

Pycnogonida from Waters Adjacent to Japan

KOICHIRO NAKAMURA
and
C. ALLAN CHILD

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*Koichiro Nakamura
and C. Allan Child*



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ABSTRACT

Nakamura, Koichiro, and C. Allan Child. Pycnogonida from Waters Adjacent to Japan. *Smithsonian Contributions to Zoology*, number 512, 74 pages, 24 figures, 1991.—One hundred of the 155 known Japanese species of Pycnogonida (plus 4 unnamed species) were collected for this report and these are described and their distribution listed. These include 20 new species fully described and figured with five additional figures given for rare species, for sexual features of previously unknown males of known species, and for two unnamed species. The 20 new species described are *Ascorhynchus simplex*, *Chonothoa verrucosa*, *Cilunculus galeritus*, *C. gracilis*, *Heterofragilia hirsuta*, *Anoplodactylus lineatus*, *A. tanseii*, *A. velamellus*, *Callipallene bullata*, *Nymphon aritai*, *N. brevis*, *N. citerium*, *N. forceps*, *N. improcerum*, *N. infundibulum*, *N. longispinum*, *N. maruyamai*, *N. okudai*, *N. pumillum*, and *N. simulatum*. The zoogeography of the 100 described species is summarized and it is concluded that one out of every six known pycnogonid species in the world is found in Japanese territorial waters within the 200 mile economic zone, making it the richest known fauna of any area of equal size in the world.

The "Bibliography" includes most literature on the pycnogonids known to the authors and published in the decade since Fry and Stock produced the first comprehensive bibliography in 1978, except for a few problematical papers and a few "fossil" chapters in books, which provide nothing new to pycnogonid science.

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Contents

	<i>Page</i>
Introduction	1
Material	1
Zoogeography	2
Acknowledgments	3
PYCNOGONIDA	3
Family AMMOTHEIDAE Dohrn	3
Genus <i>Achelia</i> Hodge, 1864	3
<i>Achelia bituberculata</i> Hedgpeth	3
<i>Achelia brevirostris</i> Losina-Losinsky	3
<i>Achelia crurispinifera</i> Kim and Kim	5
<i>Achelia echinata sinensis</i> (Lou)	5
<i>Achelia orpax</i> Nakamura and Child	5
<i>Achelia superba</i> (Loman)	6
Genus <i>Ammothea</i> Leach, 1814	6
<i>Ammothea hedgpethi</i> (Utinomi)	6
<i>Ammothea hilgendorfi</i> (Böhm)	6
Genus <i>Ammothella</i> Verrill, 1900	6
<i>Ammothella biunguiculata</i> (Dohrn)	6
<i>Ammothella indica</i> Stock	7
Genus <i>Ascorhynchus</i> Sars, 1877	7
<i>Ascorhynchus auchenicum</i> (Slater)	7
<i>Ascorhynchus cryptopygium</i> Ortmann	7
<i>Ascorhynchus glaberrimum</i> Schimkewitsch	7
<i>Ascorhynchus japonicum</i> Ives	8
<i>Ascorhynchus okai</i> Nakamura and Child	8
<i>Ascorhynchus ramipes</i> (Böhm)	8
<i>Ascorhynchus simplex</i> , new species	8
<i>Ascorhynchus tuberosum</i> Utinomi	10
<i>Ascorhynchus utinomii</i> Nakamura and Child	12
<i>Ascorhynchus</i> species A	12
<i>Ascorhynchus</i> species B	12
Genus <i>Chonothea</i> Nakamura and Child, 1983	13
<i>Chonothea verrucosa</i> , new species	14
Genus <i>Cilunculus</i> Loman, 1908	16
<i>Cilunculus armatus</i> (Böhm)	16
<i>Cilunculus galeritus</i> , new species	16
<i>Cilunculus gracilis</i> , new species	18
<i>Cilunculus haradai</i> Nakamura and Child	20
<i>Cilunculus sekiguchii</i> Nakamura and Child	21
<i>Cilunculus sewelli</i> Calman	21
Genus <i>Hemichela</i> Stock, 1954	21
<i>Hemichela micrasterias</i> Stock	21
Genus <i>Heterofragilia</i> Hedgpeth, 1943	21
<i>Heterofragilia hirsuta</i> , new species	21
Genus <i>Nymphopsis</i> Haswell, 1884	24
<i>Nymphopsis muscosa</i> Loman	24
Genus <i>Paranympheon</i> Caullery, 1896	24

<i>Paranymphon magnidigitatum</i> Hong and Kim	24
<i>Paranymphon spinosum</i> Caullery	24
Genus <i>Tanystylum</i> Miers, 1879	24
<i>Tanystylum scrutator</i> Stock	24
Family PHOXICHILIDIIDAE Sars	25
Genus <i>Anoplodactylus</i> Wilson, 1878	25
<i>Anoplodactylus carnatus</i> Nakamura and Child	25
<i>Anoplodactylus crassus</i> Nakamura and Child	25
<i>Anoplodactylus erectus</i> Cole	25
<i>Anoplodactylus excelsus</i> Nakamura and Child	26
<i>Anoplodactylus gestiens</i> (Ortmann)	26
Key to Males of the <i>Anoplodactylus gestiens</i> Group in Japanese Waters	26
<i>Anoplodactylus hwanghaensis</i> Kim and Hong	27
<i>Anoplodactylus imperialis</i> Nakamura and Child	27
<i>Anoplodactylus lagenus</i> Nakamura and Child	27
<i>Anoplodactylus lineatus</i> , new species	27
<i>Anoplodactylus mamillosus</i> Stock	29
<i>Anoplodactylus perforatus</i> Nakamura and Child	29
<i>Anoplodactylus pycnosoma</i> (Helfer)	30
<i>Anoplodactylus shimodaensis</i> Nakamura and Child	30
<i>Anoplodactylus tanseii</i> , new species	30
<i>Anoplodactylus tubiferus</i> (Haswell)	32
<i>Anoplodactylus velamellus</i> , new species	32
<i>Anoplodactylus</i> species indeterminate	34
Genus <i>Phoxichilidium</i> Milne-Edwards, 1840	34
<i>Phoxichilidium parvum</i> Hilton	34
<i>Phoxichilidium ungelatum</i> Hedgpeth	34
Family ENDEIDAE Norman	35
Genus <i>Endeis</i> Philippi, 1843	35
<i>Endeis nodosa</i> Hilton	35
Family AUSTRODECIDAE Stock	35
Genus <i>Austrodecus</i> Hodgson, 1907	35
<i>Austrodecus tubiferum</i> Stock	35
Family CALLIPALLENIDAE Hilton	35
Genus <i>Anoropallene</i> Stock, 1956	35
<i>Anoropallene laysani</i> Child	35
Genus <i>Callipallene</i> Flynn, 1929	35
<i>Callipallene amaxana</i> (Ohshima)	35
<i>Callipallene bullata</i> , new species	36
<i>Callipallene cuspidata</i> Stock	36
<i>Callipallene dubiosa</i> Hedgpeth	38
<i>Callipallene novaezealandiae</i> (Thomson)	38
<i>Callipallene panamensis</i> Child	38
<i>Callipallene sagamiensis</i> Nakamura and Child	38
<i>Callipallene</i> species indeterminate	39
Genus <i>Cheilopallene</i> Stock, 1955	39
<i>Cheilopallene nodulosa</i> Hong and Kim	39
Genus <i>Decachela</i> Hilton, 1939	39
<i>Decachela discata</i> Hilton	39
Genus <i>Pallenopsis</i> Wilson, 1881	40
Subgenus <i>Bathypallenopsis</i> Stock, 1975	40
<i>Pallenopsis</i> (<i>Bathypallenopsis</i>) <i>calcanea</i> Stephensen	40
<i>Pallenopsis</i> (<i>Bathypallenopsis</i>) <i>scoparia</i> Fage	40
<i>Pallenopsis</i> (<i>Bathypallenopsis</i>) <i>stylirostris</i> Hedgpeth	40

<i>Pallenopsis (Bathypallenopsis) tydemani</i> Loman	40
Subgenus <i>Pallenopsis</i> Stock, 1975	41
<i>Pallenopsis (Pallenopsis) sibogae</i> Loman	41
<i>Pallenopsis (Pallenopsis) virgata</i> Loman	41
Genus <i>Parapallene</i> Carpenter, 1892	41
<i>Parapallene nierstraszi</i> Loman	41
Genus <i>Propallene</i> Schimkewitsch, 1909	41
<i>Propallene longiceps</i> (Böhm)	41
Family NYMPHONIDAE Wilson	42
Genus <i>Heteronymphon</i> Gordon, 1932	42
<i>Heteronymphon horikoshii</i> Nakamura	42
Genus <i>Nymphon</i> Fabricius, 1794	42
<i>Nymphon akanei</i> Nakamura and Child	42
<i>Nymphon aritai</i> , new species	42
<i>Nymphon benthos</i> Hedgpeth	43
<i>Nymphon brevis</i> , new species	44
<i>Nymphon citerium</i> , new species	45
<i>Nymphon falcatum</i> Utinomi	47
<i>Nymphon forceps</i> , new species	47
<i>Nymphon grossipes</i> Krøyer	49
<i>Nymphon gunteri</i> Hedgpeth	49
<i>Nymphon heterospinum</i> Hedgpeth	49
<i>Nymphon improcerum</i> , new species	49
<i>Nymphon infundibulum</i> , new species	51
<i>Nymphon kodanii</i> Hedgpeth	53
<i>Nymphon longispinum</i> , new species	53
<i>Nymphon maruyamai</i> , new species	55
<i>Nymphon okudai</i> , new species	56
<i>Nymphon ortmanni</i> Helfer	58
<i>Nymphon profundum</i> Hilton	58
<i>Nymphon pumillum</i> , new species	58
<i>Nymphon simulatum</i> , new species	60
<i>Nymphon striatum</i> Losina-Losinsky	61
Family COLOSSENDEIDAE Hoek	62
Genus <i>Colossendeis</i> Jarzynsky, 1870	62
<i>Colossendeis angusta</i> Sars	62
<i>Colossendeis colossea</i> Wilson	62
<i>Colossendeis macerrima</i> Wilson	62
Genus <i>Hedgpethia</i> Turpaeva, 1973	62
<i>Hedgpethia brevitaris</i> (Losina-Losinsky and Turpaeva)	62
<i>Hedgpethia chitinosa</i> (Hilton)	63
<i>Hedgpethia dofleini</i> (Loman)	63
Family PYCNOGONIDAE Wilson	63
Genus <i>Pycnogonum</i> Brunnich, 1764	63
<i>Pycnogonum tenue</i> Slater	63
<i>Pycnogonum uedai</i> Nakamura and Child	63
Bibliography	64

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Introduction

This paper treats a collection of 100 of the 155 known species of Japanese Pycnogonida (plus 4 unnamed species) from all depths found within the Japanese 200 mile economic zone. This zone is defined for purposes of this paper as the Japanese home islands along with the Ryukyu Islands (pycnogonids are unknown from the other Japanese archipelagoes) out to a 200 mile limit except where the economic zones of Korea, Soviet Russia, Taiwan, and China foreshorten these limits. That the Japanese pycnogonid fauna is extremely rich has been known for a good while (Hedgpeth, 1949; Stock, 1954b; Utinomi, 1971a), but the eulittoral fauna had not been examined with any completeness until many collections from this shallow zone were reported on by Nakamura and Child (1982, 1983, 1986, and 1988a). From the combined efforts of these reports and the new and known species presented herein, it is evident that one out of every six known pycnogonid species in the world is found in Japanese territorial waters, making this area possibly the richest in terms of species anywhere. It is probable that the Ross Sea of Antarctica has as many species as Sagami Bay, but no body of water the size of Sagami Bay has 85 known species, with many of them endemic. Antarctic waters have received probably the greatest collecting effort of any such area in the world, but the continuity or uniformity of many species around the circumference of the Antarctic continent is in direct contrast to the lack of uniformity around the coasts of Japan. This lack of uniformity has contributed to the greater diversity of fauna in Japanese waters, perhaps greater than for any other archipelago in the world. The principal reason for this diversity in both species and number of specimens is that the Japanese islands lie

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across two important current systems, the north-flowing Kuroshio Current bringing tropical and subtropical waters to the Japanese east coast as far north as about 36 degrees, and extending into the Sea of Japan through the Korea Strait, and the Oyashio Current bringing boreal-arctic waters from the Bering Sea south to about 36 degrees. The Sea of Japan is a semi-enclosed system receiving some of the Kuroshio waters along with some from the Yellow Sea, and shows a close relationship with Korean fauna, as could be expected. The Sea of Okhotsk is another semi-enclosed system with many boreal-arctic species, some of which have been taken in northern Japanese waters.

The diversity of Japanese pycnogonids is enhanced by a relationship with and a sharing of some species that are more common to the Indonesian-Philippine archipelagoes. The boreal-arctic relationship was first elaborated by Hedgpeth (1949) in his treatment of the *Albatross* collections of Japan, while the southern relationships were described best by Stock (1954b) in his report on the Mortensen collections of the western Pacific. These papers contributed much to our growing knowledge of the breadth of Japanese fauna, as did those shorter papers by Utinomi (1951, 1954, 1955, 1959a, 1962, and 1971a). This paper is an attempt to tie the various distribution and depth records together and, along with new species descriptions, to give a coherent view of our current knowledge of the very rich Japanese pycnogonid fauna.

MATERIAL.—This report presents approximately 2650 specimens comprising 100 species in 27 genera, the collecting sources of which are almost as diverse as the specific content. The majority of the specimens are from shallow localities of the Japanese shelf taken during many surveys of local marine fauna by the staff of marine laboratories, while most of the deeper records presented are the result of many cruises by the research vessels *Tansei Maru* (the KT stations) and *Hakuho Maru* (KH stations) in continental shelf and slope surveys. Many individual collectors have contributed one or many specimens, while more than one marine laboratory has contributed its entire collection for identification.

The report includes 20 new species, 5 in the family Ammonoidea: *Ascorhynchus simplex*, *Chonothoa verrucosa*,

Cilunculus galeritus, *C. gracilis*, and *Heterofragilia hirsuta*; 1 new Callipallenidae species: *Callipallene bullata*; 3 new Phoxichilidiidae species: *Anoplodactylus lineatus*, *A. tanseii*, and *A. velamellus*; and 11 new Nymphonidae species: *Nymphon aritai*, *N. brevis*, *N. citerium*, *N. forceps*, *N. improcerus*, *N. infundibulum*, *N. longispinum*, *N. maruyamai*, *N. okudai*, *N. pumillum*, and *N. simulatum*.

ZOOGEOGRAPHY.—There has been some discussion of the break in faunal affinities between the coasts washed by the southern Kuroshio Current and those exposed to the northern Oyashio Current (Hedgpeth, 1949:237–240, Stock, 1954b:3–6). Of the 155 species known in Japanese waters, 88 are found to the south of the 36 degree confluence area of these currents, while 53 are known to the north of this area. Hedgpeth (1949:235–236) found only 6 species distributed on both sides of this presumed barrier. Stock (1954b:6) found only 2 more species with this cold-warm water distribution. Thirty species are now known in this report to cross this presumed distributional barrier, the majority of them being southern species with one or more additional records in northern Honshu or even Hokkaido, while few truly northern species have been found to the south of the 36 degree line. As yet, few species from the Sea of Okhotsk have been taken in Japanese waters, attesting to its semi-enclosed geography.

A number of previously known Japanese species are currently being found on the Korean coasts, shared in some cases on both coasts of the Sea of Japan and Korea Strait. One of the northern emigrants, *Achelia brevirostris* Losina-Losinsky, is new to Japanese waters as are the Yellow Sea and Korean species *Achelia crurispinifera* Kim and Kim, *Paranymphon magnidigitatum* Hong and Kim, and *Anoplodactylus hwanghaensis* Kim and Hong. Other species found for the first time in Japanese waters (besides the 20 new species described herein) are *Cilunculus sewelli* Calman, a species previously known from Indian Ocean localities and New Zealand, all in the southern hemisphere, *Hemichela micrasterias* Stock, known from Indonesia and the Philippines, and *Anoplodactylus crassus* Nakamura and Child (Samoa), *A. erectus* Cole (western North America, Hawaii, Samoa, and recently in Korea), and *Endeis nodosa* Hilton (Hawaii and the Marshall Islands). Another far northern species from Alaskan and Aleutian waters new to Japan is *Nymphon profundum* Hilton, while an apparently panoceanic species, *Pallenopsis (Bathypallenopsis) scoparia* Fage, is also recorded as new to Japan.

There is only one known genus endemic to Japanese waters: *Chonothea*, with 2 species now known in central Honshu. There are an enormous number of endemic species: 68, including 2 found only in the Ryukyus and the 20 new species described herein.

The Ammotheid genus *Achelia* has species in all oceans, but is found predominantly in the Pacific around its northern rim and has 13 species represented in Japan with 2 endemics. Another dominant Ammotheid genus, *Ascorhynchus*, also has 13 known species in Japan (including 1 new and 2 unnamed

species in this report) with as many as 9 of them endemic. It is surprising that only 4 of the *Ascorhynchus* species have been taken in localities other than Japan and that only one of these is known in the tropical Indo-Pacific. Another genus heavily weighted with Japanese species is *Cilunculus* with 7, only one being Indo-Pacific and 5 endemic. The genus *Ammothea* with only 3 Japanese species is known to be mostly a southern hemisphere inhabitant while *Ammothea* species are apparently mostly tropical with, again, only 3 known Japanese species. It is surprising that neither Japanese species of the genus *Scipiolus* is represented among the specimens of this report, as both are from areas of eastern Honshu most often collected. None of the 3 species of *Tanystylum* known to Japan are endemic. Two are also found on the coasts of Korea and one, *T. grossifemororum* (Hilton) (= *T. anthomasthi* Hedgpeth, new synonymy), is a rare arctic inhabitant found also in northern Japan. The genus is far more common in tropical habitats. Only 7 species (13%) of the 53 species in the family Ammotheidae known to Japan are also found in tropical habitats, reflecting the very large endemic factor in the Japanese fauna. The predominantly shallow-water family Phoxichilidiidae now has 19 known species of *Anoplodactylus* in Japan with 11 endemics, including 3 new species presented herein, and has 2 species of *Phoxichilidium* with one endemic and one known from the west coast of North America. The genus *Endeis* (Endeidae) has only 3 known Japanese species, none endemic, and the single known Japanese species of *Austrodecus* (Austrodecidae) is included herein with new records. *Pycnogonum* (Pycnogonidae) has only 4 Japanese species, but 3 of them are endemic and the fourth is known also in Korean waters.

The Callipallenidae, a family of extensive genera with 8 known to Japan, has 9 species of *Callipallene* (3 endemic) and also 9 species of *Pallenopsis* with only one endemic. The latter genus is found predominantly in warm waters and 6 of the 9 Japanese species are also known from the tropical Indo-Pacific. The other 6 genera, *Anoropallene*, *Cheilopallene*, *Decachela*, *Parapallene*, *Propallene*, and *Pigrogromitus*, with a total of 9 Japanese species, are found also in tropical Indo-Pacific localities except for *Decachela*, which has a temperate-boreal north Pacific distribution. Even the most common Japanese pycnogonid, *Propallene longiceps*, has also been taken in Korean waters. Presumably the Japanese records of these genera mark the northern extent of their ranges, again except for *Decachela*.

In terms of the number of species, the family Nymphonidae remains the most prolific with 38 (11 new) known in the Japanese zone. The one *Heteronymphon* species is endemic as are 22 species (60%) of *Nymphon*. Only 2 *Nymphon* species are also found in tropical western Pacific localities while 2 others are known from the Bering Sea and 2 are known to be circumpolar. There is little to explain this high endemism in the genus *Nymphon* except for the same reasons known for high endemism of the entire Japanese pycnogonid fauna, the

converging currents in these islands.

None of the 8 species in the family Colossendeidae known to Japan are endemic, as most of them are also known from the Bering Sea, Indo-Pacific, or are known to be panoceanic in deep water. The only family not represented in the Japanese fauna, the Rhynchothoracidae, is one of tiny shallow-water, presumably interstitial pycnogonids, species of which will probably be found in these waters when more microfaunal and interstitial faunal collecting is accomplished.

It is probable then, in light of the above summary, that with greater collecting effort at the extremes of the Japanese economic zone such as in the Ryukyus, the Bonins, and in northern Hokkaido, many additional species will be found. It is sometimes known and often suspected that the preponderance of species in one area and the lack of them in another is not due to natural distribution but is an artifact of collecting, heavy in easier to get to localities and lighter or lacking in places difficult of access.

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The types and all other specimens are deposited in the collections of the National Museum of Natural History,

Smithsonian Institution, Washington, D.C., and cataloged with the numbering system of the former United States National Museum (USNM).

We would also like to acknowledge those who reviewed this manuscript and the help of our editor, Don Fisher, for their contributions.

PYCNOGONIDA

Family AMMOTHEIDAE Dohrn

Genus *Achelia* Hodge, 1864

Achelia bituberculata Hedgpeth

Achelia bituberculata Hedgpeth, 1949:287–289, fig. 41a–g.—Stock, 1954b: 94–95, fig. 44.—Nakamura and Child, 1983:6–7 [literature].—Kim, 1984:537, fig. 6a–i.—Kim and Hong, 1986:46.—Nakamura, 1987:18–19, pl. 16.—Hong and Kim, 1987:141.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, Dec 1981 (1♂, 3♀, 3 juv); 27 Jul 1982 (1♂); 37–40 m, 23 Aug 1982 (2♂, 1♀). Off Shimoda, 30 m, 17 Aug 1973 (1♂). Aburatsubo, Miura Peninsula, 10 Aug 1984 (1♂, 1♀, 8 juv). Shirahama, Izu Peninsula, spring 1984 (1♂ with eggs, 2♀, 1 juv). Omaezaki, Shizuoka, autumn 1984 (1♂ with eggs). Chiba Prefecture, off Kominato, 5 m, 15 Aug 1984 (2♂, 1♀); 4 Feb 1986 (1 juv); 23 Feb 1986 (1 juv).

DISTRIBUTION.—This species is found from off northern Hokkaido to central Honshu and around the coasts of South Korea in depths from the littoral to 75 meters.

REMARKS.—Like most species of *Achelia*, this species has much variation among the many known specimens. The dorsal tubercles and spines of the trunk and appendages are variously small, large, absent, or present, but the low tubercle at the base of the abdomen is always present and serves to differentiate this species from the 12 other *Achelia* species known to Japan.

Achelia brevirostris Losina-Losinsky

FIGURE 1A–F

Achelia brevirostris Losina-Losinsky, 1961:95–97, fig. 19.

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°41.8'N, 145°08.9'E, 400–479 m, KT83-11, sta B15, 11 Jul 1983 (1♂, 2♀, 1 juv). HONSHU: Sanriku-oki, 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1♂).

DISTRIBUTION.—This species was previously reported from off Sakhalin Island in the Sea of Okhotsk in 48 meters, the type locality. The species is new to Japan. The depths at which these specimens were taken are considerably deeper than that of the type and extend the known depth range to 479 meters.

REMARKS.—We assign these specimens only provisionally to Losina-Losinsky's *Achelia brevirostris* and include a set of figures to emphasize the differences between the type and Japanese specimens. Although the type figures are extremely

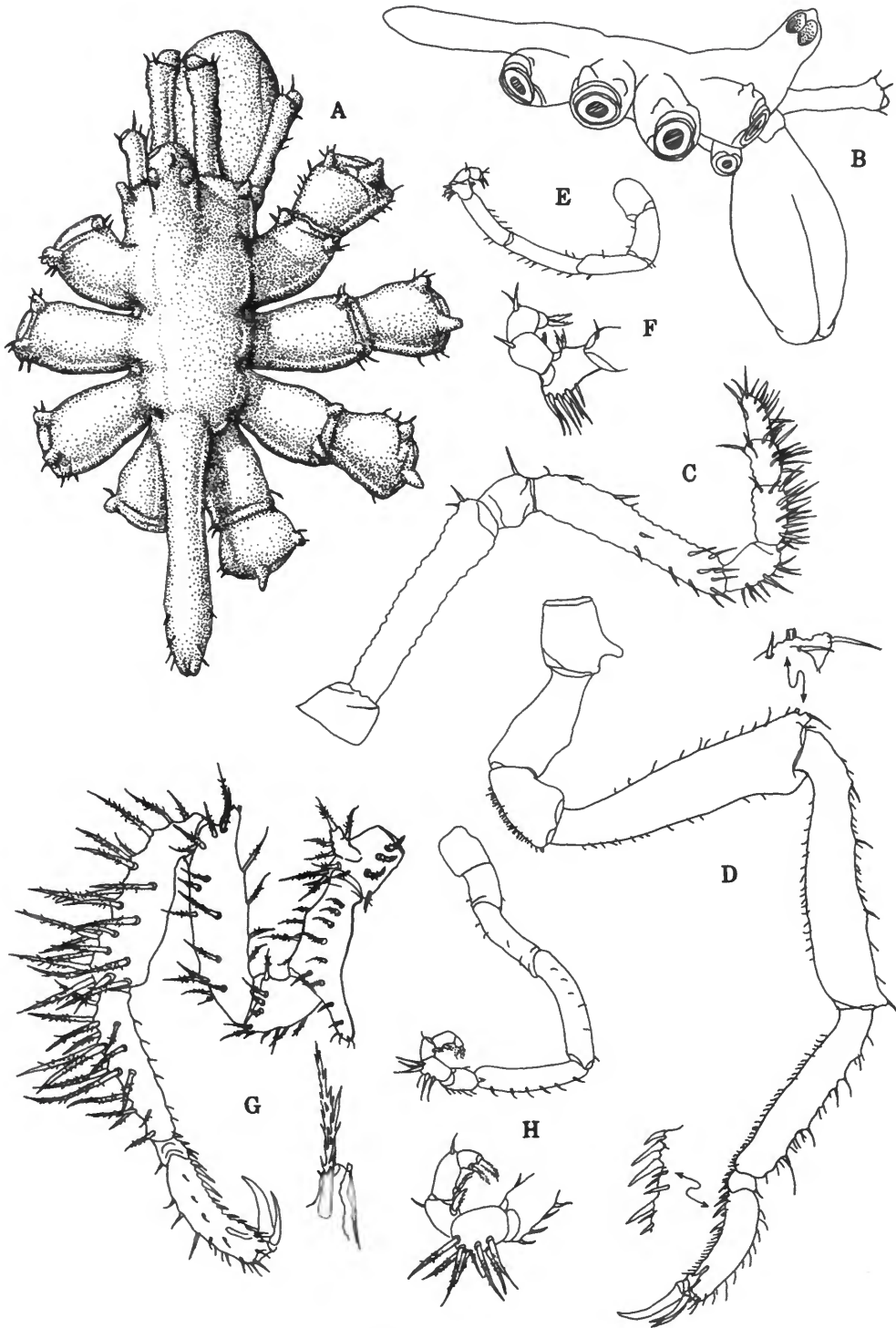


FIGURE 1.—*Achelia breviostris* Losina-Losinsky, male: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, cement gland and sole spines, enlarged; E, ovipiger; F, ovipiger strigilis, enlarged. *Achelia orpax* Nakamura and Child, male: G, third leg, cement gland tube and spine, enlarged; H, ovipiger strigilis.

diagrammatic, the differences with the Japanese specimens can still be discerned. The type has shorter palp segments, longer main claw and shorter auxiliary claws, an apparently smaller proboscis, a seventh oviger segment apparently lacking the lateral field of long setae, and contiguous lateral processes, while those of the Japanese specimens are all very close but not touching. Losina-Losinsky depicts a granular or papillose integument on the trunk dorsum, which agrees with the entire integument of the specimens in hand.

The similarities between the two are many; a great similarity in overall trunk-ocular tubercle-abdomen habitus, low lateral process tubercles and those of the anterolateral corners of the cephalic segment, leg segment length ratios, and the slight dorsodistal bulge carrying the male cement gland, chelifore, and oviger segment length, and the shape and spination of the distal oviger segments.

Given the variation displayed by many specimens of *Achelia*, the differences between the Japanese specimens and the type are not out of proportion for them to be the same species. We believe the Japanese specimens have sufficient characters in agreement with *A. brevisstris* to be assigned to that species.

Achelia crurispinifera Kim and Kim

Achelia crurispinifera Kim and Kim, 1985:120–124, figs. 1–2.

MATERIAL EXAMINED.—KOREA STRAIT: Off Tsushima Island, 34°25.3'N, 129°05.4'E, 150 m, 19 Jun 1964 (1♂, 1♀, 12 juv). YELLOW SEA: E of Zhoushan Islands, China, 30°00'N, 122°45'E, 63 m, 3 Dec 1964; (3 juv); E of Shandong Peninsula, China, 37°00'N, 123°13'E, 67 m, 6 Dec 1964 (1♂, 1 juv); 37°00'N, 123°15'E, 70 m, 29 Jan 1965 (1♂); 37°00'N, 123°14'E, 68 m, 29 Dec 1965 (1♂ with larvae); 37°26.5'N, 124°00'N, 70 m, 29 Dec 1965 (1♂); 37°14.5'N, 123°15'E, 70 m, 8 Nov 1966 (2♀); 37°00'N, 125°00'E, 59 m, 9 Nov 1966 (1♀).

DISTRIBUTION.—The type locality for this species is the southeast coast of Korea, off Pusan and Kuryongp'o, at unknown depths. These specimens extend this distribution to the northern and southern Yellow Sea, an area rarely sampled for marine fauna, and establish a depth range of 59 to 150 meters.

REMARKS.—There is very little variation in the above specimens when compared with the type figures. The principal differences are found in the numbers and placement of spine-bearing tubercles. With the male, the tubercles are more numerous and larger except that there are fewer on the scape. The cement gland tube is a tiny truncate cone placed just proximal to or at the base of the dorsodistal femur tubercle.

This large conspicuous species (female leg span about 38–39 mm) is apparently rather common and it is surprising that it has not been described before this decade, but marine collections are scarce from any localities in the Yellow Sea.

Achelia echinata sinensis (Lou)

Ammonothea (Achelia) echinata var. *sinensis* Lou, 1936:19, figs. 7–9, pls. 2–4 [figures].

Achelia echinata sinensis (Lou).—Nakamura and Child, 1983:7–8 [literature].—Kim, 1984:537, fig. 7a–i.—Kim and Hong, 1986:46.—Nakamura, 1987:19–21, pl. 17.—Hong and Kim, 1987:141–142.

MATERIAL EXAMINED.—KOREA STRAIT: W of Tsushima, 33°53.6'N, 128°33.4'E, 12 Feb 1969 (1♀, 1 juv). KYUSHU: Nagasaki Prefecture, Nomozaki, 2 Jul 1984 (4 juv). HONSHU: Wakayama Prefecture, Goboh, Feb 1981, 1.5 m, (1♂, 1♀); 5 Jul 1984 (1♂, 2♀). Sagami Bay, Miura Peninsula, Aburatsubo, 5 m, 10 Aug 1984 (1♂, 3♀, 3 juv). Nabeta Bay, 7–15 m, 19 Jun 1971 (1♂, 2♀); 23 Aug 1971 (1♂, 1 juv). Off Kisami, 37–40 m, 23 Aug 1982 (1♂); 37–45 m, 23 Aug 1982 (3♂, 6♀, 1 juv); 18–28 m, 24 Aug 1982 (1 juv); 18–35 m, 24 Aug 1982 (5♂, 5♀, 2 juv); 30–42 m, 5 Apr 1983 (1♀). Chiba Prefecture, off Kominato, 3–4 m, 12 May 1984 (1 juv); shallow, 12 Jul 1984 (1♂, 1♀, 1 juv); 6–7 m, under rock, 15 Aug 1984 (1♀, 4 juv); shallow, 4 Feb 1986 (1 juv).

DISTRIBUTION.—This species, under various subspecies designations, has been collected in northern China, Korea, and various Japanese localities along with a few in eastern Russia. It has a rather wide depth range of shore depths to 336 meters.

REMARKS.—As with many species of *Achelia*, this species displays wide variation in tubercles, setae, spines, and other characters. We have chosen to keep the subspecies named by Lou because his figures are characteristic of most of the Japanese specimens in these collections.

Achelia orpax Nakamura and Child

FIGURE 1G,H

Achelia orpax Nakamura and Child, 1983:8–10, fig. 2.
Achelia latifrons.—Kim and Hong, 1986:46–48, fig. 8.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Nabeta Bay, 7–15 m, 23 Aug 1971 (1♂); 7–15 m, 24 Jul 1974 (2♂). Off Kisami, 40–45 m, 23 Aug 1982 (1♂).

DISTRIBUTION.—This species was described from a female taken in Sagami Bay at 30 meters and has subsequently been found in Korean waters.

REMARKS.—These are the first male specimens taken. The male leg and oviger are illustrated in Figure 1G,H to emphasize the characters not shown by the female.

This species is very closely related to *A. latifrons* (Cole, 1904). Cole's holotype was reexamined for purposes of comparison. The differences can be seen most readily in the legs. The first coxae of *A. orpax* have a single posterodorsal tubercle bearing long feathered spines. All long spines of the appendages are feathered with microsetae. The first coxae of *A. latifrons* have three distal tubercles each bearing shorter simple spines the same as all spines of the appendages of this species. The posterior four second coxae of the male of *A. orpax* have a

long ventrodorsal sex pore tubercle equal to the diameter of the coxae in length. This tubercle is much shorter on males of *A. latifrons*, which also has a shorter tarsus and propodus, the latter being much more curved than the propodus of *A. orpax*. The type specimen of *A. latifrons* is much more spinose than others examined from Alaskan collections, but a character apparently shared by most *A. latifrons* specimens is that of a set of short simple setae on the trunk middorsum just anterior to the abdominal insertion. These setae are figured by Kim and Hong (1986:47, fig. 8a) on the specimen they judge to be *A. latifrons*, but their specimen also has the long feathered spines of *A. orpax*, while no specimens we have seen of *A. latifrons* have these feathered spines. We believe the species to be separate based on the presence or absence of feathered spines and other smaller differences in tubercles.

Achelia superba (Loman)

Ammonothea superba Loman, 1911a:11-12, figs. 14-24.

Achelia superba.—Utinomi, 1971a:328 [literature].—Nakamura and Child, 1983:12.—Nakamura, 1987:21-23, pls. 18, 36.

MATERIAL EXAMINED.—HONSHU: Off Misaki, Miura Peninsula, Sagami Bay, 80-84 m, 10 Jul 1985 (1 juv). Nabeta Bay, 7-15 m, 19 Dec 1976 (1♀). Kii Strait, 33°06.8'N, 135°12.5'E, 119-120 m, KT84-12, sta 24, 2 Sep 1984 (1♂).

DISTRIBUTION.—This Misaki species is from the same locality and depth as one of Loman's type specimens. The species has been taken in the Sea of Okhotsk off Sakhalin to as far south as Kii Strait, the greatest depth recorded being 300 meters and the shallowest recorded at 7 meters. This somewhat restricted distribution will probably be expanded, at least northwards, by future Russian records from Far Eastern collections.

REMARKS.—These specimens add nothing to the known characters of this distinctive species. It is easily recognized by its long chelifore scapes and other elongate appendages, which are unlike any other known species of *Achelia* from Japanese waters.

Genus *Ammonothea* Leach, 1814

Ammonothea hedgpethi (Utinomi)

Lecythorhynchus sp.—Hedgpeth, 1949:296, figs. 44e, f.

Lecythorhynchus hedgpethi Utinomi, 1959a:212-216, figs. 7-9; 1962:103; 1971a:336.

Ammonothea hedgpethi.—Stock, 1966a:388 [text].—Clark, 1977b:173, 176 [key].—Nakamura and Child, 1983:13 [key].—Nakamura 1987:23-24, pls. 19, 20.—Hong and Kim, 1987:142-143, fig. 2.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37-40 m, 23 Aug 1982 (1♀).

DISTRIBUTION.—Hedgpeth's juvenile specimen was taken just south of Suruga Bay, and Utinomi's types are from Sagami and Tokyo bays. The distribution of this species was thought to

be confined to this relatively narrow area of central Honshu until Hong and Kim recorded a specimen from the Yellow Sea off SW Korea. This is apparently a rather rare species, as very many collections have come from its known depths of 8-95 meters in areas of Japan where it is known without adding any additional specimens to the collecting records.

REMARKS.—There are a pair of prominent lateral setae longer than the segment diameter at midpoint of the femur not illustrated by Utinomi, and many other short setae on all major leg segments. The most conspicuous characters of this species are the femoral setae, distal projection of the propodus, and the retention of atrophied chelae on the rather long chelifores. The size of this species is also larger than *A. hilgendorfi*, its nearest relation. This species is very different from *A. spicula* Nakamura and Child, a small compact species with pointed proboscis and rough integument.

Ammonothea hilgendorfi (Böhm)

Corniger Hilgendorfi Böhm, 1879a:187, pl. 2; fig. 3-3d.

Lecythorhynchus hilgendorfi.—Böhm, 1879c:140.—Utinomi, 1971a:336 [literature].

Ammonothea hilgendorfi.—Stock, 1956a:43, 45.—Child, 1979:8.—Nakamura and Child, 1983:13.—Kim and Hong, 1986:48.—Hong and Kim, 1987:143.

MATERIAL EXAMINED.—HONSHU: Tokyo Bay, Yamashita Pier at Yokohama, intertidal, 12 Dec 1974 (3♂ with eggs, 2♂, 5♀, 4 juv); 13 May 1975 (5♀, 7 juv). Chiba Prefecture, Kominato, 4-5 m, 17 Feb 1976 (2 juv); under stone, 13 May 1973 (7♂ with eggs, 1♂, 4♀); shallow, 12 Jul 1984 (2 juv); 4 Aug 1984 (1 juv); 9 Aug 1984 (1♂, 1 juv); 1 m, 15 Aug 1984 (1♂, 1♀, 1 juv); 4 Feb 1986 (1 juv). Iwate Prefecture, Otsuchi, overflow trench at Marine Biological Station, 4 Oct 1984 (4♂ with eggs, 5♀, 3 juv). Sagami Bay, Shirahama, Izu Peninsula, intertidal, autumn, 1984 (1♂ with eggs); (1 juv). Off Shimoda, 37-39 m, 9 Sep 1987 (2♀). Off Kisami, 37-40 m, 23 Aug 1982 (1♀, 1 juv); 18-28 m, 24 Aug 1982 (1♀, 1 juv); 26-35 m, 24 Aug 1982 (2♂, 2♀). Susaki, 5 m, 26 Oct 1973 (1♂ with eggs). Mouth of Shimoda Bay, 40-50 m, 6 Apr 1982 (1♀). Overflow trench at Shimoda Research Center, 15 Oct 1980 (1♂).

DISTRIBUTION.—This often-collected species is known from the China Coast to Northwestern Mexico and from the Hawaiian and Society islands. It is listed in most Japanese faunal reports and is from shallow waters.

Genus *Ammothella* Verrill, 1900

Ammothella biunguiculata (Dohrn)

Ammonothea bi-unguiculata Dohrn, 1881:158, pl. 8, figs. 1-3.

Ammothella biunguiculata.—Stock, 1974:12-13, fig. 1 [literature].—Munilla, 1978:8-9 [list], 44 [text].—Nakamura and Child, 1983:17.—Kim, 1984:539, fig. 9b-f.—Kim and Hong, 1986:48.—Hong and Kim, 1987:143, fig. 3.

MATERIAL EXAMINED.—KYUSHU: Nomozaki, Nagasaki Prefecture, intertidal, 2 Jul 1984 (17♂, 6♀, 2 juv); 3 Jul 1984 (16♂, 8♀, 6 juv). HONSHU: Chiba Prefecture, Kominato,

shore, under stone, 13 May 1973 (1♀); 6 m, 15 Oct 1983 (1♂ with eggs, 2♀). 3–4 m, 12 May 1984 (1♂); shallow, 12 Jul 1984 (3♂, 2♀); 6–7 m, 15 Aug 1984 (1♂ with eggs, 2♂, 3♀, 4 juv). Sagami Bay, off Kisami, 37–45 m, 23 Aug 1982 (1♂, 2♀); 18–28 m, 24 Aug 1982 (1 juv).

DISTRIBUTION.—Sagami Bay is apparently the northern limit to the distribution of this cosmopolitan warm-water species. It is found more commonly in localities around Kyushu and to the south, usually in littoral and shallow water habitats.

REMARKS.—This species is readily separated from others in the genus by its robust appearance (most species of *Ammothella* are very slender) and by its lack of a main propodal claw.

Ammothella indica Stock

Ammothella indica Stock, 1954b:113, figs. 54–56c.—Utinomi, 1971a:331 [literature].—Nakamura and Child, 1983:18–19.—Kim, 1986:5, fig. 3.—Kim and Hong, 1986:48.—Nakamura, 1987:26–27, pls. 22, 23.—Hong and Kim, 1987:143–144.—Child, 1988a:5; 1988b:51.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Aburat-subo, 5 m, 10 Aug 1984 (1♂, 1♀). Off Kisami, 20–21 m, 24 Aug 1982 (1♀). Shirahama, spring 1984 (1 juv); unknown date (1♀, 2 juv).

