

## Maldanidae (Annelida: Polychaeta) from Japan

(Part 1)

By

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The maldanids, or bamboo-worms, have cylindrical bodies with a relatively small number (mostly 18 to 24 setigerous segments) of greatly elongated segments; in general the body is very fragile. They may occur abundantly in sandy or muddy beaches or sublittorally, and they occupy cylindrical tubes which may be thin, covered with a single layer of sand, thick mud or silt. They are highly specialised burrowers, feeding on organic particles in the mud.

Maldanids from the Japanese coast have been reported in studies by MCINTOSH (1885), IZUKA (1902), MOORE (1903), TAKAHASHI (1938), OKUDA (1937, 1938, 1939), IMAJIMA (1964), IMAJIMA and HARTMAN (1964) and UCHIDA (1968). These authors reported the following species: *Asychis disparidentata* (MOORE, 1904), *A. gotoi* (IZUKA, 1902), *A. shaccotanus* UCHIDA, 1968, *Maldane sarsi* MALMGREN, 1865, *Maldanella harai* (IZUKA, 1902), *Praxillella affinis* (SARS, 1872), *Praxilla lankesteri* (MCINTOSH, 1885), *Nicomache japonica* MCINTOSH, 1885. Three species, *Clymene mirabilonga* MOORE, 1903, *Nicomache inornata* MOORE, 1903 and *Praxilla challengeriae* (MCINTOSH, 1885) reported by MOORE (1903, p. 485) were described from body fragments.

A taxonomic study of maldanids from Japan was undertaken by the junior author as a graduation thesis from the many specimens collected by the senior author. The senior author examined the holotypes reported by MCINTOSH, 1885 from Japanese waters and the general specimens from various localities deposited in the British Museum (Natural History) and also the holotypes and paratypes reported by Moore, 1903 from Japanese waters deposited in the National Museum of Natural History, Smithsonian Institution and the Academy of Natural Science of Philadelphia. Additionally, some of the holotypes of Maldanidae deposited in the Allan Hancock Foundation, University of Southern California were examined. He also reviewed and corrected the manuscript of the junior author.

In the present study 37 species in 17 genera, and one new subgenus of maldanid are recognized from Japanese waters. The following 10 genera, *Clymenura*, *Lumbricly-*

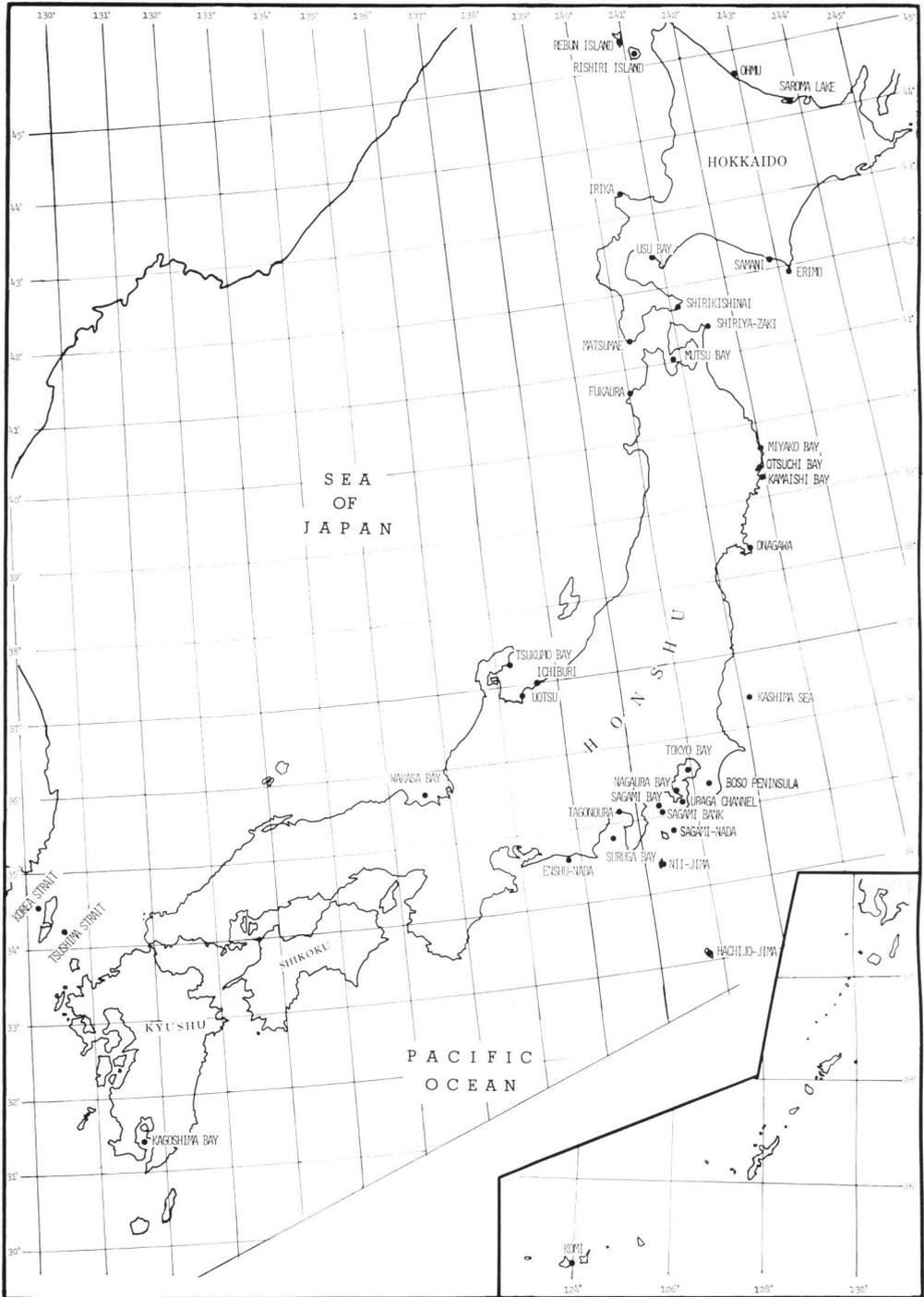


Fig. 1. Map of Japan, showing localities mentioned in the text.

*mene*, *Praxillura*, *Clymenopsis*, *Rhodine*, *Petaloproctus*, *Clymenella*, *Microclymene*, *Axiothella*, *Isocirrus* are new to the Japanese fauna. Material includes 11 new species, one species each in *Praxillura*, *Petaloproctus*, *Maldanella*, *Microclymene*, *Euclymene*, *Asychis*, two species in *Clymenella* and three species in *Clymenura*. A new subfamily Clymenurinae is proposed.

Four of the maldanid holotypes recorded in the Challenger Report by MCINTOSH (1885) are referred or transferred as follows: *Nicomache benthaliana* is referred to *Nicomache (Nicomache) lumbricalis* (FABRICIUS, 1780), *Nicomache japonica* is transferred to the genus *Lumbriclymene*, *Praxilla köllikeri* is transferred to the genus *Clymenella* and *Praxilla lankesteri* is transferred to the genus *Clymenura (Cephalata)*. Two maldanid holotypes, *Nicomache (?) inornata* and *Clymene mirabilonga* of MOORE (1903), deposited in the National Museum of Natural History, Smithsonian Institution, cannot be positively identified from the body fragments available. Moreover, *Asychis shaccotanus* UCHIDA, 1968 from Hokkaido is referred to *A. gotoi* (IZUKA).

The senior author wishes to express his thanks to Dr. J. D. GEORGE, Head of the Polychaeta and Porifera Section of the British Museum (Natural History), London for permission to examine holotypes and specimens deposited in the Museum's general Collections, and for critically reading the manuscript. Thanks are due also to Mr. A. I. MUIR of the same Section for also reading the manuscript and for his assistance during this study. Acknowledgement is made to Drs. Meredith L. JONES, Marian H. PETTIBONE, Kristian FAUCHALD of the Division of Worms, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington D. C., and Dr. Tran-ngoc LOI, the Academy of Natural Sciences of Philadelphia and Ms. Susan WILLIAMS of the Allan Hancock Foundation, University of Southern California, Los Angeles for permission to examine holotypes and for their kind help during this study. Also, he thanks the crew of the research vessel Tansei Maru (KT) of the Ocean Research Institute, University of Tokyo, for help with the collecting, and also various individuals as stated in *Material examined*.

The bulk of the collection, including type-specimens, has been deposited in the National Science Museum, Tokyo.

### List of Species of Maldanidae from Japan

Asterisks indicate species newly added to the Japanese fauna.

- |  |  |
|--|--|
| Clymenurinae Subfam. nov.                                | <i>Lumbriclymene japonica</i> (MCINTOSH, 1885)             |
| * <i>Clymenura (Clymenura) japonica</i> sp. nov.         | new comb.  |
| <i>Clymenura (Cephalata) lankesteri</i> (MCINTOSH, 1885) | * <i>Praxillura tanseiana</i> sp. nov.                     |
| * <i>Clymenura (Cephalata) longicaudata</i> sp. nov.     | * <i>Clymenopsis cingulata</i> (EHLERS, 1887)              |
| * <i>Clymenura (Cephalata) aciculata</i> sp. nov.        | Rhodininae ARWIDSSON, 1906                                 |
| * <i>Clymenura (Cephalata) columbiana</i> BERKELEY, 1929 | * <i>Rhodine loveni</i> MALMGREN, 1865                     |
| Lumbriclymeninae ARWIDSSON, 1906                         | Nicomachinae ARWIDSSON, 1906                               |
| <i>Notoproctus pacificus</i> (MOORE, 1906)               | <i>Nicomache (Nicomache) lumbricalis</i> (FABRICIUS, 1780) |

- \* *Nicomache (Nicomache) personata* JOHNSON, 1901
- \* *Nicomache (Nicomache) minor* (ARWIDSSON, 1906)
- \* *Nicomache (Loxochona) quadrispinata* ARWIDSSON, 1906
- \* *Petaloproctus dentatus* sp. nov.
- \* *Petaloproctus borealis* ARWIDSSON, 1906 stat. nov.
- Euclymeninae ARWIDSSON, 1906
- \* *Clymenella complanata* HARTMAN, 1969
- \* *Clymenella collaris* sp. nov.
- \* *Clymenella enshuense* sp. nov.
- \* *Clymenella koellikeri* (MCINTOSH, 1885) new comb.
- Maldanella harai* (IZUKA, 1902)
- \* *Maldanella nijimensis* sp. nov.
- \* *Praxillella pacifica* BERKELEY, 1929 stat. nov.
- Praxillella affinis* (SARS, 1872)
- \* *Praxillella gracilis* (SARS, 1861)
- \* *Praxillella praetermissa* (MALMGREN, 1866)
- \* *Microclymene caudata* sp. nov.
- \* *Axiothella quadrimaculata* AUGENER, 1914
- \* *Axiothella rubrocincta* (JOHNSON, 1901)
- \* *Euclymene uncinata* sp. nov.
- Euclymene oerstedii* (CLAPARÈDE, 1863)
- \* *Isocirrus planiceps* (SARS, 1872)
- Maldaninae ARWIDSSON, 1906
- Asychis gotoi* (IZUKA, 1902)
- \* *Asychis biceps* (SARS, 1861)
- Asychis disparidentata* (MOORE, 1904)
- \* *Asychis pigmentata* sp. nov.
- \* *Maldane cristata* TREADWELL, 1923

### Key to Genera of Maldanidae from Japan

1. Neurosetae start on setiger 5 and arranged in double rows (Rhodininae) . . . . . *Rhodine*
- 1'. Neurosetae start on setiger 1 or 2, and arranged in single rows . . . . . 2
2. With ventral glandular shield on setiger 8 (Clymenurinae) . . . . . *Clymenura*
- 2'. Without such ventral glandular shield on setiger 8 . . . . . 3
3. Cephalic plate rudimentary or absent; pygidium without anal plate, sometimes flattened ventrally (Lumbriclymeninae) . . . . . 5
- 3'. Cephalic plate absent; pygidium with anal plate (Nicomachinae) . . . . . 8
- 3''. Cephalic and anal plates present . . . . . 4
4. Pygidium encircled by anal cirri with anus on projecting cone or sunken in funnel; neurosetae often present on setiger 1 (Euclymeninae) . . . . . 9
- 4'. Pygidium a slanting plate with an anus above it; without anal cirri; no neurosetae on setiger 1 (Maldaninae) . . . . . 15
5. With more than 20 setigers; pygidium with anus terminal . . . . . *Praxillura*
- 5'. With less than 20 setigers; pygidium with variable position of anus . . . . . 6
6. With a deep encircling collar on setiger 4 . . . . . *Clymenopsis*
- 6'. Without such a collar on setiger 4 . . . . . 7
7. Pygidium flattened with anus dorsal . . . . . *Notoproctus*
- 7'. Pygidium conical with anus terminal . . . . . *Lumbriclymene*
8. Anal plate well developed dorsally and ventrally . . . . . *Nicomache*
- 8'. Anal plate with dorsal edge reduced, ventral part well developed . . *Petaloproctus*
9. Neurosetae not on setiger 1 . . . . . *Maldanella*
- 9'. Neurosetae present on setiger 1 . . . . . 10
10. With rostrate uncini on first three to four setigers, essentially similar to those of later setigers . . . . . *Axiothella*

- 10'. With acicular setae on first three to four setigers, differ from those of later setigers ..... 11
11. Setiger 4 with a deep, encircling collar ..... *Clymenella*
- 11'. Setiger 4 without a collar ..... 12
12. Anal plate marginally smooth ..... *Microclymene*
- 12'. Anal plate bounded by cirri ..... 13
13. Anal plate bounded by cirri similar in length ..... *Isocirrus*
- 13'. Anal plate bounded by cirri varying lengths ..... 14
14. Anus sunk in a pygidial funnel rimmed with cirri; without enlarged ventral valve ..... *Euclymene*
- 14'. Anus on a cone projecting from a circle of cirri; with a large ventral valve ..... *Praxillella*
15. Cephalic keel prominent ..... *Maldane*
- 15'. Cephalic keel low and broad ..... *Asychis*

### Systematic Account

#### Clymenurinae, new subfamily

Type genus *Clymenura* VERRILL, 1900

The body consists of 19 to 25 setigerous segments and up to 5 apodous preanal asetigers. The cephalic plate varies from poorly defined to well defined with a broad flaring rim. The nuchal organs are straight, nearly parallel to each other. The eighth setiger has a large ventral triangular, glandular shield. The notosetae include both winged capillaries and feathered forms. The first three neuropodia may have reduced or developed rostrate uncini or acicula. The pygidium is prolonged posteriorly as a cone or a deep funnel rimmed with cirri.

*Remarks.* ARWIDSSON (1906) divided the Maldanidae into five subfamilies, Lumbriclymeninae, Rhodininae, Nicomachinae, Euclymeninae and Maldaninae, on the development of the anterior and posterior ends. The Lumbriclymeninae have the following characters: anterior and posterior ends without plates, posterior segments without collars, and uncini in single rows. ARWIDSSON referred *Clymenura* VERRILL to Lumbriclymeninae because the cephalic plate is rudimentary or absent, the pygidium is prolonged as a cone with a terminal anus, and there is also a ventral glandular shield on the eighth setigerous segment. However, of the known species of *Clymenura* having a characteristic, ventral glandular shield, at least seven have a cephalic plate bordered by a raised rim and a pygidium with a funnel bearing cirri of varying length. These characters of the cephalic plate and the pygidium may also occur in the Euclymeninae.

A new subfamily Clymenurinae is proposed, characterized by a ventral glandular shield on the eighth setigerous segment. The features of the cephalic plate and the pygidium are variable within this subfamily.

Genus *Clymenura* VERRILL, 1900

The genus *Clymenura* is characterized by a ventral glandular shield on the eighth setigerous segment. The features of the cephalic plate and the pygidium are variable.

The type species of *Clymenura*, *Clymene cirrata* EHLERS, 1887, has a rudimentary cephalic plate. However, the head of known species of *Clymenura* may be of one of two kinds: (1) cephalic plate poorly defined (referred to subgenus *Clymenura*), and (2) cephalic plate well defined and bordered by a raised rim (subgenus *Cephalata*).

One species, *Clymenura japonica* sp. nov. from Japan is referable to the subgenus *Clymenura* and the following species from Japan to the subgenus *Cephalata*: *C. lankesteri* (MCINTOSH), *C. columbiana* (BERKELEY), *C. longicaudata* sp. nov., *C. aciculata* sp. nov.

*Clymenura (Clymenura)*, sensu stricto

Type *C. (C.) cirrata* (EHLERS, 1887)

The body consists of 19 to 25 setigerous segments and up to 5 apodous preanal asetigers. The eighth setigerous segment has a large triangular white glandular shield. The cephalic plate is poorly defined, and the lateral borders are situated close to the keel and extend up to it posteriorly; there are parallel nuchal grooves. The notosetae include both winged capillaries and feathery forms. The first three neuropodia have rostrate uncini with poorly developed denticles on the rostrum. The pygidium is prolonged posteriorly as a cone, with or without anal cirri.

*Clymenura (Clymenura) japonica* sp. nov.

