

Serpulinae (Annelida, Polychaeta) from Japan

I. The Genus *Hydroides*

By

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Five, maybe six, species of the genus *Hydroides* have been reported from Japan by MÖRCH (1863), GRUBE (1878), MARENZELLER (1884), MCINTOSH (1885), OKUDA (1934, 1938, 1939), FAUVEL (1936), KAWAHARA (1961, 1965, 1969), KAZIHARA (1964), ARAKAWA (1971), YAMAMURA (1972), viz.: *Hydroides fusicola* (MÖRCH, 1863), *H. exaltata* (MARENZELLER, 1884), *H. multispinosa* MARENZELLER, 1884, *H. norvegica* GUNNERUS, 1768, and *H. ezoensis* OKUDA, 1934. The last-named might prove to be synonymous with *H. diplochone* GRUBE, 1878. Recently, six more species have been recorded, viz.: *Hydroides fusca* IMAJIMA, 1976, *H. tuberculata* IMAJIMA, 1976, *H. tambalagamensis* PILLAI, 1961, *H. externispina* STRAUGHAN, 1967, *H. minax* (GRUBE, 1878), *H. albiceps* (GRUBE, 1870), based upon the material obtained from the island Tanega-shima, southern Japan (IMAJIMA, 1976).

In the present paper, 12 species including one new species (*H. longispinosa*) are recognized. *Hydroides norvegica*, reported from Ago Bay, Hiroshima Bay, Nagasaki Harbour, etc., as one of the principal fouling species, is here referred to *H. elegans* (HASWELL, 1883); *H. uncinata*, as mentioned by OKUDA (1937, 1938), USCHAKOV (1955) and CHLEBOVITSCH (1961), is referred to *H. fusicola* MÖRCH, 1863.

Most specimens were collected by the author, while others were collected by various persons as stated in *Material examined*.

The author wishes to express his thanks to Dr. H. A. TEN HOVE of the Laboratory for Zoological Ecology and Taxonomy, Utrecht, the Netherlands for critically reading the manuscript and for valuable suggestions with regard to the taxonomic problems.

The bulk of the collections, including type-specimens, has been deposited in the National Science Museum, Tokyo; a small part is in the collection TEN HOVE, Utrecht, nrs tHU 241-250.

Hydroides GUNNERUS, 1768

(including *Eupomatus* PHILIPPI, 1844)

The body is nearly symmetrical and consists of 7 thoracic setigerous segments and numerous abdominal ones. The branchiae are arranged in two circles, inserted dorsally; gill-radioles are not connected by a branchial membrane. The branchial crown has one operculum which is a modified dorsal gill-radiole. At the side opposite

to the operculum there is a rudimentary or pseudo-operculum. Sometimes there are two fully grown opercula. The peduncle is smooth cylindrical, without wings. The operculum consists of a proximal funnel with fused radii, and a distal crown of several horny spines, arising from the centre of the funnel. The collar is trilobed, with one ventral lobe and two latero-dorsal ones, which are continuous with the thoracic membranes. The latter are united ventrally on first abdominal segment. The thorax has 7 segments, 6 of which are uncinigerous. The collar setae are capillaries and bayonet-shaped setae. The remaining thoracic setae are limbate capillaries. The thoracic uncini have about 6 coarse teeth in a single row. The abdominal setae are trumpet-shaped distally, with about 20 minute teeth in one row. The abdominal uncini are similar to those of the thorax, but smaller. The tube is calcareous and is trapezoidal to circular in cross-section, with two to three longitudinal ridges.

Key to the Species of the Genus *Hydroides* from Japan

1. Spines of opercular crown all similar in size and form 2
- 1'. Spines of opercular crown dissimilar, with 1 or 2 enlarged spines 8
2. Spines of opercular crown with lateral processes 3
- 2'. Spines of opercular crown without lateral processes 6
3. Each spine with a pair of lateral processes, a median process and a basal radial process *H. tambalagamensis* PILLAI
- 3'. Each spine with several pairs of lateral processes 4
4. Each spine with 2 to 4 pairs of lateral processes; central spine short, smooth; collar setae with large subapical denticulate zone *H. elegans* (HASWELL)
- 4'. Each spine with 7 to 8 pairs of lateral processes. 5
5. Spines with 15 to 18 accessory teeth on their inner side; central spine long, with many spiculate processes; collar setae with small subapical denticulate zone. *H. longispinosa* sp. nov.
- 5'. Spines with 3 to 4 small accessory teeth on their inner side; central spine short and smooth; collar setae with large subapical denticulate zone *H. multispinosa* MARENZELLER
6. Spines black and inwardly curved distally, with a radial inwardly curved prong *H. fusca* IMAJIMA
- 6'. Spines pale brown and distally curved outwards 7
7. Spines with a series of accessory teeth on inner side *H. ezoensis* OKUDA
- 7'. Spines without series of accessory teeth on inner side, but with a knob-like radial basal tooth *H. fusicola* MÖRCH
8. Dorsal spine vesicular *H. albiceps* (GRUBE)
- 8'. Dorsal spine an enlarged hook 9
9. All spines with lateral processes directed outwards *H. externispina* STRAUGHAN
- 9'. Smaller spines without lateral processes 10

10. Enlarged hook with a pair of lateral hooklets *H. minax* (GRUBE)
 10'. Enlarged hook without lateral processes 11
 11. Smaller spines are concave valves with a swelling at their shoulders
 *H. tuberculata* IMAJIMA
 11'. Smaller spines curved outwards and distally pointed
 *H. exaltata* (MARENZELLER)

***Hydroides fusca* IMAJIMA, 1976**

Hydroides fusca IMAJIMA, 1976, pp. 130–131, fig. 6, a–i.

Material examined. Tsushima Strait, 64–115 m, 2–VIII–1968 (11); off Nejime, Kagoshima Bay, 60 m, 8–I–1974 (2); off Tanega-shima, 80 m, 16–VI–1975 (1).

Diagnosis. The largest specimen measures 18 mm in length and 0.7 mm in width in the thorax; it consists of 93 segments including the thoracic ones.

The branchiae have 10 to 12 gill-radioles on either side. The opercular funnel has 20 to 25 sharply pointed radii, curved outwards; the tips of the radii are darkish. The opercular crown has 7 to 9 glossy black horny spines; all spines end in a centrally recurved hook, and have an incurved basal radial prong.

The collar setae are limbate capillaries and bayonet-shaped setae with four large teeth, two small ones and a striated subapical zone. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 7 to 8 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 6 to 7 teeth. The tube is cylindrical, with two longitudinal ridges and many growth rings.

Distribution. Southern Japan.

***Hydroides tambalagamensis* PILLAI, 1961**

Hydroides tambalagamensis PILLAI, 1961, pp. 36–38, fig. 12, A–G; STRAUGHAN, 1967 b, p. 33, fig. 3, g; KOHN & LLOYD, 1973, p. 387; IMAJIMA, 1976, pp. 123–126, fig. 2, a–j.