DISTRIBUTION.—This Indo-Pacific species is widely distributed from South Africa to the Society Islands and to at least as far north as Sagami Bay, Japan, in shallow localities.

REMARKS.—This species is separable from many similar species by its lack of tubercles on the cephalic segment anterior corners and lateral processes, and by the first scape segment, which is notably shorter than the second.

Genus *Ascorhynchus* Sars, 1877

Ascorhynchus auchenicum (Slater)

Parazetes auchenicum Slater, 1879:281–283.

Ascorhynchus auchenicum.—Utinomi, 1971a:332 [literature].—Nakamura and Child 1983:20.—Nakamura 1987:27–28, pls. 24, 37.

Ascorhynchus glabroides Ortmann, 1890:160–161, pl. 24: figs. 3a,b.—Utinomi, 1971a:333 [literature].

MATERIAL EXAMINED.—KYUSHU: S of Danjo Archipelago, 31°29.7'N, 128°01.3'E, 146 m, 14 Jun 1964 (1♀). Bungo Strait, 33°06.8'N, 132°07.9'E, 89–091 m, KT84-12, sta 33, 4 Sep 1984 (1 juv). Amakusa Islands, Tomioka, 5 Jul 1984 (9 juv). HONSHU: Suruga Bay, off Matsuzaki, 34°45.4'N, 138°43.8'E, 135–144 m, KT74-14, sta B3, 21 Sep 1974 (1♂). Sagami Bay, off Kisami, 33–41 m, 4 Dec 1981 (1♀, 81 juv, 1 juv deformed); 36–41 m, 16 Dec 1981 (1 juv); 37–41 m, 27 Jul 1982 (4 juv); 37–40 m, 23 Aug 1982 (1♂ with eggs, 1♂, 1♀); 40–45 m, 23 Aug 1982 (3♀); 18–28 m, 24 Aug 1982 (2♂, 1♀); 30–42 m, 5 Apr 1983 (1♀). Off Shimoda, 40 m, 6 Apr 1982 (1♂, 2♀, 1 juv); 50–60 m, 11 Apr 1982 (1♀); 52–53 m, 9 Dec 1986 (2 juv); 70 m, 9 Sep 1987 (1 juv); 9 Sep 1987 (1♂ with eggs, 1♂, 5 juv). Mouth of Shimoda Bay, 40 m, 6 Apr 1983

(1♂ with eggs).

DISTRIBUTION.—This frequently encountered species is distributed from Kyushu to at least as far north as Sagami Bay, Japan. It has a wide depth range, having been taken in shallows to about 550 meters. It is apparently endemic to Japan.

REMARKS.—This species has a tarsus equal to or slightly longer than its propodus, a 1-segmented scape, lateral process tubercles, and the trunk with median tubercles. Its ocular tubercle is well posterior from the cephalic segment anterior rim, differentiating it from *Ascorhynchus tuberosum* Utinomi. It has sometimes been confused with *A. minutum* Hoek, a species from Australia and Indonesia that bears trunk and lateral process tubercles taller than those *A. auchenicum*.

Ascorhynchus cryptopygium Ortmann

Ascorhynchus cryptopygium Ortmann, 1890:159, pl. 24: fig. 2.—Utinomi, 1971a:333 [literature].

Ascorhynchus cryptopygium.—Stock, 1953b:304 [key].—Nakamura and Child, 1983:19 [key], 20.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, 5 km S of Jyogashima, 102 m, 27 Jul 1959 (1♀); 110–122 m, 10 Jul 1985 (1♂ with eggs, 2♀). KYUSHU: SW of Danjo Archipelago, 31°31.7'N, 127°27.4'E, 128 m, 9 Jul 1962 (1♀); 31°19.5'N, 127°32.0'E, 126 m, 17 Jun 1964 (1♂, 2♀).

DISTRIBUTION.—This species is often reported in the literature but its distribution has been rather narrowly confined to Sagami and Suruga bays in central Honshu. The Danjo specimens greatly extend this restricted range to well west of southern Kyushu but add nothing to the known depth range of 75–274 meters. The species is still restricted to Japanese waters, but the Danjo records point to limited collecting efforts beyond the area of well-collected central Honshu.

REMARKS.—The abdomen of this species is carried ventrally and is unseen with the specimen viewed in dorsal aspect and the tarsus (except on the anterior pair of legs) is slightly less than half the propodal length, both being recognition characters to separate this species from the growing list of others of the genus from Japan.

Ascorhynchus glaberrimum Schimkewitsch

Ascorhynchus glaberrimum Schimkewitsch, 1913b:242, pl. 3a: figs. 8–14.—Utinomi, 1971a:334 [literature].

Ascorhynchus glaberrimum.—Nakamura and Child, 1983:23–24, fig. 7.—Kim and Hong, 1986:48–50, fig. 9.—Nakamura, 1987:29–30, pls. 25, 26.—Hong and Kim, 1987:146.

MATERIAL EXAMINED.—KYUSHU: Amakusa Islands, off Tomioka, 5 Jul 1984 (1♂ with eggs, 2♀). HONSHU: Sagami Bay, off Kisami, 33–41 m, 4 Dec 1981 (1♂, 2♀, 4 juv); 36–41 m, 16 Dec 1981 (2♂); 37–41 m, 27 Jul 1982 (1♂, 1♀, 1 juv); 37–40 m, 23 Aug 1982 (1♂). Off Shimoda, 40 m, 6 Apr 1982 (1♂ with eggs, 3♂, 1♀); 37–39 m, 9 Sep 1987 (1♂). Mouth of Shimoda Bay, 38–46 m, 6 Apr 1983 (2♂ with eggs). Nabeta

Bay, 7–15 m, 9 Sep 1982 (1 juv).

DISTRIBUTION.—This species often has been taken at all these locations before and at similar depth. It is distributed from Hokkaido to Kyushu in Japan and from the southcentral Korean coast in littoral to 230 meter depth.

REMARKS.—The figures given by Nakamura and Child (1983, fig. 7) and Kim and Hong (1986, fig. 9) are sufficient to identify this species. The multiple cement glands of the male are not typical of the smaller species of this genus. The large species almost always have many cement gland pores laterally on the femur, first tibia, and sometimes the second tibia, while smaller species often have a single cement gland pore on a raised surface dorsally on the femur. This species with 8–9 cement gland cups dorsally is perhaps intermediate between the multiple lateral pores and the single dorsal pore forms.

Ascorhynchus japonicum Ives

Ascorhynchus japonicus Ives, 1891:218–223, pl. 12.—Utinomi, 1971a:333 [literature].

Ascorhynchus japonicum.—Nakamura and Child, 1983:19 [key].—Nakamura, 1987:30–31, pls. 27, 38.

MATERIAL EXAMINED.—SHIKOKU: Center of Tosa Bay, 300 m, 25 Nov 1986 (1♂); 500 m, 19 Aug 1987 (1♂). HONSHU: Suruga Bay, 34°56.2'N, 138°44.7'E, 211–282 m, KT73-6, sta B, 11 Jun 1973 (1 juv); 192–207 m, KT75-15, sta 02, 24 Nov 1975 (1♂ with eggs). Sagami Bay, off Ohshima, 34°51.6'N, 139°27.2'E, 1669–1675 m, KT82-13, sta B2, 20 Dec 1982 (1♂ with eggs, 2♂, 6♀).

DISTRIBUTION.—This large species is known from many localities around the rim of the North Pacific from Shikoku to at least the Oregon coast of America (unreported specimens in United States National Museum collections), in depths of 53 to over 1700 meters.

REMARKS.—This is much the largest species known of this genus in the Japanese islands, with a leg span sometimes reaching 15–16 cm. It has 2-segmented scapes, which are extremely short in relation to the very long palps and the bulbous long proboscis.

The juvenile specimen from Suruga Bay, about half the size of adults, has a curious deformity of the posterior left leg. The lateral process is bifurcate, creating a pair of normal-size legs in the place of one normal leg.

Ascorhynchus okai Nakamura and Child

Ascorhynchus okai Nakamura and Child, 1983:24–26, fig. 8.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 40–50 m, 6 Apr 1983 (2♂, 2♀). Off Kisami, 30–42 m, 5 Apr 1983 (2♂).

DISTRIBUTION.—This species is known from its type locality, Suruga Bay, in 75–85 meters. This record extends the distribution of this apparently rare species slightly to the east in Sagami Bay in shallower water.

REMARKS.—To the unique male type specimen description can now be added the characters of the female, which differ little except in sexual characters. The female is slightly larger, with a few less long setae on the major leg segments and shorter major oviger segments. The sex pores are located ventrodorsally on all second coxae.

This species is very similar to other Japanese small single-cement-gland species, but the ocular tubercle is notably shorter, being little longer than wide except for the apical cone. The lateral process tubercles are much shorter than those of *A. prosum*, while there are no dorsodistal lateral process tubercles on *A. fusticulum*. This is apparently the only Japanese species having a single cement gland tube in which the femur is shorter than the second tibia. The legs of most similar species are rather heavily setose, including this species, and have a tarsus equal to or shorter than half the propodus length.

Ascorhynchus ramipes (Böhm)

Gnamptorhynchus ramipes Böhm, 1879b:56–59.

Ascorhynchus ramipes.—Utinomi, 1971a:332–333 [literature].—Nakamura and Child, 1983:29.—Kim, 1986:7, fig. 4.—Kim and Hong, 1986:50.—Nakamura, 1987:31–32, pl. 28.—Hong and Kim, 1987:146.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 36–42 m, 10 Apr 1982 (1♂ with eggs); 37–41 m, 27 Jul 1982 (1♂, 1 juv); 20–21 m, 26–35 m, 24 Aug 1982 (1♂, 1♀, 1 juv). Off Shimoda, 40 m, 6 Apr 1982 (2♂ with eggs, 1♀). Mouth of Shimoda Bay, 38–46 m, 6 Apr 1983 (1♀). Nabeta Bay, 10–15 m, 27 Jul 1982 (1♂ with eggs, 3♂, 7♀, 1 juv); 10–16 m, 24 Aug 1982 (5♂, 6♀, 2 juv); 10–17 m, 5 Apr 1983 (1♂, 1♀). EAST CHINA SEA: Off Yangtze River mouth, 31°32.3'N, 123°08.9'E, 34 m, 24 Jun 1963 (1♀); 31°30.0'N, 124°15.8'E, 43 m, 15 Jun 1964 (1♂, 1♀). Yellow Sea, SE of Tsingtao, 35°00.0'N, 121°15.0'E 35 m, 28 Nov 1964 (2♀); 35°00.0'N, 121°03.0'E, 45 m, 23 Mar 1963 (3♂, 6♀, 3 juv). W of Inchon, South Korea, 37°07.5'N, 125°15.0'E 35 m, 8 Nov 1966 (1♂, 2♀).

DISTRIBUTION.—This species has been taken many times in localities from Tokyo and Sagami bays to the Gulf of Thailand and the Gulf of Manar in the Indian Ocean. These Yellow Sea records are the first from that area except for the South Korean record. The species has been taken off the west and south coasts of South Korea. The species is found in most reports on Japanese pycnogonids, but has rarely been found outside these waters. It has a shallow depth range, the deepest record being about 200 meters.

Ascorhynchus simplex, new species

FIGURE 2

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Misaki, Miura Peninsula, 110–122 m, 10 Jul 1985 (1♂, holotype, USNM 234466).

DESCRIPTION.—Size moderately small, leg span 22.4 mm.

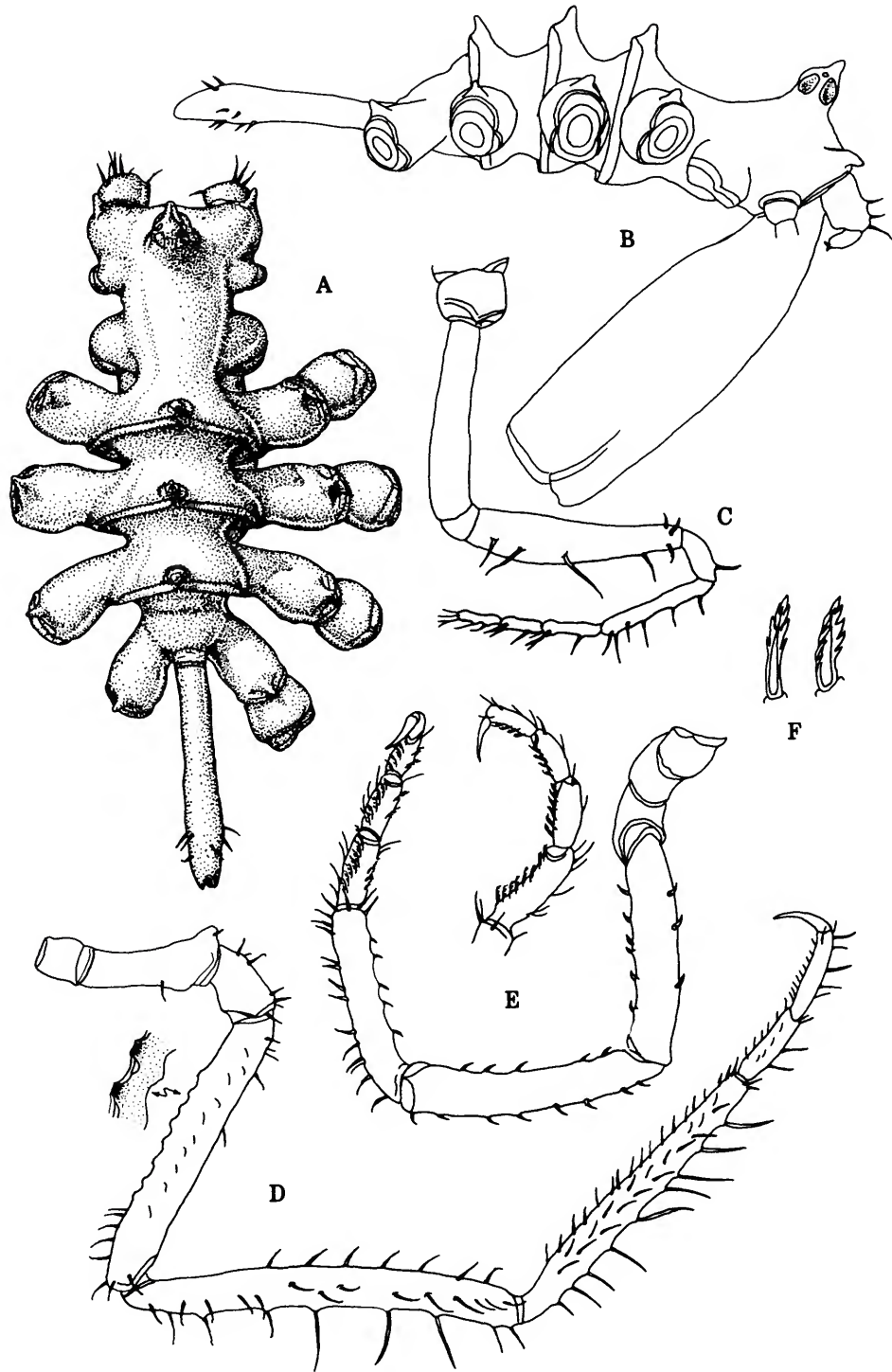


FIGURE 2.—*Ascorhynchus simplex*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, two cement glands, enlarged; E, oviger, with strigilis in lateral view; F, proximal and distal strigilis spines, enlarged.

Trunk robust, with large posterior-flaring cowls bearing small slender dorsomedian tubercles on each segment. Lateral processes crowded, separated by less than their diameters, as long as 1.5 times their maximum diameters, bearing a small slender tubercle at each dorsodistal tip. Ocular tubercle well anterior on cephalic segment, slender, about as tall as maximum diameter, with blunt small conical apex, eyes large, slightly pigmented, sensory papillae prominent. Anterolateral corners of cephalic segment with small slender anterior-pointing tubercles. Oviger implantation at median length of cephalic segment, ventrolateral, well anterior to first lateral processes. Proboscis massive, almost as long as trunk, without prominent constrictions but with suggestion of proximal constriction, oral surface abruptly flat. Abdomen long, extending to distal suture line of second coxae of posterior pair of legs, armed with several dorsal, lateral and ventral setae.

Chelifores short, scape cylindrical, shorter than twice its diameter, armed with several dorsodistal setae shorter than scape diameter. Chela tiny, vestigial, carried ventrally, with tiny remainder of movable finger laterally, without setae.

Palps sparsely setose, first, second and fourth segments wider than long, third segment slightly shorter than fifth, fifth slightly inflated, with several lateral and distal setae, some longer than segment diameter. Terminal five segments very slender, ninth and tenth combined length only as long as seventh segment, all five armed with few ventral setae longer than segment diameter.

Ovigera moderately setose, fifth segment longest, fourth little shorter, sixth slightly shorter than fourth, fourth and fifth armed with short lateral recurved spines, sixth with several lateral setae per side. Strigilis segments progressively shorter, armed with several ectal short setae, endal denticulate spines in two rows, inner row larger than outer row. Spine formula: inner row, 8:6:4:4, and outer row, 4:2:1:1, with a slender, well-curved terminal claw almost as long as terminal segment. Denticulate spines with 3-4 broad lateral serrations per side.

Legs moderately setose, with longer dorsal and lateral setae, shorter ventral setae, increasing in numbers on more distal segments. First tibiae the longest segments with femorae and second tibiae of almost equal length. Cement gland over most of dorsal length of femur with 8-9 low cribriform pores per femur. Tarsus shorter than propodus, both with few longer ectal setae and more shorter sole spines. Tarsus also with few short lateral setae. Both segments straight. Claw robust, well curved, about half length of propodus.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 2.52; trunk width (across 2nd lateral processes), 1.67; proboscis length, 2.06; abdomen length, 1.06; third leg, coxa 1, 0.36; coxa 2, 0.96; coxa 3, 0.58; femur, 2.08; tibia 1, 2.68; tibia 2, 2.12; tarsus, 0.54; propodus, 0.68; claw, 0.35.

DISTRIBUTION.—This species is known only from the type locality, off Misaki, in Sagami Bay, at 110-122 meters.

ETYMOLOGY.—The new species name is from the Latin

simplex (unmixed, single), and refers to the simple proboscis shape, which lacks the usual marked tripart segmentation bands.

REMARKS.—Of the approximately 60 species described in this genus, 13 (22%) are found in Japanese waters, including the 2 indeterminate species in this report lacking adult males. This species is closest to several of the small Japanese species bearing many setae, dorsal femoral cement glands, single scape segment, and dorsomedian trunk tubercles. These species are *A. fusticulum*, *A. okai*, *A. prosum*, *A. tuberosum*, *A. species B* of this report, and to a lesser extent, *A. auchenicum* and *A. cryptopygium*. The latter two species, although smaller than *A. japonicum* and other large species, are much less setose, have more elongate trunks with less-crowded lateral processes, and have many tiny cement gland pores rather than the more prominent raised dorsal tube or cone. The new species has similarities to *A. fusticulum* in the relatively short setose legs, the dorsal trunk tubercles, the oviger general shape, and the palp segment ratios, but the new species has a proboscis without a proximal constriction, a shorter ocular tubercle, shorter chelifore scapes, a longer sixth oviger segment, more slender palp distal segments, and a longer tarsus in ratio to the propodus, and in the male, 8 cement pores instead of the single raised pore of *A. fusticulum*.

The similarities between this new species and *A. okai*, *A. prosum*, and *A. tuberosum* are in the dorsomedian trunk and lateral process tubercles, a single segment chelifore scape, short tarsus in relation to the propodus, and relatively small size in relation to the many larger species of the genus, and in the above three species, the single dorsomedian cement gland pore in the male. This latter character separates the three from *A. simplex*, which has 8 low dorsal pores of a continuous cement gland in most of the dorsal femur. It also has small anterolateral tubercles on the cephalic segment, which are lacking in the three known species above.

There are similarities in the new species to *Ascorhynchus species B* of this report, such as the dorsal trunk tubercles and the short tarsus, but *A. sp. B* has a 2-segmented scape, larger anterolateral cephalic segment tubercles, and an ocular tubercle placed farther posterior than that of *A. simplex*. The unnamed species is known only from a damaged female, so any male characters such as the cement gland configuration remain unknown.

Ascorhynchus tuberosum Utinomi

FIGURE 3

Ascorhynchus tuberosus Utinomi, 1962:100, figs. 5-6; 1971a:334.

Ascorhynchus tuberosum.—Nakamura and Child, 1983:19 [key].—Nakamura, 1987:32-33, pl. 29.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355-388 m, KT73-6, sta D-2, 10 Jun 1973 (3♂ with eggs, 10♂, 11♀); 35°03.7'N, 138°49.2'E,

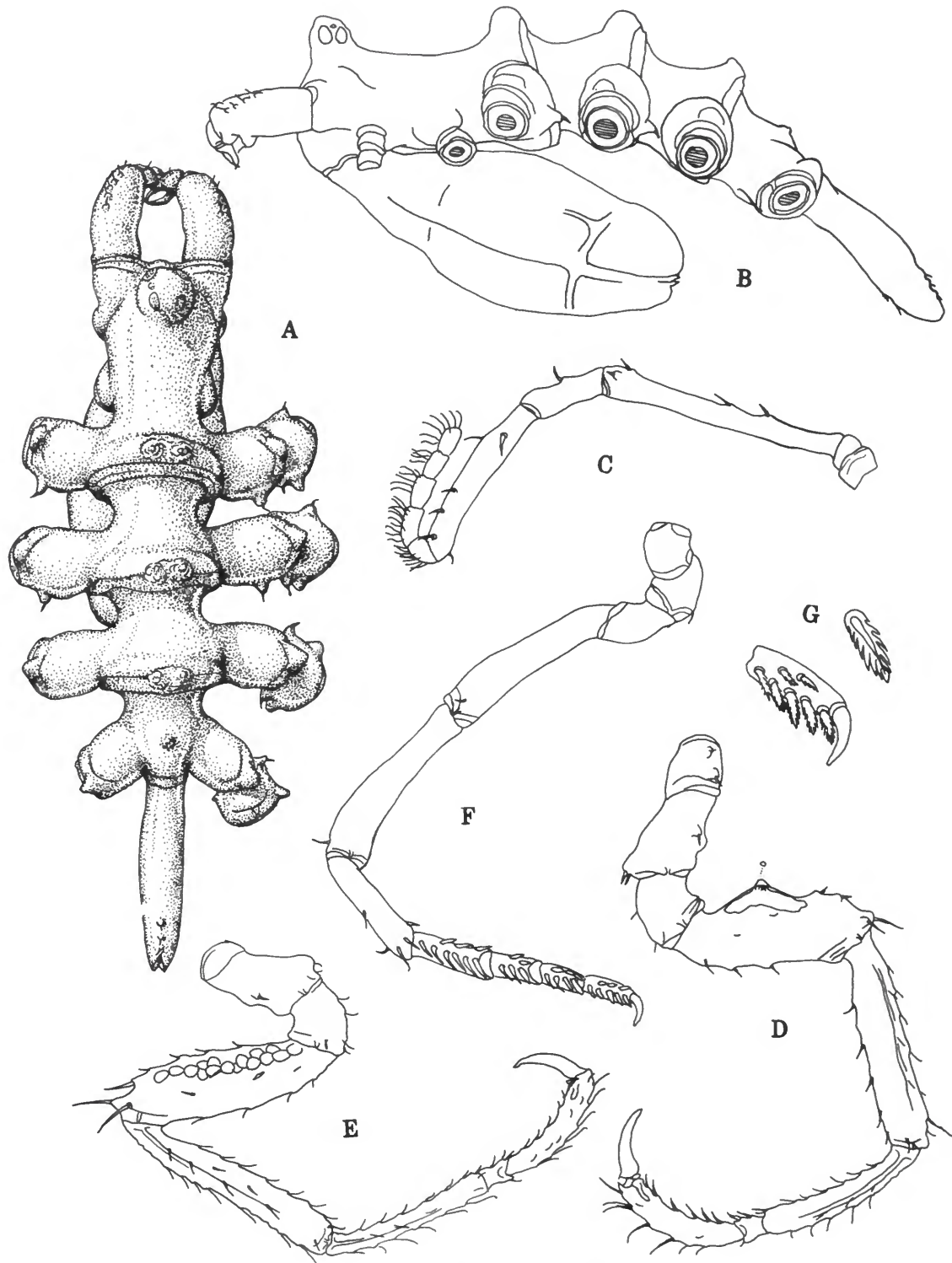


FIGURE 3.—*Ascorhynchus tuberosum* Utinomi, male: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, with cement gland pore indicated; E, female, third leg; F, male oviger; G, oviger strigilis terminal segment, male.

123–134 m KT73-6, sta A, 11 Jun 1973 (1♂ with eggs, 2♀, 3 juv); 34°55.1'N, 138°44.2'E, 290–305 m, KT75-15, sta 03, 19 Nov 1975 (1♂). Kii Strait, SE of Shirahama, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (2♂ with eggs, 8♂, 4♀); 33°28.6'N, 135°28.9'E, 353–354 m, KT 84-12, sta 15, 1 Sep 1984 (2♂ with eggs, 3♂, 1♀); 33°35.9'N, 135°09.9'E, 322–346 m, KT84-12, sta 27, 2 Sep 1984 (1♂).

DISTRIBUTION.—The species' type locality is in Sagami Bay, and the species has not been reported in the literature since his original record. These records expand its known distribution to the west in Suruga Bay and the Kii Strait without adding to the known depth range of 300 to 450 meters.

REMARKS.—Utinomi's type figures are adequate but not readily available, so additional figures of a male are provided here. This species has a character apparently unique among the known species of *Ascorhynchus*: paired or split dorsomedian trunk tubercles on the first three segments. Among the characters shared with other species, *A. tuberosum* has low rounded dorsodistal lateral process tubercles, small laterodistal setose tubercles on the anterior two pairs of lateral processes, corresponding tubercles on the anterior and posterior of each first coxa, an ocular tubercle placed at the extreme anterior of the cephalic segment, and a small cement gland pore placed on a raised surface at midfemur length. The chelifore scape has a row of tiny setose dorsolateral tubercles and two larger distal tubercles on the ventral surface of the male, while the female has four of these ventral setose tubercles. A number of Japanese species share one or more of these characters, but the most distinguishing character of this species is the paired dorsomedian trunk tubercles, which are of equal height in both sexes though sometimes not paired but coalesced in female specimens. The female leg and the tibiae in particular are notably more setose than that of the male. The tripart proboscis, the oviger, and palp are typical for the genus.

Ascorhynchus utinomii Nakamura and Child

Ascorhynchus utinomii Nakamura and Child, 1982:283–285, fig. 1; 1983:29–30.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37–41 m, 27 Jul 1982 (1♂, 1♀); 20–21 m, 24 Aug 1982 (3♂ with eggs, 1♀). Nabeta Bay, 7–15 m, 11 Aug 1978 (2♂ with eggs); 10–15 m, 27 Jul 1982 (1♂); 10–16 m, 24 Aug 1982 (3♂, 4♀).

DISTRIBUTION.—For the number of specimens now recorded of this species, it is surprising that it has never been taken outside Sagami Bay, its type locality. It has been taken from subtidal depths to 41 meters.

REMARKS.—This species is probably closest to the often-collected *Ascorhynchus ramipes*, but it lacks the typical dorsomedian trunk tubercles of that species and has a very short claw on the anterior leg pair, while *A. ramipes* has none. The proboscis of *A. utinomii* is bilobed while that of *A. ramipes* has three lobes.

The above sixteen specimens are all adults, and all other specimens reported in the literature are also adults, suggesting

that the larvae and young of this species are parasitic or commensal on or within some unknown marine organism.

Ascorhynchus species A

FIGURE 4

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT 84-12, sta 7, 31 Aug 1984 (1 juv).

REMARKS.—This specimen has characters of *Ascorhynchus japonicum* Ives, such as the tarsus approaching the propodal length, general trunk habitus, and long palp segments, but it has a tripartate proboscis, very small blunt conical median trunk tubercles, and, more importantly, single-segmented chelifore scapes. Ives' species has scapes with two segments, subequal tarsus and propodus, two part proboscis, and very broad conical median trunk tubercles. This Kii specimen is very much smaller than juveniles of *A. japonicum*, with a trunk length of 4.3 mm, proboscis length of 3.14 mm, a width of 3.18 mm, and an abdomen length of 1.4 mm. Proboscis plus trunk lengths of Ives' species are usually 45 to 55 mm combined length. This specimen is without sex pores on the legs and, since it is an apparently fully chelate juvenile, it must remain unnamed until adults can be collected with full diagnostic characters.

Ascorhynchus species B

FIGURE 5

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Misaki, 110 m, 10 Jul 1985 (1♀).

REMARKS.—This specimen is very damaged, lacking the proboscis, all leg terminal segments except the fourth left propodus and claw, and it has only one complete oviger. We refrain from naming this female because of the lack of appendages and lack of male diagnostic characters.

This unnamed species is closest to *Ascorhynchus corderoi* du Bois-Reymond Marcus and, although it lacks the hermaphroditic characters of that species, it has eggs in the femorae. It has what appear to be female ovigers without the usual tuft of setae on an inflated sixth segment and lacks any discernible evidence of cement glands. The coxae sex pores are difficult to discern.

This specimen shares many characters with Marcus' species; brachytarsal terminal leg segments, two-segmented scapes with the second segment longest, median trunk tubercles and similar dorsodistal lateral process tubercles with flanking setae, pointed tubercles over the chelifore insertion with flanking setae, abdomina of the same shape and size carried horizontally, very similar palps, and heavily setose tibiae. The differences in this specimen are, besides the lack of hermaphroditic sex characters, having a conical ocular tubercle with a constriction distal to the eyes instead of a cylindrical irregular tubercle with a tiny apical cone, a lack of setae on the median trunk tubercles, much more slender legs with longer segments, a palp and oviger with much longer and slender segments, and shorter chelae scape segments with fewer setae.

The measurements (in mm) of both species are nearly alike:

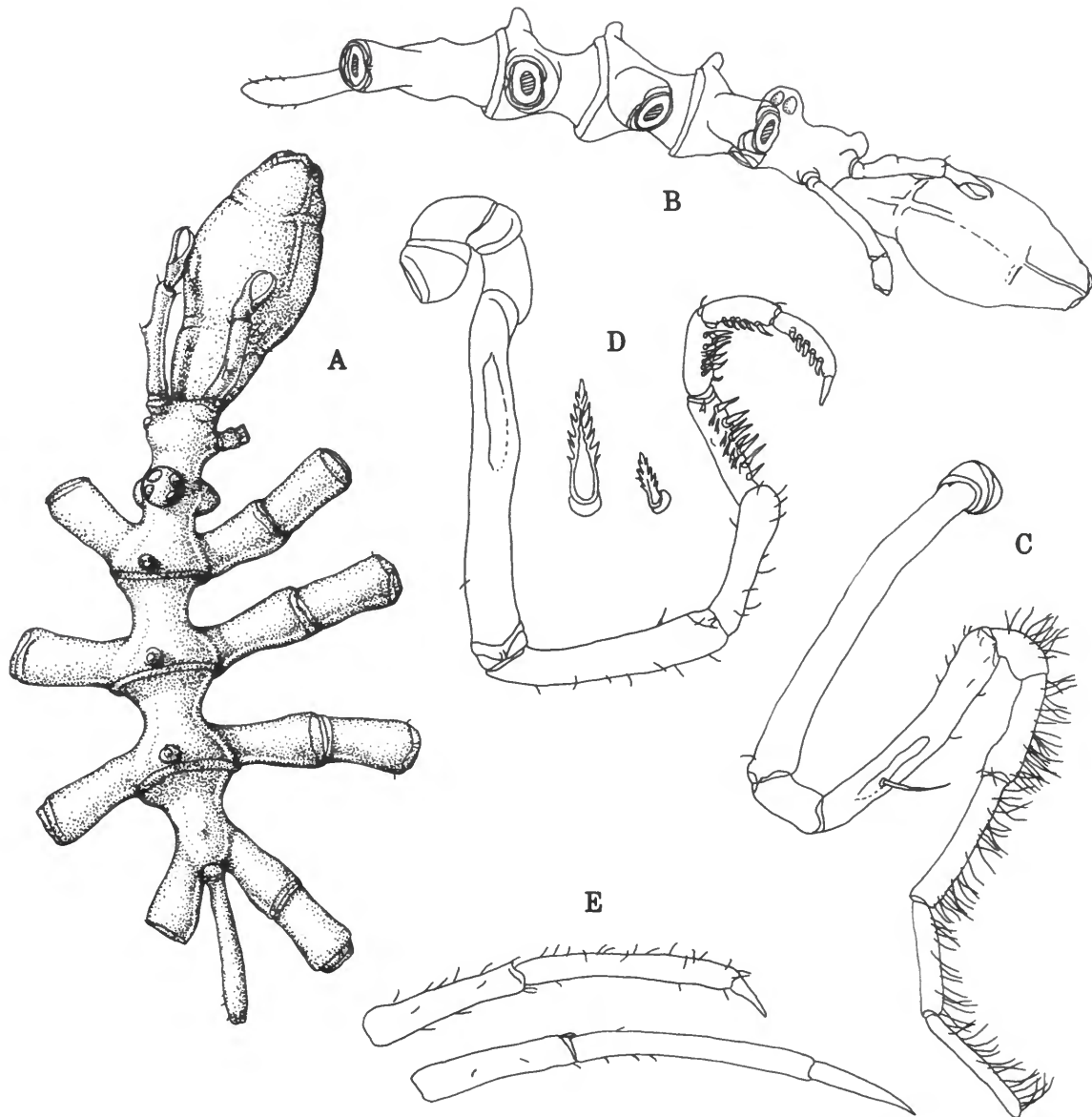


FIGURE 4.—*Ascorhynchus* species A: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, oviger, with proximal and distal spines, enlarged; E, terminal segments, first and third legs.

trunk length, 2.26 (that of *A. corderoi*, 2.41); trunk width, 1.32 (1.47); abdomen length, 0.82 (0.95).

The two species may have a common ancestor with a Tethyan origin or link.

Genus *Chonothea* Nakamura and Child, 1983

Chonothea Nakamura and Child, 1983:30.

EMENDED DIAGNOSIS.—Tanystylomorph with short, tri-

angular unsegmented trunk carrying large barrel-shaped proboscis. Ocular tubercle with eyes at posterior or anterior of cephalic segment. Chelifores very short, 1-segmented. Palp 1-segmented but with hint of multiple segments, oval. Female oviger tiny, slender, 7-segmented, without strigilis or terminal claw. Male oviger much larger, longer, 9-segmented, without strigilis but with short tiny terminal claw. Legs short, robust, terminal segments *Pycnogonum*-like, without auxiliary claws.

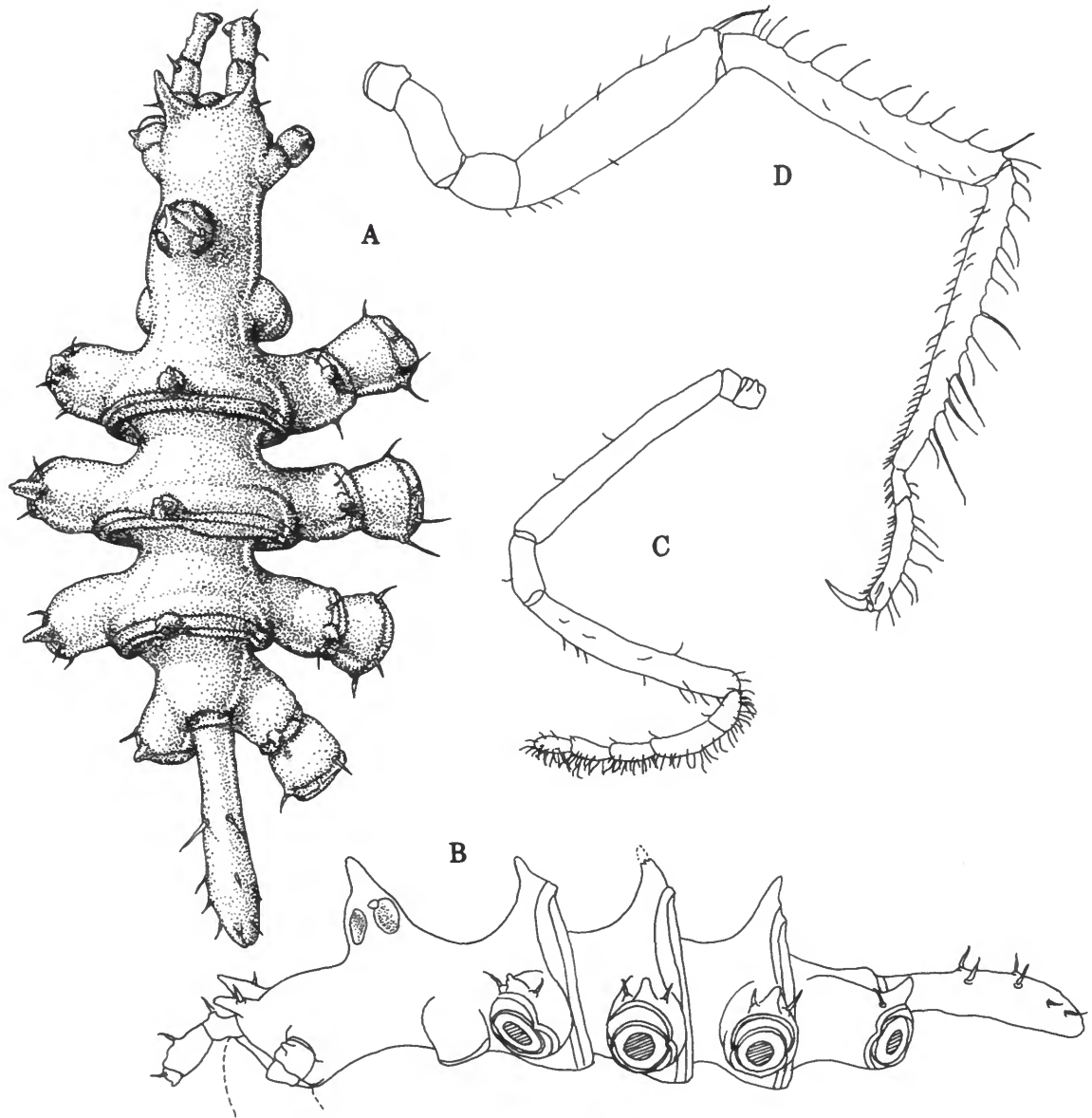


FIGURE 5.—*Ascorhynchus* species B: A, trunk, dorsal view; B, trunk, lateral view (proboscis missing); C, palp; D, third leg.

***Chonothea verrucosa*, new species**

FIGURE 6

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (1♂, holotype, USNM 234467).

DESCRIPTION.—Size moderately small, leg span about 13.2 mm. Trunk compact, widest at anterior rim, tapering posteriorly, segmentation lines incomplete, strongest posterior to low papillose tubercle placed middorsally at posterior of each trunk

segment. Lateral processes short, not much longer than their maximum diameter, crowded, almost touching, each armed with low papillose dorsodistal tubercle with posterior seta. Cephalic segment anterolateral corners with low papillose tubercles similar to those of lateral processes and dorsomedian trunk. Ocular tubercle placed toward anterior of segment, a large slightly tapering cylinder with rounded apex. Eyes at distal tubercle tip, unpigmented. Abdomen a thick cylinder, long, almost length of trunk, carried horizontally, armed with few laterodistal short setae.