(Fig. 2, a-m)

*Material examined.* Off Oshima and Futagoshima, Mutsu Bay, in 52–53 m (23 specimens); Otsuchi Bay, in 95 m (holotype and 5 paratypes); Kamaishi Bay, Iwate Pref., in 29 m (2); Kashima Sea, 36°34.9'N, 140°55.6'E–36°35.6'N, 140°56.2'E, in 120–122 m (2), 36°08.4'N, 140°55.0'E–36°09.5'N, 140°55.7'E, in 198–200 m (1), 36°12.4'N, 141°09.5'E–36°12.8'N, 141°08.8'E, in 690–710 m (17), 36°30.1'N, 141°12.5'E–36°30.8'N, 141°13.5'E, in 690–705 m (4), KT-79-13; off Boso Peninsula, 35°00.1'N, 140°06.8'E–35°00.5'N, 140°07.5'E, in 145–150 m, KT-76-16 (2); Sagami Bay, 35°13.4'N, 139°30.0'E, in 140 m (1), 35°07.4'N, 139°24.0'E, in 850 m (2), for survey in Kanagawa Fish. Exper. Sta.; Sagami Bank, 35°07.9'N, 139°19.9'E, in 540 m (14), 35°08.7'N, 139°24.1'E, in 610 m (1), 35°09.5'N, 139°23.7'E, in 465 m (6), 35°10.5'N, 139°20.0'E, in 1070 m (1), KT-66-23; Sagami-nada, 35°05.3'N, 139°30.0'E–35°03.4'N, 139°29.2'E, in 860 m (2), 34°56.2'N, 139°15.0'E–34°56.9'N, 139°15.2'E, in 1310 m (8), 34°51.3'N, 139°19.7'E–34°51.7'N, 139°20.1'E, in 1115 m (1), KT-65-34; 35°01.2'N, 139°28.1'E–35°01.2'N, 139°29.0'E, in 790–870 m (1), 34°54.0'N, 139°37.1'E–34°53.9'N, 139°37.0'E, in 815–1070 m (1), 35°09.2'N, 139°30.4'E–35°08.9'N, 139°29.5'E, in 590 m (5), KT-66-12; 35°07.9'N, 139°19.9'E, in 540 m (14), 35°08.7'N, 139°24.1'E, in 610 m (1), 35°09.5'N,

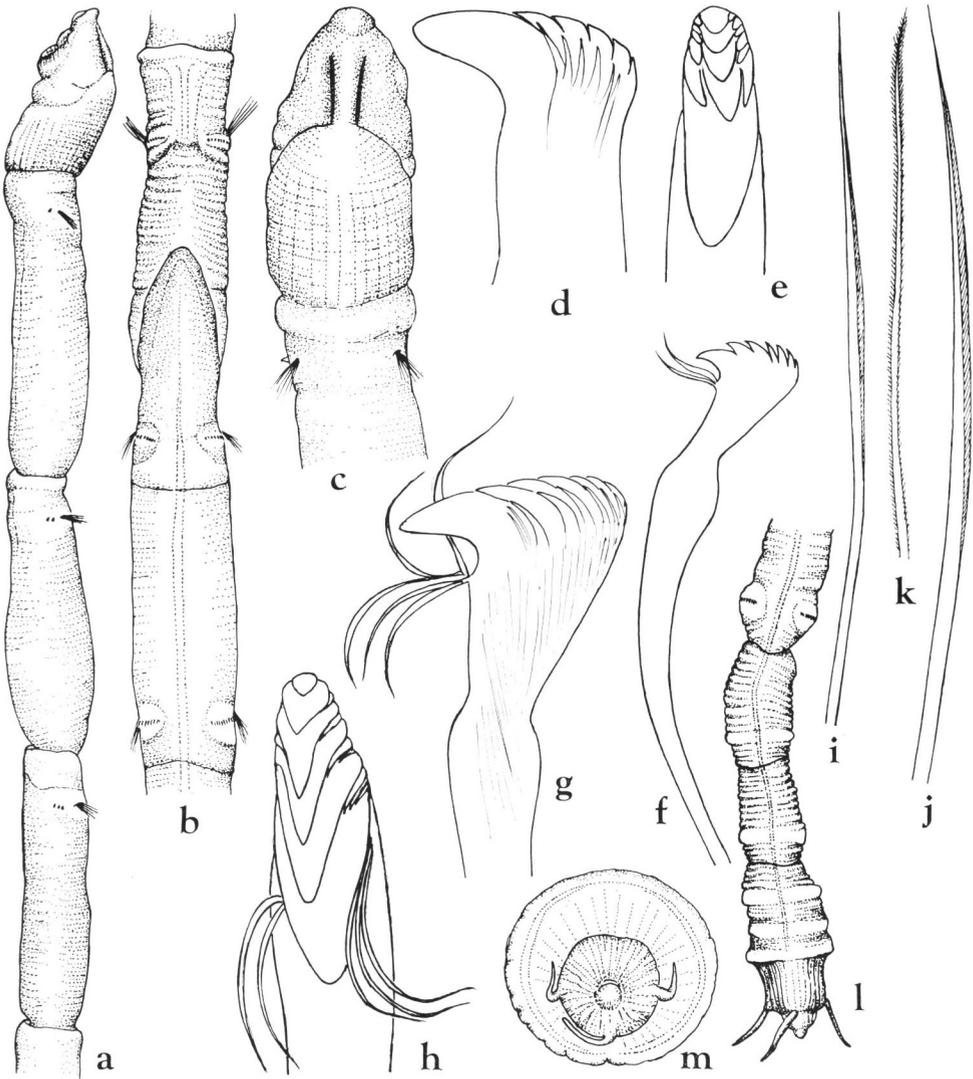


Fig. 2. *Clymenura (Clymenura) japonica* sp. nov. a, anterior end, in lateral view,  $\times 10$ ; b, glandular shield of the eighth setiger,  $\times 10$ ; c, head, in dorsal view,  $\times 20$ ; d, distal end of uncinus from the first setiger,  $\times 1200$ ; e, the same,  $\times 1800$ ; f, rostrate uncinus from the median setiger,  $\times 495$ ; g, distal end of median uncinus,  $\times 1200$ ; h, the same,  $\times 1800$ ; i, limbate capillary seta from the first setiger,  $\times 230$ ; j, limbate capillary seta from the median setiger,  $\times 230$ ; k, hirsute capillary seta,  $\times 230$ ; l, posterior end, in ventral view,  $\times 10$ ; m, pygidium, in posterior end,  $\times 20$ .

139°23.7'E, in 465 m (6), 35°10.5'N, 139°20.0'E, in 1070 m (1), KT-66-23; 35°09.1'N, 139°23.3'E-35°09.1'N, 139°23.9'E, in 478-490 m (156), 35°05.7'N, 139°23.8'E-35°06.1'N, 139°23.7'E, in 1188-1220 m (3), 35°01.2'N, 138°24.8'E-35°01.2'N, 138°25.3'E, in 1260-1290 m (11), KT-76-3; off Koyahata, Sagami Bay, in 125 m (1); Suruga Bay, 35°05.7'N, 138°38.6'E-35°06.1'N, 138°38.4'E, in 360-390 m, KT-66-22 (2); 35°04.1'N, 138°47.3'E-35°03.9'N, 138°47.6'E, in 282-211 m (1), 34°52.7'N, 138°37.6'E-34°53.3'N, 138°37.5'E, in 1500-1480 m (5), KT-73-6; 34°55.0'N, 138°44.0'E-34°54.2'N, 138°44.1'E, in 313-304 m (1), 35°03.0'N, 138°50.6'E-35°02.2'N, 138°50.8'E, in 100-99 m (1), 34°45.9'N, 138°42.3'E-34°46.5'N, 138°42.4'E, in 314-314 m (2), 35°04.00'N, 138°47.39'E-35°04.00'N, 138°47.47'E, in 252-270 m (5), KT-73-15; 34°47.0'N, 138°30.4'E-34°47.0'N, 138°30.3'E, in 435-590 m, KT-78-2 (1); Tsushima Strait, in 120 m (2); Wakasa Bay, in 70 m (2).

*Description.* The holotype from Otsuchi Bay is the largest complete specimen; it measures 43 mm in length and about 1 mm in width anteriorly, and consists of 19 setigerous segments and five preanal asetigers that lack parapodia. The anterior segments are very long about four times the width of the body (Fig. 2, a). The eighth setigerous segment has a large ventral triangular shield with a slightly, thickened rim; its anterior part extends over the posterior part of the preceding segment (Fig. 2, b).

The pro- and peristomium are completely fused; the prostomium is nearly vertical with a slightly raised frontal border. Between the nuchal organs a rather high median ridge as long as the vertical part of the prostomium is present; its posterior end extends to the arched dorsal groove. The nuchal organs are fairly long, almost parallel deep furrows. There are no ocelli. The mouth is a longitudinal fissure, surrounded by furrows, on the ventral side of the buccal segment. The features of the head are rather similar to those of *Lumbryclymene*-species (Fig. 2, a, c).

The first three neuropodial segments each have one to three rostrate uncini, 1 in the first, 2 in the second and 2-3 in the third setigers; they are of a more or less reduced type, with five teeth in a row and accessory small teeth above the main fang, no gular bristles (Fig. 2, d, e). The following neuropodia each have a transverse row of well-developed rostrate uncini numbering about 20 in each row; each uncinus has seven teeth in a row and accessory teeth above the main fang (Fig. 2, f, g, h). Anterior notopodia have bundles of limbate capillary setae (Fig. 2, i), other notopodia have limbate capillary setae (Fig. 2, j) and capillaries with minute cilia-like hairs distally (Fig. 2, k).

The last setiger is followed by five preanal apodous segments (Fig. 2, l). The pygidium is cylindrical and has three slender cirriform processes surrounding the anal cone; one cirrus midventrally and a pair dorsolaterally attached (Fig. 2, l, m). The tube is long, slender and cylindrical, covered externally with fine friable silt.

*Remarks.* *Clymenura* (*Clymenura*) *japonica* somewhat resembles *Clymenura* (*Clymenura*) *johnstoni* McINTOSH, 1915, from Loch Alsh and Loch Broom, Great Britain. The latter species was also distinguished by ARWIDSSON, 1922 (pp. 12-18, pl. 1, figs. 7-13), by features of the head and posterior body. However, *C. (C.) japonica*

differs in that (1) the cephalic lobe has no ocelli, instead of numerous well marked ocelli; (2) the mouth is a longitudinal fissure, instead of being rounded; (3) uncini of the first three neuropodia number 1 in the first, 2 in the second, and 2 to 3 in the third setigers, instead of 2–3, 4–6, 6–8 (in the specimens from Firth of Clyde, deposited in the British Museum (Natural History)).

*Clymenura (Clymenura) japonica* differs from *Clymenura tenuis* (DAY, 1957) from Durban Bay, South Africa, in the number of preanal segments, having five instead of two.

*Type-series.* Holotype, NSMT-Pol. H 151; 5 paratypes, NSMT-Pol. P 152.

*Distribution.* Japan.

### *Clymenura (Cephalata)*, new subgenus

Type *Clymenura (Cephalata) lankesteri* (MCINTOSH, 1885)

The body consists of 18 to 19 setigerous segments and 2 to 5 apodous preanal asetigers. The eighth setiger has a large ventral triangular, glandular shield. The cephalic plate is well defined and has a broad flaring rim. The nuchal organs are straight, nearly parallel to each other. The setae of the first three neuropodia are reduced or developed rostrate uncini or acicula. The notosetae include both winged capillaries and feathered forms. The pygidium is a deep funnel rimmed with cirri or a cone with an enlarged ventral valve.

The following species are herein referred to *Clymenura (Cephalata)*:

*polaris* (THÉEL, 1879, p. 58). Novaya Zemlya.

*lankesteri* (MCINTOSH, 1885, p. 403). Japan.

*columbiana* (BERKELEY, 1929, p. 315). Western Canada.

*tropica* (MESNIL & FAUVEL, 1939, p. 12). East Indies.

*gracilis* (HARTMAN, 1969, p. 439). Santa Monica Bay.

*longicaudata* new species. Central Japan.

*aciculata* new species. Southern Japan.

### Key to Japanese Species of *Clymenura (Cephalata)*

1. Nuchal organs less than half of length of cephalic plate. . . . . 2
- 1'. Nuchal organs more than half of length of cephalic plate. . . . . 3
2. Cephalic plate with two lateral notches and a distinct middorsal one; pygidium with 8 to 9 slender, long, cirri. . . . . *C. lankesteri*
- 2'. Cephalic plate with two lateral notches and a slight, middorsal incision; pygidium with 12 to 16 subequal, short cirri and one long, ventral one . . . . . *C. columbiana*
3. Cephalic plate with a middorsal notch only, without lateral ones; with normal rostrate uncini in the first neuropodium. . . . . *C. longicaudata*
- 3'. Cephalic plate with entire rim, without any notches; with thick distally crooked acicular spines in first 3 neuropodia. . . . . *C. aciculata*

*Clymenura (Cephalata) lankesteri* (McINTOSH, 1885)

(Fig. 3, a-n; Fig. 4, a-d)

*Praxilla lankesteri* McINTOSH, 1885, pp. 403–404, pl. 25 a, fig. 3.*Praxillella lankesteri*: IMAJIMA and HARTMAN, 1964, p. 320.*Leiochone borealis* ARWIDSSON, 1906, pp. 156–163, pl. 3, fig. 108–115, pl. 4, fig. 116, 117, pl. 9, fig. 281–283, pl. 11, fig. 352, 353; Wesenberg-Lund, 1950, pp. 42–43, chart 51, pl. 9, fig. 41; Uschakov, 1955, p. 340, fig. 125, g.*Clymenura borealis*: HARTMAN, 1959, p. 456.

*Material examined.* Kashima Sea, 36°30.1'N, 141°12.5'E–36°30.8'N, 141°13.5'E, in 690–705 m (22), 36°09.3'N, 140°56.6'E–36°10.0'N, 140°56.1'E, in 280–295 m (11), 36°09.8'N, 141°01.5'E–36°08.5'N, 141°02.5'E, in 498–517 m (25), 36°12.4'N, 141°09.5'E–36°12.8'N, 141°08.8'E, in 690–710 m (15), 36°25.8'N, 141°18.3'E–36°23.0'N, 141°18.2'E, in 1005–1050 m (1), 36°31.6'N, 141°03.7'E–36°30.6'N, 141°02.6'E, in 390–400 m (1), 36°34.9'N, 140°55.6'E–36°35.6'N, 140°56.2'E, in 120–122 m (1), KT–79–13; Sagami Bay, 34°20.0'N, 138°54.0'E–34°20.4'N, 138°53.1'E, in 1240 m (5), 35°05.3'N, 139°30.0'E–35°03.4'N, 139°29.2'E, in 860 m (1), 34°45.0'N, 139°38.0'E–34°44.6'N, 139°38.1'E, in 1500 m (1), KT–65–34; 34°53.6'N, 139°12.6'E–34°53.1'N, 139°12.0'E, in 660–980 m (3), 35°09.2'N, 139°30.4'E–35°08.9'N, 139°29.5'E, in 590 m (9), 34°54.0'N, 139°37.1'E–34°53.9'N, 139°37.0'E, in 815–1070 m (5), 35°02.1'N, 139°22.0'E–35°02.3'N, 139°22.4'E, in 1340–1360 m (7), 34°54.5'N, 139°19.7'E–34°54.5'N, 139°20.0'E, in 1450–1650 m (3), KT–66–12; Sagami Bank, 35°10.3'N, 139°21.5'E, in 970 m, KT–66–23 (1); 35°04.1'N, 139°31.5'E–35°04.2'N, 139°32.1'E, in 750–870 m (5), 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m (5), 35°01.2'N, 138°24.8'E–35°01.2'N, 138°25.35'E, in 1260–1290 m (1), KT–76–3; Suruga Bay, 34°55.6'N, 138°40.3'E–34°55.3'N, 138°40.3'E, in 1008–1050 m (3), KT–76–3; 34°54.9'N, 138°40.7'E–34°54.7'N, 138°40.6'E, in 1600–1540 m (10), KT–76–16.

*Description.* The largest specimen measures 45 mm in length and 1.8 mm in width; the body is uniformly slender. A few anterior segments are about twice as long as wide (Fig. 3, a). It consists of 19 setigerous segments and 5 to 6 apodous preanal asetigers. The eighth setigerous segment has a large triangular white glandular shield with the acute angle pointing forward (Fig. 3, b, c, d).

The cephalic plate is well defined and has a broad and rather flaring rim; there are lateral notches and a large, distinct posterior notch. The palpode is blunt and rounded. The nuchal organs are straight, nearly parallel to each other and about half as long as the plate; there are no ocelli (Fig. 3, e).

