

**Pycnogonida of the Western
Pacific Islands, III:
Recent Smithsonian-Philippine
Expeditions**

C. ALLAN CHILD

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Pacific Islands, III:
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C. Allan Child



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ABSTRACT

Child, C. Allan. Pycnogonida of the Western Pacific Islands, III: Recent Smithsonian-Philippine Expeditions. *Smithsonian Contributions to Zoology*, number 468, 32 pages, 12 figures, 1988.—Pycnogonida from three recent Smithsonian-Philippine cooperative shallow-water expeditions are described. They contain 30 described species, with 12 newly described and two left undescribed for lack of adult specimens. The new species described are *Ammothella alcalai*, *A. rotundata*, *Eurycyde setosa*, *Tanystylum philippinensis*, *Anoplodactylus attenuatus*, *A. brevisrostris*, *A. falciclavus*, *A. paradigmatus*, *Propallene curtialpus*, *Nymphon diabolus*, *N. megacheles*, and *Rhynchothorax orientalis*. Previous literature on Philippine pycnogonids is reviewed and the zoogeography of the species is discussed.

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Pycnogonida of the Western Pacific Islands, III: Recent Smithsonian-Philippine Expeditions

C. Allan Child

Introduction

The Pycnogonida, like many marine invertebrates, tend to be highly provincial. The absence of a planktonic larval phase reinforces their provinciality and tends to contribute to their high endemism, at least at the species level, in any given region. The shallow-water and shelf (0-200 m) pycnogonids of the Philippines are no exception to provinciality, so it comes as no surprise that 12 (40%) of the 30 shallow and shelf species reported herein are new to science. The marine fauna of the Philippine-Indonesian archipelagos have long been known to be extremely rich and yet their marine invertebrate fauna is among the least known of the world's major zoogeographic regions. Intensive collecting in the shallows of this region could hardly fail to produce a species list of at least a magnitude greater than the 16 species previously known to exist in the shallows of the Philippines. Our collecting efforts and those of others in the Philippines over the last few years have hardly served to scratch the surface of the vast wealth of tropical marine habitats known to Philippine marine biologists.

HISTORICAL BACKGROUND.—The first pycnogonid known from the Philippines, *Pycnogonum orientale* (Dana, 1849, 1852), was taken on a coral reef in the Balabac Straits south of Palawan Island in 1842. The type of this rather distinctive species has long since been lost and subsequent captures have not been reported. Almost 60 years passed before additional pycnogonids were reported from Philippine waters. Loman (1908) described three species captured in less than 200 meters in his *Siboga* monograph of primarily Indonesian material. Stock (1953), in reporting on American *Albatross* material along with an additional *Siboga* species and *Snellius* expedition captures from Indonesia, reported on three new Philippine species and a previously described species new to the Philippines. The next year, Stock (1954) reported two

additional new species and three others new to the archipelago. Later Stock (1968) added another new species and one known species new to the Philippines in his *Galathea* and *Anton Bruun* paper. Two additional new species have recently been added to the list by Stock (1981, 1983), to bring the total number of species known from the Philippines to 16 at the shallow depths under consideration. There are at least eight deeper-water species known that will not be considered herein (*Ascorhynchus orthorhynchus* Hoek, *Pycnofragilia hamisetosa* (Loman), *Nymphon hedgpethi* Stock, *Pycnosomia asterophila* Stock, *Callipallene cuspidata* Stock, *Pallenopsis temperans* Stock, *Colossendeis colossea* Wilson, *Colossendeis leptorhynchus* Hoek, and several specimens described only to genus).

The following pycnogonids have been reported in Philippine waters of 200 meters or less (* indicates species included in this report):

Achelia nana (Loman)
Nymphopsis muscosa Loman
**Anoplodactylus batangensis* (Helfer)
**Anoplodactylus tarsalis* Stock
Endeis flaccida Calman
Endeis procera (Loman)
**Pallenopsis denifera* Stock
Pallenopsis hoeki (Miers)
Pallenopsis sibogae Loman
Pallenopsis verrucosa Stock
Parapallene nierstraszi Loman
Pseudopallene zamboangae Stock
Rhopalorhynchus kroyeri (Wood-Mason)
Pycnogonum orientale (Dana)
Nymphon macilentum Stock
Nymphon spiniventris Stock

MATERIALS.—This report is based on the collections taken by three cooperative expeditions to biologically little-known areas of the Philippine Archipelago in 1978, 1979, and 1985. Smithsonian Institution biologists joined others from Silliman University, Dumaguete City, Negros Oriental Province, and the Philippine National Museum, Manila, to investigate remote shores having had little or no previous collecting effort. The

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expeditions were extremely productive and resulted in capturing a wealth of fauna from mostly shore and shallow-water areas. The pycnogonids reported on herein are from these collections but include at least one capture from deeper water to complete the report on all specimens examined.

The collections comprise about 160 specimens taken at 41 stations scattered in the mid- and southern Philippines and from the northernmost province, from about 9° to 20°N, and 118° to 123°E. The specimens represent a 27+% yield per station in 41 of the approximately 150 stations sampled. These figures attest to the richness of the Philippine fauna and also to the effective collecting techniques of our many Pilipino colleagues during the expeditions. The holotypes and other selected paratypes and non-type specimens are deposited in the Philippine National Museum, Manila, whereas all other specimens are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

CURRENT KNOWLEDGE AND ZOOGEOGRAPHY.—This report includes 30 species: three already known to the islands, 13 known species not previously reported from the Philippines, 12 species new to science, and two not described because of lack of adult material. No new genera are proposed, but eight of the 14 genera collected were unreported from the Philippines.

The Philippine fauna has its closest affinities with that of Indonesia, as would be expected. Of the 16 previously known species in the Philippines, six had also been taken in Indonesia, while four other Indonesian species are reported on here for the first time in the Philippines. Indian Ocean species (including eastern South Africa) are represented by eight now known to occur in the Philippines, while two are also known from Australia, three from Japan, and three from southern and central Pacific islands. Three Philippine species, *Anoplodactylus batangensis* (Helfer), *Endeis mollis* (Carpenter), and *Pigrogromitus timsanus* Calman, are now known to have a pantropical distribution. Distribution records for most pycnogonids are so fragmentary that knowledge of any possible Philippine endemics must await further collecting in the western Pacific islands.

ACKNOWLEDGMENTS.—I am grateful to the Philippine Government and the Director of the Philippine National Museum for kind permission to collect and examine the specimens reported herein. I wish to acknowledge the generous help given to myself and my Smithsonian colleagues, without which these expeditions would not have been possible, by Dr. Anjel Alcalá, Director of Marine Programs, Silliman University, Dumaguete City, Negros, and by Nida Calumpong, Laurie Hutchinson, Danilo Catada, and many other collectors, who made the rich Philippine fauna more available to us by their efforts. I wish also to thank the Smithsonian Oceanographic Sorting Center (SOSC) and Dr. L. Knapp for the invitation to join and for funding the 1979 collecting expedition in which I participated, and Dr. Ernani Meñez of SOSC for his good collecting help. I acknowledge with thanks the funding

assistance of Dr. D. Challinor, Assistant Secretary for Science, Smithsonian Institution, permitting my participation in the 1985 Smithsonian-Philippine Expedition. I am grateful to Dr. T.E. Bowman, Smithsonian Institution, and to Mme. F. Arnaud, Station Marine d'Endoume et Centre d'Océanographie, Marseille, France, for critically reading the manuscript and for their helpful suggestions, and to Don Fisher for his fine editing of this paper.

PYCNOGONIDA

Family AMMOTHEIDAE Dohrn

Genus *Achelia* Hodge, 1864

Achelia assimilis (Haswell)

Ammothella assimilis Haswell, 1884:1026–1027, pl. LIV: figs. 5–9.

Achelia (Ignavogriphus) assimilis.—Fry and Hedgpeth, 1969:106, figs. 152, 153, 156, tables 13, 14 [literature].

MATERIAL EXAMINED.—Negros Island, South Bais Bay, sta SP-7-2 (1 ♀); North Bais Bay, sta SP-8-1H (1 larva); Apo Island, sta SP-19-3 (2 ♂); Apo Island, sta SP-19-7 (2 ♂); Cebu Island, Sumilon Island, sta SP-17-1H (1 ♂).

REMARKS.—These seven specimens show almost as much variation as the wealth of figures published for this species. I am not sure, in fact, they are all *A. assimilis*, particularly the larval specimen, but have assigned them to this species because they conform to most of the characters, if variable, diagnosed for the species. The larval specimen is presumably this species, as the anterior legs, with tubercles, are more like those of *A. assimilis* than of *A. nana*, the other species of this genus known from the Philippines.

This species has been taken in predominantly southern hemisphere localities, but inhabits Indonesia, so it is not surprising to find specimens in the Philippine Archipelago. This is the farthest north this species has been taken, according to published records.

Genus *Ammothella* Verrill, 1900

Ammothella alcalai, new species

FIGURE 1

MATERIAL EXAMINED.—Negros Island, Silliman Marine Lab Beach, sta SP-22-1 (1 ♂ with eggs, holotype; 1 ♂ with eggs, 1 ♀, paratypes).

OTHER MATERIAL.—Silliman Marine Lab Beach, sta SP-18-1 (2 juvs.); Silliman Marine Lab Beach, sta CAC 199 (1 ♀, 1 juv.); S of Dumaguete City, sta NC-1-H (1 ♀ ovigerous, 1 juv.); Siquijor Island, sta SP-4-2 (2 juvs.); Siquijor Island, sta CAC 197A (1 ♂).

DESCRIPTION.—Size small, leg span slightly over 10 mm. Trunk fully segmented, without median tubercles or spines. Lateral processes twice as long as maximum diameter,

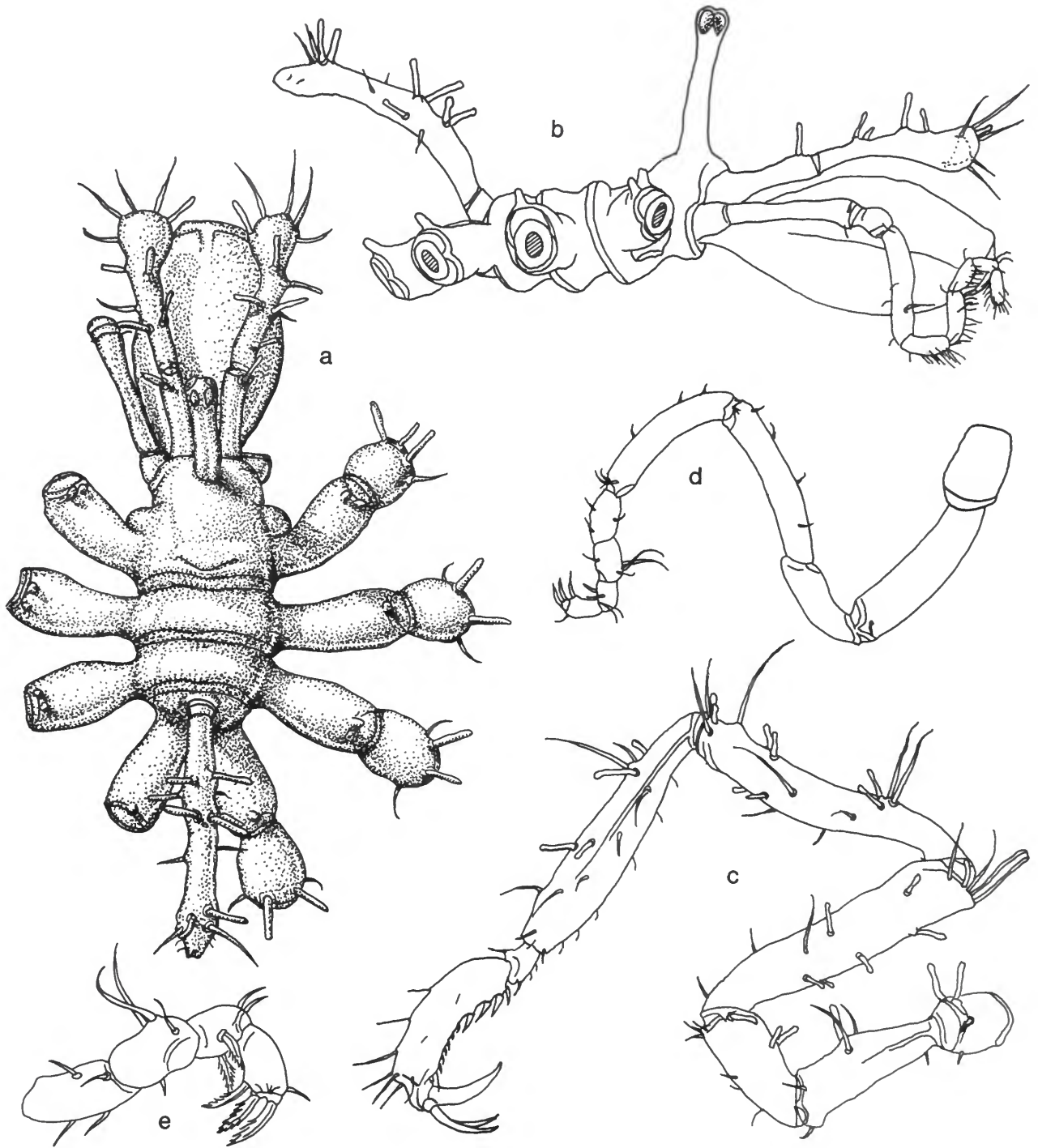


FIGURE 1.—*Ammothella alcalai*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, oviger; e, oviger strigilis, enlarged.

separated by slightly less than their minimum diameter, armed dorsodistally with one or two short peg-like tubercles of unequal length, both shorter than half lateral process diameter. Anterior three pairs of lateral processes armed with either one or two tubercles randomly, without pattern, posterior pair armed with single tubercle only. Lateral processes without setae or spines. Anteriolateral cephalic segment without tubercles or spines. Ocular tubercle tall, slender, swollen at tip with large darkly pigmented eyes. Tubercle 4.5 times longer than its diameter. Abdomen erect, longer than ocular tubercle, with median bend, armed with median and distal fields of short tubular spines each only slightly longer than segment diameter, and several shorter pointed spines.

Proboscis typical for genus, medially swollen to twice lip diameter, without proximal or distal suture lines.

Chelifores robust, long, 0.9 as long as proboscis. Scape first segment 0.7 as long as second, both armed with short tubular spines and longer distally pointed spines. First segment armed with single dorsodistal tubular spine. Second segment armed with five or six dorsal and lateral tubular spines and four distal longer pointed spines. Tubular spines only slightly longer than segment diameter. Chelae inverted in distal cup, bulbous, with tiny papilla representing vestigial finger, armed with distal seta.

Palp slender, proximally armed with few short setae, distally with fringe of ventral and lateral setae, some slightly longer than segment diameters. Second and fourth segments subequal, fifth and sixth subequal, slightly less than half length of fourth, seventh slightly shorter than sixth, eighth three-fourths as long as seventh, ninth slightly longer than seventh.

Male oviger segments two and four subequal, fifth slightly shorter than fourth, both with few lateral setae. Strigilis segments increasingly shorter distally, sixth with four lateral setae, seventh with three longer ectal setae, the longest twice segment diameter, eighth with two ectal setae and two endal denticulate spines, ninth with one ectal seta and one endal denticulate spine, tenth a bud with two distal denticulate spines. Denticulate spines with at least five serrations per side.

Legs moderately long, slender, armed with scattered tubular spines slightly shorter than segment diameters and longer pointed spines laterally and dorsally. First tibia the longest segment with femur and second tibia each slightly shorter. Dorsodistal cement gland tube robust, thick walled, slightly longer than femoral diameter. Tarsus short, quadrangular, armed with one ventrodorsal spine, several short setae. Propodus robust, moderately curved, with several lateral and dorsal spines, mostly distal. Sole with seven or eight short spines, heel with four stout spines, proximal one smaller than others. Claw robust, well curved, half propodal length, auxiliaries slender, almost 0.9 as long as main claw.

MEASUREMENTS (in mm).—Trunk length, 1.04; trunk width (across 2nd lateral processes), 1.05; proboscis length, 0.79; abdomen, 0.75; 3rd leg, coxa 1, 0.26; coxa 2, 0.47; coxa 3, 0.41; femur, 0.87; tibia 1, 0.88; tibia 2, 0.81; tarsus, 0.14; propodus, 0.46; claw, 0.23.

DISTRIBUTION.—Known from the type-locality, Dumaguete, Negros Oriental, Negros Island, and from adjacent areas of western Siquijor Island in depths of intertidal to three meters.

ETYMOLOGY.—This species is named for Dr. Anjel C. Alcalá, Silliman University, Dumaguete City, without whose more than generous help most of the specimens in this report could not have been collected.

REMARKS.—This new species is related to a fairly large number of *Ammothella* species belonging to an *appendiculata-rugulosa* group (named for the first species described), all of which are characterized by hollow tubular spines on the appendages, a tall ocular tubercle, a long down-curved abdomen having fields of long spines, and legs of similar configuration. What separates this species from the majority in the group is the presence of tubercles on the lateral processes. The species having lateral process tubercles in any form are *Ammothella setacea* (Helfer), *A. spinifera* Cole, *A. stocki* Clark, *A. marcusii* Hedgpeth, *A. tippula* Child, *A. symbia* Child, and this new species. The single lateral process tubercles of the new species are very different from those of *A. setacea*, which consist of three long rod-like projections, the longest of which is usually over twice as long as the segment diameter. The other species listed all have short single or paired lateral spines flanking the dorsodistal tubercles except for *A. marcusii*, which has pairs of broad lateral spikes on each lateral process and lacks the dorsodistal tubercle. The new species lacks any form of lateral spine or spike and has low single or double tubercles dorsodistally.

The new species is also related to several geographically nearby species besides *A. tippula* from Guam. It has similarities to *A. indica* Stock, *A. pacifica* Hilton, and *A. appendiculata* (Dohrn) from which the group derives its name. None of these species have lateral process tubercles and *A. appendiculata* is only known from the eastern Pacific at Panama. Except for the lateral process tubercles, the taller ocular tubercle, longer chelifores, and a much more inflated proboscis, this new species would be very like *A. pacifica*, although proboscis inflation is undoubtedly a poor character with which to separate species. *Ammothella alcalai* is also very close to *A. indica* except that the distal palp segments of the latter are notably longer, its oviger proximal segments and legs are longer, and its chelifore first segment is very much shorter.