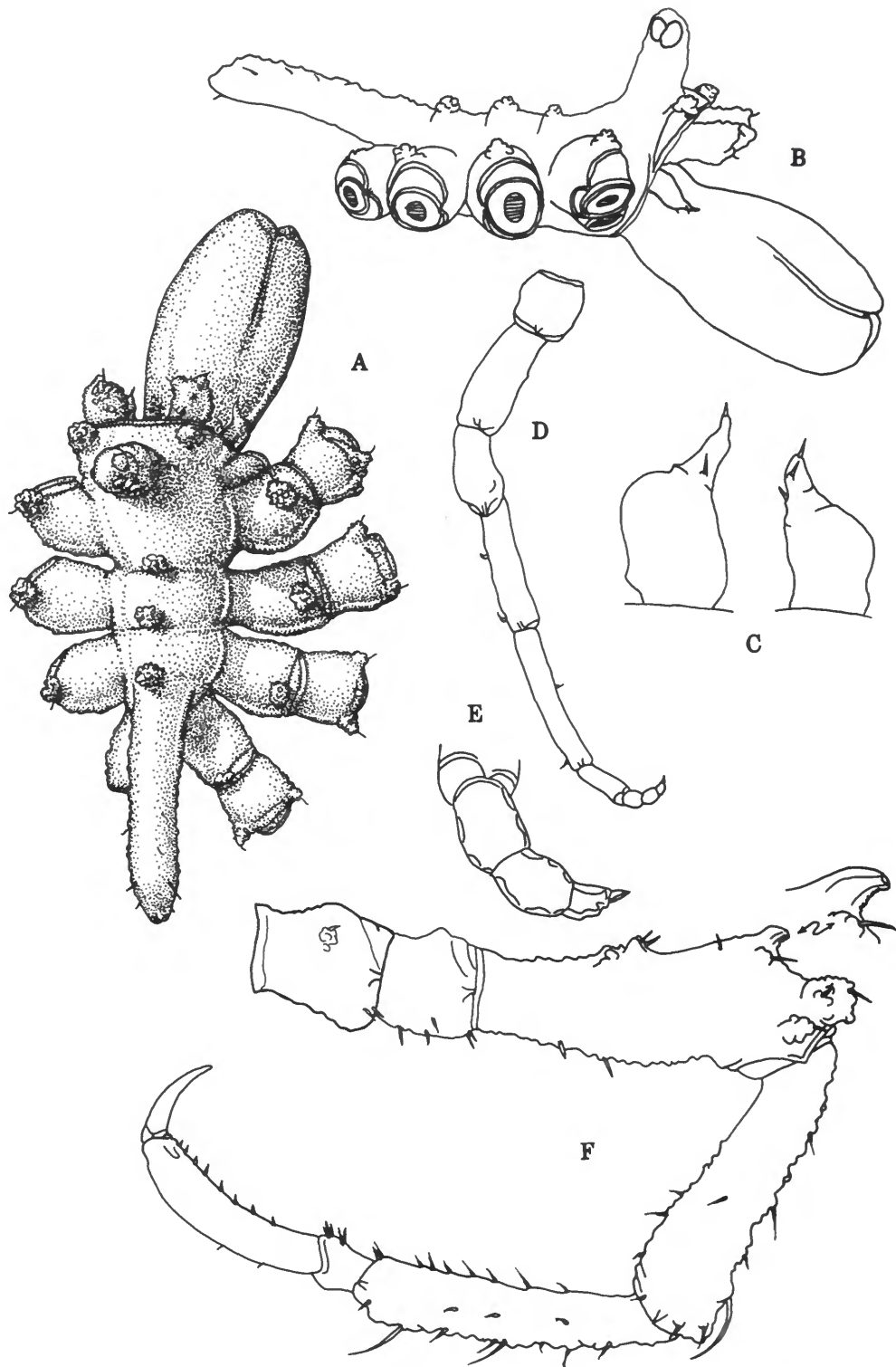


FIGURE 6.—*Chonothea verrucosa*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palps, ventral view; D, oviger; E, oviger strigilis, enlarged; F, third leg, with cement gland tubercle, enlarged.

Proboscis long, barrel-shaped, slightly less than trunk length, inflated lips separated, well curved.

Chelifores 1-segmented, short, without trace of chelae, with few dorsal and lateral small tubercles and papillae, some bearing tiny setae.

Palps very small, 1-segmented but with hint of suture lines suggesting segmentation, tapering to pointed tips bearing 2-3 short setae.

Ovigera 9-segmented, slender, fifth segment longest, slightly longer than fourth, both armed with 2-3 short lateral setae. Terminal three segments tiny, each smaller than next proximal segment, armed with tiny terminal claw almost as wide as long.

Legs moderately short, lightly setose. First coxae with low dorsolateral tubercles, smaller than those of lateral processes, each with tiny seta. Second and third coxae with several short ventral setae. Femur the longest segment, with paired dorsomedian and large dorsodistal tubercles bearing few setae, surrounded with tiny papillae. Single cement gland tube a low truncate cone at 0.8 dorsal femur length, placed on swollen mound, pointing distally. Tibiae almost equal in length, with few short dorsal, lateral, and ventral setae and longer dorsodistal seta not as long as segment diameter. Tarsus short, with tuft of ventral setae. Propodus slightly curved, without heel or heel spines, sole with few very short spines, claw 0.4 propodus length, moderately curved, without auxiliaries.

MEASUREMENTS (in mm).—Trunk length, 1.91; trunk width (across 2nd lateral processes), 1.59; proboscis length, 1.73; abdomen length, 1.16; third leg, coxa 1, 0.35; coxa 2, 0.44; coxa 3, 0.33; femur 1.39; tibia 1, 1.06; tibia 2, 1.02; tarsus, 0.19; propodus, 0.72; claw, 0.28.

ETYMOLOGY.—The dorsal tubercles of the median trunk, lateral processes, and first coxae are irregular papillose knobs resembling warts, hence the Latin name *verrucosa* (full of warts).

DISTRIBUTION.—The species is known only from Suruga Bay in 355-381 meters.

REMARKS.—The only other known species of this genus is *Chonotha hians* Nakamura and Child, from neighboring Sagami Bay, in waters half as deep as this species. The two species are quite different although they share the characters of the genus. This new species has a slightly smaller proboscis in relation to trunk length and the mouth is not as broad. The widest trunk measurement of the new species is at the second lateral processes, while *C. hians* is widest across the first lateral processes. The new species has warty tubercles, while *C. hians* has none but instead has a smooth raised tubercle in the middle of the trunk. The single segmented chelifores and palps agree in both species but are quite different in details. The types are a unique female for *C. hians*, and a unique male for *C. verrucosa*, so the ovigera are not comparable. The reduction of both chelifores and palps in this genus coupled with the reduced number of oviger segments from the more usual 10, permit easy recognition of either species among the wealth of Japanese pycnogonids.

Genus *Cilunculus* Loman, 1908

Cilunculus armatus (Böhm)

Lecythorhynchus armatus Böhm, 1879c:141-142.

Cilunculus armatus.—Utinomi, 1971a:334-335 [literature].—Nakamura and Child, 1983:33.—Nakamura, 1987:33-34, pls. 30, 39.

MATERIAL EXAMINED.—HOKKAIDO: Off Hamanaka Bay, 42°51.8'N, 145°25.6'E, 321-328 m, KT83-11, sta 26B, 10 Jul 1983 (1♀). HONSHU: Kii Strait, 33°23.9'N, 135°42.1'E, 353-416 m, KT84-12, sta 7, 31 Aug 1984 (2♀). Sagami Bay, off Misaki, 110-122 m, 10 Jul 1985 (2♂ with eggs, 1 juv); 53 m, 11 Apr 1986 (2♂ with eggs, 1♂, 1♀). Off Kisami, 36-42 m, 16 Dec 1982 (2♂ with eggs, 3♂, 9♀); 37-45 m, 23 Aug 1982 (5♂, 5♀); 18-28 m, 24 Aug 1982 (1♂ with eggs, 1♀). Off Shimoda, 40 m, 6 Apr 1982 (1 juv); 52-61 m, 9 Dec 1986 (1♂ with eggs, 1♀), 27-41 m, 9 Sep 1987 (3♂ with eggs, 17♂, 7♀, 1 juv). Mouth of Shimoda Bay, 38-50 m, 6 Apr 1983 (2♂, 1♀, 3 juv). KYUSHU: Amakusa Islands, Tomioka, 5 Jul 1984 (2♂ with eggs, 5♂, 7♀, 8 juv). East China Sea, Korea Strait, W of Tsushima, 33°53.6'N, 128°33.4'E, 12 Feb 1969 (1♀, 1 juv).

DISTRIBUTION.—This species has not been known to occur in western Kyushu and the Korea Strait although it has been taken in southern Kyushu. It has been taken as far north as the Sea of Okhotsk and as deep as 618 meters.

REMARKS.—There is some variation in the length and diameter of the ocular tubercle and in the number and placement of spines on the trunk median and lateral processes and the setae of the legs, but any differences are well within acceptable limits of variation. This species is easily recognized among the Japanese members of the genus by its bulbous proboscis, the small sharply pointed dorsomedian trunk tubercles, and the short crowded lateral processes bearing dorsodistal spines.

Cilunculus galeritus, new species

FIGURE 7

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°28.6'N, 135°28.9'E, 353-354 m, KT84-12, sta 15, 1 Sep 1984 (1♂, holotype, USNM 234468); 33°28.1'N, 135°28.5'E, 455-492 m, KT84-12, sta 16, 1 Sep 1984 (1♀, paratype, USNM 234469).

DESCRIPTION.—Size moderately small, leg span 14.3 mm. Trunk slender, elongate, completely segmented, posterior of first, second, and third segments flared with broad rim, those of second and third segments with dorsomedian tubercle bearing tubular spine as long as least diameter of segment. Lateral processes long, the longest slightly over three times longer than their maximum diameters, armed with long posterodistal seta on first pair, two anterodistal and two posterodistal setae on second and third pairs, one anterodistal and one posterodistal setae on posterior pair, all setae at least twice segment diameter or longer. Lateral processes separated by about three times their

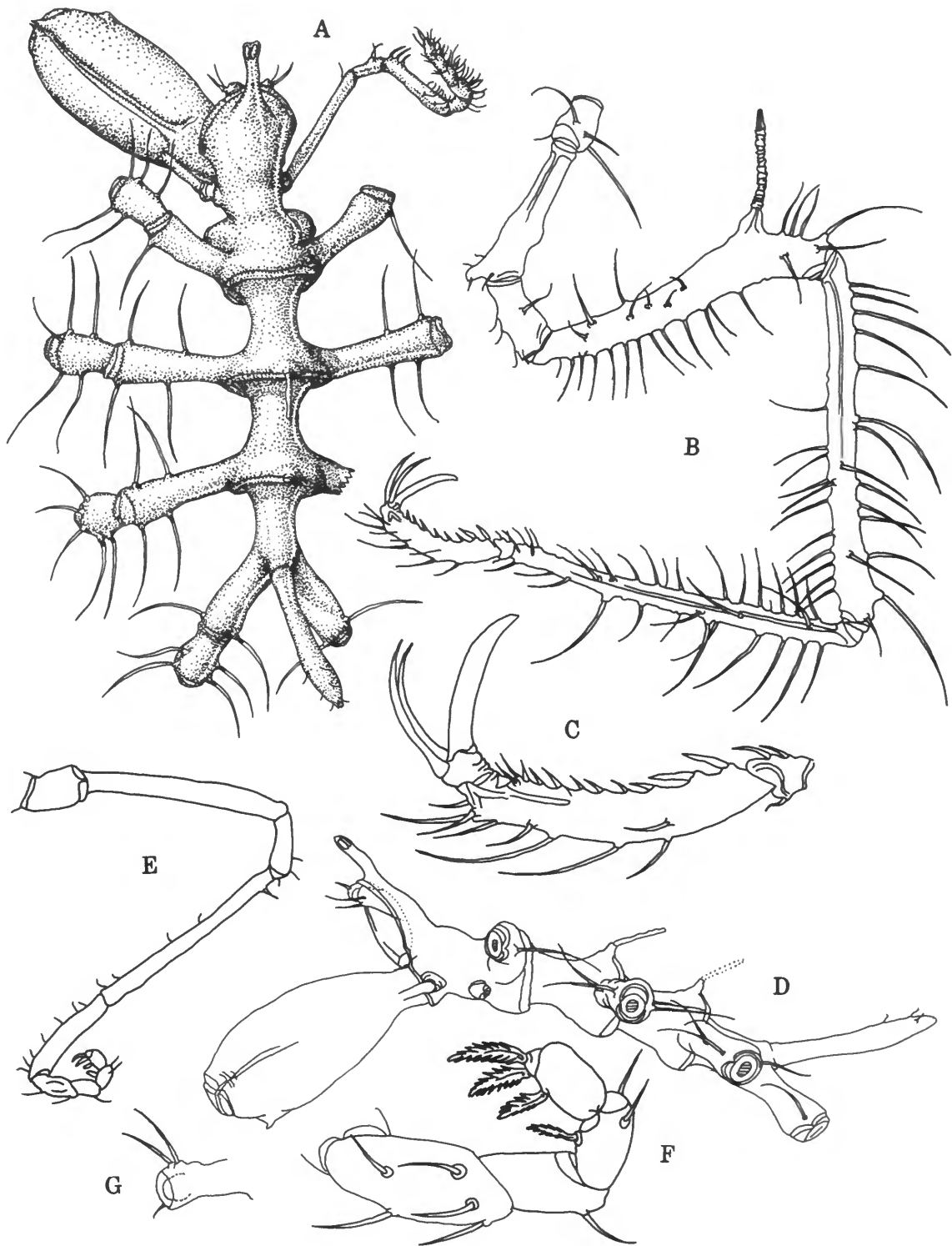


FIGURE 7.—*Cilunculus galeritus*, new species, holotype: A, trunk, dorsal view; B, third leg; C, third leg terminal segments, enlarged; D, trunk, lateral view; E, oviger; F, oviger strigilis, enlarged; G, chelifore, enlarged.

diameters. Oviger implantation directly anterior and ventral to first lateral processes. Palp bases directly anterior to oviger bases, anteroventral to short neck. Chelifores insert into broad sunken hood in trunk anterior, dorsal to slender proboscis insertion. Ocular tubercle a slender cylinder at top of hood rim, three times longer than its diameter, eyes at tip of tubercle, unpigmented. Ocular tubercle pointing anteriorly at oblique angle. Proboscis long, slender, without constrictions, with distal low pointed tubercles at rim of each antimere, lips flat. Abdomen very long, slightly over half as long as proboscis, carried with a slight dorsal bend from the horizontal, armed with few short distal setae.

Chelifores short, almost hidden in dorsal view by placement in cephalic hood, little more than twice as long as their diameters, armed with two setae distally, each twice segment diameter in length. Chelae little more than small bulbous knobs, armed with single short seta.

Palps slender, first segment not as long as wide, second segment longest, fourth about 0.8 length of second, armed with three proximal short setae and many distal short setae. Fifth through ninth segments short, subequal in length, armed with many ventral and lateral setae slightly longer than segment diameters. Ovigers very long, slender, second segment slightly shorter than fourth, fifth about half as long as fourth. Third, fourth, and fifth armed with few short lateral setae. Strigilis short, sixth segment slightly inflated, armed with five lateral recurved setae. Denticulate spines long, with many lateral serrations, with one on eighth segment, one on ninth, two on tiny bud of tenth segment.

Legs slender, very setose, first coxae with four or five very long lateral setae, one or more over three times segment diameter. Second coxae with few short setae on ventrodorsal sexpore tubercle, which is shorter than segment diameter. Major leg segments with many dorsal, ventral and lateral long setae, some over three times longer than segment diameters, setae increasing in density distally. Femoral cement gland tube very long, originating on conical tubercle placed at about 0.75 dorsal length of segment. Cement tube slightly over twice femur diameter, with many wrinkle bands along its length, carried erect. First tibiae longest of major segments with second tibiae slightly shorter. Tarsus very short, subtriangular, armed with one dorsal and two ventral setae. Propodus slender, slightly curved, without obvious heel but with two heel spines, eight shorter sole spines and several dorsal setae longer than propodus diameter. Claw slender, curved at tip, auxiliaries slightly shorter and more curved than main claw.

Female Paratype: Slightly larger than male except for oviger, which has shorter major segments. Very long setae less numerous than in male.

MEASUREMENTS (holotype, in mm).—Trunk length (dorsal hood rim to tip 4th lateral processes), 2.24; trunk width (across 2nd lateral processes), 1.46; proboscis length, 1.01; abdomen length, 0.54; third leg, coxa 1, 0.26; coxa 2, 0.64; coxa 3, 0.37;

femur, 1.31; tibia 1, 1.54; tibia 2, 1.45; tarsus, 0.09; propodus, 0.51; claw, 0.27; femoral cement gland from base, 0.52.

DISTRIBUTION.—Known only from the type locality, Kii Strait in southern Honshu in 353 to 492 meters.

ETYMOLOGY.—The name is from the Latin *galeritus* (wearing a hood), and refers to the very large cephalic segment hood of this species.

REMARKS.—Of the 20 known species of *Cilunculus*, 7 are found in Japanese waters, and 4 recently described, including the two new species in this report, are endemic to Japan as far as is known. This new species is unique for the abnormally large cephalic segment hood in which the chelifores are housed. No other known species has this large trumpet-shaped hood, which is opaque owing to the thin integument that lines the interior. The chelifores can be seen easily through the hood dorsum. Another unique feature of this species is the pair of dorsomedian tubular spines of the trunk and in particular the lack of any evidence of a tubular spine on the cephalic segment posterior rim. Such tubercles or spines, if present, usually appear on each of the three segment rims and no other known species has tubular spines on the posterior two rims only.

Cilunculus gracilis, new species

FIGURE 8

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, E of Otsuchi, 38°58.6'N, 142°56.7'E, 1430-1440 m, KT84-9, sta SR8, 11 Jul 1984 (1♂, holotype, USNM 234470, 3♂, 1 juv, paratypes, USNM 234471); 39°12.4'N, 142°18.7'E, 700-736 m, KT84-9, sta SR5, 10 Jul 1984 (5♂, 4♀, paratypes, USNM 234472).

OTHER MATERIAL.—Same locality, 39°11.4'N, 142°11.5'E, 430-435 m, KT84-9, sta SR4, 12 Jul 1984 (9♂ with eggs, 17♂, 30♀, 3 juv); 39°13.3'N, 142°16.2'E, 562-563 m, KT85-11, sta SR15, 14 Aug 1985 (2♂, 1♀).

DESCRIPTION.—Size moderately small, leg span 17.3 mm. Trunk slender, segmentation lines barely discernible or missing, integument covered with tiny papillae or rugosities. Lateral processes long, over twice as long as segment diameter, separated by their diameters or less, each armed with very slender dorsodistal tubercle and 1 or 2 tiny papillae lateral to tubercles, tubercles longer than segment diameters on second and third pairs of lateral processes, shorter than their diameters on first and fourth pairs. Neck short, shorter than anterior diameter, oviger implantation next to and partly hidden by first pair of lateral processes. Ocular tubercle tall, slender, over four times longer than basal diameter, eyes small, at tip of tubercle, unpigmented, apex with tiny tubercle. Proboscis moderately inflated, without proximal or distal suture lines, lips flat. Abdomen long, straight, carried below horizontal, armed with 5 or 6 distal setae.

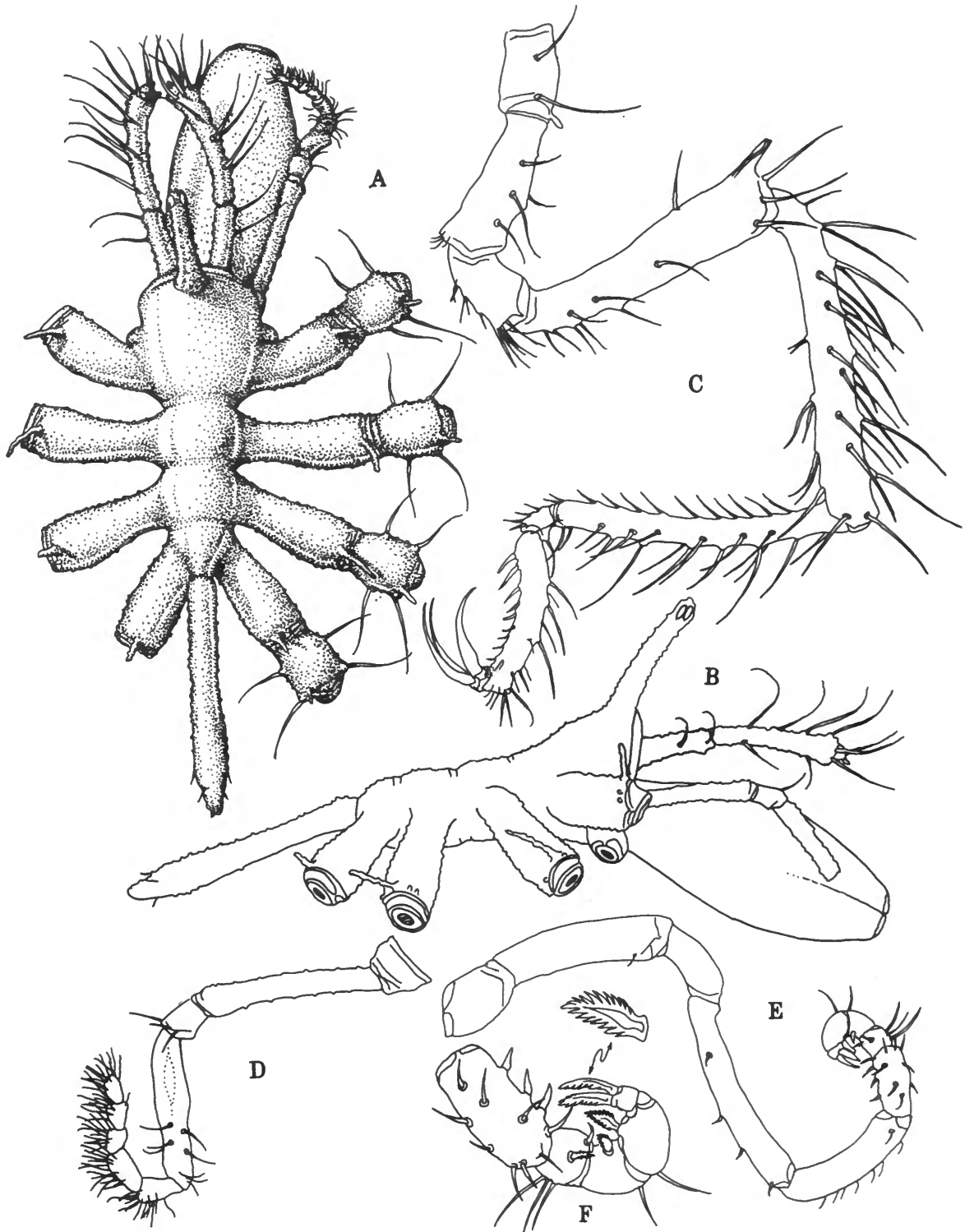


FIGURE 8.—*Cilunculus gracilis*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, third leg; D, palp; E, oviger; F, oviger strigilis, with denticulate spine enlarged.

Chelifores long, slender, 0.6 length of proboscis, with 2-segmented scape, first segment armed with 2 long lateral setae, second segment 1.5 times longer than first, armed with 9 or 10 long lateral and distal setae, all at least twice segment diameter or longer. Chelae tiny, with vestigial finger buds and distal seta as long as scape setae.

Palp second segment longest, 0.2 longer than fourth. Third, fifth, and sixth segments subequal, distal 3 segments shorter, subequal, fifth through ninth armed with dense ventral setae as long as or longer than segment diameters.

Ovigers moderately short, slender, second segment only slightly shorter than fourth, both armed with few lateral and distal setae. Fifth segment 0.6 as long as fourth, armed with ectal row of 7 or 8 short setae. Strigilis segments short, sixth segment longest, swollen, armed with four rows of short recurved spines and setae, terminal 4 segments hardly longer than wide, armed with few ectal setae longer than segment diameters and endal denticulate spines, 1 on each segment except the tiny terminal segment, which has 2. Spines broad, with many lateral serrations.

Legs moderately long, robust, very setose with setae increasing in numbers distally, setae slightly longer to 3 times longer than segment diameters. First coxa with dorsodistal tubercle like those of lateral processes but shorter and 2 anterior and 2 posterior long lateral setae. Second coxa with 2 or 3 long lateral setae. Third coxa with several short ventral setae and fringe of longer ventrodistal setae. Femur with several proximoventral setae and 1 dorsodistal seta about as long as segment diameter and several distal setae twice segment diameter. Cement gland tube a single dorsodistal cone pointing distally, not as long as segment diameter. First tibia the longest segment, slightly longer than femur and about 0.2 longer than second tibia. Both tibiae armed with ventral, lateral and dorsal rows of long setae. Tarsus short, quadrangular, armed with dorsal seta and several ventral setae. Propodus slender, well curved, without prominent heel but with 3 heel spines, 7 or 8 shorter sole spines and several long lateral and dorsal setae. Claw slender, well curved, half propodus length, auxiliaries more slender, equal in length to main claw, slightly more curved.

Female slightly larger than male except for smaller and shorter oviger. Lateral process and coxae tubercles not as long as those of male.

MEASUREMENTS (holotype, in mm).—Trunk length (anterior rim of cephalic segment to tip 4th lateral processes), 2.14; trunk width (across 2nd lateral processes), 1.51; proboscis length, 1.63; abdomen length, 1.36; third leg, coxa 1, 0.49; coxa 2, 0.75; coxa 3, 0.5; femur 1.55; tibia 1, 1.75; tibia 2, 1.39; tarsus, 0.19; propodus, 0.84; claw, 0.42.

DISTRIBUTION.—Known only from the Sanriku-oki area, east of northern Honshu, in 430 to 1440 m.

ETYMOLOGY.—The species name is from the Latin *gracilis* (slender or thin), and refers to the generally slender habitus of the specimens and to the slender lateral processes in particular.

REMARKS.—There are seven *Cilunculus* species having 2-segmented scapes, but only three of these species have long *Ammothella*-like chelifores: *C. acanthus* Fry and Hedgpeth from the Antarctic, *C. profundus* (Hedgpeth) (previously *Ammothella profunda*) from Japan, and the new species, also from Japan. The Antarctic species has median trunk tubercles and lacks eyes and auxiliary claws. This new species is very similar to *C. profundus* and both are very closely related to the genus *Ammothella* as emphasized by Hedgpeth (1948:289–291, fig. 42) in placing his new species in this genus. It was moved to *Cilunculus* by Nakamura and Child (1983:32–33) because of the shallow cephalic segment hood into which the chelifores insert, a diagnostic character of the genus *Cilunculus*. Both of these species have the shallow hood, but *C. profunda* has lateral processes spaced more closely and shorter than those of the new species and has much shorter first scape segments, shorter auxiliary claws, tibiae of equal length, and lacks any form of lateral process tubercles. The type specimen has eyes, although they were not noticed in the original description by Hedgpeth.

Both species are from similar depths, a fact that presented an enigma to Hedgpeth for the normally very shallow-water genus *Ammothella*. There is no doubt that the two genera are very closely related, and *Cilunculus* is probably the deep-water counterpart of the shallow-water *Ammothella*, the two being separated by the presence or absence of the cephalic segment hood.

Cilunculus haradai Nakamura and Child

Cilunculus haradai Nakamura and Child, 1983:33–35, fig. 11.

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (17♂, 13♀); 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (9♂, 12♀, 2 juv).

DISTRIBUTION.—This species was described from specimens taken from Sagami Bay in depths of 30–174 meters. These additional records extend its distribution to the south and into considerably deeper water at 416 meters. It should be noted that, at station 7, *Cilunculus armatus* and *C. sekiguchii* were also collected as were the latter species and *C. galeritus* at station 15. These four species apparently have a broad depth tolerance.

REMARKS.—This is one of the majority of *Cilunculus* species with a single scape segment and short chelifores, and it is easily separated from its nearest relation, *C. sekiguchii*, by its lack of dorsodistal lateral process tubercles or spines, shorter lateral processes, much shorter abdomen, and generally much more robust and compact appearance.

Cilunculus sekiguchii Nakamura and Child

Cilunculus sekiguchii Nakamura and Child, 1983:35–38, fig. 12.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°54.0'N, 138°43.7'E, 337–355 m, KT74-14, sta B8, 23 Sep 1974 (1♂, 1♀). Kii Strait, 33°28.6'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (1♂); 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀); 33°28.1'N, 135°28.5'E, 455–492 m, KT84-12, sta 16, 1 Sep 1984 (1♂).

DISTRIBUTION.—This species was known only from its type series collected in Sagami and Suruga bays in depths from 30 to 300 meters. These specimens extend its distribution to the south at Kii Strait and to a maximum known depth of 492 meters. Besides the above species, *C. armatus* and *C. haradai* were also collected at station 7, while at station 15, *C. galeritus*, *C. haradai*, and *C. sewelli* were also trawled. It is possible that these collecting stations are at the depth preferred by these species.

REMARKS.—This is a more slender species than *C. haradai*, and it has longer lateral processes bearing long lateral and dorsal setae and a long abdomen. The two species are otherwise very similar in leg, palp, and oviger characters. It differs from other known Japanese species by its lack of median dorsal tubular spines or tubercles and its long well-separated lateral processes.

Cilunculus sewelli Calman

Cilunculus sewelli Calman, 1938:161–163, figs. 8, 9.—Clark, 1963:75.—Stock, 1968b:13.

Ammothella gigas Fage, 1956c:173–175, figs. 9–14.

MATERIAL EXAMINED.—HONSHU: Off Kamaishi, 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1♂ with eggs, 4♂, 4♀, 2 juv); 39°12.4'N, 142°18.7'E, 700–736 m, KT84-9, sta SR5, 10 Jul 1984 (1♂, 5♀); 39°07.2'N, 142°23.1'E, KT84-9, sta SR6, 10 Jul 1984 (1♂, 3♀, 1 juv); NE of Miyako, 39°59.0'N, 142°37.7'E, 1225–1249 m, KT85-11, sta SR 16, 12 Aug 1985 (2♀). Kii Strait, 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀); 33°30.8'N, 135°08.3'E, 975–1112 m, KT84-12, sta 30, 2 Sep 1984 (1♀).

DISTRIBUTION.—This species is new to Japanese waters. It was described from a female taken off Zanzibar and has since been captured off such scattered places as Natal, South Africa, Kenya, Mozambique Channel, and New Zealand. These are the first records from the north Pacific and they fall within the known depth range of 183–1789 meters.

REMARKS.—This is a very characteristic species, which shows little variation in the tubercles and long spines. The cement gland tube of the male is almost as long as the femur diameter and is figured well by Fage (1956c:175, fig. 4).

The one specimen from SR6 above is an apparent gynandromorph with male cement glands and tubes on at least two legs and ovigerous female legs on other lateral processes.

Genus *Hemichela* Stock, 1954*Hemichela micrasterias* Stock

Hemichela micrasterias Stock, 1954b:90–94, figs. 42–43; 1985:153–155, figs. 1–11.—Staples, 1982:464–465 [text].—Child, 1988a:10.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jul 1973 (1♂). Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (2♂ with eggs, 2♀, 3 juv); 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀); 33°28.1'N, 135°28.5'E, 455–492 m, KT84-12, sta 16, 1 Sep 1984 (1♀).

DISTRIBUTION.—This species was described from Indonesian material and has recently been recorded from the central Philippines; all depths are from 20 to 84 meters. These are the first Japanese specimens recorded for this species. These records also lend emphasis to the proposed “corridor” of species in several genera (Child, 1983:699, 713; 1988b:55, first proposed for the genus *Auistrodecus*) that appear to inhabit islands between the Australia-New Zealand areas and northern Japan. The second known species of this genus, *H. longiunguis* Staples, is, in fact, known from the Queensland coast of Australia. The two species of the genus thus inhabit localities from Australia, Indonesia, and the Philippines to Japan, points on the proposed corridor.

REMARKS.—This species can be separated from *H. longiunguis* by a shorter propodal claw (less than half propodus length), more teeth on the chela finger (6 rather than 2), and fewer oviger denticulate spines (only 1–2 rather than 2–4). The genus is easily recognized by its lack of a dactylus in opposition to the single finger of the chela.

Genus *Heterofragilia* Hedgpeth, 1943*Heterofragilia hirsuta*, new species

FIGURE 9

MATERIAL EXAMINED.—HONSHU: Sagami Bay, E of Ohshima, 454–495 m, 25 Dec 1969 (1♂ with eggs, holotype, USNM 234473, 1♂ with eggs, 1♀, paratypes, USNM 234474).

DESCRIPTION.—Size large, leg span 70.8 mm. Trunk and all appendages very hirsute, sometimes obscuring segment outlines, most dorsal setae very long, very slender, to 2–3 times segment diameter, lateral and ventral setae much shorter. Trunk segment posteriors with large inflated rims having short blunt median tubercles bearing long setae. Lateral processes slightly clubbed distally, twice or slightly over twice as long as their diameter with 8–9 long dorsal and laterodistal setae, shorter lateral and ventral setae. Oviger implantation against first lateral process anteriors, originating in large bulbous tubercles. Palps and chelifores originating from smaller bulbous tubercles. Ocular tubercle constricted proximally, 3 times as long as minimum diameter, with distal and posterior long setae. Eyes

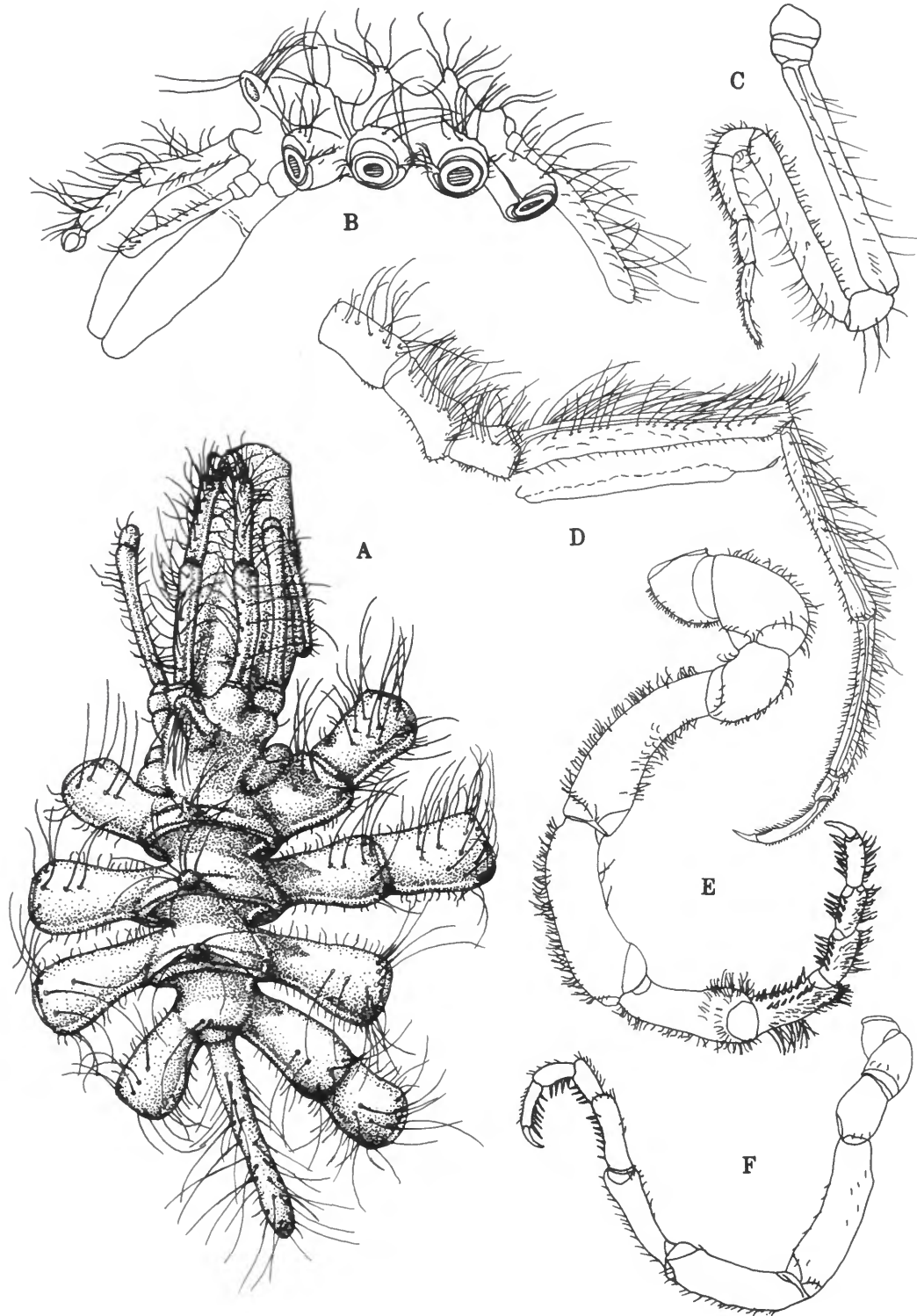


FIGURE 9.—*Heterofragilia hirsuta*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, with fourth leg cement gland outlined below femur; E, oviger. Female paratype: F, oviger.

evident in large anterior pair only, unpigmented, posterior pair lacking. Proboscis with single constriction proximally, inflated at midlength, lips flat to slightly inflated, oral aperture gaping. Abdomen long, cylindrical, curved slightly ventrally, with many long dorsal setae and shorter lateral setae.

Chelifores 0.8 proboscis length, scape 2-segmented, fully chelate, with many long dorsal setae and shorter lateral setae. First scape segment 0.2 longer than second segment. Chelae tiny, palm very short, fingers well curved, smooth, overlap at tips, without teeth, palm armed with single long seta.

Palps 10-segmented, first 2 segments not as long as their diameters, third segment longest, fifth 0.8 length of third, combined length of terminal 5 segments equal to length of fifth. Terminal 3 segments subequal, seventh slightly longer, sixth through tenth armed with fields of short ventral setae.

Ovigers with many very short ectal and endal setae. Fourth and fifth segments subequal, moderately curved, sixth segment slightly shorter, with distal field of many short setae. Strigilis 4 segments increasingly short distally, armed with ectal fields of short setae and plain endal spines without denticulations in the formula 9 : 5 : 4 : 6. Spines flanked by rows of shorter setae. Spines short on proximal segments and longer on distal segments with terminal spines of tenth segment longest, forming subchelate structure with terminal claw. Claw 0.7 length of terminal segment. Eggs tiny, carried in long cemented "blankets" wound around each oviger at the fifth segment.

Legs extremely setose dorsally with most setae twice or more as long as segment diameters. Lateral setae shorter and ventral setae very short. Femur the longest segment with first tibia longer than second. Terminal segments very small, tarsus short, only 0.35 propodus length. Propodus slender, well curved, without long setae, sole spines tiny, numerous. Terminal claw short, slightly curved, without auxiliaries. Sexual pores on posterior 2 pairs of second coxae only. Cement gland contained in swollen elevated surface as long as 0.8 of the ventral femur surface on posterior pair of legs only, with many tiny slit-like pores in integument surface. Anterior 6 legs without swollen elevated surface, lacking slit pores.

Female Paratype: Much less setose, bearing less than half the numbers of male setae with fewer long setae. Size slightly larger in all measurements except for oviger, which is smaller and bears many less setae. Strigilis plain spine count 7 : 5 : 4 : 6. Sexual pores lacking on anterior second coxa pair, present on other six second coxae.

MEASUREMENTS (holotype, in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 9.9; trunk width (across 2nd lateral processes), 8.8; proboscis length, 8.3; abdomen length, 5.6; third leg, coxa 1, 2.4; coxa 2, 2.5; coxa 3, 1.9; femur, 8.0; tibia 1, 6.1; tibia 2, 5.9; tarsus, 0.9; propodus, 2.6; claw, 0.7.

DISTRIBUTION.—The new species is known only from the outer edge of Sagami Bay, E of Ohshima, in 454–495 meters.

ETYMOLOGY.—The new species name is from the Latin *hirsuta* (hairy, shaggy), and refers to the extremely setose

aspect of the specimens.

REMARKS.—This is the fourth known species of this apparently rare genus, and there are a total of only seven specimens recorded for the four species. This new species is the largest, by far the most setose of the four, and is the second known from Japan. *Heterofragilia amica* Stock (1954b:136–139, figs. 67, 68) is known from the type specimen and one other specimen (Utinomi, 1955:38–31, figs. 17, 18), both from off southern Kyushu Island. The other two species, *H. fimbriata* Hedgpeth (1943b:53–54, pl. Xa–i) and *H. major* Stock (1986b:409–412, fig. 2), are known from single specimens taken in the Caribbean off the Windward Islands. The genus is noted for long setae on appendages and tubercles, but this new species has sufficient long setae to obscure some of the segment margins and, indeed, the specimens collected debris among these setae such that major parts of each specimen were covered. Another major difference between this species and those previously known is the length of its chelifores. The three other species have chelifores about half as long as the proboscis or slightly less, while this species has chelifores about 0.8 as long as the proboscis and of a wider diameter than the others.

Compared with the other Japanese species, *H. amica*, this new species has shorter median trunk tubercles and ocular tubercle. The chelifores of Utinomi's specimen are somewhat longer than those of the type, but this specimen is probably an adult while Stock's specimen is more juvenile, lacking sex pores. All of the earlier descriptions, including Utinomi's, fail to mention sex pores on the first leg pair, while the female has them on the posterior six legs and the male has the pores on the posterior four legs only. Stock found the same situation with the pores of his female type of *H. major*.

Although all four known species are closely related, one character that seems to differ between the species is the presence or absence of eyes. Hedgpeth's species apparently has no eyes whatsoever, although he stated "eye lacking or unpigmented" (1943b:53). Stock's (1954b:136) description of the other Japanese species lists the eyes as unobserved. The eyes of *H. major* (Stock, 1986b, fig. 2b) are faint and unpigmented according to the figure, and only the anterior pair are evident. This feature is true for *H. hirsuta* with large anterior eyes and a field of long setae where the posterior pair of eyes should appear. The genus, therefore, has only the anterior eyes or none, with the anterior pair difficult to discern.

The palps of *H. hirsuta* and *H. major* are composed of 10 segments, while those of the other two species are listed as 9-segmented. It is possible that all species have the two very short proximal segments and that one was overlooked in describing *H. fimbriata* and *H. amica*. This same error of omission happened repeatedly in earlier descriptions of new species in the genus *Ascorhynchus*, a related group also having palps with two very short proximal segments.