The first three setigerous segments have reduced neuropodial uncini, one or two in each parapodium, with three small teeth above the main fang, and no gular bristles (Fig. 3, f). The ordinary capillary setae have very narrow wings and minute cilia-like hairs (Fig. 3 g). Posterior to these there are 11 to 12 uncini per uncinigerous torus, each uncinus having five large teeth in one row and small accessory teeth above the main fang, with gular bristles (Fig. 3, h, i, j). The notopodial setae are of two kinds:

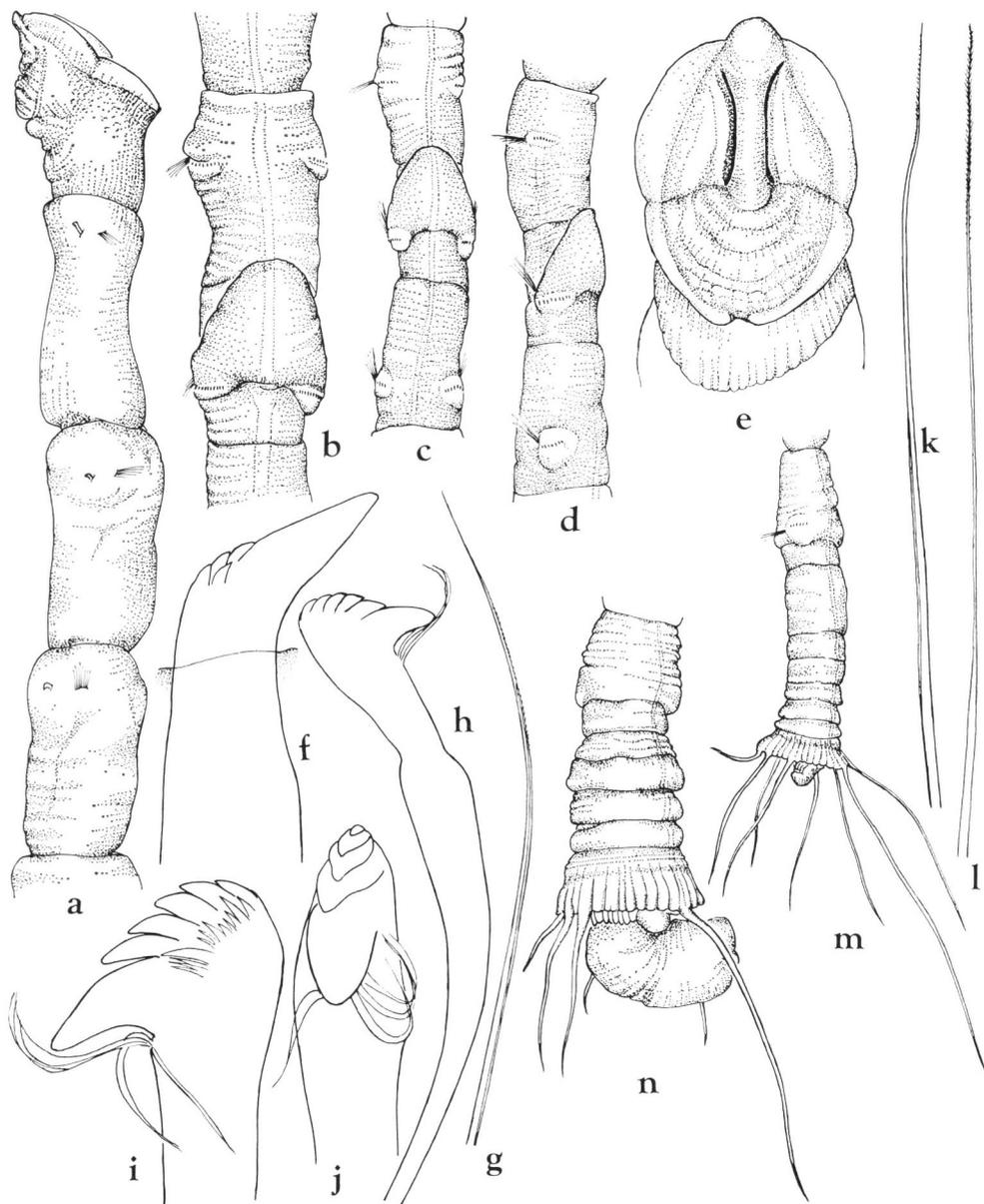


Fig. 3. *Clymenura (Cephalata) lankesteri* (McINTOSH). a, anterior end, in lateral view,  $\times 8$ ; b, c, d, glandular shield of the eighth setigerous segment, from two individuals,  $\times 8$ ; e, cephalic plate,  $\times 13$ ; f, uncinus of reduced type from the first setiger,  $\times 120$ ; g, notopodial capillary seta from the first setiger,  $\times 120$ ; h, rostrate uncinus of median setiger,  $\times 460$ ; i, j, distal ends of median uncini,  $\times 810$ ; k, l, notopodial capillary setae from median setiger,  $\times 175$ ; m, posterior end, in ventro-lateral view,  $\times 10$ ; n, posterior end with everted intestine from anus,  $\times 13$ .

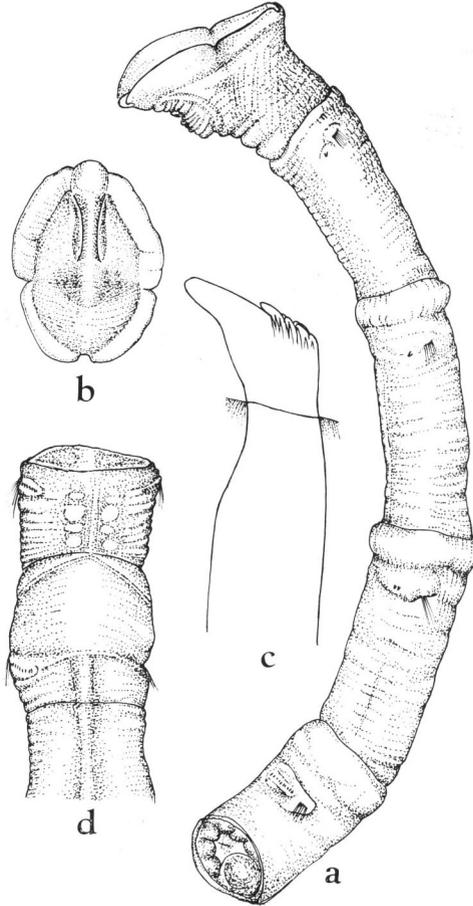


Fig. 4. *Clymenura (Cephalata) lankesteri* (MCINTOSH), from holotype of *Praxilla lankesteri* MCINTOSH. a, anterior end, in lateral view,  $\times 8$ ; b, cephalic plate,  $\times 10$ ; c, uncinus of reduced type from the third setiger,  $\times 330$ ; d, glandular shield of the eighth setiger,  $\times 10$ .

narrow limbate capillary setae (Fig. 3, k) and slender capillaries with cilia-like hairs distally (Fig. 3, l).

There are five to six asetigers in front of the pygidium. The pygidium is short, expanded and thickened, and has eight to nine slender cirri of varying length; the ventral one being the longest (Fig. 3, m). The anal cone is acute; the anus is placed at its dorsal side and sometimes it everts a part of the intestine (Fig. 3, n).

The holotype of *Praxilla lankesteri* MCINTOSH, 1885, collected from the Sagami Bay (Challenger stn. 232,  $35^{\circ}11'N$ ,  $139^{\circ}28'E$ , in 345 fathoms), 13 May, 1875 was re-examined. The anterior body, consisting of the first nine setigerous segments, is divided into three pieces; the longest one measures 12 mm in length to the 4th setiger (Fig.

4, a), and other two are 5 to 6 mm in length. The cephalic plate is well defined and the rim is divided by three distinct notches. The nuchal organs are about half as long as the plate (Fig. 4, b). The neuropodia of the first three setigers have one or two thick spines, but the tips of these spines are mostly damaged; one on the third setiger is a reduced uncinus with four minute teeth in one row above the main fang (Fig. 4, c). The anterior margin of the fifth segment is not prolonged to form a collar as stated by MCINTOSH. The eighth setigerous segment has a large triangular white glandular shield with the acute angle turning forward (Fig. 4, d). This remarkable character is that of the genus *Clymenura*.

*Leiochone borealis* ARWIDSSON, 1906 is referred to the present species due to the characteristics of the anterior body.

*Distribution.* Japan; West coast of Norway; Shetlands, Orkneys; Sea of Okhotsk.

*Clymenura (Cephalata) longicaudata* sp. nov.

(Fig. 5, a-p)

*Material examined.* Off Boso, 35°00.1'N, 140°06.8'E–35°00.5'N, 140°07.5'E, in 145–150 m (2), 34°57.2'N, 140°02.4'E–34°57.6'N, 140°02.7'E, in 115 m (1), KT-76-16; Suruga Bay, 34°52.7'N, 138°37.6'E–34°53.3'N, 138°37.5'E, in 1500–1480 m, KT-73-6 (5); Komi, Iriomote, Yaeyama Islands, sandy beach (holotype and 12 paratypes).

*Description.* The holotype is a complete specimen and measures 56 mm in length and 1 mm in width anteriorly; it consists of 18 setigerous segments, two achaetous preanal segments with rudimentary parapodia, and the pygidium. There is a white glandular belt in front of each of first seven setigers. The eighth setiger has a large ventral triangular shield with a slightly, thickened rim; its tip extends to the posterior part of the preceding segment (Fig. 5, a, b).

The cephalic plate is elliptical; the rim is wide and smooth all around except for a middorsal notch, but some of the paratypes have a slight lateral depression, rather than an incision. Nuchal organs are straight, long and parallel, extending for most of the cephalic length, and bordering a compressed cephalic keel; they slightly diverge anteriorly. The prostomium is conical, and has many, minute ocelli (Fig. 5, c, d).

The first setigerous segment has two kinds of notopodial capillaries and 6 uncini; capillaries are bilimbate setae with short thread-like tips (Fig. 5, e) and much thinner, flexible setae with minute cilia-like hairs distally (Fig. 5, f). Uncini are fully developed, rostrate with four teeth in a row and small accessory teeth above the main fang, and gular bristles (Fig. 5, g, h). These uncini number 7 in the second, 9 in the third, 11 in the fourth, 13 in the fifth and 15 in the median neuropodia. The median uncini have a long, curved, longitudinally striated shaft, a long slender nodulus, just beneath the place where they erupt from body surface; the necks are bent backwards in a great curve, the main fangs are more narrow and acute (Fig. 5, i); there are 5 to 6 teeth in a row and accessory teeth above the main fang (Fig. 5, j, k). The median parapodia have two kinds of capillaries; thick limbate setae (Fig. 5, l) and thinner feathery setae with minute cilia-like hairs (Fig. 5, m).

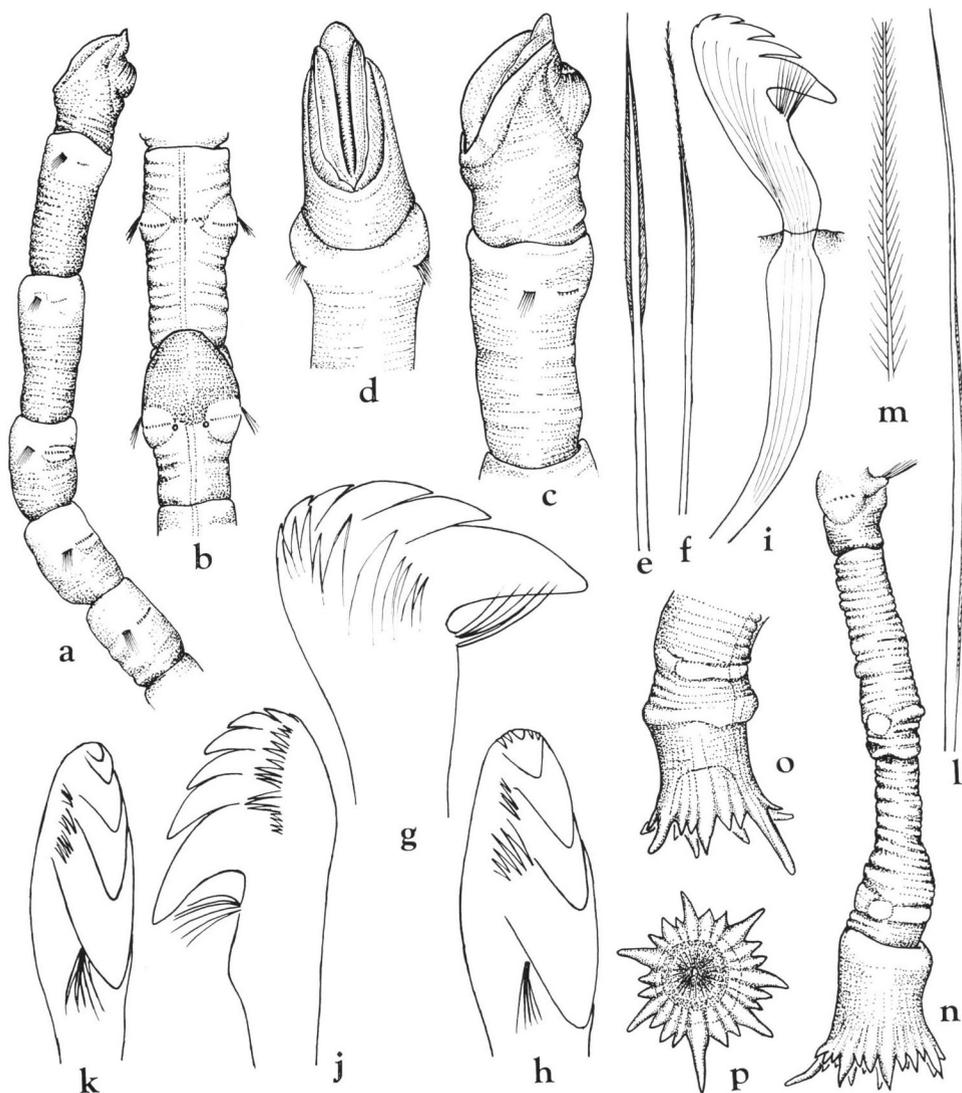


Fig. 5. *Clymenura (Cephalata) longicaudata* sp. nov. a, anterior end, in lateral view,  $\times 10$ ; b, glandular shield of the eighth setiger,  $\times 13$ ; c, cephalic plate, in dorso-lateral view,  $\times 18$ ; d, the same, in dorsal view,  $\times 18$ ; e, f, notopodial capillary setae from the first setiger,  $\times 215$ ; g, h, distal ends of the first uncini,  $\times 1700$ ; i, median uncinus,  $\times 640$ ; j, k, distal ends of median uncini,  $\times 1120$ ; l, limbate capillary seta from median notopodium,  $\times 220$ ; m, part of feathred capillary seta,  $\times 1120$ ; n, posterior end, in lateral view,  $\times 13$ ; o, pygidium of paratype, showing a long ventral cirrus,  $\times 18$ ; p, anal plate, in posterior view,  $\times 18$ .

The preanal segment is about four times as long as the body is wide; there is a pair of rudimentary parapodia (Fig. 5, n). The pygidium is a deep funnel rimmed with cirri varying in length; the ventral cirrus is by far the longest of them all (Fig. 5, o), and rather broad at the base; there are six digitate cirri of medium size with two to three triangular cirri between them. The floor of the anal plate is completely withdrawn, and the anus is centrally placed within it (Fig. 5, p).

The nephridial pores are naked and present on setigerous segments 6 to 9, immediately above the inside of the uncinigerous tori.

*Remarks.* *Clymenura longicaudata* resembles *C. gracilis* HARTMAN, 1969 from Santa Monica Bay, in the features of the cephalic plate with a smooth, wide flange all around except for a median notch, and with long, straight nuchal organs. However, *C. longicaudata* can be distinguished from the latter by the following: the body consists of 18 setigerous and two achaetous, preanal segments, instead of 19 setigers and five to six preanal segments, and the pygidium has a long midventral cirrus and cirri alternately long and short, instead of a small midventral cirrus and 18 long, subequal cirri.

*Type-series.* Holotype, NSMT-Pol. H 153; 12 paratypes, NSMT-Pol. P 154.

*Distribution.* Japan.

*Clymenura (Cephalata) aciculata* sp. nov.

(Fig. 6, a-n)

*Material examined.* Sagami Bay, 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m, KT-76-3 (32); Suruga Bay, 34°43.2'N, 138°35.2'E–34°43.8'N, 138°36.2'E, in 1850–1750 m, KT-66-22 (holotype and one paratype); 34°46.1'N, 138°42.4'E–34°46.8'N, 138°42.5'E, in 306–317 m, KT-73-6 (3).

*Description.* All of the specimens collected are anterior fragments. The holotype is the larger one and measures 27 mm in length and 2 mm in width for 12 setigerous segments. The body is cylindrical; there is a large white ventral glandular shield with the acute angle facing forward on the eighth setigerous segment (Fig. 6, a, b).

The cephalic plate is elliptical in outline; the rim is entire, without any incisions; it become gradually higher in front (Fig. 6, c). The prostomium is large and triangular. The nuchal organs are long and straight, nearly parallel to each other, about three-quarters as long as the cephalic plate; there are no ocelli (Fig. 6, d).

In the first three setigerous segments each neuropodium has a single heavy aciculum, the shaft obliquely bent to form a fang with no crown of small teeth (Fig. 6, e, f, g). The notopodial setae of the anterior segments are limbate capillaries of three lengths (Fig. 6, h, i). The fourth neuropodium has well developed, rostrate uncini with 6 teeth in a row and accessory teeth above the main fang, and with gular bristles (Fig. 6, j, k, l). Median notopodial capillary setae are of two kinds: limbate capillaries with narrow wings (Fig. 6, m) and with minute cilia-like hairs in the distal part (Fig. 6, n). The posterior end is unknown.

*Remarks.* Although the specimens are lacking posterior ends, *Clymenura (Ce-*

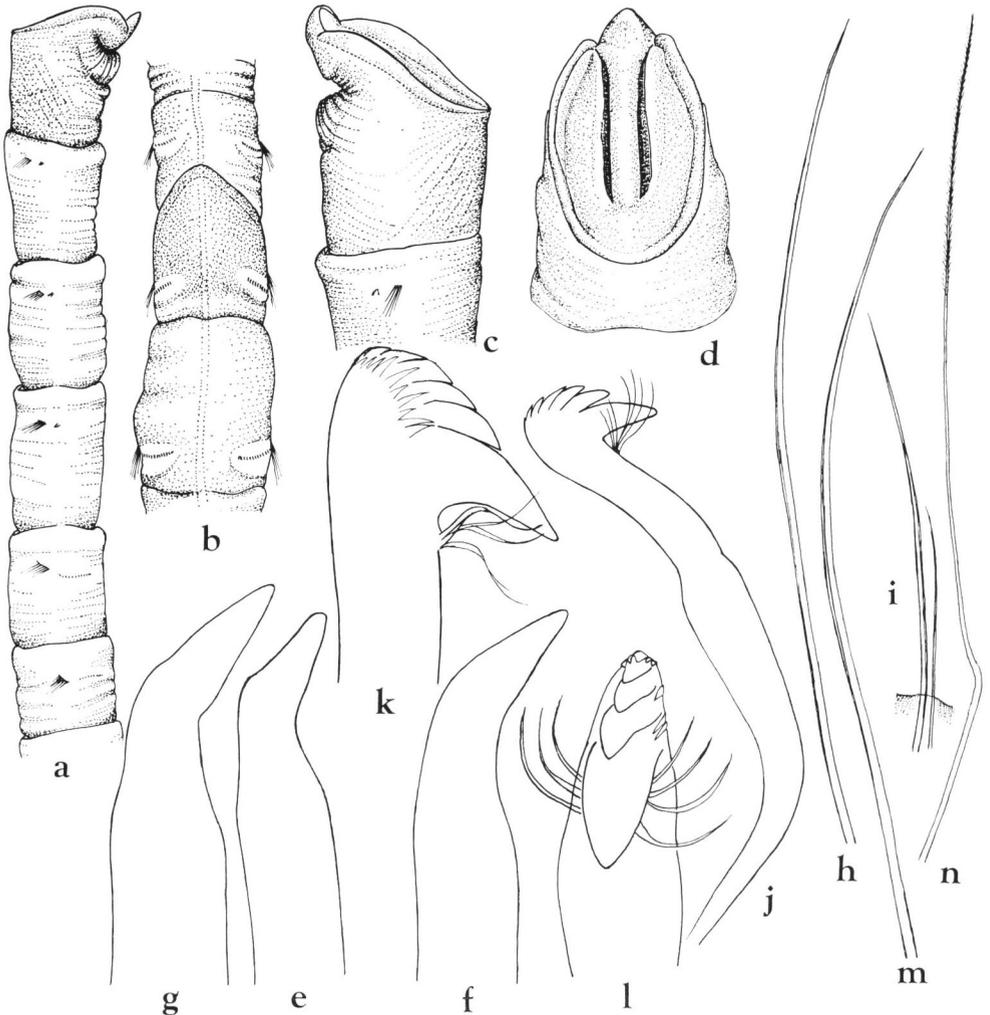


Fig. 6. *Clymenura (Cephalata) aciculata* sp. nov. a, anterior end, in ventro-lateral view,  $\times 8$ ; b, glandular shield of the eighth setiger,  $\times 8$ ; c, cephalic plate, in lateral view,  $\times 18$ ; d, the same, in frontal view,  $\times 18$ ; e, acicular spine from the first setiger,  $\times 330$ ; f, acicular spine from the second setiger,  $\times 330$ ; g, acicular spine from the third setiger,  $\times 330$ ; h, i, limbate capillaries from the second setiger,  $\times 175$ ; j, rostrate uncinus,  $\times 640$ ; k, l, distal ends of median uncini,  $\times 1120$ ; m, n, limbate capillaries from median notopodium,  $\times 175$ .