The new species is probably most closely related to its near neighbor, *A. tippula*, from which it differs in lacking the small tubercles at the anterolateral corners of the cephalic segment, in having longer ocular tubercle, chelifore second segments in relation to the first segments, oviger fourth segments in relation to the fifth, and longer major leg segments. The palp segments have different length ratios than those of *A. tippula*, and finally, the lateral process tubercles are longer than those of the Guam species. It should be noted here that a single male of *A. tippula* was also collected during the Philippine surveys and was compared with specimens of the new species.

Ammothella indica Stock

Ammothella indica Stock, 1954:113–119, figs. 54, 55, 56c, 57a–c.—Utinomi, 1971:331 [literature].—Stock, 1974:13.—Nakamura and Child, 1983:18–19.

MATERIAL EXAMINED.—Negros Island, Maloh, sta 3-PN-110 (1 juv.); Apo Island, sta SP-19-7 (2♂, 1♀); Port Siyt, sta CAC 180 (2♀, 2 juv.); Cebu Island, Tongo Point, sta CAC 190 (1♂ with eggs, 1♀); Sulu Sea, Basilian Island, sta Taylor 38 (1 juv.).

REMARKS.—There is some variation in the numbers and placement of tubular and pointed spines on the chelifores and legs of this species, but these differences are insufficient to consider these specimens as any other than *A. indica*. This species does not have lateral process tubercles or spines and the anterolateral corners of the cephalic segment lack any form of small tubercles found on many species of this genus.

This Indo-Pacific littoral species ranges as far north as Japan and has been taken in several Indonesian localities, but these are its first records from the Philippines.

Ammothella rotundata, new species

FIGURE 2

MATERIAL EXAMINED.—Batanes Province, Batan Island, sta CAC 243 (1 juvenile, holotype).

DESCRIPTION.—Size small, leg span slightly less than 10 mm. Trunk segmentation complete between first, second, and third segments, none between third and fourth. Trunk compact, robust, lateral processes almost touching to touching, short, armed dorsodistally with two or three low, slender tubercles, bifurcate at tips. Cephalic segment broad, flaring laterally at anterior, margins without tubercles or setae. Ocular tubercle situated at anterior of segment, only slightly taller than maximum diameter, with two apical low conical tubercles. Eyes large, well pigmented. Abdomen fairly long, slightly bent posteriorly, armed with dorsodistal field of two feathered spines, one clubbed hollow spine, and four short lateral setae. Proboscis massive, a very inflated oval, compressed at lips.

Chelifores of three segments, scape second segment slightly longer than first, armed with three tubular clubbed spines and five long feathered spines on distal segment, and one long feathered spine on proximal segment. Chela fingers complete, well curved, toothless (presumably atrophied in adult), armed with single long feathered spine.

Palps of nine segments, second and fourth subequal, third only slightly longer than broad, fifth through ninth increasingly short, all but first armed with few to many short setae, most ventrally, some as long as segment diameter.

Ovigers small U-shaped unsegmented tubercles in juvenile.

Legs armed with long feathered spines; four on first coxae, two on second, none on third, six dorsodistally on femur, seven dorsally and laterally on first tibiae, two dorsally on second tibiae, and five dorsally on propodi, with long tubular clubbed spines singly or in pairs dorsally on the major leg segments. Second tibia the longest segment with first tibia and femur

increasingly shorter. Cement gland undeveloped. Propodus with three large heel spines and several shorter sole spines. Claw less than half propodal length with auxiliaries about 0.7 main claw length.

MEASUREMENTS (in mm).—Trunk length, 0.65; trunk width (across 2nd lateral processes), 0.56; proboscis length, 0.49; abdomen length, 0.22; third leg, coxa 1, 0.34; coxa 2, 0.38; coxa 3, 0.36; femur, 0.7; tibia 1, 0.82; tibia 2, 0.85; tarsus, 0.19; propodus, 0.66; claw, 0.26.

DISTRIBUTION.—Known only from the type-locality, Batan Island, Batanes Province, in littoral tide pools.

ETYMOLOGY.—The specific name alludes to the fat or rotund appearance of this small species.

REMARKS.—The first remarks under *Ammothella alcalai* (p. 4) also hold true for this species; it is also one of the *appendiculata-rugulosa* group, but with the added difference of a very compact and rotund trunk. There are very few species of *Ammothella*, a commonly slender, graceful genus with well-separated lateral processes and long leg segments, that have such a compact trunk. Perhaps the trunk becomes more slender and graceful in adults of this species, but it can be predicted with some confidence, based on other adult-juvenile relationships in this genus, that the adult will not be very much less rotund than this specimen. Of the compact species known, only *A. hedgpethi* Fage and to a much lesser extent *A. symbia* Child have the compact trunk character similar to this new species. Fage's African species has laterodistal spines on the lateral processes instead of dorsal tubercles and has large broad tubercles at the corners of its cephalic segment. Its palps, chelifores, and legs are much more spinose than those of the new species. The lateral process tubercles of *A. symbia* are very similar to those of the new species, but again, the lateral processes and anterior cephalic segment have broad spines and tubercles in *A. symbia*, which are not found in *A. rotundata*. The ocular tubercle of the new species is shorter than that of most *Ammothella* species even though it appears to be taller because of its being carried on the very elevated anterior portion of the cephalic segment.

I regret having to describe this new species from a juvenile specimen, but it is obviously a new species whose description can be emended when more are taken.

Ammothella stauromata Child

Ammothella stauromata Child, 1982a:271–273, fig. 1.

MATERIAL EXAMINED.—Negros Island, South Bais Bay, Sta SP-7-H (1 juv.); Port Siyt, sta CAC 180 (1♀); Batanes Province, Batan Island, sta CAC 243 (1♂ with eggs, 1♀).

REMARKS.—This species is easily identified by the tall median dorsal tubercles, particularly the one on the cephalic segment posterior, a character shared by very few species in this genus. None known have as tall or slender tubercles as this species.

Previous to this report, the species was known only from its

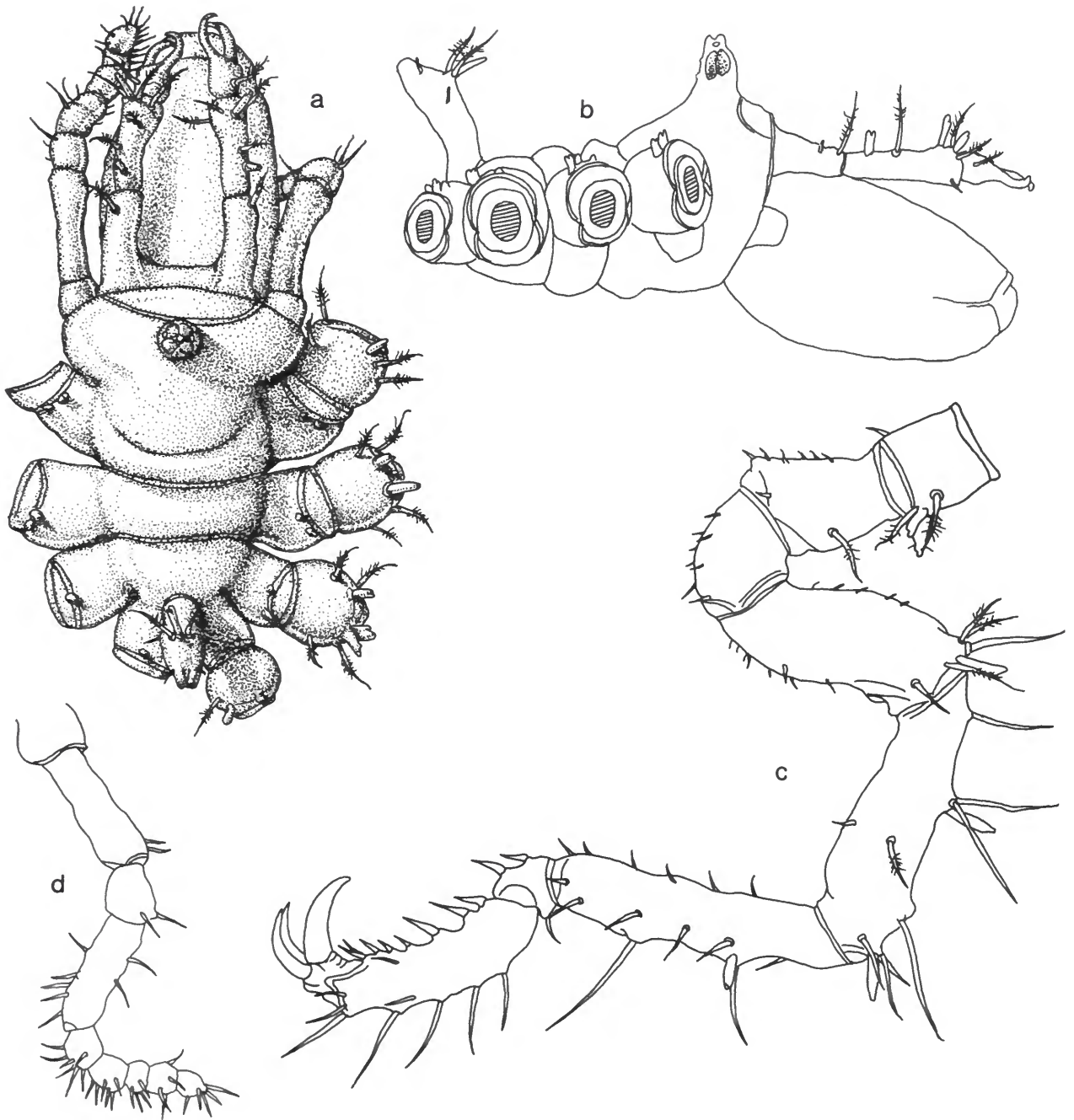


FIGURE 2.—*Ammothella rotundata*, new species, holotype: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, palp.

type-locality at Enewetak Atoll in the Marshall Islands. Its range is now extended to the central and northern Philippines in much the same depths.

Ammothella tippula Child

Ammothella tippula Child, 1983:701-705, fig. 2.

MATERIAL EXAMINED.—Sulu Sea, Cuyo Islands, Canipo Island, sta SP-11-1 (1♂).

REMARKS.—This male specimen agrees well with the type-species, also a male, from Guam. The lateral processes are a little more crowded, giving the trunk a broader oval appearance dorsally, but the low papillose bumps on the dorsodistal lateral processes are typical. There are a few more pointed spines on the chelifores and the legs of the Philippine specimen, but the general habitus of both specimens is very much alike.

The type was collected off Anaë Island on the east side of Guam, in 11 meters. This Philippine specimen extends its range southeast to the Cuyo Islands in the Sulu Sea and to a depth of two to three meters.

Genus *Eurycyde* Schiödte, 1857

Species in the genus *Eurycyde* are all closely related. All known males have long laterodistal tubercles at least on the first coxae, if not on the lateral processes. These are absent or much smaller in females, but the cement gland offers confusion to the specialist. It is a swelling and tube or just the tube close to the proximal end of the femur in the male, but there is usually a very similar swelling (without the tube) in the same place on the female. Most of the species have very long appendage dorsal spines, usually feathered with microsetae along their shafts. They have very similar palpi and ovigers, the latter terminating in a subchelate arrangement of the distal denticulate spine on the terminal segment with the terminal claw.

In a genus known for dimorphism, especially in the tubercles, it is probable that *Eurycyde acanthopus* Stock, described from a female, is the same as *E. curvata* Child, described from a single male. Capture of both sexes in a single sample will eventually clarify this relationship. The two species were taken in nearby localities of Venezuela and Colombia in the Caribbean Sea. They are combined under couplet seven of the following key.

Artificial Key to the Genus *Eurycyde*

1. Ocular tubercle with long distal spines 2
Ocular tubercle glabrous or with one or more short spines 6
2. Species robust, anterior lateral processes touching; 1st coxae with small posterior tubercle or none; chelifores robust, 1st segment only little longer than 2nd (♀ only) *E. gorda* Child
Species more slender, lateral processes not touching; 1st coxae with large tubercles; chelifores more slender 3
3. Lateral processes with dorsodistal tubercles; 1st coxae tubercles with many short setae only *E. setosa*, new species
Lateral processes without tubercles; 1st coxae posterior tubercles with long spine (at least first and second pair) 4
4. First coxae anterior tubercles almost as long as posterior tubercles; scape segments approximately the same diameter; ocular tubercle with 2 long spines *E. encantada* Child and Hedgpeth
First coxae anterior tubercles 0.5 to 0.6 as long as posterior tubercles; 2nd scape segments very slender, not so broad as 1st segments; ocular tubercle with 4 or 6 long spines 5
5. Ocular tubercle with at least 6 long spines; lateral processes separated distally by half their diameters *E. raphiaster* Loman
Ocular tubercle with 4 long spines; lateral processes touching or separated by narrow intervals *E. longisetosa* Hilton
6. Ocular tubercle glabrous 7
Ocular tubercle with 2 to 4 short spines 8
7. Lateral processes with 1 or 2 slender tubercles; scape segments of equal diameter; long abdomen spines scattered, not in fields *E. acanthopus* Stock
or *E. curvata* Child
Lateral processes without tubercles; 2nd scape segment more slender than 1st; long abdominal spines in single dorsal group *E. hispida* (Kroyer)

- 8. Ocular tubercle little taller than its diameter; abdomen very short, not curved, with lateral row of 4 long spines *E. spinosa* Hilton
 Ocular tubercle over twice longer than its diameter; abdomen longer, curved, with 4 to 6 long spines not in single row 9
- 9. Lateral processes glabrous; first coxae with single dorsodistal tubercle; ocular tubercle with two spines; oviger with two rows of denticulate spines *E. unispina* Stock
 Lateral processes (anterior two pairs) with dorsodistal tubercle; first coxae with two distal tubercles; ocular tubercle with four spines; oviger with single row of denticulate spines *E. clitellaria* Stock

***Eurycyde setosa*, new species**

FIGURE 3

MATERIAL EXAMINED.—Batanes Province, Batan Island, sta CAC 244 (1 ♂, holotype).

DESCRIPTION.—Species small; leg span 6.8 mm. Trunk completely segmented, lateral processes closely set, separated by less than half their diameters, armed with short rounded dorsodistal tubercles that decrease in size from anterior to posterior lateral processes, those anterior bearing a single seta each. Ocular tubercle constricted proximally, flaring distally, three times as long as maximum diameter, bearing seven very long tubular spines carried horizontally at apex. Apex mostly flat but with rounded small conical tubercle at anterior. Eyes moderately pigmented, situated at tubercle mid-length. Neck ventral to ocular tubercle very constricted. Abdomen of type missing. Proboscis typical of genus, carried on cylindrical basal segment. Distal proboscis segment inflated proximally, tapering distally to rounded lips.

Chelifores slender, long, scape first segment slightly longer than proboscis basal segment, armed with single long dorsodistal tubular spine. Scape second segment more slender than first, armed with eight very long tubular spines, spines as long as scape first segment. Chela slender, ovoid, fingers represented by two tiny distal papillae, armed with single slender seta distally.

Palp typical for this genus; first segment tiny, wider than long, second segment short, flaring distally with lateral conical tubercle, third segment longest, 0.25 longer than fifth, armed with two long tubular spines bearing several microsetae each. Fourth segment equal to seventh, eighth, and ninth, armed with a long dorsal tubular spine. Fifth segment slightly swollen at midpoint, armed with one long lateral spine and several distal setae. Sixth segment equal to terminal segment in length. All five distal segments armed with many ventral setae, some longer than segment diameter.

Oviger fairly short, first three segments rounded, armed with two or three short setae each. Fourth segment slightly longer than fifth, both armed with few lateral and ectal setae. Sixth curved proximally, half length of fourth segment, armed with few short setae. Strigilis segments well curved, each shorter than next proximal segment, armed with short distal setae

ectally and endally with denticulate spines in the formula 7:4:4:5, in two rows with fewer spines in the smaller or outer row. Compound spines on proximal two segments broader with fewer lateral serrations, those of distal two segments narrower, with smaller serrations in greater numbers. Distal spine on terminal segment larger, forming subchelate effect with claw of same length.

Legs bearing several very long tubular spines on each major segment, each feathered with many microsetae over most of their length. Three coxae of subequal length, the first bearing anterior and posterior long slender tubercles distally, the posterior tubercle being the longer of each pair, each clothed with many short setae, without major spines. Second coxae armed with long dorsomedian tubular spine over twice as long as segment diameter. Second and third coxae with several short and long ventrodorsal setae. Femur cylindrical, armed with four or five long tubular dorsodistal spines. Cement gland a proximal bulge placed laterally on femur, terminating in slender tube almost as long as segment diameter, carried pointing at oblique angle posteriorly from axis of segment. First tibia the longest segment, second only slightly shorter, both armed with tubular spines arranged in a tuft of three proximally on first tibia and a single spine distally. Second tibia with row of three spines dorsally. Tarsus short, propodus slender, curved, both armed with row of ventral short setae and few dorsal setae. Claw robust, about 0.3 as long as propodus.

MEASUREMENTS (in mm).—Trunk length, 1.08; trunk width (across first lateral processes), 0.8; distal proboscis segment length, 0.82; 3rd leg, coxa 1, 0.2; coxa 2, 0.18; coxa 3, 0.18; femur, 0.51; tibia 1, 0.65; tibia 2, 0.61; tarsus, 0.11; propodus, 0.44; claw, 0.14.

DISTRIBUTION.—Known only from the type-locality, Batan Island, Batanes Province, in littoral depths.

ETYMOLOGY.—The species is named for its first coxae tubercle setae.

