
Two New Species of Symphyla from the Krakatau Islands and the Ujung Kulon Peninsula (Myriapoda: Symphyla: Scolopendrellidae, Scutigereidae)

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TWO NEW SPECIES OF SYMPHYLA FROM THE KRAKATAU ISLANDS AND THE UJUNG KULON PENINSULA (MYRIAPODA: SYMPHYLA: SCOLOPENDRELLIDAE, SCUTIGERELLIDAE)

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Symphyla have been collected from the Krakatau Islands and the Ujung Kulon Peninsula on Java for the first time. Two species were found, both new to science: *Symphylella javanensis* in Scolopendrellidae and *Millotellina krakatauanus* in ScutigereUidae. They are described and figured. The dispersal of the latter species to the Krakataus is discussed.

1. INTRODUCTION

The 1984 Zoological Expedition to the Krakataus (La Trobe University, Australia, and Zoological Museum, Bogor, Indonesia), headed by Professor I. W. B. Thornton, collected Symphyla from the Krakatau Islands in the Sunda Strait and the Ujung Kulon Peninsula in westernmost Java (figure 1). This material is of great value, not only to show that symphylans have begun to recolonize the Krakataus, but also as an inducement for further studies in a completely uninvestigated area probably rich in species.

As far as is known, only a few accidental finds have been recorded from Sumatra and Java: *Symphylella vulgaris* (Hansen) and *Hanseniella orientalis* (Hansen) from Fort de Kock, Sumatra (Jupeau 1957: 27), the latter also from Singkarak and Mount Singalang on Sumatra and from Tjibodas on Java (Pocock 1894: 33 s.n. *ScutigereUa immaculata*; Hansen 1903: 32–33, 40–41). These almost certainly represent but a fraction of the species present; many more species have been collected from other tropical areas: Sri Lanka 36 (Scheller 1971), Réunion 11 (Jupeau 1954*a*), Madagascar and Nosy Bé 20 (Remy 1942; Aubry & Masson 1953; Jupeau 1954*a*; Rochaix 1956).

The collection studied here contains two species, both new to science: on two Krakatau

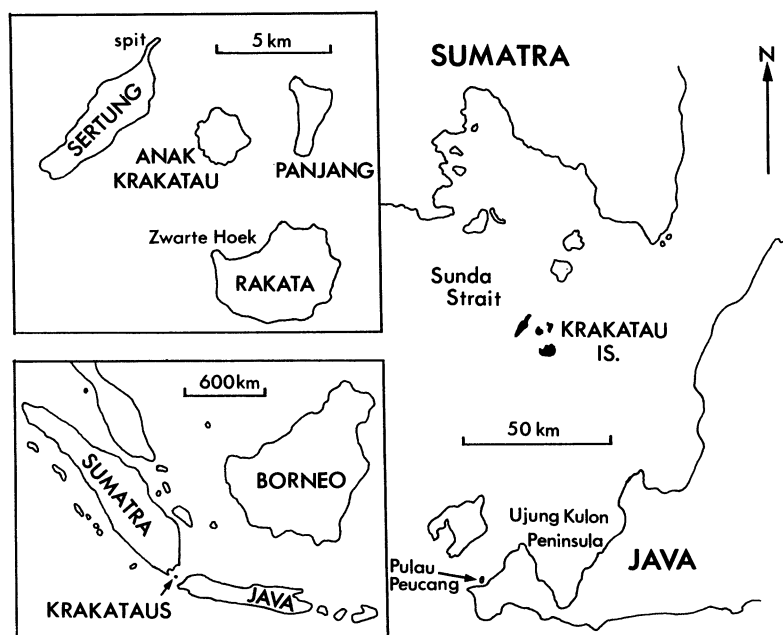


FIGURE 1. Sunda Strait, showing the Krakatau Islands in 1984.

Islands *Millotellina krakatauanus* in the family Scutigereidae, and on the Ujung Kulon Peninsula *Symphylella javanensis* in the family Scolopendrellidae.

2. SYSTEMATICS

(a) Family SCOLOPENDRELLIDAE

Genus *SYMPHYLELLA* Silvestri, 1902

The range of the genus is worldwide and about 40 species have been described from the temperate, subtropical and tropical regions.

Symphylella javanensis sp. nov.

(Figures 2 and 3.)

Type locality

Java, Ujung Kulon, Pulau Peucang Island.

Type material

Holotype. Java, Ujung Kulon, Pulau Peucang Island, 5° 45' S, 105° 15' E, ad. (♂), 19 Sep. 1984.

Paratypes. *Ibidem*, 1 subad. with 11 pairs of legs (♂), 1 juv. with 9 pairs of legs. — 3 specimens.