*phalata) aciculata* differs from other species of the genus in having a smooth entire rim around the cephalic plate and a distally bent aciculum on each neuropodium of the first three segments.

*Type-series.* Holotype, NSMT-Pol. H 155; 1 paratype, NSMT-Pol. P 156.

*Distribution.* Japan.

*Clymenura (Cephalata) columbiana* BERKELEY, 1929

(Fig. 7, a-l)

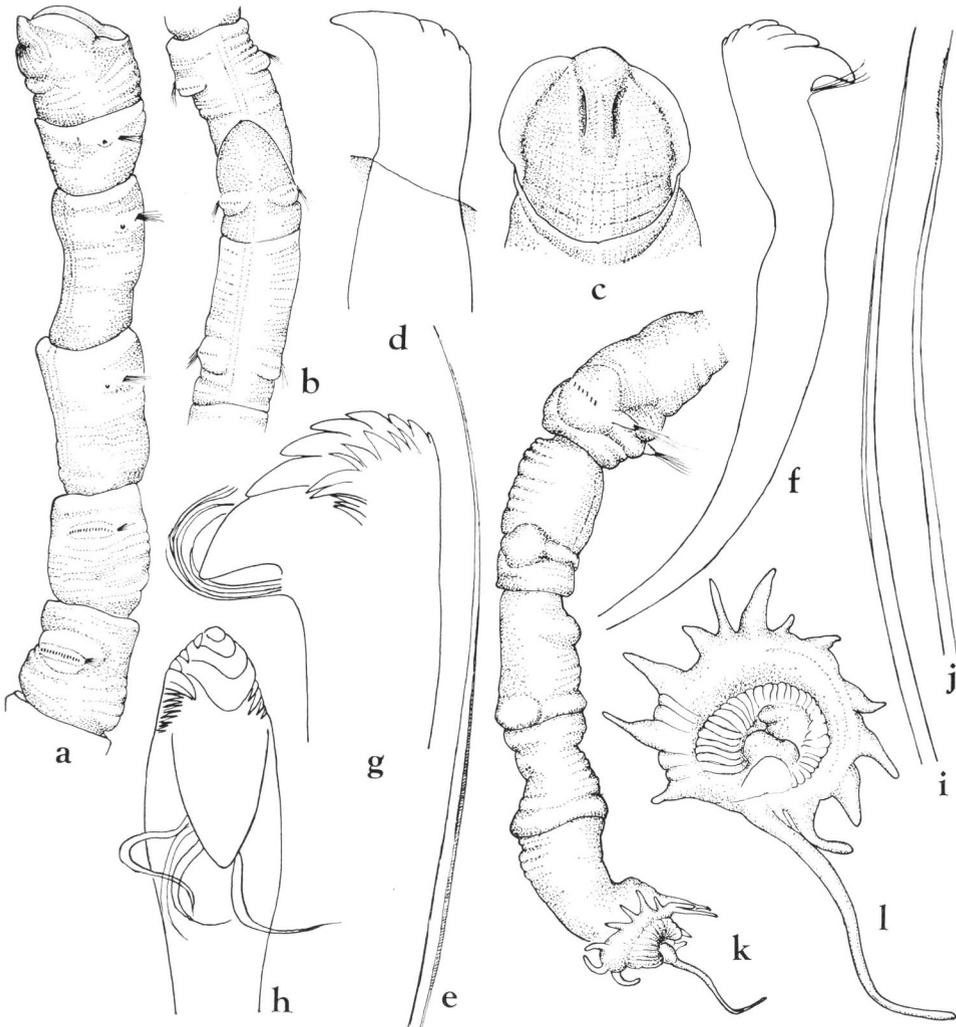
*Leiochone columbiana* BERKELEY, 1929, pp. 315–316, pl. 1, figs. 1–9; 1952, pp. 44–45, figs. 81–84.*Material examined.* Off Shiriya-zaki, Aomori Pref., in 180 m (2); Sagami Bay, 35°05.3'N, 139°30.0'E–35°03.4'N, 139°29.2'E, in 860 m, KT-65-34 (3).

Fig. 7. *Clymenura (Cephalata) columbiana* BERKELEY. a, anterior end, in lateral view,  $\times 8$ ; b, glandular shield of the eighth setiger,  $\times 8$ ; c, cephalic plate, in frontal view,  $\times 20$ ; d, uncinus from the first setiger,  $\times 640$ ; e, limbate capillary seta from the first setiger,  $\times 330$ ; f, median rostrate uncinus,  $\times 805$ ; i, j, limbate capillaries from median notopodium,  $\times 215$ ; k, posterior end, in lateral view,  $\times 13$ ; l, anal plate, in posterior view,  $\times 30$ .

*Description.* Of the collected specimens, the largest complete one measures 35 mm in length and 1.5 mm in width; it consists of 19 setigerous, three preanal segments and the pygidium. Each segment of the first seven setigers, except the second and third setigers, is slightly longer than its width (Fig. 7, a). The eighth setigerous segment is much shorter and has a large triangular, glandular shield with a slightly thickened rim, extending to the anterior margin of the segment (Fig. 7, b).

The cephalic plate is broadly oval. The rim is rather broad in front of the lateral notches, and the remainder is about half as long as the anterior rim is high; there is a slight incision middorsally. The nuchal organs are short and nearly parallel to each other; they do not reach as far as the lateral notches (Fig. 7, c).

The first three setigerous segments each have a single reduced uncinus, with three to four minute teeth in a row above the main fang, and without gular bristles (Fig. 7, d). The notopodial capillaries are slender, with narrow wings (Fig. 7, e). The following neuropodia have transverse rows of rostrate uncini that number 14 to 16 in each row; each uncinus has seven teeth in a row and small accessory teeth above the main fang, with gular bristles (Fig. 7, f, g, h). Notopodial capillaries consist of thick limbate setae (Fig. 7, i) and thinner setae with minute cilia-like hairs in distally (Fig. 7, j).

The pygidium is a shallow funnel rimmed with 12 to 16 subequal, short cirri and one long, ventral cirrus; its concave center has an elevated anal pore (Fig. 7, k, l).

*Distribution.* Western Canada; Japan.

#### Subfamily Lumbriclymeninae ARWIDSSON, 1906

##### Genus *Notoproctus* ARWIDSSON, 1907

##### *Notoproctus pacificus* (MOORE, 1906)

(Fig. 8, a-m)

*Lumbriclymene pacifica* MOORE, 1906, pp. 246–248, pl. 12, figs. 40–42.

*Notoproctus pacificus*: BERKELEY and BERKELEY, 1952, pp. 56–67, figs. 117, 118; HARTMAN, 1948, p. 8; 1969, p. 469; IMAJIMA, 1964, pp. 249–251, figs. 42–50.

*Material examined.* Off Samani, Hokkaido, in 60–80 m (2); off Shirikishinai, Hokkaido, in 125 m (5); off Onagawa, 37°55'N, 143°25'E, in 2230–2350 m, for the 2nd cruise of the Jap. Exp. of the Deep Seas; Sagami Bay, 35°09.2'N, 139°22.4'E–35°09.7'N, 139°22.2'E, in 500–520 m, KT-66-12 (2); 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m, KT-76-3 (36); 35°09.42'N, 139°32.00'E, in 330 m (1), 35°13.42'N, 139°26.00'E, in 420 m (2), for survey of Kanagawa Fish. Exper. Sta.; Korea Strait, in 210 m (3).

*Description.* The largest specimen measures 37 mm in length and 1.2 mm in width; it consists of 19 setigerous segments and two preanal apodous segments. Each of the anterior five or six segments has a glandular band on its anterior part (Fig. 8, a).

The cephalic plate is ovate and truncated, lacking any sort of rim; its dorsal part

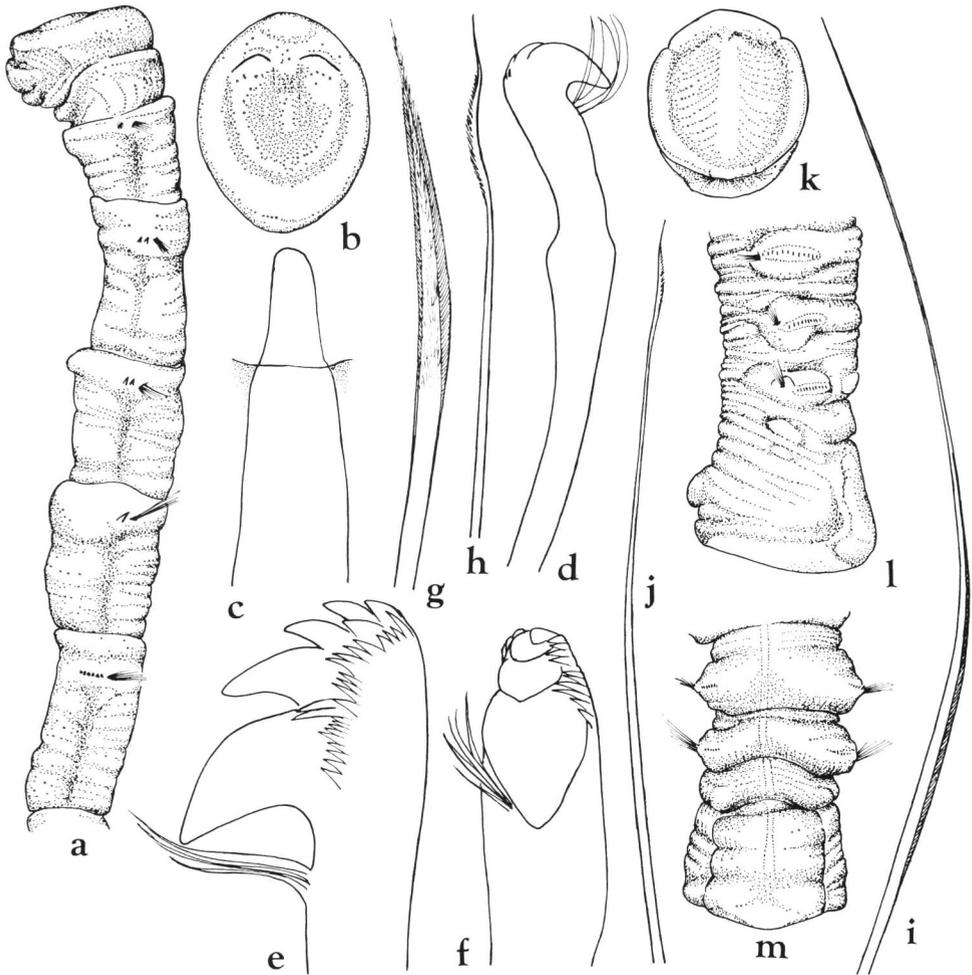


Fig. 8. *Notoproctus pacificus* (MOORE). a, anterior end, in lateral view,  $\times 10$ ; b, cephalic plate, in frontal view,  $\times 14$ ; c, acicular spine of the first setiger,  $\times 230$ ; d, rostrate uncinus from median setiger,  $\times 350$ ; e, f, distal ends of median uncini,  $\times 860$ ; g, limbate capillary seta from the first setiger,  $\times 350$ ; h, capillary seta with distally dentate tip from the first setiger,  $\times 690$ ; i, limbate capillary seta from median notopodium,  $\times 190$ ; j, capillary seta with dentate part distally from median notopodium,  $\times 350$ ; k, anal plate, in posterior view,  $\times 14$ ; l, posterior end, in lateral view,  $\times 14$ ; m, the same, in ventral view,  $\times 14$ .

is thick. Nuchal organs are short and arched, transversally placed, widely open curves. There is the slightest indication of a short keel, as a pigmented patch between the nuchal organs (Fig. 8, b).

In the first nine setigers the setal fascicles are distinctly placed in the anterior part of the segment. The first four neuropodia each have one or two thick acicular spines; their tips are blunt (Fig. 8, c). Farther back they are replaced by rostrate uncini with

four teeth in a linear row and many small teeth above a main fang (Fig. 8, d, e, f). The notopodial setae of the first setigerous segment are of two kinds: thick limbate capillaries (Fig. 8, g) and thinner capillaries with a distally dentate part (Fig. 8, h). Those in the median segments are either much longer with flagelliform tips (Fig. 8, i) or more slender with a similar dentate distal part (Fig. 8, j). The two short preanal segments have small tori, but no setae. The anal plate is almost circular with two small incisions on the ventral side (Fig. 8, k). Between these the rim of the plate is thickened, and a distinct furrow runs forward on each side of the nerve cord and unites with the last segmental furrow, thus forming a quadrangular shield on the ventral side of the pygidium. The anal pore is dorsal to the plate (Fig. 8, l, m). The tube is a thin membrane covered with sand.

*Distribution.* Southern California; western Canada and Alaska; Japan.

#### Genus *Lumbriclymene* Sars, 1872

##### *Lumbriclymene japonica* (McIntosh, 1885), new combination

(Fig. 9, a-r; Fig. 10, a-d)

*Nicomache japonica* MCINTOSH, 1885, pp. 399–400, pl. 46, fig. 5; pl. 24 a, fig. 20.

*Material examined.* Kashima Sea, 36°25.8'N, 141°18.3'E–36°23.0'N, 141°18.2'E, 1005–1050 m (5), 36°31.6'N, 141°03.7'E–36°30.6'N, 141°02.6'E, in 390–400 m (1), 36°34.9'N, 140°55.6'E–36°35.6'N, 140°56.2'E, in 120–122 m (1), KT-79-13; Sagami Bay, 35°09.2'N, 139°30.4'E–35°08.9'N, 139°29.5'E, in 590–590 m (holotype and two paratypes); 34°54.5'N, 139°19.7'E–34°54.5'N, 139°20.0'E, in 1450–1650 m (1), 34°54.0'N, 139°37.1'E–34°53.9'N, 139°37.0'E, in 815–1070 m (1), KT-66-12; Sagami Bank, 35°09.5'N, 139°23.7'E, in 465 m, KT-66-23 (1); 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m, KT-76-3 (8).

*Description.* The complete specimens measure 60 to 78 mm in length and about 1 mm in width at the middle of the body; they have 20 setigerous, and four or five preanal, apodous segments. The shape of the whole body is cylindrical, elongate with very distinct constrictions marking the segmentation; each segment is about four times as long as the body is wide (Fig. 9, a, b).

The pro- and peristomium are completely fused. The prostomium is broadly rounded in front, and keel rises abruptly from the snout. Posteriorly the keel widens backwards forming a broad, soft cushion at each side of the peristomial segment. The nuchal organs are short, and slightly curved outwards (Fig. 9, c). The mouth opens in a thick U-shaped underlip with numerous longitudinal furrows.