REMARKS.—Of the 10 (or 11) known species, including *Eurycyde setosa*, the new species appears closest, as will be seen from the preceding artificial key to the genus, to *E. gorda* Child. Both have an ocular tubercle bearing long distal spines and have tubercles on each lateral process. Other species have long spines on their ocular tubercles or have lateral process tubercles, but no other known species has the combination of

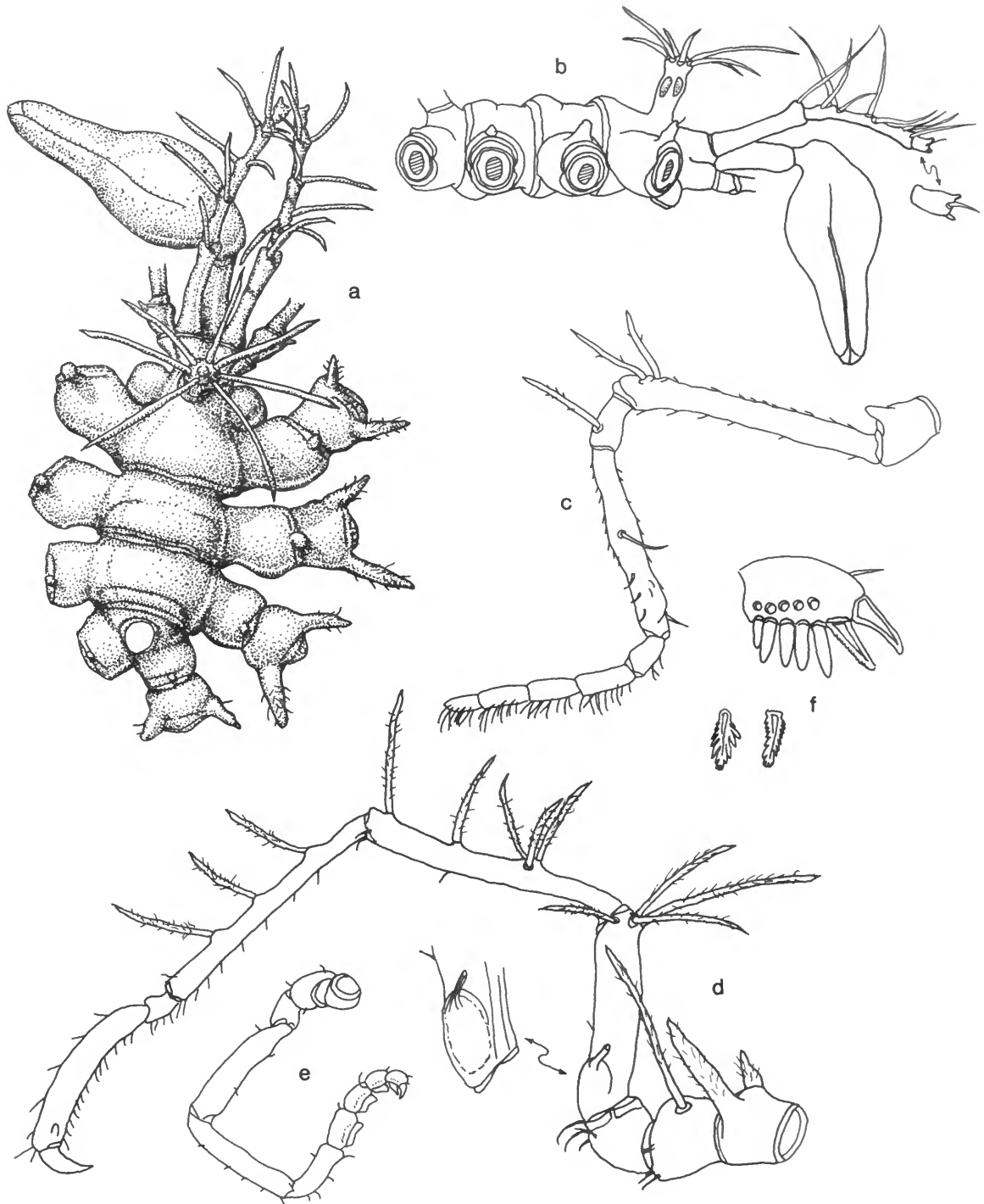


FIGURE 3.—*Eurycyde setosa*, new species, holotype: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, palp; *d*, third leg, with enlargement of cement gland; *e*, oviger; *f*, oviger terminal segment and claw, and proximal and distal denticulate spines, enlarged.

lateral process tubercles, ocular tubercle long spines, and first coxae tubercles bearing simple short setae instead of a long tubular spine.

This is the first species of *Eurycyde* to be found in the tropical western Pacific. The genus has been found in predominantly Western Hemisphere localities, except for *E. hispida*, which occurs along the European Arctic areas, so it is not entirely tropical in distribution. It is not difficult to project that other species of this wide-ranging genus will be found in Indo-West Pacific localities.

Genus *Hemichela* Stock, 1954

Hemichela micrasterias Stock

Hemichela micrasterias Stock, 1954:90–94, figs. 42, 43; 1985:153–155, figs. 1–11.—Fry, 1978:44.—Staples, 1982:464–465 [text].

MATERIAL EXAMINED.—Visayan Sea, off northern Cebu Island, *Sting Ray V* sta T-17 (1 ♂).

REMARKS.—I find genital pores on the posterior four second coxae only of this specimen, and although cement gland pores are not evident, I assume this to be a male, possibly juvenile. Like some males of *Paranymphe spinosum* Caullery and *Hemichela longiunguis* Staples, this specimen has the stellate outgrowths figured by Stock (1985, fig. 1). They form thick lateral fields the entire length of each lateral process and some of smaller size grow ventrally on the lateral processes and trunk. At the tips of each branch, which may number up to seven or eight on these processes, is a radiating group of tiny setules. The outgrowths originate in a projection of the lateral process and the outgrowths bifurcate again and again in dendritic forms topped by the circular fan of setules.

There are a few slight differences between this male and Stock's female type. The fifth oviger segment has a proximal recurved spine, the same as is shown in figure 4f of Staples' (1982:463) *Hemichela longiunguis*, and the oviger has three denticulate spines on segment seven instead of two. This specimen is slightly smaller, as would be expected for a male, than the measurements given by Stock (1954:94).

The discovery of this male extends the distribution of *Hemichela micrasterias* from the Java Sea and Straits of Makassar, Indonesia, to the Visayan Sea in the central Philippines, and from 20 to 84 meters.

Genus *Tanystylum* Miers, 1879

Tanystylum philippinensis, new species

FIGURE 4

MATERIAL EXAMINED.—Negros Island, Apo Island, sta SP-19-3 (1 ♂, holotype; 1 ♀, paratype).

OTHER MATERIAL.—Batanan Province, Batan Island, sta CAC 243 (1 ♂ with eggs, 1 ♀, 1 juv.).

DESCRIPTION.—Size very tiny, leg span only 4.5 mm. Trunk

unsegmented, circular in dorsal outline, lateral processes contiguous, without tubercles or adornment. Anterior of cephalic segment only extending little beyond circle of lateral processes. Ocular tubercle toward anterior of cephalic segment, as broad as tall, capped with narrow spike-like tubercle at apex, anterior pair of eyes slightly larger than posterior pair, only slightly pigmented. Abdomen arising well anterior to midline of third lateral processes, erect, not extending posterior to tips of fourth lateral processes, armed with four short distal setae. Proboscis an anterior tapering oval widest at center, narrowest at fairly broad flat lips.

Chelifore single segment short, blunt, extending about as far as second palp segment, armed with three distal setae.

Palp five-segmented, armed with single seta on second segment, several on third, three on fourth and a tuft of setae longer than segment diameter ventrally and distally on fifth segment. Third segment longest, fourth only slightly longer than its diameter, fifth 0.6 as long as third.

Oviger second, third, and fourth segments subequal in length, fifth longest, curved, armed with several distal setae. Sixth armed with one or two ectal setae and strong recurved spine proximally, seventh with ectodistal row of three setae as long as segment diameter, eighth and ninth with five and two setae respectively in same place. Endal spines on tenth with tiny spines having distal denticulations. Oviger without seventh segment apophysis.

Leg typical, robust, armed with few short and long setae, none as long as segment diameter. First coxae with bifid anteriolateral tubercles bearing setae. All coxae with few short ventral setae. First and second tibiae with dorsal swellings bearing setae. Femoral cement gland tube very short, tapering, placed dorsodistally. Tarsus very short, bearing three ventral spines. Propodus robust, slightly curved, low heel armed with three broad spines, sole with eight or nine short setae. Claw short, broad, less than half propodal length, auxiliaries slender, about 0.6 main claw length.

Female paratype slightly larger in all measurements except oviger. Oviger much smaller, fourth and fifth segments subequal, strigilis segments with one or two setae, without spines except tenth tiny segment with two short trifid spines.

MEASUREMENTS (holotype in mm).—Trunk length, 0.47; trunk width, 0.46; proboscis length, 0.28; abdomen length, 0.17; third leg, coxa 1, 0.15; coxa 2, 0.19; coxa 3, 0.17; femur, 0.41; tibia 1, 0.42; tibia 2, 0.42; tarsus, 0.05; propodus, 0.29; claw, 0.12.

DISTRIBUTION.—Known from Apo Island, off Negros Island in 15 to 20 meters, and also from Batan Island in the littoral.

ETYMOLOGY.—This species is named for the Philippine Islands, its type-locality.

REMARKS.—This new species shows similarities to two other species taken in the Pacific, *T. nabetensis* Nakamura and Child (now *T. ulreungum* Kim, 1983) and *T. orbiculare* Wilson. None of these three species has the seventh oviger segment apophysis or lateral setose knob found among the majority of

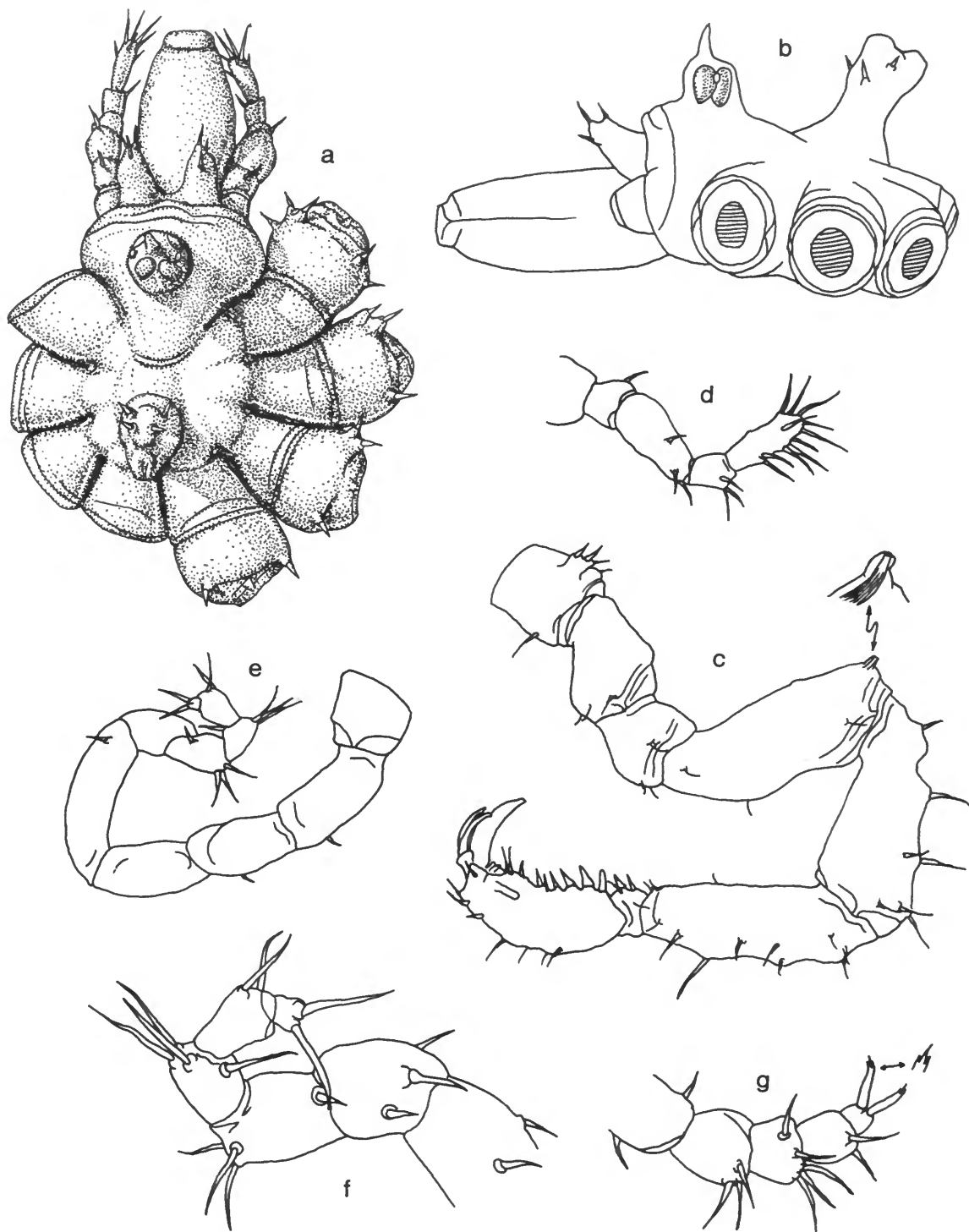


FIGURE 4.—*Tanystylum philippinensis*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, palp; e, oviger; f, oviger, reverse side of terminal segments, enlarged. Female paratype: g, oviger, distal segments.

males in this genus. All have five-segmented palps (*T. orbiculare* sometimes has six), and all have an abdomen originating farther anteriorly than with most species. The differences are that the abdomen of *T. orbiculare* is more inflated and rounded distally while that of the new species is more erect, is cylindrical, and has a dorsodistal bulge bearing setae. The abdomen of *T. ulreungum* is shorter, not erect, has a median constriction, and has many more setae. It is in characters of the male oviger where these species all differ. In *T. orbiculare* and *T. ulreungum*, the second segment is as long as the fifth or even slightly longer while the second segment of the new species is notably shorter than the fifth. The fourth segment of the two previously known species is almost as long as the fifth, but that of *T. philippinensis* is about the same length as the second and much shorter than the fifth. The terminal strigilis segment spines of *T. ulreungum* have bifid tips while those of *T. orbiculare* are plain or simple. The spines of *T. philippinensis* are trifid at their tips.

Tanystylum species indeterminate

MATERIAL EXAMINED.—Batanes Province, Batan Island, sta CAC 244 (1 juv.).

REMARKS.—This juvenile is quite different from the preceding species, *T. philippinensis*, although specimens of each were taken in the same bay. This specimen has a longer, more slender and distally tubular proboscis, a longer abdomen placed more posteriorly on the trunk, and longer palp segments. It is without ovigers and the propodus is not fully adult, having fewer spines than on propodi of typical adults. It is probable that this will become a new species when adults can be collected and described with full characters.

Family PHOXICHLIDIIDAE Sars

Genus *Anoplodactylus* Wilson, 1878

Anoplodactylus arescus Du Bois-Reymond Marcus

Anoplodactylus arescus Du Bois-Reymond Marcus, 1959:105–107, pl. 1.—Stock, 1968:53 [text]; 1975:133, figs. 10–12.—Arnaud, 1973:954.

MATERIAL EXAMINED.—Negros Island, Silliman Marine Lab Beach, sta SP-15-2 (1♀).

REMARKS.—This tiny specimen is assigned to Marcus' species with some hesitation. There are several differences between this specimen and the figures given by Marcus and Stock (both for males, except for Marcus' figure 2), and solitary females of this genus are very difficult and sometimes impossible to assign to a species because they lack many diagnostic characters. First, this specimen has two heel spines on all propodi, while males previously figured have a single heel spine. Second, this female is very much more papillose than Marcus' type-specimens, having tiny block-like papillae lateral to the ocular tubercle, dorsodistally on each lateral process, grouped along the middorsal trunk, and with several

proximally on each appendage including the abdomen. A specimen from Madagascar (Arnaud, 1973:954, first specimen), examined for comparison, shows a number of papillae in the median line of the trunk and on each chelifore, but these are much less conspicuous than those of the Philippine specimen. The ocular tubercle of this specimen is also slightly taller than the type and has two laterodistal bumps instead of a rounded appearance. It otherwise agrees quite well with Marcus' female specimen. None of these differences is sufficient in itself to warrant describing this as a new species, and in the absence of a male having full diagnostic characters, I will tentatively assign this specimen to *A. arescus*.

This species has been confined to the western Indian Ocean (at Madagascar and Tanzania) and the Red Sea at Egypt, as far as was known prior to this capture. This Philippine specimen extends its known distribution to the western Pacific for the first time, but adds nothing new to its psammophilous affinities or its known depth range of intertidal to about five meters.

Anoplodactylus attenuatus, new species

FIGURE 5

MATERIAL EXAMINED.—Siquijor Island, sta SP-3-2 (1♂ with eggs, holotype); Mindanao, Aliguay Island, sta CAC 182 (1♀, paratype).

DESCRIPTION.—Of moderate size for the genus, leg span about 11.5 mm. Trunk and appendages extremely attenuated and slender. Lateral processes separated by at least three to four times their diameters and as long as three times their diameters anteriorly, those posterior being shorter in length, armed with single distal seta or glabrous. Trunk completely segmented between very long tubular trunk segments. Ocular tubercle low, rounded, more broad than tall, eyes large, placed distally. Proboscis cylindrical, constricted proximally and distally beyond midpoint, lips flat. Abdomen (of paratype, that of holotype broken off) a slender truncate cone only twice as long as its diameter, armed with two or three distal setae.

Chelifores very slender, armed with few short setae. Chelae slender, palm rectangular, as long as fingers, which are well curved, overlapping at tips, armed with three sharp conical teeth on movable finger and two on immovable finger.

Ovigers originating in swellings halfway along ventral surface of first lateral processes. Second and fourth segments subequal, third almost twice as long, constricted proximally, all armed with few short setae. Fifth segment armed with two short blunt endal spines and four or five short ectal setae. Sixth very slender, almost as long as fifth, armed with four or five short setae.