Deposition

Holotype: Zoological Museum, Bogor, Indonesia. *Paratypes*: Australian National Insect Collection, Canberra.

Diagnosis

In some respects this species is similar to *S. vulgaris* (Hansen), which is almost cosmopolitan; to *S. tentabunda* Scheller (1971) from Sri Lanka; *S. tenella* Scheller (1961) from Hawaii; and to 3 North American species, *sierrae*, *subterranea* and *geum*, described by Michelbacher (1939*a, b*, 1941). It is easily distinguished from all of these by the shape of the styli (distally spatulate, not pointed), and is more similar to the first three species mentioned above.

Description (holotype only)

Length. 2.57 mm.

Head. 1.2 times as long as broad, broadest behind centre at level of points of articulation of mandibles; latter almost concealed; central rod very thin with traces only of its anterior half and of anterior branches; lateral branches vestigial. Dorsal surface of head behind anterior

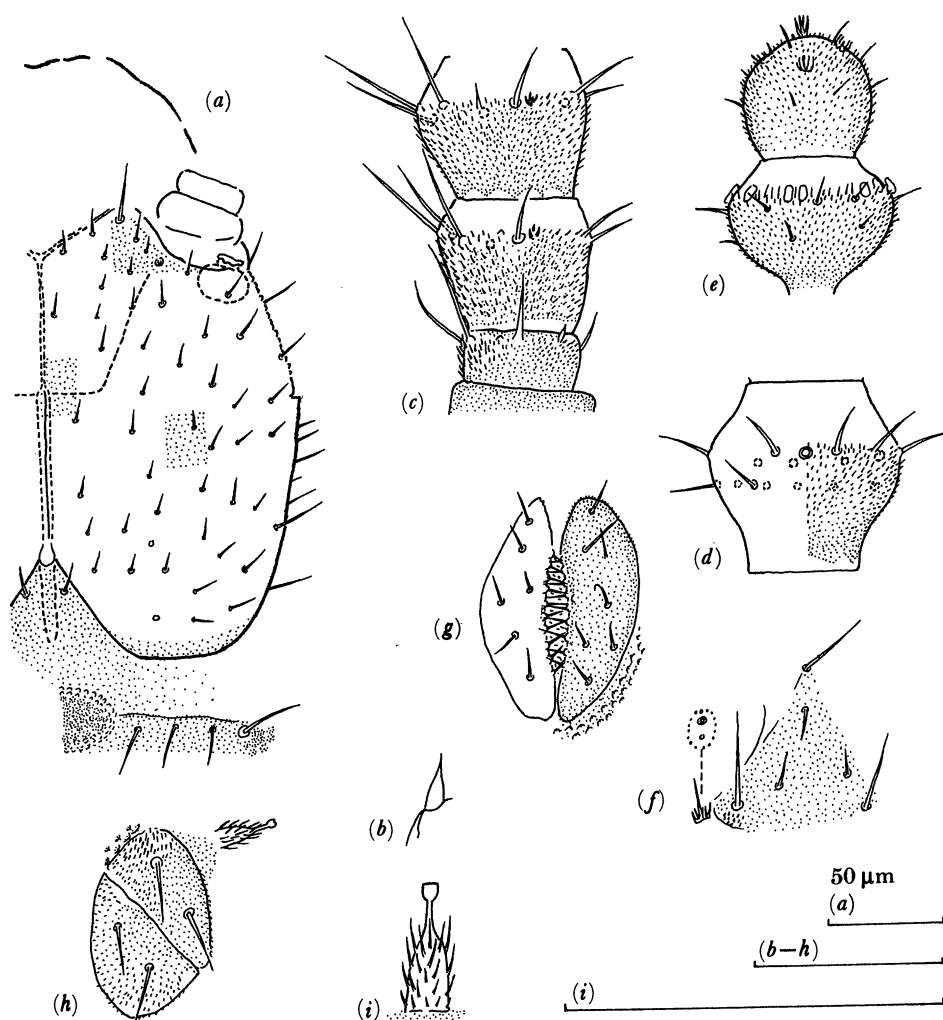


FIGURE 2. *Symphylella javanensis* sp. nov. (a) Head and tergite 1, right half. (b) Palp of first maxilla. (c-e) Right antenna, dorsal view: c, segments 1-3; (d) segment 10; (e) last two segments. (f) Rudimentary leg 1, right side, ventral view. (g) Genital opening, ♂. (h) Coxal sac and stylus, leg 9, right side. (i) Stylus, leg 6. Cuticular structures only partly drawn in (a), (d) and (g).

branches with short very thin setae of different lengths; longest setae in oblique post-antennal row and laterally, about twice as long as shorter ones. Post-antennal organ subspherical with diameter of opening half diameter of organ; diameter of organ 0.7 times that of antennal segment 1. Palp of first maxilla straight, conical, pointed. Cuticle of dorsal side of head with faint dense granulation.

