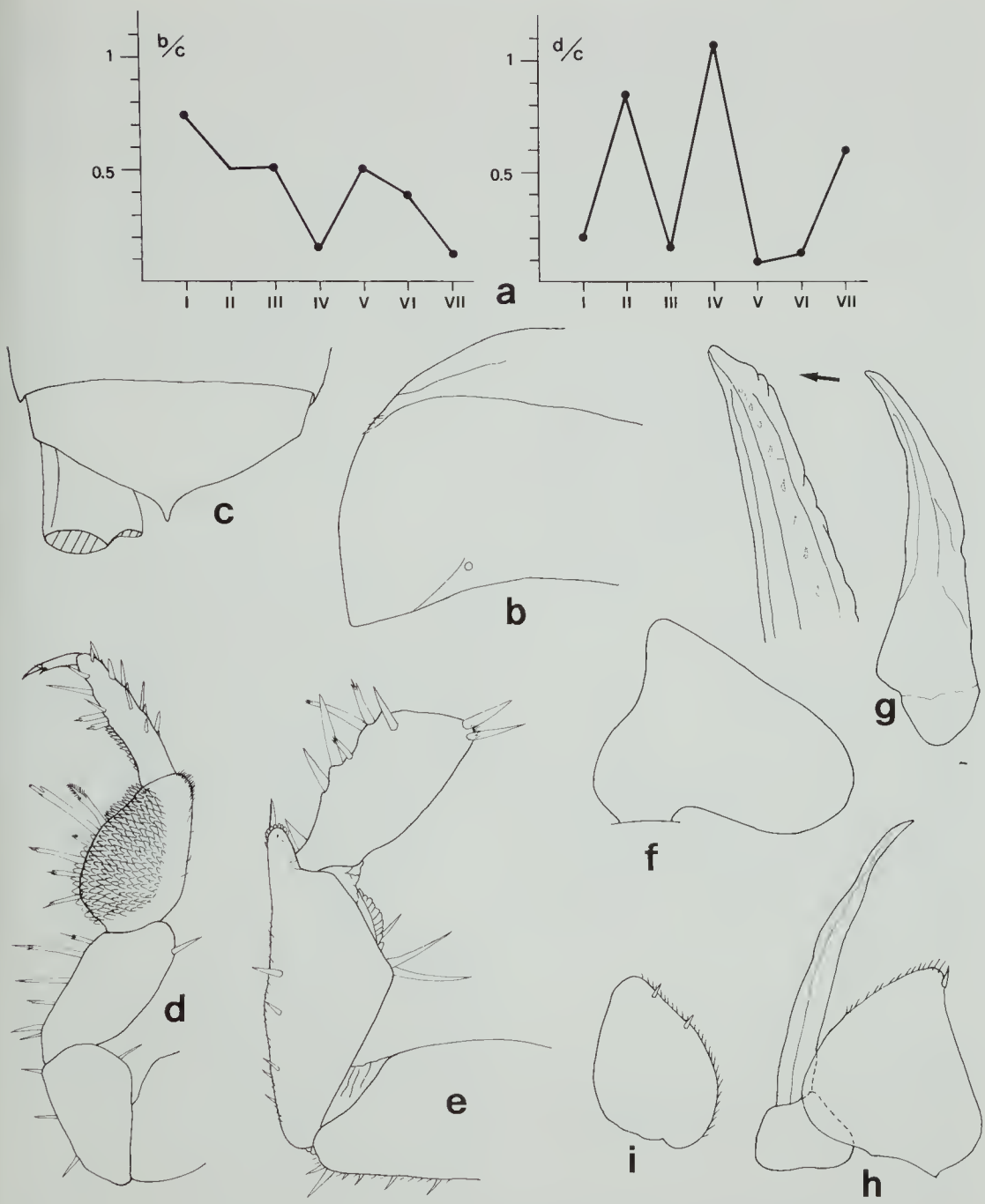

Figure 6. *Burmoniscus rakataensis* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonite 5, telson and left uropodal protopod; d, pereopod 1; e, pereopod 7; f, pleopod 1 exopod; g, pleopod 1 endopod; h, pleopod 2; i, pleopod 5 exopod.

Noduli laterales with b/c and d/c co-ordinates as in Fig. 6a. Eye with 6–7 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners acute angled. Pleonal epimera reduced, adpressed, without visible posterior points. Telson with straight sides ending with an acute point. Antenna with fifth joint of peduncle slightly longer than flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 4 and 1 aesthetases respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Antenna with fifth joint of peduncle slightly swollen. Carpus of pereopod 1 and, to a lesser extent, 2 enlarged, flattened and covered with short setae on rostral surface. Pereopod 7 ischium with a distal rounded lobe. Pleopod 1 exopod triangular, with sinuous outer margin and rounded posterior point; endopod with distal part bent outwards, without particular specialization at apex. Pleopod 2 endopod much longer than exopod. Pleopod 5 exopod as in Fig. 6i.

Distribution. Known only from the type locality.

Etymology. The name refers to the type locality, Rakata I. in the Krakataus.

Remarks. This species belongs to the group characterized by the male pereopods 1 and 2 with enlarged and flattened carpus, i.e. *B. coecus* (Budde-Lund, 1895), *B. ferrarai* (Schmalfuss, 1983) and *B. mossambicus* (Ferrara and Taiti, 1985). It is readily distinguished from all by the characteristic shape of telson, with an acute pointed apex, and male pereopod 7 ischium with a distal process.

Burmoniscus veliger sp. nov.

Figure 7

Material examined. Holotype: South Sumatra: male (MZB), Liwa, 5 Sep 1984.

Paratypes: South Sumatra: 1 male, 2 females (NMV J16123), 1 male (MF), 1 male (TM), Liwa, 5 Sep 1984; 3 females (MZB), same locality, 6 Sep 1984; 1 female (MF), same locality, 5–7 Sep 1984.

Description. Maximum length: male, 6 mm; female, 8 mm. Brown with yellowish muscle spots; a round pale spot at the base of each pereonal epimeron; postero-lateral corners of pereonites colourless. Gland pores not visible. Noduli laterales with b/c and d/c co-ordinates as in Fig. 7a. Eye with about 23 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners obtuse angled. Pleonal epimera reduced, adpressed, without visible posterior points. Telson with straight sides, apex an obtuse angle. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 7:5:4; flagellar joints 2 and 3 with 3 and 2 aesthetases respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Pereopod 7 merus with a recurved spine at the base of sternal margin. Pleopod 1 exopod with a small rounded posterior point; endopod straight with a triangular hyaline lobe on medial margin near apex. Pleopod 2 endopod much longer than exopod; exopod with some short spines on outer margin. Pleopod 5 exopod as in Fig. 7g.