Legs extremely slender, armed with few short setae increasing in numbers distally, and single long dorsodistal seta on major segments. Femur the longest segment, with two broad cement gland cups on low swellings on either side of femoral midpoint. Tarsus very short, with few setae. Propodus slender, slightly curved, with two large heel spines (sometimes a

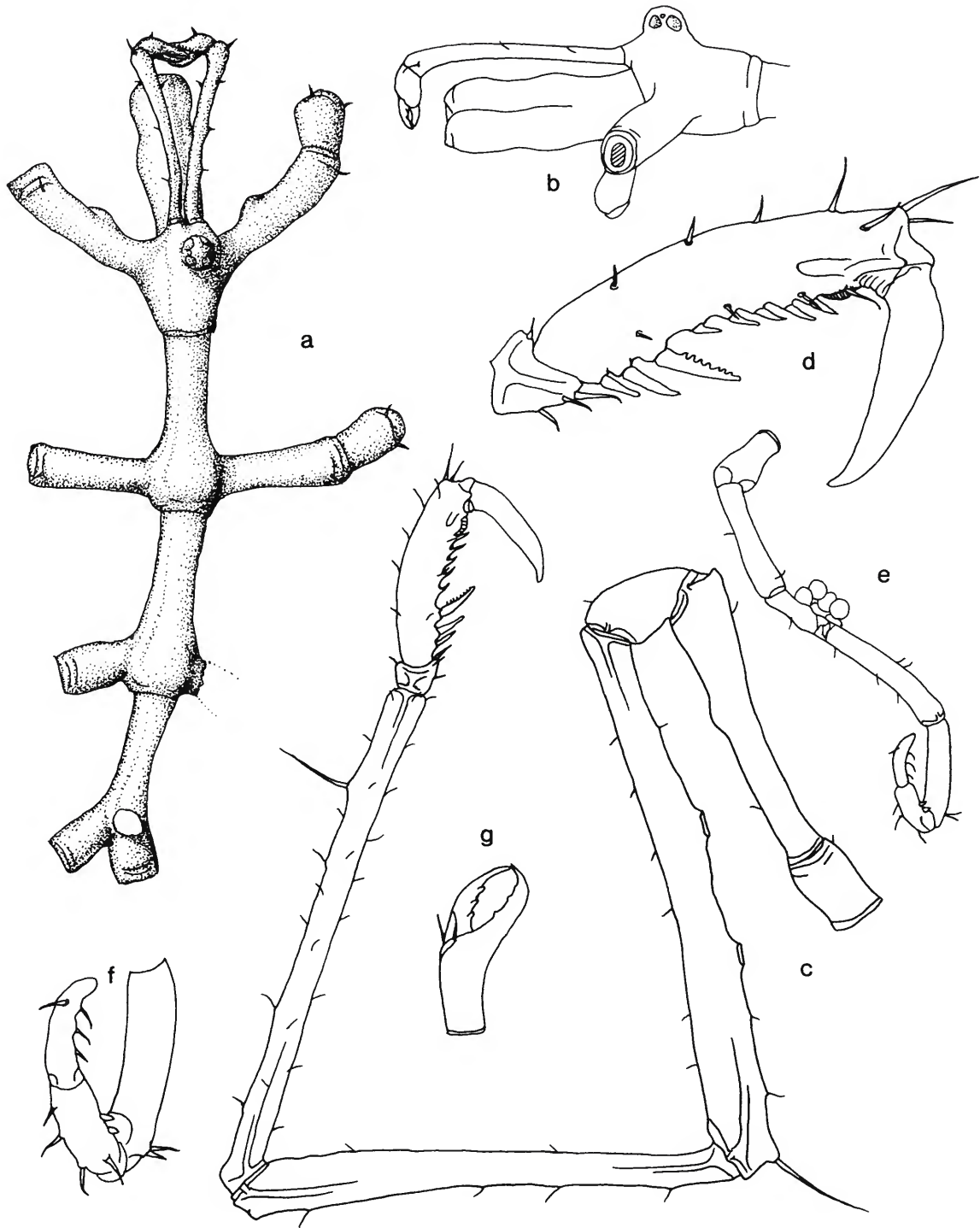


FIGURE 5.—*Anoplodactylus attenuatus*, new species, holotype: a, trunk, dorsal view; b, anterior trunk segments, lateral view; c, third leg; d, distal segments of third leg, enlarged; e, oviger; f, oviger distal segments, enlarged; g, chela.

smaller third spine is proximal to other two on some legs) with seven or eight serrations on distal largest spine. Sole with five or six broad short spines proximal to very short distal propodal lamina. Several short setae flanking the sole and several on dorsal surface. Claw robust, fairly short, only slightly curved. Auxiliaries entirely lacking.

Female slightly larger than male, with two heel spines only and longer main claw.

MEASUREMENTS (holotype in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 1.71; trunk width (across 1st lateral processes), 0.89; proboscis length, 0.54; abdomen length (paratype), 0.25; third leg, coxa 1, 0.16; coxa 2, 0.65; coxa 3, 0.24; femur, 1.23; tibia 1, 1.07; tibia 2, 1.14; tarsus, 0.11; propodus, 0.43; claw, 0.27.

DISTRIBUTION.—Known from the type-locality, the south shore of Siquijor Island, in 3 to 6 meters, and from off northern Mindanao at Aliguay Island in 1 to 1.3 meters.

ETYMOLOGY.—Named for its distinctive attenuated appearance, this new species name is from the Latin *attenuatus* (to make thin).

REMARKS.—Very few species in the genus *Anoplodactylus* approach the attenuated slenderness of this new species. *Anoplodactylus insignis* (Hoek) is a long slender species, but has very short lateral processes and many other different characters that reduce its similarity to the new species. Hedgpeth's *A. pectinus* is probably the closest species to *A. attenuatus*. Both share the character of serrations on the largest heel spine, and *A. pectinus* is also slender with well-separated lateral processes but has a single cement gland cup, a much shorter proboscis, a shorter terminal oviger segment, and shorter trunk and lateral process segments.

The new species is also related, but less closely, to *A. longiformis* Child, from islands at New Caledonia in the south Pacific, and to several attenuated species known from the north Atlantic Ocean. Both species have long slender trunks, but the new species has longer lateral processes and two cement glands, and has the serrate major heel spine lacking in *A. longiformis*. The north Atlantic forms, *A. insigniformis*, *A. massiliformis*, and *A. oculatus*, also share the long slender trunk habitus only and are otherwise very different from the new species. There is no other known species in this genus with such long lateral processes separated by extremely long trunk segments.

Anoplodactylus batangensis (Helfer)

Pycnosoma batangense Helfer, 1938:174–176, fig. 6a–c.

Anoplodactylus batangensis.—Stock, 1968:54 [literature]; 1975:1082–1083, fig. 43c–d.—Arnaud, 1973:957, figs. 3–4.—Child, 1979:50, 1982b:368.

MATERIAL EXAMINED.—Negros Island, Port Siyt, sta CAC 180 (2♂, 1 juv.); Silliman Marine Lab Beach, sta CAC 199 (1♀); sta SP-22-1 (7 juv.).

REMARKS.—This pantropical species has been taken in the Sulu Sea, west of the present collecting localities, and is

frequently taken in many different kinds of shallow-water habitats.

Anoplodactylus brevirostris, new species

FIGURE 6

MATERIAL EXAMINED.—Batanan Province, Batan Island, sta CAC 243 (1♂, holotype; 1♂ with eggs, 1♀, paratypes).

DESCRIPTION.—Size tiny; leg span 4.6 mm. Trunk fully segmented, glabrous, second and third pair of lateral processes with suture lines at juncture with trunk. All lateral processes short, as short as or shorter than their diameter, separated by half or less of their diameter. Neck very short, ocular tubercle occupying its entire dorsum, short, rounded, wider at base than its length, eyes large, lightly pigmented. Abdomen short, broad, carried at low angle, tapering to rounded point without setae.

Proboscis very short, barrel-like, tapering moderately toward lips, armed ventrolaterally with several short setae. Lips flat.

Chelifores short, robust, chelae as long as scapes. Scape armed with single dorsodistal seta, chela with two ectal short setae. Movable finger swollen proximally, tapering and well curved distally. Immobile finger shorter, almost straight, curving slightly at tip, both glabrous.

Oviger six-segmented, short, second segment slightly longer than first, third longest, only four times longer than its diameter, fourth curved, about 0.6 as long as third segment. Fifth only 0.6 length of fourth, sixth a tiny cone. All segments except first armed with one to four tiny recurved setae, without major spines.

Legs fairly short, robust, armed with very few setae, mostly ventral. Femur the longest segment, inflated, single cement gland under a low swollen area on dorsodistal third of segment, with tiny pore at midpoint of swelling. Major leg segments armed with single dorsodistal seta not as long as segment diameter. Tarsus almost triangular, propodus without marked heel but with two broad heel spines and about 10 or 11 short sole spines. Claw broad, over half propodal length, without trace of auxiliary claws.

MEASUREMENTS (holotype, in mm).—Trunk length, 0.64; trunk width (across 1st lateral processes), 0.43; proboscis length, 0.23; abdomen length, 0.15; third leg, coxa 1, 0.14; coxa 2, 0.17; coxa 3, 0.16; femur, 0.37; tibia 1, 0.35; tibia 2, 0.31; tarsus, 0.08; propodus, 0.3; claw, 0.18.

DISTRIBUTION.—Known only from the type-locality, Munan-oy Bay on Batan Island, at littoral depth.

ETYMOLOGY.—This species is named for its unusually short proboscis.

REMARKS.—*Anoplodactylus brevirostris* belongs to a growing group of small compact species previously associated under the old synonymic genus *Halosoma*. These all are characterized as short, compact, brief-limbed species, some with five-segmented ovigers. These species also have a very short neck, or that part of the ocular segment bearing the ocular tubercle, which extends anteriorly over the insertion of the proboscis.

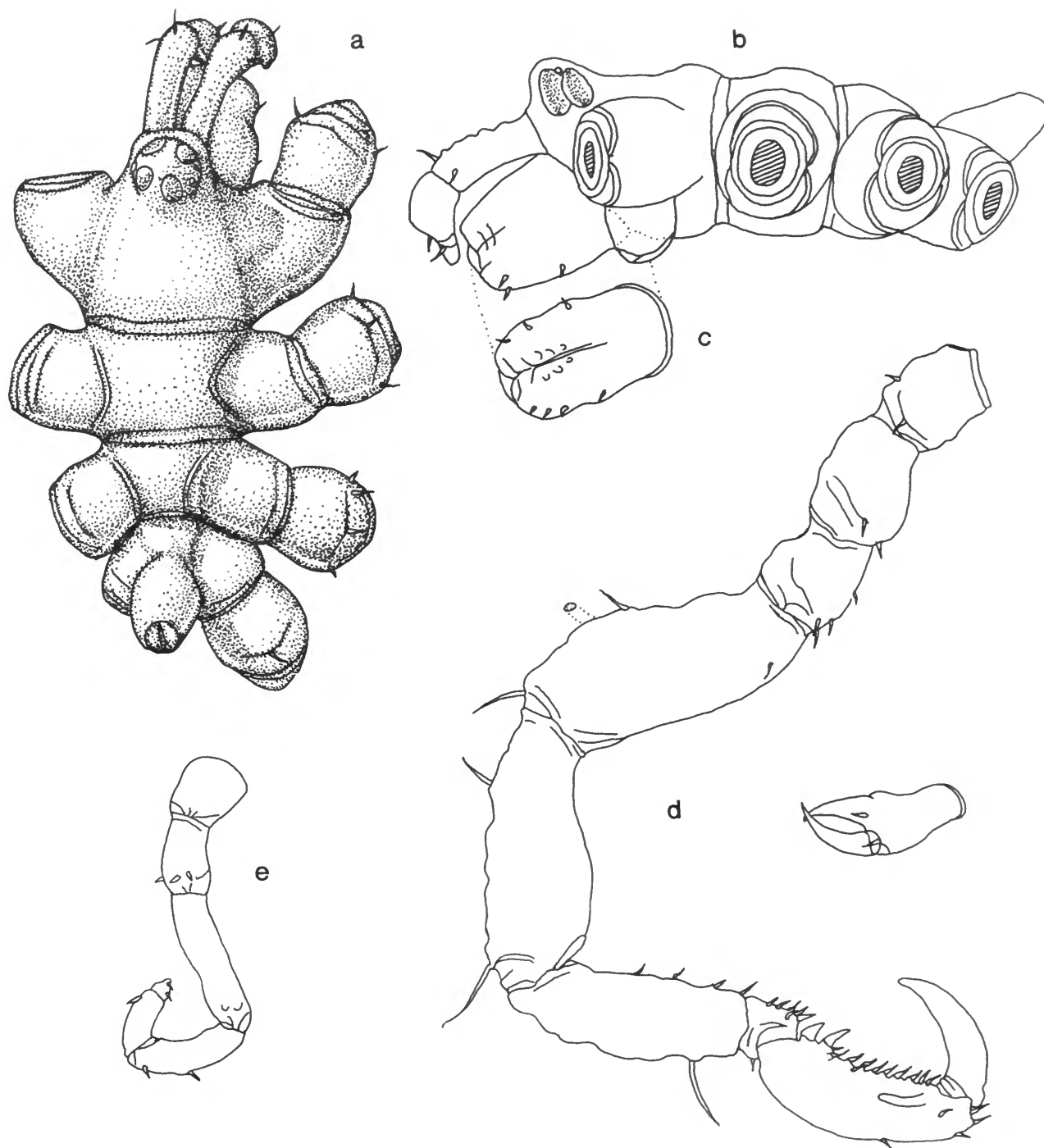


FIGURE 6.—*Anoplodactylus brevirostris*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, proboscis, ventral view; d, third leg; e, oviger; f, chela.

The presence of a six-segmented oviger with a few tiny setae removes this new species from consideration as *A. robustus*, *A. virescens*, *A. monotrema*, or *A. dentimanus*, all of which have five-segmented ovigers bearing blunt-tipped spines. Of the other *Halosoma*-like species having six oviger segments, few are found in Indo-West Pacific waters. This new species is probably closest to *A. haswelli* (Flynn), found in Australia. Flynn's species (1918:3-5, figs. 1-6) has a very much larger proboscis, longer chelifores, longer leg and oviger segments, chelae fingers with teeth arranged uniquely among the species of this genus, and a trunk lacking complete segmentation. It also has tiny auxiliary claws, but is otherwise quite similar to *A. breviostris*. The new species also has some similarities to Clark's (1963:53-55, fig. 27A-D) *Anoplodactylus* species *A*. The legs and propodus are very close to those of the new species, as is the trunk, but Clark's specimen appears to have a larger proboscis and has chelae finger teeth.

The new species has some similarities to two other west Pacific species, *A. anarthrus* Loman and *A. chamorrus* Child. These two species, which are also closely related, are not of the *Halosoma* form except that they are compact with closely crowded lateral processes, short necks, and short limbs. They have a similar lateral expansion of the anterior cephalic segment and very similar cement glands and ovigers. They both differ from *A. breviostris* by having a slightly longer neck, longer ocular tubercle, unsegmented trunk, larger and longer proboscis, longer ovigers, and the cephalic segment expansion mentioned above. This new species is the most robust and compact species thus far known to the western Pacific.

Anoplodactylus chamorrus Child

Anoplodactylus chamorrus Child, 1983:705-707, fig. 3.

MATERIAL EXAMINED.—Mindanao Island, Aliguay Island, sta CAC 182 (1♀); Siquijor Island, sta CAC 197A (1♀); same locality, sta CAC 198 (1♀); Cebu Island, Sumilon Island, sta CAC 179 (1♂, 1 juv.).

REMARKS.—These specimens are very slightly larger than the type male, but agree in almost all characters with it. The third leg, second coxa, has a larger genital spur extending ventrodistally to about 0.3 of the segment diameter. This spur is not as prominent in the type specimen. The very deep heel of this species has a single stout spine and, in the Philippine material, has four stout setae more distally on the heel before the curve to the sole. The single male from the Philippines has a right palp bud as characterized in the type, but the left bud is a larger blunt cone extending laterally in an abnormal fashion.

This species is easily differentiated from the many other known species of *Anoplodactylus* in the Pacific by its crowded lateral processes, each bearing a low distal tubercle, the small bulbous cement gland extruding into a slender tube, the very short second tibiae, and the deep heel bearing a single stout spine.

The species was described from a Guam specimen taken in 11 meters and these Philippine specimens extend its range across the Philippine Sea to similar tropical localities in shallower water.

Anoplodactylus falciclavus, new species

FIGURE 7

MATERIAL EXAMINED.—Negros Island, South Bais Bay, sta SP-7-1H (1♂, holotype; 1 juv., paratype).

DESCRIPTION.—Size small; leg span 6.5 mm. Trunk first two segmentation sutures complete, suture lacking between third and fourth segments. Lateral processes separated by their diameters or less, armed with single dorsodistal seta each. Neck very short, not as long as ocular tubercle width. Ocular tubercle broad, only slightly taller than wide, apex a rounded cone, eyes large, darkly pigmented. Abdomen fairly short, erect, armed with five or six laterodistal setae.

Proboscis short, inflated proximally, lips flat, with low bulges at ventrodistal corners.

Chelifores short, scapes slender, armed with dorsodistal seta each. Chela slender, fingers as long or slightly longer than palm, carried obliquely. Palm with seta at finger insertion. Movable finger well curved distally, overlapping immovable finger, which is straight with slight distal curve. Both fingers armed with three sharply pointed teeth.

Oviger six-segmented; third segment longest, with proximal constriction, second and fourth subequal, 0.6 as long as third, armed with several lateral and distal short setae. Fifth segment almost as long as fourth, armed with seven recurved setae. Terminal segment conical, inflated, almost half length of fifth, armed on endal surface with four recurved setae.

Legs of moderate length, slender, armed with few setae and long dorsodistal spine on major segments. Second coxae almost twice length of first, third only slightly longer than first. Femur almost cylindrical, with slight bulge over cement gland placed slightly proximal to middorsum. Cement gland a single oval cribriform pore. Femur the longest segment with second tibia slightly longer than first. Tarsus semitriangular, short, without ventral spine. Propodus robust, slightly curved, with low heel bearing three short spines and several setae, sole without spines, few setae, and lamina along entire surface. Propodus of first leg pair longer than posterior pairs, armed with longer, less-curved claw having narrow sickle-shaped cross section and blunt tip. Claws of posterior leg pairs shorter, more curved, almost round in cross section, with sharp tip. All claws with tiny basal auxiliaries.

