

Taxonomic Study on the Genus *Onuphis* (Polychaeta, Onuphidae) from Japan and Adjacent Seas, with Descriptions of Six New Species

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Abstract Onuphid polychaetes belonging to the genus *Onuphis* collected from various areas around Japan and adjacent seas were examined. Sixteen species including 6 species new to science and 1 undetermined species are described. Zoogeographical consideration for the *Onuphis* species described above and 7 more species which were collected from various Japanese coasts and the adjacent seas and were reported by other authors elsewhere clearly shows that (1) each *Onuphis* species tends to occur in a somewhat limited area, (2) the faunal elements are highly segregated between the northeastern and the southwestern parts around Japan and (3) quite a few species occur in single restricted collecting sites.

Key words: Polychaeta, Onuphidae, *Onuphis*, Taxonomy, Japan.

The taxonomic state of the family Onuphidae (Polychaeta) has been well established within the latest decade or more (Fauchald, 1982a; Paxton, 1986). Yet the recent taxonomic studies on this family from Japan clearly suggest that there could still be a variety of undescribed species in Japanese and adjacent seas (Imajima, 1986; Maekawa & Hayashi, 1989). It seems especially true of the genus *Onuphis* which consists of more than half of the local onuphid fauna described lately: Imajima (1986) recognized 4 species new to science among 6 *Onuphis* species described in and offshore Otsuchi Bay, Pacific Ocean while Maekawa & Hayashi (1989) found 4 species and subspecies new to science among 8 species and subspecies described in and offshore of Wakasa Bay, the Sea of Japan.

The present study deals with materials collected from various parts of the Japanese coasts, the southern East China Sea and Yellow Sea, and describes 16 *Onuphis* species, including 6 species new to science, with a brief descriptions of 7 more species which were reported by other authors elsewhere. We also try to give the zoogeographical consideration of *Onuphis* species including those described worldwide.

Materials and Methods

Materials on which this study is based are from various sources around Japan

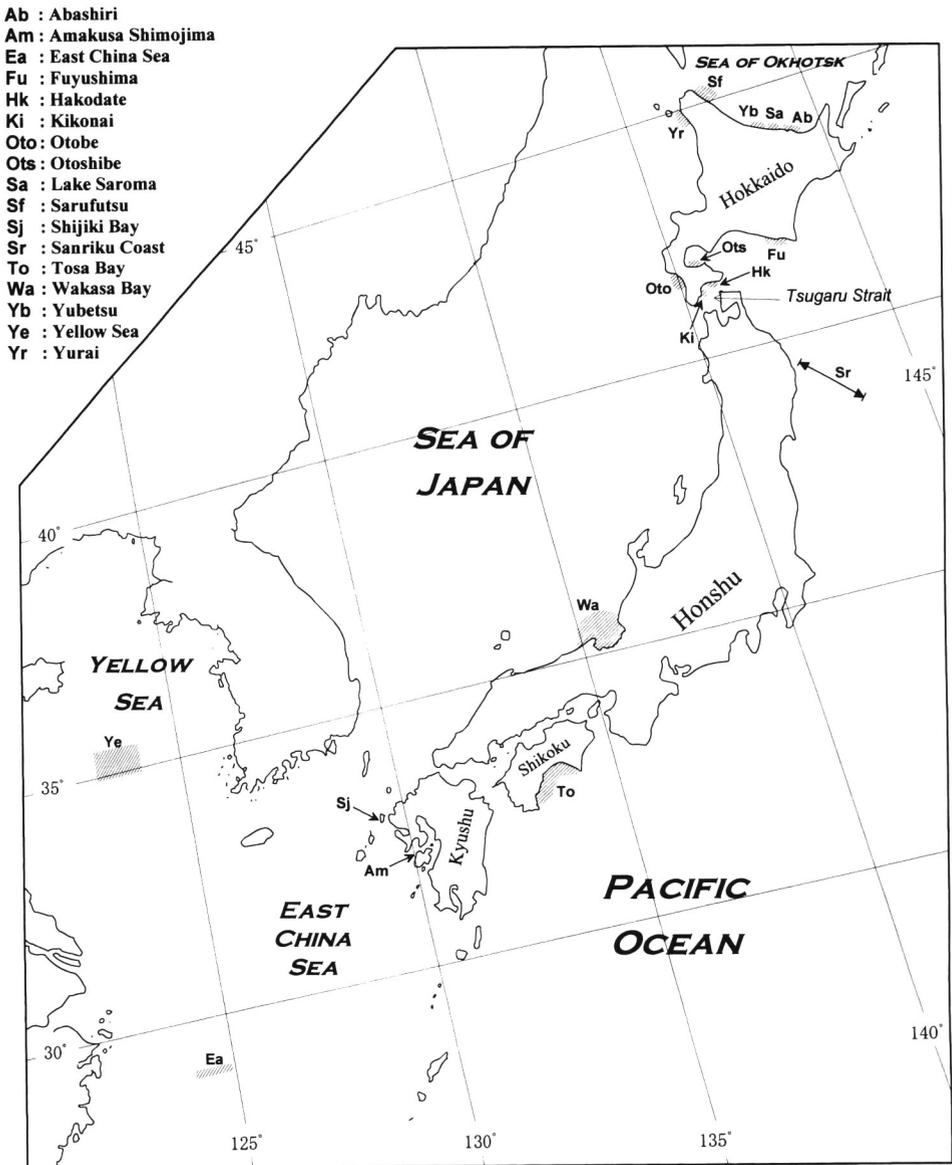


Fig. 1. Location of collecting sites of present study.

extending from Hokkaido to Kyushu Islands as well as from Yellow Sea and southern East China Sea (Fig. 1).

Around Hokkaido: Off Abashiri, Yubetsu, Sarufutsu and Lake Saroma in the Sea of Okhotsk; Off Yurai and Otobe in the Sea of Japan; Off Fuyushima and Otoshibe in the Pacific Ocean; Hakodate and Kikonai in the Tsugaru Strait. The exact lo-

calities, depths and the sampling dates are unknown. Materials collected by Shigeru Nakao, Hokkaido University.

Around Honshu Island: Off Sanriku Coast on the transect settled between 39°20'N, 142°1'E and 38°33'N, 143°28'E (124 to 2616 m deep) in the Pacific Ocean. Materials collected by Shigeaki Kojima, Ocean Research Institute, University of Tokyo, August 15, 1985; in and offshore of Wakasa Bay and the adjacent sea area in the Sea of Japan (47 to 350 m deep). Materials collected by one of the present authors (IH), August 27–28, September 25–26, 1975, July 26–28, 1976, June 8, 1982 and July 21, 1986.

Around Shikoku Island: Tosa Bay in the Pacific Ocean (20 to 312 m deep). Materials collected by Kyoichi Tamai, The National Research Institute of Fisheries and Environment, Hiroshima, November 17–20, 1975 and June 3–12, 1976.

Around Kyushu Island: Shijiki Bay, Hirado Island close to the Tsushima Strait (western entrance of the Sea of Japan) (6–44 m deep). Materials collected by one of the present authors (IH), May 10–12, 1984; intertidal coast of Tomioka, Amakusa Shimojima in the East China Sea. Materials collected by Akio Tamaki, Nagasaki University, May 20, 1989.

Yellow Sea: Within a rectangular area between latitudes 34°55'N to 35°33'N, and longitudes 122°58'E to 123°58'E, respectively (71–81 m deep). Materials collected by Takahiko Irie, The National Research Institute of Fisheries Science, Kuroshio Research Division, Kochi, October 14–16, 1986.

Southern East China Sea: Within a rectangular area between latitudes 28°55'N to 29°1'N, and longitudes 124°1'E to 124°52'E, respectively (81–95 m deep). Materials collected by Takahiko Irie, The National Research Institute of Fisheries Science, Kuroshio Research Division, Kochi, October 18–30, 1986.

The methyl green staining method was adopted according to Wisnes (1985) with a minor change; the staining solution was made by adding methyl green to 70% alcohol instead of 80%. Description of the staining patterns are based on the results obtained after the specimens were soaked in the solution for 5 minutes and then rinsed in 70% alcohol for 5 minutes for destaining of excess color.

The terminology of the prostomial and peristomial appendages adopted in this study follows Paxton (1998).

The holotypes are deposited in the National Science Museum, Tokyo, Japan (NSMT) and the paratypes and other specimens used in this study are placed in the Osaka Museum of Natural History, Osaka, Japan (OMNH).

Results

1. Taxonomic accounts

Sixteen *Onuphis* species are described in this study including 6 species new to

science and 1 undetermined species. This study also includes the brief descriptions of 7 additional species which were collected from various Japanese coasts and the adjacent seas reported by other authors elsewhere.

Genus *Onuphis* Audouin & Milne Edwards, 1833
(emended by Fauchald, 1982a and Paxton, 1986)

Prostomium subtriangular in shape with 7 prostomial appendages; a pair of oval frontal lips at its anterior margin, one pair of palps, one pair of lateral antennae (refer to Paxton, 1998; equivalent to frontal palps, anterior and posterior antennae by Paxton, 1986 and frontal palps, outer and inner lateral antennae by Fauchald, 1982a, respectively) and a single median antenna. Palps and antennae consisting of two parts; a distal ceratostyle and a proximal ceratophore. Latter well developed and usually much longer than length of prostomium. Lateral antennae longest with 10 to 25 rings (rarely to 10) on each ceratophore. Ceratostyles of palps less developed and shorter than their ceratophores. A pair of peristomial cirri extending forward from antero-lateral margin of peristomium.

Anterior 2–5 pairs of parapodia more or less modified, with slightly larger main parapodial lobes than those on following. Ventral cirri cirriform usually on anterior 4–6 setigers, replaced by glandular pads thereafter, sometimes with one or two setigers with transitory forms between them. Digitiform postsetal lobes distinct in anterior several parapodia.

Branchiae present from setiger 1 or absent in anterior several setigers; each branchia either simple strap-like filament or branched pectinate one (maximally 8 filaments). An abranchiate undescribed species also suggested (Paxton, 1986).

Aciculae, hooded pseudocompound hooks, limbate setae, pectinate setae and hooded subacicular hooks present: *O. nonpectinata* Imajima, 1986 being an exception due to lacking any pectinate setae. Compound spinigers and large hooks absent. Pseudocompound hooks usually bi- or tridentate but some species with tetradentate hooks as well. Some species with thin elongated pseudocompound hooks as well as thick short ones. Pectinate setae flat if present.

Key to Species of *Onuphis* from Japan and the adjacent seas

1. Only simple strap-like branchiae present on anterior through mid body..... 2
- Bifid or pectinate branchiae present on mid body..... 16
2. Branchiae usually starting on setiger 1 or 2 3
- Branchiae usually starting on setiger 3 or more posteriorly 10
3. Thin elongated pseudocompound hooks present 4
- Thin elongated pseudocompound hooks absent 5
4. Bi- and tridentate thick short pseudocompound hooks present.....

- *O. kammurijimaensis*
- Bidentate thick short pseudocompound hooks absent *O. shirikishinaiensis*
- 5. Bi- and tridentate pseudocompound hooks present 6
- Bidentate pseudocompound hooks absent 7
- 6. Bidentate pseudocompound hooks present from setiger 1.....
- *O. amakusaensis* sp. nov.
- Bidentate pseudocompound hooks absent in the first three setigers.....
- *O. iridescens* (?)
- 7. Pseudocompound hooks with round denticles present on the first several setigers
- 8
- All pseudocompound hooks with more or less pointed denticles 9
- 8. Body brownish with a small pigmentary patch on the base of each parapodium
- from setiger 6 *O. opalina*
- Body without any pigmentary spots..... *O. imajimai*
- 9. Dorsum with brown transverse bands *O. holobranchiata*
- Dorsum without any pigmentary spots or bands *Onuphis* sp.
- 10. Pectinate setae absent..... *O. nonpectinata*
- Pectinate setae present..... 11
- 11. Whole jaw-apparatus amber colored..... *O. fuscata*
- Jaw-apparatus otherwise 12
- 12. Pseudocompound hooks with blunt hoods..... *O. hokkaiensis* sp. nov.
- Pseudocompound hooks with pointed hoods 13
- 13. Pseudocompound hooks in first 3 setigers *O. geophiliformis*
- Pseudocompound hooks in first 4 setigers 14
- 14. Anterior dorsum with transverse pigmentary bands..... *O. tetradentata*
- Dorsum without any pigmentary spots or bands 15
- 15. Clear transverse bands occurring on ventral surface of each segment through mid
- body with methyl green staining *O. taraba*
- Clear transverse bands not occurring on ventral surface of each segment with
- methyl green staining *O. wakasaensis* (new combination)
- 16. Thin elongated pseudocompound hooks present..... 17
- Thin elongated pseudocompound hooks absent..... 18
- 17. Eyespots present: Ceratostyle of palps staining with methyl green
- *O. longisetosa*
- Eyespots absent: Ceratostyle of palps not staining with methyl green
- *O. nakaoui* sp. nov.
- 18. Bi- and tridentate pseudocompound hooks present 19
- Bidentate pseudocompound hooks absent 21
- 19. Branched branchiae starting on anterior setiger up to setiger 20 20
- Branched branchiae starting much more posteriorly *O. chinensis*
- 20. Pseudocompound hooks present on first 3 setigers *O. shijikiensis* sp. nov.

- Pseudocompound hooks present on first 8 setigers *O. variolata*
- 21. Eyespots absent: Dorsum without any pigmentary spots or bands
 *O. tosaensis* sp. nov.
- Eyespots present: Dorsum with distinct brown pigmentary spots and bands ... 22
- 22. Simple branchial filaments much longer than dorsal cirri on anterior several
 setigers *O. iriei* sp. nov.
- Simple branchial filaments almost as long as dorsal cirri *O. punggolensis*

***Onuphis amakusaensis* sp. nov.**

(Fig. 2a–o)

Material examined. Holotype (NSMT-Pol. H 430) and 4 paratypes (OMNH-Iv 1614) collected from the intertidal zone in Amakusa Shimojima, East China Sea, May 20, 1989. Holotype mature female and almost complete with 135 setigers lacking posteriormost several segments; it measuring about 60 mm in length and up to 1.9 mm in width excluding parapodia. Three of 4 paratypes complete with 131–186 setigers measuring about 37–85 mm in length and up to 1.3–2.0 mm in width excluding parapodia. One paratype anterior fragment only with 55 setigers measuring about 24 mm in length and up to 1.5 mm in width excluding parapodia.

Material used for description. Holotype.

Description. Body whitish in color in preserved condition with transverse pigmentary dorsal bands on peristomium and several anterior setigers (Fig. 2a–b).

Prostomium globular with a pair of conical frontal lips (Fig. 2a). Palps reaching setiger 2 with 11 rings each on their ceratophores. Lateral antennae reaching setiger 8 with 8 rings each on their ceratophores. Median antenna reaching setiger 8 with 6 rings on its ceratophore.

Two pairs of eyespots present: Larger pair situated between bases of palps and lateral antennae and smaller pair close to posterior bases of lateral antennae. A pair of peristomial cirri present at anterior margin of peristomium, extending as long as peristomium length.

Anterior several pairs of parapodia directed forward and first 5 pairs with slightly longer main lobes than the following ones (Fig. 2c–g). Ventral cirri cirriform in first 4 setigers, replaced by glandular pads thereafter (Fig. 2c–g). Digitiform postsetal lobes distinct in first 10 setigers, getting smaller and conical in shape thereafter (Fig. 2c–g).

Simple strap-like branchiae present from setiger 1 through end of fragment (Fig. 2c–g). Branchial filament getting longer from about setiger 18 and longest one twice as long as any anterior one. Distinct pigmentary spots present on branchial bases of setiger 1.

Bi- and tridentate pseudocompound hooks with blunt hoods present in first 4 setigers (Fig. 2h–l). Three to six pseudocompound hooks present in each parapodi-

um. In each tridentate hook, most proximal denticle much smaller than remaining distal ones (Fig. 2k–l). Pectinate setae flat and slightly oblique with about 12 long teeth each (Fig. 2m). Hooded bidentate subacicular hooks present from setiger 11 (Fig. 2n).

Maxillary formula: 1+1, 7+7, 7+0, 5+8, 1+1 (Fig. 2o).

Methyl green staining pattern. Frontal, upper and lower lips deeply staining. Ceratostyles of palps deeply staining with inner borders and distal tips remaining unstained. Peristomial cirri deeply staining. Anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining. Frontal surface of each anterior parapodial lobe deeply staining. Each anterior ventral glandular pad staining more deeply on the marginal part than inside. Two clear transverse bands present on ventral surface of each anterior segment up to setiger 60.

Character variations among specimens. None

Remarks. *Onuphis amakusaensis* sp. nov. is characterized by having simple strap-like branchiae from setiger 1 and bi- and tridentate pseudocompound hooks. These characters are shared with the following 5 *Onuphis* species: *O. shirikishinaensis* (Imajima, 1960), *O. farallonensis* Hobson, 1971, *O. kammurijimaensis* Maekawa & Hayashi, 1989, *O. elegans* (Johnson, 1901) and *O. iridescens* (?) (Uschakov & Wu, 1962). But *O. amakusaensis* differs from the first three species by lacking thin elongated pseudocompound hooks. *O. amakusaensis* also differs from *O. iridescens* (?) in having bidentate pseudocompound hooks in anterior 4 setigers instead of lacking in anterior 3 setigers. *O. amakusaensis* and *O. elegans* are both intertidal dwellers and share most of the morphological characters. The morphological difference is that *O. amakusaensis* has slender branchial filaments throughout the body while *O. elegans* has wider branchial filaments from around setiger 10 onward.

Etymology. This species is named for the locality where the holotype was collected.

Distribution. Amakusa, West Kyushu, Japan.

Onuphis geophiliformis (Moore, 1903)

(Fig. 3a–j)

Nothria geophiliformis Moore, 1903; 445–448, pl. 25, figs. 57–59.

Onuphis geophiliformis Izuka, 1912; 103–104, pl. 11, figs. 8–9.

Nothria geophiliformis Imajima & Hartman, 1964; 244–245.

Onuphis geophiliformis Fauchald, 1968; 22, pl. 6, figs. a–d.

Onuphis geophiliformis Fauchald, 1982 a; 47–48, fig. 13a, tbl. 14.

Onuphis geophiliformis Maekawa & Hayashi, 1989; 72–74, fig. 7a–j.