Antennae. Right antenna with 17 segments, left antenna with 19. First segment much smaller than following ones almost twice as broad as long, length and diameter 0.5 and 0.8 those of segment 2; 5 setae in a single whorl, 2 long and thin on inner side, one long and thicker with broad base on dorsal side, one short and thin on outer side and a small lanceolate one between the latter two; longest inner seta 0.8 greatest diameter of segment and 1.9 times length of outer seta. Segment 2 1.1 times as wide as long, with 8 setae rather evenly distributed around segment; longest setae on inner side, their length 0.7 greatest diameter of segment and 1.6 times length of outer setae. Segment 3 similar to preceding segment but with 9 setae; one dorsal seta very short. Segment 10 as wide as long with 10 setae in primary whorl; inner and outer setae subequal, their length almost 0.3 greatest diameter of segment; secondary whorl consisting of 7 very thin setae on inner dorsal, inner and ventral sides. Proximal part of antennae with one whorl of setae on each segment; secondary whorl with 2 setae ventrally on segment 9. Primary whorl with circular sense organs from segment 5 onwards to segment 15 and 17 respectively; most distally 2 such organs on each segment. Bladder-shaped organs on 8 segments next to apical one; they increase in number on distal segments to a maximum of 16. Rudimentary spined organs dorsally on segments 2–6, 14 and most distally. Apical segment subglobular, a little wider than long with several short setae on distal half; small spined sensory organs consisting of 3 curved spines around a central pillar in 3 depressions in distal surface; similar larger organ without stalk on apex of segment. All segments distinctly pubescent.

Tergites. Tergite 1 rudimentary with 8 setae in two groups of 4. Thirteen tergites with triangular processes. Second tergite complete. Ratio of distance between processes to their length 0.7 on tergites 2 and 3, 1.0 on tergite 4; triangular processes with small glabrous triangular or ovoid end-swellings; processes of posterior tergites with broader bases than those anteriorly. Tergites 3, 6, 9 and 12 longer than preceding ones. Long (sub)anterolateral setae on tergites 1–14 about as long as triangular processes on anterior tergites, posteriorly proportionately longer. Tergites 2–13 with at least one marginal seta (often more) between apical and inner basal seta. Number of posteromarginal setae on different tergites varies slightly but is small. Number of lateromarginal setae on anterior tergites: 6 on tergite 2, 9 on tergite 3, 5 or 6 on tergite 4 and 5, 7–9 on tergite 6. Last tergite with setae in 4 longitudinal rows, 5 setae in submedian rows, 6 in lateral ones. Cuticle granulated or shortly pubescent. On triangular processes and anterolateral corners many small circular spots either smooth or with fine granulation.

Legs. First pair of legs reduced to two small hairy cupules each with one long seta. Last pair of legs 0.1 of length of body. Tarsus subcylindrical with distal fifth tapering; 3.7 times as long as wide with 6 dorsal setae: 4 straight and erect, 2 curved and depressed; long subequal erect setae about as long as greatest diameter of tarsus and about 0.4 length of tibia. The latter 1.7 times as long as wide with 4 long dorsal setae; longest seta 0.8 greatest diameter of tibia and 1.1