Material examined. Ankyaba, Kakeroma Islet, Amami-Oshima, underside of coral on reef, 1 m, 22–IV–1967 (1); Tanega-shima, underside of coral on reef, 1 m (7), 30 m (2), 12–16–VI–1975.

Diagnosis. The largest specimen measures 15 mm in length and 1 mm in width in the thorax; it consists of 103 segments including the thoracic ones.

The branchiae have 11 to 13 gill-radioles on either side. The opercular funnel has 27 to 37 sharply pointed radii, curved outwards; the tips of the radii are dark brown. The opercular crown has 6 to 8 subequally sized dark brownish spines; all spines are curved outwards and have a pair of outwardly curved lateral spines at about half of their length, an inwardly curved radial spine at the same level or slightly above, and a small basal radial spine.

The collar setae are capillaries and bayonet-shaped setae with two large teeth and a striated subapical zone. The remaining thoracic setae are limbate capillaries;

the thoracic uncini have 6 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 5 teeth. The tube is sub-trapezoidal in cross-section, with two longitudinal ridges and some indefinite growth rings.

Distribution. Sri Lanka; Sumatra; Australia; Southern Japan.

***Hydroides externispina* STRAUGHAN, 1967**

Hydroides externispina STRAUGHAN, 1967 b, pp. 31–33, fig. 3, a–f; IMAJIMA, 1976, pp. 126–127, fig. 3, a–k.

Material examined. Off Tanega-shima, 70 m, 15–VI–1975 (9).

Diagnosis. The largest specimen measures 13 mm in length and 0.8 mm in width in the thorax; it consists of 85 segments including the thoracic ones.

The branchiae have 11 to 13 gill-radioles on either side. The opercular funnel has 24 to 27 sharply pointed radii, curved outwards. The opercular crown has 8 spines, including 2 large spines curved over the others. The remaining six spines have a distinct terminal hook pointing outwards and a nearly terminal one pointing downwards and inwards. All spines have a pair of darkish lateral hooks, curved outwards at about two-thirds of their length, and a small basal radial spine.

The collar setae are fine limbate capillaries and bayonet-shaped setae with two large, conical teeth. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 6 to 7 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 5 to 6 teeth. The tube is sub-trapezoidal to semi-circular in cross-section, with three longitudinal ridges.

Distribution. Australia; Southern Japan.

***Hydroides exaltata* (MARENZELLER, 1884)**

Eupomatus exaltatus MARENZELLER, 1884, p. 217, pl. 4, fig. 3; WILLEY, 1905, pp. 312–313, pl. 7, fig. 182; PIXELL, 1913, pp. 77–78, pl. 8, fig. 4; IMAJIMA & HARTMAN, 1964, p. 368; MOHAMMAD, 1971, p. 301.

Hydroides (Eupomatus) exaltatus: AUGENER, 1914, pp. 142–144.

Hydroides exaltata: FAUVEL, 1953, p. 461; DEW, 1959, pp. 27–28, fig. 6, A; PILLAI, 1960, pp. 10–12, text-fig. 4, A–E; STRAUGHAN, 1967 a, p. 220; KUMARASWAMY ACHARI, 1969, p. 40; KOHN & LLOYD, 1973, p. 387; IMAJIMA, 1976, pp. 127–128, fig. 4, a–j.

Material examined. Amakusa, Kyushu, 8–X–1963 (5); off Kumano, Mie Pref., 10 m, VI–1966 (17); Mukaishima, Hiroshima Pref., 12–X–1966 (3); Koniya, Amami-Oshima, on shell of pearl-oyster, *Pteria (Magnavricula) penguin*, 10–IV–1967 (14); Miyano-hama, Chichi-jima, Ogasawara Is., underside of corals on reef, 12–VII–1969 (4); Tanega-shima, on shell of pearl-oyster, *Pinctada margaritifera* (6), 30 m (11), 12–15–VI–1975.

Diagnosis. The largest specimen is about 20 mm in length, including branchiae, and 1.5 mm in width in the thorax; it consists of about 100 segments including the thoracic ones.

The branchiae have 15 to 16 gill-radioles on either side. The opercular funnel

has 25 to 28 marginal radii with pointed tips, curved outwards. The opercular crown has 6 to 9 spines, including a large dorsal spine. The small spines are directed outwards, and the most dorsal spine is much larger and sickle-shaped with a curved terminal hook. All spines have a small basal radial spine.

The collar setae are limbate capillaries and bayonet-shaped setae with two conical teeth; each fascicle has one or two bayonet-shaped setae with only one conical tooth. The remaining thoracic setae are limbate capillaries; the uncini have 6 to 7 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 5 to 6 teeth. The tube is sub-trapezoidal in cross-section, with three low longitudinal ridges and many growth rings.

Distribution. Red Sea; Arabian Gulf; Sri Lanka and S. India; Sumatra; W. and E. Australia; Japan; Solomon Islands.

Hydroides tuberculata IMAJIMA, 1976

Hydroides brachyacantha: DEW, 1959, pp. 28–29, fig. 7 [not RIOJA]; STRAUGHAN, 1967 a, p. 222.

Hydroides tuberculata IMAJIMA, 1976, pp. 132–133, fig. 7, a–j.

Material examined. Off Kumano, Mie Pref., 10 m, 10–VI–1966 (8); Koniya, Amami-Oshima, on shell of pearl-oyster, *Pteria (Magnavricula) penguin*, 18–IV–1967 (2); Tanega-shima, on shell of pearl-oyster, *Pinctada margaritifera* (4), underside of corals on reef (1), 30–70 m (12), 12~16–VI–1975.

Diagnosis. The largest specimen measures 23 mm in length and 0.8 mm in width in the thorax; it consists of 93 segments including the thoracic ones.

The branchiae have 7 to 9 gill-radioles on either side. The opercular funnel has 22 to 25 pointed radii, curved outwards; all radii are dark-brown in colour distally. The opercular crown has 5 spines; the most dorsal spine is larger than the other ones and has a longer or shorter distal end, curved inwards. The four remaining spines are concave valves, with a small external swelling at their shoulder and an accessory basal radial spine.

The collar setae are capillaries and bayonet-shaped setae with two large conical teeth and some small accessory teeth. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 6 to 8 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 5 to 8 teeth. The tube is sub-trapezoidal to semi-circular in cross-section, with two longitudinal ridges.

Distribution. Japan; Australia.

Hydroides minax (GRUBE, 1878)

Serpula minax GRUBE, 1878, p. 269, pl. 15, fig. 5.

Eupomatus minax: WILLEY, 1905, p. 314.

Serpula (Hydroides) monoceros GRAVIER, 1908, pp. 115–117, fig. 467–472, pl. 8, fig. 288.