MEASUREMENTS (holotype, in mm).—Trunk length, 0.83; trunk width (across 1st lateral processes), 0.63; proboscis length, 0.36; abdomen length, 0.16; third leg, coxa 1, 0.18; coxa 2, 0.34; coxa 3, 0.22; femur, 0.56; tibia 1, 0.47; tibia 2, 0.48; tarsus, 0.1; propodus, 0.36; claw, 0.23.

DISTRIBUTION.—Known only from the type-locality, South Bais Bay, Negros Island, in littoral depth.

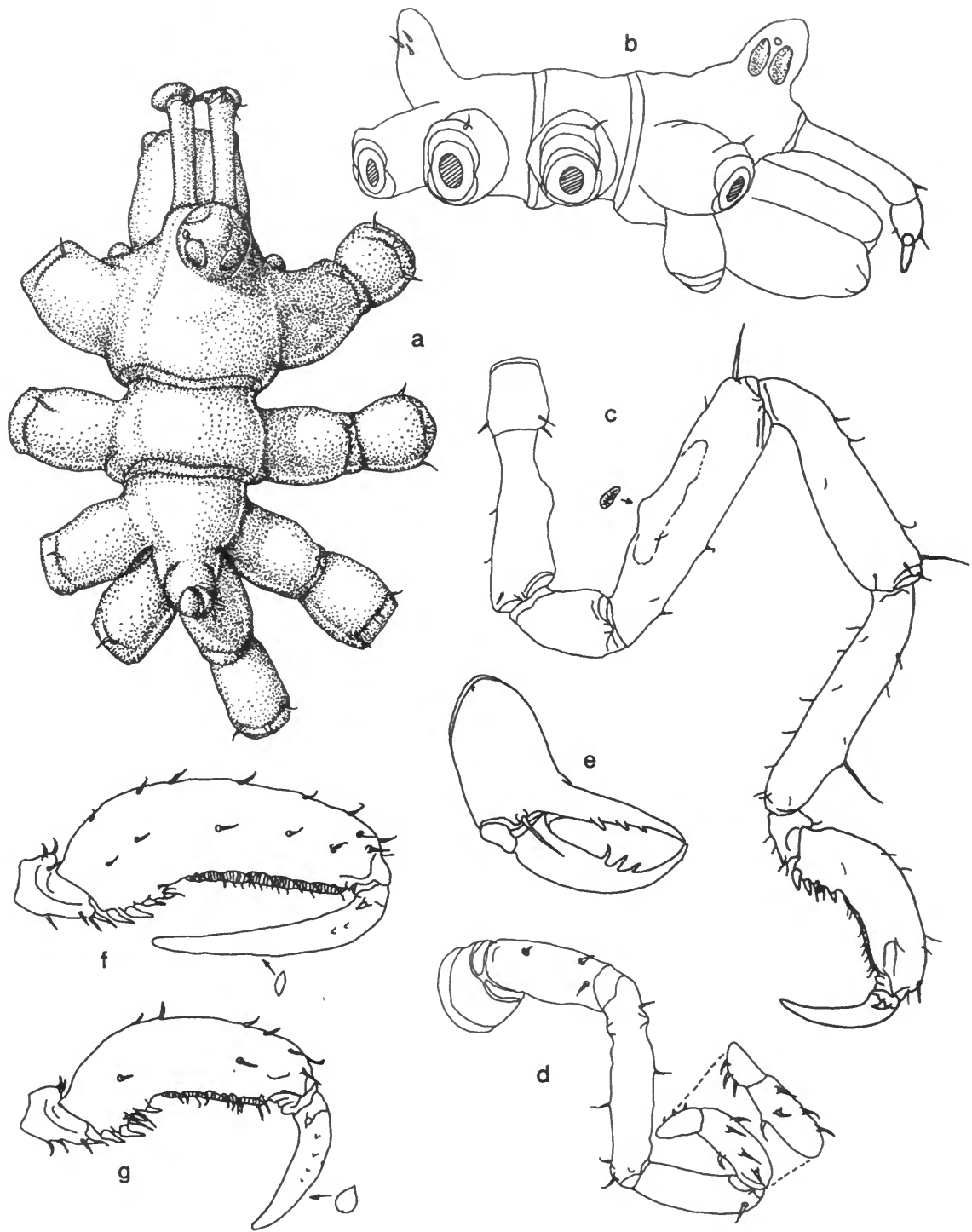


FIGURE 7.—*Anoplodactylus falciclavus*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, oviger, with distal segments in ectal view; e, chela; f, terminal segments of first leg, enlarged; g, terminal segments of fourth leg, enlarged.

ETYMOLOGY.—The name for this species is a compound of the Latin terms *falcis* (a sickle or scythe) plus *clavus* (a nail or, in this case, a toenail), and refers to the scythe-shaped anterior propodal claws.

REMARKS.—The presence of a sabre- or sickle-shaped claw on the longer propodus of the first pair of legs appears to be unique among the pycnogonids, except for modifications in the anterior leg pairs of some species in the genus *Ascorhynchus*. In this genus, the propodus and tarsus are often lengthened and the claw greatly reduced (or absent in one species) on the first legs. With the new species, the claw is modified to an apparent sharp-edged cutting instrument, much narrower than the rounded grasping claws of the posterior six legs. This unique character immediately separates this otherwise rather plain-appearing species with no conspicuously different features, from all known members of the large genus *Anoplodactylus*, which contains about 90 species. This cutting claw could offer a decided evolutionary advantage over those without it in tearing open the soft bodied food of these animals.

Anoplodactylus paradigitatus, new species

FIGURE 8

MATERIAL EXAMINED.—Negros Island, Silliman Marine Lab Beach, sta Sp-22-1 (1 ♂, holotype; 1 ♂, 5 ♀, 2 juv., paratypes).

OTHER MATERIAL.—Batan Island, Chanaryan Village, sta CAC 231 (1 ♂, 1 juv.).

DESCRIPTION.—Size moderately small; leg span 10.5 mm. Trunk suture lines complete for first and second segments, lacking between third and fourth segments. Lateral processes robust, slightly longer than their maximum diameters, separated by half their diameters or less, armed dorsodistally with low rounded tubercle slightly longer than wide on each, flanked by two or three short setae. Neck moderately long, constricted posterior to ocular tubercle, glabrous. Ocular tubercle twice as long as wide, constricted and rounded apically, eyes large, at tubercle midpoint, darkly pigmented. Abdomen moderately long, tapering to rounded tip, armed with two laterodistal setae.

Proboscis slender, cylindrical over most of length, constricted proximally and distally, lips flat.

Chelifores moderately long, scapes cylindrical, armed with few lateral, ventral and distal setae. Chela long, fingers slightly shorter than palm. Palm with several distal setae, movable finger well curved, with two proximal setae, immovable finger less curved, with one proximal seta. Fingers overlap at tips when closed, without teeth.

Oviger six-segmented, third segment longest, with proximal constriction, second segment 0.6 as long as third, both armed with few lateral setae. Terminal two segments subequal to length of fourth. Fifth and tiny sixth segments armed with dense setae, some as long as segment diameters.

Legs long, slender, moderately setose. Second coxae of posterior four legs with long ventrodorsal spur with apical sex pore, almost as long as segment diameter, with few ventral and

distal setae. Femur the longest segment, armed with four long dorsodistal setae, shorter than segment diameter. Cement gland under low swelling middorsally, with short distally projecting tube, equal in length to 0.25 of segment diameter. Second tibia slightly shorter than first, both armed with long dorsodistal seta. Tarsus very short, without ventral spine. Propodus with large heel bearing two short spines and four distal setae. Sole with seven or eight low broad spines, two long distal setae and very short lamina. Claw well curved, about 0.6 as long as propodus, auxiliaries tiny.

Female (paratype) slightly larger than male, but proboscis more narrow and tapered distally, armed with two proximoven- tral swellings or rounded tubercles. Palp buds discernible as low broad bumps laterally to proboscis insertion. Third and fourth leg pairs have low second coxa sex pore tubercles half as long as those of male.

MEASUREMENTS (holotype, in mm).—Trunk length, 1.27; trunk width (across 2nd lateral processes), 0.94; proboscis length, 0.52; abdomen length, 0.26; third leg, coxa 1, 0.25; coxa 2, 0.63; coxa 3, 0.36; femur, 0.97; tibia 1, 0.85; tibia 2, 0.79; tarsus, 0.11; propodus, 0.5; claw, 0.32.

DISTRIBUTION.—Known from its type-locality, Negros Island, in 2 m, and from Batan Island, in 0.5 to 1 m.

ETYMOLOGY.—This species is named for its similarities to *Anoplodactylus digitatus* (Böhm).

REMARKS.—With this new species, there are at least 12 described species of *Anoplodactylus* in which the female has some form of proximoven- tral proboscis tubercles or alar processes. The most marked are those of *A. portus* Calman, which are long, linear, and equipped with serrate or lobate edges. Those of other species are variously rounded tubercles of one or two pairs. Those of the female of the new species are modest bulges. The females of at least 20 species of this genus are unknown, so more species may be added to this number when both sexes of each species are known.

The species with females having some form of ventral proboscis processes are *A. arnaudae* Stock, *A. brevicollis* Loman, *A. digitatus* (Böhm), *A. evansi* Clark, *A. insignis* (Hoek), *A. polignaci* Bouvier, *A. portus* Calman, *A. stictus* Marcus (= *A. jungersi*? Fage), *A. unilobus* Stock, *A. verluysi* Loman, and the new species *A. paradigitatus*. Of the 11 previously known species, the new species is most closely related to *A. evansi* and *A. digitatus*. The ovigers particularly of *A. evansi* (Clark, 1963:53, fig. 26f) are the same as those of the new species, but the chelae and fingers of *A. evansi* are much shorter and have many more setae. Clark's species does not have the conspicuous lateral process tubercles of the new species and has a much shorter ocular tubercle.

As the proposed name suggests, the new species is most closely related to *A. digitatus*. The two species are very similar in most characters except that *A. digitatus* is without a trace of lateral process tubercles, has a longer cement gland tube, a much more inflated distal proboscis, a longer third oviger segment with many less setae on the terminal segments, and a

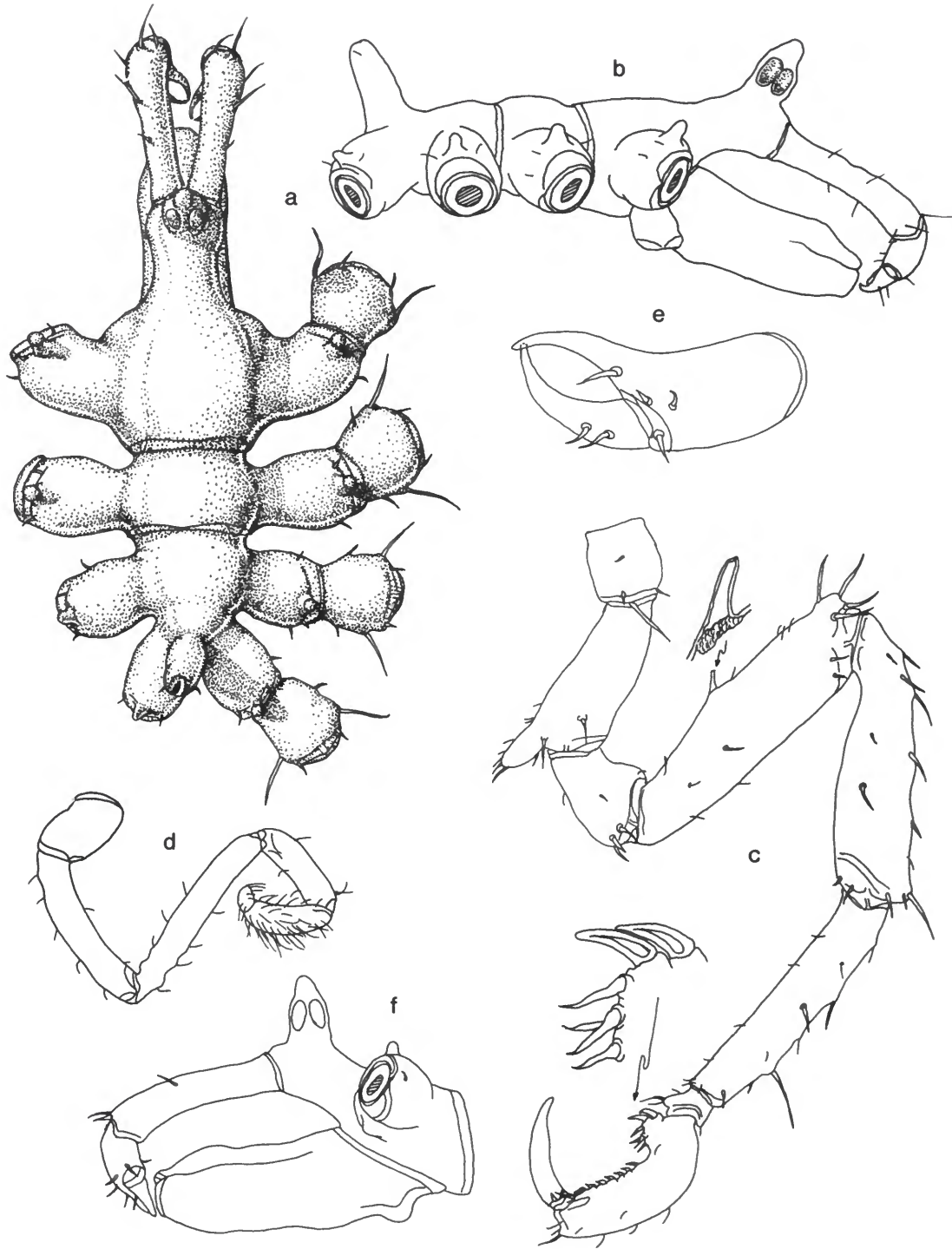


FIGURE 8.—*Anoplodactylus paradigitatus*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, third leg with enlargements of cement gland tube and heel; d, oviger; e, chela. Female paratype: f, trunk anterior, lateral view.

longer sex pore tubercle on the posterior four legs. It is the presence of the conspicuous lateral process tubercles that sets this new species off from all other *Anoplodactylus* species whose females have ventral proboscis processes.

The male paratype from Negros Island has a posterior aberration in the form of a missing lateral process and entire leg on the fourth segment. The single fourth lateral process and leg, which are normal, appear as a linear posterior extension of the trunk.

Anoplodactylus pectinus Hedgpeth

Anoplodactylus pectinus Hedgpeth, 1948:234–236, fig. 34.—Child, 1982b:372–373 [literature].

MATERIAL EXAMINED.—Batan Island, Imnajbu Village, sta CAC 240 (1♀); Batan Island, Munaniy Bay, sta CAC 243 (1♂).

REMARKS.—Examination of these specimens in comparison with the type-specimen (a male) convinces me that the three are the same species. The insignificant differences are within the realm of variation. The Philippine specimens have a slightly shorter ocular tubercle and smaller eyes, a more curved proboscis but of the same length, a slightly longer second oviger segment, and a similar but smaller cement gland aperture in the male. The claws are also slightly shorter in relation to propodal length than in the type. The remaining characters correspond almost exactly to those of the type, including setae placement and length. The chelae fingers are without teeth and setae in both specimens and the type.

This species is distributed in many localities from southern Florida and the Caribbean to a shallow capture on Madagascar. It is a shallow-water species found only as deep as 27 meters. This is the first Pacific record for the species.

Anoplodactylus pycnosoma (Helfer)

Peritrachia pycnosoma Helfer, 1938:176–177, fig. 7.

Anoplodactylus pycnosoma.—Child, 1983:708 [literature].—Nakamura and Child, 1983:50.

MATERIAL EXAMINED.—Cuyo Islands, Bisucay Island, sta SP-10-3 (2♂ with eggs); Mindanao, Silino Island, sta 79EM-6 (1 juv.); Siquijor Island, sta CAC 197A (4 juv.); sta CAC 198 (1♂ with eggs); Cebu Island, Sumilon Island, sta CAC 179 (2♀); Cebu Island, Tongo Point, sta CAC 190 (1♂ with eggs); Negros Island, Maloh, sta CAC 177 (1♀); Port Siyt, sta CAC 180 (1♂ with eggs, 2♀, 2 juv.); North Bais Bay, sta Sp-8-1H (1♀); Ayuquitan Viejo Village, sta NC-2-1H (1♀); Batanes Province, Batan Island, sta CAC 231 (3♀, 1 juv.).

REMARKS.—The five to eight male cement gland pores of this species form a good and constant recognition character. These specimens conform very well with the specimens reported from the Palau Islands (Child, 1983:708).

This species has been taken in several scattered localities from Madagascar to Japan and is recorded here from the

Philippines for the first time. It is a shallow-water species.

Anoplodactylus tarsalis Stock

Anoplodactylus tarsalis Stock, 1968:52–54, fig. 19.—Arnaud, 1973:955.

MATERIAL EXAMINED.—Cuyo Islands, Canipo Island, sta SP-11-1 (1♂).

REMARKS.—The bottom habitat was not included in collecting data for this specimen, but other specimens of *A. tarsalis* have been found both in sand and among algae. It is apparently one of the few interstitial sand-living pycnogonids known, other than those members of the genus *Rhynchothorax*. All of these interstitial species are very minute, having leg spans of only about three to five mm. They are all compact with the lateral processes closely crowded and are otherwise well suited for crawling among sand grains.

This species is easily recognized by its very long triangular tarsus, fully half as long as the propodus. The type was described from Balabac Island, also in the Sulu Sea, in less than two meters depth. Arnaud has listed other specimens from sandy reef areas of Madagascar in up to 13 meters.

Family ENDEIDAE Norman

Genus *Endeis* Philippi, 1843

Endeis biserata Stock

Endeis biserata Stock, 1968:57–60, fig. 21; 1970:1; 1974:17; 1979:28–30, fig. 9.

Phoxichilus meridionalis Loman (non Böhm, 1879), 1908:78–79.

MATERIAL EXAMINED.—Negros Island, Apo Island, sta CAC 192B (1♂ with eggs).

REMARKS.—This specimen was taken live from a clump of red algae and had the same blood red or ruby red coloration as the algae, except for its eyes, which were almost luminescent white, and the eggs, a cream color. This specimen has the distal femoral tubercle and long lateral setae of the type.