Distribution. Sumatra.

Etymology. L. *velum* = sail + stem of *gerere* = to bear.

Remarks. The new species is characterized by the male modifications of pereopod 7 and pleopod 1. Due to the presence of a hyaline lobe at the apex of pleopod 1 endopod, *B. veliger* appears close to *B. microlobatus* (Vandel, 1973) from Bismarck and Solomon Archipelagos. It is distinguished by the apex of telson obtuse angled instead of rounded, presence of a recurved spine on the male pereopod 7 merus, male pleopod 1 endopod with triangular instead of rounded subapical lobe, and shape of the male pleopods 1–2 exopods.

Burmoniscus vaughani sp. nov.

Figure 8

Material examined. Holotype: South Sumatra: male (MZB), Liwa, 5 Sep 1984.

Paratypes: South Sumatra: 3 males, 1 female (MZB), 3 males, 1 female (NMV J16124), 3 males, 1 female (MF), Liwa, 5 Sep 1984; 3 males, 1 female (NMV J16150), 1 male, 5 females (MZB), same locality, 1 Sep 1984; 1 male (MF), same locality, 5–7 Sep 1984; 1 female (MZB), 2 females (NMV J16149), 3 males , 1 female (TM), same locality, 6 Sep 1984.

Description. Maximum length: male, 4.5 mm; female, 5.5 mm. Light brown with yellowish muscle spots; postero-lateral corners of pereonites or all pereonal epimera colourless. Several gland pores along the whole lateral margin of pereonal epimera. Noduli laterales with b/c and d/c co-ordinates as in Fig. 8a. Eye with 22–24 ommatidia. Cephalon and buccal pieces as in *B. orientalis*. Pereonite 7 with postero-lateral corners acute angled. Pleonal epimera reduced,

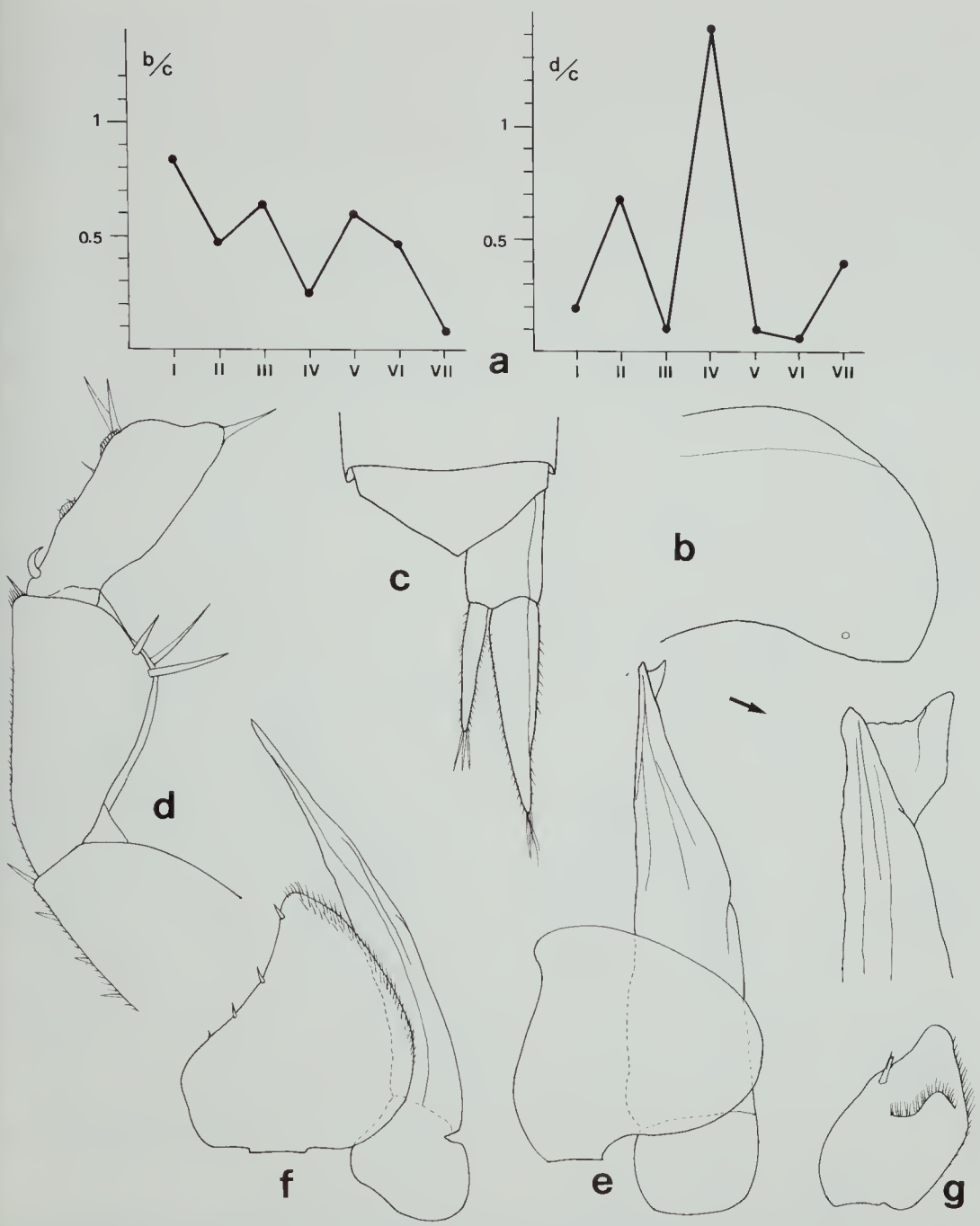

Figure 7. *Burmoniscus veliger* sp. nov., male: a, co-ordinates of noduli laterales; b, right epimeron of pereonite 7; c, pleonite 5, telson and right uropod; d, pereopod 7; e, pleopod 1; f, pleopod 2; g, pleopod 5 exopod.

adpressed, without visible posterior points. Telson with slightly sinuous sides, apex rounded. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 5:4:3; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