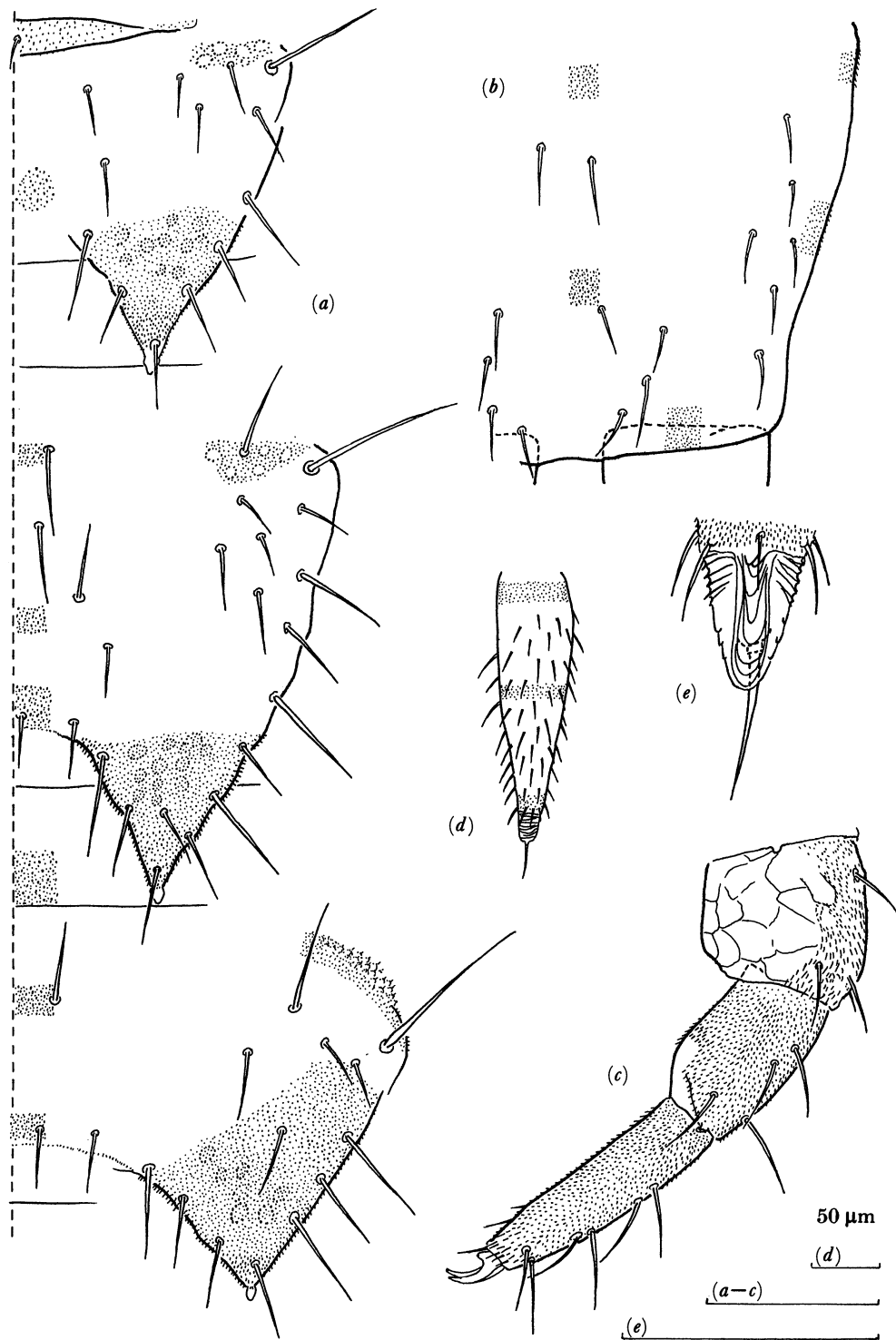


FIGURE 3. *Symphylella javanensis* sp. nov. (a) Tergites 2–4. (b) Last tergite. (c) Leg 12, first three segments, posterior view. (d) Cercus, right side, dorsal view. (e) Cercus, distal part, ventral view. Cuticular structures only partly drawn in (a), (b) and (d).

times length of longest seta of tarsus. Femur as long as wide. Anterior claw 0.3 length of tarsus, 1.3 times length of posterior claw, latter a little more curved and more slender than anterior claw. Tarsus and tibia wholly pubescent, densest on posterior side. Femur distinctly pubescent dorsally, ventrally and posteriorly with cuticular thickenings in pattern of large scales.

Styli at bases of legs 3–12; proximal $\frac{2}{3}$ subconical, with strong and slightly curved hairs which increase in length distally; distal third spatulate, apically truncate (also in the subad. 11 specimen but not in the juv. 9 specimen). Coxal sacs at bases of legs 3–9. Coxal plates of leg 10 with 3 setae, those of leg 11 with 2, of leg 12 with one.

Cerci. 3.6 times as long as wide, with somewhat curved sides, $\frac{1}{14}$ length of body and about $\frac{3}{4}$ length of leg 12. Setae on all sides, mainly short, thin, slightly curved; 5–6 longer protruding setae on ventral side and 1–2 on inner side, longest ones 0.4 greatest diameter of cercus. Terminal area short, about 10 ventral lamellae. Apical seta 1.1 times as long as terminal area and 0.1 times length of cercus. Pubescence very dense and short.

(b) Family SCUTIGERELLIDAE

Genus *MILLOTELLINA* Jupeau, 1954a

The genus *Millotellina* has two subgenera. The nominate subgenus, which has not been collected outside the tropics, includes five species: *splendens* Jupeau (known from Nosy Bé, Madagascar, Réunion, Sri Lanka), *parva* Jupeau (Réunion), *media* Jupeau (Cameroun), *reducta* Jupeau (New Guinea) and *monteithi* Nauman (northern Australia). The second subgenus, *Diplomillotellina*, has a single species, *bidens* Scheller (southern Australia). The new species falls in the nominate subgenus.