The species is known from Brazil, the Gulf of Aqaba to Madagascar, India, the East Indies, and Hawaii. Its range is extended to the Philippines with this record. It has been taken in shallow depths to 37 meters, the same depth as this record.

Endeis mollis (Carpenter)

Phoxichilus mollis Carpenter, 1904:182–183, figs. 1–7.

Endeis mollis.—Utinomi, 1971:327 [literature].—Stock, 1975a:1083–1085; 1975b:76.—Child, 1979:66.—Nakamura and Child, 1983:41.

MATERIAL EXAMINED.—Palawan Island, Ulugan Bay, sta SP-32-1 (2♂, 1♀).

REMARKS.—This species is easily recognized by having legs with only scattered short spines, a femur without bulges, a second tibia only slightly longer than the first, and less than 20 cement gland pores on the ventral surface of each male femur.

This is a pantropical species here recorded from the Philippines for the first time, although it has been taken in several places zoogeographically near the Philippines: the Ryukyu Islands and the East Indies. Its shallow occurrence is not extended by this capture in 1 to 15 meters.

Family CALLIPALLENIDAE Hilton

Genus *Callipallene* Flynn, 1929

Callipallene novaezealandiae (Thomson)

Pallene novae-zealandiae Thomson, 1884:246-247, pl. 14: figs. 1-4.
Callipallene novaezealandiae.—Child, 1982a:277 [literature]; 1983:708.

MATERIAL EXAMINED.—Cuyo Islands, Tagauayan Island, sta SP-12-1 (1 larva, probably this species); Mindanao, Aliguay Island, sta CAC 181 (1♂); Mindanao, Silino Island, sta 79EM-6 (1 juv.); sta CAC 185 (1 larva, probably this species); Siquijor Island, sta SP-4-2 (1 larva, probably this species); sta SP-3-2 (1♀ ovigerous); sta CAC 197A (1♀ ovigerous); sta CAC 198 (1♂ with eggs, 1♀ ovigerous, 2 juv.); Cebu Island, Sumilon Island, sta CAC 179 (1♂ with eggs); Negros Island, Port Siyt, sta CAC 180 (2 juv.); Apo Island, sta SP-19-2 (1♀).

REMARKS.—There is little difference between these specimens and those found in the Marshall and Caroline islands. The ocular tubercle apical spike is as tall as the ocular tubercle itself, but has variously shorter lengths in males. It is always shorter to absent in females. The strigilis spine count varies between specimens of the same sex; from nine to six denticulate spines on the seventh segment and proportionately smaller counts for the distal three segments.

It is not surprising that this species is found in the Philippines. It occurs to the east in Micronesia and to the south in New Zealand and Australia, besides being found in east Africa and Japan. The greatest depth recorded for the species is about 275 meters, but most captures have been in much shallower depths and the Philippine specimens are all from the littoral.

Genus *Pigrogromitus* Calman, 1927

Pigrogromitus timsanus Calman

Pigrogromitus timsanus Calman, 1927:408-410, fig. 104a-f.—Hedgpeth, 1947:7 [text]; 1948:214-216, fig. 23.—Stock, 1968:46; 1975a:1015-1016.—Lipkin and Safriel, 1971:9.—Arnaud, 1972:159-160.—Child, 1979:47; 1982b:367-368.—Staples, 1982:457, fig. 2g-j.
Clotenopsa prima Hilton, 1942:52-53, fig. 8.

MATERIAL EXAMINED.—Negros Island, Apo Island, sta CAC 194 (1♀).

REMARKS.—This species has much the appearance of species in the genus *Pycnogonum*, except that it has three-segmented chelifores. This, along with its robust appearance, makes it easily recognized.

This pantropical shallow-water species has been taken in

several isolated places in the Indo-Pacific including Hawaii, Australia, the Philippines, the Indian Ocean, and Gulf of Oman.

Genus *Propallene* Schimkewitsch, 1909

Propallene curtivalpus, new species

FIGURE 9

MATERIAL EXAMINED.—Siquijor Island, sta CAC 197A (1♂ with larvae, holotype).

OTHER MATERIAL.—Negros Island, Port Siyt, sta CAC 180 (1♀, 1 juv.); Silliman Marine Lab Beach, sta Sp-18-1 (1♀, 1 juv.); same locality, sta SP-22-1 (1♀, 2 juv.); Cebu Island, Tanon Strait, sta CAC 192A (7 juv.).

DESCRIPTION.—Size small, leg span about 5.1 mm. Trunk fully segmented. Lateral processes compact, separated by slightly less than their diameters with anterior pairs, more closely crowded with posterior pairs, length 1.5 longer than their diameters, armed with laterodistal short setae, single dorsal seta on second and third pairs. Neck short, without parallel sides. Ocular tubercle a low broad swelling with moderately large eyes and prominent sensory papillae. Abdomen typical of genus, short, directed horizontally, glabrous. Proboscis short, broad, only slightly longer than basal width, egg-shaped distally, lips flat.

Chelifore scape robust, fairly short, armed with few setae. Palm ovoid, armed with several distal setae. Movable finger slightly longer than palm, armed with six large teeth decreasing in size distally. Immobile finger shorter, armed with proximal setae and four large teeth. Finger tips overlap when closed.

Palps very small, less than half length of proboscis, of two segments. First segment broader than long, without setae, second segment slightly over three times longer than its diameter, armed with two distal setae as long as twice segment diameter.

Oviger segments three through six armed with several lateral and ectal recurved setae. Segment five longest, with low distal apophysis armed with fringe of short setae. Segment seven armed with field of many long ectal setae, segment eight with two distal very long curved setae. Strigilis denticulate spines arranged in single row in the formula 9:7:7:8. Spines dimorphic with proximal spines symmetrical, distal spines with short distal lobes and long lateral lobes, longer on one side than other.

Legs with few setae, dorsodistal setae of main segments not as long as segment diameters. Femur the longest segment, tibiae increasingly shorter. Cement gland tubes very short, less than three times longer than their diameters, distally constricted, arranged on femur with one tube, first tibia with one tube, and second tibia with two tubes, each segment apparently containing a separate ventral gland. Tarsus very short, triangular, armed with ectal and endal setae. Propodus robust, tapering distally, with narrow strongly projecting heel armed with two strong spines, the distal one having few crenulations

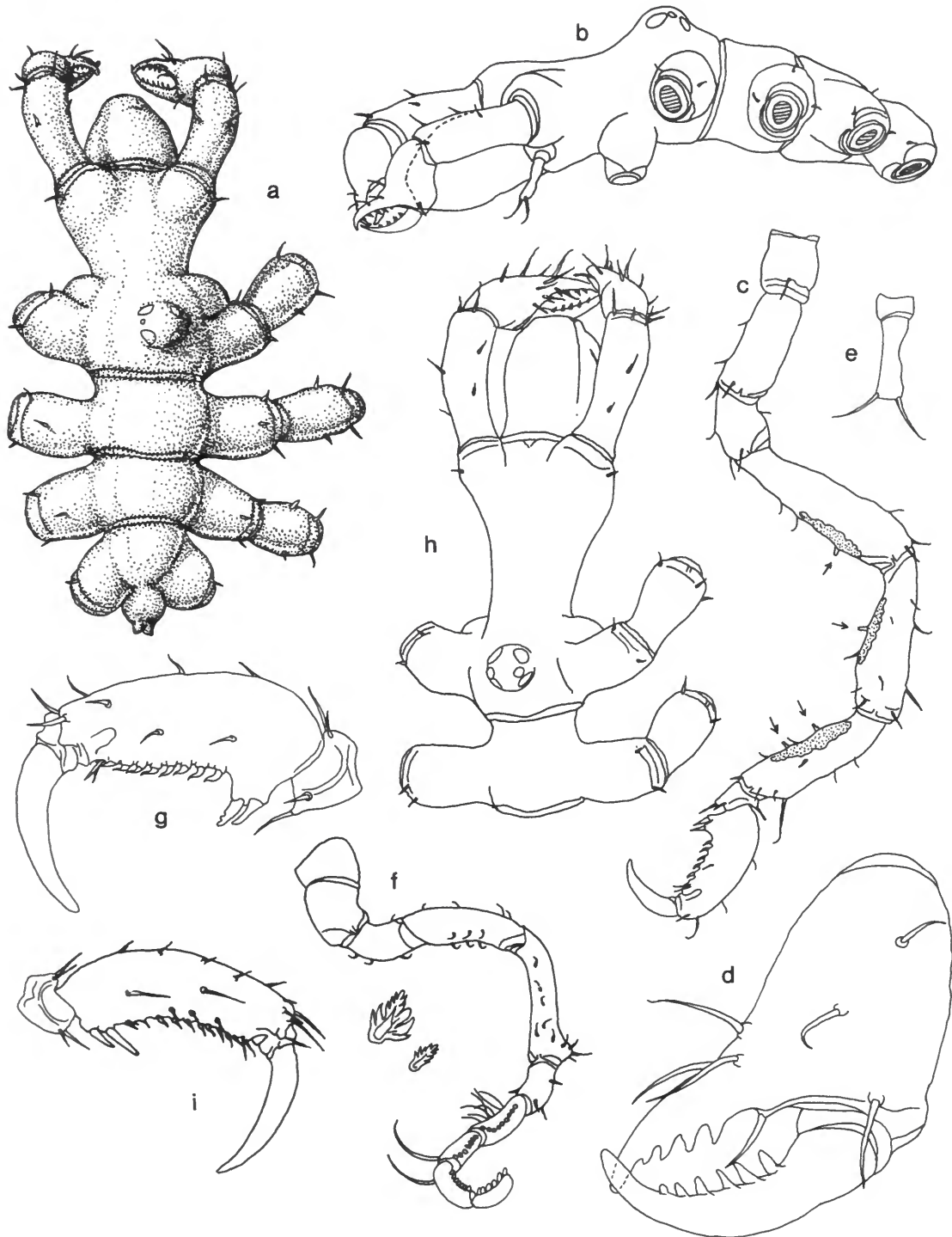


FIGURE 9.—*Propallene curtipalpus*, new species, holotype: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, chela; *e*, palp; *f*, oviger, with enlargements of proximal and distal spines; *g*, terminal segments of third leg, enlarged. Female paratype: *h*, trunk anterior, dorsal view; *i*, terminal leg segments, enlarged.

on distal surface. Sole armed with eight or nine low broad spines and several short lateral setae. Claw robust, well curved, slightly over half length of propodus, without auxiliaries.

Female: larger than male in all measurements except oviger. Neck longer with parallel sides. Propodal heel not projecting but armed with slightly longer spines. Oviger strigilis, although smaller, has more denticulate spines in the formula 12:10:9:12, spines dimorphic as in male. Fifth oviger segment subequal to fourth, without distal apophysis and setae.

MEASUREMENTS (holotype in mm).—Trunk length, 1.0; trunk width, 0.62; proboscis length, 0.39; third leg, coxa 1, 0.15; coxa 2, 0.25; coxa 3, 0.16; femur, 0.43; tibia 1, 0.38; tibia 2, 0.36; tarsus, 0.07; propodus, 0.29; claw, 0.17.

DISTRIBUTION.—Known from the type-locality, Siquijor Island, in less than 1 meter, and also from Silliman Marine Lab Beach, Negros Island, in 1 to 2 meters.

ETYMOLOGY.—The specific name refers to the very short palp of this new species.

REMARKS.—All known species of the genus *Propallene*, which have mostly Indo-West Pacific distribution, are remarkably similar in most characters and it is usually impossible to separate isolated females in this dimorphic genus. The two characters that separate the male of this new species from nine or 10 other species in this genus are, first, the extremely short simple palp measuring less than half the length of the proboscis and, second, the very reduced number of cement gland tubes, which originate, unlike in most species, in all three major leg segments. The cement gland arrangement is unknown for two species, *P. similis* Barnard and *P. stocki* Fage, but all other species have more than four or five tubes usually confined to the femur. Two species, *P. saengeri* Staples and *P. longiceps* (Böhm), are the only ones known to have gland tubes on segments other than the femur. *Propallene saengeri* has four to six on the femur, four on the first tibia, and three or four on the second tibia, while *P. longiceps* has seven to 16 on the femur and two or three on the third coxae. This new species is only the second known with cement glands on all three major leg segments, but with fewer tubes than *P. saengeri*.

No other species of *Propallene* has such a short palp. In all known species, the palps are longer, reaching well past midlength of the proboscis, and have more setae (except that of *P. stocki*, which is glabrous). In most other characters, this new species is very close to *P. saengeri* and only slightly less related to the other species in this closely knit genus.

Genus *Pallenopsis* Wilson, 1881

Pallenopsis (Pallenopsis) dentifera Stock

Pallenopsis (Pallenopsis) dentifera Stock, 1983:300–304, figs. 1–10.

MATERIAL EXAMINED.—Visayan Islands, sta R/V *Alpha Helix* (2♀).

REMARKS.—These two females have the denticulate immovable chelae fingers as described in the type-specimens, but

with the Philippine (*Alpha Helix*) specimens, the denticulate area is very slender and has the shape of a propodal lamina rather than with peg-like teeth. These females agree in most other particulars with *P. dentifera*, except that the propodal heels have four or five spines instead of three, the femur is a little longer than the first tibia instead of shorter, the seventh and eighth oviger segments are not coalesced as in Stock's (1983:302, fig. 6) paratype, and the cone above the eyes is not quite so spike-like. The chelifore scapes of these specimens have a hint of suture lines extending partway around their circumference, which is not present in the type-specimens.

Having only two females, I have some hesitation in designating them as this species without having a male to confirm all of the diagnostic characters, but there are no other species except *P. temperans* Stock and *Pallenopsis* sp. of Stock (1953:291–293, fig. 10, and 293–294, fig. 11) having long auxiliary claws and long slender oviger terminal segments in this area. The two Visayan specimens do not agree as well with *P. temperans* and *P. species* as they do with *P. dentifera*. For purposes of comparison, *P. species* Stock was examined and found to be a different species altogether from *P. dentifera*, and it must await a male for full description of all characters. It was taken east of Mindoro Island in 143 meters.

In comparison with *P. temperans*, the propodus and claw are more slender and longer in these two females, and the lateral processes are longer and more widely separated.

These specimens extend the distribution of *P. dentifera* from the more northern Mindoro Straits to the southern Bohol Strait and into more shallow water than the types that were taken in 166–172 meters.

Family NYMPHONIDAE Wilson

Genus *Nymphon* Fabricius, 1794

Nymphon diabolus, new species

FIGURE 10

MATERIAL EXAMINED.—Negros Island, Apo Island, sta SP-19-7 (1♂ with eggs, holotype; 1♀ semiadult, 1 juv., paratypes).

OTHER MATERIAL.—Siquijor Island sta SP-3-2 (1♀ ovigerous).

DESCRIPTION.—Size moderately small; leg span 9.3 mm. Trunk completely segmented, lateral processes up to twice as long as their diameters, separated by about 1.5 times their diameters, glabrous. Ocular tubercle only slightly taller than wide, with large slightly pigmented eyes, armed with apical pair of lateral tubercles half as tall as ocular tubercle itself. Abdomen small, as tall as ocular tubercle, armed with two distal setae. Neck short, without parallel sides. Entire anterior from neck (chelifores, palps, and proboscis) reduced in size in relation to remainder of trunk and appendages. Proboscis small, cylindrical, with rounded lips.

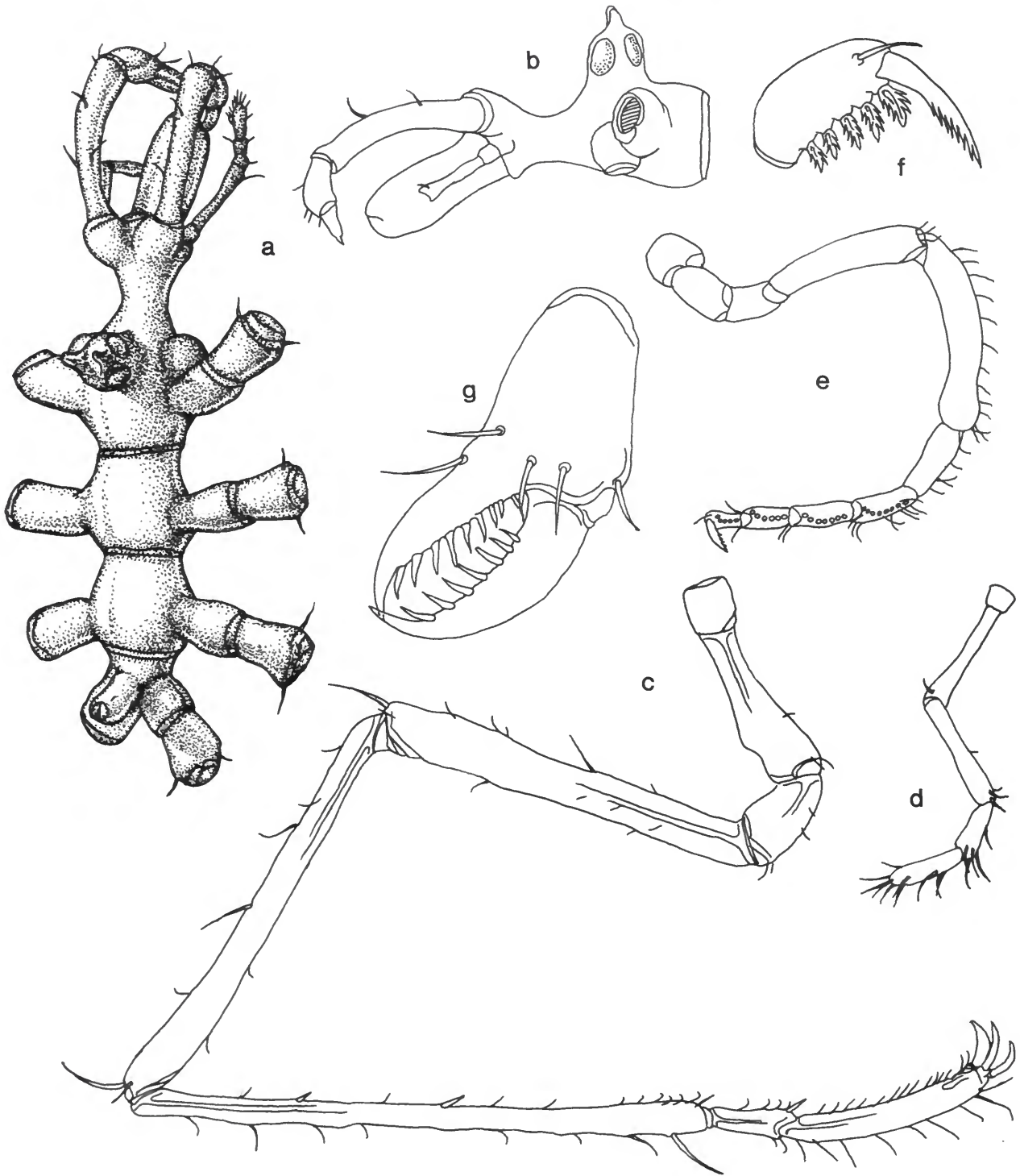


FIGURE 10.—*Nymphon diabolus*, new species, holotype: *a*, trunk, dorsal view; *b*, trunk anterior, lateral view; *c*, third leg; *d*, palp; *e*, oviger; *f*, oviger terminal segment and claw, enlarged; *g*, chela.