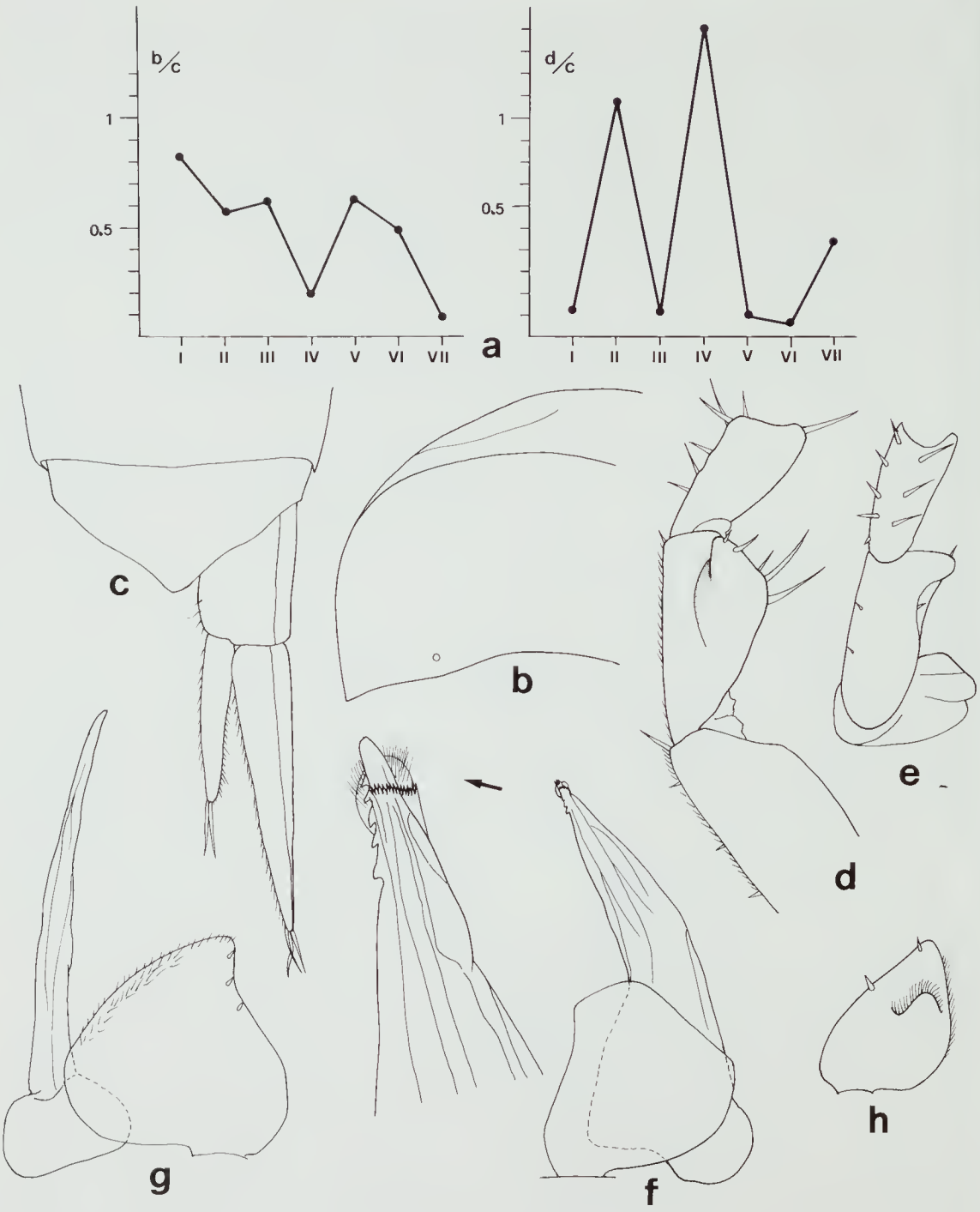

Figure 8. *Burmoniscus vaughani* sp. nov., male: a, co-ordinates of noduli laterales; b, left epimeron of pereonite 7; c, pleonite 5, telson and right uropod; d, pereopod 7, rostral surface; e, pereopod 7, sternal surface; f, pleopod 1; g, pleopod 2; h, pleopod 5 exopod.

Male. Pereopod 7 ischium with a concavity on rostral surface and a distal lobe protruding transversely. Pleopod 1 exopod truncated distally; endopod with apical part triangular with some denticles on outer margin and a rounded setose lobe on caudal surface. Pleopod 2 endopod about twice as long as exopod. Pleopod 5 exopod as in Fig. 8h.

Distribution. Sumatra.

Etymology. The new species is named after Mr P.J. Vaughan, Department of Zoology, La Trobe University, Bundoora.

Remarks. B. vaughani is easily distinguished from all the other species of *Burmoniscus* by the male pereopod 7 ischium with a concavity and a transverse lobe, and male pleopod 1 exopod truncated and endopod with apical part very complex.

Burmoniscus thorntoni sp. nov.

Figure 9

Material examined. Holotype: West Java: male (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Paratypes: West Java: 2 males, 2 females (NMV J16120), 1 male, 1 female (MF), 1 male, 1 female (TM), 4 females (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Description. Maximum length: male, 4 mm; female, 5 mm. Brown with yellowish muscle spots. Gland pores not visible. Noduli laterales with b/c and d/c co-ordinates as in Fig. 9a. Eye with about 18 ommatidia. Cephalon and buccal pieces as in *B. orientalis.* Pereonite 7 with postero-lateral corners broadly rounded. Pleonal epimera reduced, adpressed, without small posterior points visible in dorsal view. Telson short, with straight sides, apex bluntly rounded. Antenna with fifth joint of peduncle as long as flagellum; ratio of flagellar joints 4:3:3; flagellar joints 2 and 3 with 3 and 2 aesthetascs respectively. Uropodal protopod grooved on outer margin; insertions of exo- and endopod at the same level.

Male. Pereopod 7 ischium with sternal margin convex. Pleopod 1 exopod with a triangular acute posterior point bent outwards, outer margin sinuous; endopod straight without evident modifications. Pleopod 2 exopod with a small protrusion near the base of outer margin (present also on exopods of pleopods 3 and 4); endopod much longer than exopod. Pleopod 5 exopod as in Fig. 9g.

Distribution. Java.

Etymology. The new species is named after Prof. I.W.B. Thornton, Head of the Department of Zoology, La Trobe University, Bundoora.

Remarks. B. thorntoni is characterized by the rounded postero-lateral corners of pereonite 7, short and obtuse telson, and male pleopod 1 exopod with an acute posterior point bent outwards. The new species is close to *B. bartolozzii* Taiti and Manicastri, 1988, from Sri Lanka, from which it is distinguished by the shorter telson, convex instead of straight sternal margin of male pereopod 7 ischium, male pleopod 1 exopod with more acute posterior point and endopod without apical modifications.

Serendibia Manicastri and Taiti, 1987

Serendibia sp.