The first four setigerous segments have a single acicular spine ventrally in the rudimentary parapodium. Each spine is completely straight, and the tip has a hastate outline, with a slight circular constriction close to the tip (Fig. 9, d, e). The uncini have a marked shoulder just beneath the point at which they erupt through the body surface, a neck growing slightly broader and curved backwards, leading to a big, coarse

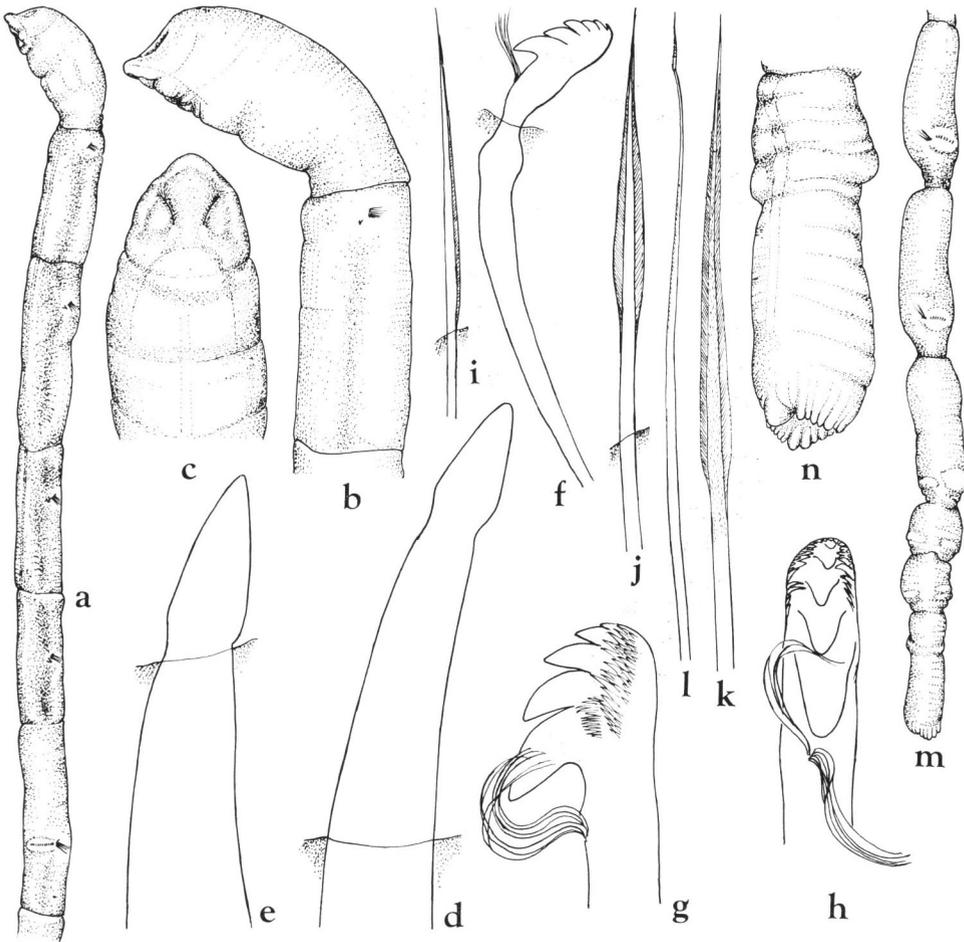


Fig. 9. *Lumbriclymene japonica* (MCINTOSH). a, anterior end, in lateral view,  $\times 5$ ; b, head, in lateral view,  $\times 10$ ; c, the same, in dorsal view,  $\times 13$ ; d, acicular spine from the first setiger,  $\times 330$ ; e, acicular spine from the fourth setiger,  $\times 330$ ; f, rostrate uncinus from median setiger,  $\times 330$ ; g, h, distal ends of median uncini,  $\times 550$ ; i, j, limbate capillaries from the first setiger,  $\times 330$ ; k, bilimbate capillary seta from median setiger,  $\times 330$ ; l, capillary seta with dentate part distally from median setiger  $\times 330$ ; m, posterior end, in lateral view,  $\times 10$ ; n, pygidium, in ventro-lateral view,  $\times 30$ .

main fang coming off at an acute angle; there are five teeth in a row and small accessory teeth above the main fang, with gular bristles (Fig. 9, f, g, h). A few anterior notopodia have limbate capillary setae (Fig. 9, i, j). Farther back there are bilimbate capillaries (Fig. 9, k) and capillaries with a short dentate, distal end (Fig. 9, l).

The four or five preanal segments become gradually shorter in length and more slender posteriorly (Fig. 9, m). The pygidium is cylindrical, with indistinct transverse

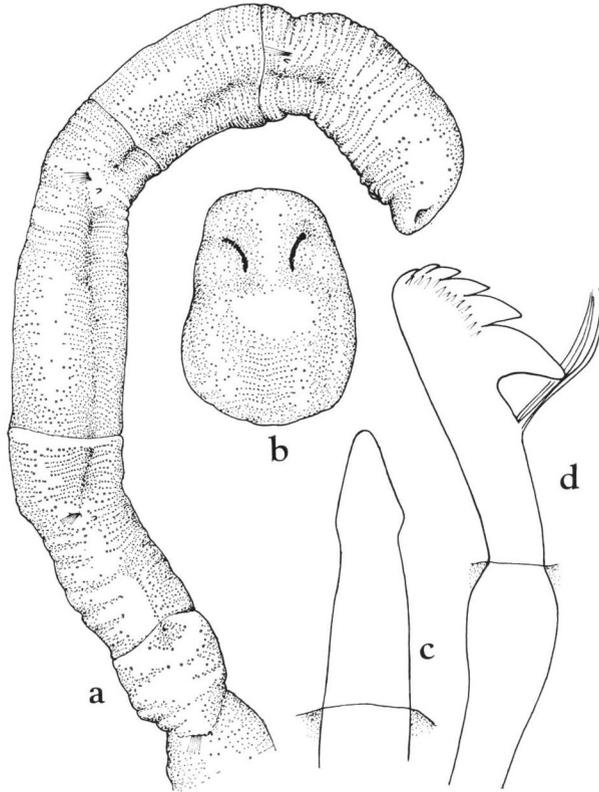


Fig. 10. *Lumbriclymene japonica* (MCINTOSH, 1885), from holotype of *Nicomache japonica* MCINTOSH. a, anterior end, in lateral view,  $\times 6$ ; b, head, in frontal view,  $\times 13$ ; c, acicular spine of the fourth setiger,  $\times 120$ ; d, distal end of median uncinus,  $\times 460$ .

wrinkles, and an anus opens almost terminally, surrounded by a number of longitudinal striations and small rounded papillae in the ventral midline; there is one papilla which is considerably bigger than the others (Fig. 9, n).

The holotype of *Nicomache japonica* MCINTOSH, 1885, collected from the Sagami Bay (Challenger stn. 232,  $35^{\circ}11'N$ ,  $139^{\circ}28'E$ , in 345 fms., 12 May, 1875) was re-examined. The specimen measures 60 mm in length and consists of 11 setigerous segments. The anterior segments are about three times as long as the body is wide. The head is smoothly rounded above and has a pair of short, slightly, outwardly curved nuchal organs (Fig. 10, a, b). Setigerous segments one to four have an acicular seta with a hastate tip in the neuropodium (Fig. 10, c). Rostrate uncini have a main fang surmounted by five teeth in a row; the long gular bristles are curved upwards over the fang (Fig. 10, d). *Nicomache japonica* MCINTOSH is transferred to *Lumbriclymene* because of the above mentioned characteristics.

*Distribution.* Japan.

Genus *Praxillura* VERRILL, 1880*Praxillura tanseiana* sp. nov.

(Fig. 11, a-n)

*Material examined.* Kashima Sea, 36°08.4'N, 140°55.0'E–36°09.5'N, 140°55.7'E, in 198–200 m, KT-79-13 (1); Sagami Bay, 35°08.80'N, 139°34.85'E, in 83 m (holotype);

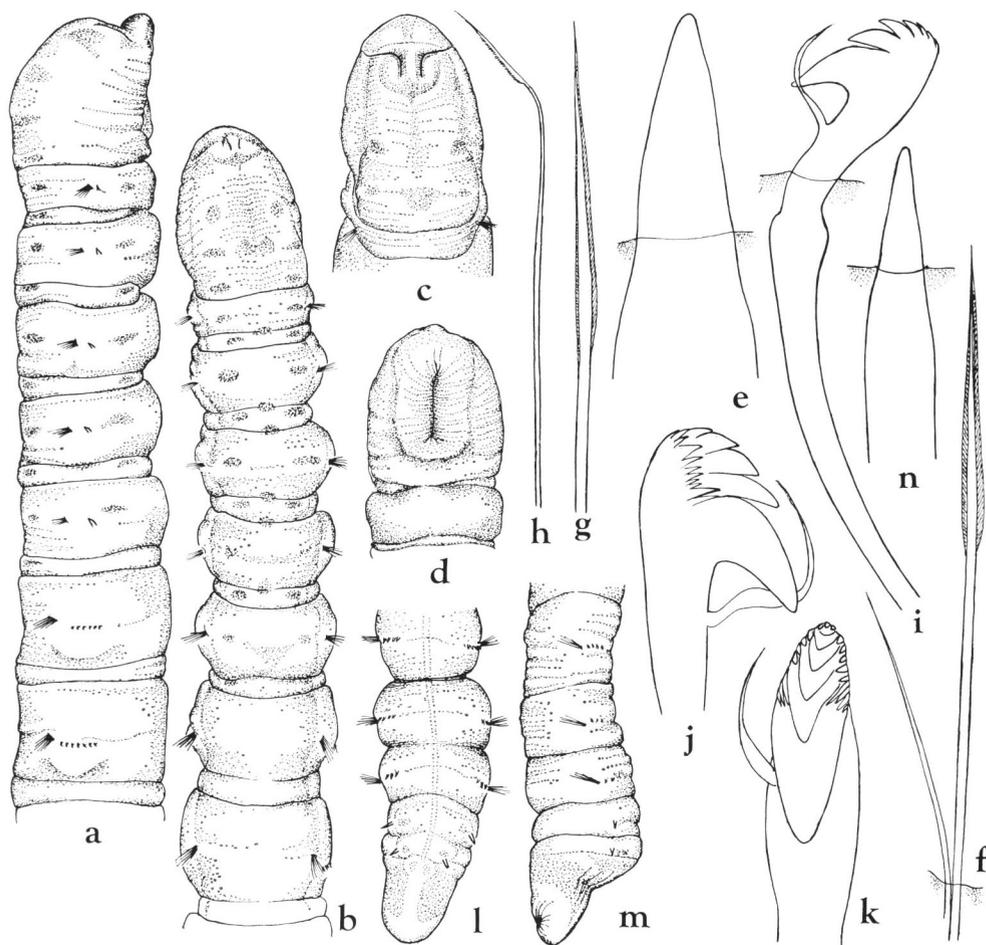


Fig. 11. *Praxillura tanseiana* sp. nov. a, anterior end, in lateral view,  $\times 18$ ; b, the same, in dorsal view,  $\times 18$ ; c, head, in dorsal view,  $\times 20$ ; d, head, in ventral view,  $\times 20$ ; e, acicular spine from the first setiger,  $\times 330$ ; f, capillary seta from the first setiger,  $\times 330$ ; g, limbate capillary seta from median setiger,  $\times 330$ ; h, capillary seta with dentate part distally from median setiger,  $\times 330$ ; i, rostrate uncinus from median setiger,  $\times 460$ ; j, k, distal ends of median uncini,  $\times 545$ ; l, posterior end, in ventral view,  $\times 18$ ; m, the same, in lateral view,  $\times 20$ ; n, acicular spine from posterior setiger,  $\times 330$ .

35°05.3'N, 139°30.0'E–35°03.4'N, 139°29.2'E, in 860 m, KT-65-34 (1); 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m, KT-76-3 (2); Sagami Bank, 35°08.3'N, 139°19.8'E, in 520 m, KT-66-23 (1).

*Description.* The holotype is a complete specimen and measures 74 mm in length and about 1 mm in width anteriorly; it consists of 56 setigerous segments. The body is thread-like; segments are separated by deep furrows and are strongly biannulate. The anterior end, including the head and five setigerous segments have a conspicuously maculated pattern of small rounded brown spots arranged in three longitudinal rows on the dorsum; these spots are frequently arranged symmetrically. Moreover, there are two longitudinal rows of brown spots along the ventral side beneath the neuropodia (Fig. 11, a, b).

The prostomium is blunt and flat, and completely fused with the following segment. The nuchal organs are short, the concavities of which turn laterally, and a keel is narrow and low (Fig. 11, c). The mouth is a longitudinal fissure, surrounded by furrows, on the ventral side of the buccal segment (Fig. 11, d).

The first five setigerous segments each have one spine in the neuropodium; the spines are stout and nearly straight, tapering to a blunt point (Fig. 11, e). The first notopodial setae are of two kinds: long, limbate capillaries and short, thinner ones (Fig. 11, f). Further back the notosetae are limbate capillaries with a distal dentate part (Fig. 11, h). Uncini appear first from the sixth neuropodium; they have five teeth in a row, diminishing in size distally, and small accessory teeth above the main fang, and only one gular bristle (Fig. 11, i, j, k). The posterior body gradually diminishes in size; the last four segments have a brown spot near the neurosetae. There is no preanal aetous segment. The last two segments each have one stout neurospine but no notosetae (Fig. 11, n). The pygidium is constricted ventrally, but has a rounded margin in ventral view. The anal pore, surrounded by irregular radiate wrinkles, opens on the dorsal side (Fig. 11, l, m, n).

*Remarks.* *Praxillura tanseiana* is characterised by the fact that (1) the anterior dorsum has a maculated pattern of small rounded brown spots in three longitudinal rows, (2) there is no preanal aetous segment.

*Type-series.* Holotype, NSMT-Pol. H 157; 2 paratypes, NSMT-Pol. P 158.

*Distribution.* Japan.

#### Genus *Clymenopsis* VERRILL, 1900

#### *Clymenopsis cingulata* (EHLERS, 1887)

(Fig. 12, a-k)

*Clymene cingulata* EHLERS, 1887, pp. 185–188, pl. 47, figs. 2–5.

*Clymenopsis cingulata*: HARTMAN and BARNARD, 1960, pp. 144–145.

*Lumbriclymene constricta* WESENBERG-LUND, 1948, pp. 12–15, fig. 4.

*Clymenopsis californiensis* HARTMAN, 1969, pp. 437, 438.

*Material examined.* Otsuchi Bay, in 89 m (1); Kamaishi Bay, in 53 m (12);

Kashima Sea, 36°09.3'N, 140°56.6'E–36°10.0'N, 140°56.1'E, in 280–295 m (8), 36°09.8'N, 141°01.5'E–36°08.5'N, 141°02.5'E, in 498–517 m (3), 36°12.7'N, 141°18.1'E–36°15.6'N, 141°18.7'E, in 975–1020 m (1), 36°12.4'N, 141°09.5'E–36°12.8'N, 141°08.8'E, in 690–710 m (5), 36°30.1'N, 141°12.5'E–36°30.8'N, 141°13.5'E, in 690–705 m (3), KT-79-13; off Boso, 35°00.1'N, 140°06.8'E–35°00.5'N, 140°07.5'E, in 145–150 m, KT-76-16 (15); Sagami Bay, 34°58.6'N, 139°28.6'E, in 1340 m, KT-65-34 (3); 34°54.2'N, 139°28.0'E–34°54.2'N, 139°27.5'E, in 1350–1340 m, KT-66-12 (1); 35°09.1'N,

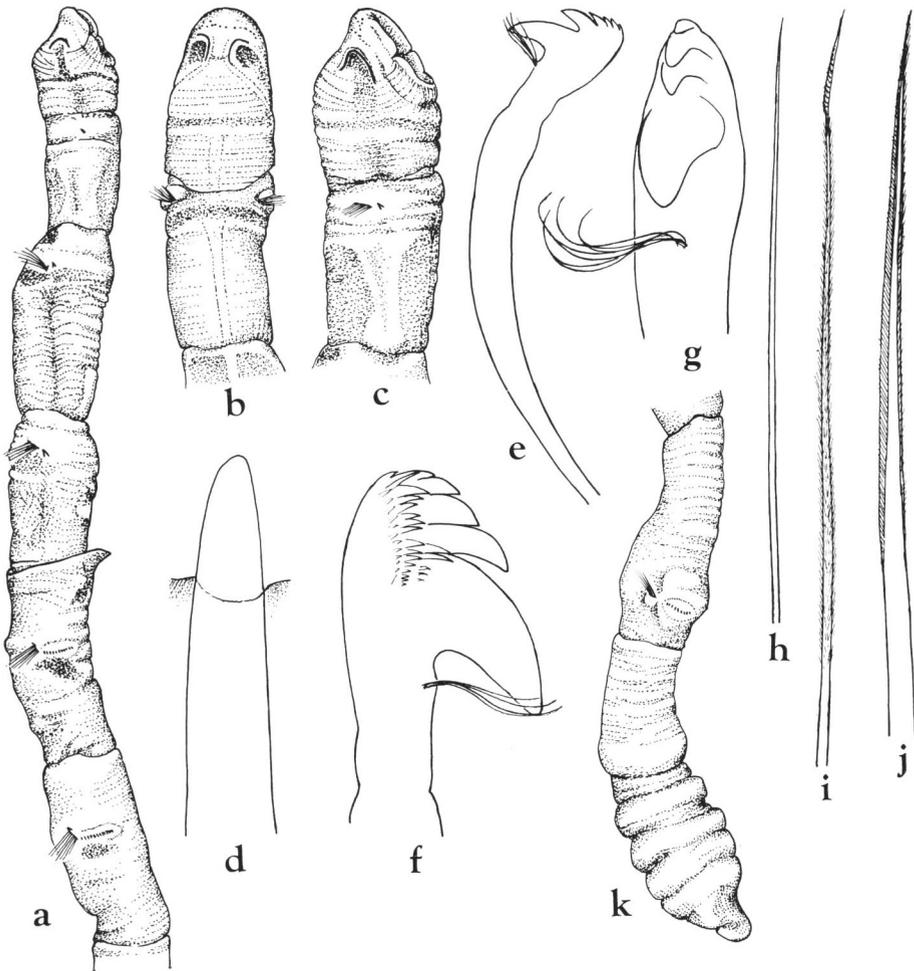


Fig. 12. *Clymenopsis cingulata* (EHLERS). a, anterior end, in lateral view,  $\times 10$ ; b, head, in dorsal view,  $\times 15$ ; c, the same, in lateral view,  $\times 15$ ; d, acicular spine from the first setiger,  $\times 500$ ; e, rostrate uncinus from median setiger,  $\times 350$ ; f, g, distal ends of median uncini,  $\times 350$ ; h, limbate capillary seta from the first setiger,  $\times 230$ ; i, hirsute capillary seta with dentate part distally from median setiger,  $\times 350$ ; j, limbate capillary seta from median setiger,  $\times 350$ ; k, posterior end, in lateral view,  $\times 10$ .

139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m, KT-76-3 (9); 35°12.36'N, 139°36.00'E, in 20 m (6), 35°15.2'N, 139°28.00'E, in 84 m (3), 35°09.42'N, 139°32.00'E, in 330 m (3), 35°11.42'N, 139°32.00'E, in 350 m (1), 35°11.42'N, 139°30.00'E, in 550 m (1), 35°11.42'N, 139°28.00'E, in 720 m (2), for survey in Kanagawa Fish. Exper. Sta.; Sagami Bay, 35°08.7'N, 139°34.8'E, in 83 m (1); Sagami Bank, 35°08.3'N, 139°19.8'E, in 520 m (4), 35°10.6'N, 139°24.5'E, in 704 m (1), KT-66-23; Suruga Bay, 35°03.08'N, 138°50.60'E–35°02.21'N, 138°50.86'E, in 99–100 m (2), 34°55.06'N, 138°44.06'E–34°54.24'N, 138°44.11'E, in 300–319 m (2), 34°45.97'N, 138°42.32'E–34°46.45'N, 138°42.40'E, in 314–320 m (3), 35°04.00'N, 138°47.39'E–35°04.00'N, 138°47.47'E, in 252–270 m (2), KT-73-15; 34°54.8'N, 138°45.2'E–34°54.4'N, 138°45.3'E, in 162–180 m, KT-76-3 (1); Korea Strait, in 145 m (5), Tsushima Strait, in 96–115 m (16).