Chelifores moderately small, scape curved ventrally, armed with several dorsal and distal setae not as long as segment diameter. Chela slender, fingers short, robust, armed with seven slender teeth on movable finger and nine on immovable finger. Palm with several distal setae.

Oviger distal segments from five to 10 armed with several lateral and distal setae as long as segment diameters. Fourth and fifth segments subequal, fifth curved, without distal apophysis. Strigilis segments armed with denticulate spines having two lateral lobes on the proximal spines of each segment and three lobes on the distal spines, arranged in the formula 6:7:6:5. Terminal claw almost as long as terminal segment, armed with six to eight endal teeth.

Palp small, slender, second segment only slightly longer than third, terminal segment 0.2 longer than fourth, both armed with few setae, each longer than segment diameters.

Legs long, slender, armed with few short setae, two or three longer dorsal and dorsodistal setae on major segments, and three sharp spines proximally, medially and distally on second tibiae ventral surface. Propodus 2.4 times longer than tarsus, both slender, armed with several short and long ectal setae and row of short sole spines. Claw and auxiliaries very short, main claw only 0.23 length of propodus, auxiliaries only slightly shorter than main claw. Cement glands not found.

Female paratype: slightly larger in all measurements except for oviger. Apical horns on ocular tubercle larger and taller than those of male. Chelifore finger teeth more numerous; nine on movable finger, 11 on immovable finger. Smaller oviger with one additional denticulate spine per strigilis segment. Tarsus notably longer than in male, propodus slightly less than twice tarsus length.

MEASUREMENTS (holotype in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 1.08; trunk width (across 2nd lateral processes), 0.47; proboscis length, 0.3; abdomen length, 0.16; third leg, coxa 1, 0.11; coxa 2, 0.38; coxa 3, 0.23; femur, 0.83; tibia 1, 0.94; tibia 2, 1.19; tarsus, 0.18; propodus, 0.44; claw, 0.1.

DISTRIBUTION.—Known from the type-locality, Apo Island off Negros Island in 1 meter, and from Siquijor Island in 3 to 6 meters.

ETYMOLOGY.—The name *diabolus* is Latin (meaning a devil) and is in reference to the horn-like tubercles at the ocular tubercle apex, which are reminiscent of a satanic caricature.

REMARKS.—This new species shares several characters with a closely related species, *Nymphon micronesicum* from the Marshall Islands, and has several characters in common with a less closely related species, *N. spiniventris*, from southern Mindanao Island. With *N. micronesicum*, it shares long slender leg segments with ventral spines on the second tibia, but lacks the endal serrations on the propodal claws, it has very similar ovigers, but different denticulate spines and terminal claw, and it has similar trunk proportions except that the anterior appendages are smaller and the chelae have simple teeth instead

of the bifurcate teeth of *N. micronesicum*. With its nearest neighbor known, *N. spiniventris*, it also shares similar leg proportions, including the tarsus, propodus, and claw relative lengths, but its legs are shorter. It has similar chelae and ovigers, although the chelae of *N. diabolus* are shorter and have fewer teeth and its ovigers are proportionately shorter with fewer spines. The principal differences are in the very long neck and the second lateral process ventrolateral tubercles of *N. spiniventris*.

The combination of reduced anterior appendage size, fairly tall horns on the ocular tubercle, and relative length ratios of legs and palp segments are shared by no other known pycnogonid of this genus.

Nymphon megacheles, new species

FIGURE 11

MATERIAL EXAMINED.—Batan Island, Munanioy Bay, sta CAC 244 (1♀, holotype).

DESCRIPTION.—Size small; leg span 8.8 mm. Trunk compact, fully segmented. Lateral processes only as long as their diameter, separated by half their diameters, glabrous. Neck short, only as long as width of oviger tubercles, which touch first lateral processes. Crop anterior to neck wider than trunk, armed with setae over insertion of chelifore. Ocular tubercle moderately slender, slightly less than twice as tall as wide, with two lateral short slender tubercles at apex. Eyes large, filling most of ocular tubercle, darkly pigmented. Abdomen short, little longer than ocular tubercle, armed with two distal setae. All anterior appendages large, massive in relation to trunk and legs.

Proboscis massive, inflated at midlength, tapering distally to rounded lips.

Chelifores very large, scapes robust, straight, armed with dorsal and lateral setae as long as or longer than segment diameter. Chelae huge, palm globular, greatly inflated, armed with many short setae. Fingers shorter than palm, set obliquely to palm, very slightly curved with tips not overlapping, without setae, both with closely set bicuspid teeth, anterior cusps longer than posterior points, with 10 or 11 teeth on movable finger, 13 on immovable finger.

Palps as long as trunk, second segment longest, third only 0.6 length of second, terminal segment 0.6 length of third, and fourth slightly shorter than terminal segment. Second segment armed distally with fringe of short setae, fourth with ventrodorsal fringe, and terminal two segments with dense ventral and lateral setae, some longer than twice segment diameter.

Oviger segment five the longest segment, slightly inflated distally, without an apophysis, armed ectally and laterally with many setae longer than segment diameter. Segment six slightly longer than four, six and strigilis armed with lateral and ectal setae similar to fifth segment. Strigilis segments small,

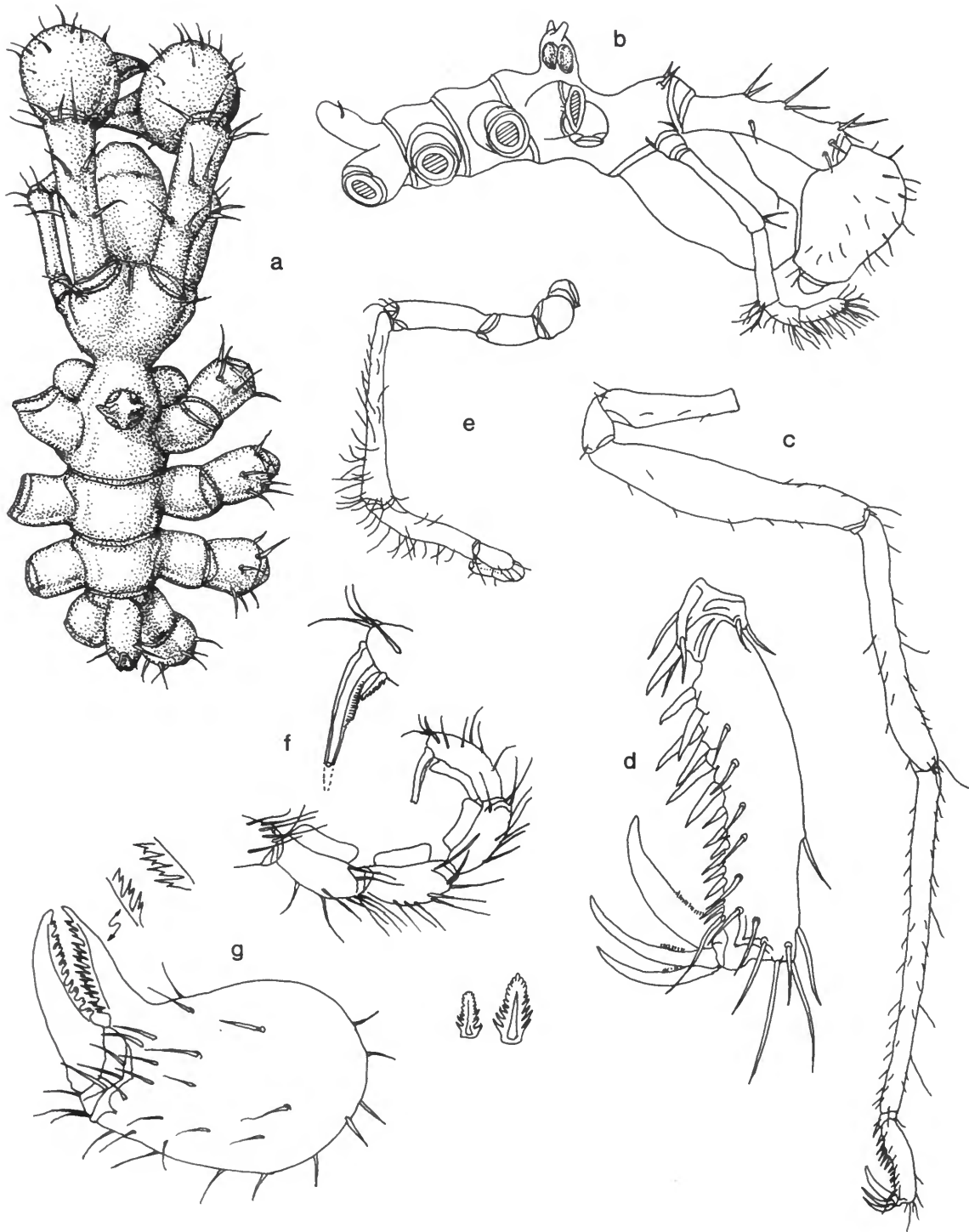


FIGURE 11.—*Nymphon megacheles*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, third leg terminal segments, enlarged; e, oviger; f, oviger terminal segments, enlarged, with terminal claw and denticulate spines further enlarged; g, chela, with enlargement of several teeth.

subequal in length, armed with endal denticulate spines in the formula 10:9:9:10, with a terminal claw almost as long as last segment, very slightly curved, armed with tiny proximal fringe or lamina, without teeth.

Legs slender, second tibia longest major segment, femur slightly longer than first tibia, armed with few long dorsodistal setae and short setae increasing in number distally on leg. Femur inflated over proximal half, thin-walled. Tarsus very short, armed with one ventral spine and few dorsal and ventral setae. Propodus moderately short, slightly curved, without marked heel, armed with six large heel spines in two rows and six or seven smaller sole spines with flanking rows of short setae. Few setae distally, some longer than propodal diameter. Claw less than half propodal length, auxiliaries 0.75 as long as main claw, all three with endal proximal row of tiny spinules.

MEASUREMENTS (in mm).—Trunk length, 1.13; trunk width (across 2nd lateral processes), 0.62; proboscis length, 0.59; abdomen length, 0.19; third leg, coxa 1, 0.2; coxa 2, 0.46; coxa 3, 0.19; femur, 0.89; tibia 1, 0.81; tibia 2, 1.1; tarsus, 0.07; propodus, 0.27; claw, 0.12.

DISTRIBUTION.—Known only from the type-locality, Munanoy Bay, Batan Island in 0.4 meters.

ETYMOLOGY.—The species is named for its disproportionately large chelae.

REMARKS.—This species, as with the last described species, *Nymphon diabolus*, has the anterior characters of chelifores, palps, and proboscis out of proportion or scale with the remainder of the animal. In this species, the anterior is disproportionately large in relation to the trunk and legs. This lack of proportion is not unique among *Nymphon* species. The chelae of the new species are similar, as is the proboscis, to *N. aequidigitatum* Haswell, but the chelae of *N. megacheles* are more inflated and have bicuspid teeth, while Haswell's species has simple chelae teeth. *Nymphon micronesicum* Child has bicuspid chelae teeth, but has chelifores and proboscis in normal proportion to the remainder of the animal. There is no known species, to my knowledge, particularly in the western Pacific, with the larger anterior segments, grossly inflated chelae, and bicuspid teeth of *N. megacheles*. There are other species having bicuspid teeth, such as *N. floridanum* Hedgpeth and *N. bifurcatus* Stock, or with inflated chelae, such as *N. giraffa* Loman, but none appear to have the unique combination of characters listed above.

Family PYCNOGONIDAE Wilson

Genus *Pycnogonum* Brünnich, 1764

Pycnogonum occa Loman

Pycnogonum occa Loman, 1908:35–36, pl. 12: figs. 171–174.—Bouvier, 1922:116.—Stock, 1966:401; 1968:61–62, fig. 22c–e.

MATERIAL EXAMINED.—East of Luzon Island, *Albatross* sta 5447 (1 juv.).

REMARKS.—This juvenile specimen has more of the diagnostic characters of *P. occa* than any other *Pycnogonum* species, but it is sufficiently different as to render its determination slightly questionable. The differences are as follows: the proboscis is more slender than the type, the integument shows slight incipient reticulation, which is difficult to discern, the lateral process and median trunk tubercles are more blunt and broad, the ocular tubercle is taller, and the first coxae are without the laterodistal tubercles. In a juvenile, these differences may be perfectly reasonable and it is possible the specimen would have developed into an adult like the type. Examination of an adult female in the National Museum of Natural History collections showed enough similarities to warrant calling this specimen *P. occa* until a series of juveniles and adults of *P. occa* is collected for comparison. There are no anterior cephalic segment tubercles as described and figured by Stock (1968) on this Philippine specimen.

This species was described from specimens found in the Ceram Sea, Indonesia, and there is a questionable record (Stock, 1968) from the Kermadec Trench in 2470 meters. The Ceram specimens are from 567 and 835 meters. By coincidence, the present record is also from 567 meters and marks the farthest north record for this species.

Pycnogonum species indeterminate

MATERIAL EXAMINED.—Siquijor Island, sta CAC 197A (1 juv.).

REMARKS.—This small reticulate juvenile is closest to *Pycnogonum portus* Barnard (1946:62; 1955:153–154, fig. 32), from South Africa, but is sufficiently juvenile and has enough divergent characters to make it indeterminate. The only other *Pycnogonum* species previously known in the Philippines, *P. orientale* (Dana), is unquestionably a different species than this juvenile, although both were found in reef habitats. I believe this to be a new species that must await the collection of adults with which to show the full range of diagnostic characters necessary for a proper description.

In comparison with *P. portus*, this specimen does not have as broad a cephalic segment nor does it have the trunk tubercles lateral to the ornamented median tubercles. The proboscis is a tapering cone, but the distal portion is not nearly so narrow and pointed as in *P. portus*. It has small lateral process papillae but not the ornamented tubercles, nor those on the femur like *P. portus*. It coincides in reticulation, crowded lateral processes, low ocular tubercle, very short second tibiae, and lack of auxiliaries, but is young enough to have no hint of ovigers. It should be noted that Barnard's male specimen carried eggs but lacked any trace of ovigers, so lack of ovigers in this juvenile specimen is not significant until it can be determined that this case holds for adults of this Philippine specimen.

Family RHYNCHOTHORAXIDAE Thompson

Genus *Rhynchothorax* Costa, 1861*Rhynchothorax orientalis*, new species

FIGURE 12

MATERIAL EXAMINED.—Negros Island, Apo Island, sta SP-19-7 (1 ♀?).

DESCRIPTION.—Size tiny; leg span only 2.8 mm across first lateral processes. First two trunk segmentation lines complete, third lacking. Entire trunk and appendages for most of length covered with granular papillae, including tubercles. Suture lines between trunk and lateral processes faint but present. Trunk segments armed with bifid median-dorsal tubercles twice as tall as their diameters, the anterior projection on each taller than posterior projection, armed with single distal and proximal setae. Ocular tubercle with broad base, consisting of dorsal low tubercle and long anterior-projecting ramus with single dorsal and distal setae. Eyes very small, within basal stalk, unpigmented. Ocular tubercle flanked with two posterolateral slender tubercles not so tall as ocular tubercle. Lateral processes shorter than their diameters, slightly separated, armed with anterior and posterior groups of granular papillae, small dorsodistal tubercles on first or anterior pair, and tiny dorsodistal tubercles on posterior pair, without tubercles on second and third pairs. Unsegmented palp bases well defined lateral to cephalic segment, armed with groups of lateral papillae. Abdomen long, slightly inflated laterally, extending slightly beyond second coxae on fourth pair of legs, armed with pair of dorsodistal setae.

Proboscis downcurved, with two dorsolateral bumps at midlength, two ventrolateral bumps more proximally, a dorsodistal constriction, and a ventral labial fringe on oral antimeres similar to propodal lamina.

Palp four-segmented, with conspicuous papillae. First segment longest, armed with dorsodistal tubercle twice as long as segment diameter, bearing distal seta. Second segment slightly over half length of first, with very small dorsodistal tubercle with distal seta and three or four ventral setae. Terminal two segments increasingly short, without tubercles, armed with several ventral and distal setae longer than segment diameters.

Oviger typical of genus; fourth and sixth segments subequal, fifth slightly shorter, with two or three short setae on longer segments. Strigilis segments subequal, armed with short broad spines without denticulation or bifid tips, in the formula 2:3:3:2, with curved terminal claw forming a subchelate position with an opposed lamina.

Legs of different lengths with anterior pair longest, posterior

pairs shorter with posterior two the shortest. First coxae with dorsodistal tubercle slightly longer than wide at base, posterior two first coxae without tubercle. Second coxae slightly shorter or subequal to third. Major leg segments cylindrical, armed with few short setae and very long dorsodistal seta each, setae over twice as long as segment diameters. Tarsus short, with one to three ventral setae, propodus moderately long, slightly curved, armed with three to six sole spines, few lateral and dorsodistal setae, and short robust claw less than half propodal length. Without auxiliaries. Neither sex pores nor femoral cement glands evident, holotype probably female.