Material examined. South Sumatra: 2 females (MZB), 3 females (NMV J16122), 2 females (MF), Liwa, 5 Sep 1984.

Remarks. These specimens belong to the genus *Serendibia* as defined by Manicastri and Taiti (1987). The lack of males does not permit a specific identification.

Trachelipidae

Nagurus Holthuis, 1949

Nagurus nanus (Budde-Lund, 1908)

Nagara nana.—Richardson Searle, 1922: 1.

Material examined. South Sumatra: 1 male (MZB), Krui, 7 Sep 1984.

Krakatau Islands: 1 male, 1 female (MF), Anak Krakatau, 2 Sep 1984; 1 male, 1 female (MZB), 2 males, 1 female (NMV J16119), same locality, 10 Sep 1984.

Distribution. Pantropical.

Nagurus cristatus (Dollfus, 1889)

Nagara cristata.—Richardson Searle, 1922: 1.

Porcellio (*Nagara*) *cristata.*—Wahrberg, 1922: 178.

Material examined. South Sumatra: 1 female (MZB), Liwa, 1 Sep 1984; 1 female (NMV J16106), same locality, 5 Sep 1984; 2 females (MZB), Krui, 7 Sep 1984.

Krakatau Islands: 1 female (NMV J16105), Sertung, 19 Aug 1985; 1 female, 2 juv. (MZB), 1 female, 1 juv. (NMV J16108, J16110), Panjang, 14 Sep 1984; 1 juv. (MZB), same locality, 20 Sep 1984; 6 females (MZB), Panjang, Mid Ridge, 25 Sep 1986; 6 females (NMV J16109), Panjang, Central, 17 Aug 1985; 3 females (MZB), Rakata, West Ridge, 5 Sep 1984; 1 female (MZB), same locality, 12 Sep 1984; 1 female (NMV J16165), 4 females (MZB), same locality, 19 Sep 1984;

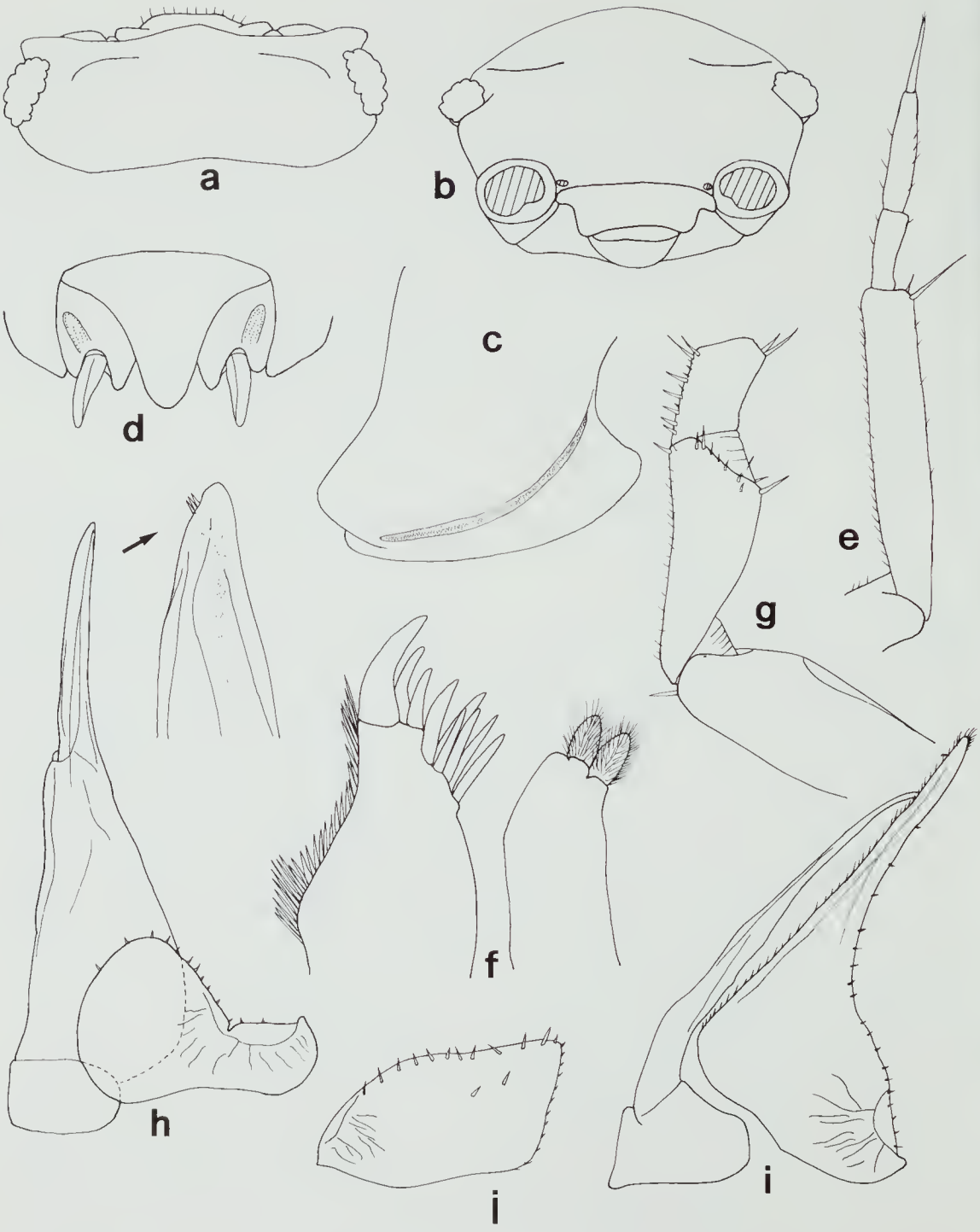

Figure 10. *Saidjahus guttatus* (Dollfus, 1898): a, cephalon in dorsal view; b, cephalon in frontal view; c, right epimeron of pereonite 1; d, pleonite 5, telson and uropods; e, antenna; f, maxillule; g, pereopod 7 male; h, pleopod 1 male; i, pleopod 2 male; j, pleopod 5 exopod male.

5 females (NMV J16107), Rakata, Zwarte Hoek, 5 Sep 1984; 1 female (MZB), Rakata, South Beach, 18 Sep 1984; 24 females (MZB), Rakata, summit, 18–19 Sep 1984; 2 females (NMV J16114), 6 females, 8 juvs (TM), same locality, 23 Aug 1985; 9 females, 9 juvs (MF), same locality, 24 Aug 1985; 1 female (MZB), Rakata, Owl Bay, 22 Sep 1984; 1 female (MZB), same locality, 26 Aug 1985; 11 females, 1 juv. (MZB), 11 females (NMV J16115, J16117, J16118), Rakata, South Face, 24 Aug 1985; 1 female (NMV J16103), same locality, 25 Aug 1985; 1 juv. (NMV J16116), Rakata, 259 m, 19 Sep 1984.