Material examined. The Sea of Japan; 6 specimens (OMNH-Iv 1615) from off Wakasa Bay, 80–215 m deep, July 18–September 26, 1975, 9 specimens (OMNH-Iv 1616) from off Tango Peninsula, 265–269 m deep, July 21, 1986. Pacific Ocean; 2

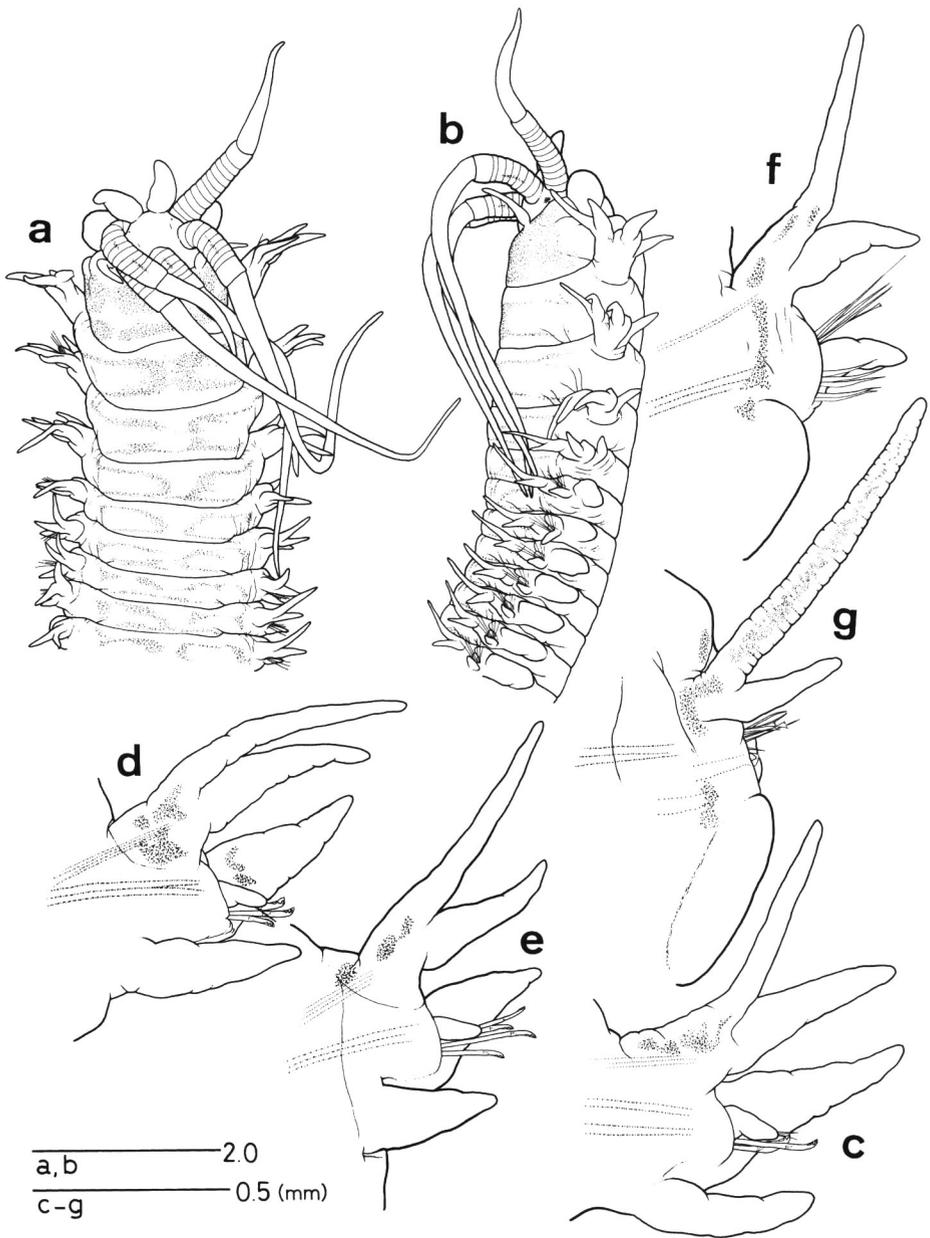


Fig. 2.

specimens (OMNH-Iv 1617) from Fuyushima, Hokkaido (exact collecting site, depth and sampling date unknown), 1 specimen (OMNH-Iv 1618) from off Sanriku Coast, 39°18'N, 142°03'E, 145 m deep, August 15, 1985. All specimens anterior fragments only with 28–102 setigers measuring about 5–26 mm in length and up to 1.0 mm in width excluding parapodia.

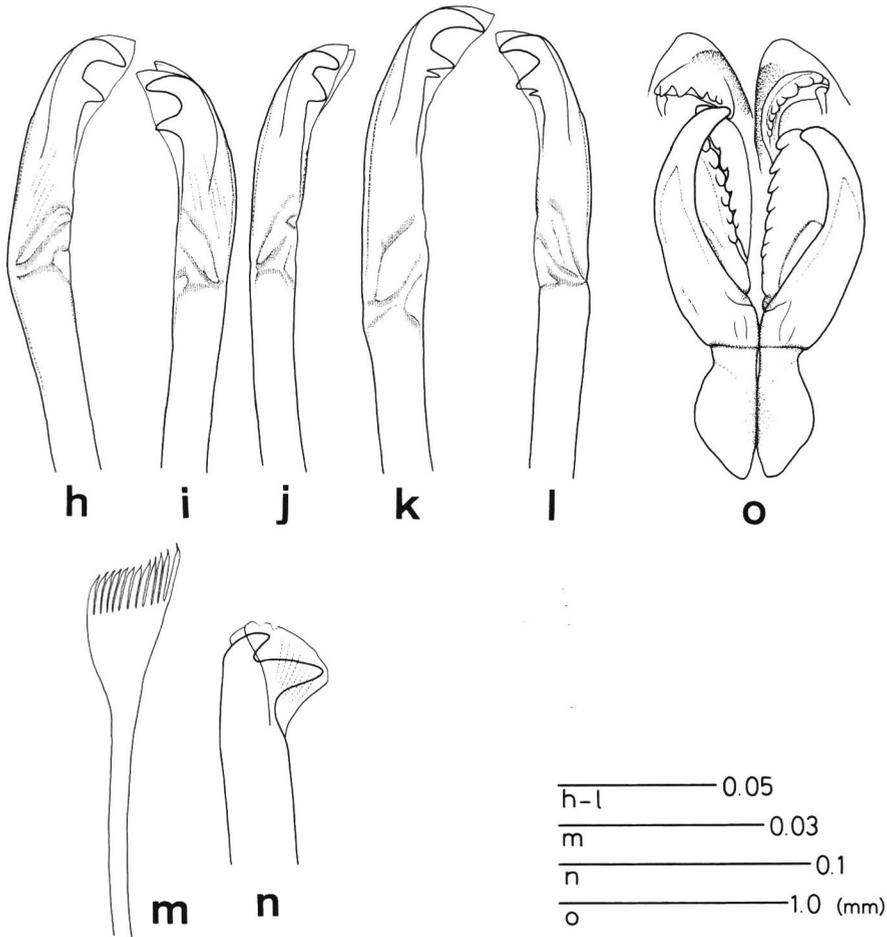


Fig. 2. *Onuphis amakusaensis* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; second parapodium, anterior view, d; third parapodium, anterior view, e; fourth parapodium, anterior view, f; fifth parapodium, anterior view, g; 20th parapodium, anterior view, h; bidentate pseudocompound hook from first parapodium, i; bidentate pseudocompound hook from second parapodium, j; bidentate pseudocompound hook from fourth parapodium, k; tridentate pseudocompound hook from first parapodium, l; tridentate pseudocompound hook from third parapodium, m; pectinate seta from 20th parapodium, n; bidentate subacicular hook from 40th parapodium, o; maxillae.

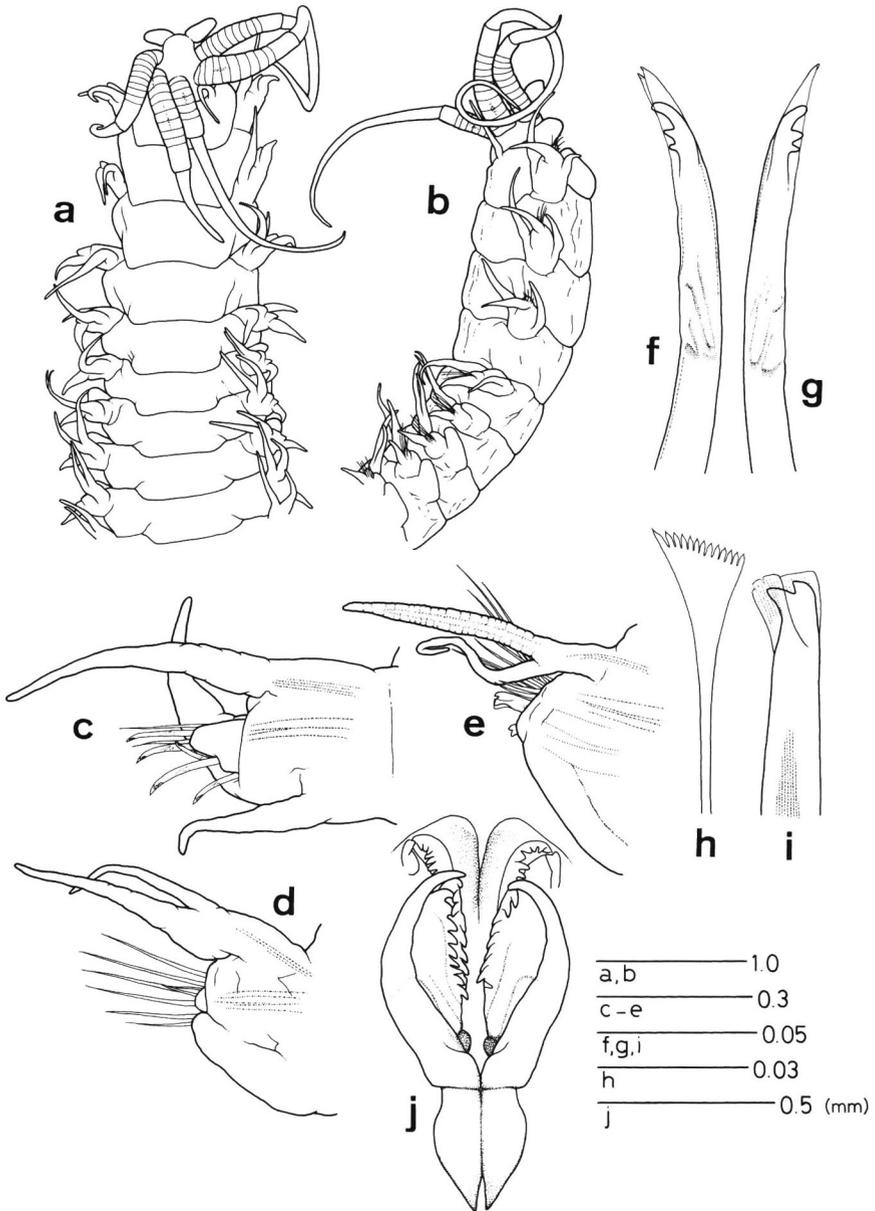


Fig. 3. *Onuphis geophiliformis* (Moore, 1903). a; Anterior end, dorsal view, b; anterior view, lateral view, c; first parapodium, anterior view, d; fifth parapodium, anterior view, e; 23rd parapodium, anterior view, f; tridentate pseudocompound hook from first parapodium, g; tridentate pseudocompound hook from third parapodium, h; pectinate seta from 43rd parapodium, i; bidentate subacicular hook from 23rd parapodium, j; maxillae.

Material used for description. Specimen (OMNH-Iv 1618) collected from off Sanriku coast with 43 setigers measuring about 11 mm in length and up to 1.0 mm in width excluding parapodia.

Description. Dorsum light brown without any pigmentary spots or bands. Eye-spots absent. Simple strap-like branchiae starting on setiger 5 (Fig. 3a, e). Ventral cirri cirriform in first 4 setigers, replaced by glandular pads thereafter (Fig. 3c–d). Digitiform postsetal lobes distinct in about first 13 setigers (Fig. 3c–d).

Tridentate pseudocompound hooks with pointed hoods present in first 3 setigers (Fig. 3f–g). Pectinate setae flat and each with about 14 teeth (Fig. 3h). Hooded bidentate subacicular hooks present from setiger 12 (Fig. 3i).

Maxillary formula: 1+1, 9+9, 8+0, 7+9, 1+1 (Fig. 3j).

Methyl green staining pattern. Upper and lower lips moderately staining while frontal lips faintly staining; first two with more deeply staining outer borders. Ceratostyles of palps faintly staining. Peristomial cirri, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Each anterior ventral glandular pad deeply staining on frontal margin. Two faint transverse bands on ventral surface of each anterior segment up to setiger 10.

Remarks. Although the anteriormost setiger with branchiae varies between 3 and 6 among specimens according to Fauchald (1982a), branchiae start on setiger 5 in most specimens; only one specimen from Fuyushima with branchiae starting on setiger 3.

Distribution. Japan, East Pacific Ocean, East Atlantic

***Onuphis hokkaiensis* sp. nov.**

(Fig. 4a–n)

Material examined. Holotype (NSMT-Pol. H 431) and two paratypes (OMNH-Iv 1619) collected from off Ootshibe, Hokkaido, Pacific Ocean. Exact collecting sites, depths and sampling dates unknown. All specimens anterior fragments only; holotype anterior 61 setigers measuring about 18 mm in length and up to 1.2 mm in width excluding parapodia. Paratypes with anterior 36–101 setigers measuring about 11–25 mm in length and up to 1.1 mm in width excluding parapodia.

Material used for description. Holotype.

Description. With anterior 61 setigers measuring about 18 mm in length and up to 1.2 mm in width excluding parapodia. Dorsum light brown without any pigmentary spots or bands. Anterior 4 or more setigers cylindrical, then flattened thereafter (Fig. 4b). Prostomium subtriangular with round tip, accompanied by a pair of oval frontal lips (Fig. 4a).

Prostomial appendages having fairly long ceratophores with clear rings on their bases. Palps short reaching setiger 1 with 8 rings each on their ceratophores. Lateral

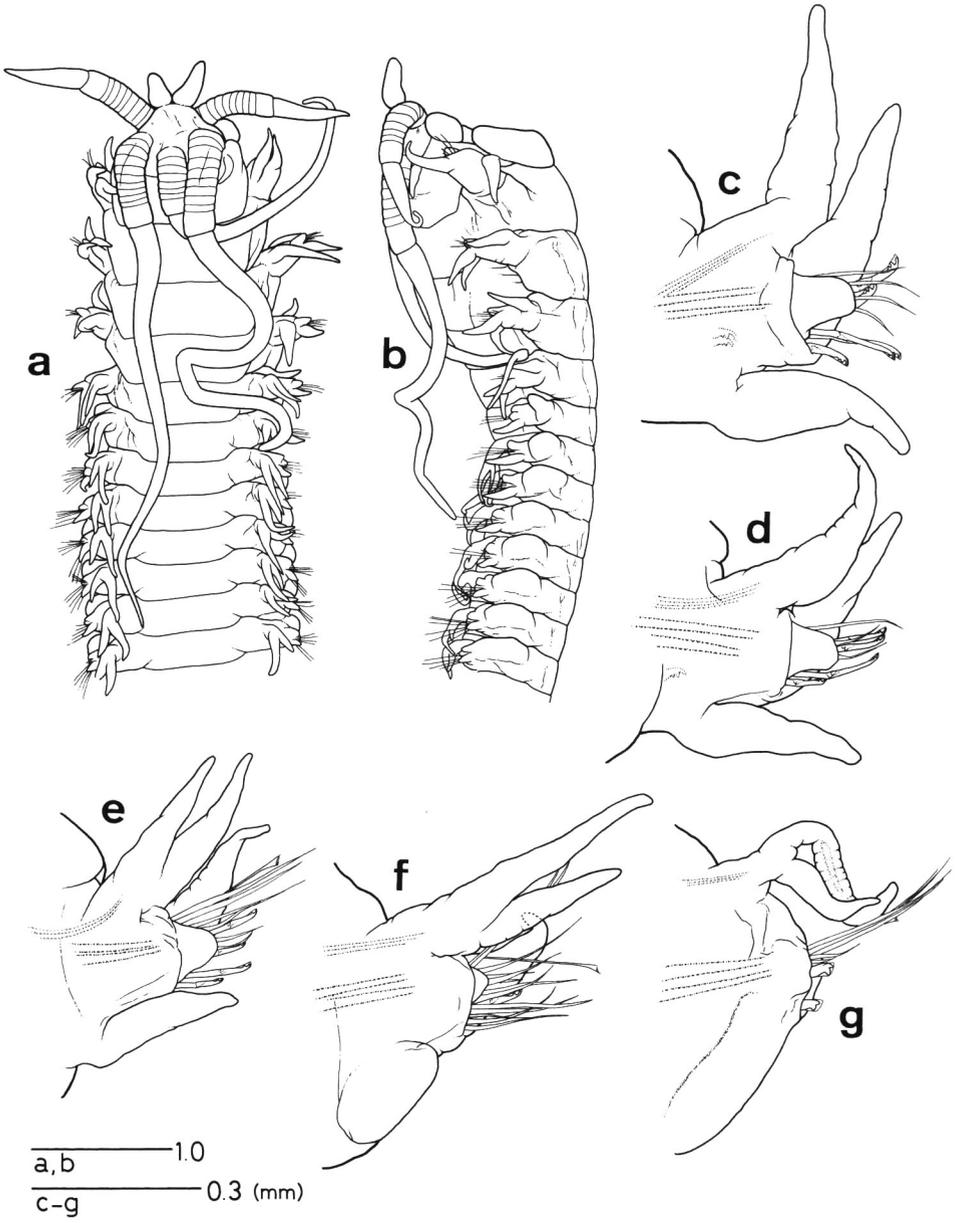


Fig. 4.

antennae considerably longer reaching setiger 12 with 9 rings each on their ceratophores. Median antenna reaching setiger 9 with 7 rings on its ceratophore (Fig. 4a). Pair of peristomial cirri situated at anterior margin of peristomium extending about half as long as peristomium (Fig. 4a).

Two pairs of eyespots present: One pair near posterior bases of lateral antennae while other towards anterior margin of prostomium close to bases of frontal lips (Fig. 4a).

Anterior 3 pairs of parapodia slightly directed forward and first 4 pairs with

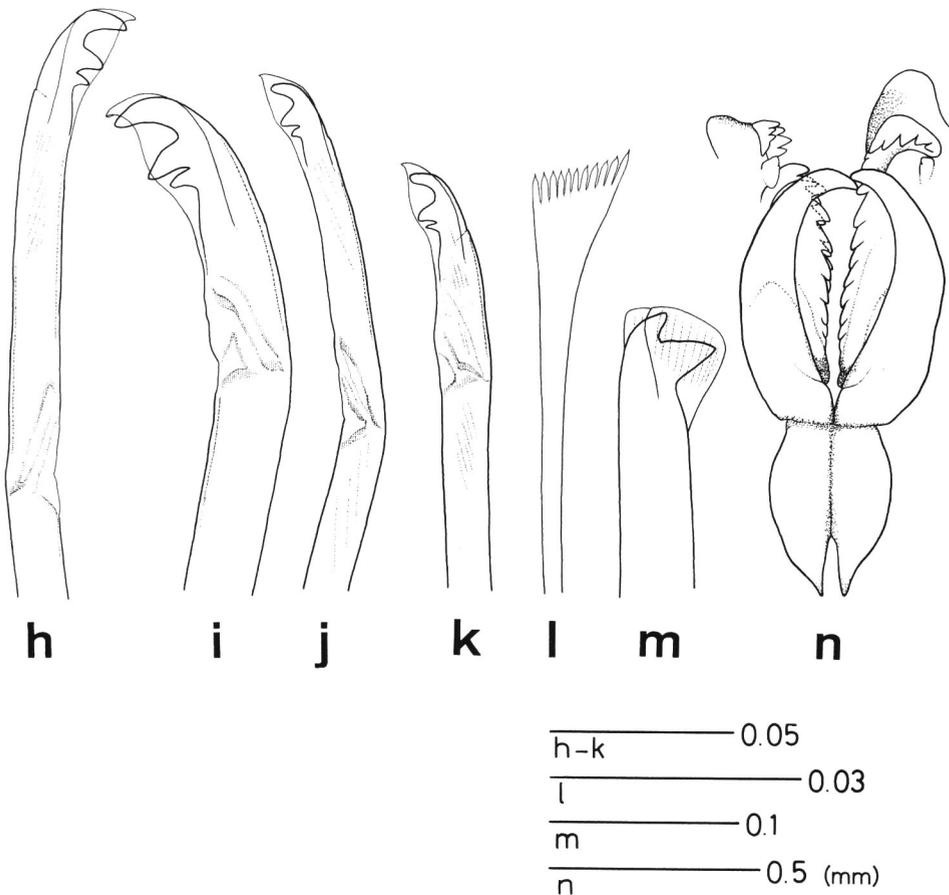


Fig. 4. *Onuphis hokkaiensis* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; third parapodium, anterior view, e; forth parapodium, anterior view, f; fifth parapodium, anterior view, g; 20th parapodium, anterior view, h, i; tridentate pseudocompound hooks from first parapodium, j; tridentate pseudocompound hook from third parapodium, k; tridentate pseudocompound hook from forth parapodium, l; pectinate seta from fifth parapodium, m; bidentate subacicular hook from 20th parapodium, n; maxillae.

more enlarged main lobes than following ones. Main parapodial lobes of first 4 pairs of parapodia more enlarged than remaining ones. Ventral cirri cirriform in first 4 setigers, replaced by glandular pads thereafter (Fig. 4c–f). Digitiform postsetal lobes distinct in first 9 setigers and small conical knob-like thereafter (Fig. 4c–g).