Hydroides monoceros: PIXELL, 1913, p. 76; FAUVEL, 1953, p. 460, fig. 241, g; DAY, 1967, p. 808, fig. 38. 4. o–p; STRAUGHAN, 1967 a, p. 221, fig. 6 (n); 1967 b, p. 31; PILLAI, 1971, pp. 110–112, fig. 7, D.

Hydroides minax: FAUVEL, 1953, p. 460, fig. 241, f; PILLAI, 1960, pp. 8–10, text-fig. 3, A–E; 1971, p. 110; GIBBS, 1971, p. 202; IMAJIMA, 1976, pp. 129–130, fig. 5, a–j.

Material examined. Tanega-shima, on shell of pearl-oyster, *Pinctada margaritifera*, 18–VI–1975 (4).

Diagnosis. The largest specimen measures 22 mm in length and 1 mm in width in the thorax; it consists of 106 segments including the thoracic ones.

The branchiae have 16 gill-radioles on either side. The opercular funnel has 32 to 33 radii, which gradually increase in size from the dorsal towards the ventral side of the funnel. The opercular crown has 7 to 9 spines; the most dorsal spine is much larger, with a pair of lateral curved hooks, and is recurved ventrally in a terminal hook.

The collar setae are limbate capillaries and bayonet-shaped setae with two conical teeth. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 5 to 6 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 4 to 5 teeth. The tube is sub-triangular in cross-section, with three serrated longitudinal ridges.

Distribution. Southern Africa; Indian Ocean; Red Sea; Sri Lanka; Australia; Philippines; Japan; Solomon Islands; French Polynesia.

Hydroides albiceps (GRUBE, 1870)

Serpula (Eupomatus) albiceps GRUBE, 1870, pp. 520–521.

Hydroides albiceps: STRAUGHAN, 1967 a, p. 220, fig. 6 (m); IMAJIMA, 1976, pp. 133–135, fig. 8, a–v.

Material examined. Karasu-jima, Tamano, Okayama Pref., 8–V–1964 (2); Usa, Kochi Pref., 12–V–1964 (1); Koniya, Amami-Oshima, on shell of pearl-oyster, *Pteria (Magnavricula) penguin*, 10–IV–1967 (4); Ankyaba, Kakeroma Islet, Amami-Oshima, 12–IV–1967 (5); Tsushima Strait, 95 m, 2–VIII–1968 (1); Kabira Bay, Ishigaki-jima, on shell of pearl-oyster, *Pinctada margaritifera*, 3–VI–1973 (3); Komi, Iriomote-jima, underside of corals on reef, 19–VI–1973 (1); off Nezime, Kagoshima Bay, 60 m, 8–I–1975 (3); Tanega-shima, underside of corals on reef (41), on shell of pearl-oyster, *Pinctada margaritifera* (5), 30–70 m, 18–VI–1975 (63); off Uotsu, Toyama Pref., 40–50 m, 10–III–1976 (1), N. HORII coll.

Diagnosis. The largest specimen measures 35 mm in length and 1.8 mm in width in the thorax; it consists of 125 segments including the thoracic ones.

The branchiae have 14 to 17 gill-radioles on either side. The opercular funnel has 28 to 34 radii with laterally expanded margins. The opercular crown has a stout, vesicular dorsal spine and 10 to 14 elongate bottle-like spines; the dorsal spine is globular towards the centre of the crown, with two dorso-lateral enlargements.

The collar setae are smooth capillaries and bayonet-shaped setae with two conical teeth. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 7 to 8 teeth. The abdominal setae are trumpet-shaped distally; the uncini have 5 to 6 teeth. The tube is sub-trapezoidal in cross-section, with two or three longitudinal ridges.

Distribution. Red Sea; Australia; Japan.

Hydroides fusicola MÖRCH, 1863

(Fig. 1, a-k)

Hydroides (Eupomatus) fusicola MÖRCH, 1863, p. 374; AUGENER, 1925, p. 18.

Hydroides uncinata: OKUDA, 1937, pp. 63–64, text-fig. 10; 1938, p. 104; USCHAKOV, 1955, p. 427, fig. 161, J, K; CHLEBOVITSCH, 1961, p. 233.

Eupomatus uncinatus: IMAJIMA & HARTMAN, 1964, pp. 368–369; UCHIDA, 1968, p. 610.

Hydroides okudai PILLAI, 1972, pp. 10, 15, 23, 25, 26.

Material examined. Shirikishinai, Hakodate, off Atuga, 20 m, Akkeshi, off Tokoro, 30 m, Lake Saroma-ko, Sawaki, Saruru, Irika, in Hokkaido; Rishiri Island; Asamushi, Aomori Pref.; Miyako and Yamada Bays, Iwate Pref.; Matsukawa Bay, 100 m, Fukushima Pref.; Tateyama, Chiba Pref.; off Uotsu, 40–50 m, Toyama Pref.; Mano Bay, Sado Island; Hayama, Kanagawa Pref.; Shimoda, Shizuoka Pref.; Sugasima, Mie Pref.; Mukaishima, Hiroshima Pref.; Korea and Tsushima Straits, 120–207 m; Kagoshima Bay, attached to pearl-oyster, *Pinctada fucata*; Chichijima, Ogasawara Islands.

Description. The largest specimen measures 40 mm in length, including branchiae, and about 2 mm in width in the thorax; it consists of 170 segments including the thoracic ones.

The branchiae have 19 to 22 gill-radioles on either side; the gill-radioles end in enlarged slender tips. The peduncle is inserted to the left or right side at the base of the branchial lobe, just below and between the first and second normal filament.

The opercular funnel has 34 to 38 marginal radii with distally pointed tips. The opercular crown has a spinose circlet of 7 to 20 spines. Each spine of the operculum composed of many spines is long, tapered and delicate (Fig. 1, a); on the other hand, each one of the few spines is short, thick, curved outwards (Fig. 1, b). All spines have a small, basal radial spine (Fig. 1, c).

The collar setae are of two types: fine capillaries (Fig. 1, d) and bayonet-shaped setae with one or two large, conical teeth at the base of the minutely serrated blade (Fig. 1, e, f). The remaining thoracic setae are limbate capillaries (Fig. 1, g). The thoracic uncini are subrectangular, with 6 teeth; the anterior one is the largest (Fig. 1, h). Abdominal setae are trumpet-shaped distally, with about 30 minute teeth in one row (Fig. 1, j). The abdominal uncini are subtriangular, with 6 teeth; they are smaller than those of the thorax (Fig. 1, i).

The tube is white, sub-trapezoidal in cross-section, with two longitudinal ridges and many growth rings; it is 2 to 3 mm in diameter near the mouth (Fig. 1, k). The tubes form aggregated masses on rocks, shells and other hard substrates in the intertidal zone; those at Yamada Bay form a mass together with tubes of *Hydroides ezoensis*.