West Java: 4 females (MZB), 1 female (NMV J16113), Ujung Kulon, Pulau Peucang, 11 Sep 1984; 1 female (NMV J16112), same locality, 13 Sep 1984; 2 females (NMV J16111), same locality, 15 Sep 1984; 1 female (MZB), 1 female (NMV J16104), same locality, 19 Sep 1984; 2 females (MZB), Gunung Payung, 12–13 Sep 1984; 1 female (NMV J16102), Cibunar, 20 Sep 1984.

Distribution. Pantropical.

Remarks. As far as can be judged from the description and illustrations, it is very probable that the specimens from Ranu Bedali, Java, and Tjurup, Sumatra, identified by Herold (1931: 355, figs 111–114) as *Nagara modesta* (Dollfus, 1898), also belong to *N. cristatus.*

Eubelidae

Saidjahus Budde-Lund, 1904

Saidjahus guttatus (Dollfus, 1898)

Figure 10

Mesarmadillo guttatus Dollfus, 1898: 370, figs 15, 15a–d.

Saidjahus guttatus.—Budde-Lund, 1904: 51.

Type material re-examined. Sumatra (?): 1 female (holotype of *Mesarmadillo guttatus* Dollfus), leg. M. Weber, 1888 (Dollfus Collection, ZMA).

Material examined. South Sumatra: 1 male, 1 female (MZB), 2 females (NMV J16159), 1 female (TM), 1 female (MF), Liwa, 5 Sep 1984; 1 male (MF), same locality, 6 Sep 1984; 1 female (MZB), same locality, 5–7 Sep 1984.

West Java: 1 male (NMV J16160), 1 female (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1984.

Description. Maximum dimensions: male, 8 × 3.5 mm; female, 9 × 4.5 mm. Brown-grey with pale muscle spots and a large pale spot on each epimeron of pereonites. Dorsum very convex, smooth with inconspicuous scale-spines. Eye with 18 ommatidia. Cephalon with profrons slightly protruding frontwards; lateral lobes small, rounded; interocular line widely interrupted in the middle. Pereonite 1 with lateral margin thickened and slightly grooved; sulcus arcuatus deep and narrow; outer lobe of schisma clearly protruding backwards compared with inner one. Pereonites 2-3 with a transverse thickening on ventral surface of epimera. Telson triangular, with sides regularly incurved; bluntly rounded apex which surpasses the rear margin of the uropods. Antenna with first joint of flagellum shorter than second. Maxillular outer branch with simple teeth; inner branch with two stout penicils. Pleopods with pseudotracheae in all exopods. Uropodal protopod deeply indented on posterior margin; exopod well developed, clearly surpassing tip of telson.

Male. Pereopods 1–3 with brushes of short trifid spines on carpus and merus. Pereopod 7 without evident modifications. Pleopod 1 exopod with ovoid medial part; endopod straight, without modifications at apex. Pleopod 2 exopod as long as endopod. Pleopod 5 exopod as in Fig. 10j.

Distribution. Sumatra and Java.

Remarks. Comparison with type material proves that the specimens examined belong to *S. guttatus.* The redescription provided here is based on the present material.

Armadillidae

Cubaris Brandt, 1833

Cubaris murina Brandt, 1833

Armadillo murinus.—Dollfus, 1898: 359.—Budde-Lund, 1885: 27.— 1904: 119.

Cubaris murina.—Richardson Searle, 1922: 1.

Nesodillo murinus.—Herold, 1931: 319

Material examined. South Sumatra: 1 female juv. (MZB), Krui, 7 Sep 1984.

Distribution. Pantropical.

Cubaris sp.

Material examined. Krakatau Islands: 1 female (MF), 1 juv. (MZB), Rakata, Owl Bay, 22 Sep 1984; 1 juv. (NMV J16161), Rakata, South Face, 25 Aug 1985.

Remarks. These specimens are not *C. murina* but the material is insufficient for a certain identification.

Venezillo Verhoeff, 1927

Venezillo parvus (Budde-Lund, 1885)

Material examined. Krakatau Islands: 4 males, 6 females, 6 juvs (MZB), 4 males, 6 females (NMV J16164), 4 males, 6 females (MF), Sertung, 11 Sep 1984; 1 male, 1 female (TM), Sertung, East Ridge, 19 Aug 1985; 1 male (NMV J16162), Sertung, South-East Ridge, 27 Sep 1986.