Simple strap-like branchiae starting on setiger 4 through end of fragment (Fig. 4e). First pair of branchial filaments slightly shorter than dorsal cirri but remaining pairs much longer than dorsal cirri (Fig. 4e–g).

Tridentate pseudocompound hooks with blunt hoods present in first 5 setigers (Fig. 4h–k); 5 hooks in each parapodium in first 4 setigers but only one hook in 5th parapodium. Pectinate setae flat and weakly oblique with about 12 teeth each (Fig. 4l). Hooded bidentate subacicular hooks present from setiger 10 (Fig. 4m).

Maxillary formula: 1+1, 7+8, 8+0, 6+7, 1+1 (Fig. 4n).

Methyl green staining pattern. Most parts remaining unstained. Anterior dorsal cirri and anterior branchial filaments faintly staining. Each anterior ventral cirrus staining as a narrow line running along axis. Each anterior ventral glandular pad with more deeply staining posterior half.

Character variations among specimens. Hooded bidentate subacicular hooks present from setiger 9 in two paratypes instead of from setiger 10 in holotype. Numbers of ceratophore rings of prostomial appendages vary from 6 to 8 in palp, from 8 to 11 in lateral antennae and from 6 to 7 in median antenna, respectively.

Remarks. In spite of having rather short ceratophores each with a small number of rings on it, this species should be referred to the genus *Onuphis* rather than *Kinbergonuphis*, because the ceratophore of each palp is longer than the length of the ceratostyle. Of more than 10 *Onuphis* species described which lack branchiae in the first several setigers, *O. geophiliformis* (Moore, 1903), *O. taraba* Maekawa & Hayashi, 1989 and *O. vibex* (Fauchald, 1972) are similar to *Onuphis hokkaiensis* sp. nov. on the following characters: Branchiae simple and strap-like, lacking any pigmentary dorsal bands and having shorter ceratophores with fewer numbers of rings on them. But *O. hokkaiensis* clearly differs from the first two species on the methyl green staining pattern; most parts remaining unstained in *O. hokkaiensis*. It also differs from *O. vibex* in having a considerably longer median antenna.

Etymology. The name of this new species comes from the locality the holotype was collected.

Distribution. Northwestern Pacific Ocean off Hokkaido, Japan.

Onuphis holobranchiata Marenzeller, 1879

(Fig. 5a–i)

Onuphis holobranchiata Marenzeller, 1879; 132–134, pl. 4, fig. 1.

Onuphis holobranchiata Izuka, 1912; 106–108, pl. 11, figs. 10–12.

Onuphis holobranchiata Imajima & Hartman, 1964; 244–245.

Onuphis holobranchiata Fauchald, 1982 a; 48.

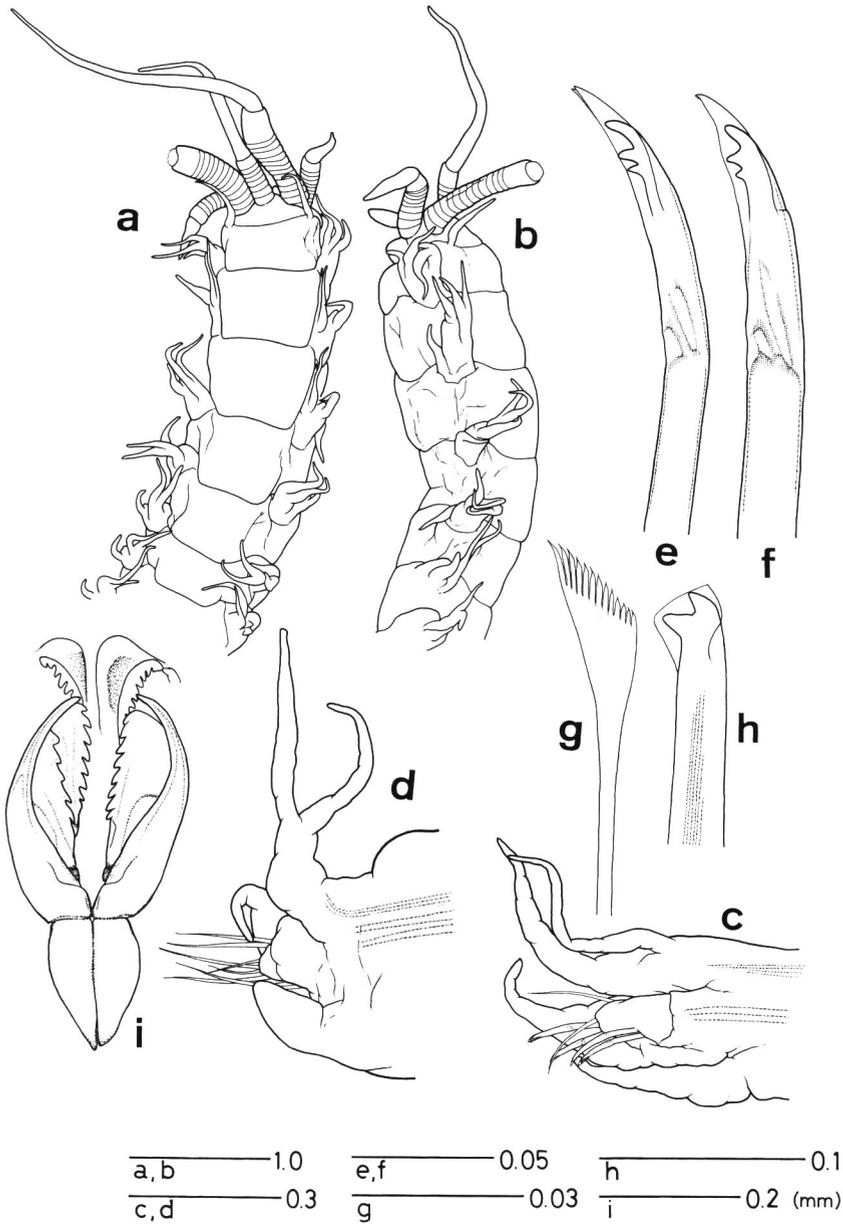


Fig. 5. *Onuphis holobranchiata* Marenzeller, 1879. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; fifth parapodium, anterior view, e; tridentate pseudocompound hook from first parapodium, f; tridentate pseudocompound hook from fourth parapodium, g; pectinate seta from 23rd parapodium, h; bidentate subacicular hook from 20th parapodium, i; maxillae.

Onuphis holobranchiata Imajima, 1986; 94–96, fig. 25q.

Materials examined. One specimen (OMNH-Iv 1620) collected from Fuyushima, Hokkaido. Exact collecting site, depth and sampling date unknown. Anterior fragment only with 30 setigers measuring about 11 mm in length and up to 1.2 mm in width excluding parapodia.

Material used for description. Same specimen.

Description. Body with a transverse pigmentary dorsal band on each segment and one pigmentary patch at dorsal base of each parapodium.

A pair of eyespots present. Ceratophores of palps with 9 rings each, lateral ceratophores with 12 rings each and median ceratophore with 7 rings, respectively. Branchiae present from setiger 1 as a single filament to end of fragment (Fig. 5a–d). Ventral cirri cirriform in first 4 setigers (Fig. 5b–c), followed by transitory forms on setiger 5 (Fig. 5d), then glandular pads thereafter. Digitiform postsetal lobes distinct in first 11 setigers (Fig. 5c–d).

Tridentate pseudocompound hooks with pointed hoods present in first 4 setigers (Fig. 5e–f). Pectinate setae flat and oblique, each with about 13 teeth (Fig. 5g). Hooded bidentate subacicular hooks present from setiger 12 (Fig. 5h).

Maxillary formula: 1+1, 6+8, 7+0, 7+9, 1+1 (Fig. 5i).

Methyl green staining pattern. Frontal, upper and lower lips faintly staining. Peristomial cirri deeply staining with distal tips remaining unstained. Ceratostyles of palps remaining unstained. Anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Posterior surface of each anterior parapodial lobe deeply staining. Each anterior ventral glandular pad weakly staining with deeply staining thick line running obliquely.

Remarks. The number of eyespots of this species varies among authors, from 1 pair (Marenzeller, 1879; Izuka, 1912) to 2 pairs (Imajima, 1986). This species differs from *O. holobranchiata* reported from southern Africa by Day (1967) in that the latter has (1) a white median stripe on the dorsum and (2) pseudocompound hooks on the anterior 7 setigers instead of anterior 4 setigers. It also seems quite dubious that this species is same as *O. holobranchiata* reported from Indian Ocean by Fauvel (1953) since the latter has bidentate pseudocompound hooks instead of lacking them.

Distribution. Japan.

***Onuphis imajimai* Maekawa & Hayashi, 1989**

(Fig. 6a–k)

Onuphis imajimai Maekawa & Hayashi, 1989; 77–79, fig. 10a–k.

Materials examined. Twenty one specimens collected from off Wakasa Bay, the Sea of Japan: Eight specimens (OMNH-Iv 1621, 1622), 240–295 m deep, August 27–28, 1975 and 13 specimens (OMNH-Iv 1623), 265–269 m deep, July 21, 1986.

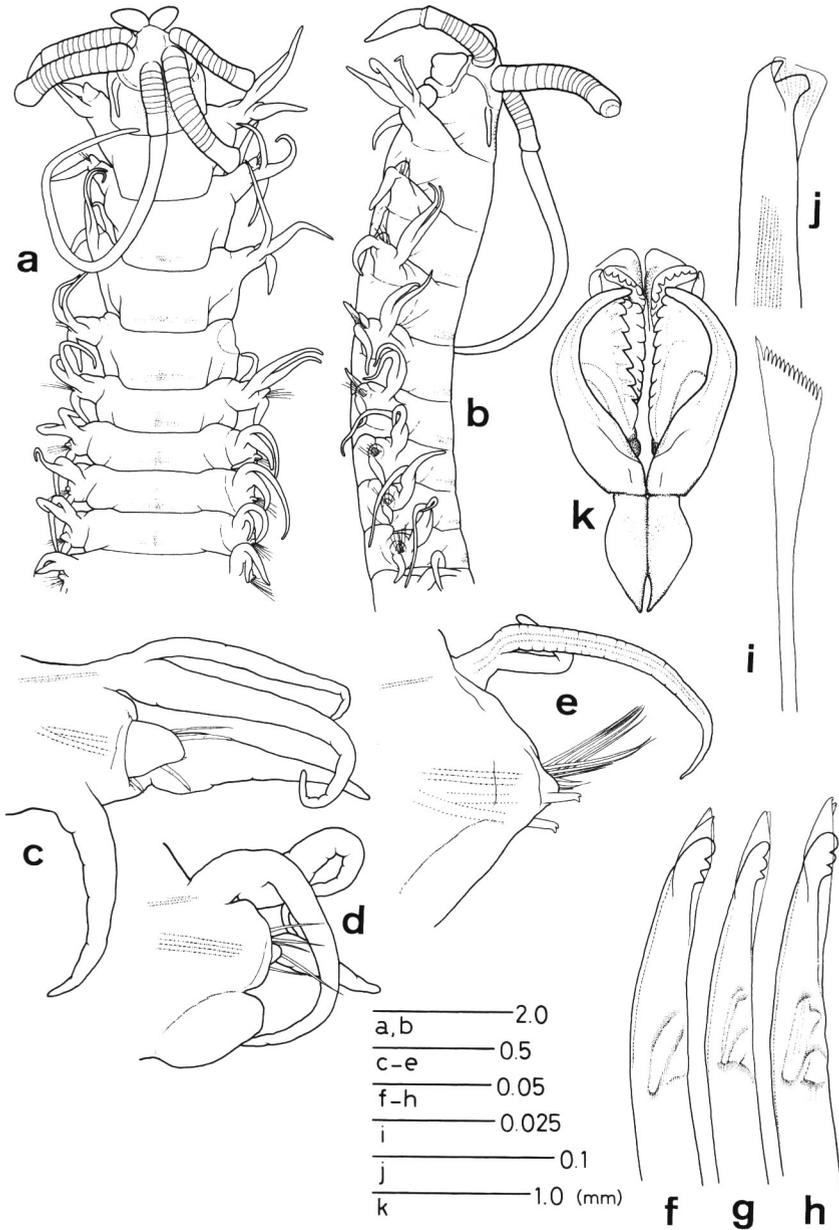


Fig. 6. *Onuphis imajimai* Maekawa & Hayashi, 1989. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; sixth parapodium, anterior view, e; 40th parapodium, anterior view, f; tridentate pseudocompound hook from first parapodium, g; same from second parapodium, h; same from third parapodium, i; pectinate seta from 40th parapodium, j; bidentate subacicular hook from 40th parapodium, k; maxillae.

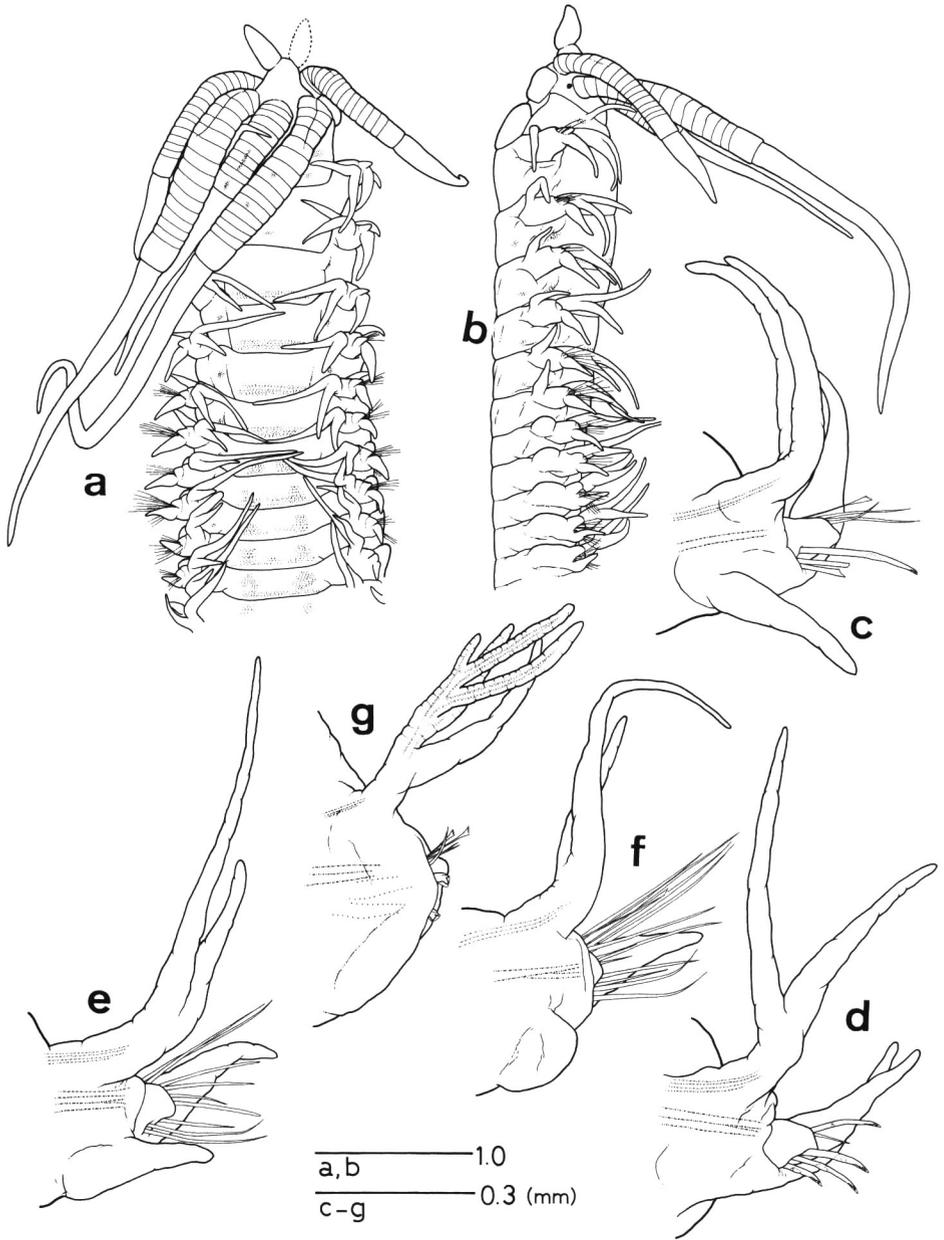


Fig. 7.