Remarks. *Hydroides fusicola* resembles *H. novaepommeraniae* AUGENER (1925, pp. 69–70, pl. 1, fig. 5, 5a). The question if the species are synonymous should be solved by comparison of the types, and study of more material.

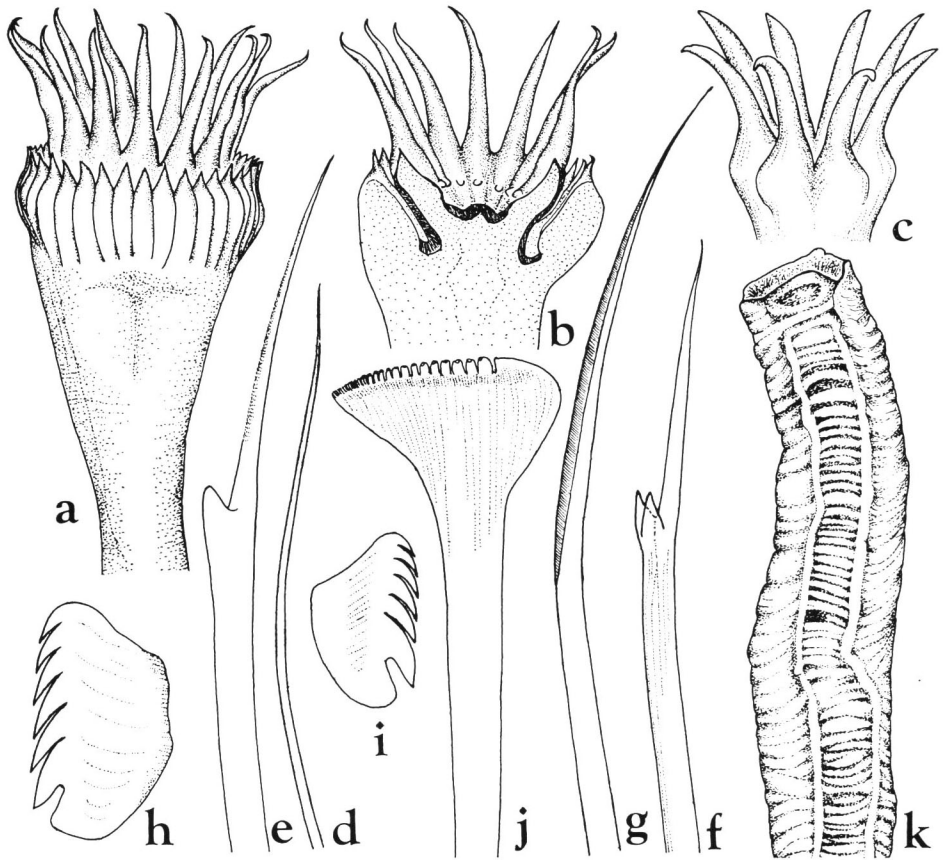


Fig. 1. *Hydroides fusicola* MÖRCH. a, Operculum, in lateral view, $\times 30$; b, Same operculum, half of both funnel and crown removed, $\times 30$; c, Opercular crown with a few spines, in lateral view, $\times 35$; d, Capillary collar seta, $\times 195$; e-f, Bayonet-shaped collar setae with one (e) or two (f) conical teeth, $\times 195$; g, Thoracic seta, $\times 265$; h, Thoracic uncinus, $\times 790$; i, Abdominal seta, $\times 1080$; j, Abdominal uncinus, $\times 790$; k, Tube, $\times 10$.

Distribution. South Kuril; Japan.

Hydroides ezoensis OKUDA, 1934

(Fig. 2, a-o)

Hydroides ezoensis OKUDA, 1934, pp. 239-242, text-figs. 5-7; 1939, p. 243; ICHIKAWA & TAKAGAKI, 1942, pp. 1-8, fig. 1; USCHAKOV, 1955, p. 427, fig. 161, A-I; UCHIDA, YAMADA and others, 1963, p. 19; IMAJIMA & HARTMAN, 1964, p. 369; IMAJIMA & HAYASHI, 1969, p. 6.

Hydroides diplochone: ZAKS, 1933, p. 135.

Material examined. Sawaki, Akkeshi, Samani, Utabetu, Atsuga, Harutachi, Shirikishinai, Hakodate, Moheji, Matsumae, Tomari, Irika, Yoichi in Hokkaido;

Asamushi, Aomori Pref.; Miyako and Yamada Bays, Iwate Pref.; Onagawa, Miyagi Pref.; Uotsu, Toyama Pref., N. HORII coll.; Tsukumo Bay, Noto Peninsula; Mano Bay, Sado Island; Tateyama, Chiba Pref.; Tokyo Bay, attached to buoys; Aburatsubo Bay and Hayama, Kanagawa Pref.; Numazu, Shizuoka Pref., as fouling organisms attaching to pearl-oyster, *Pinctada fucata*; Sugashima, Matoya Bay, Ago Bay and Kumano, Mie Pref.; Shirahama, Wakayama Pref.; Mukaishima, Hiroshima Pref.; Amakusa, Kyushu; Usa, Shikoku.

Description. The body is up to 40 mm in length, including branchiae, and 2 mm in width in the thorax; it consists of about 100 segments including the thoracic ones.

The branchiae have 19 to 22 gill-radioles on either side; the gill-radioles end in moderately long pinnule-free filaments. The peduncle is cylindrical and arises from the left or right side of the branchial lobes.

The opercular funnel has about 50 marginal radii, pointed outwards. The opercular crown has a spinose circlet of about 30 spines, which are fused basally for 1/3 to 2/3 of their length; each spine has 6 to 8 short accessory teeth arranged in one row on its inner side. There is a central smooth tooth, of varying length (Fig. 2, b, c).

The collar setae are of two types: fine capillaries (Fig. 2, d) and bayonet-shaped setae with one conical tooth (Fig. 2, e, f), two symmetrical conical teeth (Fig. 2, g) or two asymmetrical ones (Fig. 2, h, i) at the base of the minutely serrated blade. Specimens from the southern coast of Japan have more often bayonet-shaped setae with one conical tooth only. The remaining thoracic setae have limbate capillaries (Fig. 2, j); the thoracic uncini have 6 to 7 acute teeth, of which the most anterior is the largest (Fig. 2, k). The abdominal uncini are smaller than those of the thorax, with 5 to 6 teeth (Fig. 2, l, m); the abdominal setae are trumpet-shaped distally, with about 20 minute teeth in one row (Fig. 2, n).

The tube is white, more or less irregularly coiled; it is semicircular in cross-section, with two parallel longitudinal ridges (Fig. 2, o). The tubes form large aggregated masses on rocks, shells, roots of kelps and other substrata.

Distribution. Japan; Peter the Great Bay, USSR.

Hydroides elegans (HASWELL, 1883)

(Fig. 3, a-n)

Eupomatus elegans HASWELL, 1883, p. 633, pl. 12, fig. 1.