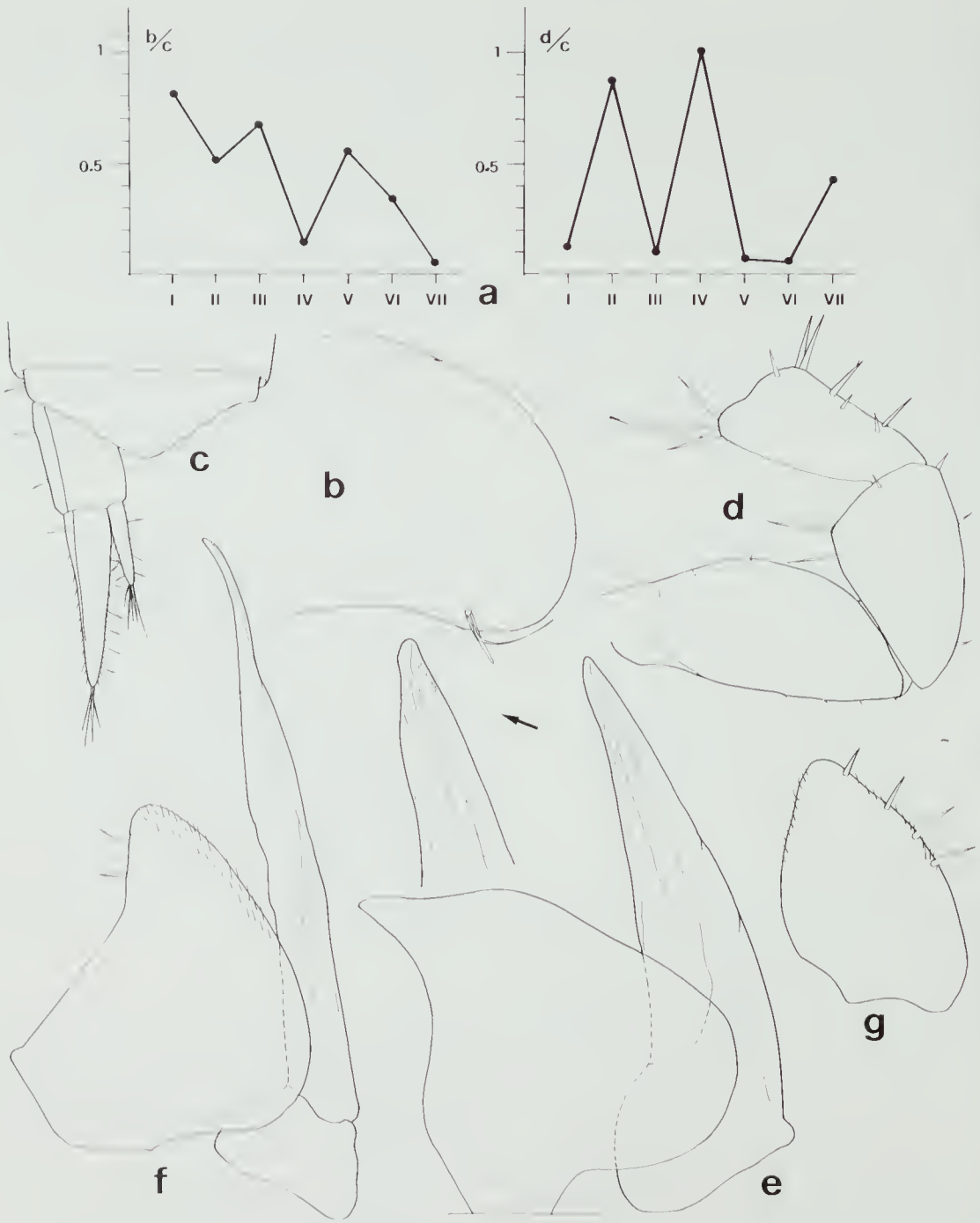

Figure 9. *Burmoniscus thorntoni* sp. nov., male: a, co-ordinates of noduli laterales; b, right epimeron of pereonite 7; c, pleonite 5, telson and left uropod; d, pereopod 7; e, pleopod 1; f, pleopod 2; g, pleopod 5 exopod.

Distribution. Lands encompassed by the Indian and Pacific Oceans; Ascension I. in the Atlantic Ocean.

Spherillo Dana, 1853

"Spherillo" velutinus (Dollfus, 1898)

Figure 11

Armadillo velutinus Dollfus, 1898: 363 (partim).
Spherillo velutinus.—Budde-Lund, 1904: 94 (partim).

Type material re-examined. Sulawesi: 1 male, 1 female (syntypes of *Armadillo velutinus* Dollfus), Macassar, leg. F. and P. Sarasin (Dollfus Collection, NHMB); 1 female (syntype of *Armadillo velutinus* Dollfus), Loewoe, leg. M. Weber (Dollfus Collection, ZMA).

Sumatra: 1 male juv., 1 female (syntypes of *Armadillo velutinus* Dollfus), Singalang, leg. M. Weber (Dollfus Collection, ZMA).

Material examined. West Java: 1 male (MF), 1 female (NMV J16163), 1 female, 1 juv. (MZB), Ujung Kulon, Pulau Peucang, 19 Sep 1985.

Description. Dimensions: male, 4.5 × 1.8 mm; female, 6.5 × 2.5 mm. Brown with yellowish muscle spots. Body convex, able to roll into a perfect ball. Dorsum smooth with numerous tiny dark brown scale-spines. Eye with about 13 ommatidia. Cephalon with frontal shield sepa-