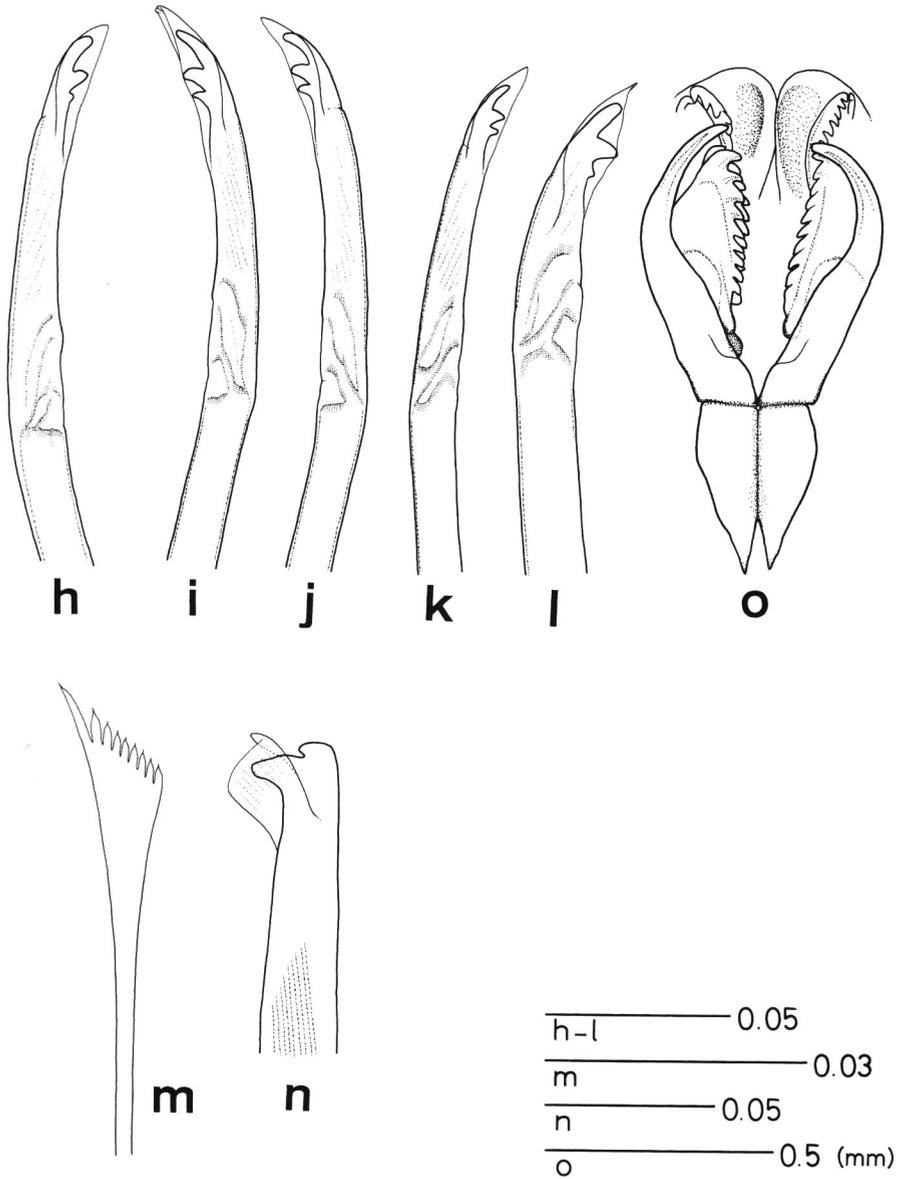


Fig. 7. *Onuphis iriei* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; third parapodium, anterior view, e; fourth parapodium, anterior view, f; seventh parapodium, anterior view, g; 31st parapodium, anterior view, h; tridentate pseudocompound hook from first parapodium, i, j; same from second parapodium, k, l; same from third parapodium, m; pectinate seta from first parapodium, n; bidentate subacicular hook from 17th parapodium, o; maxillae.

All specimens anterior fragments only with 37–192 setigers measuring about 17–104 mm in length and about 1.0–2.0 mm in width excluding parapodia.

Material used for description. Mature female (OMNH-Iv 1621) collected from Wakasa Bay, 240 m deep August 28, 1975 with anterior 111 setigers measuring about 61 mm in length and up to 1.2 mm in width excluding parapodia.

Description. Anterior body whitish without any pigmentary spots or bands. Right peristomial cirrus missing.

Eyespots absent. Ceratophores of palps with 11 rings each, lateral ceratophores with 13 to 14 rings each and median ceratophore with 8 rings, respectively. Simple strap-like branchiae present from setiger 1 (Fig. 6a–e). Ventral cirri cirriform on first 5 setigers, then replaced by glandular pads thereafter (Fig. 6c). Digitiform postsetal lobes distinct in first 13 setigers and short conical knobs in shape thereafter (Fig. 6c–e). Tridentate pseudocompound hooks with pointed hoods present in first 4 setigers; all denticles with round tips (Fig. 6f–h). Pectinate setae flat and oblique with about 15 teeth each (Fig. 6i). Hooded bidentate subacicular hooks present from setiger 12 (Fig. 6j).

Maxillary formula: 1+1, 7+8, 8+0, 8+9, 1+1 (Fig. 6k).

Methyl green staining pattern. Frontal, upper and lower lips moderately staining with more deeply staining outer margins. Ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Each anterior ventral glandular pad deeply staining on frontal margin only. Two clear transverse bands on ventral surface of each anterior segment far back beyond setiger 60.

Remarks. The number of setigers with digitiform postsetal lobes varies between 10 and 13 among specimens examined.

Distribution. The Sea of Japan off Wakasa Bay, Japan.

Onuphis iriei sp. nov.

(Fig. 7a–o)

Onuphis eremita oculata Maekawa & Hayashi, 1989; 70–72, fig. 6a–n.

Material examined. Holotype (NSMT-Pol. H 432) and 2 paratypes (OMNH-Iv 1624) collected from southern East China Sea, 28°58'N, 124°01'E, 82 m deep, October 30, 1986. All specimens anterior fragments only. Holotype mature female with anterior 104 setigers measuring about 35 mm in length and up to 1.1 mm in width excluding parapodia. Two paratypes with 87–119 setigers measuring about 30–43 mm in length and up to 0.7–0.8 mm in width excluding parapodia

Material used for description. Holotype.

Description. Body weakly brownish in color in preserved condition with clearly colored both sides of each segment making two longitudinal dorsal bands up to setiger 50. Body cylindrical up to about setiger 5, then getting flattened with segment

shorter in length (Fig. 7a–b).

Prostomium subtriangular with a round tip accompanied by a pair of elongated ovoid frontal lips (Fig. 7a–b) (right one missing). Palps reaching setiger 2 with 15 rings each on their ceratophores. Lateral antennae reaching setiger 10 with 15 rings each on their ceratophores. Median antenna reaching setiger 5 with 10 rings on its ceratophore (Fig. 7a–b).

A pair of eyespots present just behind bases of lateral antennae (Fig. 7b). A pair of peristomial cirri present at anterior margin of peristomium just behind bases of lateral antennae, each extending slightly longer than peristomium length.

First 4 pairs of parapodia directed forward and these with slightly longer main lobes than following ones (Fig. 7a, c–g). On setiger 1 ventral cirri and postsetal lobes almost same length, but less than dorsal cirri and branchial filaments (Fig. 7c). Ventral cirri cirriform in first 6 setigers, then replaced by glandular pads thereafter (Fig. 7b–f). Digitiform postsetal lobes distinct up to around setiger 13, then getting reduced to small conical knobs in shape in posterior part (Fig. 7c–g).

Branchiae present from setiger 1 through end of fragment; simple and strap-like in shape and much elongated in length with longest one on around setiger 10, reaching two-thirds of body width excluding parapodia: Branchiae branching from setiger 20, with maximally 5 branchial filaments.

Tridentate pseudocompound hooks present in first 3 setigers (Fig. 7h–l): About 4 hooks in each fascicle. Pectinate setae flat and oblique with about 9 teeth each (Fig. 7m). Hooded bidentate subacicular hooks present from setiger 10 (Fig. 7n).

Maxillary formula: 1+1, 9+9, 9+0, 5+8, 1+1 (Fig. 7o).

Tube: Semitransparent membrane

Methyl green staining pattern. Frontal, upper and lower lips deeply staining. Peristomial cirri, ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Each anterior ventral glandular pad moderately staining on posterior half only. Two transverse bands on ventral surface of each anterior segment up to around setiger 15.

Character variations among specimens. Branched branchiae first present from setiger 18 in one paratype specimen instead of setiger 20 in holotype and another paratype. Digitiform postsetal lobes in anterior 11 or 13 setigers, respectively among two paratypes. Subacicular hooks first present on setiger 11 or 12 among two paratypes.

Remarks. Among known *Onuphis* species with branchiae from setiger 1 and branching posteriorly, two species described in this study (*O. iriei* sp. nov. and *O. tosaensis* sp. nov.) and 2 more species (*O. branchiata* Treadwell, 1931 and *O. pungolensis* Tan & Chou, 1998) differ from others in not having elongated pseudocompound hooks, bidentate pseudocompound hooks and interramal papillae on the bases of the dorsal cirri on the anterior segments. *O. iriei* clearly differs from *O. branchiata*

in not having extremely elongated lateral and median antennae. It also differs from *O. punggolensis* in having much more elongated branchial filaments than dorsal cirri instead of being as long as dorsal cirri. *O. iriei* and *O. tosaensis* are clearly separated from each other by the pigmentary patterns on their anterior dorsums as well as their staining patterns with methyl green as stated below.

Etymology. This new species is named after Dr. Irie who provided us the materials for this study.

Distribution. Southern East China Sea, Wakasa Bay, the Sea of Japan, Japan.

***Onuphis kammurijimaensis* Maekawa & Hayashi, 1989**

Onuphis kammurijimaensis Maekawa & Hayashi, 1989; 81–83, fig. 12a–n.

Materials examined. Holotype (NSMT-Pol. H287) collected from coarse sand bottom in Wakasa Bay, the Sea of Japan, 35°41'N, 135°27'E, 72 m deep, June 8, 1982. Anterior fragment only with 65 setigers measuring about 19 mm in length and up to 0.8 mm in width excluding parapodia.

Material used for description. Same specimen.

Description. Anterior dorsum whitish with a light brown transverse band on each segment. Pigmentary bands more distinct on peristomium than following segments. Prostomium narrowed anteriorly accompanied by a pair of conical frontal lips. Palps reaching setiger 2 with 9 rings each on their ceratophores. Lateral antennae reaching setiger 7 with 12 rings each on their ceratophores. Median antenna reaching setiger 4 with 6 rings on its ceratophore.

A pair of small eyespots present near outer bases of palps. Ventral cirri cirriform in first 4 setigers, followed by transitory forms on setigers 5 and 6, replaced by glandular pads thereafter. Digitiform postsetal lobes distinct in first 11 setigers and short conical knobs in shape thereafter.

Simple strap-like branchiae starting on setiger 1 through end of fragment. Two types of pseudocompound hooks present in first 4 setigers: Bi- and tridentate thin elongated and short thick types, respectively. Pectinate setae flat and oblique with about 11 teeth each. Hooded bidentate subacicular hooks present from setiger 11.

Maxillary formula: 1+1, 7+9, 10+0, 7+10, 1+1.

Methyl green staining pattern. Frontal, upper and lower lips deeply staining. Peristomial cirri deeply staining. Ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Each anterior ventral glandular pad moderately staining. Anterior surface of each parapodial lobes deeply staining. Two transverse bands on ventral surface of each anterior segment up to setiger 30.

Distribution. Wakasa Bay, the Sea of Japan, Japan.

Onuphis nakaoui sp. nov.

(Fig. 8a–o)

Material examined. Four specimens collected from various Hokkaido coasts; holotype (NSMT-Pol. H 433) from Otobe, west coast of southern Hokkaido, the Sea of Japan, one paratype (OMNH-Iv 1625) from Yurai, west coast of North Hokkaido, the Sea of Japan and two specimens (OMNH-Iv 1626) from Sarufutsu, east coast of North Hokkaido, Okhotsk Sea. Exact collecting sites, depths and sampling dates unknown. All specimens anterior fragments only; holotype with anterior 66 setigers measuring about 29 mm in length and up to 1.6 mm in width excluding parapodia, paratype with anterior 83 setigers measuring about 40 mm in length and up to 1.8 mm in width excluding parapodia and other 2 specimens with 89–172 setigers measuring about 40–77 mm in length and up to 1.9 mm in width excluding parapodia.

Material used for description. Holotype.

Description. Body creamy white in color in preserved condition with a transverse pigmentary dorsal band on each segment from setiger 5 through setiger 35. A pigmentary spot also present on the postero-dorsal base of each parapodium throughout fragment. Body cylindrical up to about setiger 4, then getting slightly flattened but segments almost same as anterior ones in length (Fig. 8a–b).

Prostomium subtriangular with round tip accompanied by a pair of short ovoid frontal lips (Fig. 8a–b). Palps reaching setiger 2 with 13 rings each on their ceratophores. Lateral antennae reaching setiger 8 with 13 rings each on their ceratophores. Median antenna reaching setiger 5 with 8 rings on its ceratophore (Fig. 8a–b).

Eyespots absent. A pair of peristomial cirri present at anterior margin of peristomium close to inner posterior bases of lateral antennae, extending as long as peristomium length.

First several pairs of parapodia directed forward and these with slightly longer main lobes than following ones (Fig. 8a, c–g). Ventral cirri cirriform in first 5 setigers, replaced by glandular pads thereafter (Fig. 8c–g). Digitiform postsetal lobes distinct up to setiger 10, getting reduced to small conical knobs in shape from setiger 18 onward (Fig. 8c–g).

Branchiae present from setiger 1 through end of fragment: Branchial filaments mostly simple and strap-like but some bifid branchiae also present on posterior setigers from setiger 35 (Fig. 8g).

Two types of pseudocompound hooks present in first 5 setigers; thin elongated ones and thick short ones (Fig. 8h–l). On setiger 1 each fascicle includes eleven bi- and tridentate elongated hooks and two bidentate short hooks: Among former, bidentate hooks comparable to tridentate ones in number, but some bidentate elongated hooks being replaced by tridentate ones on setigers 2 and 3. On setiger 4 two short hooks with bi- and tridentate tips each. On setiger 5 only two elongated hooks and 4 short hooks present. Pectinate setae flat and oblique with about 11 teeth each (Fig.

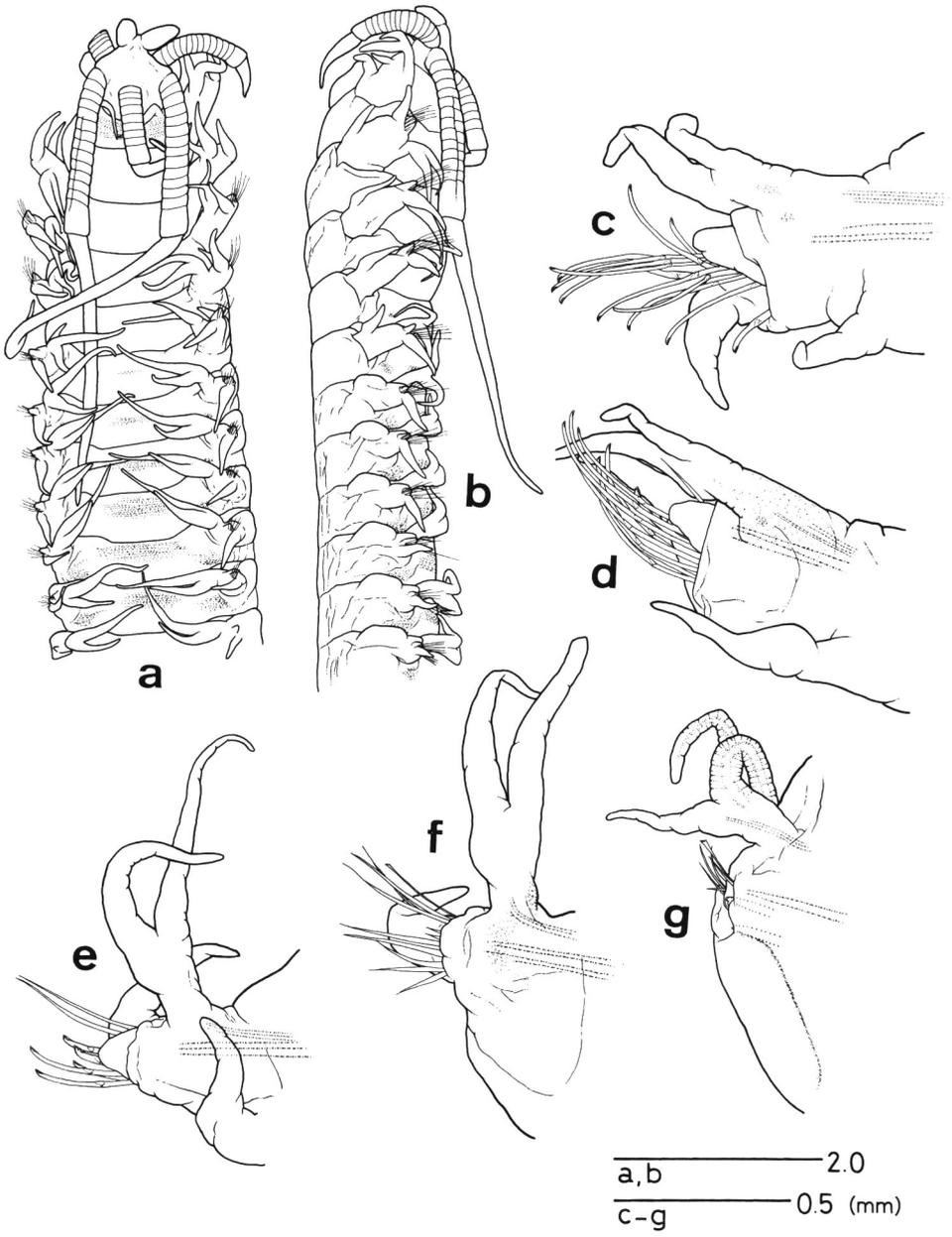


Fig. 8.

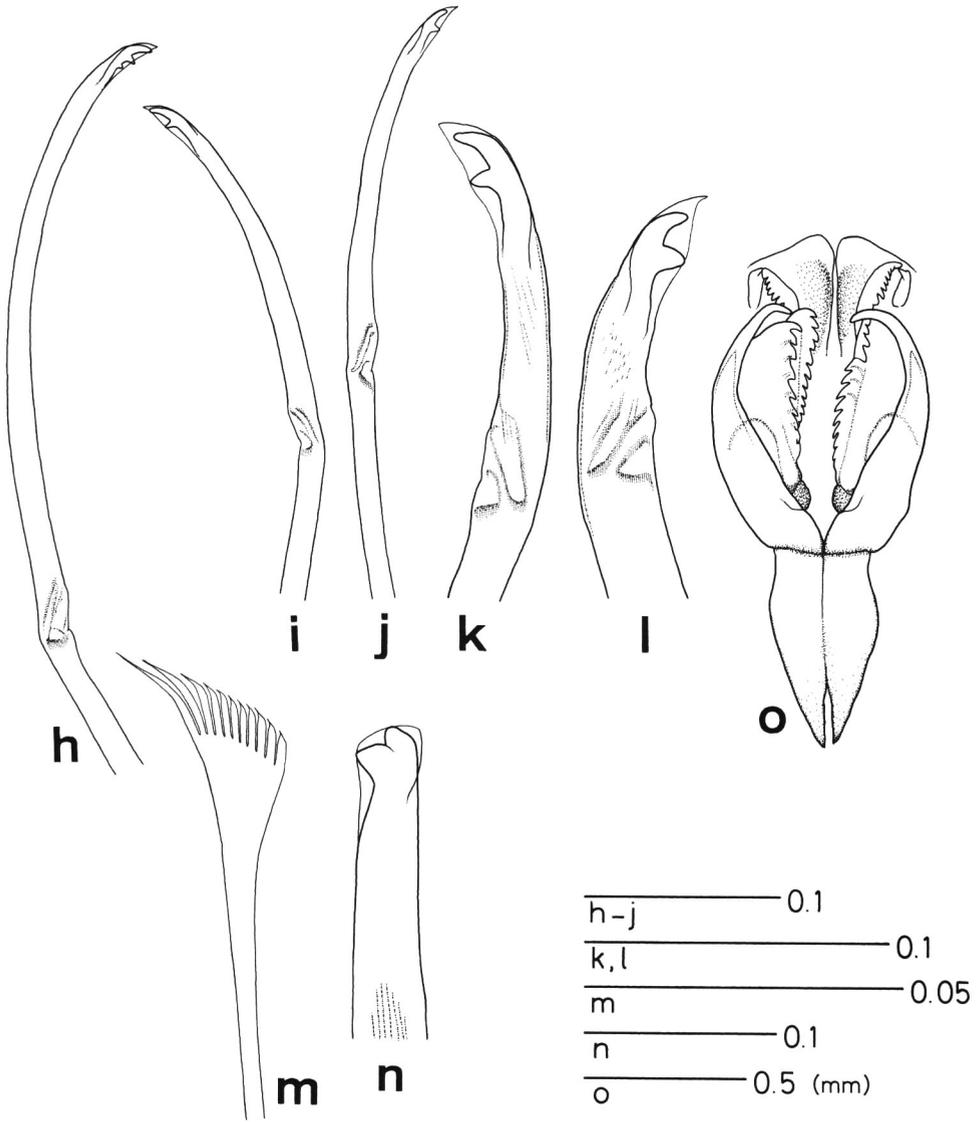


Fig. 8. *Onuphis nakaai* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; second parapodium, anterior view, e; fifth parapodium, anterior view, f; sixth parapodium, anterior view, g; 42nd parapodium, anterior view, h; thin elongated tridentate pseudocompound hook from first parapodium, i; thin elongated bidentate pseudocompound hook from first parapodium, j; same from fifth parapodium, k; bidentate pseudocompound hook from first parapodium, l; same from fifth parapodium, m; pectinate seta from 42nd parapodium, n; bidentate subacicular hook from 15th parapodium, o; maxillae.