*Description.* The largest specimen measures 50 mm in length and 1.3 mm in width; the body is slender, cylindrical and consists of 19 setigerous, and five preanal asetigerous segments, followed by a tapering anal end. The cephalic lobe and three anterior segments have a transverse brown band across them near the setal tori. The fourth setigerous segment has a conspicuous collar arising from the anterior part of the uncinigerous ridge (Fig. 12, a); the collar is low on the dorsal side and increases midventrally to its highest point; it is deepest above. The anterior three setigerous segments are subequal in length, and setigers four to six are rather longer than the preceding three.

The nuchal organs are crescentic to nearly right-angled, with short arms. The peristomium is not clearly demarcated from the first setigerous segment. The nuchal keel is short and deeply marked laterally by the nuchal organs. Posteriorly the keel widens to a high, broad, cushion-like neck at each side of the peristomial segment. There are many, distinct ocelli on the prostomium (Fig. 12, b, c).

The first three neuropodia have a heavy, straight acicular spine (Fig. 12, d). The following neuropodia have rostrate uncini numbering 11 to 16 in a single transverse row; each has five or six teeth in a row and small accessory teeth above the main fang, with gular bristles (Fig. 12, e, f, g). Notopodial setae are present from the first setigerous segment and are of three kinds: thinner, limbate capillaries (Fig. 12, h), laterally fimbriated capillaries with a short, denticulate tip (Fig. 12, i), and thick, fimbriated capillaries (Fig. 12, j). The last five asetous segments are much shorter and form a ringed cone, terminating in a little blunt, soft papilla, on the dorsal side of which the anus is situated (Fig. 12, k).

The species is new to the Japanese fauna.

*Distribution.* Southern Florida; southern California; Greenland; Japan.

#### Subfamily Rhodininae ARWIDSSON, 1906

Genus *Rhodine* MALMGREN, 1865

*Rhodine loveni* MALMGREN, 1865

(Fig. 13, a-m)

*Rhodine loveni*: ARWIDSSON, 1906, pp. 64–74, pl. 2, figs. 39–52; pl. 7, figs. 235, 236; pl. 11, figs. 346,

347; USCHAKOV, 1955, p. 336, fig. 123, j; HARTMAN, 1966, p. 72, pl. 23, figs. 9–11; HARTMANN-SCHRÖDER, 1971, pp. 433–434, fig. 152.

*Material examined.* Off Samani, Hokkaido, in 40–70 m (6); Otsuchi Bay, in 60–89 m (6); Kamaishi Bay, in 29–53 m (4); Kashima Sea, 36°34.9'N, 140°55.6'E–36°35.6'N, 140°56.2'E, in 120–122 m, KT-79-13 (1); off Boso, 35°00.1'N, 140°06.8'E–35°00.5'N, 140°07.5'E, in 145–150 m, KT-76-16 (2); Sagami Bay, 34°45.0'N, 139°38.0'E, in 1500 m (1), 34°56.2'N, 139°15.0'E, in 1310 m (2), 34°51.3'N, 139°19.7'E–34°51.7'N, 139°20.1'E, in 1115 m (1), 35°02.4'N, 139°14.6'E–35°03.2'N, 139°14.4'E, in 1340 m (1), KT-65-34; 35°09.2'N, 139°30.4'E–35°08.9'N, 139°29.5'E, in 590 m (3), 35°09.2'N, 139°22.4'E–35°09.7'N, 139°22.2'E, in 500–520 m (2), 35°09.0'N, 139°14.2'E–35°09.6'N, 139°14.2'E, in 980–1140 m (2), 35°01.2'N, 139°28.1'E–35°01.2'N, 139°29.0'E, in 870–790 m (3), 35°00.9'N, 139°35.7'E–35°00.7'N, 139°36.0'E, in 1060–990 m (1), 34°54.0'N, 139°37.1'E–34°53.9'N, 139°37.0'E, in 815–1070 m (5), 34°54.5'N, 139°19.7'E–34°54.5'N, 139°20.0'E, in 1450–1650 m (3), KT-66-12; 35°04.1'N, 139°31.5'E–35°04.2'N, 139°30.8'E, in 750–870 m (2), 35°09.1'N, 139°23.3'E–35°09.1'N, 139°23.9'E, in 478–490 m (246), 35°01.2'N, 138°24.8'E–35°01.2'N, 138°25.35'E, in 1260–1290 m (12), KT-76-3; 35°12.27'N, 139°36.00'E, in 20 m (1), 35°15.42'N, 139°32.00'E, in 43 m (1), 35°11.42'N, 139°32.00'E, in 350 m (1), 35°09.42'N, 139°32.00'E, in 330 m (1), 35°16.42'N, 139°26.00'E, in 420 m (2), 35°09.42'N, 139°26.00'E, in 890 m (1), for survey in Kanagawa Fish. Exper. Sta.; Sagami Bank, 35°07.9'N, 139°19.9'E, in 540 m (2), 35°11.7'N, 139°20.2'E, in 1025 m (1), 35°10.3'N, 139°21.5'E, in 970 m (2), 35°09.4'N, 139°22.9'E, in 480 m (8), 35°10.0'N, 139°24.3'E, in 524 m (1), KT-66-23; off Koyahata, in 70 m (1); Suruga Bay, 34°52.7'N, 138°37.6'E–34°53.3'N, 138°37.5'E, in 1500–1480 m, KT-73-6 (29); 35°01.66'N, 138°51.14'E–35°02.51'N, 138°50.64'E, in 83–99 m (2), 34°56.33'N, 138°44.51'E–34°56.94'N, 138°44.50'E, in 286–326 m (1), KT-73-15; Enshu-nada, 35°38.3'N, 137°49.3'E, in 15 m (3); Korea Strait, in 145–210 m (3).

*Description.* All specimens were damaged; the largest anterior fragment consists of 16 setigerous segments and the largest posterior fragment is 19 setigerous segments. The first setiger is long and slender, about three times as long as wide (Fig. 13, a). The following five setigers are about half as long as the first setiger, and succeeding setigers are about two-thirds as long as the first setiger. The ninth and tenth setigerous segments are fused (Fig. 13, b, c). The second and third setigers have an anterior collar incised middorsally, covering the base of the preceding segment, but the third one less so (Fig. 13, d). Setigerous segments three to nine or ten have conspicuous ventral glandular shields on the anterior half of segment, and at the sides of parapodia.

The head has a dorsal crest marking the junction with the first setiger (Fig. 13, a, e). The prostomium is rounded in front and laterally bordered, and the cephalic keel is high and compressed, gradually passing over posteriorly. The nuchal organs are deep, and bent at a rather sharp angle forming two unequal arms; the inner, longer ones running parallel to the median ridge, and opening posteriorly. There are no ocelli.

The first four setigerous segments have only notopodial capillaries. Neuropodial

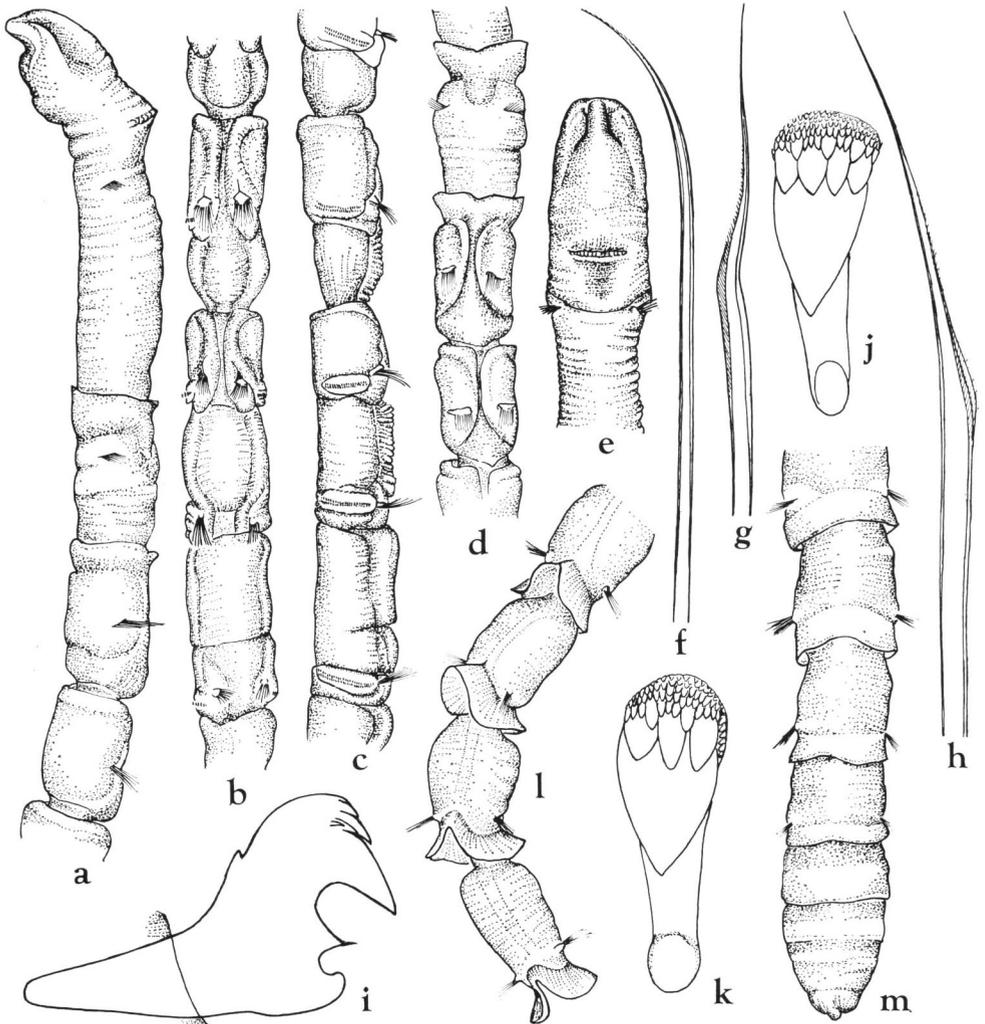


Fig. 13. *Rhodine loveni* MALMGREN. a, anterior end, in lateral view,  $\times 8$ ; b, part of body, showing the 8th, 9th, 10th, 11th setigers, in dorsal view,  $\times 8$ ; c, the same, in lateral view,  $\times 8$ ; d, part of body, showing collars of the 2nd and 3rd setigers,  $\times 8$ ; e, head, in dorsal view,  $\times 10$ ; f, limbate capillary seta from the first setiger,  $\times 215$ ; g, geniculate capillary seta from the first setiger,  $\times 330$ ; h, limbate capillary seta from median setiger,  $\times 330$ ; i, median uncinus,  $\times 635$ ; j, k, median uncini, in frontal view,  $\times 1120$ ; l, posterior body, showing developed collar arising from posterior end of segments,  $\times 10$ ; m, posterior end, in dorsal view,  $\times 18$ .

uncini appear in the fifth setigerous segment as double, interlocking rows of uncini, and continue to setiger 14, and in single series thereafter. The notopodial setae are of two kinds; narrow limbate capillaries with a short distally pilose part (Fig. 13, f), and flat-

tened sword-like, blades with a smooth or minutely serrated margin (Fig. 13, g, h). The uncini have a large beak surmounted by several transverse arcs of small teeth; the first arc has three or four large teeth; there is a stout accessory subrostral spine (Fig. 13, i, j, k). From the 17th setigerous segment all segments have posterior collars, which increase in depth posteriorly (Fig. 13, l), even on the aetous preanal segments. The pygidium is a short blunt cone with a terminal anus and a large ventral valve (Fig. 13, m).

The species is new to the Japanese fauna.

*Distribution.* Arctic boreal; Atlantic, Pacific and Antarctica; Japan.

#### Subfamily Nicomachinae ARWIDSSON, 1906

##### Key to Japanese Species of *Nicomache*

1. With acicular spines on first three setigerous segments. . . . . 2
- 1'. With acicular spines on first four setigerous segments. . . *N. (Loxochona) quadrispinata*
2. Body consisting of 22 setigerous and one or two preanal apodous segments. . . . 3
- 2'. Body consisting of 23 setigerous and one preanal apodous segment. . . . .  
 . . . . . *N. (Nicomache) minor*
3. With one preanal apodous segment. . . . . *N. (Nicomache) personata*
- 3'. With two preanal apodous segments. . . . . *N. (Nicomache) lumbricalis*

##### *Nicomache (Nicomache) lumbricalis* (FABRICIUS, 1780)

(Fig. 14, a-n)

*Nicomache lumbricalis*: ARWIDSSON, 1906, pp. 86–93, pl. 8, figs. 244, 245; FAUVEL, 1927, pp. 190–191, fig. 66, a-i; WESEBERG-LUND, 1948, pp. 23–27, figs. 10, 11 d-f; 1950, p. 41; HARTMAN, 1948, p. 42; 1969, p. 465; BERKELEY and BERKELEY, 1952, pp. 54–55, figs. 111, 112; PETTIBONE, 1954, pp. 305–306, fig. 34, i, j; USCHAKOV, 1955, p. 336, fig. 124, A-D; IMAJIMA, 1964, pp. 248–249, figs. 39–41; DAY, 1967, p. 621, fig. 30. 1. i-o; HARTMANN-SCHRÖDER, 1971, pp. 428–430, fig. 149, a-f.

*Nicomache benthaliana* MCINTOSH, 1885, p. 400, pl. 46, fig. 8; pl. 24 a, fig. 21.

*Material examined.* Otsuchi Bay, in 62–55 m (1); Kamaishi Bay, in 29 m (1); off Onagawa Bay, 37°55'N, 143°25'E, in 2230–2350 m, by 2nd cruise of Jap. Exp. of Deep Seas (10); Kashima Sea, 36°31.6'N, 141°03.7'E–36°30.6'N, 141°02.6'E, in 390–400 m (4), 36°34.9'N, 140°55.6'E–36°35.6'N, 140°56.2'E, in 120–122 m (1), KT-79-13; off Uotsu, Niigata Pref., in 180–230 m (1), N. HORIE coll.; Sagami Bay, 34°44.6'N, 139°13.0'E–34°44.0'N, 139°13.6'E, in 580 m (1), 35°05.3'N, 139°30.0'E–35°03.4'N, 139°29.2'E, in 860 m (2), KT-65-34; 35°09.2'N, 139°30.4'E–35°08.9'N, 139°29.5'E, in 590–590 m, KT-66-12 (1); Suruga Bay, 35°04.1'N, 138°47.3'E–35°03.9'N, 138°47.6'E, in 282–211 m (5), 34°46.1'N, 138°42.4'E–34°46.8'N, 138°42.5'E, in 306–317 m (1), KT-73-6; 35°04.00'N, 138°47.39'E–35°04.00'N, 138°47.47'E, in 252–270 m (8), 34°56.33'N, 138°44.51'E–34°56.94'N, 138°44.50'E, in 295–302 m (2), 34°55.06'N, 138°44.06'E–34°54.24'N, 138°44.11'E, in 313–304 m (1), 34°51.88'N, 139°26.79'E–34°51.67'N, 139°27.03'E, in 1680 m (1), 35°01.66'N, 138°51.14'E–35°02.51'N, 138°50.64'E, in

88–99 m (1), KT-73-15; 35°03.6'N, 138°47.2'E–35°03.2'N, 138°46.2'E, in 245–315 m, KT-76-16 (1); 35°03.08'N, 138°47.1'E–35°03.09'N, 138°47.2'E, in 280–300 m, KT-77-7 (8).

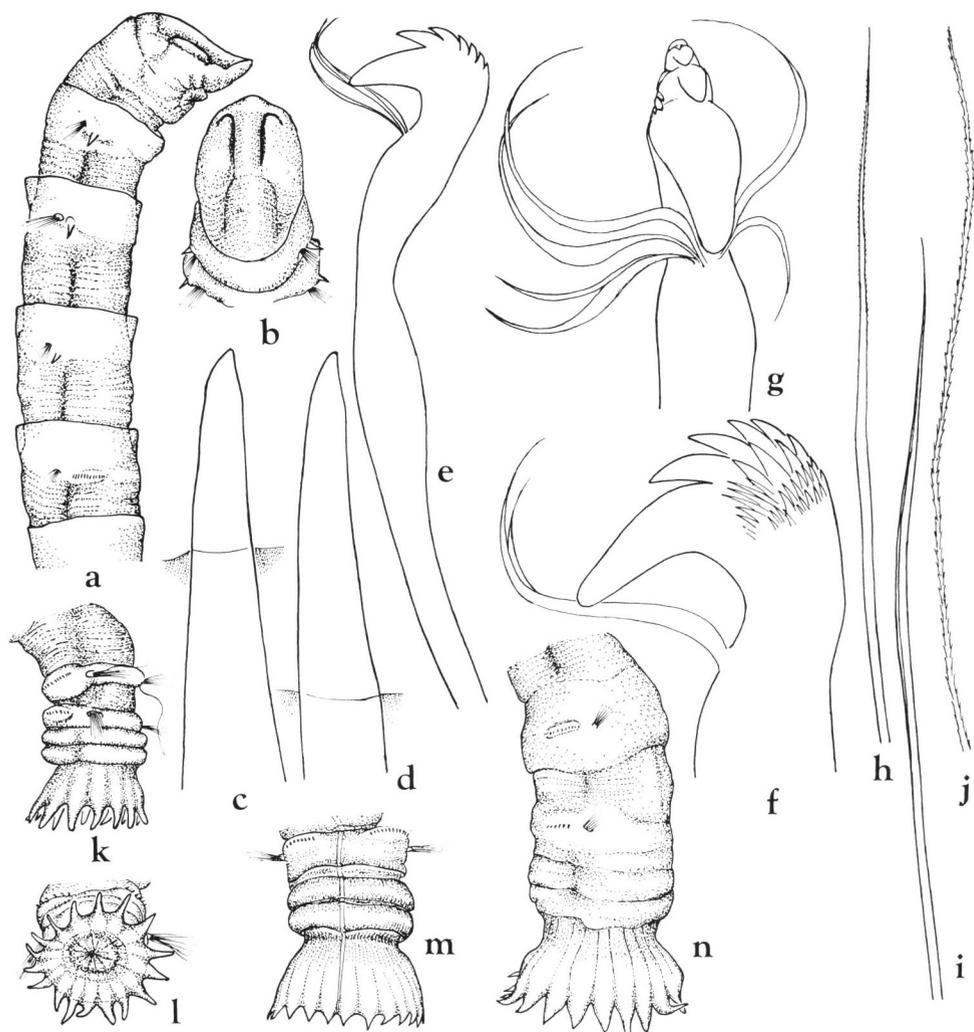


Fig. 14. *Nicomache (Nicomache) lumbricalis* (FABRICIUS). a, anterior end, in lateral view,  $\times 5$ ; b, head, in dorsal view,  $\times 5$ ; c, acicular spine from the first setiger,  $\times 80$ ; d, acicular spine from the second setiger,  $\times 80$ ; e, rostrate uncinus from median setiger,  $\times 330$ ; f, g, distal ends of median uncini,  $\times 545$ ; h, limbate capillary seta from the first setiger,  $\times 175$ ; i, limbate capillary seta from the median setiger,  $\times 80$ ; j, spinose capillary seta,  $\times 55$ ; k, posterior end, in lateral view  $\times 10$ ; l, anal plate, in posterior view,  $\times 10$ ; m, posterior end of other specimen, in ventral view,  $\times 5$ ; n, posterior end of holotype of *Nicomache benthaliana* McIntosh, in dorso-lateral view,  $\times 8$ .