Hydroides elegans: ZIBROWIUS, 1971, pp. 721-727, figs. 56-64; 1973 a, pp. 42-44; 1973 b, pp. 684-685; TEN HOVE, 1974, p. 46, figs. 1-3.

Hydroides norvegica: FAUVEL, 1936, p. 87; MAWATARI & KOBAYASHI, 1954, p. 39; DEW, 1959, pp. 24-25, fig. A-I; PILLAI, 1960, pp. 12-14, fig. 5, A-E; KAWAHARA & IZIMA, 1960, p. 585; KAWAHARA, 1961, p. 67; 1965, p. 331; 1969, p. 111; IMAJIMA & HARTMAN, 1964, pp. 369-370; KAZIHARA, 1964, p. 22; HARTMAN, 1966, pp. 237-238; IMAJIMA & HAYASHI, 1969, p. 6; ARAKAWA, 1971, pp. 75-82, pl. 9; YAMAMURA, 1972, pp. 2038-2051.

Material examined. Mouth of river Sumida-gawa, Tokyo Bay; Aburatsubo Bay,

Kanagawa Pref.; Numazu, Shizuoka Pref., attached to pearl-oyster, *Pinctada fucata*; Lake Hamana-ko, Shizuoka Pref.; Ago Bay, Mie Pref., Y. YAMAMURA coll., attached to pearl-oyster, *Pinctada fucata*; Shirahama, Wakayama Pref.; Izumi-Otsu, Osaka Bay; Hiroshima Bay, attached to cultured oyster, *Crassostrea gigas*; Nagasaki Harbour, T. OKINO coll.; Amakusa and Kagoshima Bay, Kyushu; Usa, Kochi Pref.; Koniya, Amami-Oshima, attached to pearl-oysters, *Pinctada fucata* and *Pteria (Magnavricula) penguin*.

Description. The body is about 20 mm in length, including operculum, and 1.5 mm in width in the thorax; it consists of 65 to 80 segments including the thoracic ones.

The branchiae have 15 to 19 gill-radioles on either side; the gill-radioles end in a slender, pinnule-free filament.

The opercular funnel has 30 to 42 marginal radii with distally pointed tips. A typical opercular crown has 14 to 17 spines; each spine has 2 to 4 lateral processes and an inner medial row of short, accessory teeth. There is a small central tooth (Fig. 3, a, c). Some aberrant opercular crowns are present: there are but a few inner accessory teeth near the base (Fig. 3, d), or accessory teeth and central tooth are lacking (Fig. 3, b).

The ventral lobe of the collar is slightly depressed in the median part. The collar setae are of two types: limbate capillaries (Fig. 3, e) and bayonet-shaped setae with a well defined apical hairy zone, four to seven small teeth and a large subapical denticulate zone (Fig. 3, f, g, h). The remaining thoracic setae are simple capillaries (Fig. 3, i) and limbate capillaries (Fig. 3, j); the thoracic uncini have 6 to 8 teeth, the most anterior tooth is the largest (Fig. 3, k). Abdominal setae are trumpet-shaped, with about 20 minute teeth in one row (Fig. 3, l); the abdominal uncini are similar to those of the thorax, but are smaller, with 6 to 7 teeth (Fig. 3, m).

The tube is white, sinuous; it is sub-trapezoidal in cross-section with two longitudinal ridges and many transverse wrinkles (Fig. 3, n).

Remarks. The main difference between *Hydroides elegans* and *H. norvegica* may be found in the collar setae, with or without a subapical denticulate zone as mentioned by ZIBROWIUS (1970) and TEN HOVE (1974). Specimens reported previously from Japan as *H. norvegica* were reexamined; all specimens were referred to *H. elegans* by having collar seta with a subapical denticulate zone. Since *H. norvegica* is a typical W. European species it is not to be expected on the Japanese coasts.

Distribution. Australia; W. Europe and Mediterranean Sea; Sri Lanka; Hawaiian Islands; Philippines; Japan; Caribbean Sea.

Hydroides multispinosa MARENZELLER, 1884

(Fig. 4, a-k)

Hydroides multispinosa MARENZELLER, 1884, pp. 216-217, pl. 4, fig. 2; MCINTOSH, 1885, pp. 527-528, pl. 29a, figs. 26, 27; pl. 39a, fig. 12; ZIBROWIUS, 1972, pp. 443-444, fig. 3.
NOT *H. multispinosa*: AUGENER, 1914, pp. 139-142; HARTMAN, 1954, pp. 622, 629; REISH, 1968, p.