8m). Hooded bidentate subacicular hooks present from setiger 10 (Fig. 8n).

Maxillary formula: 1+1, 9+12, 11+0, 9+10, 1+1 (Fig. 8o).

Tube: Semitransparent thin membrane

Methyl green staining pattern. Frontal and lower lips deeply staining while upper lips staining marginally only. Peristomial cirri deeply staining. Ceratostyles of palps remaining unstained. Anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining. Each anterior ventral glandular pad with deeply staining margin. Two transverse bands on ventral surface of each segment throughout fragment, especially clear on around setigers 5 through 20.

Character variations among specimens. Following characters are variable among specimens; maximum number of branchial filaments 2 or 3; branched branchiae first present from setiger 32 to from 54; developed postsetal lobes present on anterior 10 to 18 setigers; number of ceratophore rings between 13 and 15 for palps, between 13 and 16 for lateral antennae and between 8 and 11 for median antenna.

Remarks. This species is quite similar to *O. longisetosa* Imajima, 1986 in having branched branchial filaments, two types of pseudocompound hooks, thin elongated and thick short ones, both with bi- and tridentate tips but this new species differs from *O. longisetosa* in having bidentate pseudocompound hooks in first several setigers instead of being restricted on setiger 1 only. In addition the direct comparison of methyl green staining patterns between the two species clearly showed that the ceratostyles of palps do not stain in *O. nakaoui* instead of deeply staining in *O. longisetosa*.

Etymology. This new species is named after Professor Shigeru Nakao, Hokkaido University who provided us the materials for this study.

Distribution. Various Hokkaido coasts in the Sea of Japan and Okhotsk Sea, Japan.

***Onuphis opalina* (Verrill, 1873)**

Nothria opalina Verrill, 1873; 102.

Onuphis opalina Fauchald, 1982a; 50–51, fig. 14b, table 16.

Onuphis opalina Imajima, 1986; 97–99, fig. 3a–s.

Onuphis opalina Maekawa & Hayashi, 1989; 74–75, fig. 8a–j.

Materials examined. Only one specimen (OMNH-Iv 1627) collected from mud bottom off Tango Peninsula, the Sea of Japan, 35°55'N, 135°05'E, 257 m deep, August 27, 1975. Anterior fragment only with 23 setigers measuring about 19 mm in length and 3.3 mm in width excluding parapodia.

Material used for description. Same specimen.

Description. Dorsum brown and a small pigmentary patch present on base of each parapodium from setiger 6 through end of fragment. Peristomial cirri and ceratostyles of palps missing.

Eyespots absent. Anterior 5 pairs of parapodia directed forward but not enlarged. Ventral cirri cirriform in first 6 setigers, then replaced by glandular pads thereafter. Digitiform postsetal lobes distinct in first 13 setigers and small conical knobs thereafter.

Simple strap-like branchiae starting on setiger 1 through end of fragment. Tridentate pseudocompound hooks with blunt hoods present in first 4 setigers; some with round denticles. Pectinate setae flat and oblique with about 14 teeth each. Hooded bidentate subacicular hooks present from setiger 14.

Maxillary formula: 1+1, 8+8, 9+0, 6+?, 1+1.

Methyl green staining pattern. Frontal, upper and lower lips deeply staining. Anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining. Posterior surface of each parapodial lobe deeply staining. Each anterior ventral glandular pad deeply staining marginally with inside remaining unstained. Two transverse bands on ventral surface of each segment throughout fragment.

Remarks. We could not examine the specimens from Atlantic Ocean, the type locality in this study but our specimen shows no significant differences compared to the specimens from the original locality, as long as based on its description (Fauchald, 1982a). This species has already been known from the northern part of Japan in Northwest Pacific (Imajima, 1986).

Distribution. Atlantic Ocean off New England, Pacific Ocean off Sanriku Coast of Honshu Island of Japan, the Sea of Japan off Tango Peninsula of Honshu Island of Japan.

Onuphis shijikiensis sp. nov.

(Fig. 9a–o)

Material examined. Five specimens collected from Shijiki Bay, East China Sea, May 12, 1984; holotype (NSMT-Pol. H 434) from 33°11'N, 129°23'E, 8 m deep and 4 paratypes (OMNH-Iv 1628) from 33°11'N, 129°24'E, 8 m deep. All specimens anterior fragments only. Holotype with anterior 59 setigers measuring about 16 mm in length and up to 1.1 mm in width excluding parapodia; 4 paratypes with 34–97 setigers measuring about 7–28 mm in length and up to 1.1 mm in width excluding parapodia.

Material used for description. Holotype.

Description. Body brownish in color in preserved condition with a transverse pigmentary dorsal band on peristomium and many pigmentary spots on ceratophores of prostomial appendages (Fig. 9a–b). In addition a faint pigmentary dorsal band also present on each setiger. Body cylindrical through setiger 4, getting flattened and shorter in length thereafter.

Prostomium subtriangular with round tip accompanied by a pair of conical

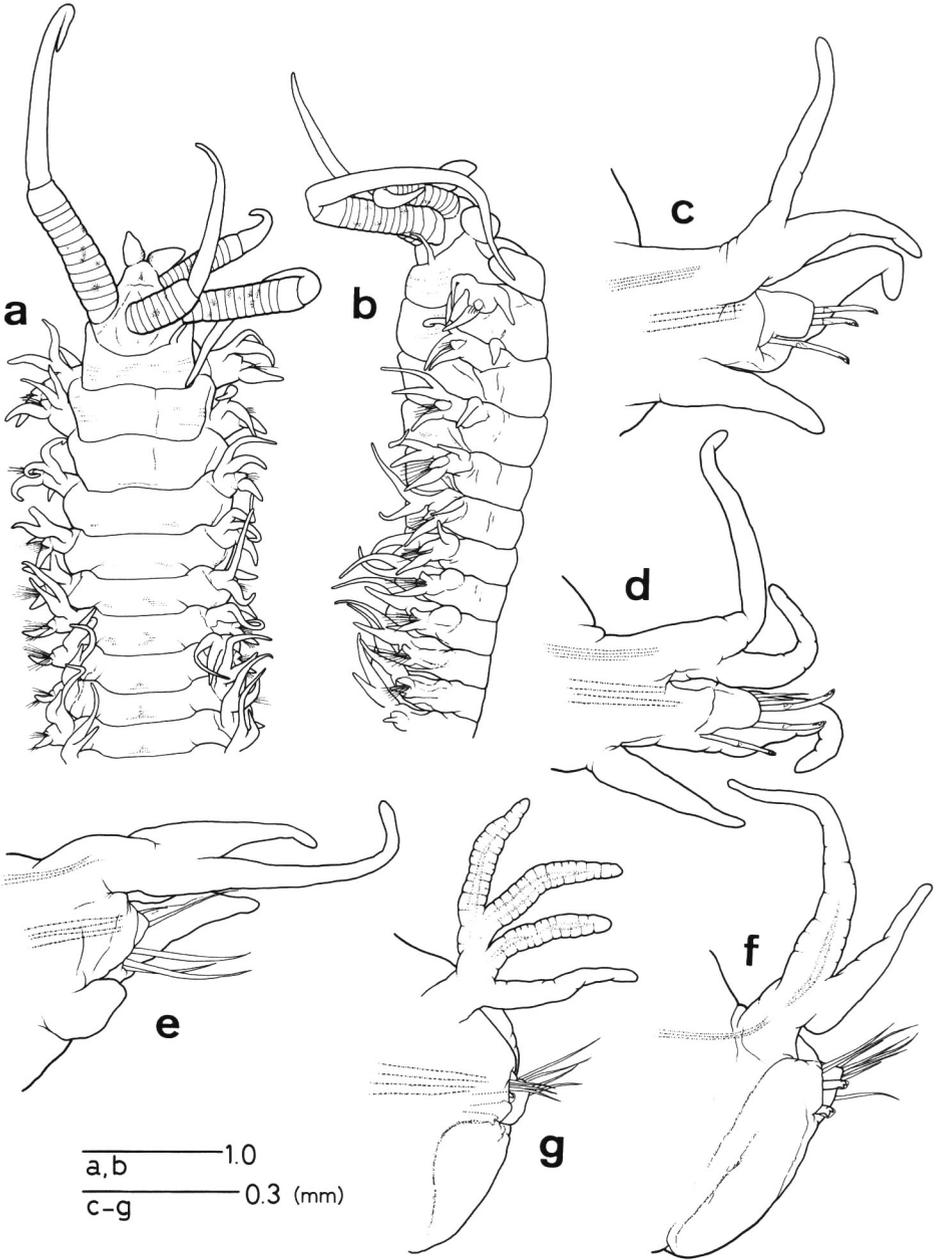


Fig. 9.

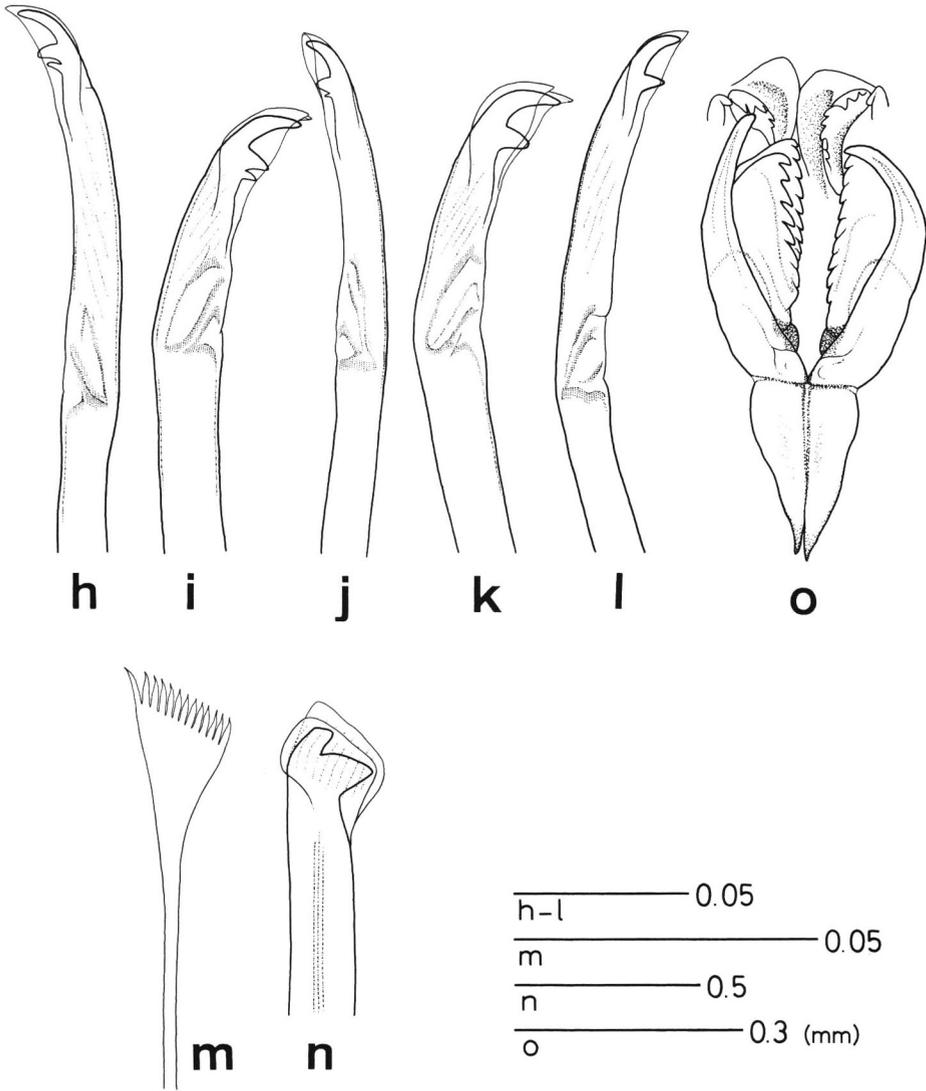


Fig. 9. *Onuphis shijikiensis* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; second parapodium, anterior view, d; third parapodium, anterior view, e; sixth parapodium, anterior view, f; 14th parapodium, anterior view, g; 23rd parapodium, anterior view, h; tridentate pseudocompound hook from first parapodium, i; same from second parapodium, j; same from third parapodium, k; bidentate pseudocompound hook from first parapodium, l; same from second parapodium, m; pectinate seta from 57th parapodium, n; bidentate subacicular hook from 14th parapodium, o; maxillae.

frontal lips (Fig. 9a). Palps reaching setiger 1 with 11 rings each on their ceratophores. Lateral antennae reaching setiger 9 with 13 rings each on their ceratophores. Median antenna reaching setiger 5 with 6 rings on its ceratophore.

Eyespots absent. A pair of peristomial cirri present at anterior margin of peristomium just behind bases of lateral antennae (left cirrus missing), extending less longer than peristomium length (Fig. 9a).

First 4 pairs of parapodia directed slightly forward and these with slightly longer main lobes than following ones (Fig. 9c–f). On setiger 1 dorsal cirri, ventral cirri and digitiform postsetal lobes almost same in length. Dorsal cirri getting more slender and shorter from about setiger 20 onward. Ventral cirri cirriform in first 5 setigers, followed by transitory forms on setiger 6, replaced by glandular pads thereafter (Fig. 9b–f). Digitiform postsetal lobes distinct in first 10 setigers or more, small and conical in shape thereafter (Fig. 9c–g).

Branchiae present from setiger 1 through end of fragment; simple and strap-like in shape and shortest in setiger 1, being inferior to dorsal cirri in length. Branchiae getting longer from setiger 2 and branching from setiger 18, up to 4 branchial lobes from setiger 25 (Fig. 9c–g).

Bi- and tridentate pseudocompound hooks present in first 3 setigers (Fig. 9h–l): About 3 hooks in each fascicle, dominated by tridentate hooks (Fig. 9h–j). Pectinate setae flat and oblique with about 13 teeth each (Fig. 9m). Hooded bidentate subacicular hooks present from setiger 10 (Fig. 9n).

Maxillary formula: 1+1, 7+9, 8+0, 6+8, 1+1 (Fig. 9o).

Tube: Semitransparent thin membrane without sediment granules.

Methyl green staining pattern. Frontal, upper and lower lips deeply staining; latter two more deeply staining on outer halves. Peristomial cirri deeply staining. Ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining. Each anterior ventral glandular pad deeply staining. Two transverse bands on ventral surface of each segment throughout fragment, especially clear up to around setiger 15.

Character variations among specimens. Setiger with branched branchiae first present between 16 and 19 within paratypes. Some paratypes have cirriform ventral cirri on setiger 6. Digitiform postsetal lobes distinct on anterior 10 to 13 setigers in paratypes.

Remarks. *O. shijikiensis* sp. nov. is similar to *O. chinensis* Uschakov and Wu, 1962 and *O. variolata* Shoupeng, 1987 in most diagnostic characters according to their original descriptions. But *O. shijikiensis* clearly differs from *O. chinensis* in having branched branchial filaments much more anteriorly than the latter. Although the anteriormost setiger with branched branchial filaments could vary within the species, the difference observed between two species seems too great (setigers 16 to 19 vs 72) to recognize it as the intraspecific variation. *O. shijikiensis* also differs from *O. variolata* in having pseudocompound hooks in first 3 setigers instead of first 8 setigers.

Etymology. This new species is named after the locality the holotype was collected.

Distribution. Shijiki Bay, East China Sea, Japan.

***Onuphis shirikishinaiensis* (Imajima, 1960)**

(Fig. 10a–i)

Nothria shirikishinaiensis Imajima, 1960; 55–58, figs. 1–14.

Nothria shirikishinaiensis Imajima & Hartman, 1964; 245–246.

Onuphis shirikishinaiensis Fauchald, 1982a; 53, fig. 14d.

Materials examined. Seven specimens from various areas around Hokkaido; 2 specimens from Fuyushima (OMNH-Iv 1629), Pacific Ocean; 3 specimens from Yubetsu (OMNH-Iv 1630) and 1 specimen from Abashiri (OMNH-Iv 1631), Okhotsk Sea; 1 specimen from Hakodate (OMNH-Iv 1632), Tsugaru Strait. Exact sampling sites, depths and sampling dates unknown. Two complete specimens with 106–112 setigers measuring about 23–24 mm in length and up to 1.0 mm in width excluding parapodia and other 5 specimens anterior fragments only with 50–155 setigers measuring about 15–47 mm in length and about 1.0 mm in width excluding parapodia.

Material used for description. Specimen from Hakodate (OMNH-Iv 1632) with anterior 75 setigers measuring about 25 mm in length and up to 1.8 mm in width excluding parapodia.

Description. Body whitish in color in preserved condition with transverse pigmentary dorsal bands on prostomium, peristomium and anterior setigers, especially clear up to around anterior 30 setigers. Ceratophores also with several pigmentary spots along axes. Prostomium globular with a pair of conical frontal lips (Fig. 10a). Palps reaching setiger 1 with 9 rings each on their ceratophores. Lateral antennae reaching setiger 10 with 11 rings each on their ceratophores. Median antenna reaching setiger 5 with 6 rings on its ceratophore.

Eyespots absent. Simple digitiform branchiae starting on setiger 1 present through end of fragment (Fig. 10a–d). Ventral cirri cirriform in first 7 setigers, replaced by glandular pads thereafter (Fig. 10b–d). Two types of pseudocompound hooks present; thin elongated and thick short ones, respectively. Former bi- or tridentate and present in first 7 setigers, while latter tridentate and present in first 5 setigers (Fig. 10e–f). Digitiform postsetal lobes distinct in first 16 setigers, replaced by short conical knobs thereafter (Fig. 10b–d). Pectinate setae flat and slightly oblique with about 16 teeth each (Fig. 10g). Hooded bidentate subacicular hooks present from setiger 11 (Fig. 10h).

Maxillary formula: 1+1, 6+6, 6+0, 5+8, 1+1 (Fig. 10i).

Methyl green staining pattern. Frontal, upper and lower lips deeply staining. Peristomial cirri and ceratostyles of palps, anterior dorsal cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining less stained.