As the first male specimen of this genus described, this description is the first of the cement gland character for the

genus. It is surprising to find the apparently unique placement of very elongate glands with slit pores in the posterior pair of legs only. Cement glands may vary from leg to leg on any single specimen, but as far as we can discern in the literature, this is the first time cement glands have been described as existing only in one pair of legs. The placement of the glands only in the last pair of legs is reinforced by the presence of many short setae in place of the slit pores on the other six legs of the male.

Genus *Nymphopsis* Haswell, 1884

Nymphopsis muscosa Loman

Nymphopsis muscosus Loman, 1908:52, pl. 13: figs. 175-188.

Nymphopsis muscosa.—Utinomi, 1971a:335 [literature].—Nakamura, 1987: 34-36, pls. 31, 32, 40.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 33-41 m, 4 Dec 1981 (2♂, 1♀, 1 juv); 26-35 m, 24 Aug 1983 (1♀).

DISTRIBUTION.—This species has been found in scattered localities from Malaysia and the Philippines to localities in Sagami Bay in 12 to 300 meters.

Genus *Paranympyon* Caullery, 1896

Paranympyon magnidigitatum Hong and Kim

Paranympyon magnidigitatum Hong and Kim, 1987:150-152, figs. 10, 11.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 49 m, 9 Sep 1987 (2♀); 79-80 m, 9 Sep 1987 (1 juv).

DISTRIBUTION.—This species was described with five specimens from two locations in the Yellow Sea off SW Korea in 59-68 meters. The above three specimens extend its known distribution to eastern Honshu and expand the known depth range to 49-80 meters.

REMARKS.—Two new species of this genus have only recently been described, this species being the last, while *P. filarium* Stock (1986b:413-415, fig. 3) was the other. The genus has been monospecific since *P. spinosum* Caullery (1896:361, pl. 12: figs. 1-6) was first described from the Bay of Biscay. This species is notably different from either of the other species, on first examination, by the very large chelae fingers with many evenly spaced large teeth and the finger tips greatly curved. The fingers of the other species are less elongate and have unevenly spaced teeth of varying lengths. The second tibiae of this species and those of *P. spinosum* are shorter than the combined length of tarsus, propodus, and claw, while the second tibiae of *P. filarium* are longer than the combined length of these segments. This Oriental species is otherwise superficially very much like *P. spinosum* except for the chelae and a pair of laterodistal tubercles on each first coxa, which are absent from either of the other species.

There are several minor differences between these two

Japanese females and the male type figures of Hong and Kim, only some of which can be attributed to gender.

The abdomen of the Japanese specimens has two rows of many short setae along most of its length, the first coxae have a dorsomedian row of short setae on most of their length, there are definite but unpigmented eyes at the distal tip of the ocular tubercle, the chelae have many more short dorsal setae, and the teeth number 16-17 on the immovable finger while they number 17-18 on the movable finger, there is an additional denticulate spine on the seventh and eighth oviger segments, and the legs are much more setose in definite rows, particularly laterally and ventrally. These specimens otherwise agree very well with the type figures.

Paranympyon spinosum Caullery

Paranympyon spinosum Caullery, 1896:361, pl. 12: figs. 1-6.—Hedgpeth, 1948:253, fig. 41 [figures].—Stock, 1978a:204-205, fig. 5d-g [figures, literature].—Nakamura and Child, 1983:38.—Stock, 1986b:413 [text], fig. 4.—Hong and Kim, 1987:149-150, figs. 8, 9.

MATERIAL EXAMINED.—KYUSHU: Kohyaki Island, off Nagasaki, 7 m, 2 Oct 1985 (9 juv). HONSHU: Bungo Strait, 33°06.6'N, 132°08.3'E, 89-91 m, KT84-12, sta 32, 4 Sep 1984 (1 juv); 33°06.8'N, 132°07.9'E, KT84-12, sta 33, 89-91 m, 4 Sep 1984 (2 juv). Suruga Bay, 34°46.4'N, 138°47.4'E, 306-317 m, KT73-6, sta D-1, 10 Jun 1973 (7♂, 9♀); 34°45.7'N, 138°42.3'E, 312-328 m, KT74-14, sta B4, 23 Sep 1974 (1♂ with eggs, 1♂, 2♀); 34°54.0'N, 138°43.7'E, 337-355 m, KT74-14, sta B8, 23 Sep 1974 (2♀); 34°56.2'N, 138°44.7'E, 192-207 m, KT75-15, sta 02, 24 Nov 1975 (1♀); 34°55.1'N, 138°44.2'E, 290-305 m, KT75-15, sta 03, 19 Nov 1975 (1♂); 34°45.9'N, 138°42.7'E, 262-290 m, KT76-3, sta 006, 28 Feb 1976 (1♂).

DISTRIBUTION.—These specimens along with those of Hong and Kim from SW Korean waters serve to confirm the presence of this species in NW Pacific waters, far from its usually reported collecting sites in the north Atlantic. It was first reported with a single specimen as a possible distributional anomaly in Japanese waters by Nakamura and Child (1983:38). The presence of this species in such diverse areas as the western Yellow Sea, western Kyushu, and eastern Honshu attest to the fact that it is well established in the northwest Pacific. The depth of the above specimens increases its known broad depth range to 7 meters, previously from 55 to about 2000 meters.

Genus *Tanystylum* Miers, 1879

Tanystylum scrutator Stock

Tanystylum scrutator Stock, 1954b:142-145, fig. 70.—Utinomi, 1971a:337.—Nakamura and Child, 1983:41.—Kim and Hong, 1986:50.

MATERIAL EXAMINED.—HONSHU: Wakayama Prefecture, Goboh, 1.5 m, Feb 1981 (1♂, 1♀); 3 m, Feb 1981 (1♂). Sagami Bay, Nabeta Bay, 7-15 m, 3 Jun 1972 (1♀). Off

Kisami, 33–40 m, 4 Dec 1981 (1♀). Chiba Prefecture, Kominato, shallow, 23 Feb 1986 (2♂ with eggs, 2♀, 4 juv).

DISTRIBUTION.—Although this species is the most collected of the three species known to Japanese waters, the genus is relatively rare in Japan and is more typical of tropical shallow waters from which about 40 species have been described. This species was only known from Sagami Bay until recently when it was recorded from Korea (Kim and Hong, 1986:50), and herein from south of Sagami Bay in the shallows of Kii Strait. The greatest depth known for the species is 15 meters.

REMARKS.—The Goboh male is the first recorded for this species and the oviger has the seventh segment apophysis with 5–6 long setae. The apophysis is typical in the majority of male ovigers of the genus. The denticulate spines of the ninth and tenth segments are long, with 2–3 tiny lateral serrations per side, but with simple tips lacking any bifurcation. These spines on the majority of species in the genus are without lateral serrations. These characters will readily separate this species from its closest relation, *Tanystylum ulreungum* Kim (synonym = *T. nabetensis* Nakamura and Child), also found in Sagami Bay. Kim's species has the seventh oviger segment without a lateral apophysis and simple oviger terminal spines with bifurcate tips. The only other known member of the genus in Japanese waters is *T. grossiforum* Hilton (was *T. anthomasthi* Hedgpeth, new synonymy) known from Hokkaido. This latter species is larger and grossly setose with inflated leg segments. It has not been taken as far south as Sagami Bay.

Family PHOXICHILIDIIDAE Sars, 1891

Genus *Anoplodactylus* Wilson, 1878

Anoplodactylus carnatus Nakamura and Child

Anoplodactylus carnatus Nakamura and Child, 1983:42–44, fig. 14.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Aburat-subo, Miura Peninsula, 5 m, 10 Aug 1984 (3♂).

DISTRIBUTION.—This species is so far known only in Sagami Bay. The above specimens were taken across the Bay from the type locality at Nabeta Bay, but in much the same shallow depth.

REMARKS.—These three males differ only in small degrees from the type male; fewer setae on the legs of one specimen, slightly shorter tibiae on another, slightly shorter tubercles on the lateral processes, but the general characters are almost exactly the same as those of the type. This is apparently one of the localized endemics that appear to be more common for this genus than for many others.

Anoplodactylus crassus Nakamura and Child

Anoplodactylus viridintestinalis.—Kim, 1986:3–5, fig. 2.—Kim and Hong, 1986:44.—Hong and Kim, 1987:161.—Nakamura and Child, 1988b:812–813 [text], fig. 2a–f.

Anoplodactylus crassus Nakamura and Child, 1988b:810–813, fig. 1.

MATERIAL EXAMINED.—HONSHU: Shirahama, Izu Peninsula, Spring 1984 (3♂ with eggs, 1♀); (4♂ with eggs, 1♂, 1♀). Omaezaki, Shizuoka Prefecture, 18 May 1984 (1 juv, probably this species). Sagami Bay, Shimoda Marine Research Center overflow drain, 15 Oct 1980 (1♀).

DISTRIBUTION.—This species was taken in American Samoa (type locality) and has been found along the Korean coast (as *A. viridintestinalis*) in several shallow localities. These above records are the first from Japan and establish intermediate localities between Korea and Samoa. The species is well established on the Korean coast and at the above two localities in Japan. Cole's species has not been found in Asiatic waters.

REMARKS.—This species has many characters closely allied to those of *A. viridintestinalis*, both of which are compared and figured in Nakamura and Child, 1988b. The dimorphism between the trunks of the male and female is the most obvious shared character. The female trunk of both species has well-separated third and fourth lateral process pairs while those of the male are like the remaining pairs, well crowded together and in contact. Differences that do not need both species in hand for comparison are an abdomen carried in an almost horizontal position in *A. crassus*, large laterodistal tubercles on the first coxae, the sex pore tubercle on the second coxae is low and is much less than half as long as the segment diameter, and the chelifore scape usually has 2–3 low dorsal tubercles with setae.

Anoplodactylus erectus Cole

Anoplodactylus erectus Cole, 1904a:289–291, pl. 14: fig. 12, pl. 26: figs. 1–9.—Child, 1979:52–53 [literature].—Kim and Hong, 1986:41–42, fig. 5.—Hong and Kim, 1987:161.—Nakamura and Child, 1988b:813.

MATERIAL EXAMINED.—KYUSHU: Kohyaki Island, off Nagasaki, 7 m, 2 Oct 1985 (1♂). Amakusa Islands, Tomioka, 31 m, 7 Jul 1984 (1♂).

DISTRIBUTION.—This species has long been known from the Pacific coast of North America (Panama to Canada), is known from the Society Islands and Samoa, and has recently been found on the Korean coast. These are the first Japanese records for this wide-ranging species. It is known from shallow or intertidal depths to about 40 meters.

REMARKS.—There are apparently two forms of this species, at least in oriental collections. We re-examined Cole's type series (4♂ paratypes, USNM 81299, San Diego, Cal.) for purposes of comparison and found them to be what we call the "slender form" with longer appendages and longer lateral processes more separated than the "compact form." The latter form, figured by Kim and Hong (1986:42, fig. 5) has shorter lateral processes placed closer together and shorter appendages. The Nagasaki male above is the "slender form" while the Amakusa specimen is of the "compact form." We can find no appreciable differences in the principal diagnostic characters between the two species except these differences in appendage

length and the compact or slender trunk habitus. The femoral cement gland, a very reliable character in this genus, is almost exactly the same for both "forms," although the length of the tube varies slightly from specimen to specimen without relation to which form each belongs. We are calling those "forms" rather than separate species because there appears to be no way to separate the forms by use of the usual characters that separate one species from another in this sometimes difficult genus.

Anoplodactylus excelsus Nakamura and Child

Anoplodactylus excelsus Nakamura and Child, 1983:44-46, fig. 15.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 52-53 m, 9 Dec 1986 (1♀); 79-80 m, 9 Sep 1987 (1♂ with eggs, 1♂, 1♀). Off Kisami, 37-40 m, 23 Aug 1982 (1♀). Kii Strait, 33°23.9'N, 135°42.1'E, 353-416 m, KT84-12, sta 7, 31 Aug 1984 (1♂); 33°28.6'N, 135°28.9'E, 353-354 m, KT84-12, sta 15, 1 Sep 1984 (2♂).

DISTRIBUTION.—This species was described from specimens taken in Suruga and Sagami bays in 75-113 meters. The above specimens extend this distribution to the south in Kii Strait, and broaden the known depth range to 37-416 meters.

REMARKS.—There is some variation shown in the above specimens, particularly in the deeper-water males. The trunk sutures are complete between the first, second, and third segments while that between the third and fourth is only the hint of a suture. The ocular tubercle has a taller apical cone than those of the type and the male cement gland tube is slightly longer and placed more distally on the femur. The remaining characters agree very well with those of the type specimens. The single heel spine with a pair of smaller spines laterodistal to it are typical as are the characters of the long oviger and the very long delicate chelae fingers, which lack teeth.

This species is one of a group of closely related species of Japan, the relationships of which will be discussed and placed in the form of a key under the remarks section of *Anoplodactylus gestiens*, the first species of this group to be described.

Anoplodactylus gestiens (Ortmann)

Phoxichilidium gestiens Ortmann, 1890:166, pl. 24: figs. 8a-d.

Anoplodactylus gestiens.—Utinomi, 1971a:325-326 [literature].—Nakamura and Child, 1982:289-290 [text], fig. 4.—Child and Nakamura, 1982:292-296, fig. 1.—Nakamura and Child, 1983:46.—Nakamura, 1987:15-16, pl. 12.

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°41.8'N, 145°08.9'E, 400-479 m, KT83-11, sta B15, 11 Jul 1983 (2♂ with eggs, 1♂, 2♀). HONSHU: Sanriku-oki, E of Otsuchi, 39°11.4'N, 142°11.5'E, 430-435 m, KT84-9, sta SR4, 12 Jul 1984 (1♂, 1♀, 1 juv); 39°14.8'N, 142°10.3'E, 333-354 m, KT85-11, sta SR13, 14 Aug 1985 (1♂, 3♀). Sagami Bay, 35°00.9'N, 139°08.6'E, 113 m, 17 Jul 1969 (1♀). Suruga Bay, 34°45.4'N, 138°43.8'E, KT74-14, sta B3, 21 Sep 1974 (4♂, 1♀); 34°54.0'N, 138°43.7'E, 337-355 m, KT74-14, sta B8, 23 Sep 1974 (6♂); 34°59.6'N, 138°45.9'E, 126-135 m, KT83-18, sta SH-12, 13 Nov 1983 (3♀). Kii Strait, 33°24.3'N, 135°43.0'E, 293-335 m, KT84-12, sta 6, 30 Aug 1984 (1♀); 33°28.1'N, 135°28.5'E, 455-492 m, KT84-12, sta 16, 1 Sep 1984 (1♀).

DISTRIBUTION.—This frequently collected species is known only from the islands of Japan. It has a wide depth distribution, previously from the littoral to 300 meters, but with these records it is extended to 479 meters. The species has not previously been taken as far north as the above Akkeshi record, which points toward the species occupying both cold and warmer waters within and outside the Kuroshio Current zones.

REMARKS.—This species was the first described of a series of very similar species found in Japanese waters. The species are all slender and graceful with relatively long and well-separated lateral processes lacking any form of tubercles, long and slender chelae fingers, a single cement gland tube and very long third oviger segment in the males, and a long and slender propodus with heel and lamina. The five species, including *A. gestiens*, are best separated by use of an artificial key. Females of these species as well as most females of the genus are difficult or impossible to identify without accompanying males. The key therefore concentrates on male characters for the five species.

Key to Males of the *Anoplodactylus gestiens* Group in Japanese Waters

1. First tibia equal to or slightly shorter than femur length; chelae fingers without teeth but with setae; oviger third segment twice length of second or less, sixth segment at least half length of fifth; propodal lamina at least 0.3 sole length; leg span 20 mm or less 2
- First tibia longer than femur or second tibia; chelae fingers with few pointed teeth and many setae; oviger third segment almost 3 times length of second, sixth segment only 0.3 length of fifth; propodal lamina tiny, only about 0.1 sole length leg span about 28 mm *Anoplodactylus imperialis*
- 2(1). Cement gland an open tube; femur with distinctive distal downcurve; oviger terminal segment with row of lateral spines or setae; propodal lamina almost half sole length or longer 3

- Cement gland a low broad tube capped with sieve plate; femur without distinctive distal downcurve; oviger terminal segment with tuft of distal setae; propodal lamina 0.3 sole length *Anoplodactylus excelsus*
- 3(2). Propodal lamina half sole length or less; propodus with 1 heel spine and 2 lateral heel spines; oviger terminal segment 0.75 length of fifth or longer, both with row of long setae 4
 Propodal lamina about 0.75 sole length; propodus with 2 lateral heel spines only; oviger terminal segment half length of fifth, both with row of very short recurved spines *Anoplodactylus lineatus*, new species
- 4(3). Cement gland tube arising from tall triangular cone on distal third of femur, tube length equal to cone height; second tibia with many short lateral setae imparting hairy appearance; propodal lamina about half sole length distal to 9-10 sole spines *Anoplodactylus tanseii*, new species
 Cement gland tube arising from low acute triangular cone just distal to midfemur, tube longer than cone height; second tibia with few lateral setae; propodal lamina about 0.4 sole length distal to 12-13 sole spines
 *Anoplodactylus gestiens*

***Anoplodactylus hwanghaensis* Kim and Hong**

Anoplodactylus hwanghaensis Kim and Hong, 1986:41-44, fig. 6.—Hong and Kim, 1987:161.

MATERIAL EXAMINED.—HONSHU: Shirahama, Izu Peninsula, Spring, 1984 (2♂, 1♀); May 1984 (1♂ with eggs). Omaezaki, 5 May 1984 (1♀); 17 May 1984 (1♀, 2 juv); 18 May 1984 (1♀, 1 juv); spring 1984 (1♂ with eggs).

DISTRIBUTION.—This species was known only from the Korean coast in the Yellow Sea and is new to the Japanese east coast. The Korean depths are not given but the above Japanese records are all from "shallow (intertidal)" waters.

REMARKS.—This small round species is easily recognized by its crowded lateral processes, barrel-like proboscis, and very short neck. The cement gland, toward the proximal end of the femur, is a slightly raised pore without a tube or cone. Other species of *Anoplodactylus* in the Pacific are similar, but none have the matching set of characters of the crowded lateral processes, short neck, barrel proboscis, proximal cement gland along with different chelae, propodus, and oviger characters. The species is also very small with a leg span of about 7.3 mm.

***Anoplodactylus imperialis* Nakamura and Child**

Anoplodactylus species.—Nakamura and Child, 1983:54, fig. 18.
Anoplodactylus imperialis Nakamura and Child, 1986:895-897, fig. 3.—Nakamura, 1987:16, pl. 13.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 38-46 m, 6 Apr 1983 (1♂ juv); 40-50 m, (4 juv).

DISTRIBUTION.—This species is known only from Sagami Bay and may be endemic to central Honshu. The depth distribution is also fairly restricted, to 38-68 meters.

REMARKS.—This is one of the look-alike species of the *A. gestiens*-group, which is discussed at greater length under that species. A key to the group is also included under *A. gestiens* to

assist in differentiating the various Japanese species. This is the only species of the group in which the first tibiae are longer than either the second tibiae or the femorae, the chelae have endal teeth besides the universally present setae, and the propodal lamina is very short (0.1 of sole length).

***Anoplodactylus lagenus* Nakamura and Child**

Anoplodactylus lagenus Nakamura and Child, 1983:48-49, fig. 16.—Nakamura, 1987:17, pl. 14.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37-40 m, 23 Aug 1982 (1♂).

DISTRIBUTION.—This is another species known only in central Honshu, at Sagami Bay, a depth range of 30-94 meters.

REMARKS.—This species is characterized by having very setose appendages with short setae, a very long slender oviger, short chelae with no teeth, a bottle-shaped cement gland tube half as long as the segment diameter, and long tubercles on the femorae and first tibiae dorsodistal tips. The species also has a long sex pore tubercle in the male equal to the coxal length. There is no other known Asiatic species with these characters.

***Anoplodactylus lineatus*, new species**

FIGURE 10

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 79-80 m, 9 Sep 1987 (1♂, holotype. USNM 234475).

DESCRIPTION.—Size moderately small, leg span 12 mm. Trunk faintly segmented between first, second, and third segments, that between third and fourth lacking, trunk slender, neck very slender, about as wide as ocular tubercle diameter. Lateral processes long, almost 3 times maximum diameter, slender, separated by twice their diameters in anterior pairs, 1.5 times their diameters in posterior pairs, armed with 2 short

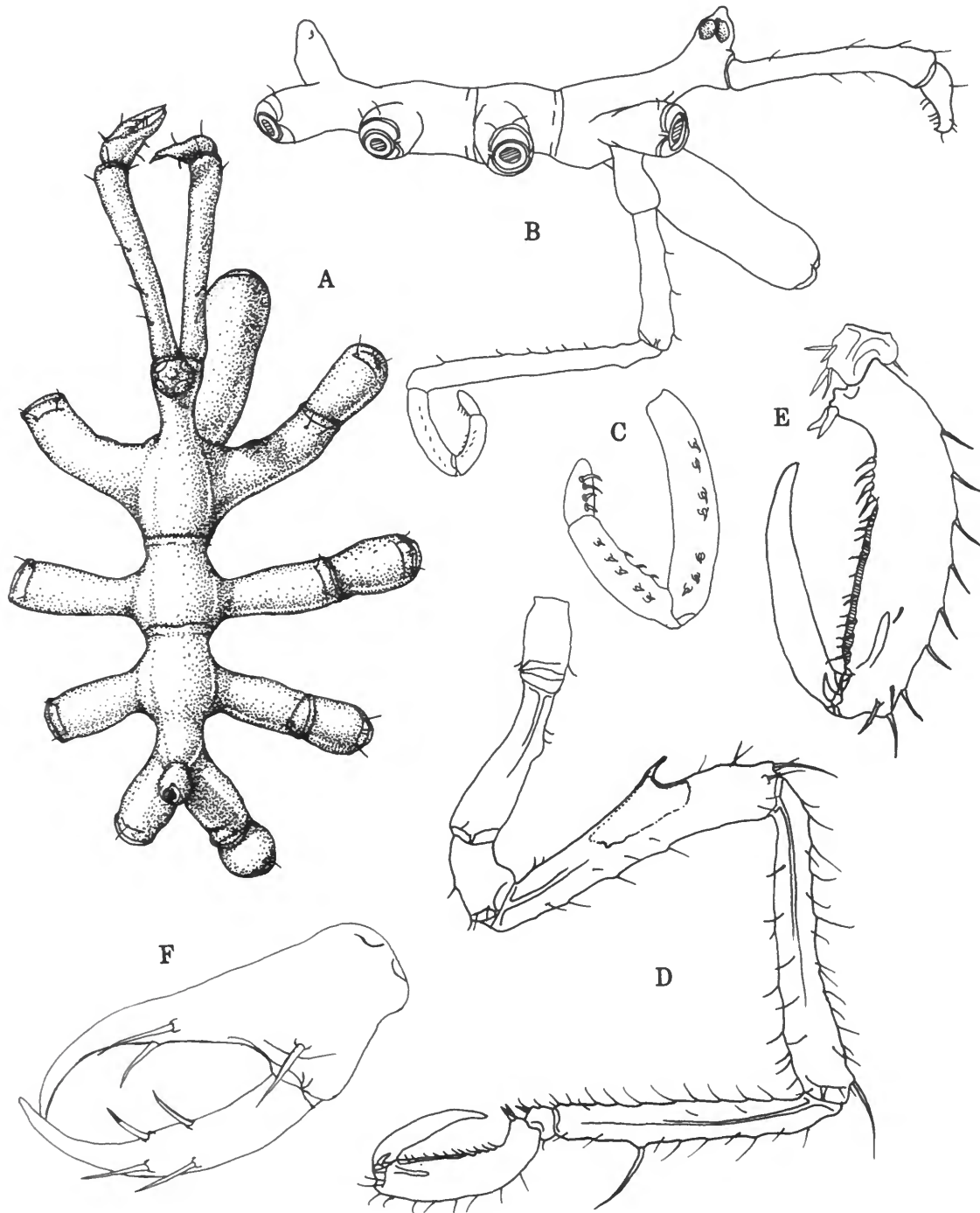


FIGURE 10.—*Anoplodactylus lineatus*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, oviger strigilis, enlarged; D, third leg; E, third leg terminal segments, enlarged; F, chela, enlarged.

dorsodistal setae. Ocular tubercle not taller than wide, eyes filling most of tubercle space except for small distal knob, eyes darkly pigmented. Abdomen only twice as long as wide, cylindrical proximally, tapering to blunt cone distally, armed with 2 laterodistal setae. Proboscis moderately slender, long, swollen at median length, oral surface rounded.

Chelifores long, slender, scape about 7 times longer than diameter, armed with few short dorsal and ventral setae. Chela fingers long, 1.5 times palm length, slender, well curved, crossing at tips, palm armed with 2-3 distal setae, immovable finger with 2 endolateral setae, movable finger slightly longer, with 5-6 endal and lateral setae, fingers without teeth. Ovigera moderately long, second segment 0.6 length of third, both armed with few setae. Fourth segment slightly longer than fifth and sixth combined. All 3 strigilis segments armed with 2-3 rows of short recurved spines except terminal segment with 4-5 short recurved spines in single row. Terminal segment a short inflated cone half length of fifth segment.

Legs moderately short, second coxae almost twice length of first or third coxae. Femur equal in length to first tibia, second tibia slightly shorter, tibiae armed with many short dorsal, lateral and ventral setae, femur with few short setae, major segments with single long dorsodistal seta each. Cement gland at middorsal segment length, tube emerging from low distal-pointing cone, tube slender, not as long as segment diameter. Tarsus very short, armed with 3-4 ventral setae and 1 short spine and short dorsal seta. Propodus slender, well curved proximally with marked heel bearing 2 short lateral spines. Sole with 4 proximal spines and very long lamina spanning 0.65 to 0.75 sole length, flanked by short setae. Few short setae on dorsal and distal surfaces. Claw long, almost 0.7 propodus length, curved distally, with very short slender auxiliary claws. Female characters unknown.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 1.6; trunk width (across 2nd lateral processes), 1.1; proboscis length, 0.79; abdomen length, 0.24; third leg, coxa 1, 0.31; coxa 2, 0.6; coxa 3, 0.28; femur, 1.09; tibia 1, 1.09; tibia 2, 0.97; tarsus, 0.12; propodus, 0.58; claw, 0.41.

DISTRIBUTION.—Known only from off Shimoda in Sagami Bay, in 79-80 meters.

ETYMOLOGY.—The species name is from the Latin *lineatus* (a line or row) and refers to the linear arrangement of recurved spines on the oviger terminal segments.

REMARKS.—This is one of a very closely related group of species, the *A. gestiens*-group (differentiated by the key under *A. gestiens* in this section), which have slender trunks and lateral processes, long chelifores with slender setose fingers, and relatively long oviger segments when compared with many species of this genus. The features in the male that separate this new species from others are its long propodal lamina, slender cement gland tube, only two propodal heel spines arranged laterally, and the rows of short recurved spines on the oviger terminal segment. These differences are sometimes subtle and

may not always be invariable, but the cement gland character has proved to be one of the most reliable characters in this difficult genus with species now numbering almost one hundred. Another usually reliable character is the propodal lamina, which is not known to undergo much variation among specimens of the same species. The lamina of this new species is longer than that of any other species of the *A. gestiens*-group and provides another in the few available recognition characters for this species. The female lamina is unknown for the species but is usually a slightly different length than that of the male. It could be predicted that the female lamina will be found to be as long as or longer than that of the male.

Anoplodactylus mamillosus Stock

Anoplodactylus mamillosus Stock, 1954b:72-74, figs. 31c-e, 32.—Utinomi, 1971a:327.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Misaki, Miura Peninsula, 96 m, 10 Jul 1985 (1♂, 1♀); 110-122 m, 10 Jul 1985 (1♂ with eggs, 2♀).

DISTRIBUTION.—This species was described from specimens taken in the Sagami Sea from 549-732 meters. Utinomi's single female from the Inland Sea in 2 meters we regard as doubtful, although his description agrees in several characters with Stock's species. Females, of course, are difficult or impossible to identify without accompanying males in this genus and this, combined with the extraordinarily shallow depth of his specimen, makes this identification questionable. The above new records do not extend the known range of this species, but decrease its depth to 96 meters with a maximum known depth of 732 meters.

REMARKS.—This seldom-taken species has very characteristic dorsodistal tubercles on the lateral processes and first and second coxae, and a proboscis with ventrolateral bulges. The chelifore scapes show variation from Stock's type figures in having the low tubercles in different places and they are sometimes less conspicuous. The very long propodal claw and lamina are other stable recognition characters as are the small toothless chelae. The oviger has segments not as progressively reduced in diameter along the appendage as are apparent in Stock's (1954b, fig. 32f) type figure. Segments 2, 3, and 4 have almost the same diameter in these Misaki specimens, but otherwise agree very well with the type description and figures.

Anoplodactylus perforatus Nakamura and Child

Anoplodactylus perforatus Nakamura and Child, 1982:289-291, fig. 3; 1983:49; 1988a:663; 1988b:814.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 40 m, 6 Apr 1982 (6 juv); 27-80 m, 9 Sep 1987 (1♂ with eggs, 1♂, 3♀). Off Kisami, 30-42 m, 5 Apr 1983 (5 juv); 20-42 m, various dates (3♂ with eggs, 14♂, 22♀, 11 juv). Nabeta Bay, 10 m, 9 Sep 1982 (1♂); 7-16 m, various dates (6♂ with eggs, 5♂, 18♀, 11 juv). KYUSHU: Amakusa

Islands, off Tomioka, 11–12 m, 1 Jun 1984 (2♂, 2♀); 5 Jul 1984 (3♂ with eggs, 2♂, 5♀). Kohyaki Island, off Nagasaki, 7 m, 2 Oct 1985 (4♂ with eggs, 3♂, 3♀, 10 juv).

DISTRIBUTION.—This species was described from specimens taken in Sagami Bay in shallow waters (7–113 m), but has since been found in Samoa and the Ryukyu Islands, also in shallow localities. The above Nagasaki records extend the Japanese home islands records from Sagami Bay westward to western Kyushu, but none of these records extend the known depth range for the species.

REMARKS.—This very commonly collected (in Sagami Bay) species is easily recognized, at least in the male, by many tiny dorsal cement gland pores on each femur and the very long slender oviger, notably longer than the trunk. The species also has unusually long chelifores, chelae with long slender fingers without teeth, and a long propodus with a very tiny lamina.

Anoplodactylus pycnosoma (Helfer)

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

Anoplodactylus pycnosoma.—Stock, 1953a:41, fig. 5.—Nakamura and Child, 1983:50 [literature].—Child, 1983:708.—Hong and Kim, 1987:161.—Child, 1988a:20.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Shirahama, Izu Peninsula, spring 1984 (2♂ with eggs, 3♂, 1♀); autumn 1984 (1♂). Off Misaki, 110–122 m, 10 Jul 1985 (1♀). Wakayama Prefecture, Goboh, 1.5 m, Feb 1981 (1♂ with eggs, 1♀); 5 m, (1♀ juv).

DISTRIBUTION.—This species has been taken from the western Indian Ocean to Japan and in several scattered places between these localities in shallow and littoral depths.

REMARKS.—These specimens conform very well with the figures of the types as refigured by Stock (1953a:41, fig. 5). The multiple cement gland slits on each femur are useful good male characters.

Anoplodactylus shimodaensis Nakamura and Child

Anoplodactylus shimodaensis Nakamura and Child, 1982:285–287, fig. 2, 1983:50.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisanami, 30 m, 16 May 1971 (2♂ with eggs, 1♀).

DISTRIBUTION.—This is another species with a very narrow known distribution: from several places just off the Izu Peninsula in 30–40 meters. It probably is an east coast Japanese endemic.

REMARKS.—The placement of the cement gland tube almost at the distal tip of the femur is a good recognition character in males of this species. Other useful characters are the lengthy lamina along most of the propodal sole, the relatively long lateral processes in relation to the shortness of the trunk segments, and the tiny toothless chelae. The ocular tubercle is slightly club-shaped, being widest at the distal eye level.

Anoplodactylus tansiei, new species

FIGURE 11

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (1♂, holotype, USNM 234476), 15♂, 19♀, 2 juv, 1 mixed sex, paratypes, USNM 234477); 33°24.3'N, 135°43.0'E, 293–335 m, KT84-12, sta 6, 30 Aug 1984 (1♀, paratype, USNM 234478); 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (30♂, 29♀, 4 juv, paratypes, USNM 234479); 33°28.1'N, 135°28.5'E, 455–492 m, KT84-12, sta 16, 1 Sep 1984 (2♀, paratypes, USNM 234480).

OTHER MATERIAL.—HONSHU: Suruga Bay, 35°03.7'N, 138°49.2'E, 123–134 m, KT73-6, sta A, 11 Jun 1974 (1♂, 1♀); 35°04.0'N, 138°47.4'E, 211–282 m, KT73-6, sta B, 11 Jun 1973 (1♂, 2♀, 1 juv); 34°46.4'N, 138°47.4'E, 306–317 m, KT 73-6, sta D-1, 10 Jun 1973 (126 specimens); 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (92 specimens); 34°45.7'N, 138°42.3'E, 312–328 m, KT74-14, sta B4, 23 Sep 1974 (18♂, 12♀); 34°54.0'N, 138°43.7'E, 337–355 m, KT74-14, sta B8, 23 Sep 1974 (19♂, 20♀, 3 juv); 290–305 m, KT75-15, sta 03, 19 Nov 1975 (13♂, 9♀); 34°45.9'N, 138°42.7'E, 262–290 m, KT76-3, sta 006, 28 Feb 1976 (1♂, 1♀); 34°59.6'N, 138°45.9'E, 126–135 m, KT83-18, sta H12, 13 Nov 1983 (1♂). Sanriku-oki, off Otsuchi, 39°13.3'N, 142°16.2'E, 562–563 m, KT85-11, sta SR15, 14 Aug 1985 (1♂).

DESCRIPTION.—Size moderate, leg span 17.3 mm. Trunk slender, elongate, first-second and second-third segmentation lines clear, third-fourth line incomplete. Lateral processes slender, over twice longer than their diameters, anterior pairs separated by about 2.5 times their diameters, posterior pairs separated by about twice their diameters, armed with 2–3 short dorsodistal setae and single short seta more proximal to distal rim. Neck very slender, minimum diameter not wider than ocular tubercle. Ocular tubercle slightly over twice longer than its diameter, eyes distal, slightly pigmented, capped by tiny cone at apex. Abdomen slender, tapering from base, armed with 3–4 lateral and dorsal setae. Proboscis long, slender, swollen at median length, lips rounded.

Chelifores long, very slender, scape over 6 times longer than maximum diameter, armed with few short dorsal and lateral setae. Chela long, fingers almost twice length of palm. Palm and immovable finger armed with row of setae extending along half length of finger, movable finger armed with few lateral and ectal setae at midlength, both without teeth, well curved, overlap at tips.

Ovigers long, slender, second segment slightly over half length to third, third armed with few ectal short setae. Fourth segment of strigilis 0.2 longer than combined length of fifth and sixth, all distal segments armed with row of setae longer than segment diameters, fifth with an additional row of short lateral recurved spines. Terminal segment about 0.7 length of fifth, both cylindrical.

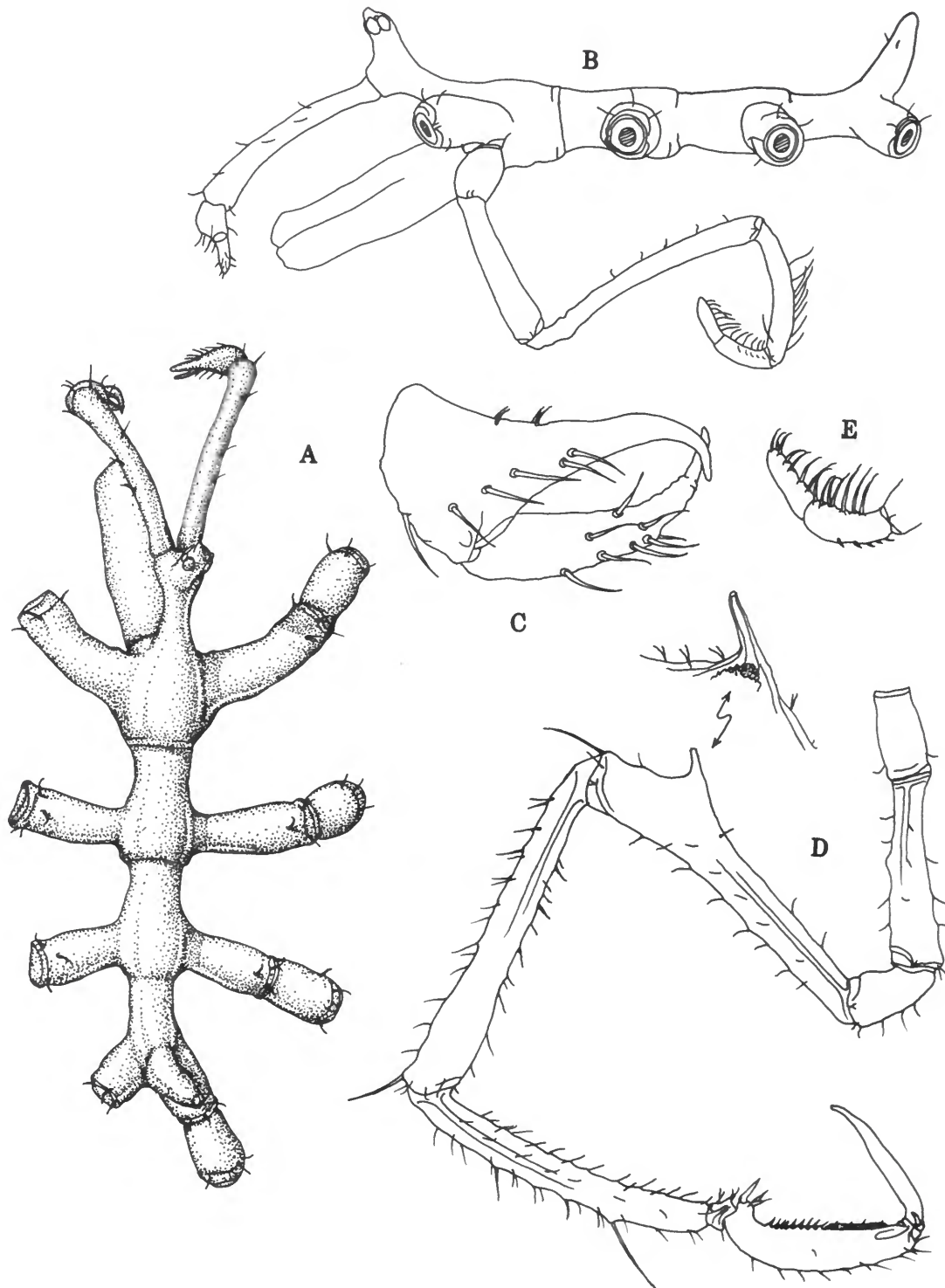


FIGURE 11.—*Anoplodactylus tansiei*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, oviger strigilis, enlarged; D, third leg, with cement gland tube, enlarged; E, chela, enlarged.

Legs long and slender, femur the longest segment with tibiae 1 and 2 each respectively shorter. Second coxa longer than twice length of either first or third, armed with few short setae each. Femur with few short lateral and ventral setae with 3–4 dorsally. Cement gland placed about 0.75 of dorsal length, with tall cone bearing slender tube not as long as segment diameter. Tibiae armed with many short dorsal and ventral setae, tibia 2 with a lateral row. Tarsus very short, armed with 4–5 ventral setae and single dorsal seta. Propodus long, with marked heel bearing 1 major spine and 2 lateral shorter spines distally. Sole with 9–10 short spines proximally and long distal lamina over half sole length. Claw very long, only slightly curved, almost 0.8 propodal length, auxiliaries tiny.

Female slightly larger, typically with slightly inflated femorae.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 2.0; trunk width (across 2nd lateral processes), 1.39; proboscis length, 1.14; abdomen length, 0.42; third leg, coxa 1, 0.41; coxa 2, 0.85; coxa 3, 0.39; femur, 1.61; tibia 1, 1.59; tibia 2, 1.41; tarsus, 0.14; propodus, 0.88; claw, 0.69.

DISTRIBUTION.—Known from the type locality, Kii Strait, in 293–416 m, and from Sanriku-oki and Suruga Bay, in 262–563 meters.

ETYMOLOGY.—The name *tansei* is Japanese (a light blue color, the school color of the University of Tokyo) and refers to the research vessel *Tansei Maru*, from which many of the species in this report were collected.

REMARKS.—There are sufficient specimens in this material to discern a degree of variation in the ocular tubercle height and femoral cement gland placement. The ocular tubercle tip varies from a rounded cap just above the eyes to a long slender cone with eyes at less than half its length. The eyes of all specimens examined remain the same distance above the tubercle base but the cap varies in length distal to the eyes. The cement gland tube and cone is variously placed nearer or farther toward the femoral tip, but the length of cone and tube do not vary in the specimens examined.