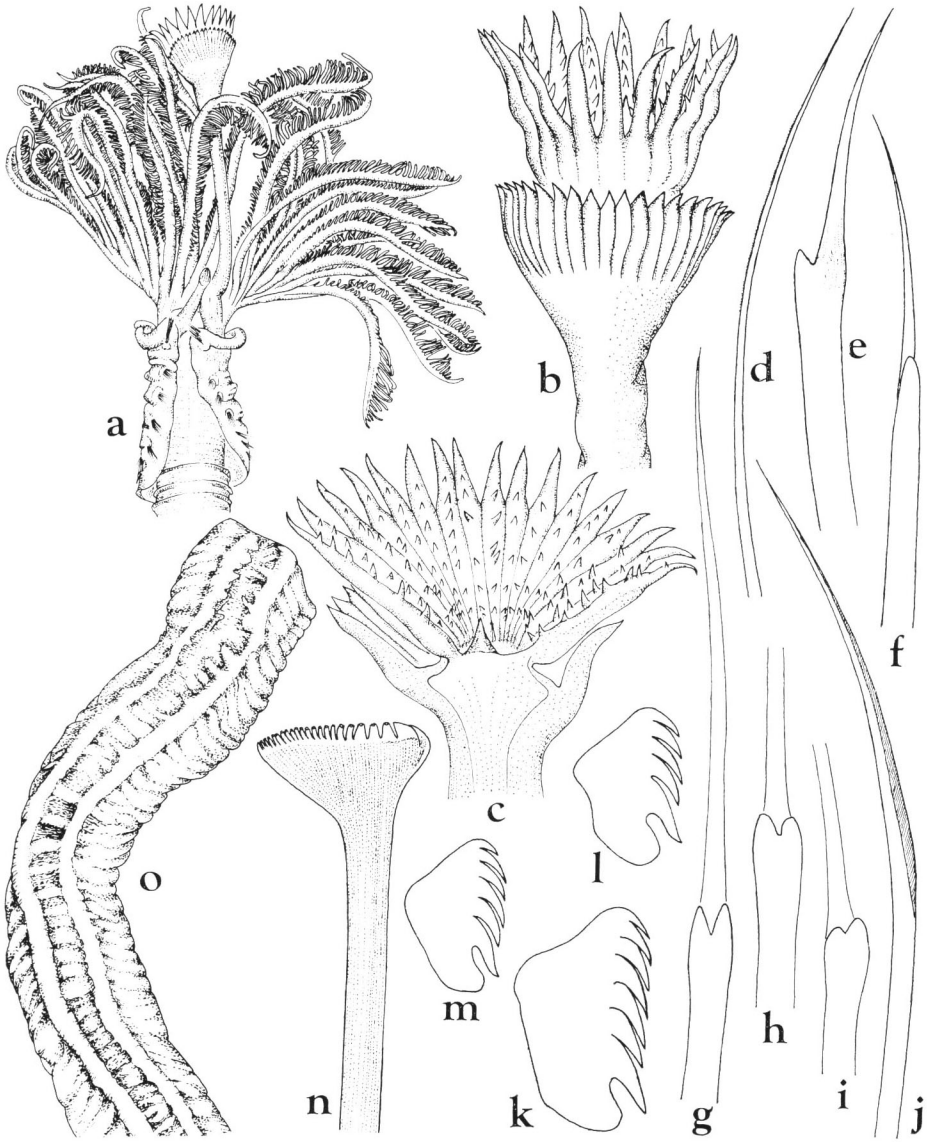


Fig. 2. *Hydroides ezoensis* OKUDA. a, Anterior end, showing branchiae, operculum and thoracic region, in dorsal view, $\times 6$; b, Operculum, in lateral view, $\times 27$; c, Operculum, half of both crown and funnel removed, $\times 25$; d, Capillary collar seta, $\times 180$; e, Bayonet-shaped collar seta with one conical tooth, in lateral view, $\times 180$; f, The same, in frontal view, $\times 180$; g-i, Bayonet-shaped collar setae with two conical teeth, in frontal view, $\times 230$; j, Thoracic seta, $\times 270$; k, Thoracic uncinus, $\times 900$; l-m, Abdominal uncini, with 5 or 6 teeth, $\times 900$; n, Abdominal seta, $\times 950$; o, Tube, $\times 9$.

228; AUGENER, 1927, p. 273; ALLEN & WOOD, 1950, p. 100. These records belong to *H. elegans*.

Material examined. Tomioka Bay, Amakusa, Kyushu, 30 m, 6-V-1965 (2), T. KIKUCHI coll.; Kagoshima Bay, attached to pearl-oyster, *Pinctada fucata*, VI-1970 (5).

Description. The largest specimen measures about 20 mm in length, including branchiae, and 1 mm in width in the thorax; it consists of 54 segments including the thoracic ones.

The branchiae have 10 to 11 gill-radioles on either side; the gill-radioles end in slender, pinnule-free filaments. The peduncle arises from the left side, a rudimentary operculum is present at the opposite side.

The opercular funnel is whitish; it has 26 fleshy marginal radii, with an obtuse distal tip. The opercular crown has 13 spines. Each spine is curved outwards distally; it has 6 to 7 pairs of lateral processes and 3 to 4 inner, medial accessory teeth. There is a small central tooth (Fig. 4, a, b, c).

The collar setae are of two types: bayonet-shaped setae with 3 to 4 small teeth and a large subapical denticulate zone (Fig. 4, d, e), and capillaries with minutely serrated margin (Fig. 4, f). The remaining thoracic setae are thick (Fig. 4, g) and slender (Fig. 4, h) limbate capillaries; the thoracic uncini are subtriangular and have 8 teeth (Fig. 4, i). The abdominal uncini are similar to those of the thorax, but smaller, with 6 teeth (Fig. 4, j). The abdominal setae are trumpet-shaped distally, with 15 to 16 minute marginal teeth in one row; they number three in a fascicle (Fig. 4, k).

The tube is white, thin; it is subcylindrical in cross-section, with many transverse wrinkles. It is about 1.5 mm in diameter near the mouth.

Remarks. *Hydroides multispinosa* is similar to *H. elegans* in form of the operculum and collar setae. However, *H. multispinosa* can be distinguished from *H. elegans* by the spines of the opercular crown, which are elongated, with 6 to 8 lateral processes, instead of rather short spines with 2 to 4 lateral processes. Although ZIBROWIUS (1972, p. 444) does not figure a central tooth in the crown of the operculum of the holotype of *H. multispinosa*, most probably owing to the paucity of his material, the material examined belongs without doubt to this species.

Hydroides multispinosa also resembles *H. azorica* ZIBROWIUS (1972, pp. 435-438, fig. 1) in the form of the operculum. However, the bayonet-shaped collar setae have a large subapical denticulate zone in the former, which is absent in the latter.

Distribution. Southern Japan.

Hydroides longispinosa sp. nov.

(Fig. 5, a-q)

Material examined. Koniya, Amami-Oshima, attached to pearl-oyster, *Pteria (Magnavicula) penguin*, IV-1967 (2); Miyanojima, Chichi-jima, Ogasawara Islands, VII-1969 (3).