Subgenus *MILLOTELLINA* s. str.

Millotellina (*M.*) *krakatauanus* sp. nov.

(Figures 4 and 5.)

Type locality

Krakatau Islands, Sertung, northern spit.

Type material

Holotype. Krakatau Islands, Sertung, spit, 6° 04' S, 105° 24' E, on beach, under bark of dead *Ficus*, ad. (♂), 11 Sep. 1984.

Paratypes. Rakata, Zwarte Hoek, 6° 09' S, 105° 25' E, under bark of log, 4 ad. (3 ♂, 1 ♀), 15 Sep. 1984; *ibidem*, under log, 1 ad. (♀), 15 Sep. 1984; 5 specimens.

Deposition

Holotype: Zoological Museum, Bogor, Indonesia. Paratypes: Australian National Insect Collection, Canberra.

Diagnosis

As far as external morphology is concerned the species of the subgenus constitute a homogeneous group, but *M. krakatauanus* appears to be most similar to *splendens*, *parva* and *media*, all of which have seven appendages between coxal sacs 5 and 11. The new species is easily

distinguished from them by the shape and cuticular structure of the ventral appendages, which are distally lengthened, blunt, with coarse curved pubescence hairs (conical, pubescent, with a distal granular swelling in *splendens*; evenly conical, pubescent in *media*; very small, subconical, granular in *parva*). *M. krakatauensis* is most similar to the Cameroun species, *media* (Juberthie-Jupeau 1954b). Apart from the differences in the shape of the ventral appendages the new species differs from *media* in: the anterior claw of the last pair of legs is more slender, the posterior claw less curved, the tibia of the last pair of legs is more setose, and the cerci are proportionately longer.