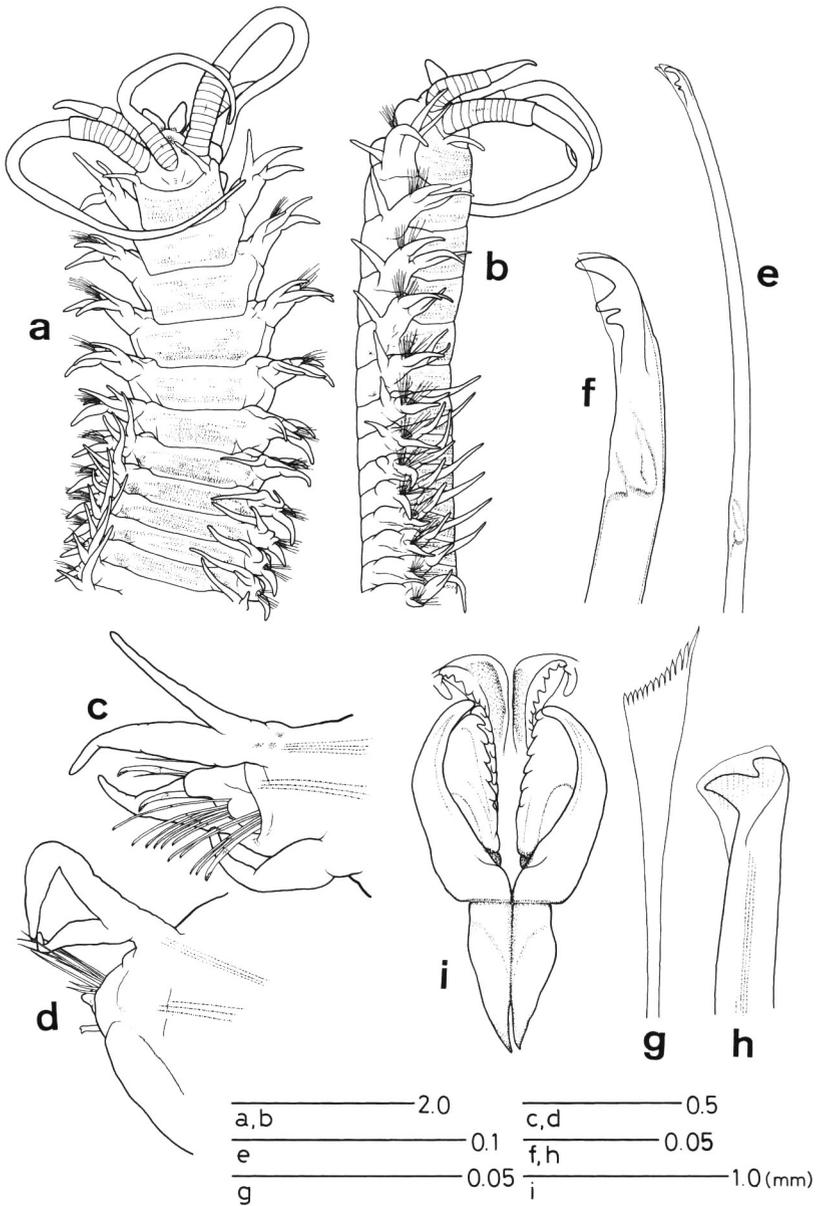


Fig. 10. *Onuphis shirikishinaiensis* (Imajima, 1960). a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; 20th parapodium, anterior view, e; thin elongated tridentate pseudocompound hook from first parapodium, f; tridentate pseudocompound hook from first parapodium, g; pectinate seta from 8th parapodium, h; bidentate subacicular hook from 20th parapodium, i; maxillae.

Ventral cirri moderately staining. Each anterior ventral glandular pad with deeply staining posterior half. Two transverse bands on ventral surface of each anterior segment up to around setiger 20.

Remarks. The number of setigers with cirriformed ventral cirri varies between 6 and 8 among specimens examined.

Distribution. Northwest Pacific off Sanriku coast of Honshu Island, Japan and the Sea of Okhotsk off Hokkaido, Japan.

***Onuphis taraba* Maekawa & Hayashi, 1989**

(Fig. 11a–j)

Onuphis taraba Maekawa & Hayashi, 1989; 79–81, fig. 11a–n.

Materials examined. Only one specimen (OMNH-Iv 1633) collected from sand bottom in the westernmost part of Wakasa Bay (Tango-kai), 115 m deep, July 27, 1976. Anterior fragment only with 105 setigers measuring about 49 mm in length and up to 1.5 mm in width excluding parapodia.

Material used for description. Same specimen.

Description. Body light brown without any pigmentary spots or bands in preserved condition. Prostomium globular with a pair of conical frontal lips (Fig. 12a). Palps reaching setiger 2 with 11 rings each on their ceratophores. Lateral antennae reaching setiger 6 with 12 rings each on their ceratophores. Median antenna reaching setiger 5 with 7 rings on its ceratophore.

Eyespots absent. Simple strap-like branchiae starting on setiger 4 through end of fragment (Fig. 11a–e). Ventral cirri cirriform in first 5 setigers, followed by transitory forms on setiger 6, replaced by glandular pads thereafter (Fig. 11b–e). Digitiform postsetal lobes distinct in first 11 setigers and short conical knobs thereafter (Fig. 11b–e). Tridentate pseudocompound hooks with pointed hoods present in first 4 setigers (Fig. 11f–g). Pectinate setae flat and oblique with 16 teeth each (Fig. 11h). Bidentate subacicular hooks present from setiger 11 (Fig. 11i).

Maxillary formula: 1+1, 7+8, 8+0, 7+12, 1+1 (Fig. 11j).

Methyl green staining pattern. Frontal and lower lips deeply staining; upper lips with more deeply staining outer margins. Peristomial cirri and ceratostyles of palps moderately staining with distal tips remaining unstained. Anterior dorsal cirri and postsetal lobes deeply staining with distal tips less staining while ventral cirri moderately staining. Anterior branchial filaments moderately staining. A deeply staining spot on the posterior surface of each anterior parapodial lobe. Each anterior ventral glandular pad deeply staining marginally with inside less stained. Two clear transverse bands on ventral surface of each segment, especially clear on mid body area beyond setiger 20.

Distribution. The Sea of Japan off Wakasa Bay, Japan.

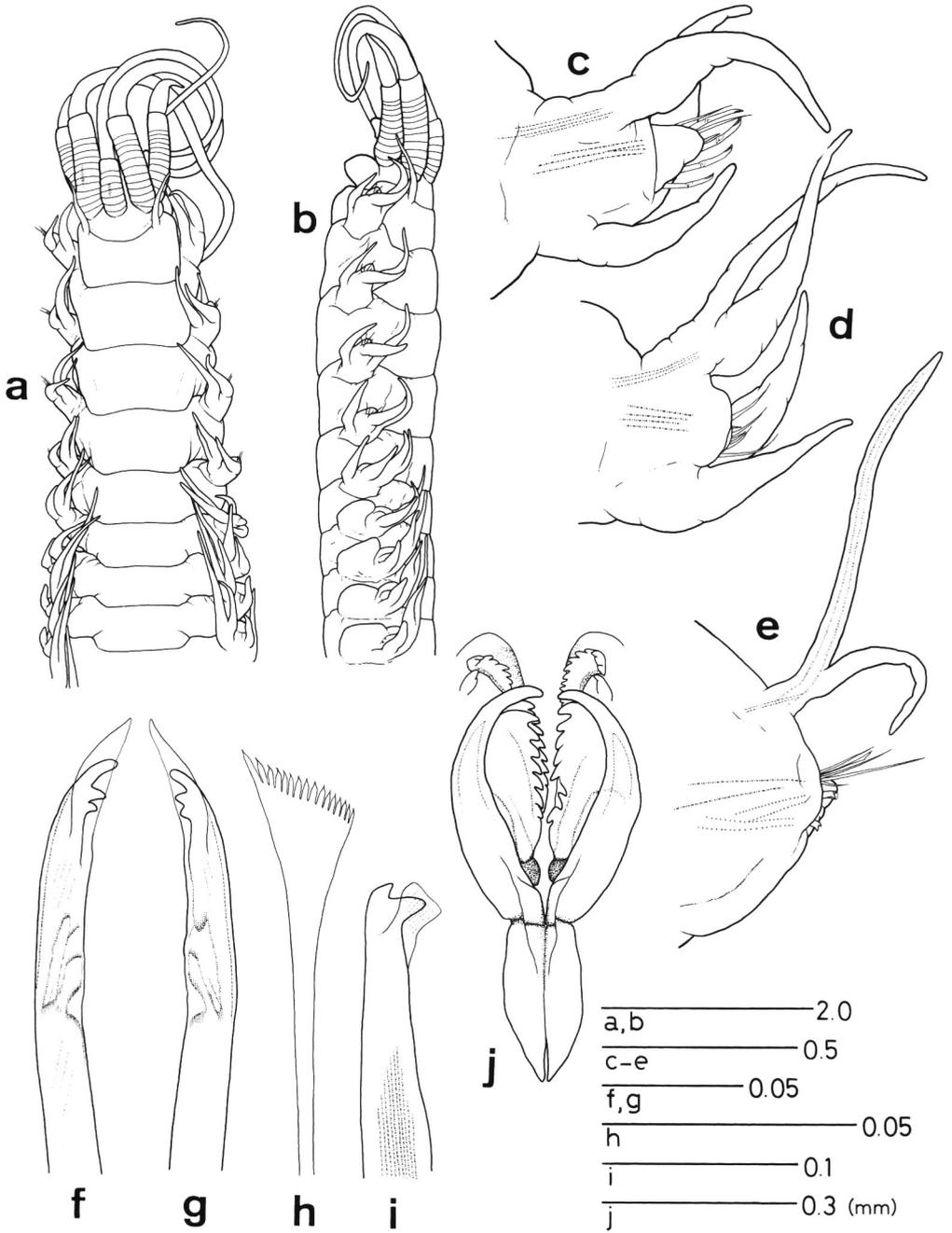


Fig. 11. *Onuphis taraba* Maekawa & Hayashi, 1989. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; fifth parapodium, anterior view, e; 80th parapodium, anterior view, f; tridentate pseudocompound hook from first parapodium, g; same from fourth parapodium, h; pectinate seta from 80th parapodium, i; bidentate subacicular hook from 80th parapodium, j; maxillae.

Onuphis tetradentata Imajima, 1986

(Fig. 12a–p)

Onuphis tetradentata Imajima, 1986; 102–104, fig. 5a–p.

Material examined. Five specimens collected from Yellow Sea; two specimens (OMNH-Iv 1634) from 35°30'N, 123°00'E, 71 m deep, October 14, 1986; two specimens (OMNH-Iv 1635, 1636) from 35°30'N, 123°26'E, 75 m deep, October 15, 1986; one specimen (OMNH-Iv 1637) from 35°33'N, 123°55'E, 81 m deep, October 15, 1986. All specimens anterior fragments only with 47–86 setigers measuring about 16–31 mm in length and up to 1.1–1.5 mm in width excluding parapodia.

Material used for description. Mature female (OMNH-Iv. 1635) collected October 15, 1986 with anterior 72 setigers measuring about 30 mm in length and up to 1.5 mm in width excluding parapodia.

Description. Body whitish in color in preserved condition with a transverse pigmentary dorsal band on each setiger and a pigmentary spot on posterior base of each parapodium through about setiger 25 (Fig. 12a). Body cylindrical through setiger 4, getting flattened with segments shorter in length thereafter (Fig. 12a, b).

Prostomium subtriangular with a round tip accompanied by a pair of oval frontal lips (Fig. 12a). Palps reaching setiger 1 with 8 rings each on their ceratophores. Lateral antennae reaching setiger 12 with 8 rings each on their ceratophores. Median antenna reaching setiger 5 with 6 rings on its ceratophore.

Eyespots absent. A pair of peristomial cirri present at anterior margin of peristomium, extending as long as peristomium length.

First 3 pairs of parapodia directed forward but their main lobes as long as following ones (Fig. 12c–f). Ventral cirri cirriform in first 5 setigers, followed by transitional forms on setigers 6 and 7, replaced by glandular pads thereafter (Fig. 12c–g). Digitiform postsetal lobes distinct in first 10 setigers or more, small and conical in shape thereafter (Fig. 12c–g).

Simple strap-like branchiae present from setiger 4 through end of fragment (Fig. 12e–g). Branchiae slightly longer than dorsal cirri in setiger 4, getting longer thereafter. Branchial filament maximum in length in about setiger 10, extending half as long as body width. Branchiae less developed in posterior region of fragment (Fig. 13g).

Tri- and tetradentate pseudocompound hooks with pointed hoods present in first 4 setigers (Fig. 12h–m): Most with tetradentate tips but some tetradentate hooks with most proximal denticle faintly bidentate, showing 5 denticles on their distal tips present in first 3 setigers (Fig. 12i). Pectinate setae flat and slightly oblique with about 15 teeth each (Fig. 12n). Hooded bidentate subacicular hooks present from setiger 12 (Fig. 12o).

Maxillary formula: 1+1, 9+8, 9+0, 8+9, 1+1 (Fig. 12p).

Methyl green staining pattern. Frontal lips deeply staining. Upper and lower

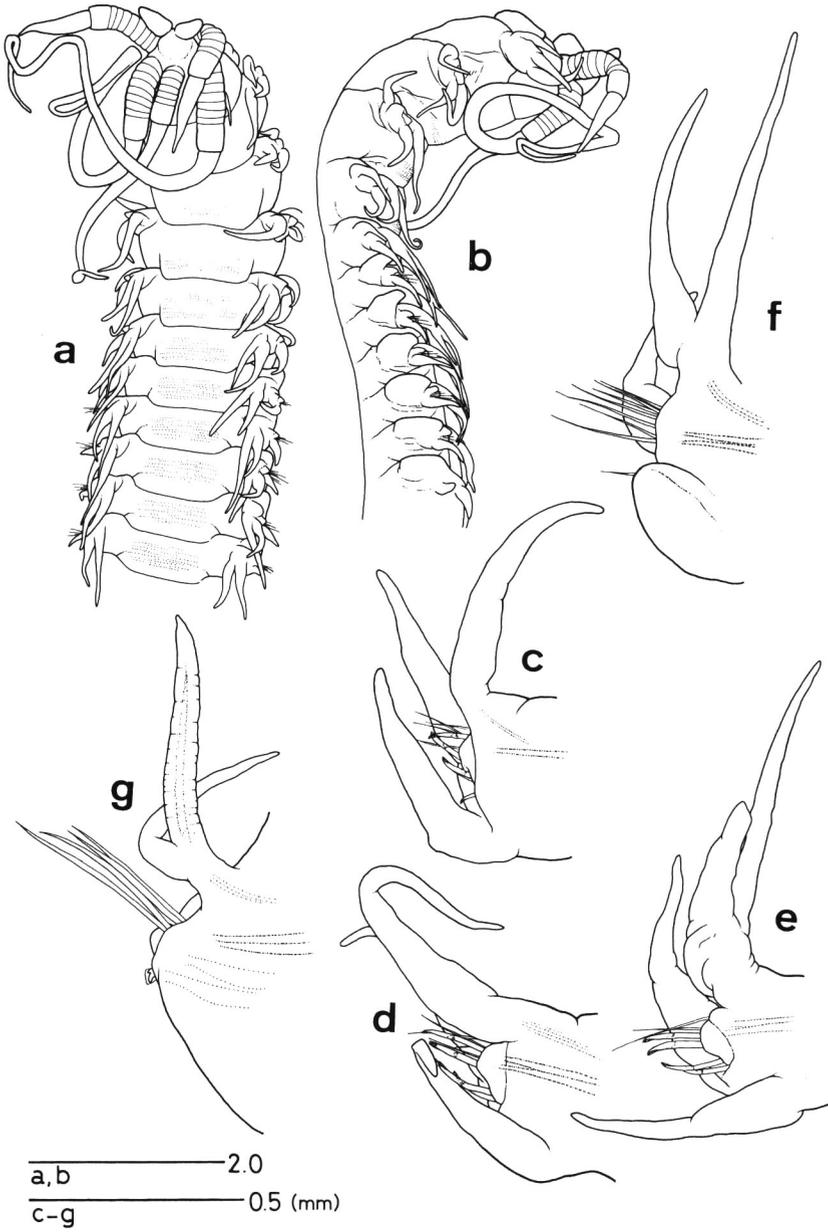


Fig. 12.

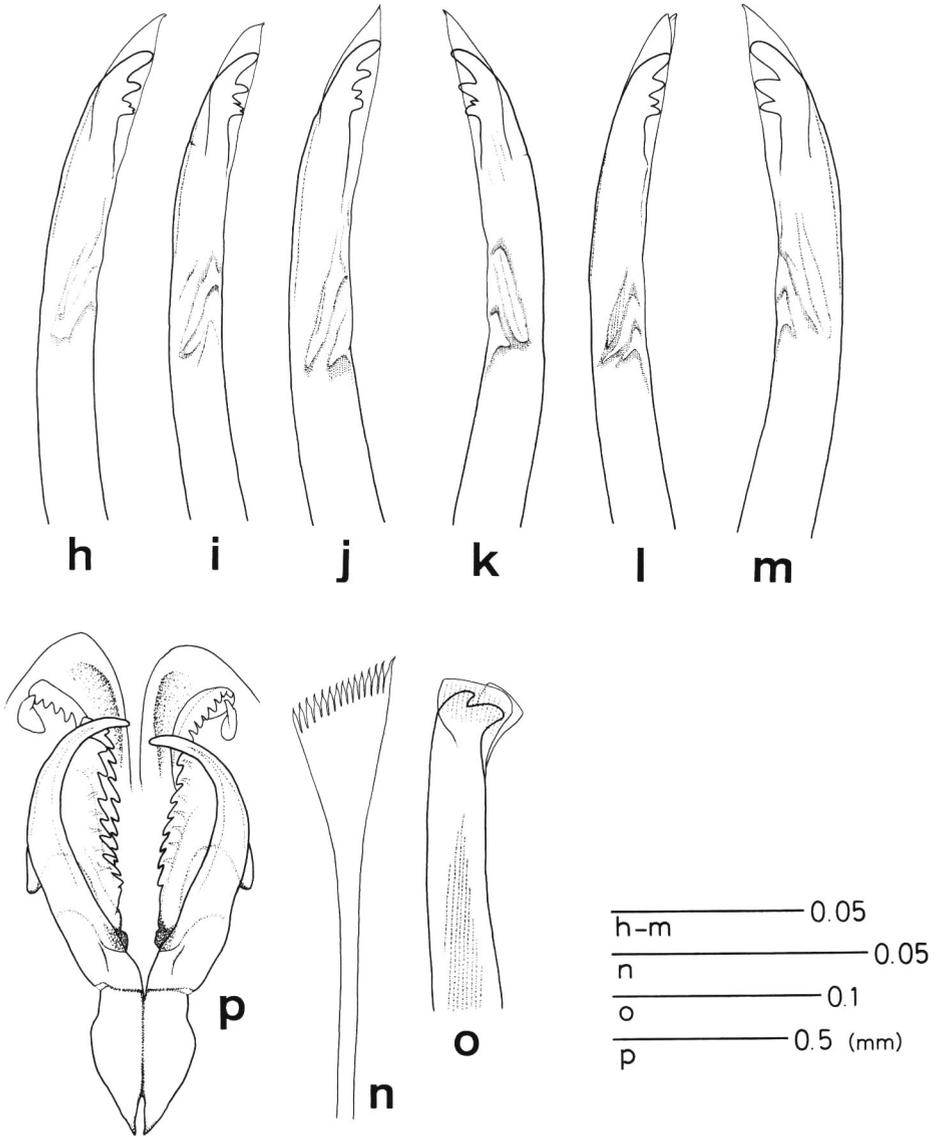


Fig. 12. *Onuphis tetradentata* Imajima, 1986. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; second parapodium, anterior view, e; forth parapodium, anterior view, f; sixth parapodium, anterior view, g; 21st parapodium, anterior view, h; tetradentate pseudocompound hook with bifid proximal tooth from first parapodium, i; same from second parapodium, j; tetradentate pseudocompound hook from second parapodium, k; tetradentate pseudocompound hook from third parapodium, l; tetradentate pseudocompound hook from forth parapodium, m; tridentate pseudocompound hook from forth parapodium, n; pectinate seta from 21st parapodium, o; bidentate subacicular hook from 21st parapodium, p; maxillae.