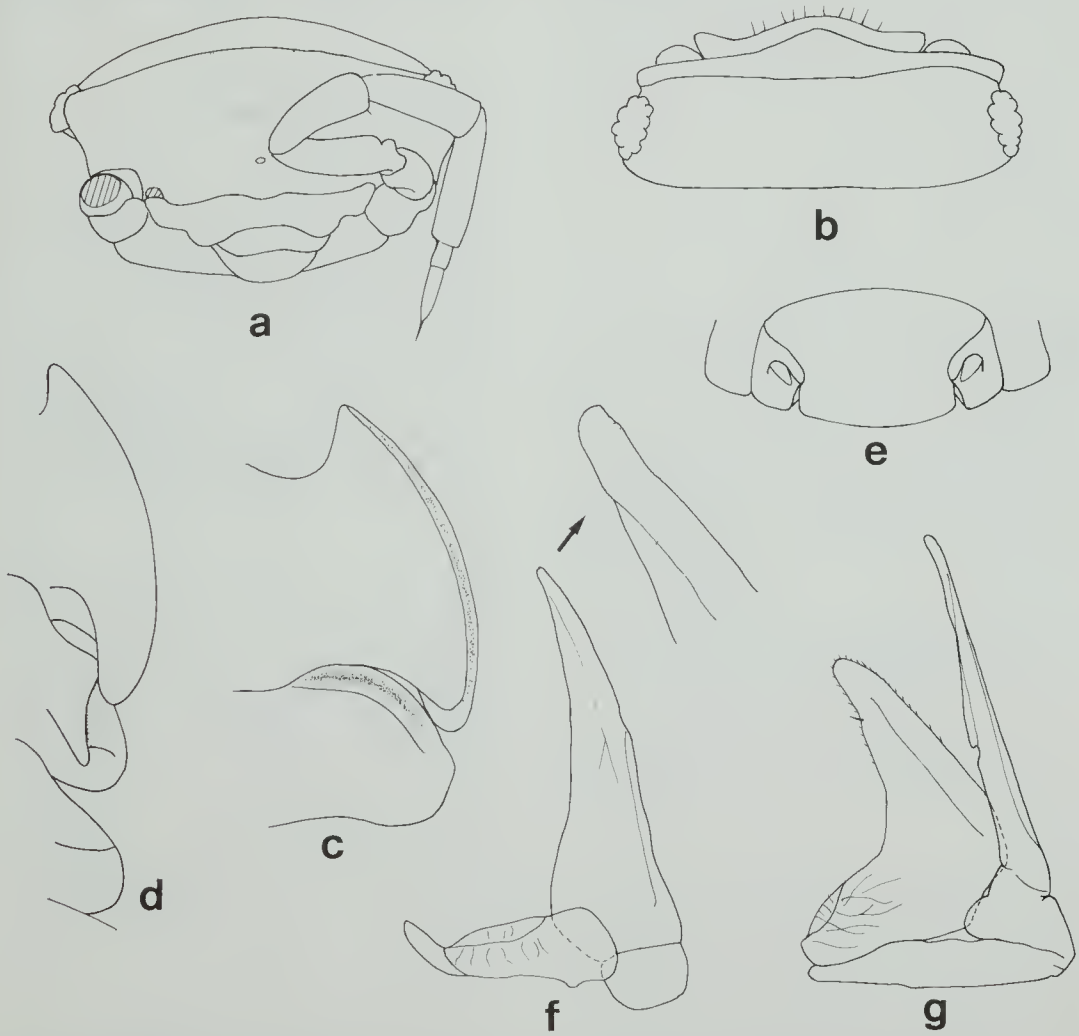

Figure 11. *"Spherillo" velutinus* (Dollfus, 1898): a, cephalon and left antenna in frontal view; b, cephalon in dorsal view; c, right epimera of pereonites 1–2 in dorsal view; d, left epimera of pereonites 1–3 in ventral view; e, pleonite 5, telson and uropods; f, pleopod 1 male; g, pleopod 2 male.

rated from vertex by a continuous line but not protruding over it; profrons slightly protruding frontwards with a V-shaped mark in the middle. Pereonite 1 with distal margin sinuous; lateral margin with a shallow but distinct groove along its whole length; schisma with inner lobe rounded, clearly protruding backwards compared with outer one. Pereonite 2 dorsally with a deep excavation on anterior margin of epimeron where the posterior margin of pereonite 1 folds in when the animal rolls up; ventral surface of epimeron with a sharp triangular tooth. Pereonite 3 with a lobe and pereonites 4–5 with a transverse thickening on ventral surface of epimera. Telson hour-glass-shaped, wider than long with distal margin convex. Antenna short, with second joint of flagellum about twice as long as first. Uropods with quadrangular protopod (as visible in dorsal view); exopod inserted dorsally and directed obliquely.

Male. Pereopods without modifications. Pleopod 1 exopod very small, triangular, about twice wider than long; endopod slightly bent outwards, without evident modifications at the apex. Pleopod 2 as in Fig. 11g.

Distribution. Sulawesi and Java.

Remarks. Armadillo velutinus was described by Dollfus (1898) on specimens from Sulawesi and Sumatra. Re-examination of the type materials proves that:

(a) the specimens from Sulawesi (Macassar and Loewoe) are probably those on which Dollfus based the description of this species. We designate the male specimen from Macassar as lectotype and give a new description of this species; and

(b) the specimens from Sumatra (Singalang) certainly belong to a different species and genus (probably *Dryadillo* Herold, 1931).

The specimens from Java examined here are conspecific with those from Sulawesi.

Armadillo velutinus was transferred by Budde-Lund (1904) to the genus *Spherillo* Dana, 1853, and since then no author has dealt with this species.

The problem of the definition and composition of *Spherillo* Dana, 1853 (= *Sphaerillo* Verhoeff, 1926) has been discussed often but never clarified. The proposal of Jackson (1941) and Vandel (1973b) to consider *Spherillo* Dana as a nomen nudum and to replace it with *Sphaerillo* Verhoeff can not be accepted as it goes against the rules of zoological nomenclature. The only way for unequivocally redefining the genus *Spherillo* is to re-examine the four species (*S. monolinus, S. vitiensis, S. hawaiensis* and *S. spinosus*) described by Dana (1853) and to designate one of these as type species of the genus. Awaiting such a revision, we are keeping *A. velutinus* in *Spherillo* as stated by Budde-Lund (1904).

Discussion

Seventeen species of terrestrial isopods were collected in the Krakatau Islands and surrounding areas of Java and Sumatra by the Zoological Expeditions to the Krakataus (1984–1986):

(1) *Alloniscus oahuensis* Budde-Lund, 1885;
(2) *A. pallidulus* Budde-lund, 1885;
(3) *Pseudotyphloscia alba* (Dollfus, 1898);
(4) *Anchiphiloscia pilosa* (Budde-Lund, 1913);
(5) *Burmoniscus orientalis* sp. nov.;
(6) *B. rakataensis* sp. nov.;
(7) *B. veliger* sp. nov.;
(8) *B. vaughani* sp. nov.;
(9) *B. thorntoni* sp. nov.;
(10) *Serendibia* sp.;
(11) *Nagurus nanus* (Budde-Lund, 1908);
(12) *N. cristatus* (Dollfus 1889);
(13) *Saidjahus guttatus* (Dollfus, 1898);
(14) *Cubaris murina* Brandt, 1833;
(15) *Cubaris* sp.;
(16) *Venezillo parvus* (Budde-Lund, 1885);
(17) *"Spherillo" velutinus* (Dollfus, 1898).

This collection certainly represents only a small part of the oniscidean fauna present in this area. It is typical of the Oriental Region, being characterized by the presence of species of *Pseudotyphloscia, Burmoniscus, Serendibia, Nagurus, Saidjahus* and *Cubaris*.

However, the collection is interesting because it includes five new species and adds four species to the fauna of Java (*Pseudotyphloscia alba, Burmoniscus orientalis, B. thorntoni, Saidjhaus guttatus*) and five to that of Sumatra (*Burmoniscus veliger, B. vaughani, Serendibia* sp., *Nagurus nanus* and *N. cristatus*).

At present 11 species are known from the Krakataus (Table 1). *Alloniscus oahuensis* and *A. pallidulus* are strictly littoral while all the others are common in different biotopes. Of the three species from the Krakataus listed by Richardson Searle (1922), only *Cubaris murina* was not collected in the recent surveys. With the exception of *Burmoniscus rakataensis*, at present known only from Rakata, and *Cubaris* sp., due to taxonomic uncertainties, all the other species are widespread in the Oriental Region or have a pantropical distribution. All of these species have a great facility for dispersal, most of them

Table 1. Distribution of terrestrial isopods in the Krakataus.

	Sertung	Rakata	Panjang	Anak Krakatau
Alloniscus oahuensis	×	o		
A. pallidulus	×			
Pseudotyphloscia alba	×			×
Anchiphiloscia pilosa	×	×	×	
Burmoniscus orientalis		×	×	
B. rakataensis		×		
Nagurus nanus				×
N. cristatus	×	×o	×	
Cubaris murina		o		
Cubaris sp.		×		
Venezillo parvus	×			
	6	7	3	2

o = Species recorded by Richardson Searle (1922).
× = Species collected by the Zoological Expeditions to the Krakataus (1984–1986), La Trobe University, Bundoora.

are euryoecious and have certainly been introduced (with driftwood, human activities, etc.).