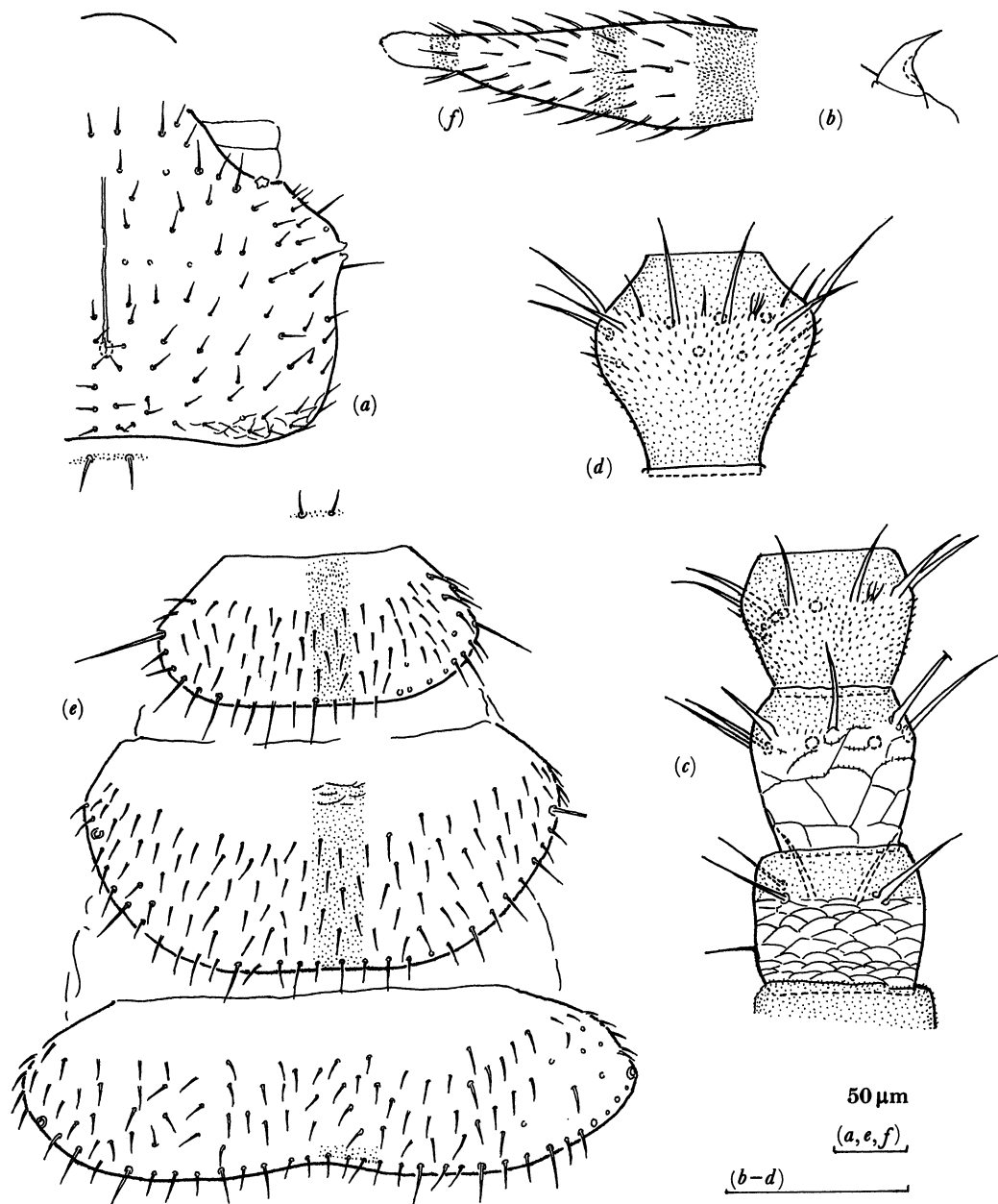


FIGURE 4. *Millotellina* (*M.*) *krakatauensis* sp. nov. (a) Head and rudimentary tergite 1, dorsal view (anterior setae not drawn). (b) Palp of first maxilla, ventral view. (c) Segments 1–3 of right antenna, dorsal view. (d) Antennal segment 10, dorsal view. (e) Tergites 1–4. (f) Cercus, left side, inner view. Cuticular structures only partly drawn in (e) and (f).

Description

Length. (2.04–) 2.80 (–3.07) mm.

Head. Approximately as broad as long, broadest just posterior to middle. Lateral angle at point of articulation of mandible very distinct. Dorsal surface rather sparsely beset with short setae; longest setae at base of antenna and around lateral angle; longest seta in front of lateral angle, 0.3 diameter of antennal segment 1. Anterior setae of oblique post-antennal rows longer than posterior setae; the latter about as long as longest lateral angle setae. Dorsal surface glabrous; meshwork of cuticular thickenings only at posterolateral corners (and sometimes posteriorly and laterally). Central rod thin, visible only anterior to posterocentral ovoid end-swelling, (0.2–) 0.3 length of head; distance between end-swelling and posterior margin of head 0.2 length of head; neither anterior nor lateral branches. Post-antennal organ spherical, with small irregular opening; diameter of organ 0.2 that of antennal segment 1. Palp of first maxilla conical, with thick base, curved posteriorly, pointed; length 1.8 (–2.2) its greatest width.

Antennae. Left antenna of holotype broken at segment 2, right antenna at segment 14. In 2 paratype specimens antennae complete, with 24 and 28 segments. Antennal base short, undivided, densely granular. Segment 1 1.2 times as wide as long. Primary whorl of 5 setae: dorsal seta longest, (0.6–) 0.7 width of segment; two thin straight inner or inner-dorsal setae on prominent bases, (0.8–) 0.9 length of dorsal seta; 2 ventral setae similar to dorsal one but a little curved and not constricted at base. One short thin seta on inner surface proximal to primary whorl; not quite 0.5 length of inner primary setae. Segment 2 as broad as long. Primary whorl of 8 setae, their lengths 0.6–0.8 diameter of segment. Two inner setae thinnest, 0.8 length of longest outer seta. Segment 3 similar to preceding one. Primary whorl of 9 (or 10) setae, one inner seta, one very short and thin inner-ventral one; outer and inner setae subequal in length; holotype and one paratype specimen with one secondary whorl seta on inner side. Segment 10 has 14 (or 15) setae of very different lengths in primary whorl; (1–) 4 setae in secondary whorl. Proximal segments with single primary whorl of setae on each segment; secondary whorl begins on inner surface of segments 3 (–9) but never complete; an indistinct third whorl appears from segment 10 (–14) onwards. Apical segment (paratypes only) about 1.5 times as long as wide, with 2 small and one large spined organ. Cuticle of segment 1 glabrous, densely scaly, particularly on proximal quarter. Segment 2 with (3–) 4 (–5) rows of much larger scales, distal ones with sparse row of very short pubescence hairs on distal margins. Segment 3 no scales, but sparse evenly distributed short hairs. Pubescence progressively denser and longer on more distal segments.