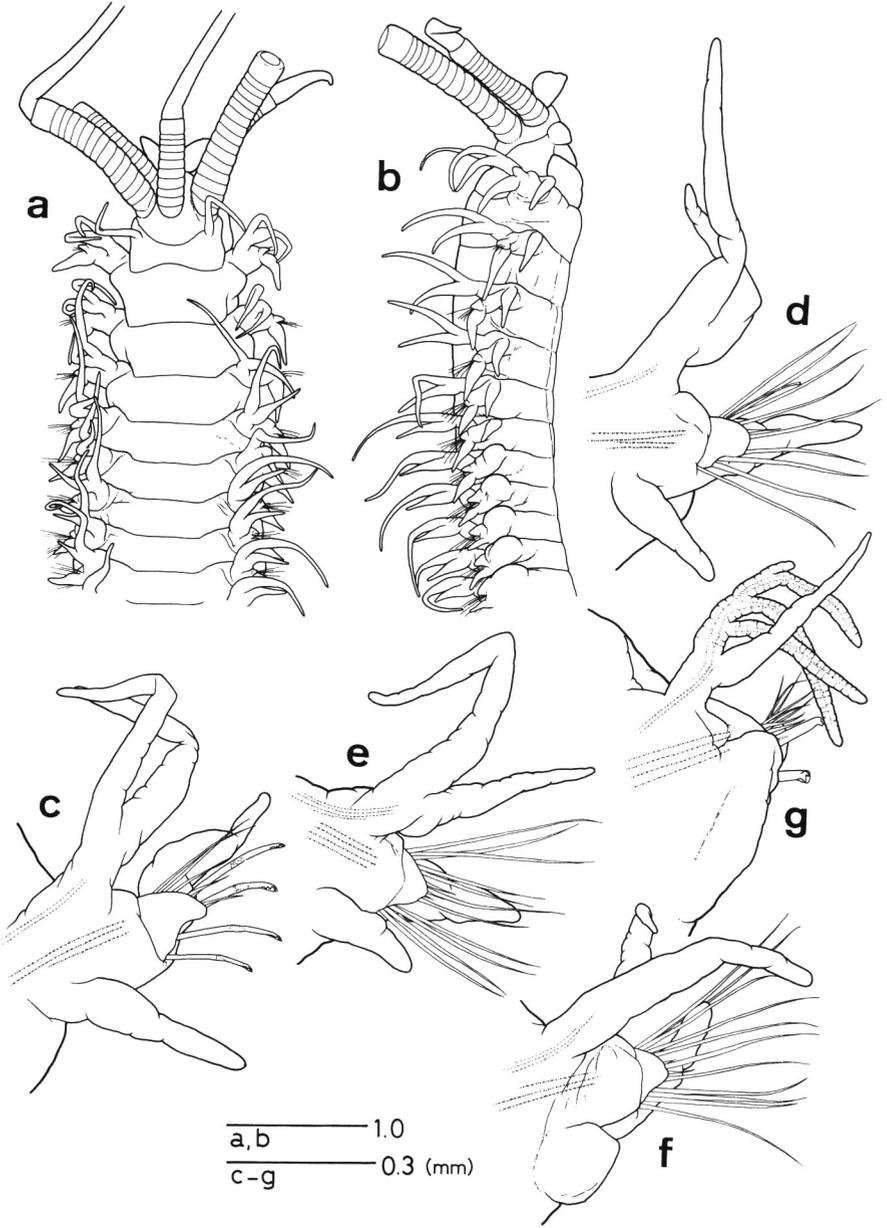


Fig. 13.

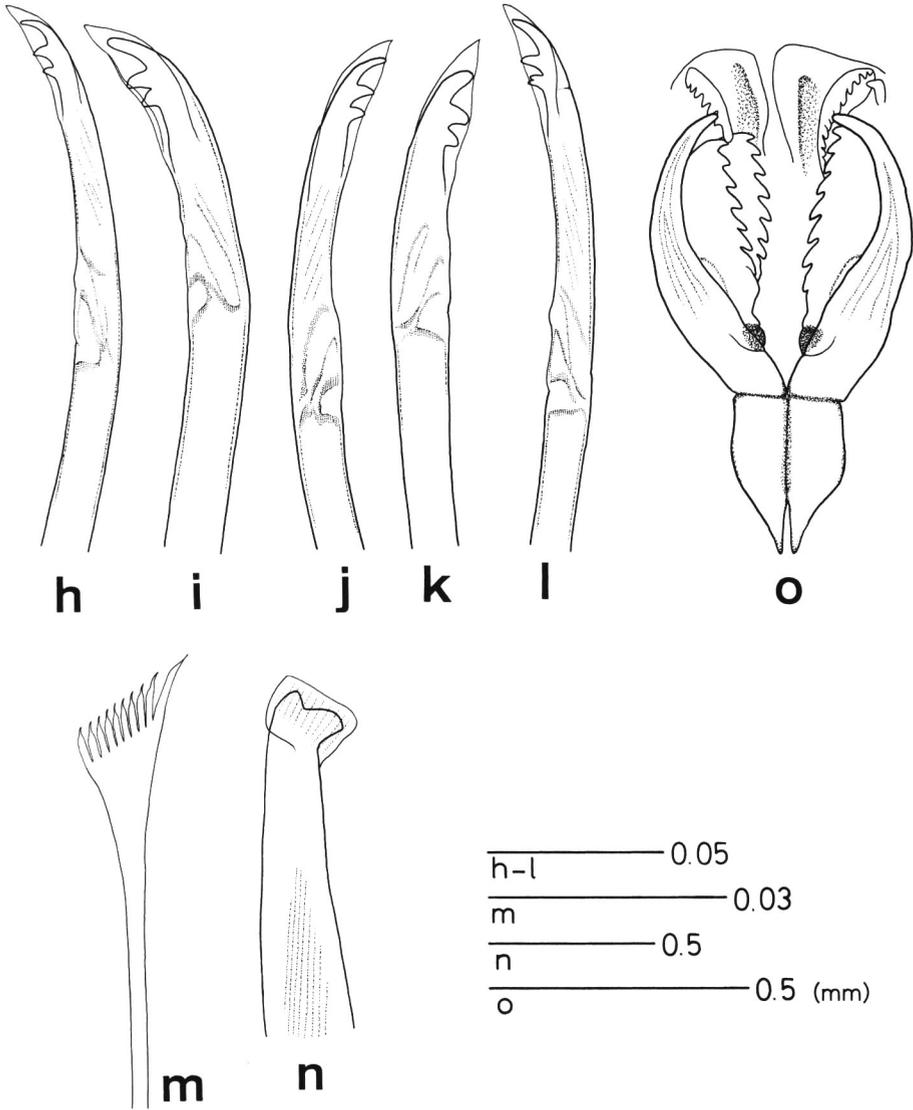


Fig. 13. *Onuphis tosaensis* sp. nov. a; Anterior end, dorsal view, b; anterior end, lateral view, c; first parapodium, anterior view, d; forth parapodium, anterior view, e; fifth parapodium, anterior view, f; sixth parapodium, anterior view, g; 35th parapodium, anterior view, h-i; tridentate pseudocompound hooks from first parapodium, j; same from second parapodium, k; same from third parapodium, l; tridentate pseudocompound hook with bifid proximal tooth from first parapodium, m; pectinate seta from 35th parapodium, n; bidentate subacicular hook, o; maxillae.

lips moderately staining with more deeply staining outer borders. Peristomial cirri, ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments deeply staining with distal tips remaining unstained. Each anterior ventral glandular pad deeply staining on frontal margin only.

Remarks. The present specimen differs from holotype in having quadridentate pseudocompound hook. But no other specimens examined have extra denticle(s) on any tetridentate pseudocompound hook, so having quadridentate pseudocompound hook seems not valid for the specific character. Further difference between the present specimens and holotype is that no eyespots are present in the present specimens. But this difference might be intraspecific variation as well.

Distribution. Pacific Ocean off northeastern Japan, Yellow Sea.

***Onuphis tosaensis* sp. nov.**

(Fig. 13a–o)

Material examined. Two specimens collected from Tosa Bay; holotype (NSMT-Pol. H 435) from 33°22.4'N, 133°46.4'E, 107 m deep, November 17, 1975 and one paratype (OMNH-Iv 1638) from 33°21.3'N, 133°38.3'E, 94 m deep, November 18, 1975. Both specimens anterior fragments only. Holotype with anterior 49 setigers measuring about 13 mm in length and up to 1.4 mm in width excluding parapodia. Paratype with anterior 99 setigers measuring about 19 mm in length and up to 1.0 mm in width excluding parapodia.

Material used for description. Holotype.

Description. Body weakly brownish in color without any pigmentary bands or spots in preserved condition. Body cylindrical through about setiger 6, then getting flattened with segment shorter in length.

Prostomium subtriangular with round tip accompanied by a pair of ovoid frontal lips (Fig. 13a). Palps reaching setiger 2 with 15 rings each on their ceratophores. Lateral antennae reaching setiger 14 with 15 rings each on their ceratophores. Median antenna reaching setiger 9 with 10 rings on its ceratophore (Fig. 13a).

Eyespots absent. A pair of peristomial cirri present at anterior margin of peristomium just behind bases of lateral antennae, each extending as long as peristomium length (Fig. 13a).

First 2 pairs of parapodia directed forward and about first 5 pairs with slightly longer main lobes than following ones (Fig. 13a, c–g). On setiger 1 ventral cirri and postsetal lobes almost same in length, but less than dorsal cirri and branchial filaments (Fig. 13c). Anterior dorsal cirri swelling proximally with distinct contraction folds at bases (Fig. 13d–e). Ventral cirri cirriform in first 6 setigers, replaced by glandular pads thereafter (Fig. 13b–f). Digitiform postsetal lobes distinct up to around setiger 13, getting indistinct thereafter (Fig. 13e–g).

Branchiae present from setiger 1 through end of fragment; simple and strap-like

in shape and always longer than dorsal cirri with longest one on around setiger 7, reaching three-fourths of body width excluding parapodia. Branchiae branching from setiger 19, with maximally 4 branchial filaments (Fig. 13g)

Tridentate pseudocompound hooks present in first 3 setigers (Fig. 13h–l): Around 4 to 5 hooks in each fascicle, some with bifid proximal denticles showing tetrudentate appearances (Fig. 13h–k). Pectinate setae flat and oblique with about 10 slightly long teeth each (Fig. 13m). Hooded bidentate subacicular hooks present from setiger 10 (Fig. 13n).

Maxillary formula: 1+1, 7+8, 7+0, 6+11, 1+1 (Fig. 13o).

Methyl green staining pattern. Most parts hardly staining except anterior dorsal cirri and anterior ventral glandular pads; the former moderately staining with distal tips remaining unstained while latter moderately staining more or less homogeneously.

Character variations among specimens. Paratype having tridentate pseudocompound hooks only without any extra denticles.

Remarks. This species resembles *O. iriei* sp. nov. on morphology and distribution of branchiae, pseudocompound hooks and digitiform ventral cirri but clearly differs from it as follows. *O. tosaensis* lacks any eyespots and the transverse pigmentary bands and shows quite poor staining pattern with methyl green different from *O. iriei*.

Etymology. This new species is named after the locality the holotype was collected.

Distribution. Tosa Bay, Pacific Ocean, Japan.

***Onuphis wakasaensis* (Maekawa & Hayashi, 1989)**

(new combination)

(Fig. 14a–j)

Onuphis tetrudentata wakasaensis Maekawa & Hayashi, 1989; 83–85, fig. 13a–j.

Material examined. Holotype (NSMT-Pol. H289) collected from muddy bottom in Wakasa Bay, 35°45'N, 135°35'E, 150 m deep, July 18, 1975. Anterior fragment only with 62 setigers measuring about 28 mm in length and up to 1.5 mm in width excluding parapodia.

Material used for description. Holotype.

Description. Dorsum whitish without any pigmentary spots or bands. Eyespots absent. Ceratophores of palps, lateral antennae and median antenna with 14 rings each, 16 rings each and 7 rings, respectively. First 4 pairs of parapodia directed forward and these with slightly larger main lobes than following ones. Ventral cirri cirri-form in first 5 setigers (Fig. 14a, b), followed by transitory forms on setiger 6, replaced by glandular pads thereafter. Digitiform postsetal lobes distinct in anterior setigers but getting shorter posteriorly and absent from setiger 14 (Fig. 14a–c).

Simple strap-like branchiae starting on setiger 4 through end of fragment (Fig.

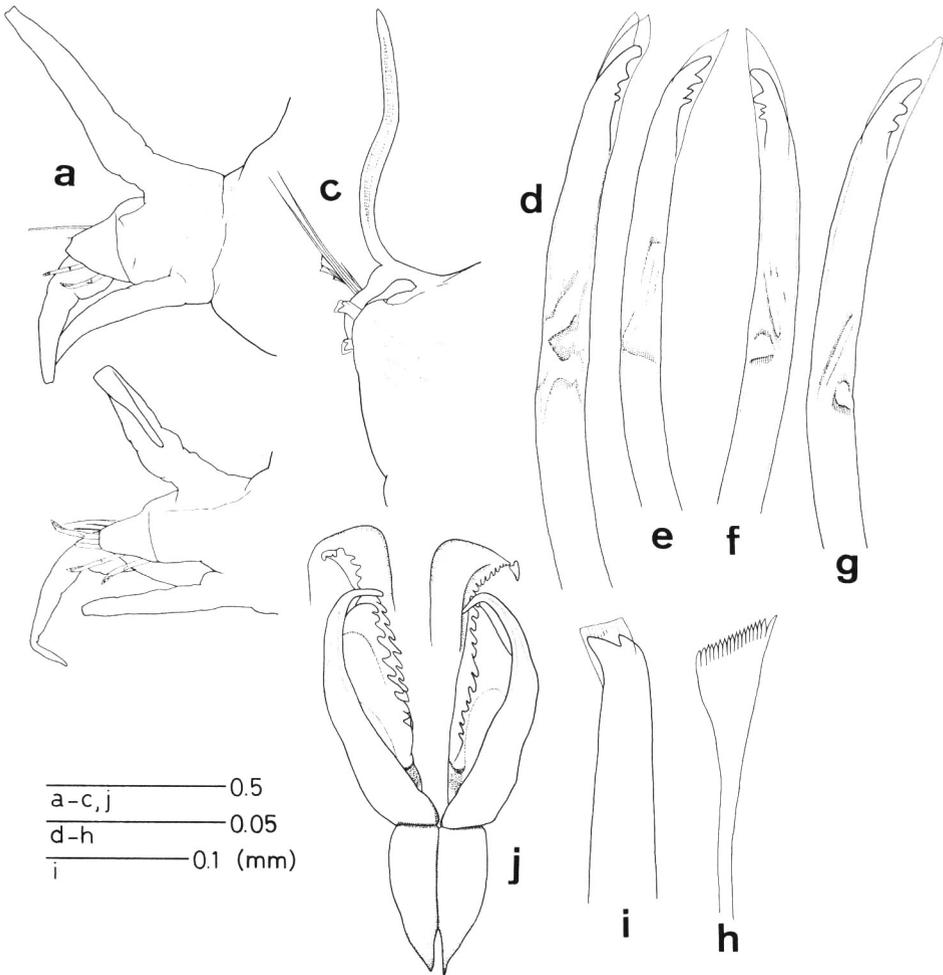


Fig. 14. *Onuphis wakasaensis* (Maekawa & Hayashi, 1989). a; Second parapodium, anterior view, b; third parapodium, anterior view, c; 44th parapodium, anterior view, d; tetradentate pseudocompound hook from first parapodium, e; same from second parapodium, f; same from third parapodium, g; tridentate pseudocompound hook from third parapodium, h; pectinate seta from 44th parapodium, i; bidentate subacicular hook from 44th parapodium, j; maxillae.

14c). Tri- and tetradentate pseudocompound hooks with pointed hoods present in first 4 setigers (Fig. 14d–g); at least 1 tri- and 2 tetradentate hooks on setiger 2, 3 tetradentate hooks on setiger 3 and 1 tetradentate hook on setiger 4. Pectinate setae flat and oblique with about 18 teeth each (Fig. 14h). Hooded bidentate subacicular hooks present from setiger 13 (Fig. 14i).

Maxillary formula: 1+1, 9+8, 9+0, 8+9, 1+1 (Fig. 14j).

Methyl green staining pattern. Frontal, upper and lower lips moderately stain-

ing. Peristomial cirri, ceratostyles of palps, anterior dorsal and ventral cirri, postsetal lobes and anterior branchial filaments moderately staining with distal tips remaining unstained. Each anterior ventral glandular pad with frontal margin moderately staining.

Remarks. Imajima (1986) regarded having tetradentate pseudocompound hooks as the specific diagnostic character when he described *O. tetradentata*. But the recent studies revealed that *O. tetradentata* is not the only species which has tetradentate pseudocompound hooks (Orensanz, 1990; this study). This fact guides us to conclude that there is no reason any more to place this species in the subspecies of *O. tetradentata* only due to having tetradentate pseudocompound hooks. Lacking any dorsal pigmentary spots or bands should be enough to regard as the different species from *O. tetradentata* which has a dorsal transverse band on each segment.

Distribution. Wakasa Bay, the Sea of Japan, Japan.

***Onuphis* sp.**

(Fig. 15a–k)

Onuphis rullieriana Maekawa & Hayashi, 1989; 76–77, fig. 9a–k.

Materials examined. Only one specimen (OMNH-Iv 1639) from muddy bottom in Wakasa Bay, the Sea of Japan, 35°45'N, 135°35'E, 150 m deep, July 18, 1975. Anterior fragment only with 51 setigers measuring about 27 mm in length and up to 2.0 mm in width excluding parapodia.

Material used for description. Same specimen.

Description. Body creamy white in color without any pigmentary spots or bands in preserved condition. Prostomium subtriangular with round tip accompanied by a pair of thumb-like frontal lips (Fig. 15a). Palps reaching setiger 2 with 9 rings each on their ceratophores. Lateral antennae reaching setiger 9 with 10 rings each on their ceratophores. Median antenna with 7 rings on its ceratophore (ceratostyle missing).

Eyespots absent. A pair of peristomial cirri present at anterior margin of peristomium, extending as long as peristomium length (Fig. 15a).

First 4 pairs of parapodia directed slightly forward and these with slightly longer main lobes than following ones (Fig. 15a). Distinct contraction folds present at bases of dorsal cirri (Fig. 15c–d). Ventral cirri cirriform in first 5 setigers, followed by transitory forms on setigers 6 and 7, replaced by glandular pads thereafter (Fig. 15b–e). Digitiform postsetal lobes distinct in first 12 setigers, small and conical in shape thereafter (Fig. 15b–e).

Simple and strap-like branchiae present from setiger 2 through end of fragment (Fig. 15b–e).