The peculiar history of these volcanic islands (see Thornton, 1985) provides an unique opportunity for studying problems like recolonisation and turnover of species. Unfortunately lack of previous reliable data on the presence of terrestrial isopods does not allow any conclusion. The present list of species from the Krakataus can be considered as a good starting point for future research.

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References

Arcangeli, A., 1927. *Paraperiscyphis Calegarii* Arc. nuova specie di Isopodo terrestre di Sumatra. *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore di Agricoltura di Portici* 20: 79–82.

Arcangeli, A., 1935. Isopodi terrestri di Sumatra raccolti dal Sig. J. C. van der Meer Mohr. *Miscellanea Zoologica Sumatrana* 98: 1–4, pls I–III.

Arcangeli, A., 1954. Contributo alle conoscenze sugli Eubelidi di Asia (Crostacei Isopodi terrestri). *Bollettino dell'Istituto e Museo di Zoologia dell'Università di Torino* 4 (1953–1954): 9—17, pl. 1.

Arcangeli, A., 1960. Revisione del genere *Alloniscus* Dana. Il sistema respiratorio speciale agli exopoditi dei pleopodi delle specie appartenenti allo stesso genere (Crostacei Isopodi terrestri). *Bollettino dell'Istituto e Museo di Zoologia dell'Università di Torino* 6 (1958–1960): 17–79, pls I–XIV.

Budde-Lund, G., 1885. *Crustacea Isopoda terrestria per familias et genera et species descripta.* Nielsen and Lydiche: Hauniae. 320 pp.

Budde-Lund, G., 1904. A revision of "Crustacea Isopoda terrestria" with additions and illustrations. 2. Spherilloninae. 3. *Armadillo.* H. Hagerup: Kjøbenhavn. Pp. 33–144, pls VI–X.

Budde-Lund, G., 1908. Isopoda von Madagaskar und Ostafrika mit Diagnosen verwandter Arten. *Wissenschaftliche Ergebnisse. Reise in Ostafrika.* 2 (4): 263–308.

Budde-Lund, G., 1912a. Description of a new species of terrestrial Isopoda from Java. *Notes of the Leyden Museum* 34: 169–170, pl. 8.

Budde-Lund, G., 1912b. Oniscoidea, nachgelassenes Fragment. *Die Fauna Südwest-Australiens* 4: 17–44, pl. 1.

Budde-Lund, G., 1913. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of Mr. J. Stanley Gardiner. (IV. No. XXII). Terrestrial Isopoda particularly considered in relation to the distribution of the southern Indo-Pacific species. *Transactions of the*

Linnean Society of London (Zoology) 15: 367–394.

Bunn, S.E. and Green, A.J.A., 1982. Oniscoidea (Crustacea: Isopoda) from Rottnest Island, Western Australia. *Journal of the Royal Society of Western Australia* 65: 147–151.

Dammerman, K.W., 1948. The fauna of Krakatau 1883–1933. *Verhandelingen der Koninklijke Nederlandsche Akademie van Wetenschappen, Afd. Natuurkunde (Tweede Sectie)* 44: 1–594.

Dana, J.D., 1853. *United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N. Vol. XIII. Crustacea. Pt. 2.* C. Sherman: Philadelphia. Pp. 691–1618. Atlas (1855) with 96 pls.

Dollfus, A., 1898. Isopodes terrestres des Indes Néerlandaises recueillis par M. le Professeur Max Weber et par M.M. les Docteurs Fritz et Paul Sarasin (de Bâle). In: M. Weber, *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien, Leiden* 4 (2): 357–382, pls XIII–XV.

Ferrara, F. and Taiti, S., 1985. The terrestrial isopods (Crustacea) of Aldabra. *Zoological Journal of the Linnean Society* 85: 291–315.

Ferrara, F. and Taiti, S., 1986. Validity of the genus *Anchiphiloscia* Stebbing, 1908 (Crustacea Isopoda Oniscidea). *Monitore Zoologico Italiano (N.S.) Supplemento* 21: 149–167.

Herold, W., 1931. Land-Isopoden von den Sunda-Inseln. Ausbeuten der Deutschen Limnologischen Expedition und der Sunda-Expedition Rensch. *Archiv für Hydrobiologie Supplement* 9: 306–393.

Jackson, H.G., 1933. Marquesan terrestrial Isopoda. *Bulletin of the Bernice P. Bishop Museum* 114: 145–162.

Jackson, H.G., 1941. Check-list of the terrestrial and fresh-water Isopoda of Oceania. *Smithsonian Miscellaneous Collections* 99 (8): 1–35.

Manicastri, C. and Taiti, S., 1987. Terrestrial Isopods from Sri Lanka, III: Philosciidae (Crustacea, Oniscidea): Part 1. *Revue Suisse de Zoologie* 94 (1): 17–34.

Richardson Searle, H., 1922. Terrestrial Isopoda collected in Java by Dr. Edward Jacobson with descriptions of five new species. *Proceedings of the United States National Museum* 60: 1–7, pls 1–2.

Schultz, G. A., 1985. Three terrestrial isopod crustaceans from Java, Indonesia (Oniscoidea: Philosciidae). *Journal of Natural History* 19: 215–223.

Taiti, S. and Manicastri, C., 1988. Terrestrial Isopods from Sri Lanka, IV: Philosciidae (Crustacea, Oniscidea): Part 2. *Revue Suisse de Zoologie* 95 (1): 51–86.

Thorton, I.W.B., 1985. *1984 Zoological Expedition to the Krakataus. Preliminary Report.* Department of Zoology, La Trobe University: Bundoora. VIII + 57 pp.

Vandel, A., 1973a. Les Isopodes terrestres (Oniscoidea) de la Mélanésie. *Zoologische Verhandelingen* 125: 1–160.

Vandel, A., 1973b. Les Isopodes terrestres de l'Australie. Étude systématique et biogéographique. *Mémoires du Muséum National d'Histoire Naturelle, Paris (N.S.) (série A, Zoologie)* 82: 1–171.

Verhoeff, K.W., 1928. Isopoden aus Formosa. 39. Isopoden-Aufsatz. *Mitteilungen aus dem Zoologischen Museum in Berlin* 14: 200–226.

Wahrberg, R., 1922. Results of Dr. E. Mjöberg's Swedish Scientific Expeditions to Australia 1910–1913. 30. Terrestre Isopoden aus Australien. *Arkiv för Zoologi* 15: 1–298.