Description. The holotypus is the largest specimen from Koniya, the paratypus

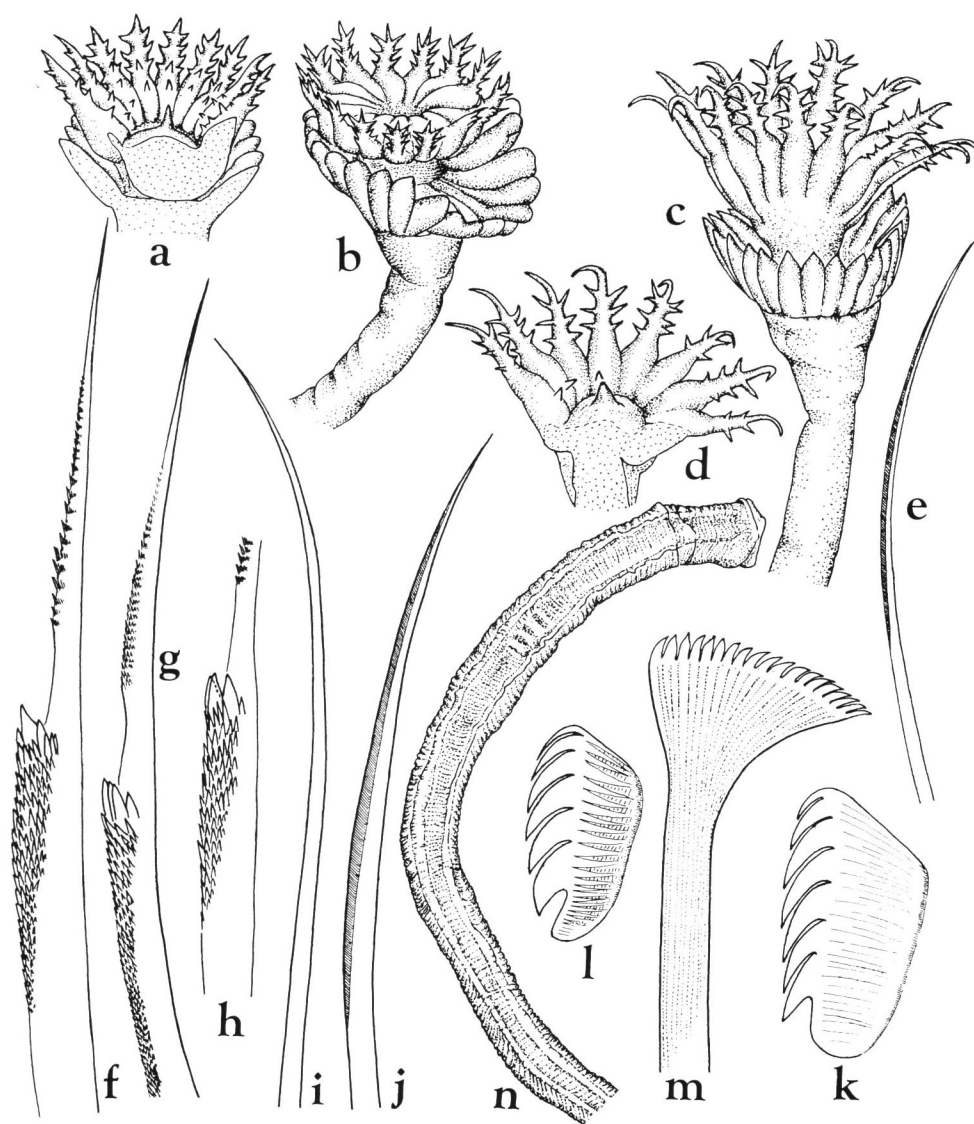


Fig. 3. *Hydroides elegans* (HASWELL). a, Operculum, from Usa, Kochi Pref., half of both crown and funnel removed, $\times 28$; b, Operculum, from Izumi-Otsu, Osaka Bay, $\times 28$; c, Operculum, from Koniya, Amami-Oshima, $\times 28$; d, A half crown of different operculum, $\times 28$; e, Capillary collar seta, $\times 345$; f-h, Bayonet-shaped collar setae, $\times 600$; i-j, Thoracic setae, $\times 840$; k, Thoracic uncinus, $\times 840$; l, Abdominal uncinus, $\times 840$; m, Abdominal seta, $\times 1000$; n, Tube, $\times 7$.

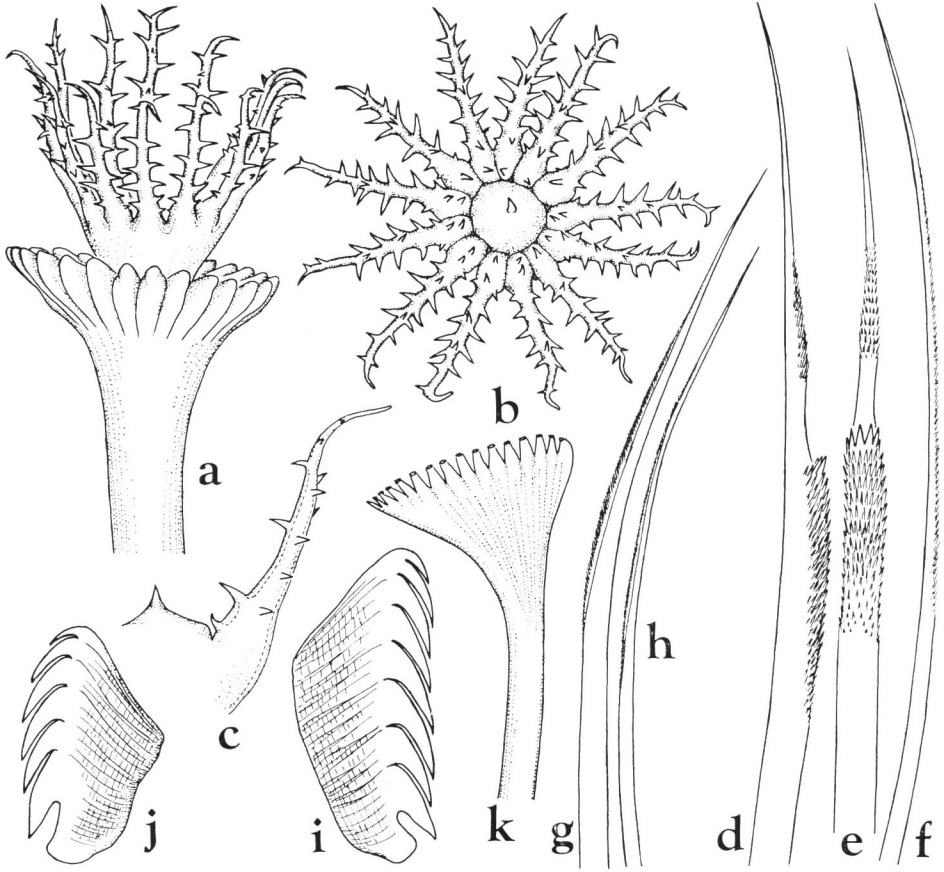


Fig. 4. *Hydroides multispinosa* MARENZELLER. a, Operculum, in lateral view, $\times 40$; b, Opercular crown from above, $\times 40$; c, Part of opercular crown in lateral view, showing the central tooth and a single spine, $\times 64$; d-e, Bayonet-shaped collar setae, in lateral (d) and frontal (e) views, $\times 480$; f, Capillary collar seta, $\times 395$; g-h, Thoracic setae, $\times 345$; i, Thoracic uncinus, $\times 1180$; j, Abdominal uncinus, $\times 1180$; k, Abdominal seta, $\times 1180$.

is the smallest. The former is about 10 mm in length, including branchiae, and 1 mm in width in the thorax, with 48 segments including the thoracic ones. The latter is about 7 mm in length, with 39 segments.

The branchiae have 12 gill-radioles on either side; the gill-radioles have slender pinnule-free tips. The opercular peduncles are inserted to the right.

The opercular funnel is fleshy and has 20 marginal radii with obtuse distal tips (Fig. 5, a, b). The opercular crown has a circle of 15 spines and a long central spine (Fig. 5, c). The spines from the circle are curved outwards, and have 7 to 9 pairs of lateral processes, directed obliquely outwards. All spines also have 15 to 18 accessory

teeth, arranged in a single or double row on the inner side. The most distal accessory tooth of the spine is conspicuous (Fig. 5, d, e, f). The central spine is slightly longer than the other spines; its distal half has about 20 spiculate randomly placed processes, the proximal part is smooth (Fig. 5, c, g). The smaller opercular crown of the paratypus has 14 spines in a circle, with 3 to 4 pairs of lateral processes and a central spine with a few accessory ones (Fig. 5, h, i, j), but its still has the characteristic features of the holotypus.