This is another of the *A. gestiens*-group of very similar Japanese species. As can be seen from the key to this group (see under *A. gestiens*), this species can be identified by the tall cement gland cone placed distally on the femur of the male, the "hairy" second tibiae, and its propodal lamina of about half the sole length. This combination of characters is not found any other members of the *A. gestiens*-group nor is it known for any other long slender *Anoplodactylus* species. The variations in the apex character of the ocular tubercle height offer confusion but the finely tapered abdomen in combination with the above characters should allow identification of at least males of the species without difficulty. Many specimens of this new species, when first examined, appeared to be *A. gestiens*, but were eventually separated by use of the above characters. It is probable that many specimens reported in the past as *A. gestiens* are this species, as it is apparently very common in the localities where it is found.

Anoplodactylus tubiferus (Haswell)

Phoxichilidium tubiferum Haswell, 1885:1032, pl. 57: figs. 1–5.

Anoplodactylus tubiferus.—Cole, 1904a:288.—Staples, 1982:457–459, fig. 2C–F [literature].

Anoplodactylus pulcher Carpenter, 1907:97–98, pl. 12: figs. 13–19.—Nakamura and Child, 1983:49.

Anoplodactylus stylops Loman, 1908:71, pl. 11: figs. 20–24.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37–41 m, 27 Jul 1982 (3♂, 5♀, 1 juv); 37–45 m, 23 Aug 1982 (2♂, 1♀); 30–42 m, 5 Apr 1983 (2 juv). Nabeta Bay, 10–16 m, 24 Aug 1982 (1 juv). Off Misaki, 53 m, 11 Apr 1986 (1♀). Mouth of Shimoda Bay, 38–50 m, 6 Apr 1983 (2♂, 1 juv).

DISTRIBUTION.—This species has a wide distribution (under various names) in the Persian Gulf, Indian Ocean, and South Pacific, but was first recorded from Japan in 1983 (Nakamura and Child). Its known depth records are from subtidal to 135 meters to which the above additional records add nothing new.

REMARKS.—This species has very long spines distally on each lateral process, a long ocular tubercle and abdomen, and a very elongate cement gland tube in the male. A key to many Japanese species of this genus is given by Nakamura and Child (1983:41–42).

Anoplodactylus velamellus, new species

FIGURE 12

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 50–60 m, 11 Apr 1982 (1♂, holotype, USNM 234481).

DESCRIPTION.—Size moderately small, leg span 7.9 mm. First 2 trunk segmentation lines complete, third incomplete, slightly evident laterally. Lateral processes not much longer than their diameters, longest pair anteriorly, increasingly shorter toward posterior, separated by their diameters or less, armed with pair of dorsodistal short setae except glabrous posterior pair. Ocular tubercle twice length of basal width, eyes placed proximally, darkly pigmented, apex with conical tubercle slightly longer than basal diameter. Proboscis short, cylindrical, slightly inflated distally, lips prominent, inflated. Abdomen as tall as ocular tubercle, tapering at tip, armed with pair of short laterodistal setae.

Chelifore scapes short, less than proboscis length, armed with low blunt dorsodistal tubercle, few dorsal and distal setae. Chela small, palm as long as fingers, with few distal setae. Movable finger with 3–4 ectal short setae, 2 sharp endal teeth, immovable finger with 1 sharp endal tooth, no setae. Fingers moderately curved, overlap at tips.

Ovigers short, second and fourth segments subequal, third 1.6 times length of second, all armed with few lateral short setae. Fifth segment slightly shorter than fourth, armed with 10–11 short recurved spines. Sixth segment a tiny cone about 0.3 length of fifth segment, armed with 2–3 endal short recurved spines.

Legs moderately short, armed with sparse short setae, longer

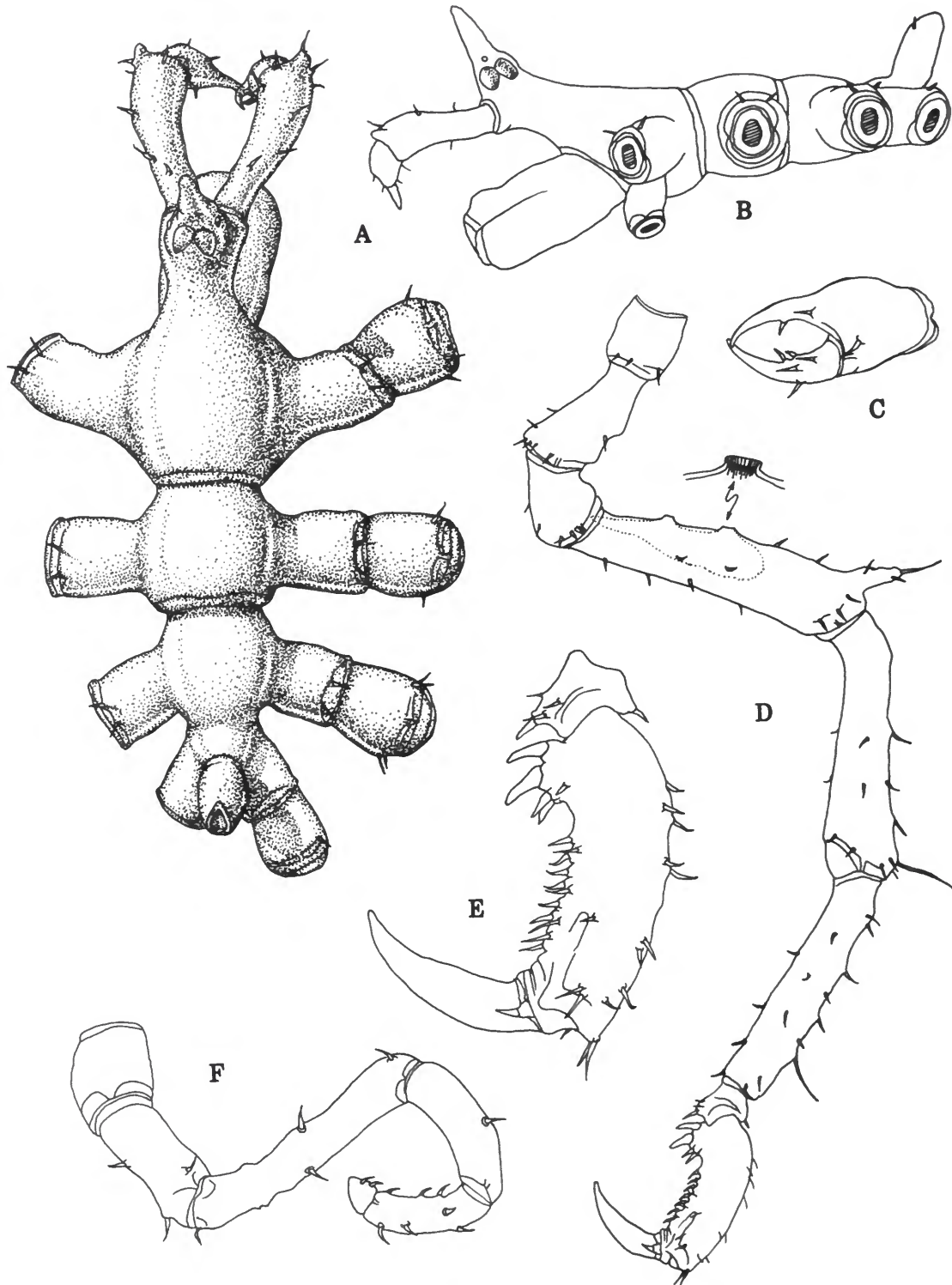


FIGURE 12.—*Anoplodactylus velamellus*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, oviger; D, third leg, with one cement gland pore enlarged; E, third leg, terminal segments, enlarged; F, chela, enlarged.

dorsodistal seta on major segments. Second coxa 1.7 length of first, third slightly longer than first, all armed with few short lateral and ventral setae. Femur longest segment with first tibia slightly longer than second. Femur with dorsodistal tubercle as long as minimum segment diameter, pointing distally. Cement gland with 2 slightly raised cribriform cups placed in proximal half of segment. Tarsus very short, armed with single ventral spine and few lateral setae. Propodus robust, well curved, with low heel bearing 2 short broad spines and 2 slender spines distally. Sole with 8–9 low broad spines, several lateral setae, without distal lamina. Claw broad, well curved, 0.6 propodal length, auxiliaries tiny.

Female characters unknown.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 1.18; trunk width (across 1st lateral processes), 0.73; proboscis length, 0.46; abdomen length, 0.25; third leg, coxa 1, 0.19; coxa 2, 0.32; coxa 3, 0.24; femur, 0.78; tibia 1, 0.68; tibia 2, 0.62; tarsus, 0.1; propodus, 0.41; claw, 0.25.

DISTRIBUTION.—Known only from its type locality, off Kisami in Sagami Bay, in 50–60 meters.

ETYMOLOGY.—The species name is from the Latin prefix *ve* (without) plus *lamella*, diminutive for *lamina* (a thin plate or blade) and refers to the lack of a propodal lamina in this species.

REMARKS.—This new species has similarities to three other Pacific species with multiple cement gland orifices: *Anoplodactylus longiceps* Stock, *A. longiformis* Child, and *A. stellatus* Nakamura and Child. With *A. longiceps* (synonym = *A. longicollis* Williams, preoccupied), the new species shares a tall conical ocular tubercle, a short oviger in relation to the trunk, a small dorsodistal scape tubercle, a longer dorsodistal femoral tubercle, and two cribriform cement gland pores. It is perhaps closest to *A. longiceps*, but differs in having a much shorter trunk lacking complete segmentation, relatively shorter appendages, chelifore fingers with teeth, and a propodus with two heel spines and a propodal sole without a lamina. The first tibiae of *A. longiceps* have a low dorsodistal tubercle while the tibiae of new species lack this character.

Most of the same characters apply for *A. longiformis* (the longer trunk and appendages, the femur and first tibia tubercles, 8–10 cribriform cement gland cups rather than only two), but this species and the new one share the tall ocular tubercle cone, a dorsodistal femur tubercle, and two heel spines, while *A. longiformis* has a short propodal lamina.

Anoplodactylus stellatus is another closely related species, but it has three cement gland pores, long setose lateral tubercles on the femur, and a peculiar trituberculate process distally on the proboscis. It shares with *A. velamellus* the ocular tubercle cone, dorsodistal scape tubercle, dorsodistal femur tubercle, short oviger segments, chela finger teeth, two heel spines, and lack of a propodal lamina.

The new species has no characters that are unique, but the combination of characters is like no other species.

Anoplodactylus species indeterminate

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Nabeta Bay, 7–15 m, 11 Aug 1978 (1♀). Chiba Prefecture, Kominato, night, surface tow-net, 15 Aug 1984 (1 juv). KYUSHU: Kohyaki Island, off Nagasaki, 5–10 m, 29 May 1987 (1 larva).

REMARKS.—Females and young of this genus are nearly impossible to determine without accompanying males.

Genus *Phoxichilidium* Milne Edwards, 1840

Phoxichilidium parvum Hilton

Phoxichilidium parvum Hilton, 1939a:28.—Hedgpeth, 1941:257 [key].—Hilton, 1942c:71–72.—Child, 1975b:205, fig. 6a.

Phoxichilidium hokkaidoensis Utinomi, 1954:4–7, figs. 2–3, pl. I: fig. 1; 1965:335, fig. 18.

Anoplodactylus hokkaidoensis.—Utinomi, 1971a:326.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (1♂, damaged).

DISTRIBUTION.—This species was described from California specimens, presumably from shallow or intertidal waters. Utinomi (1954:4–7) described a new species from Hokkaido, which, from his figures in comparison with Hilton's types, is also Hilton's species. Utinomi's specimens were from shallow-water hydroids. The Suruga Bay male is from very much deeper water. If, indeed, these specimens are all the same species, it has a very scattered distribution and wide depth range.

REMARKS.—This specimen has a black integument rendering it impervious to light and impossible to see details other than outlines of the trunk and appendage shape. The specimen has more similarities to the figures given by Utinomi for his Hokkaido specimens than to the type specimens of Hilton's. The propodus of this specimen is similar to Utinomi's figure 3C, except that this male has only one heel spine. The Suruga Bay specimen is without chelifores except for torn stumps, but the oviger has five segments and matches Utinomi's figure 2H. The general trunk habitus, ocular tubercle, and abdomen agree very well with Utinomi's figures. The similarities are sufficient to tentatively assign this specimen to *P. parvum* until other specimens are collected to clarify these differences. This species is very much smaller than *P. ungelatum* Hedgpeth.

Phoxichilidium ungelatum Hedgpeth

Phoxichilidium ungelatum Hedgpeth, 1949:281–283, fig. 38.—Stock, 1954b:71.—Utinomi, 1955:22, fig. 12; 1971a:325.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, 34°40.4'N, 139°15.0'E, 410–440 m, KH78-5, sta BS8, 9 Dec 1978 (1♀). Sanriku-oki, E of Otsuchi, 39°16.5'N, 142°09.4'E, 288–300 m, KT84-9, sta SR3, 12 Jul 1984 (1♂); 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (2♂).

Kii Strait, 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀). HOKKAIDO: E of Akkeshi Bay, 42°41.8'N, 145°08.9'E, 400–479 m, KT83-11, sta B15, 11 Jul 1983 (1 juv). HONSHU: Toyama Bay, off Tomari, 160–180 m, 18 Jan 1985 (1♂ with eggs, 1♂, 1♀).

DISTRIBUTION.—This species is widely distributed around Japan on both coasts with a depth range from 0 to 5 meters in plankton tows to the above depth of 479 meters. It has not been found outside Japanese waters.

REMARKS.—This is a very large species in relation to others of the genus and its legs are longer and more slender. It lacks the long chelae finger teeth of *P. horribilis* Hedgpeth.

Family ENDEIDAE Norman

Genus *Endeis* Philippi, 1843

Endeis nodosa Hilton

Endeis (Phoxichilus) nodosa Hilton, 1942d:47–48, fig. 4.

Endeis nodosa.—Stock, 1968b:59 [key].—Child, 1982b:275–277, fig. 2g–i.—Nakamura and Child, 1988a:663–664.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, Nabeta Bay, 7–15 m, 11 Aug 1978 (1♂, 2♀, 3 juv); 10–16 m, 24 Aug 1982 (1♂, 3 juv). Off Kisami, 37–41 m, 27 Jul 1982 (10 juv); 40–45 m, 23 Aug 1982 (1 juv); 20–21 m, 24 Aug 1982 (6 juv); 18–28 m, 24 Aug 1982 (1♂, 3♀ 4 juv); 26–35 m, 24 Aug 1982 (2♂, 2♀, 3 juv).

DISTRIBUTION.—This member of a difficult genus to separate into species is known only from Hawaii and from Enewetak in the Marshall Islands, and is recently recorded from the Ryukyu Islands. It has been taken in littoral situations, and the above depth of 45 meters is its deepest recorded capture.

REMARKS.—These specimens all have the typical gut diverticula pockets or caecae and the broad low tubercle or swelling on the ventral femur, which, in combination, prevent the species from being confused with other known *Endeis* species. The other known Japanese species, *E. mollis* (Carpenter) and *E. meridionalis* (Böhm), are listed frequently in reports of Japanese pycnogonids, but this species is recorded here for the first time from the main Japanese islands. Neither of the other species was taken during the course of specimen collection for this paper.

Family AUSTRODECIDAE Stock

Genus *Austrodecus* Hodgson, 1907

Austrodecus tubiferum Stock

Austrodecus tubiferum Stock, 1957c:75–77, fig. 43.—Nakamura and Child, 1988a:669.

Austrodecus gordonae Stock, 1954b [part]:153, fig. 76e.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, NE of Shimoda, 34°40.8'N, 139°00.8'E, 11 Nov 1981 (1♀). Off

Kisami, 37–40 m, 23 Aug 1982 (1♀). Off Misaki, Miura Peninsula, 110–122 m, 10 Jul 1985 (1♀).

DISTRIBUTION.—This species was known only from Sagami Bay until it was found in the Ryukyu Islands at Okinawa. The above specimen from Kisami adds a shallower depth record, making the known depth range 37–187 meters.

REMARKS.—This is the only species of a genus of extremely tiny pycnogonids to occur in Japanese waters, as far as is known. It is readily separated from all other Japanese pycnogonids by its tiny size (leg span, 3–4 mm), and its long tubular proboscis having many segmentation lines.

Family CALLIPALLENIDAE Hilton

Genus *Anoropallene* Stock, 1956

Anoropallene laysani Child

Anoropallene laysani Child, 1972:147–150, fig. 1.—Nakamura and Child, 1983:57.—Nakamura, 1987:8–9, pl. 6: figs. 4–10.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 20–21 m, 24 Aug 1982 (1♀).

DISTRIBUTION.—The type of this species was taken off Laysan Island in the Hawaiian Islands in 80 meters. It was subsequently found off Shimoda, near Kisami in 30 meters. The above record reduces the known depth range to 20 meters, but adds nothing to the known range.

REMARKS.—This is the first female (and third specimen) of this species to be taken and it adds little to the diagnosis of this species except for the lack of palps in the female and its slightly larger size. The tubercles of the male are slightly smaller in the female and the oviger, particularly in the fifth segment, is slightly reduced in size.

This species is the only one of the genus *Anoropallene* to be found in Asiatic waters. It is diagnosed as having 4-segmented palps in the male only, 9-segmented oviger lacking a terminal claw but with a full strigilis having denticulate spines, and a propodus with auxiliary claws. It is a difficult genus to diagnose, as are several in the Callipenidae, because other genera are very similar. The genus *Oropallene* has species with both oviger terminal claw and auxiliary claws, but *Anoropallene* lacks these, except for *A. laysani*, which, with auxiliaries, is intermediate between the two genera. This enigma has not been resolved with capture of more specimens, but it has been noted (Nakamura and Child, 1983:53) that auxiliary claw presence or absence is not as valid a diagnostic character as is the presence or absence of an oviger terminal claw.

Genus *Callipallene* Flynn, 1929

Callipallene amaxana (Ohshima)

Pallene amaxana Ohshima, 1933d:216–219, figs. 8–12; 1936:863.

Callipallene phantoma amaxana.—Utinomi, 1971a:322–323 [literature].

Callipallene amaxana.—Stock, 1954b:37 [text].—Nakamura and Child,

1983:58 [key].—Kim, 1986:1, fig. 1.—Kim and Hong, 1986:38.—Hong and Kim, 1987:153.

MATERIAL EXAMINED.—KYUSHU: W of Goto Islands, 32°36.7'N, 127°42.8'E, 145 m, 17 Jun 1964 (1♂).

DISTRIBUTION.—The Straits of Malacca is the southernmost record for this species, but it is more commonly found around the southern half of Japan and along the Korean coast. It has been taken at night in pelagic tow-nets and as deep as 160 meters in Sagami Bay. It has not been taken in benthic littoral collections except for one record of 4 meters listed by Utiinomi (Utiinomi, 1971a:323).

REMARKS.—Ohshima's species is known mainly for its excessively long neck and its very long legs, in particular, the second coxae.

Callipallene bullata, new species

FIGURE 13A-F

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37–41 m, 27 Jul 1982 (1♂, holotype, USNM 234482).

DESCRIPTION.—Size moderately small, leg span 21 mm. Trunk moderately long, completely segmented, lateral processes 1.5 times longer than their diameters or less, separated by little more than their diameters distally, glabrous. Neck moderately long, proximal section as long as distal crop area (anterior area of chelifore-proboscis expansion), crop armed with 3 to 4 distal setae around chelifore insertion. Ovipiger implantation almost against first lateral processes. Ocular tubercle low, eyes large, lightly pigmented, lateral papillae prominent, tubercle capped with slender cone slightly taller than ocular area, carried obliquely anterior. Proboscis moderately long for genus, broadest at base, with proximal constriction and inflated area distally, tapering distally to round mouth having small lips. Abdomen short, erect, slightly inflated, armed with pair of dorsodistal setae.

Chelifores robust, very setose, scape only slightly longer than chelae, scape armed with several midlateral and distal setae, some longer than segment diameter. Chelae palm subrectangular, longer than fingers, armed with many short lateral and dorsal setae. Fingers of equal length, straight, with slightly serrate edge on movable finger, serrate distal edge and toothed proximal edge on immovable finger. Teeth low, round.

Ovipigers lightly setose. First 2 segments very short, third and fourth combined as long as fifth. Fifth with distal tall apophysis almost as long as segment diameter, armed with 3 setae longer than apophysis. Strigilis segments armed with homogeneous spines bearing tiny serrations over entire rim. Spines arranged in single row in the formula 11 : 9 : 8 : 8.

Legs moderately long, increasingly setose distally, second tibiae very long. Second coxae long, 4 times length of first coxae, both armed with pair of long stout setae laterally and few short setae distally. Femorae and first tibiae with conspicuous bulges at 0.3 and 0.6 their lengths and inflated distally, bulges

each bearing row of lateral setae, some longer than segment diameter. Both segments with long dorsodistal setae. Second tibiae with many short setae and few longer dorsal setae. Tarsus very short, with single ventral spine. Propodus small, moderately short, slightly curved, armed with 5 heel spines in 2 rows, 9–10 short sole spines, several short dorsal setae, and many longer distal setae. Claw short, robust, auxiliary claws about 0.7 main claw length. Cement gland pores not found.

Female characters unknown.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 2.01; trunk width (across 2nd lateral processes), 0.86; proboscis length, 0.75; abdomen length, 0.25; third leg, coxa 1, 0.29; coxa 2, 1.16; coxa 3, 0.45; femur, 2.21; tibia 1, 1.98; tibia 2, 3.03; tarsus, 0.1; propodus, 0.58; claw, 0.27.

DISTRIBUTION.—Known only from the type locality, off Kisami in Sagami Bay, in 37 to 41 meters.

ETYMOLOGY.—The species name is from the Latin *bullata*, diminutive of *bulla* (a bubble, knob, or boss) and refers to the prominent bulges of the femorae and first tibiae.

REMARKS.—This species is probably closest to *Callipallene emaciata* subspecies Stock (1954b:46–48, figs. 19h–i, 20c–e), from New Zealand. The two species share the femur and tibia bulges, the general trunk habitus similarities, very similar chelae, and matching terminal leg segments. The differences are that this new species has a much longer apical cone on the ocular tubercle, a differently shaped proboscis with round distal corners rather than a constricted oral area, larger and much setose leg bulges, a half-again larger size, a longer second coxa in relation to the first and third, a much longer second tibia in relation to the first, and generally many more setae on the legs.

The new species has some characters of the Japanese species *C. amaxana* Ohshima. The slight leg bulges, ocular tubercle cone, long coxae and second tibiae, and propodus habitus are similar, but the neck of *C. amaxana* is much longer in most cases than that of the new species, and the legs are much less setose than Ohshima's species. The chelae of *C. amaxana* have distinct teeth while the few teeth on the immovable finger of the new species are indistinct. Ohshima described his species as being without eyes, but subsequent captures of the same species show that it has eyes that may be indistinct. This species does not have the pectinate auxiliary claws as found by Stock (1968b:37–38, fig. 14a–d) on his specimens described as a subspecies.

Callipallene cuspidata Stock

Callipallene cuspidata Stock, 1954b:37–39, fig. 15.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°46.4'N, 138°47.4'E, 306–317 m, KT73-6, sta D-1, 10 Jun 1973 (1♂ with eggs, 1♀, 1 juv); 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (1♂, 1♀). Kii Strait, 33°24.3'N, 135°43.0'E, 293–335 m, KT84-12, sta 6, 30 Aug

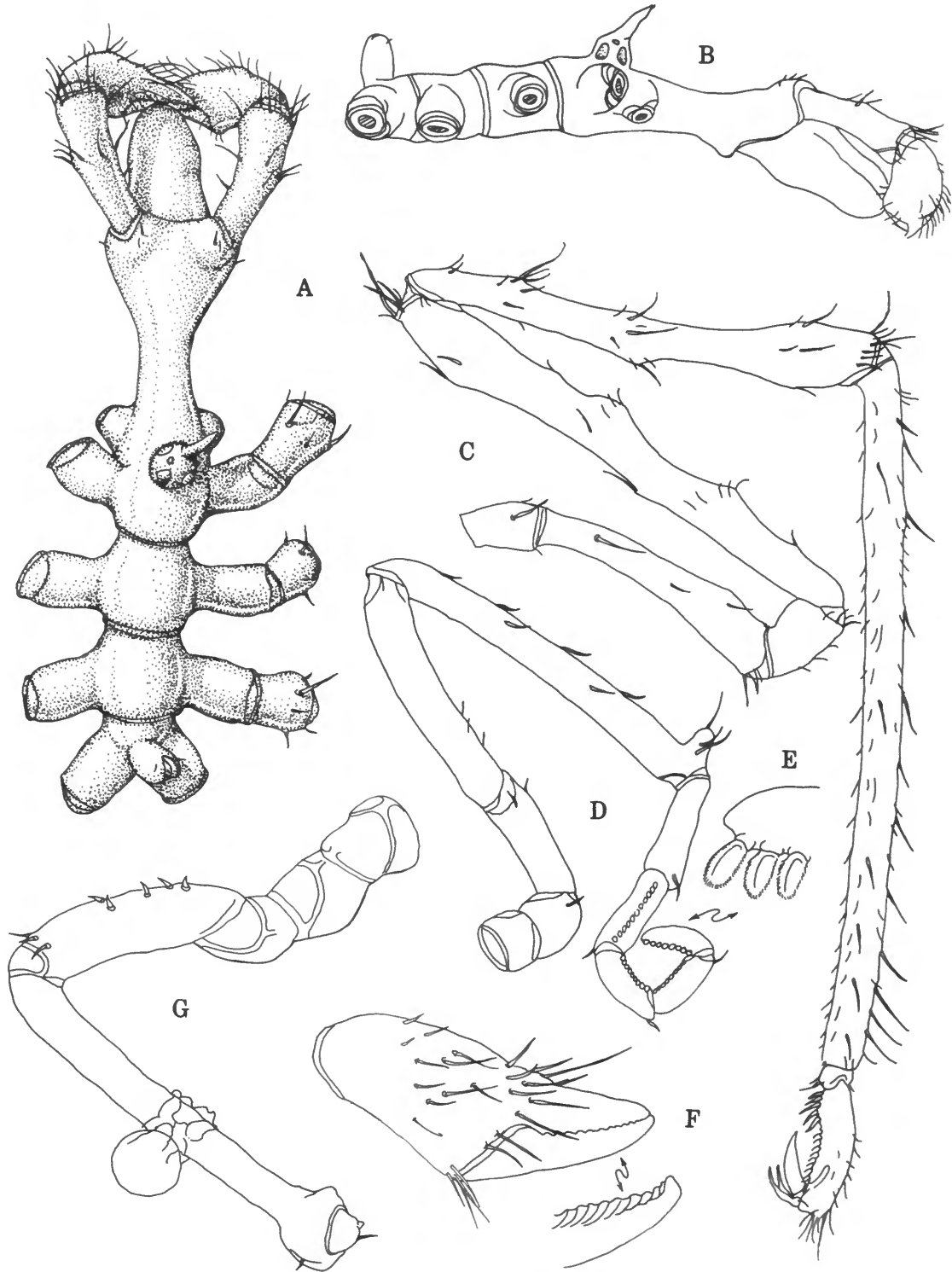


FIGURE 13.—*Callipallene bullata*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, third leg; D, oviger; E, oviger terminus, enlarged; F, chela, with movable finger, enlarged. *Cheilopallene nodulosa* Hong and Kim, male: G, oviger.

1984 (1♀). Off Mie Prefecture, 34°05.9'N, 136°40.4'E, 422–426 m, KT86-6, sta KN4, 27 May 1986 (1 juv); 34°11.1'N, 136°38.7'E, 148–149 m, KT86-6, sta KN3, 28 May 1986 (1♂).

DISTRIBUTION.—This species was described from a male taken in Sagami Bay at 400 fm (732 m), and from another male taken in the southern Philippines at 200 fm (366 m). The above specimens constitute the second record for this species, which does not seem to be rare, but only seldom collected. It is now known from central eastern Honshu, from almost 300 to 732 meters.

REMARKS.—The above females are the first of the species known and display differences both related to and unrelated to sex. Those unrelated to sex are that the ocular tubercle may have a much shorter conical apex or none at all, but instead may be rounded. The propodus of some specimens varies in length and may bear two or three heel spines (the type has three). The legs are universally quite long and the neck has very short parallel sides before expanding into the crop. Of the sex-related differences, the female oviger is shorter, of course, than that of the male, and has a few more denticulate spines, all of a single form in both sexes.

Callipallene dubiosa Hedgpeth

Callipallene dubiosa Hedgpeth, 1949:275, fig. 35.—Utinomi, 1971a:322 [literature].—Nakamura and Child, 1983:58 [key].—Kim, 1984:535, figs. 4m-i, 5a-c.—Kim and Hong, 1986:38.—Hong and Kim, 1987:153.

MATERIAL EXAMINED.—HOKKAIDO: Kikonai, shallow, 30 Jun 1984 (1♂ with eggs, 1♂, 1♀). HONSHU: Chiba Prefecture, Kominato, shallow, 4 Feb 1986 (2♂ with eggs, 5 juv). Wakayama Prefecture, Goboh, 33°51.3'N, 135°09.6'E, 3.5 m, Feb 1981 (1♂).

DISTRIBUTION.—This species has scattered distribution from East Africa to Singapore and on Honshu and Hokkaido islands in Japan. It occupies shallow habitats from the tide line down to about 45 meters.

REMARKS.—The trunk, legs, ovigers, and neck of this species are characterized by their shortness. The propodus is very short and well curved, unlike other species of the genus reported on here. It is the most compact species found thus far in Japan.

Callipallene novaezealandiae (Thomson)

Pallene novae-zealandiae Thomson, 1884:246–247, pl. 14: figs. 1–4.
Callipallene brevirostris novaezealandiae.—Child, 1975:10 [literature].—Nakamura and Child, 1983:58–59.
Callipallene novaezealandiae.—Child, 1983:708; 1988a:21.

MATERIAL EXAMINED.—YELLOW SEA: W of Korean islands, 34°57.3'N, 125°25.0'E, 21 Nov 1969 (1♂). Tsushima Strait, S of Tsushima Islands, 34°10.0'N, 129°04.2'E, 19 Nov 1969 (1♂ with eggs, 3♂, 2♀). Korea Strait, W of Tsushima Islands, 33°53.6'N, 128°33.4'E, 12 Feb 1969 (2♂, 5♀); 34°03.9'N, 128°16.4'E, 21 Nov 1969 (1♂). HONSHU: Sagami Bay, off Kisami, 33–41 m, 4 Dec 1981 (1♂

with eggs); 37–41 m, 27 Jul 1982 (3♂ with eggs, 5♂, 16♀, 2 juv). Chiba Prefecture, Kominato, shallow, 23 Feb 1986 (1♂, 1 juv). Inland Sea, Okayama Prefecture, Ieshima, 3 m, 27 Aug 1985 (1♀).

DISTRIBUTION.—This species has been taken from Tanzania, East Africa, to the Philippines, Palau Islands, Ryukyus, and in Sagami Bay, Japan. The above specimens extend its distribution to the Yellow Sea and as far north as Chiba Prefecture (35°N). Unfortunately, the Yellow Sea and Tsushima Strait specimens above lack depth records, but the species has a wide depth range of 1 to over 300 meters.

REMARKS.—This species is recognized by having smooth (nonpectinate) auxiliary claws, monomorphic denticulate spines of the strigilis, chelae fingers shorter than the palms, and usually four propodal heel spines.

Callipallene panamensis Child

Callipallene panamensis Child, 1979:42–44, fig. 14.—Nakamura and Child, 1983:59.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Shimoda, 37–39 m, 9 Sep 1987 (1♀).

DISTRIBUTION.—This species exhibits one of the peculiarities in the distribution of many pycnogonid species: widely disparate records on either side of the Pacific with no captures known between these records. The species was described from the Pacific side of Panama and was subsequently taken in Sagami Bay, Japan. It is known from the littoral to 30 meters and the above record extends this maximum depth to 39 meters.

REMARKS.—This female specimen shares the characters of the type except for the differences in the oviger and sex pores due to sex differences. The ocular tubercle apex is rounded and the eyes are very large, the oviger denticulate spines are dimorphic with the distalmost spine bearing larger broad spines, the chelae fingers bear rather large broad teeth, particularly on the immovable finger, and the auxiliary claws have 2–3 pectinate spines as long or longer than the claw diameter. The principal difference between this female and the type is in the heel spines. Two propodi have four heel spines and those of the other available legs have five spines: the heels with four have no empty socket denoting a missing spine and are otherwise normal and without damage.

Callipallene sagamiensis Nakamura and Child

Callipallene sagamiensis Nakamura and Child, 1983:59–61, fig. 20.—Kim and Hong, 1986:38–39, fig. 3.—Nakamura, 1987:9–10, pl. 7.—Hong and Kim, 1987:153.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (1♀); 34°45.4'N, 138°43.8'E, 135–144 m, KT74-14, sta B3, 21 Sep 1974 (1♂); 34°54.0'N, 138°43.7'E, 337–355 m, KT74-14, sta B8, 23 Sep 1974 (3♂ with eggs, 2♂, 1♀, 1 juv). Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7,

31 Aug 1984 (1♀).

DISTRIBUTION.—This species was known from Sagami Bay and the Korean coast in the Yellow Sea in 100 to 160 meters. The above records extend its distribution to the south on the coast of Honshu and extend the known depth of capture to 416 meters.

REMARKS.—The differences between this species and *C. cuspidata*, the nearest related species, are discussed by Nakamura and Child (1983:61). This species lacks the ocular tubercle cone of *C. cuspidata* along with having a shorter palm in relation to the fingers, which have a different shape and denticulation, and the leg segments lack any form of swelling or bumps as found in Stock's species.

Callipallene species indeterminate

MATERIAL EXAMINED.—HOKKAIDO: Off Daikoku-shima, Akkeshi Bay, 5 m, 25 Mar 1986 (2 larvae). HONSHU: Kii Strait, 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, (1♀); 33°35.9'N, 135°09.9'E, 322–346 m, KT84-12, Sta 27, 2 Sep 1984 (1♀).

REMARKS.—The two females from Kii Strait are possibly *C. cuspidata*, but are damaged, lacking most legs, and have shorter propodal claws and shorter necks than this species as represented by specimens reported on elsewhere. Both females have wide brown bands around the suture lines of the trunk and coxae while other species in this report lack the bands.

Genus *Cheilopallene* Stock, 1955

Cheilopallene nodulosa Hong and Kim

FIGURE 13G, H

Cheilopallene nodulosa Hong and Kim, 1987:153–155, fig. 12.

MATERIAL EXAMINED.—HONSHU: Wakayama Prefecture, off Goboh, 5 m, Feb 1981 (1♂ with eggs). Sagami Bay, off Kisami, 30–42 m, 5 Apr 1983 (1♂ with larvae).

DISTRIBUTION.—This species was recently described from *Sargassum* in the infralittoral of the mid-south Korean coast in the Yellow Sea. The above two specimens place it also on the mid-Honshu coast of Japan in the deeper known depth of 42 meters.

REMARKS.—The above males are the first to be taken and offer opportunity to complete the description of this species. We include figures of the male oviger, which, in both of the above males, is 6-segmented with the same clubbed fifth segment as in *C. clavigera* Stock. This clubbed oviger, with a small knob as the vestige of a sixth segment and the remainder of the strigilis completely lacking, presents an enigma. Several *Cheilopallene* species have conventional 10-segmented ovigers in the male, while *C. clavigera* and this species have the reduced and clubbed oviger. The two separate male oviger states in the five known species of this genus would suggest a pair of genera rather than one were it not that the females of all

species (where known) have conventional 10-segmented ovigers with a terminal claw, including this species. The genus is united in the following characters: three protruding prominent lips, no palps in either sex, an oviger terminal claw in both sexes (where the male has a 10-segmented oviger), no auxiliary claws, and an irregular chelae with an immovable finger having nodes and tubercles.

The female described by Hong and Kim (with a juvenile not mentioned further) has bulbous nodes at the proximolateral ends of both scapes. These do not appear on the scapes of either of our males, which suggests that they may be either the result of damage to the type or that they are only found in females of this species. No other female specimens known in this genus have such lateral scape nodes.

Genus *Decachela* Hilton, 1939

Decachela discata Hilton

Decachela discata Hilton, 1939a:34; 1942:71.—Hedgpeth, 1949:280, fig. 37.—Utinomi, 1971a:325.

MATERIAL EXAMINED.—KOREA STRAIT: Off Tsushima, 34°25.3'N, 129°05.4'E, 150 m, 19 Jun 1964 (2♂ with eggs, 2♀).

DISTRIBUTION.—Originally described from the California coast, this species was also recorded by Hedgpeth (1949:280) from the west coast of Hokkaido. The above record is only the third capture for this apparently rare species and marks a distribution extension in Japan from the northern end of the Sea of Japan to its southern end at the Korea Strait. It also represents the deepest record, the other being 108 meters, while the depth for Hilton's specimens was unrecorded but presumably quite shallow. The distribution of the two species in this genus is sympatric in at least part of their Asiatic range.

REMARKS.—This species can not be confused with the only other known species in this genus, *Decachela dogieli* Losina-Losinsky, which is very tuberculate, particularly in the male. Both species share the propodal spine, which apparently has a subchelate function with the opposable claw.

This species is characterized by a lack of tubercles and large numbers of setae on the lateral processes and appendages. It is much smaller than *D. dogieli* (trunk length 3.5 mm, while *D. discata* trunk length 0.9 mm), and lacks the pronounced sex pore tubercle and dorsodistal femur tubercle, while the proboscis is notably shorter in relation to trunk length.

There is no record accompanying the above specimens to show whether or not they came from an echinoderm host as suggested for *D. dogieli* by Hong and Kim (1987:158). Their specimens of *D. dogieli* were taken from the ambulacral grooves of starfish, apparently in a commensal (parasitic?) relationship. There is no record of this relationship with specimens of *D. discata*.

Genus *Pallenopsis* Wilson, 1881

Subgenus *Bathypallenopsis* Stock, 1975

Pallenopsis (Bathypallenopsis) calcaea Stephensen

Pallenopsis calcaea Stephensen, 1933a:21–24, fig. 5.—Hedgpeth, 1948:211, fig. 21e–g; 1969:26.—Nesis, 1970:168.—Turpaeva, 1971a:286.—Stock, 1978:216 [as sp. aff. *calcaea*].—Mauchline, 1984:316–317, fig. 1.

Pallenopsis (Bathypallenopsis) calcaea.—Stock, 1975a:1032 [text].—Child and Harbison, 1986:113, 116 [text].

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°23.9'N, 135°42.1'E, 353–416 m, KT84-12, sta 7, 31 Aug 1984 (1♂, 1♀, 1 juv); 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (2♂, 1♀).

DISTRIBUTION.—This bathypelagic species is known from scattered records worldwide, but the above depth records are apparently the shallowest at which the species has been taken. It has been known from about 660 to 2000 meters. These are the second Japanese records for this species.

REMARKS.—The above specimens are all without legs excepting the juvenile, the legs of which do not provide all of the usual leg diagnostic characters. The propodus and claw, even of the juvenile, are very like those of *P. (B.) calcaea* except that the heel spines are shorter than those of adults and the sole has no setae or short spines. The legs have approximately the same segment measurements, if smaller, as those given by Hedgpeth (1948:211). The long chelifores, slightly longer than the proboscis, the inflated distal proboscis, and the abnormally long vestigial palp stumps of this species are good recognition characters.

There has been speculation (Child and Harbison, 1986) on whether or not this and other species of this subgenus are all parasites of bathypelagic coelenterates after discovery of *P. (B.) scoparia* on a scyphomedusa from midwater depths. It is possible that at least several of these species are parasites through their life cycles on scyphomedusae but become separated from hosts during trawl hauls to and from the surface.

Pallenopsis (Bathypallenopsis) scoparia Fage

Pallenopsis scoparia Fage, 1956c:171–172, figs. 1–4.—Stock, 1964b:49, 51 [text].—Arnaud, 1973b:148–150, figs. 1, 2, table 1.

Pallenopsis (Bathypallenopsis) scoparia.—Stock, 1975a:1032 [text].—Mauchline, 1984:318–320, fig. 3.—Child and Harbison, 1986:113–117, figs. 1, 2.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°45.7'N, 138°42.3'E, 312–328 m, KT74-14, sta B4, 23 Sep 1974 (2 juv); 35°01.2'N, 138°38.6'E, 1295–1335 m, KT78-18, sta SH, 19 Nov 1978 (1 juv). Kii Strait, 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀).

DISTRIBUTION.—This bathypelagic species is a cosmopolitan predator of a scyphomedusa (*Periphylla periphylla*), at least in one proven instance, and probably is carried to tropical and temperate localities on this or other scyphomedusae. There are very few records of this species, but they appear in all oceans

except for Polar seas at bathypelagic depths of 660 to 1520 meters. These are the first records of the species from Japan. Unfortunately, the hosts were unknown for any of the records.