Tergites. Tergite 1 rudimentary with 2 thin pointed setae. Tergite 2 complete, 2.0 (–2.4) times as broad as long; posterior margin straight (or somewhat convex) with distinct lateral angles. Anterolateral macrochaetae 0.4–0.5 (–0.7) length of diameter of antennal segment 1, directed anteriorly and outwards. Posteromarginal setae number (17–) 21, longest ones (0.4–) 0.6–0.8, shortest 0.2–0.3 length of anterolateral macrochaetae. Posterior $\frac{2}{3}$ of tergite densely setose with short setae. All setae tapering, pointed. Tergite 3 (2.0–) 2.1 (–2.2) times as broad as long, as broad as (–slightly broader than) head; posterior margin straight (–somewhat convex). Posteromarginal setae (24–) 27 in number; chaetotaxy as for tergite 2. Tergite 4 (2.9–) 3.4 (–3.6) times as broad as long, broader than tergite 3 and with posteromedian

emargination. Posteromarginal setae (23–) 30 in number. More posteriorly all tergites slightly emarginate. Anterolateral macrochaetae on tergites 2, 3, 4, 6, 7 and 9. Pubescence of tergite 2 dense, short, anteriorly mainly on mesh-like cuticular thickenings; posterior margin narrow, glabrous. On more posterior tergites anterior mesh-like thickenings more distinct.

Legs. Tarsus of leg 1 (3.3–) 4.3 times as long as wide, tapering distally and with (4–) 5 longitudinal rows of setae; 4 (–5) setae in longest dorsal row, 3 (–4) in longest ventral one; length of setae increasing distally, longest one about as long as greatest width of tarsus. Anterior claw elongate, almost straight, not quite 0.2 length of tarsus, (1.7–) 2.0 times as long as more

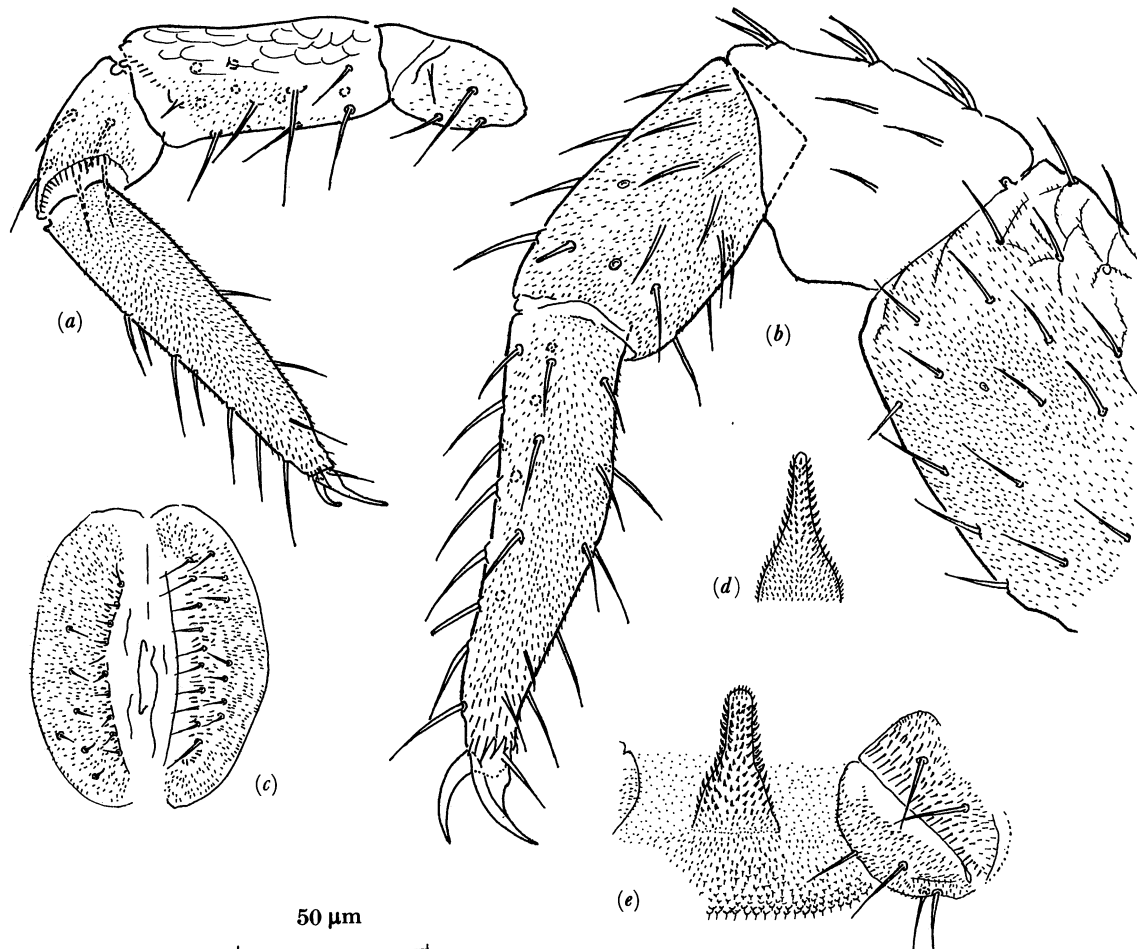


FIGURE 5. *Millotellina (M.) krakatauensis* sp. nov. (a) Leg 1, right side, anterior view. (b) Leg 12, right side, anterior view (pubescence not drawn on femur). (c) Genital opening, ♂. (d) Median ventral appendage, leg 5. (e) Median ventral appendage and left coxal sac, leg 9.