MEASUREMENTS (in mm).—Trunk length (anterior rim of cephalic segment to tip 4th lateral processes), 0.59; trunk width (across first lateral processes), 0.37; proboscis length, 0.32; abdomen length, 0.16; first leg, coxa 1, 0.06; coxa 2, 0.06; coxa 3, 0.07; femur, 0.24; tibia 1, 0.27; tibia 2, 0.19; tarsus, 0.05; propodus, 0.19; claw, 0.07.

DISTRIBUTION.—Known only from the type-locality, Apo Island, just off Negros Island, in 1 meter.

ETYMOLOGY.—This species is named for its type-locality, Negros Oriental Province, in which tiny Apo Island is situated.

REMARKS.—This new species is closely related to the first species named in this genus, *Rhynchothorax mediterraneus* Costa. It has the same anterior-projecting ocular tubercle, similar dorsal trunk tubercles, lateral process, and first coxae tubercles, although it lacks these tubercles on the second and third lateral process pairs, and has a very similar palp. The differences between the two species are that the new species has shorter lateral processes, taller and more deeply bifid trunk tubercles, a more slender proboscis, no major spine on the endal surface of the second or third palp segment, taller tubercles on the palp segments, and it lacks the long sex pore tubercle on coxa three of the third legs found on males of *R. mediterraneus*. It is possible that males of this new species, assuming that the specimen is a female, do have this long tubercle but more specimens must be collected to solve this point. The outstanding character that separates this new species from *R. mediterraneus* is its longer anterior legs in comparison with the shorter posterior pair. This character has not been described for any other member of the genus, to my knowledge, and is apparently unique. This situation is common to juvenile specimens of pycnogonids, but with the ovigers fully developed in this specimen, it should be past the juvenile growth stages where shorter posterior legs would prevail.

This new species also has some similarities to *R. percivali* Clark, which shares with it an anterior-pointing ocular tubercle and large trunk tubercles, but the trunk tubercles are not bifid and the lateral process tubercles are taller and differently shaped in *R. percivali*.

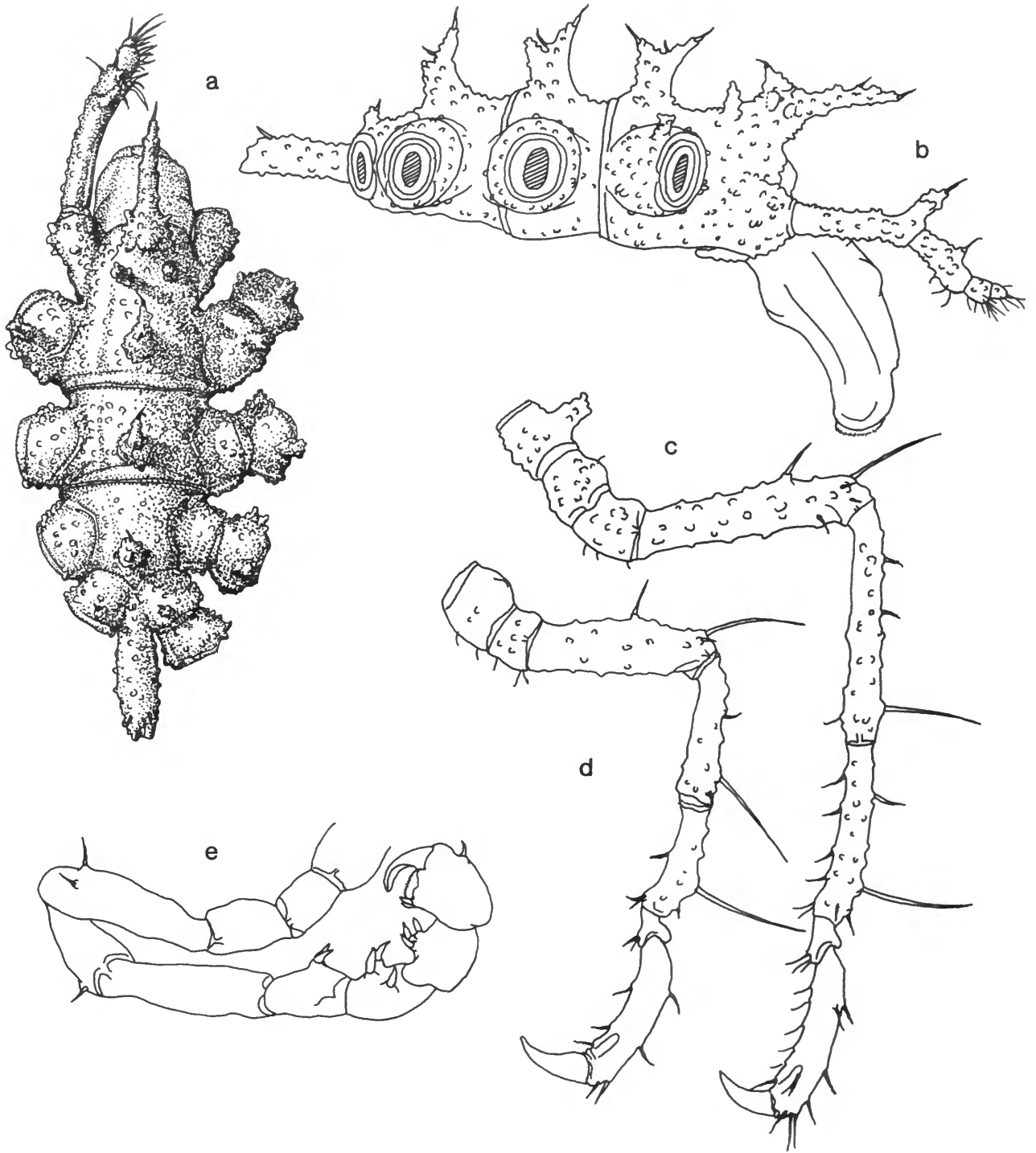


FIGURE 12.—*Rhynchothorax orientalis*, new species, holotype: a, trunk, dorsal view; b, trunk, lateral view; c, first leg; d, fourth leg; e, oviger.

Appendix

Station List with Specimens Collected

Sulu Sea, Cuyo Islands, Palawan Province

Bisucay Island, S side, 3–17 m, 10°48'36"N, 120°58'24"E, 22 May 1978, sta SP-10-3, coll. Smithsonian Oceanographic Sorting Center (SOSC).

Anoplodactylus pycnosoma (Helfer)

Canipo Island, N side, 2–3 m, 11°00'00"N, 120°56'54"E, 23 May 1978, sta SP-11-1, coll. SOSC.

Anoplodactylus tarsalis Stock

Ammothella tippula Child

Tagauayan Island, off NW side, 6–7 m, 10°58'33"N, 121°12'36"E, 25 May 1978, sta SP-12-1, coll. SOSC.

Callipallene novaezealandiae (Thomson)

Sulu Sea, Basilian Province

Basilian Island, on Kilay Islet near Langas Island, rocks and coral reef, 2 m, Jan 1941, sta Taylor 38, coll. native divers.

Ammothella indica Stock

Bohol Sea, Mindanao Island, Zamboanga del Norte Province

Aliguay (Aligbay on some maps) Island, SW shore, rubble, 2 m, 08°44'48"N, 123°12'42"E, 2 May 1979, sta 181, coll. C.A. Child.

Callipallene novaezealandiae (Thomson)

Aliguay Island, SW shore, rubble, 2 m, 2 May 1979, sta 182, coll. C.A. Child.

Anoplodactylus attenuatus, new species

Anoplodactylus chamorrus Child

Silino Island, SW side, rubble, 1–1.5 m, 08°51'40"E, 123°25'00"E, 3 May 1979, sta 185, coll. C.A. Child.

Callipallene novaezealandiae (Thomson)

Silino Island, NW side, algal wash, 2.5 m, 3 May 1979, sta 79EM-6, coll. E. Meñez.

Callipallene novaezealandiae (Thomson)

Anoplodactylus pycnosoma (Helfer)

Bohol Sea, Siquijor Province

Siquijor Island, S coast near San Juan, coral rubble, 3–6 m, 09°09'35"N, 123°29'05"E, 9 May 1978, sta SP-3-2, coll. SOSC.

Anoplodactylus attenuatus, new species

Nymphon diabolus, new species

Callipallene novaezealandiae (Thomson)

Siquijor Island, coral reef N of channel near Tonga Point, 2–3 m, 09°13'10"N, 123°27'30"E, 10 May 1978, sta SP-4-2, coll. SOSC.

Ammothella alcalai, new species

Callipallene novaezealandiae (Thomson)

Siquijor Island, just W of Siquijor Village near stream mouth, rubble, 0.5 m, 09°13'40"N, 123°29'00"E, 14 May 1979, sta 197A, coll. C.A. Child.

Ammothella alcalai, new species

Anoplodactylus chamorrus Child

A. pycnosoma (Helfer)

Callipallene novaezealandiae (Thomson)

Propallene curtialpus, new species

Pycnogonum species.

Siquijor Island, NW shore, near point W of stream, algal wash, 0–1 m, 15 May 1979, sta 198, coll. C.A. Child.

Anoplodactylus chamorrus Child

Anoplodactylus pycnosoma (Helfer)

Callipallene novaezealandiae (Thomson)

Bohol Sea, Cebu Strait, Cebu Province

Sumilon Island, SW shore, intertidal, 09°26'00"N, 123°23'24"E, 17 Jun 1978, sta SP-17-1H, coll. SOSC.

Achelia assimilis (Haswell)

Sumilon Island, SE shore, rubble, 1–2 m, 09°26'00"N, 123°23'30"E, 27 Apr 1979, sta 179, coll. C.A. Child.

Anoplodactylus chamorrus Child

Anoplodactylus pycnosoma (Helfer)

Callipallene novaezealandiae (Thomson)

Bohol Sea, Tañon Strait, Cebu Province

Cebu Island, Tongo Point, Moalboal Barrio Beach, rubble, 1–2 m, 09°56'20"N, 123°22'00"E, 8 May 1979, sta 190, coll. C.A. Child.

Ammothella indica Stock

Anoplodactylus pycnosoma (Helfer)

Cebu Island, Santa Filomina Barrio, S of Badian Point, rubble from edge of mangroves, 0.5–1 m, 09°50'N, 123°22'15"E, 8 May 1979, sta 192A, coll. C.A. Child.

Propallene curtialpus, new species

Bohol Sea, Negros Oriental Province

Apo Island, W side, rubble, 0.1–1 m, 09°05'N, 123°16'E, 23 Jun 1978, sta SP-19-2, coll. SOSC.

Callipallene novaezealandiae (Thomson)

Apo Island, N side, 15–20 m, 09°05'24"N, 123°16'20"E, 23 Jun 1978, sta SP-19-3, coll. SOSC.

Achelia assimilis (Haswell)

Tanystylum philippinensis, new species

Apo Island, E side, 1 m, 09°05'00"N, 123°16'30"E, 23 Jun 1978, sta SP-19-7, coll. SOSC.

Achelia assimilis (Haswell)

Ammothella indica Stock

Nymphon diabolus, new species

Rhynchothorax orientalis, new species

Apo Island, N end, on red algae, 37 m, 09°05'20"N, 123°16'30"E, 10 May 1979, sta 192B, coll. D. Catada.

Endeis biserata Stock

Apo Island, extreme S end, reef of large basalt rocks, algal wash, 1–2 m, 11 May 1979, sta 194, coll. C.A. Child.

Pigrogromitus timsanus Calman

Negros Island, Maloh, just SW of Siaton Point, algae and rubble, 2 m, 09°02'30"N, 123°01'15"E, 24 Apr 1979, sta 177, coll. C.A. Child.

Anoplodactylus pycnosoma (Helfer)

Negros Island, Maloh, plankton net at surface, 09°03'06"N, 122°59'06"E, 26 Apr 1979, sta 3-PN-110, coll. SOSC.

Ammothella indica Stock

Negros Island, Port Siyt, just S of Zamboanguita, coral, rubble, sand, on mud flats, 0–1.5 m, 09°04'25"N, 123°09'00"E, 26 Apr 1979, sta 180, coll. C.A. Child.

Ammothella indica Stock

A. stauromata Child

Anoplodactylus batangensis (Helfer)

A. pycnosoma (Helfer)

Callipallene novaezealandiae (Thomson)

Propallene curtialpus, new species

Negros Island, beach just S of Dumaguete City, 1 m, 09°16'45"N, 123°18'15"E, 3 Jun 1978, sta NC-1-1-H, coll. N. Calumpong.

Ammothella alcalai, new species

Negros Island, Bantayan, Silliman University Marine Lab beach, dip net, 1 m, 09°19'40"N, 123°18'50"E, 16 Jun 1978, sta SP-15-2, coll. SOSC.

Anoplodactylus arescus Marcus

Negros Island, same locality, 1–2 m, 18 June 1978, sta SP-18-1, coll. SOSC.

Ammothella alcalai, new species (from sediment)

Propallene curtialpus, new species (from fish net)

Negros Island, same locality, 2 m, 26 June 1978, sta SP-22-1, coll. SOSC.

Ammothella alcalai, new species

Anoplodactylus batangensis (Helfer)

A. paradigitatus, new species

Propallene curtialpus, new species

Negros Island, same locality, 0.5–1 m, tidal flats with mud, sand, algae, 16 May 1979, sta 199, coll. C.A. Child.

Ammothella alcalai, new species

Anoplodactylus batangensis (Helfer)

Negros Island, Ayuquitan Viejo Village, just N of Dumaguete City, off beach, 3 m, 09°25'00"N, 123°14'15"E, 5 Jun 1978, sta NC-2-1H, coll. N. Calumpong.

Anoplodactylus pycnosoma (Helfer)

Negros Island, South Bais Bay, shore inside Daco Island, 0–1 m, 09°34'18"N, 123°09'00"E, 15 May 1978, sta SP-7-1H, coll. SOSC.

Ammothella stauromata Child

Anoplodactylus falciclavus, new species

Negros Island, same locality, off Daco Island, 10–17 m, 15 May 1978, sta SP-7-2, coll. SOSC.

Achelia assimilis (Haswell)

Negros Island, North Bais Bay, NE point of Daco Island, 1–2 m, 09°35'46"N, 123°09'24"E, 17 May 1978, sta SP-8-1H, coll. SOSC.

Achelia assimilis (Haswell)

Anoplodactylus pycnosoma (Helfer)

Bohol Sea, Bohol Province

Off Bohol Island, trawl, 90 m, 22 Nov 1979, coll. R/V *Alpha Helix*.

Pallenopsis (Pallenopsis) dentifera Stock

Visayan Sea, Cebu Province

NE of Bantayan Island, trawl, 84 m, 11°23'17"N, 123°50'23"E, 7 Jun 1978, sta T-17, coll. R/V *Sting Ray V*.

Hemichela micrasterias Stock

South China Sea, Palawan Province

Palawan Island, Ulugan Bay, off Camungyan Island, 1–15 m, 10°09'00"N, 118°45'45"E, 10 Jul 1978, sta SP-32-1, coll. SOSC.

Endeis mollis (Carpenter)

Philippine Sea, Camarines Sur Province

Luzon Island, 3.5 mi NE of San Miguel Point, trawl, 567 m, 13°28'N, 123°46'18"E, 4 June 1909, sta 5447, coll. R/V *Albatross*.

Pycnogonum occa Loman (found on dried coral specimen, 1981)

Balintang Channel, Batanes Province

Batan Island, Chanaryan Village, just S of Basco, poison, 0.5–1 m, 20°26'00"N, 121°58'E, 30 May 1985, sta 231, coll. C.A. Child.

Anoplodactylus pycnosoma (Helfer)

A. paradigitatus, new species

Batan Island, Imnajbu Village, at end of S shore road, tidal flats and pools, 0–1 m, 20°22'15"N, 121°58'15"E, 5 Jun 1985, sta 240, coll. C.A. Child.

Anoplodactylus pectinus Hedgpeth

Batan Island, Munaniy Bay, tall rock pinnacle, tide pools, poison, 0–1.5 m, 20°24'10"N, 121°57'50"E, 6 Jun 1985, sta 243, coll. C.A. Child.

Ammothella rotundata, new species

A. stauromata Child

Tanystylum philippinensis, new species

Anoplodactylus brevirostris, new species

A. pectinus Hedgpeth

Batan Island, Munaniy Bay, sea cliff and shallow caves at base of point at S end of Bay, poison, 0–4 m, 20°24'40"N, 121°58'35"E, 8 Jun 1985, sta 244, coll. C.A. Child.

Eurycyde setosa, new species

Tanystylum species

Nymphon megacheles, new species

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Copy must be prepared on typewriter or word processor, double-spaced, on one side of standard white bond paper (not erasable), with 1¼" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: **title page** with only title and author and no other information, **abstract page** with author, title, series, etc., following the established format; table of **contents** with indents reflecting the hierarchy of heads in the paper; also, **foreword** and/or **preface**, if appropriate.

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Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but no other preparation (such as all caps or underline, except for the underline necessary for generic and specific epithets). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or numbered table captions.

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Taxonomic keys in natural history papers should use the aligned-couplet form for zoology and may use the multi-level indent form for botany. If cross referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa, using the same numbers with their corresponding heads in the text.

Synonymy in zoology must use the short form (taxon, author, year:page), with full reference at the end of the paper under "Literature Cited." For botany, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in "Literature Cited") is optional.

Text-reference system (author, year:page used within the text, with full citation in "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all Contributions Series and is strongly recommended in the Studies Series: "(Jones. 1910:122)" or "... Jones (1910:122)." If bibliographic

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Footnotes, when few in number, whether annotative or bibliographic, should be typed on separate sheets and inserted immediately after the text pages on which the references occur. Extensive notes must be gathered together and placed at the end of the text in a notes section.

Bibliography, depending upon use, is termed "Literature Cited," "References," or "Bibliography." Spell out titles of books, articles, journals, and monographic series. For book and article titles use sentence-style capitalization according to the rules of the language employed (exception: capitalize all major words in English). For journal and series titles, capitalize the initial word and all subsequent words except articles, conjunctions, and prepositions. Transliterate languages that use a non-Roman alphabet according to the Library of Congress system. Underline (for italics) titles of journals and series and titles of books that are not part of a series. Use the parentheses/colon system for volume (number): pagination: "10(2):5-9." For alignment and arrangement of elements, follow the format of recent publications in the series for which the manuscript is intended. Guidelines for preparing bibliography may be secured from Series Section, SI Press.

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