REMARKS.—The propodi of this species have the soles, at least in adults, covered with a fine pile of straight setae forming a brush-like surface that, as far as we can determine, is unique among the hordes of known pycnogonids. This species is usually rather flaccid and delicate with thin integument, as are most specimens of the subgenus, lending additional credence to the proposal that they all are predators given protection within a host. This protection would relieve the need for a stiff or more rigid integument necessary for support as found in most free-living pycnogonids.

Pallenopsis (Bathypallenopsis) stylirostris Hedgpeth

Pallenopsis stylirostris Hedgpeth, 1949:278–280, fig. 36a–e.

Pallenopsis (Bathypallenopsis) stylirostris.—Stock, 1975a:1032 [text].

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, E of Fudai, 39°59.0'N, 142°37.7'E, 1225–1249 m, KT85-11, sta SR16, 12 Aug 1985 (1♂ with eggs, 3♀, 1 juv).

DISTRIBUTION.—Hedgpeth found no evidence that this species is bathypelagic and none exists for the above specimens. The types were taken off southern Honshu in 1000 to 1300 meters. The above record greatly extends the known distribution for this species in Japan to northern Honshu, but it falls within the known depth range.

REMARKS.—The slender tapering proboscis, long chelifore scapes (longer than proboscis) with small chelae, and large ocular tubercle with well-developed eyes serve to distinguish this species from others of the subgenus in these waters. The above females are the first reported for this species. The distal major leg segments have less short setae than those of the male and the oviger is typically smaller than that of the male and has a single bend rather than the distal recurved segments of the male. Adults of both sexes are approximately the same size.

Pallenopsis (Bathypallenopsis) tydemani Loman

Pallenopsis tydemani Loman, 1908:65–66, pl. 10: figs. 139–145.—Hedgpeth, 1949:277, fig. 36i, j.—Utinomi, 1951:160; 1971a:323.

Pallenopsis (Bathypallenopsis) tydemani.—Stock, 1975a:1035–1036 [text].

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (3♂).

DISTRIBUTION.—This is another species first described from Indonesia and subsequently found in several Japanese localities. It has been taken off Kyushu and in the Kii Strait, Honshu, and this record makes the most northern collection. Its collecting depths are from 100 to 964 meters.

REMARKS.—This species has an Atlantic subspecies, *P. (B.) caraibica* Stock (1975a:1033–1036, figs. 31d, 32), which Stock separates from the Pacific subspecies by slight differences in the oviger and the distances separating the western

Pacific and Caribbean forms.

The chelifore scapes of this species are shorter than the proboscis and it has a vestigial ocular tubercle lacking eyes.

Subgenus *Pallenopsis* Stock, 1975

Pallenopsis (Pallenopsis) sibogae Loman

Pallenopsis sibogae Loman, 1911:a14.—Utinomi, 1971a:324 [literature].

Pallenopsis (Bathypalleniosis) sibogae.—Stock, 1975a:1032 [text].—Nakamura, 1987:10–11, pl. 8.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Port Okada, 48°3'N, 139°23.3'E, 109–116 m, KT73-15, sta T2, 26 Oct 1973 (1♂ with eggs).

DISTRIBUTION.—This species is known from Indonesia to Sagami and Suruga bays on Honshu Island in 37 to 160 meters. The present record adds nothing new to its known distribution.

REMARKS.—The long feathered setae on the long legs of this species are a good recognition character, along with the very long second tibiae and the cement gland tube, which is slightly longer than the segment diameter.

Pallenopsis (Pallenopsis) virgata Loman

Pallenopsis virgatus Loman, 1908:69, pl. 9: figs. 135, 136.

Pallenopsis virgata.—Utinomi, 1971a:324 [literature].

Pallenopsis (Pallenopsis) virgata.—Stock, 1975:a1032 [text].—Nakamura and Child, 1983:61.—Nakamura, 1987:13, pl. 10.

MATERIAL EXAMINED.—KYUSHU: Off Tomioka, Amakusa Islands, 5 Jul 1984 (1♀, 1 juv). HONSHU: Sagami Bay, off Kisami, 30–42 m, 5 Apr 1983 (1 juv). Mouth of Shimoda Bay, 40–50 m, 6 Apr 1983 (1♀, 1 juv). Off Shimoda, 60–61 m, 9 Dec 1986 (1♀).

DISTRIBUTION.—This species also was originally described from Indonesia, but has subsequently been taken at many localities in Japan. These specimens are from the same locality as specimens reported by Utinomi (1971a:324).

REMARKS.—This is a shallow-water species recognized by paired small dorsodistal tubercles on each first coxa.

Genus *Parapallene* Carpenter, 1892

Parapallene nierstraszi Loman

Parapallene nierstraszi Loman, 1908:44, pl. 9: figs. 122–127.—Utinomi, 1971a:323.—Child, 1975:15, fig. 7 [literature].

Pseudopallene zamboangae.—Utinomi, 1971a:323.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 37–40 m, 23 Aug 1982 (1♂).

DISTRIBUTION.—This specimen marks the farthest north the species has been taken. It is known from the vicinity of Nagasaki and in Tsushima Strait, besides having been taken farther south in the Philippines, Indonesia, Australia, and from South Africa, with the greatest collecting depth given as 112 meters.

REMARKS.—Child (1975, fig. 7) refigured the diagnostic characters of this species. The oral fringe of the proboscis, the long neck and very long appendages, and the spinose ventral proboscis all serve as good recognition characters for this species, the only one of its genus known from the Japanese Islands.

The specimen listed as *Pseudopallene zamboangae* Stock, in Utinomi, 1971a, has been determined by one of us (KN) to be *P. nierstraszi* from the Nagasaki area.

Genus *Propallene* Schimkewitsch, 1909

Propallene longiceps (Böhm)

Pallene longiceps Böhm, 1879b:59.

Propallene longiceps.—Nakamura and Child, 1983:61–62 [literature].—Kim and Hong, 1986:40–41, fig. 4.—Nakamura, 1987:13–15, pl. 11.—Hong and Kim, 1987:158.—Nakamura and Child, 1988a:668.

MATERIAL EXAMINED.—*Specimens with Flat Propodi*: HONSHU: Sagami Bay, Nabeta Bay, 7–15 m, 13 Aug 1970 (2♂ with eggs); 19 Jan 1971 (2 juv); 23 Aug 1971 (7♂ with eggs); 26 Oct 1973 (3♂, 17 juv); 10–15 m, 27 Jul 1982 (8♂ with eggs, 3♂, 13♀, 13 juv); 10 m, 9 Sep 1982 (2♂ with eggs, 2♀). Off Kisami, 30 m, 16 May 1971 (3 juv); 33–41 m, 4 Dec 1981 (18♂ with eggs, 58♂, 13♀, 23 juv); 30 m, 5 Apr 1982 (2♂, 5♀); 37–41 m, 27 Jul 1982 (11♂ with eggs, 4♂, 9♀, 3 juv); 18–28 m, 24 Aug 1982 (1 juv); 30 m, 5 Apr 1983 (15 juv). Mouth of Shimoda Bay, 38–46 m, 6 Apr 1983 (6♀, 40 juv); 40–50 m, 6 Apr 1983 (2♀, 1 juv).

Specimens with Inflated Propodi: HONSHU: Nabeta Bay, 10–16 m, 24 Aug 1982 (1♂ with eggs, 7♂, 2♀); 10 m, 9 Sep 1982 (18♂ with eggs, 1♂, 18♀). Off Kisami, 33–41 m, 4 Dec 1981 (3♂ with eggs, 4♂, 5♀); 40–45 m, 23 Aug 1982 (1♂, 1 juv); 20–21 m, 24 Aug 1982 (1♂ with eggs, 1♂, 3♀); 30–42 m, 5 Apr 1983 (2♂, 4♀, 18 juv); 30 m, 5 Apr 1983 (1♂). Off Shimoda, 40 m, 6 Apr 1982 (1♂ with eggs, 5♂, 14♀, 30 juv); 88–90 m, 9 Sep 1987 (1♀); 33–40 m, 10 (1♂ with eggs, 1♂); 27–30 m (2♂ with eggs, 1♂, 3♀); 37–39 m (13♂ with eggs, 2♂, 14♀, 1 juv).

DISTRIBUTION.—This species was thought to be endemic to central Japan until Kim and Hong reported specimens from the western Korean coast in the Yellow Sea. Other specimens have subsequently been taken on the southern Korean coast and in the Ryukyu Islands. The depths recorded are from about 6 meters to 103 meters for the deepest collection.

REMARKS.—We have found a dimorphism in the propodi of this group of specimens. The majority have a slender propodus when viewed dorsally, but some collections (segregated above) have a very inflated propodus with the inflation more proximal than distal. This dimorphism is rather prominent when viewed dorsally but apparently does not originate in an increase or expansion of the musculature within the propodus, as both forms have approximately the same number of striations denoting musculature. We have no explanation for this

inflation of some but not all specimens. In at least two instances, collections made on the same day in slightly varying depths yield either the slender or the inflated specimens. There appears to be no pattern of sex, distribution, or depth for the "fat" and "thin" propodus forms and we can find no other difference in the morphology of the specimens. Such a small character as propodus inflation is insufficient to designate a subspecies based on this difference alone for this very commonly collected species.

Family NYMPHONIDAE Wilson

Genus *Heteronymphon* Gordon, 1932

Heteronymphon horikoshii Nakamura

Heteronymphon horikoshii Nakamura, 1985:31-34, fig. 2.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, E of Hachinohe, 40°22.4'N, 143°24.0'E, 1970-2000 m, KH81-4, sta 3, 10 Jul 1981 (1♀).

DISTRIBUTION.—This species was described from material taken east of Honshu in 700 to 736 meters. The above record is also east of Honshu, but from much deeper waters, extending the known depth distribution to 2000 meters.

REMARKS.—This female differs little from the male type specimen except for a slightly larger size and the absence of male sexual characters. The species is very long legged, has a tarsus almost as long as the propodus, the second and fourth palp segments subequal with fifth shorter, and, like all members of the genus, an ocular tubercle placed at the anterior rim of the cephalic segment.

Genus *Nymphon* Fabricius, 1794

Nymphon akanei Nakamura and Child

Nymphon akane Nakamura and Child, 1983:54-56, fig. 19.—Kim and Hong, 1986:37-38, fig. 2.—Hong and Kim, 1987:158.

MATERIAL EXAMINED.—KYUSHU: Amakusa Island, off Tomioka, 5 Jul 1984 (1♂ with eggs, 1♀).

DISTRIBUTION.—This species was described from a female specimen taken in Sagami Bay and a male was subsequently figured by Kim and Hong (1986, fig. 2) from a specimen taken from the western Korean coast in the Yellow Sea. These specimens are from a point intermediate between the Japanese and Korean collections. The collecting depths were not given for the Korean specimens, but they were collected by scuba diving, so the shallow depth of 7 to 15 meters are approximate for the species.

REMARKS.—This species has little to distinguish it from the hordes of other *Nymphon* species except that it is found in shallower water than usual and it has slender propodal claws

with the auxiliaries about two-thirds the main claw length. The terminal palp segment is subequal to the third, and both are only slightly shorter than the second, the chelae palms are shorter than the fingers, which have 12-14 large sharp teeth, and the tarsus is almost 0.7 as long as the propodus.

The species name is changed with an "i" suffix to conform properly with the *International Code of Zoological Nomenclature*.

Nymphon aritai, new species

FIGURE 14

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°41.8'N, 145°08.9'E, 400-479 m, KT83-11, sta B15, 11 Jul 1983 (1♀, holotype, USNM 234483).

DESCRIPTION.—Size moderately large, leg span 54.7 mm. Trunk elongate, slender, lateral processes separated distally by greater than their diameters, as long as 1.5 times their maximum diameters, glabrous. Neck slightly longer than crop (anterior area of chelifore-proboscis expansion), oviger implantations against anterior of first lateral processes, directly ventral to ocular tubercle. Ocular tubercle low, rounded, with conspicuous lateral sensory papillae, eyes large, unpigmented. Proboscis large, cylindrical, with slight median swelling, oral area rounded to flat lips. Abdomen short, proximally cylindrical, tapering distally, with 3-4 short distal setae.

Chelifores large, scape as long as proboscis, armed with few short lateral and dorsal setae. Chelae long, slender, palms armed with many short setae, fingers equal to palms in length, carried at oblique angle, slightly curved, overlapping at tips. Immobile finger with 33 short slightly curved teeth of equal size, movable finger with 39 similar teeth.

Palps moderately slender, third segment slightly shorter than second, the longest, fifth slightly shorter than third, and fourth about 0.8 length of fifth. Third segment with fringe of short distal setae, fourth with many short ventral setae, and fifth with many short lateral and ventral setae.

Ovigers with segment four very slightly shorter than segment five, sixth about 0.6 length of fifth. Sixth armed with many short setae. Strigilis with many short ectal setae, endal denticulate spines in the formula 15 : 13 : 12 : 13, with a small short terminal claw bearing 20 tiny teeth. Denticulate spines with single large proximal serration and 7-8 tiny distal serrations per side.

Legs moderately long, slender, major segments armed with many tiny short setae and few longer setae, none as long as segment diameters. Tarsus about 0.25 longer than propodus, both armed with few short dorsal and lateral setae, tarsus with many short sole spines of equal length, propodus with many short sole spines with some longer than others, particularly at midlength of segment. Claw slender, well curved, half propodal length, auxiliaries slightly over half main claw length, slender, slightly curved.

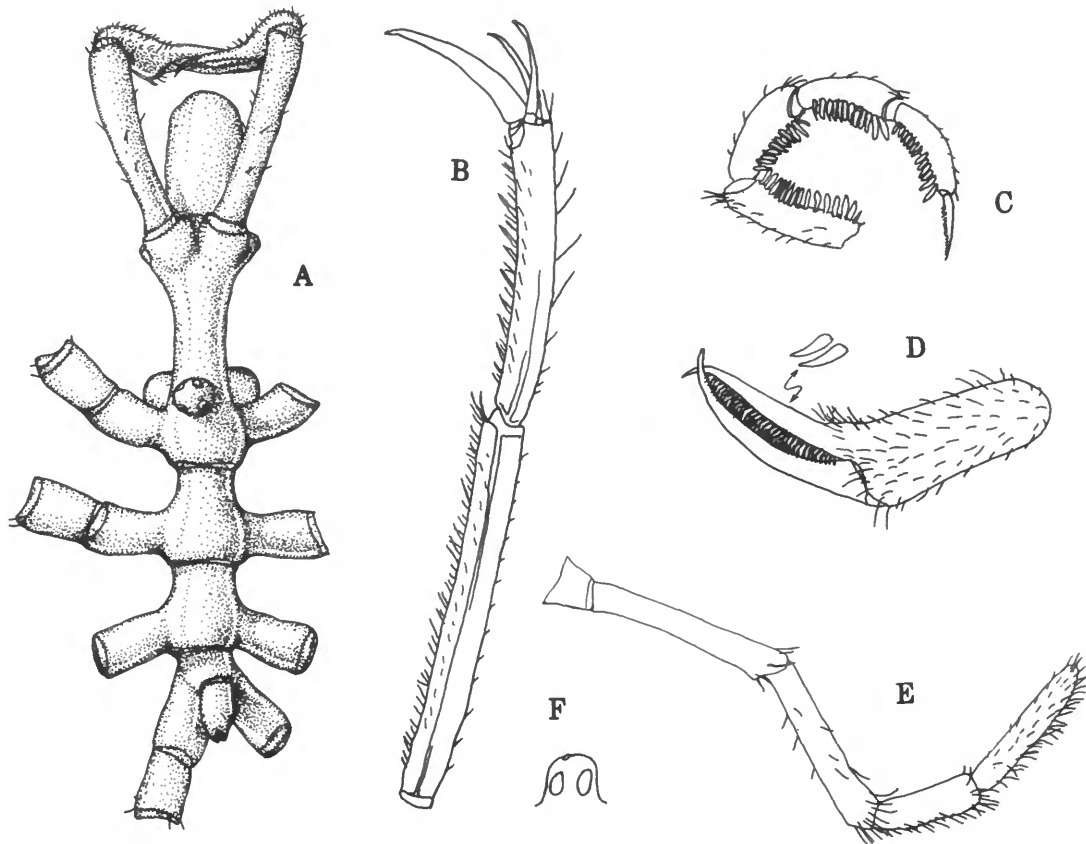


FIGURE 14.—*Nymphon aritai*, new species, holotype: A, trunk, dorsal view; B, third leg, terminal segments, enlarged; C, oviger strigilis; D, chela, with two teeth, enlarged; E, palp; F, ocular tubercle, lateral view.

Male characters unknown.

MEASUREMENTS (in mm).—Trunk length, 4.74; trunk width (across 2nd lateral processes), 1.99; proboscis length, 1.63; abdomen length, 0.61; first leg, coxa 1, 0.67; coxa 2, 1.94; coxa 3, 1.04; femur, 5.32; tibia 1, 5.98; tibia 2, 7.58; tarsus, 1.63; propodus, 1.21; claw, 0.6.

DISTRIBUTION.—This species is known only from the type locality, Hokkaido, SE of Akkeshi Bay, in 400–479 meters.

ETYMOLOGY.—We are pleased to name this species after the late Dr. Keizo Arita, Kyushu University, Fukuoka, Japan, for his early contributions to the knowledge of Japanese pycnogonids.

REMARKS.—This species is closely related, among Japanese species, to *N. gunteri* Hedgpeth (1949:257–259, fig. 26) in general habitus. The lateral processes of the new species are shorter and placed slightly farther apart, but neck, proboscis, and chelifores are quite similar. The chelae of *N. gunteri* have fewer finger teeth than on *N. aritai*, and the third palp segment is longer (= 2nd) than that of the new species. The legs of both species are very similar in length and setation, but the tarsus of

the new species is longer than in Hedgpeth's species, which has two propodal sole spines longer than that segment's diameter while there are none this long in *N. aritai*. The main claw is more slender and more curved than that of the new species and the auxiliaries are shorter than those of *N. aritai*. Both species are described from a single female taken off northern Japan. Northern Honshu and the offshore areas of Hokkaido appear to be the major source of species of this genus in Japan.

Nymphon benthos Hedgpeth

Nymphon benthos Hedgpeth, 1949:256–257, fig. 25.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, E of Kamaishi, 39°59.0'N, 142°37.7'E, 1225–1249 m, KT85-11, sta SR16, 12 Aug 1985 (2♀, 2 juv).

DISTRIBUTION.—This is only the second record for this species, Hedgpeth's being from just off Suruga Bay in 505 fathoms (923 m). These specimens extend its known range to the north and to a greater depth of 1249 meters. This is another

of the several species to cross the so called 36 degree transition zone between the warmer currents of the Kuroshio and the colder currents of the Oyashio. Apparently, this zone does not present much of a barrier to deeper-water species as it does for the shallow-water species, which are more subject to the thermal vagaries of warm and cold currents.

REMARKS.—Re-examination of Hedgpeth's type for purposes of comparison with these specimens suggests that it is not a female as listed, but that it is actually a juvenile without sex pores. The type specimen agrees very well with the two juveniles and is little different from the adult females. The characters of this species that set it apart from the many *Nymphon* species from Japan are the relatively short palp in total length (only slightly longer than the proboscis) and in the length ratios of the short segments. The other recognition characters are the tarsus, which is 0.6–0.7 as long as the propodus, the very short auxiliary claws in relation to the main claw, and the general habitus of the chelae, which have a setose palm slightly longer than the fingers, each bearing 11–12 sharp teeth in adults.

Nymphon brevis, new species

FIGURE 15

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°52.4'N, 145°06.2'E, 102 m, KT83-11, sta 18B, 10 Jul 1983 (1♀, holotype, USNM 234484).

DESCRIPTION.—Size moderately small, leg span 30.3 mm. Trunk compact, robust lateral processes slightly longer than their maximum diameters, separated by about half their diameters, armed with short dorsodistal and dorsolateral setae. Neck very short, without parallel sides, crop just anterior to oviger implantation, which is slightly below and touching first lateral processes. Chelifore insertions raised above crop, armed with row of short setae. Ocular tubercle low, slightly shorter than basal width, with 2 tiny apical tubercles. Eyes moderately large, slightly pigmented. Proboscis robust, cylindrical, less than twice longer than wide, rounded distally at lips. Abdomen moderately long, swollen, tapering distally, armed with 4 short laterodistal setae.

Chelifores large, robust, scape slightly over 3 times longer

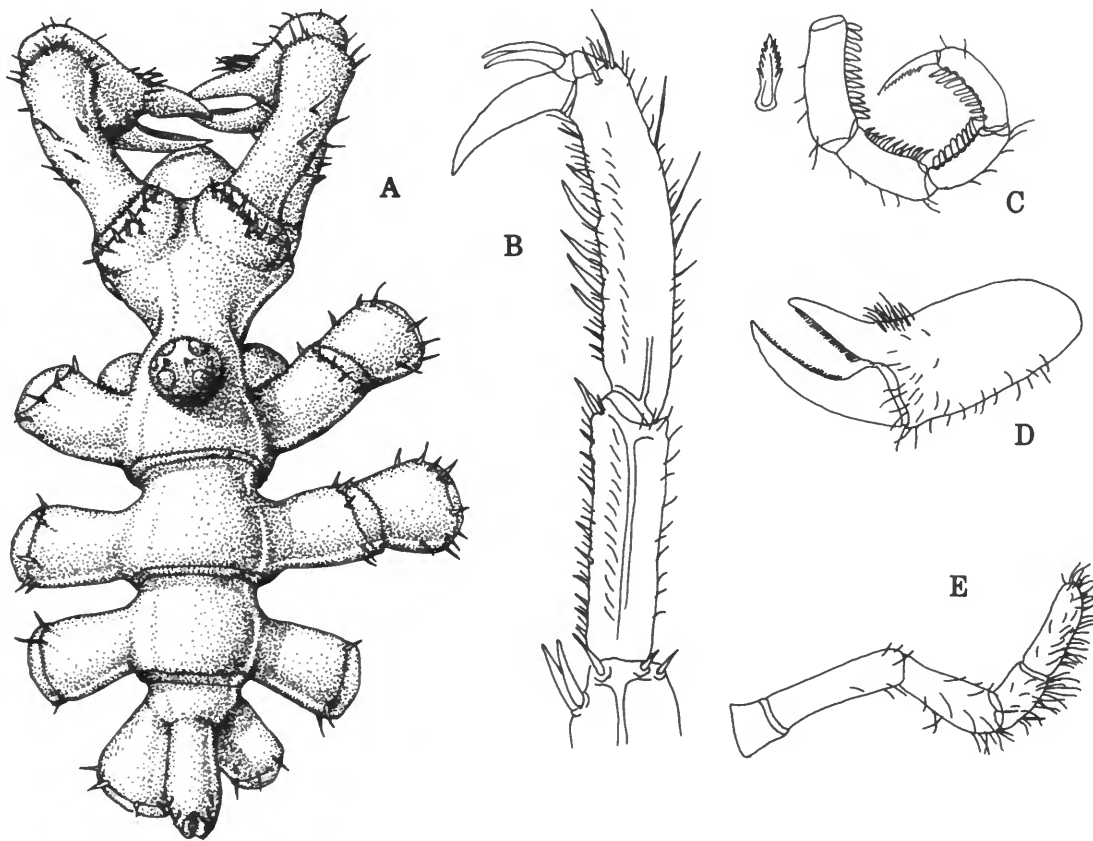


FIGURE 15.—*Nymphon brevis*, new species, holotype: A, trunk, dorsal view; B, third leg, terminal segments, enlarged; C, oviger strigilis, with denticulate spine, enlarged; D, chela; E, palp.

than its diameter, armed with many short dorsal and distal setae. Chela as long as scape, fingers shorter than palm, which is a swollen cylinder armed with many short dorsal, distal, and ventral setae. Fingers carried at obtuse angle to palm, without setae, with many tiny short closely spaced teeth. Movable finger curved, longer than immovable finger, which is straight.

Palps very short, second segment longest, less than 5 times longer than its diameter. Third segment 0.8 length of second, fourth only twice longer than its diameter, fifth only 3 times longer. Third through fifth armed with many very short lateral and ventral setae not as long as segment diameters.

Oviger segments short, fifth with small distal apophysis. Strigilis with few short ectal setae, short endal denticulate spines in the formula 11 : 9 : 8 : 8, and terminal claw with 9–10 endal short teeth. Denticulate spines with smooth sides for half their length, one large serration per side and about 6 tiny serrations distal to large one.

Legs moderately short, armed with dorsal, lateral, and ventral setae increasing in numbers on distal segments, few longer than segment diameters. Tarsus 0.8 length of propodus, armed with large ventrodiscal spine. Propodus slightly curved, armed with 5–6 sole spines, the largest at midlength of sole. Claw robust, only slightly curved, 0.4 length of propodus, auxiliaries slender, about half main claw length.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 2.31; trunk width (across 1st lateral processes), 1.51; proboscis length, 0.8; abdomen length, 0.53 first leg, coxa 1, 0.53; coxa 2, 1.1; coxa 3, 0.7; femur, 2.76; tibia 1, 3.24; tibia 2, 3.72; tarsus, 0.86; propodus, 1.07; claw, 0.4.

DISTRIBUTION.—Known only from the type locality, SE of Akkeshi Bay, Hokkaido, in 102 meters.

ETYMOLOGY.—The species name is from the Latin *brevis* (short) and refers to the very short palp length of the type specimen.

REMARKS.—This species is closest to *N. brashnikowi* and would probably be placed with this species were it not for the very different leg segment ratios, oviger spines and their numbers, and the third palp segment of *N. brashnikowi*. In the new species, the femur is the shortest segment followed by a slightly longer first tibia and a second tibia only slightly longer than the first. In *N. brashnikowi*, the original figures by Schimkewitsch (1906b, pl. 1: figs. 1–7) give the femur and first tibia an equal length while the second tibia is very much longer (40%) than first tibia. The third palp segment is equal to the second in Schimkewitsch's figure 3, while the third palp segment in the new species is only 0.8 as long as second. The oviger spines of *N. brashnikowi* have four prominent serrations per side while those of the new species have one prominent serration plus many tiny serrations per side. There are fewer oviger denticulate spines on the female oviger (formula: 7 : 5 : 5 : 6) than on the oviger of the new species, also a male. Finally, the ocular tubercle of *N. brashnikowi* is notably taller, has the eyes placed very distally, and lacks any form of apical

tubercle, unlike the ocular tubercle of this species. Hedgpeth (1949:250) reports on two collections of *N. brashnikowi* made off the south of Hokkaido, just to the west of this capture, but we feel that the differences listed above are sufficient to separate the two species until specimens displaying intermediate characters are found.

No species of *Nymphon* of the north Pacific has such abbreviated palp segments. Those species closest to the palp length of this new species are *N. benthos*, *N. dissimilis*, and *N. microsetosum*, which have palpi nearing the shortness of this species, but at the same time each is slightly longer. The chela of *N. microsetosum* is very similar to that of the new species, but the tarsus is very short and much shorter than the propodus, unlike this species. The habitus of *N. dissimilis* is much more elongate than that of the new species although the oviger segment spines, the claw teeth, and the propodus spines are similar to the new species. The single similarity with *N. benthos* is the palp segment lengths while the remainder of that species is much more attenuated with longer leg segments, shorter main claw and auxiliaries, differences in oviger spination, and longer neck and other chelifore differences.

Nymphon citerium, new species

FIGURE 16

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, E of Kamaishi, 39°59.0'N, 142°37.7'E, 1225–1249 m, KT85-11, sta SR16 12 Aug 1985 (1♂ with eggs, holotype, USNM 234485, 3♂, 10♀, 2 juv. paratypes, USNM 234486); 38°45.6'N, 143°11.5'E, 1950–1970 m, KH81-4, sta 8, 25 Jul 1981 (1♂, paratype, USNM 234487).

DESCRIPTION.—Size large for genus, leg span about 130 mm. Trunk slender, lateral processes proximally separated by slightly more than their diameters, as long as 1.5 times their diameters, glabrous. Neck moderately long, parallel-sided area slightly longer than crop. Oviger implantation at posterior of neck, against first lateral processes and directly ventral to ocular tubercle. Ocular tubercle low, rounded, slightly wider at base than tall, eyes moderately small, not pigmented. Proboscis cylindrical, with slight median swelling, 2 ventrodiscal swellings, and rounded oral surface. Abdomen cylindrical, distally tapering, slightly longer than fourth lateral processes, with several tiny dorsolateral setae.

Chelifores large, scape longer than proboscis, slightly curved ventrally, armed with few short dorsal and lateral setae. Chela long, slender, well curved, fingers longer than palm, carried anaxially. Palm a curved cylinder, with many short dorsal and lateral setae. Immobile finger with few short setae at base, only slightly curved, armed with 38–40 small pointed teeth. Movable finger well curved, overlapping immobile finger at tip, without setae, armed with 58–60 teeth, each smaller than teeth on opposing area of immobile finger.

Palps slender, second and third segment subequal, fifth

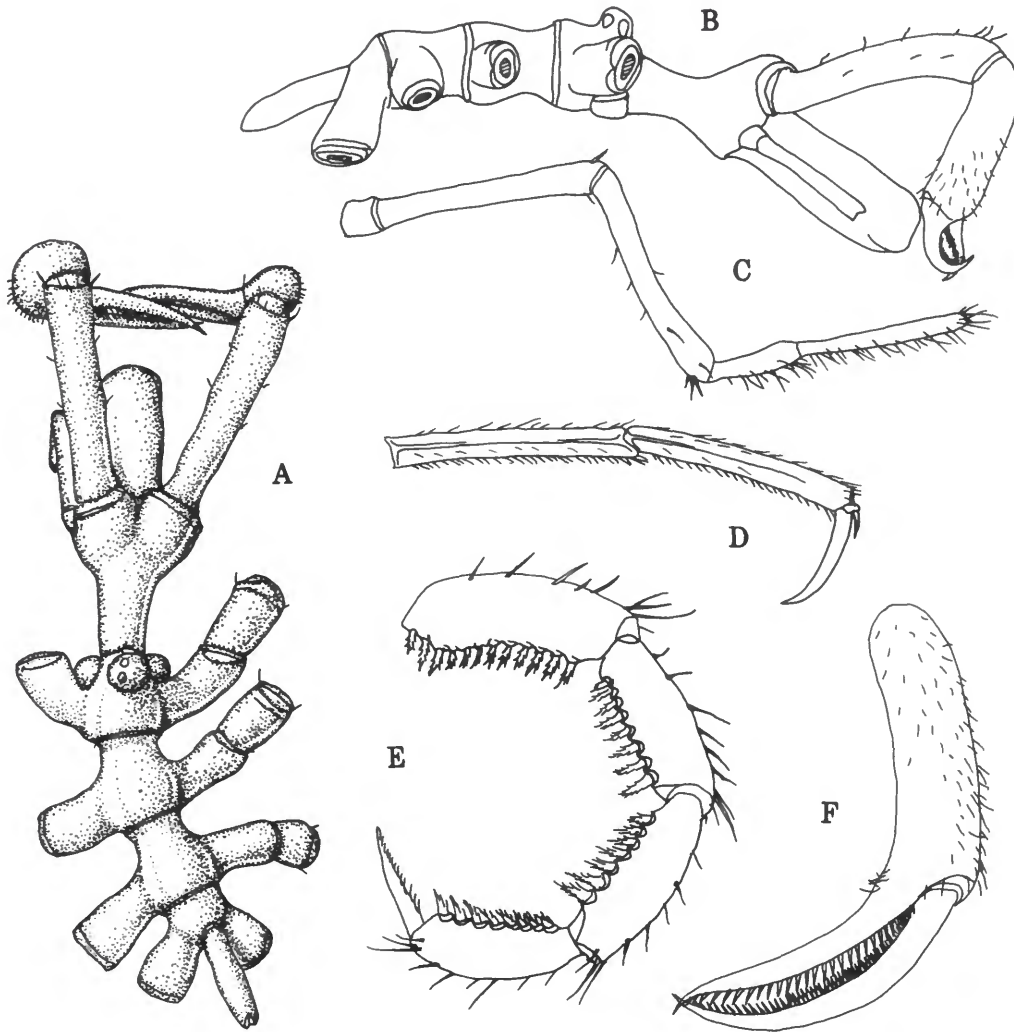


FIGURE 16.—*Nymphon citerium*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, terminal segments; E, oviger strigilis, enlarged; F, chela, enlarged.

almost twice length of fourth, combined length of fourth and fifth only slightly longer than third segment. Third segment armed with few short lateral and ventral setae, fourth with few ventral setae, fifth with more short ventral setae, almost none of setae longer than segment diameter.

Oviger segments 4 and 5 slightly swollen distally, well curved, armed with few short distal setae. Sixth segment cylindrical, with increased number of short setae. Strigilis with few dorsal and distal setae, endal denticulate spines in formula 13 : 8 : 7 : 8, with terminal claw almost as long as terminal segment, armed with 10 closely spaced short teeth. Denticulate spines with 3 large lateral serrations per side.

Legs very slender, armed with few short setae on major

segments, only those dorsodistal as long as segment diameter. Propodus almost as long as tarsus (about 0.9), both armed with few short dorsal setae, some longer than others, and many short sole spines of equal length, without larger sole spines. Claw about 0.4 length of propodus, robust, slightly curved, auxiliaries less than 0.25 length of main claw, slender. Cement gland pores on femur only as 5 tiny ventral pores. Egg diameter slightly less than fourth segment on which they are carried.

Female Paratype: Measurements slightly larger in all lengths except for oviger fifth segment, which is subequal to fourth. Strigilis spine count 12 : 8 : 6 : 8, with 7-9 teeth on terminal claw. Chelae teeth 34 and 61 on one female, 23 and 60 on another.

MEASUREMENTS (holotype, in mm).—Trunk length, 10.94; trunk width (across 2nd lateral processes), 5.64; proboscis length, 3.4; abdomen length, 2.11; first leg, total length 62.1; tarsus, 2.27; propodus, 2.5; claw, 1.06; auxiliaries, 0.23.

DISTRIBUTION.—The new species is known only from its type locality, east of Honshu, off Sanriku-oki, in 1225–1970 meters.

ETYMOLOGY.—The new species name is from the Latin *citeria* (a caricature or likeness) and refers to the many similarities between this species and *Nymphon japonicum* Ortmann.

REMARKS.—This species has many similarities to *N. japonicum*, but does not agree in any but two of the stable characters listed by Stock (1954b:18–20) for that species. The characters are the subequal length tarsus and propodus (tarsus longer than propodus in *N. citerium*), oviger spines sparsely serrated with two to three large serrations (three coarse serrations in the new species), few widely spaced teeth on the oviger claw (teeth closely spaced), the large size of the specimens (agrees for both species), and the relative lengths of the palp segments (fourth almost as long as fifth segment in *N. japonicum*, fourth only half as long as fifth in *N. citerium*). Both Stock and Hedgpeth (1949:249–250) found these characters more or less stable in *N. japonicum*, although Ortmann's description and figure are far from clear on most characters.

The two species appear very similar superficially, but the neck of Ortmann's species appears to be consistently slightly longer in specimens examined of that species for comparison. Ortmann's species, as far as our examinations of reference specimens can go, does not have the two ventrodiscal proboscis bumps as shown for *N. citerium*. These swellings are unusual for the genus and are more often found among species of the genus *Callipallene*, suggesting a close affinity with that genus.

Both species share large chelae with many more teeth on the movable finger than are found on the immovable finger, very similar ovigers in segmentation and spination, terminal leg segments superficially very similar, trunk habitus similarities, although the lateral processes are more crowded in *N. japonicum*, and long, very slender legs without large numbers of setae. The palp is more like of *N. kodanii*, with its short fourth segment, than the palp of *N. japonicum*.

Nymphon falcatum Utinomi

Nymphon falcatum Utinomi, 1955:15–17, fig. 9.—Stock, 1956c:94–97, fig. 15; 1965:21–22 [list, key].—Utinomi, 1971a:321.

MATERIAL EXAMINED.—KYUSHU: East China Sea, W and SW of the Danjo Archipelago, 31°19.7'N, 127°32.0'E, 126 m, 17 Jun 1964 (2♀, 1 juv); 32°00.6'N, 127°12.0'E, 120 m, 17 Jun 1964 (1♂ with eggs); 32°36.7'N, 127°42.8'E, 145 m, 17 Jun 1964 (1♂).

DISTRIBUTION.—This species is known from six specimens in the literature from eastern Kyushu in 421 meters, and from

west of the Goto Islands (near the above specimen's locality) in 137 meters. The above records only reduce the minimum known depth to 120 meters and extend the distribution slightly to the south of the Goto Islands. The species is apparently endemic around Kyushu.

REMARKS.—This is a distinctive species, easily recognized by its very long lateral processes, long neck, distinctive long chelifores carried broadly expanded laterally, with a sharply acute angle between scape and chela, and the lack of any auxiliary claws. The male fifth oviger segment segment is well curved proximally and extremely long, and the propodal claws are notably long, measuring about 0.6 of the propodus. This species lacks auxiliary claws and the terminal palp segment has a distinct curve in lateral view.

Nymphon forceps, new species

FIGURE 17

MATERIAL EXAMINED.—HONSHU: Sagami Bay, 34°40.4'N, 139°15.0'E, 410–440 m, KH78-5, sta BS8, 9 Dec 1978 (1♂ with larvae, holotype, USNM 234488, 2♀, 2 juv paratypes, USNM 234489).

DESCRIPTION.—Size moderately small, leg span 26.7 mm. Trunk compact, posterior rim of each segment swollen in lateral view, lateral processes separated by less than their diameters, only slightly longer than their diameters, armed with 2–3 short dorsodistal setae. Oviger implantation against anterior of first lateral processes, on short neck. Ocular tubercle dorsal to center of oviger implantations, low, not as tall as basal diameter. Eyes large, lightly pigmented, sensory papillae not evident. Crop narrow. Proboscis fairly large compared to trunk, cylindrical, oral surface moderately flat. Abdomen short, a truncate cone bearing several short dorsolateral setae.

Chelifores moderately large, scape almost as long as proboscis, cylindrical, armed with few long dorsal and lateral setae longer than segment diameters. Chelae slender, palm semi-triangular, shorter than fingers, armed with dorsal and ventral fields of long setae as long as palm is wide. Fingers forcipulate, tong-like, slender, movable finger well curved, with 17 long well-spaced teeth, immovable finger only distally curved, with 14 similar teeth. Fingers carried anaxially when closed.

Palps moderately short, second segment slightly longer than third, fourth and fifth very short, combined length only as long as third. Fifth segment slightly longer than fourth. Armed with few short setae on second and third, fourth and fifth with many short lateral and ventral setae.

Ovigers fairly short, fifth segment longest, with swelling and few setae distally. Strigilis of reduced size relative to proximal segments, with denticulate spines in the formula 8 : 5 : 4 : 5, and claw equal in length to the terminal segment, bearing 8 small teeth. Spines with 6–7 lateral serrations, those proximal largest while decreasing in size distally.

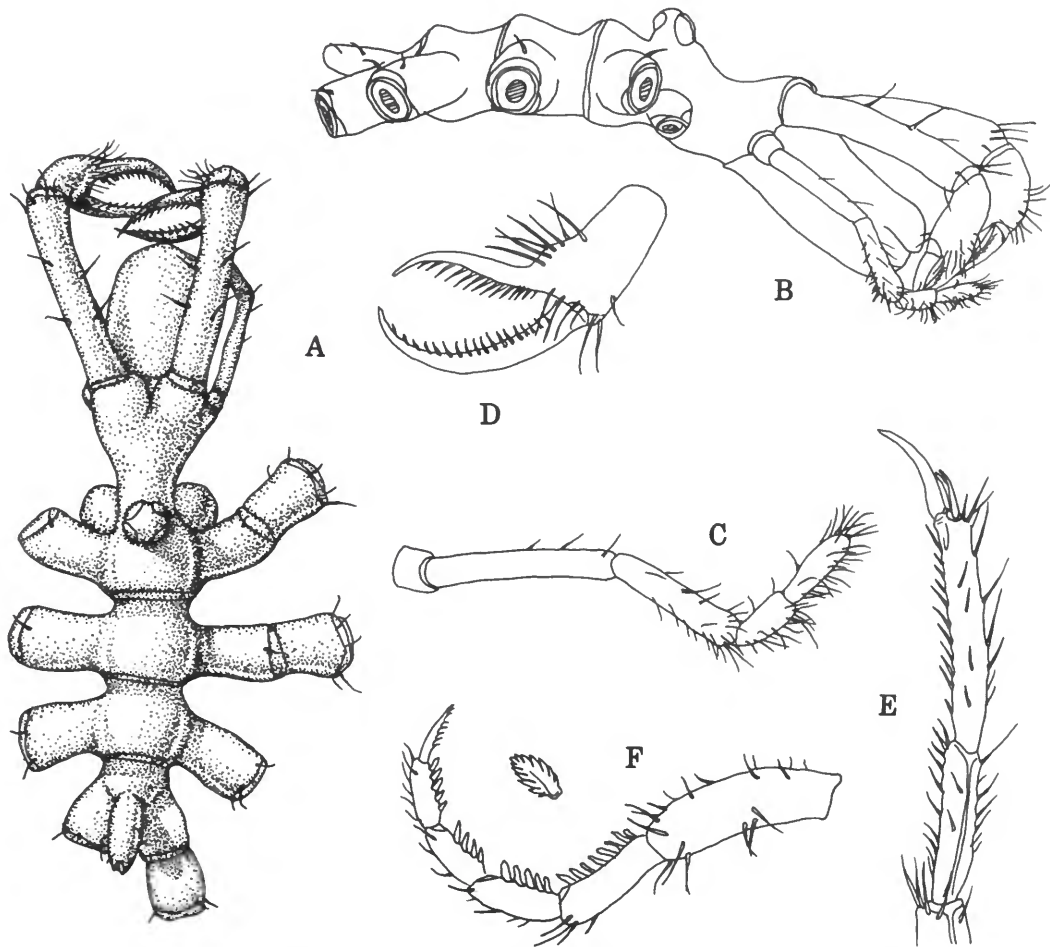


FIGURE 17.—*Nymphon forceps*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, third leg, terminal segments, enlarged; E, oviger strigilis, enlarged; F, chela, strigilis, and denticulate spine enlarged.