*Description.* The largest specimen measures 60 mm in length and 3 mm in width in the anterior body; it consists of 22 setigerous and two preanal apodous segments. The anterior segments are more strongly pigmented, uniform reddish brown with marked iridescence. Each of the first six setigerous segments has a glandular belt on its anterior end, which surrounds the base of the preceding segment as a collar-like process (Fig. 14, a).

The prostomium and peristomium are completely fused, and the prostomium is rounded with a hook-like projection overhanging the mouth. The nuchal organs are long parallel slits with their anterior ends curved outwards. The cephalic keel stretches a little further back than the nuchal organs (Fig. 14, b).

The first three setigerous segments have especially stout and straight acicular spines, one in each parapodium (Fig. 14, c, d). From the following segment, neurosetae are replaced by rostrate uncini with five or six teeth in a row and many small accessory teeth above the main fang (Fig. 14, e, f, g). The few anterior notosetae are slender limbate capillaries only (Fig. 14, h) and the following notosetae are of two kinds: long, limbate capillaries (Fig. 14, i) and very long, filamentous, laterally spinose capillaries (Fig. 14, j).

The posterior end terminates in a cup-like anal funnel; its margin is dentate with a series of 17 to 31 short, subequal cirri, and its concave center has an elevated anal pore (Fig. 14, k, l, m). Tubes are usually in more or less complex coils, the wall is covered with fine sand about 4 to 5 mm thick in large specimens.

The holotype of *Nicomache benthaliana* MCINTOSH, 1885 from west of Japan (35°41'N, 157°42'E, in 2300 fms.) was re-examined. The specimen is posterior body consisting of four setigers and two preanal asetigers and pygidium (Fig. 14, n). The pygidium is funnel-shaped, bounded by 22 (19 cirri + missing three cirri) short, subequal cirri; it has an anal pore in the center. The characteristics correspond with those of *N. lumbricalis*.

*Distribution.* Greenland; North Sea; Kara Sea; Bering Sea; Pacific coast of North America; Japan.

### *Nicomache (Nicomache) personata* JOHNSON, 1901

(Fig. 15, a-k)

*Nicomache personata* JOHNSON, 1901, pp. 419–420, pl. 13, figs. 134–139; HARTMAN, 1948, pp. 41–42, fig. 11, d-g; 1969, p. 467; BERKELEY and BERKELEY, 1952, p. 54, figs. 109–110; USCHAKOV, 1955, p. 339.

*Material examined.* Notsuka, Rishiri Island (1), Rebun Island, from *Zostera* bed (1), Erimo, intertidal zone (2), Hokkaido.

*Description.* The largest, complete specimen measures 21 mm in length and 1.5 mm in width anteriorly; it consists of 22 setigerous segments and one preanal apodous asetiger.

The head and first three to four segments are chocolate-brown, except for a white

band across the head or around the segments in the setal region. Nuchal organs are short, more or less S-shaped (Fig. 15, a, b).

The first three setigerous segments have acicular spines, one in each parapodium, which are stout with relatively slender tips (Fig. 15, c). Uncini of some of the following segments (three to five per neuropodium) are not fully developed, and have only two teeth in a row above the main fang and sometimes a few small gular bristles. The typical rostrate uncini have seven teeth in a row above the main fang and long gular bristles (Fig. 15, d, e, f). A few anterior notopodia have thick bilimbrate capillary setae (Fig. 15, g) and distally spinose capillary setae (Fig. 15, i); in addition some very long,

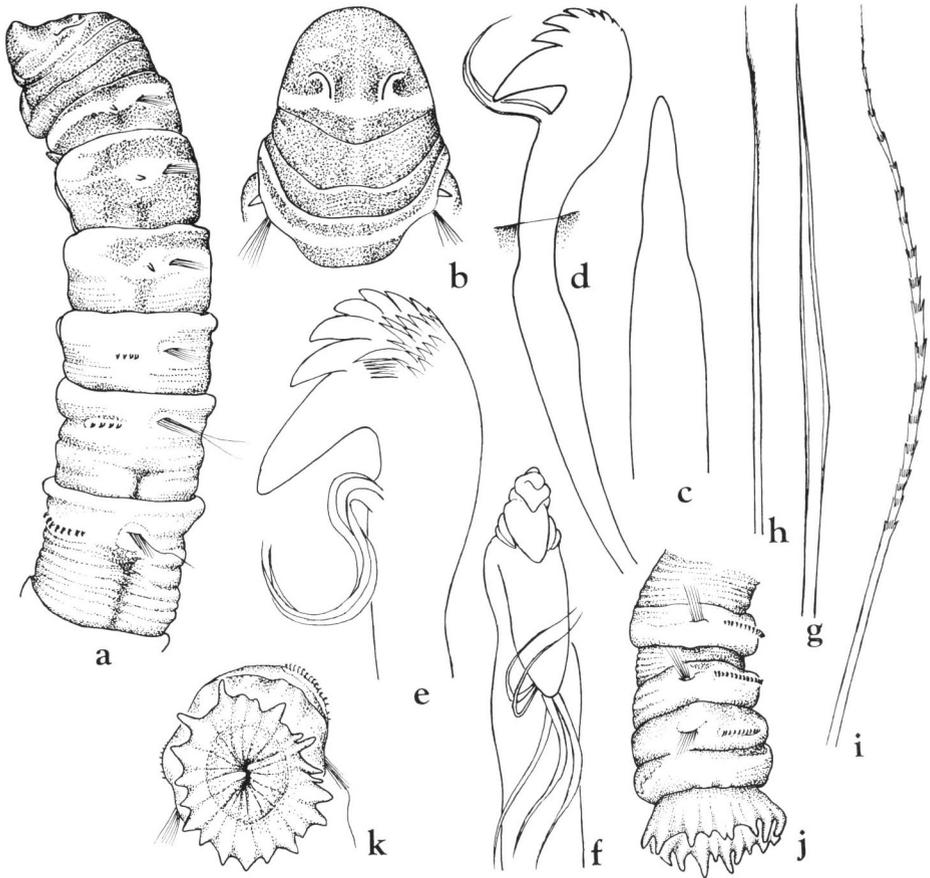


Fig. 15. *Nicomache (Nicomache) personata* JOHNSON. a, anterior end, in lateral view,  $\times 13$ ; b, head, in frontal view,  $\times 18$ ; c, acicular spine from the first setiger,  $\times 215$ ; d, rostrate uncinus from median setiger,  $\times 460$ ; e, f, distal ends of median uncini,  $\times 805$ ; g, limbate capillary seta from the first setiger,  $\times 215$ ; h, hirsute capillary seta from the first setiger,  $\times 330$ ; i, spinose capillary seta,  $\times 330$ ; j, posterior end, in lateral view,  $\times 13$ ; k, anal plate, in posterior view,  $\times 18$ .

slender, and very finely pinnate setae are already present from the fifth setigerous segment and continue to the last setiger; they extend far out from the sides of the body.

The posterior end terminates in a circular funnel with a series of about 20 short, triangular papillae, some reduced to mere elevations; the anal pore is present at the concave center of the plate (Fig. 15, j, k).

The species is new to the Japanese fauna.

*Distribution.* Pacific coast of north America from southern Alaska to Vancouver; Japan.

*Nicomache (Nicomache) minor* (ARWIDSSON, 1906)

(Fig. 16, a-m)

*Nicomache minor* ARWIDSSON, 1906, pp. 100–104, pl. 2, figs. 68–73; pl. 8, figs. 252–256; USCHAKOV, 1955, p. 338, fig. 124, E.

*Material examined.* Notsuka, Rishiri Island, from *Zostera* bed (14), Rebun Island (4), Irika (98), Erimo (47), Shirikishinai (26), Matsumae (22), Saroma Lake (1), intertidal zone, Hokkaido; off Shiriya-zaki, in 320 m (3); Korea Strait, in 195 m (2).

*Description.* The largest specimen measures 70 mm in length and 1.7 mm in width anteriorly; it consists of 23 setigerous segments and one preanal apodous asetiger and the pygidium. The anterior body is mottled with chocolate-brown on white.

The head is rather short and thick, rounded with a well defined median ridge. The nuchal organs are S-shaped; the curves more or less flattened according to fixation (Fig. 16, a, b).

The first three setigerous segments have stout, blunt-tipped acicular spines, only one in each parapodium (Fig. 16, c, d). The following neuropodia have four to 15 rostrate uncini; those in the first few neuropodia are not fully developed, with only two teeth in a row above the main fang and sometimes a few small, gular bristles. Fully developed uncini have six to eight acute teeth in a row above the main fang and large gular bristles (Fig. 16, e, f, g). Notopodial capillary setae are of two kinds; thin bilimbate capillaries (Fig. 16, h), laterally spinous capillaries (Fig. 16, i, j). In addition, after the fifth setiger, there are some very long, filamentous pinnate setae, extending far out from the sides of the body (Fig. 16, k). The posterior end terminates in a circular funnel with a series of about 20 short, subequal cirri, some reduced to mere elevations, and its concave center has an anal pore (Fig. 16, l, m).

The species is new to the Japanese fauna.

*Distribution.* Norway; Sea of Japan; Okhotsk Sea; Bering Sea; Japan.

*Nicomache (Loxochona) quadrispinata* ARWIDSSON, 1906

(Fig. 17, a-m)

*Nicomache (Loxochona) quadrispinata* ARWIDSSON, 1906, pp. 108–113, pl. 3, figs. 80–84; pl. 5, figs. 179–180; pl. 8, figs. 262–267; WESENBERG-LUND, 1948, pp. 27–29, figs. 12, 13; 1950, pp. 41–42.

*Material examined.* Kashima Sea, 36°34.6'N, 140°55.6'E–36°35.6'N, 140°56.2'E,

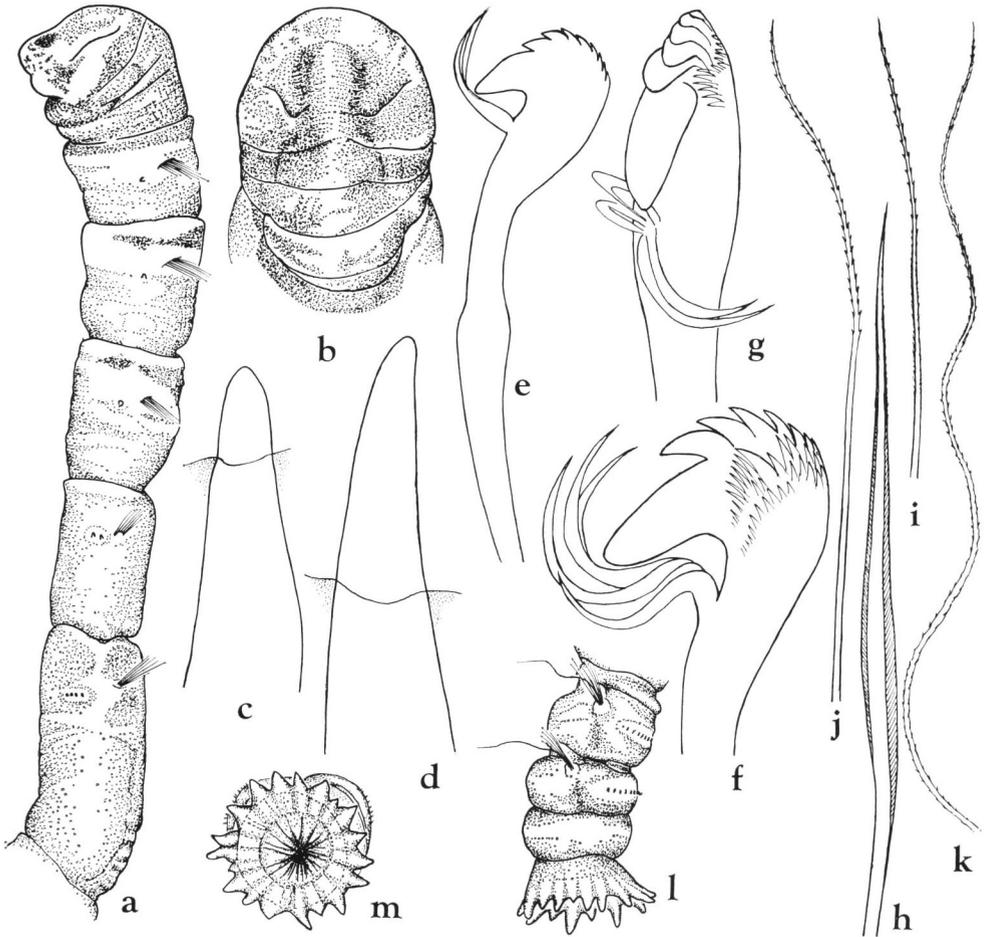


Fig. 16. *Nicomache (Nicomache) minor* ARWIDSSON. a, anterior end, in lateral view,  $\times 18$ ; b, head, in frontal view,  $\times 30$ ; c, acicular spine from the first setiger,  $\times 330$ ; d, acicular spine from the second setiger,  $\times 330$ ; e, rostrate uncinus from median setiger,  $\times 460$ ; f, g, distal ends of uncini,  $\times 805$ ; h, bilimbate capillary seta from median setiger,  $\times 215$ ; i, j, spinose capillaries from median setiger,  $\times 215$ ; k, distal end of filamentous pinnate seta,  $\times 215$ ; l, posterior end, in lateral view,  $\times 18$ ; m, anal plate, in posterior view,  $\times 20$ .

in 120–122 m, KT-79-13 (1); Suruga Bay,  $34^{\circ}55.60'N$ ,  $138^{\circ}44.06'E$ – $34^{\circ}54.24'N$ ,  $138^{\circ}44.11'E$ , in 313–304 m (1),  $35^{\circ}01.66'N$ ,  $138^{\circ}51.14'E$ – $35^{\circ}02.51'N$ ,  $138^{\circ}50.64'E$ , in 83–99 m (1), KT-73-15; Tsushima Strait, in 64–125 m (4).

*Description.* All the specimens are anterior fragments; the largest one measures 47 mm in length and 2 mm in width, and consists of 13 setigerous segments. The anterior end of the body is slightly club shaped. There are white glandular belts in front of the setal fascicles from the second to the seventh setiger; these anterior borders

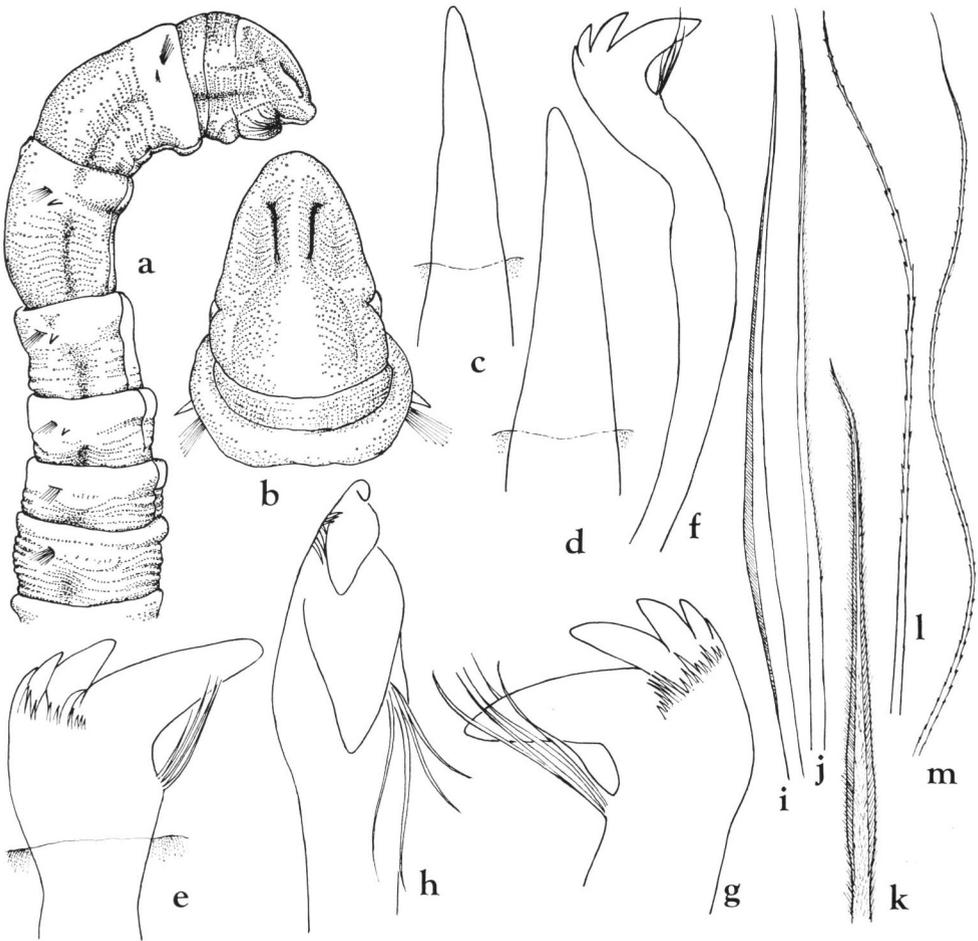


Fig. 17. *Nicomache (Loxochona) quadrispinata* ARWIDSSON. a, anterior end, in lateral view,  $\times 8$ ; b, head, in dorsal view,  $\times 13$ ; c, acicular spine from the first setiger,  $\times 120$ ; d, acicular spine from the fourth setiger,  $\times 120$ ; e, distal end of uncinus from the fifth setiger,  $\times 545$ ; f, rostrate uncinus from median setiger,  $\times 330$ ; g, h, distal ends of median uncini,  $\times 545$ ; i, limbate capillary seta from median setiger,  $\times 230$ ; j, k, pilose capillary setae from median setiger,  $\times 230$ ; l, spinose capillary seta from median setiger,  $\times 230$ ; m, distal end of filamentous pinnate seta,  $\times 230$ .

are more or less membraneous collar-like and telescope the posterior part of the preceding segment (Fig. 17, a).