curved posterior claw. Frontal seta 0.6 (–0.7) length of anterior claw. Segment 2 with 5 setae, following segments with (15–) 16 (–19) and (3–) 4 (–5) setae respectively. Leg 1 pubescent, except posterior and outer side segment 3 glabrous and with scale-like cuticular thickenings. Leg 12. Tarsus (3.2–) 3.8 times as long as wide, slender, tapering distally, densely setose with setae in (5–) 6 longitudinal rows; setae increasing in length distally, longest dorsal seta (0.6–) 0.8 and longest ventral seta (0.6–) 0.7 greatest width of tarsus; dorsal setae thickest; longest

dorsal row with 4 (–6) setae, longest ventral one with 3 (–4) setae. Anterior claw (0.2–) 0.3 length of tarsus, slightly more curved than anterior claw of leg 1, 1.2 (–1.4) times length of posterior claw; the latter basally less broad than anterior claw, more strongly curved than posterior claw of leg 1; frontal seta 0.7 (–0.9) length of posterior claw. Tibia (1.8–) 1.9 (–2.0) times as long as wide, 0.7 (–0.8) length of tarsus; dorsal surface with 2 (–3) longitudinal rows of setae, each of 4 (–6) setae; several thinner setae on anterior and ventral surfaces; longest dorsal seta about 0.5 greatest width of segment. Femur approximately as long as wide with 3 setae in 2 dorsal rows. Trochanter with numerous fine setae on dorsal, anterior and ventral sides and a few anterior setae only. Tarsus rather uniformly pubescent except dorsal side almost glabrous and distal $\frac{1}{5}$ has hairs increasing in length outwards. Tibia pubescence as tarsus but shorter distally. Dorsal sides of femur and trochanter with pubescence on cuticular thickenings. Styli at bases of legs 3–12, slender, (2.6–) 3.1–3.4 (–4.5) times as long as wide; outer seta (0.5–) 0.6 length of stylus, (2.1–) 2.2–2.5 (–2.8) times length of inner seta; both setae tapering to sharp point; no additional setae. Coxal sacs at bases of legs 3–10. Coxal plates of leg 11 with 3 (or 4) setae, those of leg 12 with 2 setae. Median ventral processes between coxal sacs of legs 5–11 skittle-shaped, blunt, with coarse, curved, oblique pubescence hairs; processes about as long as styli and (1.3–) 1.4–1.9 times as long as greatest width.

Cerci. (3.3–) 3.5 (–4.3) times as long as wide, 0.1 length of body, densely setose except over proximal part; longest dorsal longitudinal row with (7–) 9 setae, longest ventral one with (7–) 8; distal setae longer than proximal ones, longest dorsal seta (1.2–) 1.5 (–1.6) times as long as shortest proximal seta, (0.3–) 0.4 greatest width of cercus. Apical setae broken. Cuticle with short dense uniform pubescence.

3. THE DISPERSAL OF *MILLOTELLINA KRAKATAUANUS* TO THE KRAKATAUS

Symphylans were collected on two of the Krakatau Islands, Sertung and Rakata (the remnant of Krakatau). It is believed that the biota of both was extirpated in the explosive eruption of Krakatau Island in 1883. Both islands were covered by glowing ash and pumice, to depth of 30–60 m in places.

Since 1883 at least one species of Symphyla has succeeded in crossing the saltwater barrier between the archipelago and Java or Sumatra or both, but its source area and means of dispersal are unknown. Not only the adjacent areas of Sumatra and Java, but the entire islands, are uninvestigated so far as Symphyla is concerned, and nothing is known of the ability of symphylans to disperse across sea.

Two means of dispersal are considered possible. Unintentional transport by man may have occurred, because specimens were collected at the Sertung Spit where a small cottage existed for a short time (Thornton & Rosengren 1988). Because symphylans thrive in cultivated soil they may have been present in root-clumps of garden plants and have then invaded surrounding ground. Zwarte Hoek on Rakata is frequently visited by fishermen, although there has been no permanent dwelling there. *M. krakatauanus* may also have colonized by means of some floating object, among the roots of a tree from a flooded river or in air-filled cavities in driftwood, which is common on the beaches of the Krakataus. Of the two possibilities, accidental introduction by man is perhaps the more likely.

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