Legs short for genus, quite setose, with ventrodistal tufts of setae on second and third coxae, many setae longer than segment diameters on major segments, increasing in numbers distally. First tibiae almost as long as second. Cement gland pores on all 3 major segments: 4–6 on femorae, 4–5 on first tibiae, and 2–5 on second tibiae. Tarsus only 0.7 length of propodus, with both short and long dorsal and lateral setae, sole spines mostly of uniform length, 1 or 2 slightly longer on distal tarsus and at propodus midsole. Claw slender, moderately curved, half propodus length, auxiliaries 0.4 as long as main claw, slender.

Female measurements larger than male, all femorae inflated denoting recent extrusion of ova. Strigilis spines in the formula 9:6:5:6, with 7 small teeth on terminal claw. Auxiliary claws slightly longer, fully half main claw length, while tarsus is slightly shorter than that of male. Proximal leg segments with fewer setae and without ventral coxae tufts.

MEASUREMENTS (holotype, in mm).—Trunk length, 3.03; trunk width (across 2nd lateral processes), 1.67; proboscis length, 1.27; abdomen length, 0.58; second leg, coxa 1, 0.6; coxa 2, 1.16; coxa 3, 0.62; femur, 2.28; tibia 1, 2.76; tibia 2, 2.94; tarsus, 0.68; propodus, 1.0; claw, 0.49.

DISTRIBUTION.—The new species is known only from the type locality, Sagami Bay, in 410 to 440 meters.

ETYMOLOGY.—The species name is from the Latin *forceps* (forcipulate or tong-like) and refers to the slender chelae fingers.

REMARKS.—This species is probably closest to *N. brashnikovi* Schimkewitsch and *N. brevis* (this report). The palp of *N. brashnikovi* figured by Hedgpeth (1949:251, fig. 21c) is much longer than that figured for the type by Schimkewitsch (1906b, pl. 1: fig. 3). There is also an apparent dimorphism in the chelae of *N. brashnikovi* as shown in figure 2 by Schimkewitsch. Hedgpeth does not comment on this nor do we find this

dimorphism in Japanese specimens identified by Hedgpeth. The dimorphism may be the result of a damaged male type specimen. The chelae of the new species are very similar to those of *N. brashnikowi*, although the fingers of the new species are longer and have longer teeth. They also have a more marked forcipulate configuration. The trunk of both species is similar although the lateral processes of *N. brashnikowi* are slightly shorter and bear lateral setae or spines, which are lacking in the new species. The legs, ovigers, proboscis, and abdomen of both species are similar, but the ocular tubercle is shorter and the strigilis spines are slightly different in the new species. The palp of the new species has longer segments than that figured by Schimkewitsch, and shorter segments than that figured by Hedgpeth. The similarities of the new species to *N. brevis* are less marked. The general shortness of the trunk and appendages of both species suggests a relationship, but the legs of *N. brevis* are longer, the palp segments are very much shorter, the chelae are very different with shorter fingers bearing short closely crowded teeth, and the oviger segments are slightly more slender and bear a great number of denticulate spines of a different shape. The trunk of both species is inflated at the posterior segmentation lines, but the setae placement, particularly over the chelifore insertion in *N. brevis*, is very different.

Nymphon grossipes Krøyer

?*Pycnogonum grossipes* O. Fabricius, 1780:229.

Nymphon grossipes Krøyer, 1845:108.—Hedgpeth, 1949:247 [literature].—Utinomi, 1971a:318 [literature].

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°52.4'N, 145°06.2'E, 102 m, KT83-11, sta 18B, 10 Jul 1983 (1♂, 1♀, 1 juv). Daikokushima, Akkeshi Bay, 30–40 m, 6 Jun 1984 (1 juv).

DISTRIBUTION.—This is a circumboreal species, taken as far south as Sagami Bay and as shallow as 15 meters, but it is more often taken in northern Atlantic and Alaskan-Russian Arctic localities.

REMARKS.—Since 1780, this species has been deluged with subspecific and other species designations to denote the variation found by various authors examining the broad spectrum of arctic specimens. The variation is often found in the terminal leg segments where the tarsus may be of varying lengths in relation to that of the propodus. The heel and sole of the propodus have several larger spines among the smaller spines and the expanded neck, or crop, does not have tubercles over the chelifore insertion.

Nymphon gunteri Hedgpeth

Nymphon gunteri Hedgpeth, 1949, 257–259, fig. 26.—Nakamura, 1987:4–5, pl. 2.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 40°22.4'N, 143°24.0'E, 1970–2000 m, KH81-4, sta 4, 10 Jul 1981 (2♂, 2♀, 4 juv); 38°45.6'N, 143°11.5'E, 1950–1970 m,

KH81-4, sta 8, 25 Jul 1981 (2♂, 4♀, 1 juv); 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1♀); 39°12.4'N, 142°18.7'E, 700–736 m, KT84-9, sta SR5, 10 Jul 1984 (3♂, 2♀); 39°13.3'N, 142°16.2'E, 562–563 m, KT85-11, sta SR15, 14 Aug 1985 (1♂ with eggs, 1 juv). E of Kii Peninsula, Kumano Sea, 34°05.9'N, 136°40.4'E, 422–426 m, KT86-6, sta KN4, 27 May 1986 (1♀).

DISTRIBUTION.—This species was described from a female taken at the same station as the *N. heterospinum* type, off northern Honshu in 378 meters. These specimens extend its distribution slightly to the north and a farther distance to the south off Kii Peninsula. Nakamura (1987) found it in Sagami Bay at 100 meters, but the above specimens extend the depth to 2000 meters. Therefore, the species remains an endemic to Japan, as far as is known, and is one of those few species with northern and southern Honshu distribution.

REMARKS.—The recognition characters for this species are two large spines almost at midsole length, a propodus subequal to the tarsus, a very short fourth palp segment, slightly over half length of the fifth, and strigilis spines with two lateral serrations per side and many tiny distal serrations. The chelae fingers are long, as long as the palm, and bear 10–15 large teeth.

Nymphon heterospinum Hedgpeth

Nymphon heterospinum Hedgpeth, 1949:259–260, fig. 27.

MATERIAL EXAMINED.—HOKKAIDO: E of Akkeshi Bay, 42°52.4'N, 145°06.2'E, 102 m, KT83-11, sta 18B, 10 Jul 1983 (1 juv). HONSHU: Sanriku-oki, 39°16.5'N, 142°09.4'E, 288–300 m, KT84-9, sta SR3, 12 Jul 1984 (2♀); 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1 juv); 39°13.3'N, 142°16.2'E, 562–563 m, KT85-11, sta SR15, 14 Aug 1985 (1♂ with eggs, 1♂).

DISTRIBUTION.—This species was described from a male taken off northern Honshu about 100 km south of the Sanriku-oki specimens above. The species, from sparse records, appears to be confined to northern Japan in the cold Oyashio current in 102 to 563 meters.

REMARKS.—This species is characterized by two or three large heel spines, chela fingers shorter than the palm and armed with many small teeth, auxiliary claws almost half the main claw length, and strigilis spines with a larger basal serration and tiny leaf-like distal serrations. From the few specimens in hand, there seems to be very little variation in the above characters, all of which Hedgpeth described and figured very well.

Nymphon improcerum, new species

FIGURE 18

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Kisami, 33–41 m, 4 Dec 1981 (1 ovigerous ♀, holotype, USNM 234490).

DESCRIPTION.—Size moderately small, leg span 23.1 mm. Trunk fully segmented, moderately short, lateral processes only

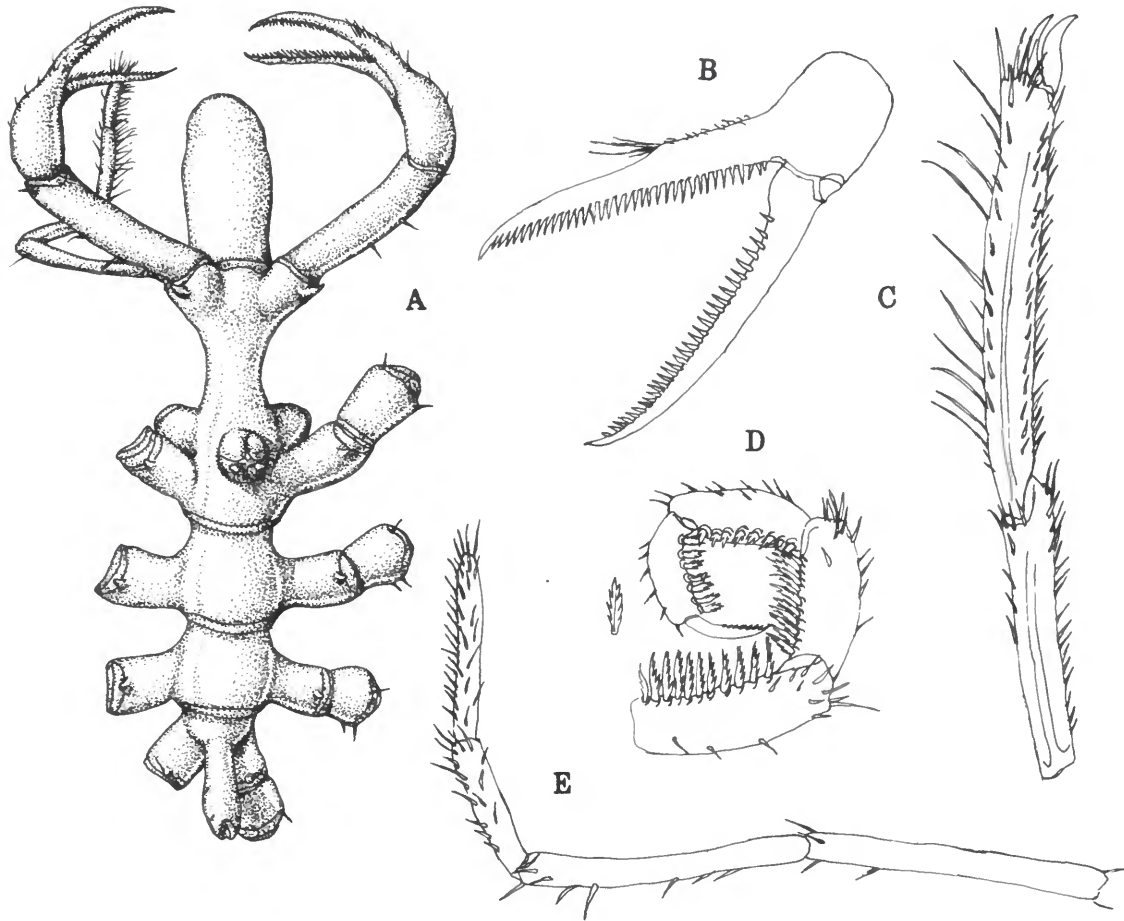


FIGURE 18.—*Nymphon improcerum*, new species, holotype: A, trunk, dorsal view; B, chela; C, third leg, terminal segments, enlarged; D, oviger strigilis with one denticulate spine, enlarged; E, palp.

slightly longer than their diameters, separated by slightly more than their diameters or less, each armed with tiny low dorsodistal tubercle, without setae. Neck moderately short, about as long as chelifore expansion, armed with small low laterodistal tubercles pointing anteriorly. Ocular tubercle low, rounded, with 2 tiny laterodistal tubercles, eyes filling entire ocular tubercle, slightly pigmented. Ocular tubercle placed between first lateral processes, slightly posterior to oviger implantation, which touches first lateral processes. Proboscis moderately short, cylindrical, rounded distally at mouth. Abdomen slender, cylindrical, tapering distally, armed with 4 laterodistal short setae.

Chelifores large, carried well laterally to plane of trunk. Scape not as long as chela, cylindrical, slightly curved to anterior, armed with few lateral setae shorter than scape diameter. Chela large, fingers longer than palm, curved inward toward mouth. Palm a curved cylinder tapering proximally,

armed with few tiny setae. Fingers slightly curved, more at overlapping tips. Movable finger armed with 32 slender sharply pointed teeth, without ectal setae. Immovable finger armed with 35 similar teeth, several long setae at about 0.4 finger length, setae longer than finger diameter.

Palps slender, second segment longest, with third segment little shorter. Terminal 2 segments shorter, fourth 0.8 length of fifth, both with many short lateral and ventral setae, some longer than segment diameter.

Oviger fifth segment slightly longer than fourth, both with few short setae. Strigilis segments fairly short, with many short dorsodistal setae and denticulate spines in the formula 12 : 9 : 8 : 8, and a slender well-curved terminal claw bearing 9 small endal teeth. Denticulate spines fairly short, sides bearing 3-4 serrations each.

Legs long, very slender, armed with many short setae, few longer serae. Second tibia much longer than first, which is

slightly shorter than femur. Tarsus slightly more than half propodus length, both armed with many lateral short setae, few dorsal setae longer than segment diameter, and many short sole setae. Broad sole spines lacking. Claw extremely short, hardly longer than propodus diameter, robust, well curved, auxiliaries almost as long as main claw.

MEASUREMENTS (in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 2.04; trunk width (across 2nd lateral processes), 1.06; proboscis length, 0.79; abdomen length, 0.39; third leg, coxa 1, 0.32; coxa 2, 0.86; coxa 3, 0.47; femur, 2.11; tibia 1, 2.46; tibia 2, 3.37; tarsus, 0.44; propodus, 0.84; claw, 0.15.

DISTRIBUTION.—This species is only known from its type locality, off Kisami, Sagami Bay, in 33 to 41 meters.

ETYMOLOGY.—The species name is from the Latin *improce-*rum (short or undersized) and refers to the very short or undersized main claw of the propodi.

REMARKS.—There are no known Japanese (or Pacific) species with the combination of extremely short main claws, auxiliary claws of approximately the same length, and no major sole spines. This species is related in some ways to *N. akanei*, a species described from the same locality in 30 meters. It has the same length neck, large chelifores curved toward the mouth, chelae with long and sharply pointed teeth (but more in number), a similar ocular tubercle with apical tubercles, similar palp segment lengths, and similar oviger characters. Where *N. akanei* differs is in its lack of tiny lateral process and chelifore insertion tubercles, and the terminal leg segment characters of this new species.

Nymphon infundibulum, new species

FIGURE 19

MATERIAL EXAMINED.—HONSHU: Kii Strait, 33°28.6'N, 135°28.9'E, 353–354 m, KT84-12, sta 15, 1 Sep 1984 (1♀, holotype, USNM 234491, 1♂ with eggs, damaged, 4 juv, paratypes, USNM 234492); 33°28.1'N, 135°28.5'E, 455–492 m, KT84-12, sta 16, 1 Sep 1984 (2 juv, paratypes, USNM 234493).

DESCRIPTION.—Size very large, leg span about 156 mm. Trunk elongate, slender, lateral processes separated by twice their diameters, as long as twice their diameters, glabrous. Oviger implantations slightly anterior to first lateral processes, not touching, ocular tubercle slightly posterior but over implantations. Neck very long, parallel sides over twice longer than crop, which is rather narrow. Proboscis long, cylindrical with slight median swelling, distal constriction, almost flat oral surface. Proboscis as long as neck. Abdomen short, slender, tapering distally, with few tiny setae.

Chelifores long, slender, scape as long as proboscis, armed with few short lateral setae, many short distal setae. Chelae slender, palm cylindrical, armed with fringe of short distal setae including an ectal pad with setae at proximal end of immovable

finger. Fingers carried synaxially on palm, long, slender, immovable finger only curved distally, armed with 16–17 slender sharp teeth, those more distal being longer than finger diameter. Movable finger gently curved throughout, longer than immovable finger, armed with 17–18 sharp slender teeth slightly smaller than those of immovable finger.

Palps slender, third segment 0.9 length of second, the longest, fourth segment only about 0.3 length of second, fifth slightly over half length of second, all armed with short setae increasing in numbers on distal segments.

Ovigers slender, fourth segment gracefully curved, about 0.9 length of fifth. Sixth segment with many short setae, segment as long as seventh and eighth combined. Strigilis segments increasingly shorter than each more proximal segment, armed with short dorsal and distal setae, endal denticulate spines in the formula 19 : 15 : 13 : 15, with a short very slender terminal claw bearing 11–12 slender teeth in the form of serrations. Denticulate spines very slender, with 3–4 major serrations per side and many tiny distal serrations.

Legs extremely slender, very long, with many short dorsal, lateral, and ventral setae in rows. Propodus only about 0.6 length of tarsus, both armed with few short dorsal and lateral setae and many short sole spines of varying lengths, those of propodus somewhat longer than basal diameter of main claw.

Male Paratype: Slightly smaller in most measurements. The chelae have 19 and 21 teeth on the immovable and movable fingers respectively, and the fifth oviger segment is slightly longer, and has a slight distal swelling and a moderate curve matching that of the fourth segment. The strigilis spine count differs, of course, having more spines in the formula 21 : 12 : 13 : 16, with only 9 teeth on the terminal claw. The male specimen has only fragmented legs.

MEASUREMENTS (holotype, in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 8.34; trunk width (across 2nd lateral processes), 3.3; proboscis length, 2.96; abdomen length, 0.84; fourth leg (female holotype, proximal segments), coxa 1, 1.22; coxa 2, 3.62; coxa 3, 1.46; femur, 10.56; tibia 1, 25.63; tibia 2, 28.68.

Male paratype, distal segments: tarsus, 2.24; propodus, 1.72; claw, 0.91; auxiliaries, 0.25.

DISTRIBUTION.—The species is only known from the type locality, Kii Strait, central Honshu, in 353 to 492 meters.

ETYMOLOGY.—The species name is from the Latin *infundibulum* (a funnel) in recognition of its long funnel-shaped neck and crop.

REMARKS.—There are few species of *Nymphon* in the north Pacific with necks approaching the length of that of *N. infundibulum*. All of the specimens identified as this new species are damaged, the male particularly, with the loss of most or all of the long legs, but this does not deter from recognition of the extremely long funnel-like neck and crop. Only *N. dissimilis* Hedgpeth, *N. micropedes* Hedgpeth, *N. elongatum* Hilton, *N. falcatum* Utinomi, *N. quadriclavus*

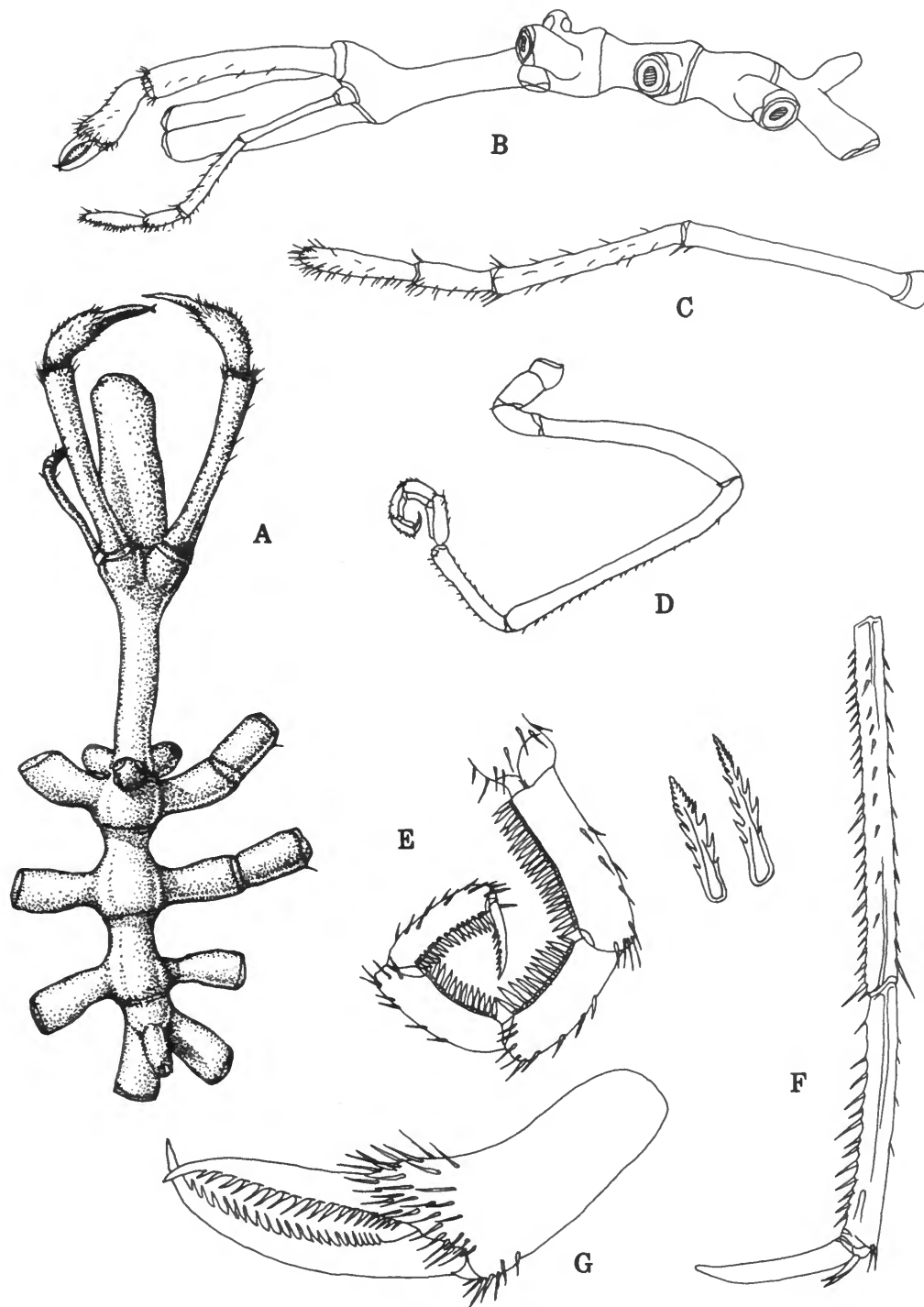


FIGURE 19.—*Nymphon infundibulum*, new species, holotype: A, trunk, dorsal view; B, trunk, lateral view; C, palp; D, oviger; E, oviger strigilis, with two spines, enlarged; F, third leg, terminal segments, enlarged; G, chela, enlarged.

Nakamura and Child, and, possibly, *N. striatum* Losina-Losinsky have the character of a long- to medium-long neck coupled with the character of well-separated lateral processes as shown by the new species. *Nymphon falcatum* can be discarded from further comparison because of its lack of auxiliary claws. *Nymphon striatum* has conspicuous tubercles over the chelifore insertions, which are lacking in this new species, and *N. quadriclavus* has five conspicuous cement gland tubes on the ventral femur and first tibia, again lacking in the male of the new species. The very reduced size of terminal leg segments in *N. micropedes* differs markedly with the new species in which these segments are much longer and the tarsus is longer than the propodus, unlike those of Hedgpeth's species. The latter character holds true for *N. dissimilis* also, with a tarsus only half as long as the propodus, which has several long sole spines. The palp of the latter species is much shorter in each segment than that of *N. infundibulum*. This new species is probably closest to *N. elongatum*, but that species has a tarsus almost twice the length of its propodus and notably smaller chelae with shorter fingers in relation to the palm length. The two species otherwise appear quite similar.

Nymphon kodanii Hedgpeth

Nymphon kodanii Hedgpeth, 1949:252-254, fig. 23.—Stock, 1954b:21, fig. 6f.—Utinomi, 1955:7, fig. 3; 1962:92; 1971a:320.—Turpaeva, 1971a:275-276, fig. 1 (6-9).

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 38°45.6'N, 143°11.5'E, 1950-1970 m, KH81-4, sta 8, 25 Jul 1981 (1♀, 2 juv); 39°59.0'N, 142°37.7'E, 1225-1249 m, KT85-11, sta SR16, 12 Aug 1985 (2♂, 1♀). Kii Strait, 33°23.9'N, 135°42.1'E, 353-416 m, KT84-12 sta 7, 31 Aug 1984 (1♂ with eggs, 1♀, 2 juv); 33°28.6'N, 135°28.9'E, 353-354 m, KT84-12, sta 15, 1 Sep 1984 (1♂, 3 juv).

DISTRIBUTION.—The southern Kuril Islands appear to be the northernmost collecting record for this species, and it has been taken in the Sea of Japan, eastern Honshu, and to the west of Kyushu in depths of 137 to 1970 meters, the deepest record being the three specimens from station 8 above.

REMARKS.—This is one of those perplexing variable species in which it is difficult to perceive where variation should end and speciation should begin. On first examination, these specimens appeared to be at least two species, but further examination of the literature and specimens convinced us that all were the same species. The palp's two terminal segments are various lengths and have varying ratios in comparable length as do the tarsus and propodus. Neither of the terminal palp segments are as long as the second or third, but the terminal segment offers the greatest variation in length of the five segments. Among specimens examined, the tarsus is sometimes slightly longer than the propodus, while it is shorter in others. The most reliable recognition characters appear to be the oviger denticulate spines, which are coarsely serrate with two teeth per side, the auxiliary claws, which are about 0.3 as

long as the main claw, and the relatively long neck with parallel sides as long or longer than the crop.

Nymphon longispinum, new species

FIGURE 20

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, off Kamaishi, 39°12.4'N, 142°18.7'E, 700-736 m, KT84-9, sta SR5, 10 Jul 1984 (1♂, holotype, USNM 234494, 2♂, 3♀, 1 juv, paratypes, USNM 234495); 39°07.2'N, 142°23.1'E, 926-950 m, KT84-9, sta SR6, 10 Jul 1984 (1♂, 5♀, damaged, paratypes, USNM 234496).

DESCRIPTION.—Size moderately small for genus, leg span 33.6 mm. Trunk slightly elongate, lateral processes separated by about their diameters proximally, slightly longer than their maximum diameters, glabrous. Neck moderately short, parallel-sided part shorter than crop, which is narrow. Oviger implantation distinctly anterior to first lateral processes, not touching. Ocular tubercle low, as tall as basal diameter, placed dorsal to gap between oviger implantation and first lateral processes, eyes large, slightly pigmented. Proboscis moderately slender, swollen at midlength, constricted slightly just posterior to rounded lips. Abdomen slender, cylindrical, tapering distally to rounded tip, glabrous.

Chelifores slender, long, scapes as long as proboscis, armed with few short distal setae, shorter than scape diameter and 3 longer dorsolateral setae, longer than scape diameter. Chelae slender, palm triangular in dorsal aspect, cylindrical in lateral view, armed with many short setae. Fingers carried at low angle, slender, movable finger well curved, overlapping curved tip of immovable finger, both armed with moderately long slender pointed teeth, 14 on immovable and 15 on movable finger.

Palps slender, second segment very slightly longer than third, fourth and fifth segment lengths combined less than length of third segment, armed with short setae in increasing numbers on distal segments.

Ovigers moderately slender, fifth segment very slightly longer than fourth, armed with few short setae, without distal swelling. Strigilis segments slender, each segment slightly shorter than last, armed with few short dorsodistal setae, endal denticulate spines in the formula 18 : 12 : 11 : 13, with a very slender terminal claw having 13 tiny teeth. Denticulate spines slender, with single large proximolateral serration and many tiny serrations distally per side.

Legs moderately slender, armed with few short setae increasing in numbers on distal segments and few long dorsal and lateral setae longer than their segment diameters. First coxae with 2 long laterodistal setae. Tarsus only 0.6 propodal length, armed with few short dorsal and ventral setae and single ventrodistal spine longer than segment diameter. Propodus very slightly curved, armed with few dorsal and lateral setae, sole spines of varying sizes with 3 larger spines proximally,

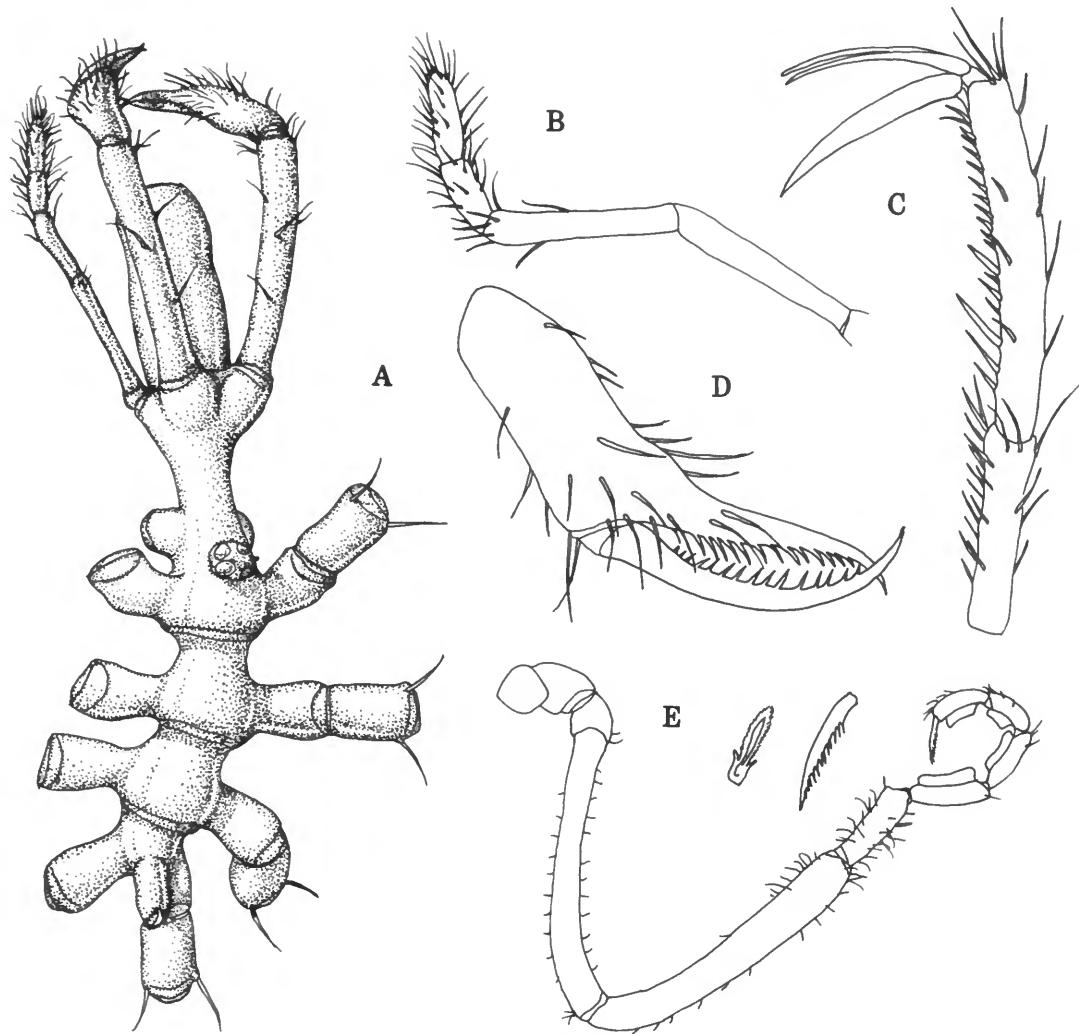


FIGURE 20.—*Nymphon longispinum*, new species, holotype: A, trunk, dorsal view; B, palp; C, third leg, terminal segments, enlarged; D, chela; E, oviger, with terminal claw and a spine, enlarged.

spines longer than propodal diameters. Claw slender, about 0.6 length of propodus, only slightly curved distally, auxiliaries very slender, about 0.8 length of main claw.

Female Paratype: Measurements slightly greater in all segments except for oviger fifth segment, which equals fourth segment. Oviger strigilis spine formula: 16 : 12 : 10 : 12, with terminal claw teeth numbering 13. Palp segment four slightly shorter than that of male. Chelae finger teeth fewer in number; both fingers with 13 sharply pointed teeth.

MEASUREMENTS (holotype, in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 3.36; trunk width (across 2nd lateral processes), 1.48; proboscis length, 1.4; abdomen length, 0.46; fourth leg, coxa 1, 0.54; coxa 2, 1.6;

coxa 3, 0.67; femur, 2.88; tibia 1, 3.3; tibia 2, 4.36; tarsus, 0.64; propodus, 0.98; claw, 0.6, auxiliaries, 0.48.

DISTRIBUTION.—The new species is known only from off Kamaishi, Sanriku-oki, in northern Honshu, in 700 to 950 meters.

ETYMOLOGY.—This new species is named for its conspicuous long spines on the chelifore scapes and first coxae.

REMARKS.—This species was first thought to be *N. gunteri* Hedgpeth, but critical examination brought several characters to light that are not found in Hedgpeth's species. The most conspicuous differences are in the oviger placement on the neck, separated distinctly from the first lateral processes in this new species and not separated but adjacent to the first lateral

processes in *N. gunteri*. Also, the conspicuous long setae of the chela scape and first coxae are not present in Hedgpeth's species, while they are prominent in the new species.

Other differences that are less conspicuous involve the terminal palp segment, which is longer in relation to the fourth segment in *N. gunteri* than is the fifth palp segment in the new species. The usual differences in chela finger teeth counts and oviger denticulate spine counts are present not only between specimens of *N. gunteri* but between the two species and specimens within the new species type series, making this comparison inconclusive. The count differences within either species are almost the same as count differences between the two species. Another difference is in the length of auxiliary claws in relation to the main propodal claw, those of the new species being almost as long as the main claw, while the auxiliaries of *N. gunteri* are half or less than half as long as the main claw. The propodal sole spination is very similar with both species having two to three large proximal spines among other spines of varying length.

Finally, the size of the two species is also conspicuous. The new species is only half the measured size of *N. gunteri*, but since several genera have had species described that show great variation in overall size (*Anoploactylus lentus*, for instance), this difference is probably of little consequence in separating the two species.

Nymphon maruyamai, new species

FIGURE 21

MATERIAL EXAMINED.—HONSHU: Sagami Bay, 34°40.4'N, 139°15.0'E, 410–440 m, 9 Dec 1978 (1♂ with eggs, holotype, USNM 234497, 8♂, 2♀, 4 juv, paratypes, USNM 234498).

DESCRIPTION.—Size moderately large, leg span 54 mm. Trunk elongate, slender, lateral processes separated by slightly more than their diameters distally, as long as 1.5 times their diameters except posterior shorter pair, with 2–3 very short dorsodistal setae. Neck long, about 1.5 times longer than expanded area of crop. Oviger implantation anterior and slightly separate from first lateral processes with ocular tubercle dorsal to point where oviger bases join first lateral processes. Ocular tubercle slightly taller than basal diameter, lateral sensory papillae inconspicuous, eyes large, unpigmented. Proboscis large, cylindrical, with slight constriction anterior to midpoint and swelling just posterior to rounded oral surface. Abdomen short, a truncate cone armed with 2–3 tiny distal setae.

Chelifores long, scape as long as proboscis, armed with several short lateral, dorsal and distal setae. Chelae slender, palm shorter than fingers, a flattened cylinder with several short lateral setae and fringe of distal setae. Immobile finger with swollen ectal pad bearing many short and long setae, finger only slightly curved proximally, strongly curved distally, with

15 sharply pointed teeth with those longest at midpoint and those more proximal and distal shorter. Movable finger longer than immovable one, well curved, crossing immovable finger at tip, with 14 teeth similar to those opposing.

Palps slender, only slightly setose, second segment longest, third 0.8 length of second, fourth and fifth combined length only as long as third, fifth slightly longer than fourth, both with moderate number of short setae.

Oviger fifth segment slightly longer than fourth, with many balls of tiny cemented eggs in masses, eggs tiny. Strigilis segments with ectal tufts of short dorsodistal setae, endal denticulate spines in the formula 19 : 15 : 12 : 14, with a terminal claw 0.6 as long as terminal segment, armed with 10 tiny teeth. Denticulate spines very slender, with 4 large serrations per side.

Legs long, very slender, armed with few short setae. Cement gland pores not found. Tarsus little longer than propodus, both armed with few ectal short setae, 12–15 short sole spines of equal size, without large spines. Claw about 0.4 as long as propodus, robust, slightly curved, auxiliaries little over half main claw length, slender.

Female Paratype: Neck slightly longer in relation to crop, propodal sole spines of different lengths with 3–4 median spines longer than those more proximal and distal, strigilis spines more numerous with the formula 25 : 17 : 17 : 17, 13 teeth on the terminal claw, and fifth oviger segment shorter in relation to fourth.

MEASUREMENTS (holotype, in mm).—Trunk length, 3.01; trunk width (across 2nd lateral processes), 2.38; proboscis length, 2.11; abdomen length, 0.85; third leg, coxa 1, 0.82; coxa 2, 2.5; coxa 3, 1.02; femur, 4.84; tibia 1, 5.35; tibia 2, 8.2; tarsus, 1.25; propodus, 1.12; claw, 0.46.

DISTRIBUTION.—This species is known only from the outer reaches of Sagami Bay, Honshu, in 410 to 440 meters.

ETYMOLOGY.—We take pleasure in naming this new species for Mr. Sotoshi Maruyama, former Principal of Higashi Yamato Senior High School, Metropolitan Tokyo, for his encouragement and support of the research conducted by the senior author.

REMARKS.—The swollen pad bearing many setae at the base of the immobile chela finger is uncommon among the many *Nymphon* species, particularly among those of the Japanese fauna. The chelae of *N. gunteri* bear a smaller setose pad and those of *N. benthos* an even smaller one, neither as large or setose as the pad of the new species. The neck length and lateral process separation of the new species are reminiscent of *N. dissimilis*, but the palp segment length relationships and terminal leg segment features are very different from *N. maruyamai*. The new species has characters shared by *N. infundibulum*, new species (this report), such as a small setose chela pad, palps of similar length ratios except for the shorter second segment of *N. infundibulum*, very similar oviger segments and denticulate spines, but a much longer tarsus in relation to the propodus and longer auxiliary claws when

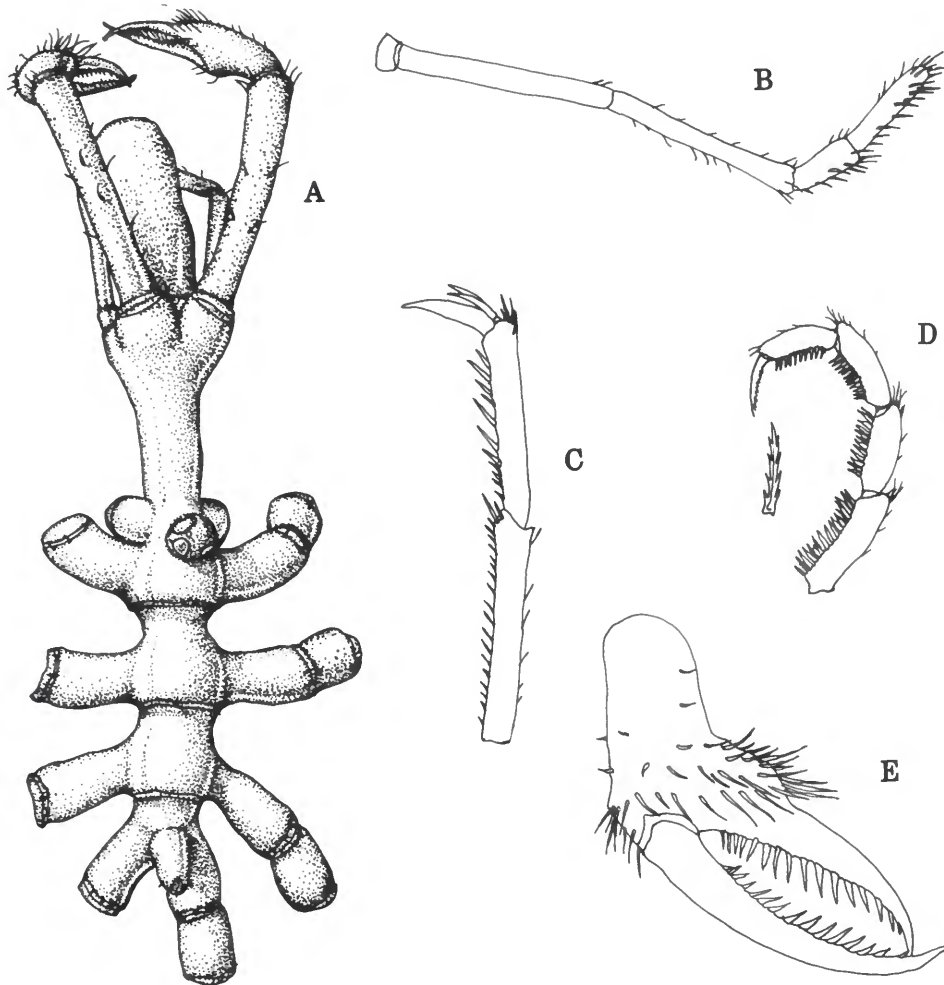


FIGURE 21.—*Nymphon mariyamai*, new species, holotype: A, trunk, dorsal view; B, palp; C, third leg, terminal segments, enlarged; D, oviger strigilis, with a spine, enlarged; E, chela.

measured against the main claw of the new species.