The head is rather short and thick; there is a pair of slightly curved nuchal organs and the cephalic keel is high and compressed. The prostomium is rounded with a flat, thickened but narrow border (Fig. 17, b). The first and second setigerous segments are longer than the following four.

The first four setigerous segments have a single, very strong, stout neuropodial acicular spine (Fig. 17, c, d). From the fifth setigerous segment the aciculum is replaced by rostrate uncini. Those of the first few neuropodial tori number 9 to 12, and are moderately developed, with three small, acute teeth in a row and small teeth above the main fang, and a few gular bristles (Fig. 17, e). The fully developed uncini on the more posterior segments number 20 in a torus; they have four acute teeth in a row above the main fang and large gular bristles (Fig. 17, f, g, h). The notopodial capillary setae are thick limbate (Fig. 17, i) and pilose capillaries (Fig. 17, j, k) and thinner, laterally spinose capillaries (Fig. 17, l). In addition, some long filamentous pinnate setae, extending far out from the sides of the body, are present from the seventh setiger to the end of the fragment (Fig. 17, m). Although all specimens lack a posterior end, they are referred to this species because they have acicular spines on the first four segments.

The species is new to the Japanese fauna.

*Remarks.* *Nicomache japonica* MCINTOSH, 1885, from Sagami Bay, in 345 fms. was characterized by the first four segments each having a neuropodial acicular spine. However, the species was referred to *Lumbriclymene japonica* as previously mentioned (see p. 28).

The species is new to the Japanese fauna.

*Distribution.* Norway; Greenland; Japan.

#### Genus *Petaloproctus* QUATREFAGES, 1865

#### Key to Japanese Species of *Petaloproctus*

1. 22 setigerous segments; anal plate with about 30 subequal, triangular denticles ..... *P. dentatus*
- 1'. 21 setigerous segments; anal plate with smooth margin. .... *P. borealis*

#### *Petaloproctus dentatus* sp. nov.

(Fig. 18, a-n)

*Material examined.* Off Ichiburi, Niigata Pref., in 1000 m (holotype and 5 paratypes); off Noto-ogi, Noto Peninsula, in 1100 m, attached to gastropod shells, *Buccinum striatissimum* and *Nephtunea intersculpta* (31).

*Description.* The holotype measures 70 mm in length and about 2 mm in width anteriorly; it consists of 22 setigerous, and two preanal asetigerous segments and the pygidium. The body is cylindrical. The first five setigerous segments are about as long as the width, the sixth setiger is nearly twice as long as the fifth setiger and the seventh to ninth setigers are about three times the length of the fifth. The rest become gradually shorter compared with the length of the anterior setigers. The anterior margins of the fourth and fifth setigers have a kind of thick collar in front, not a true collar with a free margin (Fig. 18, a).

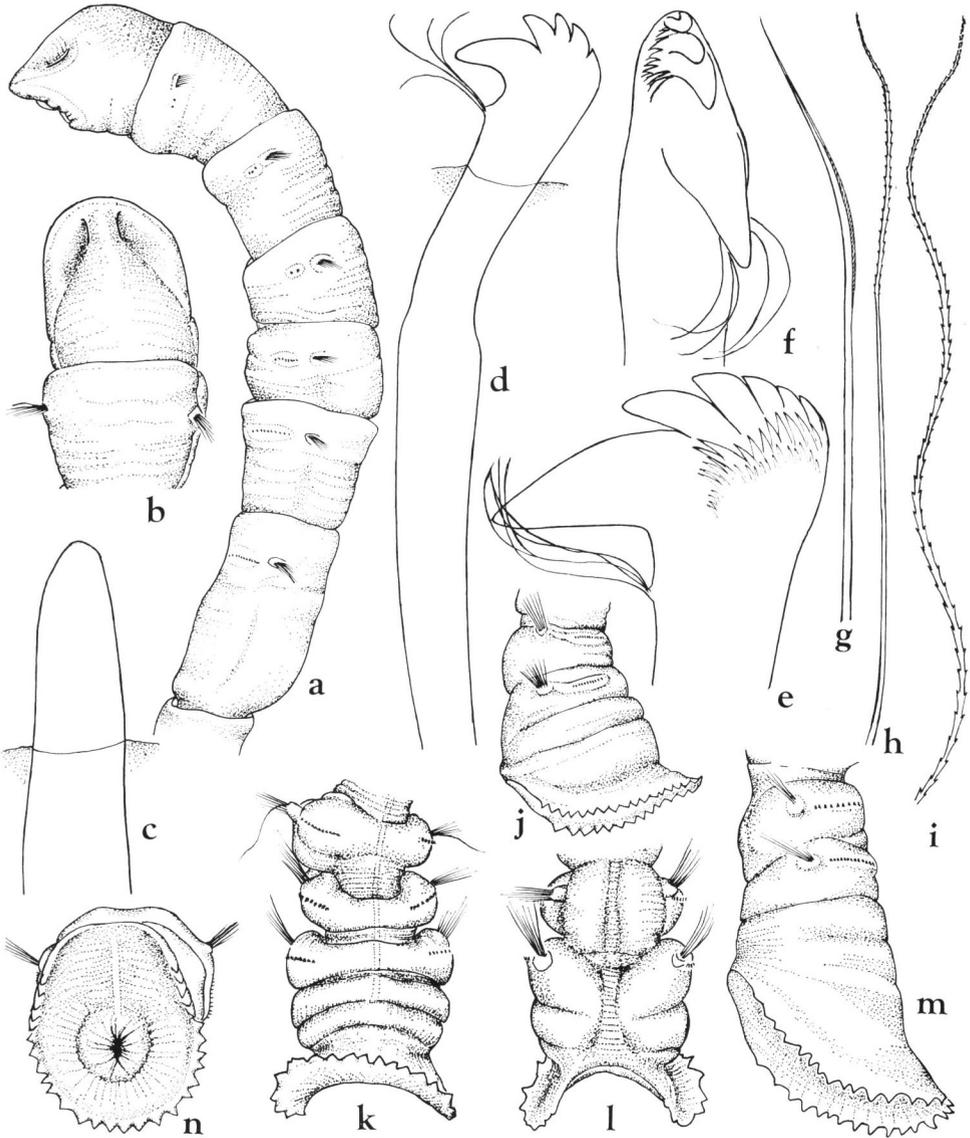


Fig 18. *Petaloproctus dentatus* sp. nov. a, anterior end, in lateral view,  $\times 5$ ; b, head, in dorsal view,  $\times 7$ ; c, acicular spine from the first setiger,  $\times 330$ ; d, rostrate uncini from median setiger,  $\times 460$ ; e, f, distal ends of median uncini,  $\times 800$ ; g, limbate capillary setae from median setiger,  $\times 120$ ; h, spinose capillary seta,  $\times 120$ ; i, distal end of filamentous pinnate seta,  $\times 120$ ; j, posterior end, in lateral view,  $\times 7$ ; k, the same, in ventral view,  $\times 10$ ; l, the same, in dorsal view,  $\times 10$ ; m, posterior end of paratype,  $\times 10$ ; n, anal plate, in posterior view,  $\times 7$ .

The prostomium and peristomium are completely fused, rather short and stout; the prostomium is nearly vertical with a rounded thickened frontal border. The nuchal organs are fairly long and slightly curved anteriorly. The cephalic keel is high and compressed; it gradually grades into the neck, which is high and swollen (Fig. 18, b). The mouth is round with a thick, U-shaped under-lip and a straight upper-lip; both lips are furrowed.

The first three neuropodia have two to three stout acicular spines with obtuse tips (Fig. 18, c). The following neuropodia have eight to 15 rostrate uncini, but those in the first few neuropodia are not fully developed, with only two teeth in a row above the main fang and no gular bristles. The fully developed uncini have six teeth in a row above the main fang and large gular bristles (Fig. 18, d, e, f). The notopodial capillary setae are of three kinds: limbate capillaries (Fig. 18, g), slender distally spinous capillaries (Fig. 18, h), and very long, filamentous pinnate setae, extending far out from the sides of the body from the eighth setiger (Fig. 18, i).

The last setiger is followed by two short preanal segments, the second of which is incomplete dorsally (Fig. 18, j, k, l). The anal plate is a large oblique flange with a series of 29 triangular denticles all of the same size and with the same interspaces, except for a smooth margin on the dorsal side. One of the paratypes has a more elongated anal plate, fringed by about 30 triangular denticles (Fig. 18, m). The anal pore lies a little below the median line (Fig. 18, n).

*Remarks.* *Petaloproctus dentatus* is closely allied to *P. cirratus* MONRO, 1937 from the Arabian Coast, and *P. ornatus* HARTMAN, 1969 from off Palos Verdes Point, California, in 251 fms. *P. dentatus*, however, is characterized by the anal plate which has about 30 subequal, triangular denticles along its edge, instead of about 15 short cirriform processes as in *P. cirratus*, and 14 to 22 thick cirri, and a more robust body as in *P. ornatus*. *P. dentatus* is also distinguished from *P. tenuis* (THÉEL, 1879) from the Arctic Ocean in that the body consists of 22 setigerous, plus 2 preanal segments, instead of 20 plus 1. Moreover, *P. dentatus* was compared with the holotype of *P. crenatus* CHAMBERLIN, 1919 from off Central America, in 774 fms., deposited to the National Museum of Natural History, Smithsonian Institution. The specimen of *P. crenatus* is a posterior body consisting of 11 setigerous segments and two preanal asetigers and the pygidium. The anal plate has about 20 triangular denticles, all of the same size along the edge. However, *P. crenatus* can be distinguished from *P. dentatus* in the dorsal features of the anal plate.

*Type-series.* Holotype, NSMT-Pol. H 159; paratype, NSMT-Pol. P 160.

*Distribution.* Japan.

***Petaloproctus borealis* ARWIDSSON, 1906, stat. nov.**

(Fig. 19, a-k)

*Petaloproctus tenuis* var. *borealis* ARWIDSSON, 1906, pp. 118–122, pl. 3, figs. 85–90; pl. 8, figs. 268–272; HARTMAN, 1948, p. 42; USCHAKOV, 1955, p. 339, fig. 125, H; HARTMANN-SCHRÖDER, 1971, pp. 431–432, fig. 151, a-d.

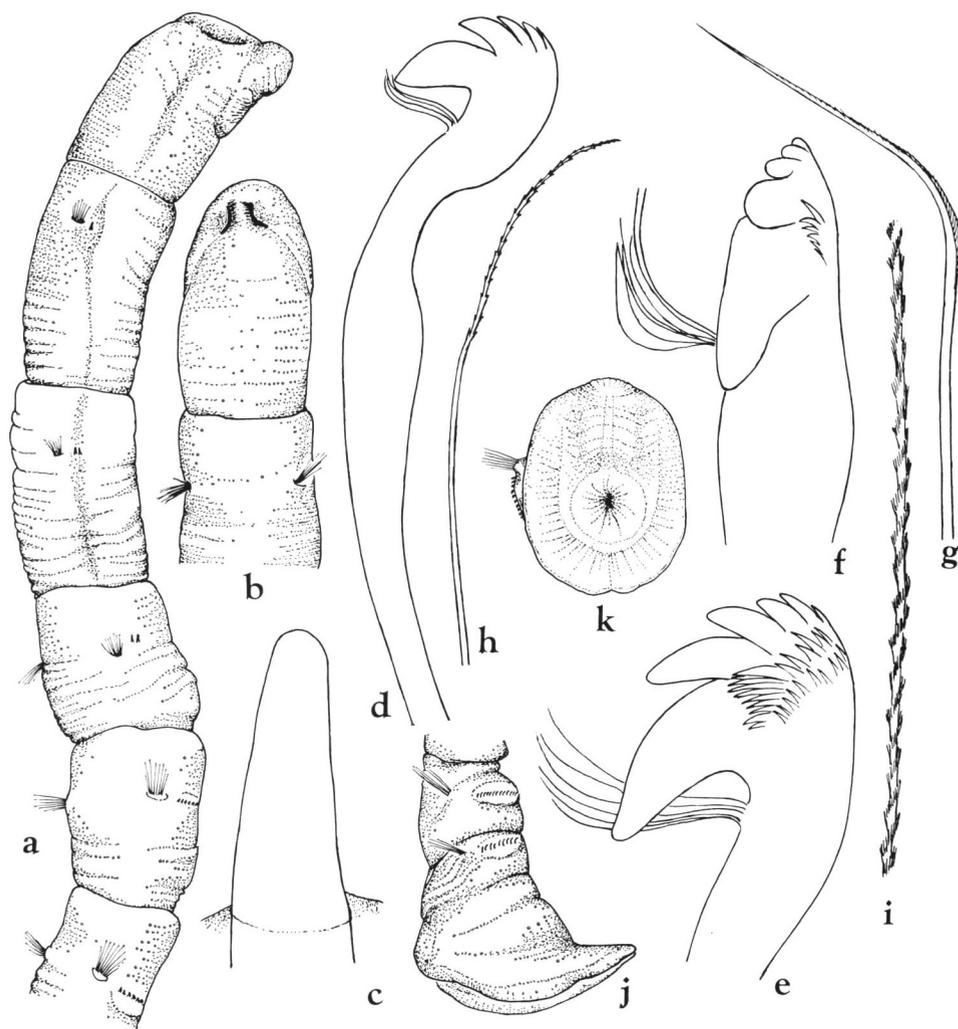


Fig. 19. *Petaloproctus borealis* ARWIDSSON. a, anterior end, in lateral view,  $\times 10$ ; b, head, in dorsal view,  $\times 11$ ; c, acicular spine from the first setiger,  $\times 330$ ; d, rostrate uncinus from median setiger,  $\times 460$ ; e, f, distal ends of median uncini,  $\times 805$ ; g, limbate capillary seta from the first setiger,  $\times 80$ ; h, spinous capillary seta,  $\times 460$ ; i, part of filamentous pinnate seta,  $\times 55$ ; j, posterior end, in lateral view,  $\times 11$ ; k, anal plate, in posterior view,  $\times 11$ .

*Material examined.* Toyama Bay, in 250 m (2); Suruga Bay,  $34^{\circ}51.88'N$ ,  $139^{\circ}26.79'E$ – $34^{\circ}51.67'N$ ,  $139^{\circ}27.03'E$ , in 1680 m, KT-73-15 (1); Korea Strait, in 210 m (3).

*Description.* The largest specimen measures 73 mm in length and about 2 mm in width anteriorly; it consists of 21 setigerous, two preanal segments and a pygidium. The anterior segments have a broad glandular band in each presetal anterior part. The first two setigerous segments are about 1.5 times as long as wide, the second and

third setigers are about as long as wide, and the following 10 setigers are not quite as long as the first two setigers. The rest of the setigers gradually shorten towards the rear of the worm (Fig. 19, a).

The prostomium and peristomium are completely fused; the prostomium is anteriorly rounded. The nuchal organs are rather short, deep furrows curved anteriorly. The nuchal keel is high and compressed and grades into the neck, which is swollen (Fig. 19, b). The mouth is round with a thick lip.

The first three neuropodia have one or two stout acicular spines with obtuse tips (Fig. 19, c). The following neuropodia have six to 14 rostrate uncini, but those in the first few neuropodia are not fully developed, with only two teeth in a row above the main fang and no gular bristles. The fully developed uncini have five teeth in a row above the main fang and large gular bristles (Fig. 19, d, e, f). The notopodial capillary setae are of three kinds: limbate capillaries (Fig. 19, g), slender spinous capillaries (Fig. 19, h) and very long, filamentous pinnate setae, extending far out from the sides of the body from the seventh setiger (Fig. 19, i).

The last setiger is followed by two short preanal segments, the second of which is incomplete dorsally (Fig. 19, j). The anal plate is a large and oblique flange with a smooth margin. The anal pore lies a little below the median line (Fig. 19, k).

*Remarks.* The variety, *Petaloproctus tenuis* var. *borealis* ARWIDSSON is here newly referred to specific rank, because the stem is clearly distinguished from the variety at the specific level, in that the stem has 20 setigers, instead of 21, and the anal plate has a serrulate margin, instead of a smooth margin.

The species is new to the Japanese fauna.

*Distribution.* Sweden; North Sea; Okhotsk Sea; Pacific coast of North America; Japan. (To be continued.)