Tridentate pseudocompound hooks with pointed hoods present in first 4 setigers (Fig. 15f, g). Pectinate setae flat and oblique with about 16 teeth (Fig. 15i). Hooded

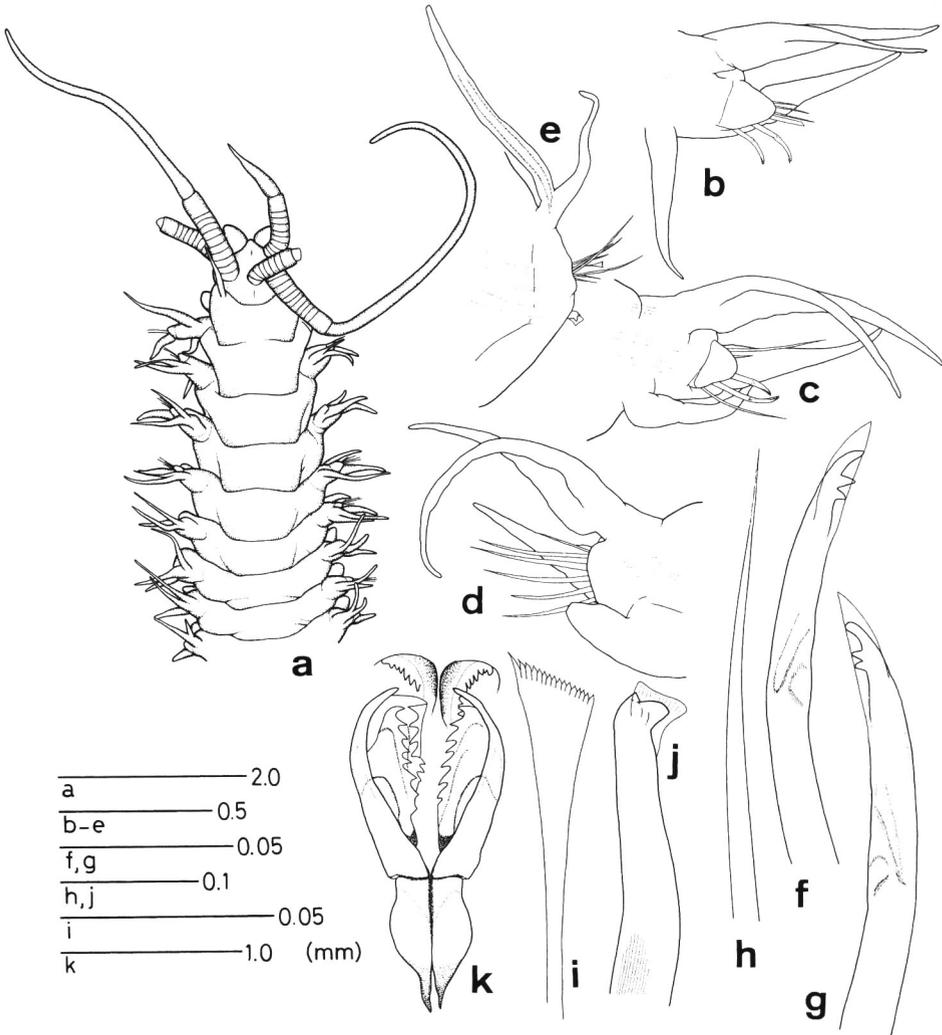


Fig. 15. *Onuphis* sp. a; Anterior end, dorsal view, b; second parapodium, anterior view, c; fourth parapodium, anterior view, d; sixth parapodium, anterior view, e; 30th parapodium, anterior view, f; tridentate pseudocompound hook from second parapodium, g; same from fourth parapodium, h; simple seta from fourth parapodium, i; pectinate seta from 30th parapodium, j; bidentate subacicular hook from 30th parapodium, k; maxillae.

bidentate subacicular hooks present from setiger 13 (Fig. 15j).

Maxillary formula: 1+1, 8+7, 7+0, 6+12, 1+1 (Fig. 15k).

Methyl green staining pattern. Frontal, upper and lower lips deeply staining; upper lips with more deeply staining outer margins. Peristomial cirri weakly staining. Ceratostyles of palps, anterior dorsal and ventral cirri and postsetal lobes deeply

staining with distal tips remaining unstained. Branchial filaments remaining unstained. Each anterior ventral glandular pad with moderately staining anterior half. Two faint transverse bands on the ventral surface of each anterior segment up to setiger 10.

Remarks. This species resembles *O. lithobiformis* Fauchald, 1982b (= *O. pseudoiridescens* Averincev, 1972 according to Orensanz (1990)) sharing most of the characters including having contraction folds at the bases of the dorsal cirri. Methyl green staining patterns are almost the same as well. One of the morphological differences lies on the maxillary formula: MIII is 7+0 in *Onuphis* sp. and 4+0 in *O. lithobiformis*, respectively. The body colors in preserved condition are also different: While all paratype specimens of *O. lithobiformis* examined (USNM-067490) are dark brown, this species is creamy white. But these morphological differences seem to be still insufficient. Although the localities where both species come from are completely different (South Atlantic Ocean off Falkland Islands for *O. lithobiformis* and the Sea of Japan, Northwest Pacific for *Onuphis* sp.), we should leave it as *Onuphis* sp. until we have more materials.

Distribution. In and offshore of Wakasa Bay, the Sea of Japan, Japan

The following 7 species have also been described around Japan and the adjacent seas by other authors, but were not examined in this study. According to their original descriptions, these species are characterized morphologically as follows:

***Onuphis chinensis* Uschakov & Wu, 1962**

Onuphis chinensis Uschakov & Wu, 1962; 131–132, pl. 4a–g.

Onuphis chinensis Fauchald, 1982a; 44.

Branchiae present from setiger 1 as a simple strap-like filament, but branching posteriorly from setiger 72 with trifold filaments maximally. Ventral cirri present in first 6 setigers. Digitiform postsetal lobes distinct in first 10 setigers. Bi- and tridentate pseudocompound hooks present in first 5 setigers.

***Onuphis fuscata* Imajima, 1986**

Onuphis fuscata Imajima, 1986; 104–106, fig. 6a–r.

Body with a brown transverse dorsal band on each segment. One pair of eyespots present. Whole jaw apparatus amber colored. Ventral cirri present in first 5 setigers. Digitiform postsetal lobes distinct in first 10 setigers. Branchiae present from setiger 3 as a simple strap-like filament and never branched. Tridentate pseudocompound hooks present in first 5 setigers. Most parts deeply staining with methyl green; only tentacular cirri faintly staining. Transverse bands occurring on ventral surface of about anterior 20 setigers.

Onuphis iridescens (Johnson, 1901) (?)

Onuphis (Nothria) iridescens Uschakov & Wu, 1962; 132–133.

Ventral cirri present in first 6 to 7 setigers. Branchiae starting from setigers 1 to 4; each branchia simple and strap-like. Bi- and tridentate pseudocompound hooks present in first 4 setigers.

Remarks. According to Orensanz (1990), several species had ever been incorrectly identified as *O. iridescens*: They include *O. pseudoiridescens* Averincev, 1972, *O. lithobiformis* Fauchald, 1982b, *O. heterodontata* Fauchald, 1982b and other possible species, although both *O. lithobiformis* and *O. heterodontata* were synonymized as *O. pseudoiridescens* later by Orensanz. It is, therefore, very difficult at this moment to decide whether this species was correctly identified since the description is insufficient without any figures. Bidentate pseudocompound hook is not known in *O. iridescens* (Johnson, 1901) (Fauchald, 1982a; Hilbig, 1995).

Onuphis longisetosa Imajima, 1986

Onuphis longisetosa Imajima, 1986; 106–107, fig. 7a–p.

One pair of eyespots present. Ventral cirri present in first 5 setigers. Digitiform postsetal lobes distinct in first 30 setigers. Branchiae present from setiger 1 as a simple strap-like filament, then bifid from setiger 24. Bi- and tridentate pseudocompound hooks present in first 5 setigers. Two types of pseudocompound hooks, thin elongated and thick short ones, present. Most parts deeply staining with methyl green; only lower lips faintly staining. Clear transverse bands occurring on ventral surface of each segment.

Onuphis nonpectinata Imajima, 1986

Onuphis nonpectinata Imajima, 1986; 99–101, fig. 4a–p

Two pairs of eyespots present. Ventral cirri cirriform in first 4 setigers, followed by transitory forms in following several setigers, replaced by glandular pads thereafter. Digitiform postsetal lobes distinct in first 10 setigers. Branchiae present from setiger 5 as a simple strap-like filament. Tridentate pseudocompound hooks present in first 3 setigers. Without pectinate setae.

Onuphis punggolensis Tan & Chou, 1998

Onuphis punggolensis Tan & Chou, 1998; 129–131, fig. 2a–n.

Distinct pigmentary spots and bands present on anterior dorsum. One pair of eyespots present. Ventral cirri present in first 8 setigers. Digitiform postsetal lobes

distinct in first 14 setigers. Branchiae present from setiger 1 as a simple strap-like filament, then branching from setiger 17 with maximally 4 branchial filaments. Tridentate pseudocompound hooks present in first 3 setigers. Bidentate subacicular hooks present from setiger 10.

Onuphis variolata Shoupeng, 1987

Onuphis variolata Shoupeng, 1987; 221–226, fig. 2.1–15.

Distinct pigmentary transverse bands present on anterior dorsum. Ventral cirri cirriform in first 6 setigers. Branchiae present from setiger 1 as a simple strap-like filament, then branching posteriorly with maximally 4 branchial filaments from setigers 19 to 30. Bi- and tridentate pseudocompound hooks with blunt hoods present in first 8 setigers. Bidentate subacicular hooks present from setiger 10.

2. Zoogeographical accounts

Adding 6 new and 1 undetermined species and 1 new combination described here, 23 species belonging to the genus *Onuphis* have been known from the Japanese waters and the adjacent seas including one questionable species (*O. iridescens?*). They consist of almost as many as half of ever described species and subspecies of *Onuphis* world-wide (more than 40 species including 4 not given the species names yet and 2 subspecies; see Table 1). In addition, the recent taxonomic studies of the family Onuphidae carried out from some Japanese coastal regions clearly showed that about half of the species consisting of each local onuphid fauna belong to this genus (Imajima, 1986; Maekawa & Hayashi, 1989). These facts precisely follow the previous indications that this genus is more representative in the western Pacific Ocean and the Indian Ocean (Fauchald, 1982a; Paxton, 1986).

In spite of such prosperity of this genus in the Japanese onuphid fauna, each species shows a more or less restricted distribution pattern.

In Figure 16 the collecting sites are shown for each *Onuphis* species described above excluding four species; for two species from Yellow Sea, *O. chinensis* and *O. iridescens* (?), collecting sites are poorly shown in the original description and for the remaining two species, *O. variolata* and *O. punggolensis* described from South China Sea and off Singapore, respectively, collecting sites could not be included in this figure.

As seen in this figure, *Onuphis* species seem to be included in any local sediment bottom polychaete fauna all over the Japanese coast. This figure also clearly shows that *Onuphis* fauna tends to be more diverse in the northeastern part than the southwestern part. In addition, it is quite interesting to see that the faunal elements are highly segregated between both geographical areas: While the northeastern elements include *O. fuscata*, *O. geophiliformis*, *O. hokkaiensis* sp. nov., *O. holobranchi-*

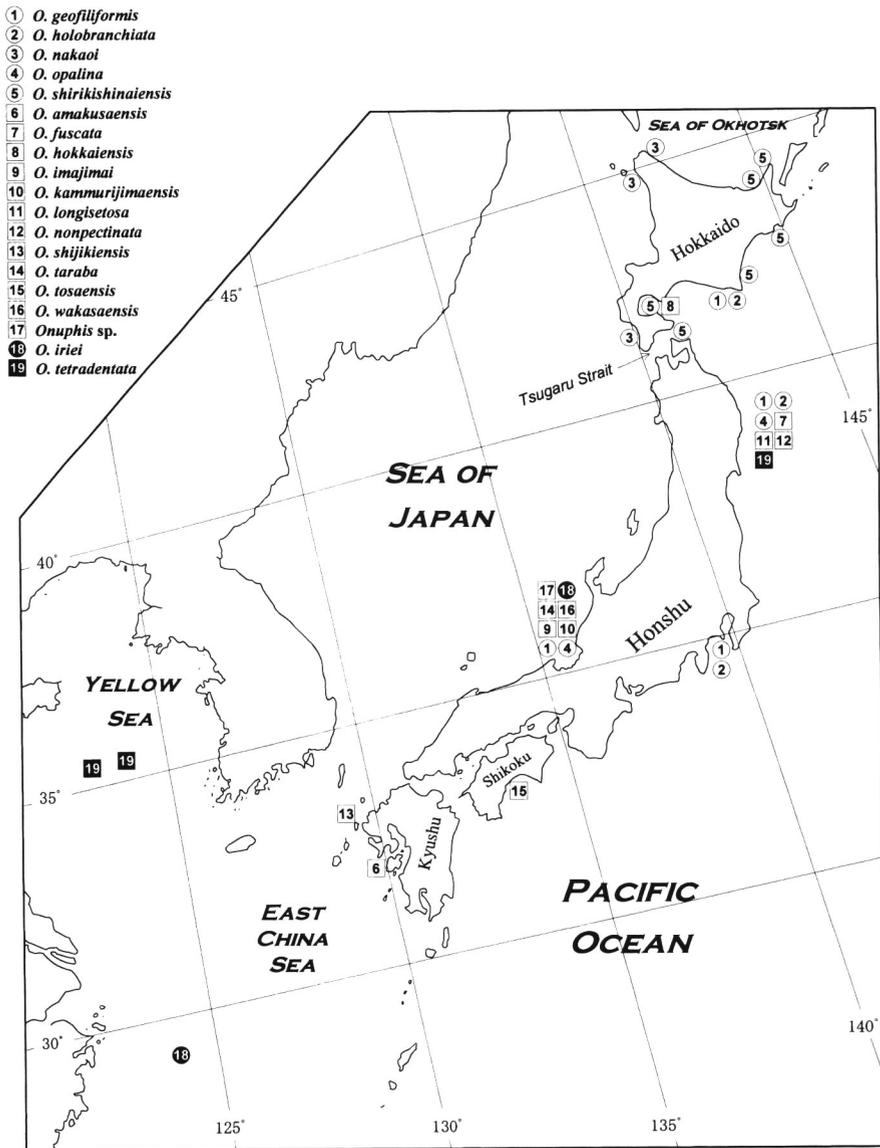


Fig. 16. Distribution of 19 *Onuphis* species ever described around Japanese coast and the adjacent seas. *O. chinensis* and *O. iridescens* (?) were omitted in this figure due to lack of the information on the exact collecting sites of these two species. *O. variolata* from South China Sea and *O. punggolensis* from Singapore were also omitted since the original collecting sites could not be included in this figure. Symbols mean as follows. Circle; species collected from more than two collecting sites in either northeastern (open circle) or southwestern (solid circle) areas. Solid square; species collected both northeastern and southwestern areas. Open square; species whose collections were restricted to single collecting sites.

Table 1. Geographical occurrences of *Onuphis* species

Species	Atlantic		Pacific		Indian Ocean
	East	West	East	West	
<i>O. falesia</i>	○ ¹⁾				
<i>O. rullieriana</i>	○				
<i>O. geophiliformis</i>	○ ²⁾		○ ³⁾	●	○ ⁴⁾
<i>O. eremita</i>	○				
<i>O. declivorum</i>		○ ⁵⁾			
<i>O. eremita oculata</i>		○			
<i>O. heterodontata*</i>		○ ⁵⁾			
<i>O. lithobiformis*</i>		○ ⁵⁾			
<i>O. pseudoiridescens</i>		○ ⁶⁾			
<i>O. texana</i>		○ ⁵⁾			
<i>Onuphis</i> sp. A		○ ⁷⁾			
<i>O. opalina</i>		○		●	
<i>O. iridescens</i>		○* ⁸⁾	○	○(?)* ⁹⁾	
<i>O. affinis</i>			○ ³⁾		
<i>O. elegans</i>			○		
<i>O. eremita parva</i>			○		
<i>O. farallonensis</i>			○		
<i>O. mexicana</i>			○		
<i>O. multiannulata</i>			○ ¹⁰⁾		
<i>O. pallida</i>			○		
<i>O. similis</i>			○		
<i>O. vibex</i>			○		
<i>Onuphis</i> sp. (intermediate)			○ ¹¹⁾		
<i>O. amakusaensis</i> sp. nov.				●	
<i>O. branchiata</i>				○	
<i>O. chinensis</i>				○	
<i>O. fuscata</i>				○ ¹²⁾	
<i>O. holobranchiata</i>				●	
<i>O. hokkaiensis</i> sp. nov.				●	
<i>O. imajimai</i>				●	
<i>O. iriei</i> sp. nov.				●	
<i>O. kammurijimaensis</i>				●	
<i>O. longisetosa</i>				○ ¹²⁾	
<i>O. nakaoui</i> sp. nov.				●	
<i>O. nonpectinata</i>				○ ¹²⁾	
<i>O. punggolensis</i>				○ ¹³⁾	
<i>O. shijikiensis</i> sp. nov.				●	
<i>O. shirikishinaiensis</i>				●	
<i>O. taraba</i>				●	
<i>O. tetradentata</i>				●	
<i>O. tosaensis</i> sp. nov.				●	
<i>O. variolata</i>				○ ¹⁴⁾	
<i>O. wakasaensis</i>				●	
<i>Onuphis</i> sp.				●	
<i>Onuphis</i> sp. (abranchiate)				○ ¹⁵⁾	
<i>O. aucklandensis</i>				○	○ ⁴⁾
<i>O. dibranchiata</i>					○

¹⁾Castelli (1982), ²⁾Day (1967), ³⁾Hilbig (1995), ⁴⁾Fauvel (1953), ⁵⁾Fauchald (1982 b), ⁶⁾Orensanz (1990), ⁷⁾Gathof (1984), ⁸⁾Monro (1930), ⁹⁾Uschakov and Wu (1962), ¹⁰⁾Shisko (1981), ¹¹⁾Hobson (1971), ¹²⁾Imajima (1986), ¹³⁾Tan and Chou (1998), ¹⁴⁾Shoupeng (1987), ¹⁵⁾Paxton (1986). Open circle without numeral based on Fauchald (1982a); solid circle is the species examined here.

*Orensanz (1990) regards these species as the synonyms of *O. pseudoiridescens*.

ata, *O. longisetosa*, *O. nakaoui* sp. nov., *O. nonpectinata*, *O. opalina* and *O. shirikishinaiensis*, the southwestern elements include *O. amakusaensis* sp. nov., *O. iriei* sp. nov., *O. shijikiensis* sp. nov., *O. tosaensis* sp. nov., *O. punggolensis* and *O. variolata*. Only *O. tetradentata* occurs to both geographical areas. Besides this, there are also quite a few species whose occurrences are limited to single restricted collecting sites. They include *O. amakusaensis*, *O. fuscata*, *O. hokkaiensis*, *O. imajimai*, *O. kammurijimaensis*, *O. longisetosa*, *O. nonpectinata*, *O. punggolensis*, *O. shijikiensis*, *O. taraba*, *O. tosaensis*, *O. variolata*, *O. wakasaensis* (new combination) and *Onuphis* sp. A somewhat unique faunal pattern is observed in Wakasa Bay and its adjacent area where both the northeastern and the southwestern elements occur sympatrically although the former elements fairly dominate.

It is interesting to point out here that the same tendency is also recognized on the global scale as well. As shown in Table 1 most species of *Onuphis* have been reported from restricted specific sea areas. Paxton (1986) also points out that the individual species of *Onuphis* as well as *Kinbergonuphis* and *Mooreonuphis* has relatively limited geographical distribution. When we pay attention to the fact that most *Onuphis* species show somewhat restricted distributions, it seems quite probable to expect that much more undescribed *Onuphis* species would be discovered as the investigation extends to the areas which have never been surveyed yet, especially around the Japanese coasts and its neighboring areas.

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