This one of many new *Nymphon* species in Japanese waters again emphasizes the seemingly infinite possible combinations of character states that are available to the ever-expanding discoveries in world pycnogonid fauna.

Nymphon okudai, new species

FIGURE 22

MATERIAL EXAMINED.—HOKKAIDO: SE of Kiritappu, 42°51.8'N, 145°25.6'E, 321–328 m, 10 Jul 1983 (1♂ with eggs, holotype, USNM 234499); 42°51.8'N, 145°22.0'E, 216–224 m, 10 Jul 1983 (1♂ with eggs, 1♀, 1 juv, paratypes, USNM 234500).

DESCRIPTION.—Size moderately large, leg span 67 mm. Trunk fairly compact, lateral processes separated by about their diameters or slightly less, slightly less than twice their diameters in length, with few short dorsodistal setae. Oviger implantation against first lateral processes directly ventral to ocular tubercle, which is rounded, as tall as wide. Eyes large, slightly pigmented, with prominent lateral sensory papillae. Neck moderately short, parallel sides not as long as crop. Proboscis cylindrical with slight median swelling, lips almost flat. Abdomen short, with distinct basal articulation, armed with few short distal setae.

Chelifores moderately large, scape as long as proboscis, armed with few lateral and distal setae and one dorsomedian seta as long as scape diameter. Chela palm cylindrical, expanded distally, armed with many short lateral and distal

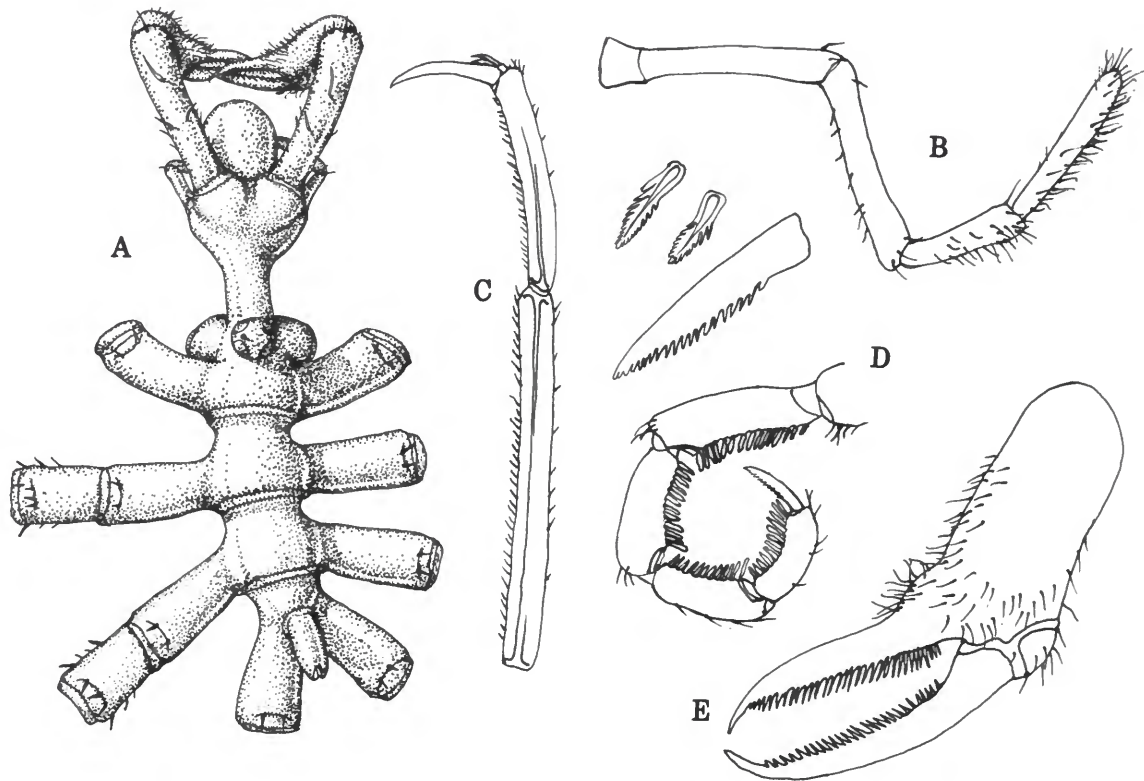


FIGURE 22.—*Nymphon okudai*, new species, holotype: A, trunk, dorsal view; B, palp; C, third leg, terminal segments, enlarged; D, oviger strigilis, with terminal claw and spines, enlarged; E, chela.

setae. Fingers slender, carried anaxially, as long as palm, very slightly curved except for well-curved overlapping tips. Immobile finger with 24–28 slender pointed teeth, movable finger with 27–28 similar teeth.

Palps moderately long, slender, third segment slightly longer than second, fourth about 0.75 as long as fifth, which is 0.85 as long as third. Third segment armed with few short lateral and ventral setae, fourth and fifth with many short lateral and ventral setae, none longer than segment diameter.

Oviger fourth and fifth segments subequal in length, slightly curved, fifth with very slight inflation distally bearing short setae. Eggs carried in ovoid cemented ball on fifth segment, each egg slightly less in diameter than the segment. Sixth segment long, over five times its diameter, slightly curved, armed with many short setae. Strigilis segments each shorter than last, armed with few dorsodistal setae, endal denticulate spines in the formula 18 : 13 : 13 : 14, with a small, slightly curved terminal claw bearing 14–15 tiny closely spaced teeth. Denticulate spines very slender, with 1–2 larger lateral serrations and many tiny distal serrations per side.

Legs very slender, long, armed with few short dorsal and ventral setae, and 1 to several longer lateral setae on first coxae,

first and second tibiae. Cement gland pores found only on femorae, numbering 19–23 per segment. Tarsus about 0.3 longer than propodus, both with few short dorsal setae, a row of very short sole spines of slightly varying lengths, none large. Claw fairly short, robust, well curved at tip, auxiliaries short, about 0.3 as long as main claw.

Female Paratype: Neck slightly longer than that of male, all measurements slightly larger. Terminal palp segment shorter in relation to fourth than that of male, chelae teeth fewer in number, while strigilis terminal claw bears 19 tiny teeth continued to claw tip, and chelae teeth count is 22 for immobile finger and 18 for movable finger.

MEASUREMENTS (holotype, in mm).—Trunk length, 4.78; trunk width (across 2nd lateral processes), 2.84; proboscis length, 1.74; abdomen length, 0.62; third leg, coxa 1, 0.72; coxa 2, 2.54; coxa 3, 1.34; femur, 6.22; tibia 1, 7.6; tibia 2, 9.3; tarsus, 2.16; propodus, 1.52; claw, 0.62.

DISTRIBUTION.—The new species is known only from eastern Hokkaido, southeast of Kiritappu, in 216 to 328 meters.

ETYMOLOGY.—We are pleased to name this species for the late Dr. Shiro Okuda, Professor at Hokkaido University, for his pioneering work on the metamorphosis of a pycnogonid

associated with hydromedusae.

REMARKS.—This species is closest to *N. elongatum* Hilton, a species known from Sakhalin and the Sea of Japan (Hedgpeth, 1949:251–252), while the type specimen is from off the Aleutian Islands. It has a consistently longer tarsus than that of *N. okudai* and, as its name implies, a longer trunk and generally longer appendages than the new species. The similarities are in the chelae, which are quite similar, the palp segment (*N. elongatum* has a longer second segment than that of *N. okudai*), the strigilis spines, which are very similar, and the length and curvature of the oviger fourth and fifth segments, although both are longer in *N. elongatum*.

The distinctive characters of *N. okudai* are the rather long lateral processes with a fairly compact trunk, the small chelae with palm and fingers of the same length, and the long tarsus combined with very short auxiliary claws.

Nymphon ortmanni Helfer

Nymphon ortmanni Helfer, 1938:164, fig. 1.—Utinomi, 1971a:320 [literature].—Nakamura and Child, 1983:56–57.—Nakamura, 1987:6–7, pls. 4, 35.

MATERIAL EXAMINED.—HONSHU: Suruga Bay, 35°03.7'N, 138°49.2'E, 123–134 m, KT73-6, sta A, 11 Jun 1973 (5♂, 2♀, 1 juv); 35°04.0'N, 138°47.4'E, 211–282 m, KT73-6, sta B, 11 Jun 1973 (1♂, 1♀, 1 juv); 34°46.4'N, 138°47.4'E, 306–317 m, KT73-6, sta D-1, 10 Jun 1973 (12♂, 5♀, 14 juv); 34°47.0'N, 138°42.0'E, 355–381 m, KT73-6, sta D-2, 10 Jun 1973 (2♂ with eggs, 31♂, 15♀, 97 juv); 34°45.7'N, 138°42.3'E, 312–328 m, KT74-14, sta B4, 23 Sep 1974 (1♂, 1♀, 2 juv); 34°45.9'N, 138°42.7'E, 262–290 m, KT76-3, sta 006, 28 Feb 1976 (1♂ with eggs, 1♂, 1 juv).

DISTRIBUTION.—This endemic species is known from Tsugaru Strait to Suruga Bay in about 150 to 450 meters, to which the above records add nothing new.

REMARKS.—Stock (1954b:20–21) pointed out that this species is quite a bit smaller than its nearest Japanese relation, *N. japonicum* Ortmann, and that the auxiliary claws are short, the main claw is longer than half the propodal length, and the tarsus is usually subequal to the propodus. There is a large variation in some of the leg segment lengths and the number and placement of setae and spines on the distal leg segments.

Nymphon profundum Hilton

Nymphon profundum Hilton, 1942a:3.—Hedgpeth, 1949:270–271, fig. 33a–f.—Stock, 1965a:22 [list, key].

Nymphon noctum Hilton, 1942a:3.—Hedgpeth, 1949:271, fig. 33g–k.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, off Kuji, 40°05.6'N, 143°57.7'E, 4200–4220 m, KH81-4, sta 7, 15 Jul 1981 (1♀).

DISTRIBUTION.—This species was known from off the Alaska coast and the Aleutian Islands in 2869 and 3230 meters. The above record extends its distribution considerably to the

southwest to Honshu, Japan, and into an additional 1000 meters of depth. This is apparently one of those species brought south by the Oyashio Current.

REMARKS.—This is apparently only the fourth specimen recorded for this species, not counting the two juveniles of *N. noctum*. Hilton's female type of *N. profundum* is also a juvenile without sex pores, but has sufficient characters for comparison with the Japanese specimen here. All specimens lack auxiliary claws, have approximately the same terminal leg segment lengths with slight variation, biserrate oviger strigilis spines, long curved chelae with the same shape teeth, although the counts vary among specimens and from juvenile to adult, and have, at least in the Japanese specimen and Hilton's *N. profundum*, an ocular tubercle space containing tiny conical tubercles in pairs: two for the adult and four for the juvenile. The ocular tubercle, of course, is lacking.

This is the second species of *Nymphon* in this report lacking auxiliary claws, although with the invariably deeper-water work of the *Albatross*, Hedgpeth listed four Japanese species, three of them new, lacking auxiliaries. It is a common rule among species of *Nymphon*, with notable exceptions, that uniunguiculate species are found in moderately deeper to abyssal waters.

Nymphon pumillum, new species

FIGURE 23

MATERIAL EXAMINED.—HOKKAIDO: SE of Akkeshi Bay, 42°52.4'N, 145°06.2'E, 102 m, KT83-11, sta 18B, 10 Jul 1983 (1♀, holotype, USNM 234501).

DESCRIPTION.—Size moderate for genus, leg span 43.6 mm. Trunk moderately slender, lateral processes separated by slightly more than their diameters, about 1.5 times longer than their diameters, armed with 3–4 short dorsodistal setae. Neck moderately long, slightly longer than crop. Crop, chelifores, and proboscis slightly small in relation to trunk size. Oviger implantation against first lateral processes, ocular tubercle dorsal and slightly posterior to anterior edge of oviger bulges. Ocular tubercle low, rounded, without projections, eyes large, slightly pigmented. Proboscis cylindrical, without areas of inflation, lips rounded. Abdomen short, distally tapering, armed with 4–5 short dorsodistal setae.

Chelifores setose, scape slightly shorer than proboscis, armed with many dorsal, lateral, and distal short setae, none as long as segment diameter. Chela palm longer than fingers, cylindrical, armed with many short setae. Fingers carried anaxially to palm, short, robust, slightly curved, armed with 16–17 short, well-pointed teeth on immovable finger, 19–20 similar teeth on movable finger.

Palps short, first 3 segments only as long as proboscis, third segment slightly shorter than second, fourth only twice as long as its diameter and 0.6 as long as fifth segment, fourth and fifth segments together slightly longer than second. Second and

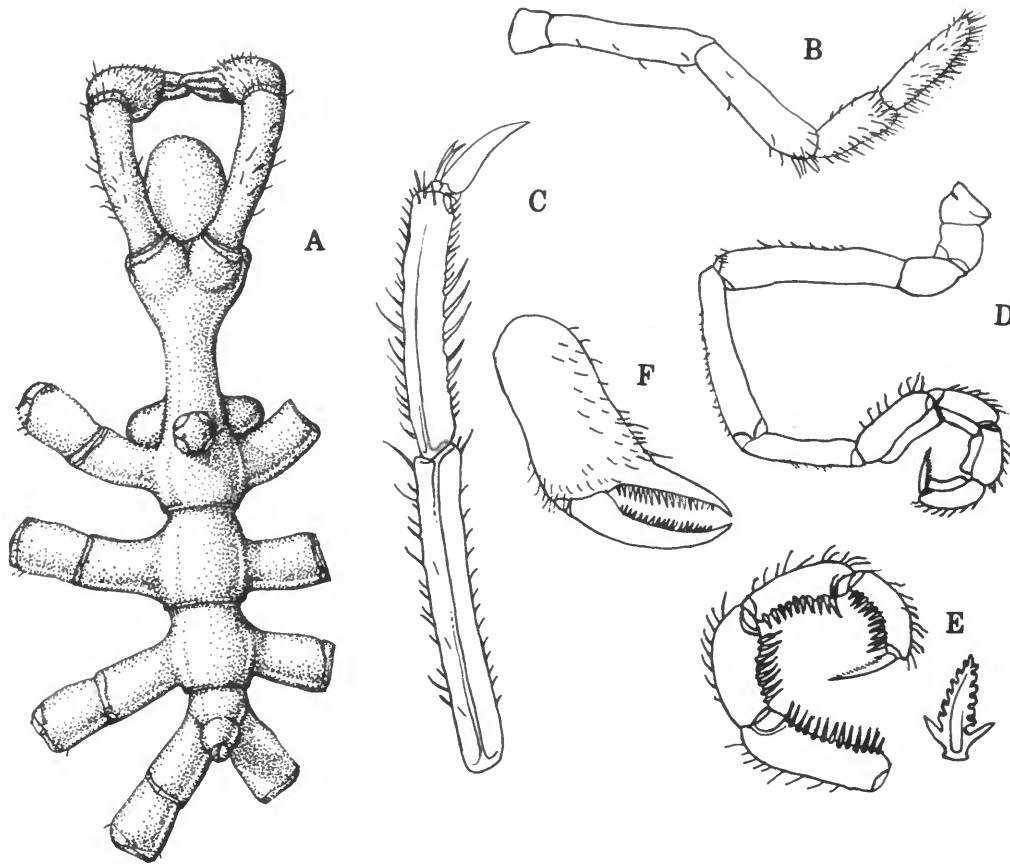


FIGURE 23.—*Nymphon pumillum*, new species, holotype: A, trunk, dorsal view; B, palp; C, fourth leg, terminal segments, enlarged; D, oviger; E, strigilis, with spine enlarged; F, chela.

third armed with few short lateral and ventral setae, fourth and fifth with many short setae.

Oviger major segments moderately setose, fourth and fifth segments subequal in length, sixth over half as long as fifth. Strigilis segments with few ectal short setae, endal denticulate spines in the formula 13 : 11 : 10 : 12, with fairly long terminal claw bearing 12 tiny closely spaced teeth. Denticulate spines with single large basal serration and 6 tiny distal serrations per side.

Legs moderately short, lightly setose, major segments with few long lateral setae, some longer than segment diameters. Femur only slightly shorter than first tibia. Second tibia longest. Tarsus slightly longer to 0.3 times longer than propodus on anterior to posterior legs respectively, both tarsus and propodus armed with few short dorsal and lateral setae and short spines with 1-2 longer spines on distal tarsus sole and 4-6 longer spines on median propodal sole, long spines only as long as segment diameter. Claw short, robust, curved only at tip, auxiliaries almost half main claw length, slender.

Male characters unknown.

MEASUREMENTS (in mm).—Trunk length, 3.6; trunk width (across 2nd lateral processes), 1.72; proboscis length, 1.13; abdomen length, 0.43; third leg, coxa 1, 0.67; coxa 2, 1.66; coxa 3, 1.01; femur, 4.21; tibia 1, 4.39; tibia 2, 5.71; tarsus, 1.43; propodus, 1.16; claw, 0.47; auxiliaries, 0.23.

DISTRIBUTION.—This species is known only from the type locality, SE of Akkeshi Bay, Hokkaido, in 102 meters.

ETYMOLOGY.—The species name is from the Latin diminutive of *pumilis* (dwarfish or little) and refers to the somewhat reduced size of the anterior characters of chelifores, proboscis, and palps.

REMARKS.—There are few *Nymphon* species with slightly to greatly reduced anterior characters. The most characteristic Pacific species is *N. diabolus* Child, with very small anterior segments in relation to the characters posterior to the neck. The anterior of this new species does not reach the extreme reduction of *N. diabolus*, but the reduction, particularly in the shortened palp segments, is reminiscent of *N. diabolus*.

The new species has similarities to several other Japanese species: *N. akanei* Nakamura and Child, *N. simulatum* (this

report), *N. kodanii* Hedgpeth, and possibly *N. striatum* Losina-Losinsky. All of these species share a neck of median length, lateral processes separated by at least their diameters or slightly more, a second palp segment equal to the third or longer than the third and other segments, a fifth palp segment as long or almost as long as the third, and a tarsus longer than the propodus (except in *N. akanei* where the tarsus is shorter than the propodus).

The differences between the new species and *N. striatum* are that, in the latter species, the auxiliaries are longer (half the main claw length), the fifth palp segment is equal in length to the third (the third is shorter in *N. pumillum*), and there are conspicuous tubercles on the dorsal crop where the chelifores insert, which are lacking in the new species.

The principal differences between the new species and *N. akanei* are a much shorter third palp segment, longer auxiliaries, shorter tarsus, and very different chelae in *N. akanei*. This new species is perhaps closest to *N. kodanii* except for relationships in the length of all appendages. The neck of *N. kodanii* is longer, the chelae fingers are longer in relation to the palm and have more teeth, the oviger and palp segments are longer and the denticulate spines are very different and fewer in numbers, and the legs are longer while the auxiliary claws are shorter than those of the new species.

The other species similar to *N. pumillum*—*N. simulatum*—is about four times larger, only has minute auxiliary claws, has a much longer fifth palp segment, the chelae are quite different with longer fingers but similar teeth, much longer (in proportion) oviger and leg segments, and larger anterior segments in relation to the remainder of the trunk.

Nymphon simulatum, new species

FIGURE 24

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 38°45.6'N, 143°11.5'E, 1950–1970 m, KH81-4, sta 8, 25 Jul 1981 (1♂, holotype, USNM 234502, 1♀, paratype, USNM 234503); 40°22.4'N, 143°24.0'E, 1970–2000 m, KH81-4, sta 3, 10 Jul 1981 (2♀, paratypes, USNM 234504).

DESCRIPTION.—Size very large, leg span 170 mm. Trunk elongate, slender, fully segmented, lateral processes separated by their diameters to twice their diameters, as long as 1.5 times their diameters, glabrous. Neck long, parallel-sided element as long as crop. Oviger implantation touching and slightly below first lateral processes with ocular tubercle directly dorsal to implantation. Ocular tubercle small, low, not taller than basal diameter, eyes large, unpigmented, anterior pair larger than posterior pair. Ocular tubercle rounded, without apical tubercles, sensory papillae not evident. Proboscis long, as long as first trunk segment, cylindrical, with slight constriction just posterior to rounded oral surface. Abdomen moderately short, slightly shorter than fourth lateral processes, carried horizontally, slightly downcurved, armed with 2 tiny dorsodistal setae.

Chelifores large, scape as long as proboscis, slightly downcurved, armed with many tiny dorsal setae. Chela long, slender, palm slightly shorter than fingers, cylindrical, armed with many tiny setae. Fingers carried anaxially to palm, long, slender, curved strongly only at overlapping tips, armed with 21 long, sharply pointed teeth on immovable finger, 25 similar teeth on movable finger, distal teeth longer than adjacent finger diameter. Palps armed with very short setae increasing in numbers on distal segments. Second and third segments subequal, fourth about 0.35 length of third, fifth about 0.9 length of third, all segments slender.

Oviger proximal segments with many very tiny setae, strigilis with few tiny ectal setae. Fourth and fifth segments moderately curved, fifth about 1.7 length of fourth, cylindrical, without distal expansion or “clubbed” tip, sixth segment slightly curved, little longer than strigilis segments. Strigilis segments each little shorter than next distal segment, armed with endal denticulate spines in the formula 13 : 11 : 9 : 9, with a terminal claw having 7 endal teeth. Spines with 3–4 lateral serrations per side. Terminal claw about 0.6 length of terminal strigilis segment, slightly curved.

Legs very long, extremely slender, armed with many tiny setae increasing in numbers on distal segments. Tarsus about 0.25 longer than propodus, both armed with many very short sole spines of approximately equal size with few shorter, none as long as half segment diameter. Claw robust, very slightly curved, little less than half propodal length, auxiliaries tiny, less than half basal diameter of main claw in length.

Female Paratype: Slightly larger in most measurements except oviger, which has fifth segment only 0.2 longer than fourth and slightly longer sixth segment, denticulate spines in formula 14 : 12 : 11 : 10 and 8 claw teeth, chela fingers with 22 and 27 teeth on the immovable and movable fingers respectively.

MEASUREMENTS (holotype, in mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 13.5; trunk width (across 2nd lateral processes), 6.2; proboscis length, 5.5; abdomen length, 1.7; third leg, coxa 1, 1.22; coxa 2, 6.0; coxa 3 2.76; femur 15.84; tibia 1, 21.36; tibia 2, 24.48; tarsus, 4.68; propodus, 3.48; claw, 1.56; auxiliaries, 0.12.

DISTRIBUTION.—The new species is known only from eastern Honshu in 1950 to 2000 meters.

ETYMOLOGY.—This species name is from the Latin *simulatum* (like) and refers to its similarity to the known species *N. hodgsoni* Schimkewitsch.

REMARKS.—This species has many similarities to *N. hodgsoni* Schimkewitsch (1913b:244–248, pl. 3: figs. 15–25), but has sufficient diagnostic differences, we believe, to constitute a separate species. Neck length in the genus *Nymphon* is a relatively stable character, unlike the neck lengths of *Callipallene* species, which apparently vary with age of the specimens. The neck length of this species with its parallel sides is much longer than that of *N. hodgsoni*, a species with a very short neck without parallel sides. The trunk is much

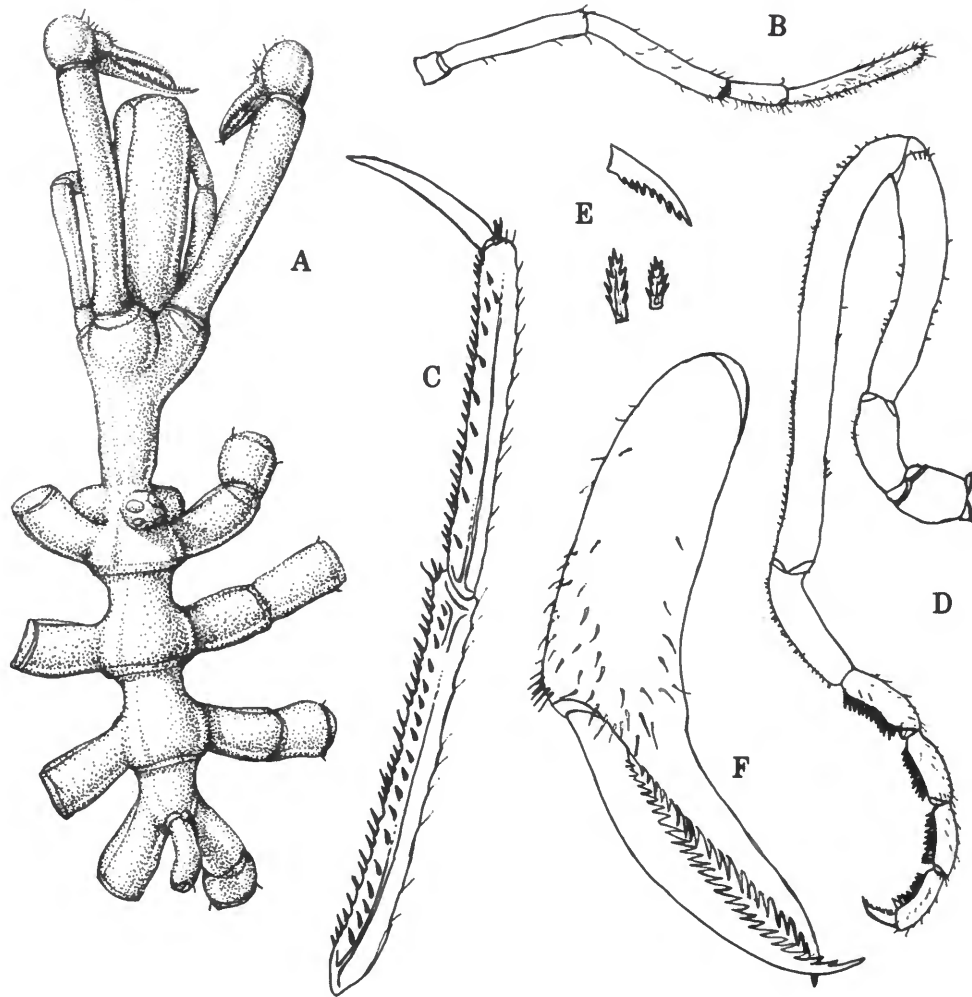


FIGURE 24.—*Nymphon simulatum*, new species, holotype: A, trunk, dorsal view; B, palp; C, third leg, terminal segments, enlarged; D, oviger; E, strigilis, with terminal claw and spine, enlarged; F, chela.

more compact and the lateral processes closer together in *N. hodgsoni*, which has notably shorter legs, a shorter fifth oviger segment with distal swelling, a longer sixth segment, and strigilis segments with differing spine counts and spines with fewer lateral serrations.

The similarities are in the terminal leg segments, which have a similar tarsus-propodus length ratio, very short sole spines, and extremely short auxiliary claws, and in the palp, which has a terminal segment equal to the length of the second or third segments. The chelae are also quite similar except that the fingers of *N. hodgsoni* (Schimkewitsch, 1913b, fig. 19) have many more teeth on the immovable finger than on the immovable finger of the new species. Finally, both species are quite large, but *N. hodgsoni* measures only about 0.85 as long

in the trunk as *N. simulatum*. Specimens of *N. hodgsoni* identified by Hedgpeth (1949:250, fig. 21d-g) were compared with the new species for the above characters and measurements.

Nymphon striatum Losina-Losinsky

Nymphon striatum Losina-Losinsky, 1929a:538-539, fig. 1.—Utinomi, 1971a:319 [literature].—Hong and Kim, 1987:160-161.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 39°22.1'N, 142°08.3'E, 211-212 m, KT83-11, sta 113B, 8 Jul 1983 (18 juv); 39°17.6'N, 142°06.5'E, 199-209 m, KT85-11, sta SR11-1, 15 Aug 1985 (1♂). Toyama Bay, 160-180 m, 15 Jan 1985 (1 juv); depth unknown, 20 Mar 1985 (4♂ with eggs,

2♀). HOKKAIDO: Akkeshi Bay, off Daikokushima, 40 m, 6 Jun 1984 (1♂, 1♀).

DISTRIBUTION.—This species is almost confined to the Sea of Japan and the Gulf of Tatar, except for two records in Akkeshi Bay, eastern Hokkaido, and the Sanriku-oki records above. Most capture records in the northern Sea of Japan and Gulf of Tatar are from littoral captures to the deepest record above, 212 meters.

REMARKS.—This is one of several *Nymphon* species of the north Pacific with tubercles over the chelifore insertion. Those of this species are erect and slightly taller than their diameter. The species is slender with a long neck and well-separated lateral processes, a propodus only 0.7 as long as the tarsus, auxiliary claws slightly less than half the main claw length, palp two terminal segments subequal, and a cylindrical palm equal to the length of the fingers, which are armed with many short teeth. The propodal sole spines are also very short.

Family COLOSSENDEIDAE Hoek

Genus *Colossendeis* Jarzynsky, 1870

Colossendeis angusta Sars

Colossendeis angusta Sars, 1877:268–269.—Hedgpeth, 1948:269–271, fig. 50a [literature].

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 39°13.3'N, 142°16.2'E, 562–563 m, KT85-11, sta 15, 14 Aug 1985 (1 spec.); 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1 juv).

DISTRIBUTION.—This species is apparently worldwide in distribution, if all specimens attributed to it are correctly identified. It has been taken as shallow as 157 meters but is found more commonly in deep to abyssal depths.

REMARKS.—The juvenile above is fully chelate with the chelifores appearing almost exactly as those figured by Hoek (1881, pl. 10: fig. 6) for *C. gracilis*. The species can be recognized by its very long propodal claws, as long or sometimes longer than the propodus, and its very short seventh palp segment, being hardly longer than wide.

Colossendeis colossea Wilson

Colossendeis colossea Wilson, 1881:244–246, pl. 1: fig. 1, pl. 3: figs. 5–7.—Fry and Hedgpeth, 1969:53 [literature].—Stock, 1975a:987; 1983:300; 1986b:418.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 39°44.0'N, 143°38.1'E, 2530–2540 m, KH69-2, sta 9, 6 May 1969 (1 adult); 38°45.6'N, 143°11.5'E, 1950–1970 m, KH81-4, sta 8, 25 Jul 1981 (1 adult, 1 juv). Shikoku, center of Tosa Bay, 650 m, 2 Sep 1987 (2 adults).

DISTRIBUTION.—This is a frequently collected cosmopolitan deep-water species.

Colossendeis macerrima Wilson

Colossendeis macerrima Wilson, 1881:246–247, pl. 1: fig. 2, pl.3: figs. 9–12, pl. 5: fig. 32.—Hedgpeth, 1948:273, fig. 50d [literature].—Stock, 1953b: 308–311, fig. 17e–h.—Barnard, 1954:85.—Stock, 1963:326; 1978b:400–401, fig. 2M.

Colossendeis villegentii A. Milne-Edwards, 1881:933.

Colossendeis leptorhynchus var. *septentrionalis* Caullery, 1896: 362–363.

Colossendeis japonica.—Hedgpeth, 1949:299–300, fig. 46a–d.—Fage, 1956c:176. [Not *C. japonica* Hoek, 1898:295–296, pl. III: figs. 11–13.]

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, off Hachinoe, 40°22.4'N, 143°24.0'E, 1970–2000 m, KH81-4, sta 3, 10 Jul 1981 (2 adults, 2 juv); 38°45.6'N, 143°11.5'E, 1950–1970 m, KH81-4, sta 8, 25 Jul 1981 (5 adults, 2 juv); 39°13.3'N, 143°16.2'E, 562–562 m, KT85-11, sta 15, 14 Aug 1985 (1 juv). Shikoku, center of Tosa Bay, 500 m, 19 Aug 1987 (1♀).

DISTRIBUTION.—Like the species above, this is another often-collected cosmopolitan deep-water species.

REMARKS.—The female Tosa Bay specimen is probably a subadult as it is about half as large as the Sanriku-oki adults and has very indistinct sex pores. Of the two juveniles in the Sanriku-oki sample, the smallest is fully formed, but is very flaccid as though it had recently ecdysed, has no sex pores, and has a slightly shorter proboscis than the adults when compared with the trunk length of each.

This species is characterized by having a second palp segment notably shorter than the fourth, a long slender proboscis, and a tarsus twice as long as the propodus with a relatively short terminal claw. The sixth palp segment is approximately equal to the seventh and the terminal three segments are only slightly longer, in combined length, than the seventh. The oviger terminal claw in shorter in all these specimens than that shown by Wilson for his type specimen (pl. 3: fig. 10), and those of several other figures of the species.

In agreement with Stock (1963:326), we believe Hedgpeth's (1949:299–300) listed specimens are indeed *C. macerrima* as defined by Stock (1963, 1978b), and not *C. japonica*.

Genus *Hedgpethia* Turpaeva, 1973

Hedgpethia brevitaris (Losina-Losinsky and Turpaeva)

Colossendeis brevitaris Losina-Losinsky and Turpaeva, 1958:26–27, fig. 2; 1961:109.

Rhopalorhynchus brevitaris.—Stock, 1970b:9 [key].

Hedgpethia brevitaris.—Turpaeva, 1973:183 [text], 185 [key], table 2.—Nakamura and Child, 1983:63.

MATERIAL EXAMINED.—HONSHU: Sanriku-oki, 39°11.4'N, 142°11.5'E, 430–435 m, KT84-9, sta SR4, 12 Jul 1984 (1 juv); 39°13.3'N, 142°16.2'E, 562–563 m, KY85-11, sta sr15, 14 Aug 1985 (4♂, 5♀, 3 juv).

DISTRIBUTION.—This species is known from Sagami Bay to the Gulf of Alaska in depths of 290 to 563 meters.

REMARKS.—The tarsus and propodal claw of this species are much reduced in length when compared with other species of the genus. They are as long or longer than the propodus in other species.

Hedgpethia chitinosa (Hilton)

Colossendeis chitinosa Hilton, 1943b:4.—Utinomi, 1971a:337-338 [literature].

Rhopalorhynchus chitinosum.—Stock, 1970b:9 [key].

Hedgpethia californica chitinosa.—Turpaeva, 1973:186-189, table 3.

Hedgpethia chitinosa.—Nakamura and Child, 1983:63.—Nakamura, 1987:36-37, pl. 33.

MATERIAL EXAMINED.—KYUSHU: SW of Danjo Archipelago, 31°07.2'N, 127°37.0'E, 126 m, 17 Jun 1964 (1♀). HONSHU: Toyama Bay, 22 Oct 1984 (1 juv). Sagami Bay, off Kisami 37-41 m, 27 Jul 1982 (1 spec.). Off Shimoda, 40-50 m, 6 Apr 1983 (1 spec.). W of Misaki, 46-50 m, 10 Jul 1985 (1♀). Sanriku-oki, 39°07.2'N, 142°23.1'E, 926-950 m, KT84-9, sta SR6, 10 Jul 1984 (1 spec.). Kii Strait, 33°24.3'N, 135°43.0'E, 293-335 m, KT84-12 sta 6, 30 Aug 1984 (1 juv); 33°28.6'N, 135°28.9'E, 353-354 m, KT84-12, sta 15, 1 Sep 1984 (12 spec.); 33°06.8'N, 135°12.5'E, 119-120 m, KT84-12, sta 24, 2 Sep 1984 (1 juv); 33°35.9'N, 135°09.9'E, 322-346 m, KT84-12, sta 27 (30 spec.).

DISTRIBUTION.—The known distribution for this species is from the Aleutian Islands to Kyushu, Japan, and the above records extend this range to the Sea of Japan, an area where few collections have been reported. The wide depth distribution of this species, 20 to about 800 meters, is increased to 950 meters by the above record from Sanriku-oki, Honshu.

REMARKS.—The sex of most of these specimens is difficult to discern because of the extremely tiny sex pores of the coxae. There occurs some variation in this large collection, mostly in the distal leg segments. The tarsus is not always slightly longer than the propodus, but can be equal or even slightly shorter. The long propodal claw can also be shorter than those of the figures given for this species. The oviger claw is invariably short with an opposable spine just proximal to it.

Hedgpethia dofleini (Loman)

Colossendeis dofleini Loman, 1911a:4-5, pl. 1: figs. 6-13.—Utinomi, 1971a:337 [literature].

Rhopalorhynchus dofleini.—Stock, 1958b:114-118 [text].

Hedgpethia dofleini.—Turpaeva, 1973:183 [text], 184-185 [key].

MATERIAL EXAMINED.—HOKKAIDO: S of Akkeshi Bay, 42°41.8'N, 145°08.9'E, 400-479 m, KT83-11, sta B15, 11 Jul 1983 (1 spec.).

DISTRIBUTION.—This species has been taken sporadically from the Bering Sea to south of Kyushu, Japan, in depths of 20 to 923 meters.

REMARKS.—This species is much larger (3×) than any of the many *H. chitinosa* specimens of this report. It also has a notably shorter claw in relation to the propodus and the tarsus is slightly longer than the propodus. Hedgpeth (1949:301) stated that there were no spines on the "tarsal joints," but the tarsus and propodus do have tiny setae on both the dorsal and ventral surfaces. The oviger claw is somewhat larger in relation to the terminal segment, but there are no larger spines in opposition to this claw as in *H. chitinosa*.

Family PYCNOGONIDAE Wilson

Genus *Pycnogonum* Brunnich, 1764*Pycnogonum tenue* Slater

Pycnogonum littorale var. *tenue* Slater, 1879:281-283.

Pycnogonum tenue.—Hedgpeth, 1949:303, figs. 48b, 50c.—Utinomi, 1971a:338 [literature].—Nakamura and Child, 1983:64.—Nakamura, 1987:37, pl. 34.

MATERIAL EXAMINED.—HONSHU: Sagami Bay, off Misaki, 96 m, 10 Jul 1985 (1♂). Kii Strait, 33°24.3'N, 135°43.0'E, 293-335 m, KT84-12, sta 6, 30 Aug 1984 (1♀); 33°23.9'N, 135°42.1'E, 353-416 m, KT84-12, sta 7, 31 Aug 1984 (1♂); 33°28.6'N, 135°28.9'E, 353-354 m, KT84-12, sta 15, 1 Sep 1984 (1♂); 33°35.9'N, 135°09.9'E, 322-346 m, KT84-12, sta 27, 2 Sep 1984 (1♂ with eggs). KYUSHU: W of Kyushu, 31°46.6'N, 128°09.9'E, 145 m, 4 Dec 1967 (1♀). Tomioka, Amakusa Island, 5 Jul 1984 (1♀); 42-45 m, 7 Jun 1984 (1♀).

DISTRIBUTION.—This species has been taken in many localities in Japan and appears to be endemic. The depths of capture are from 7 meters to the deepest at 416 meters in the above collections.

REMARKS.—This species was one of the first pycnogonids recognized from Japan and it has subsequently been recorded in most reports on the fauna of these Islands. It is most easily recognized by its long slender tapering proboscis and slender median trunk tubercles. It has incipient reticulation, prominent in some specimens and lacking others.

Pycnogonum uedai Nakamura and Child

Pycnogonum uedai Nakamura and Child, 1983:64-66, fig. 21.

Pycnogonum (Retroviger) koreanum Kim and Stock, 1984:685-688, figs. 1-6.—Kim and Hong, 1986:50.—Hong and Kim, 1987:161.

MATERIAL EXAMINED.—HONSHU: Wakayama Prefecture, Goboh, 1.5 m, Feb 1981 (1♂, 1♀). Sagami Bay, off Shimoda, 49 m, 9 Sep 1987 (1♀); 88-90 m (1♀).

DISTRIBUTION.—This species was described with a male from Sagami Bay. The species has subsequently been taken at several localities along the Korean coast. These records extend its distribution to the south on the Japanese coast to Wakayama Prefecture and to their deepest known depth of 90 meters. The species is found more often in the sublittoral.

REMARKS.—Examination of three specimens of *P. koreanum* from the type locality confirms that this species is actually *P. uedai*, particularly in such characters as the low median dorsal trunk tubercles and low ocular tubercle, the extremely tiny auxiliary claws, the general shape of the proboscis, and the shape and size of the leg segments. No other species has these characters in combination, particularly that of the minute auxiliary claws in combination with a very angular femur.

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