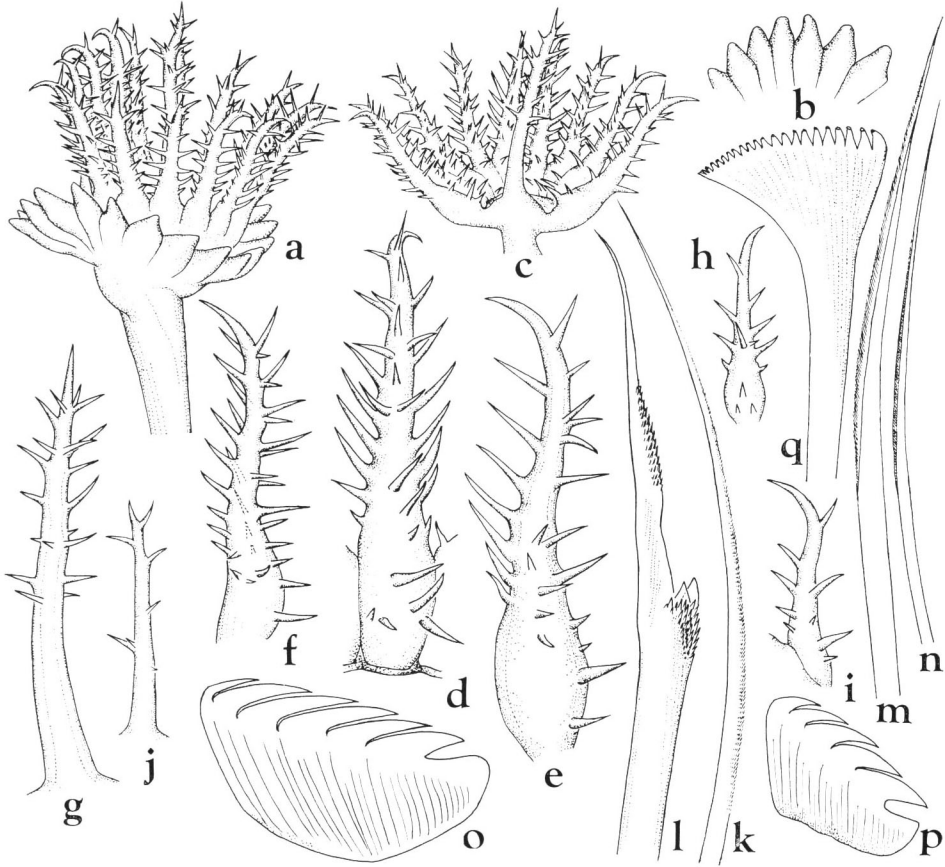


Fig. 5. *Hydroides longispinosa* sp. nov. a, Operculum, in lateral view, $\times 42$; b, Part of opercular funnel from above, $\times 42$; c, Opercular crown, half of the crown removed, showing a long central spine, $\times 42$; d-e, Crown-spines in full (d) and lateral (e) views, $\times 100$; f, Crown-spine from a different specimen, in lateral view, $\times 85$; g, Central spine of the crown, in lateral view, $\times 85$; h-i, Crown-spine of paratypus, in full (h) and lateral (i) views, $\times 85$; j, Central spine of the crown of paratypus, in lateral view, $\times 85$; k, Capillary collar seta, $\times 420$; l, Bayonet-shaped collar seta, in lateral view, $\times 420$; m-n, Thoracic setae, $\times 85$; o, Thoracic uncinus, $\times 1035$; p, Abdominal uncinus, $\times 1035$; q, Abdominal seta, $\times 1035$.

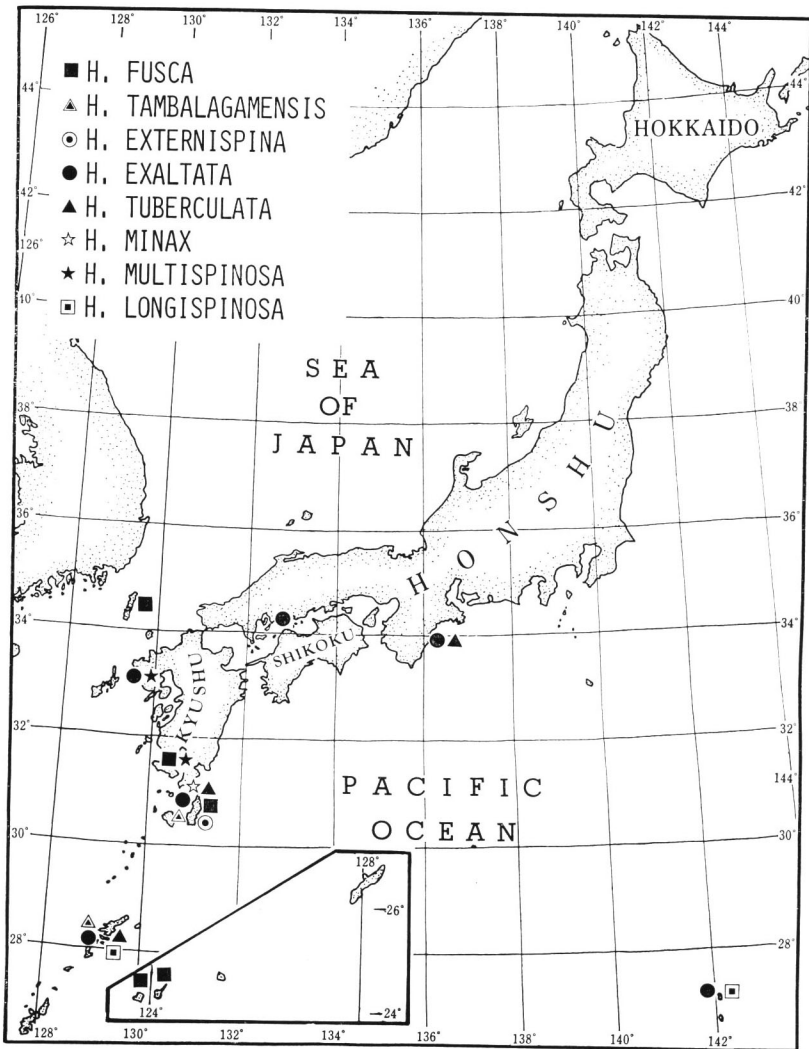


Fig. 6. Distributions of *Hydroides fusca*, *H. tambalagamensis*, *H. externispina*, *H. exaltata*, *H. tuberculata*, *H. minax*, *H. multispinosa* and *H. longispinosa* in Japan.

The thoracic membrane are wide. The collar setae are of two types: slender, minutely serrated capillaries (Fig. 5, k) and bayonet-shaped setae with two large conical teeth and a small subapical denticulate zone (Fig. 5, l), which is much shorter than in *H. elegans* and *H. multispinosa*. The remaining thoracic setae are limbate capillaries (Fig. 5, m, n); the thoracic uncini have 5 to 6 teeth (Fig. 5, o). The abdominal uncini are smaller than those of the thorax, with 5 to 6 teeth (Fig. 5, p). There are 4 abdominal setae in a fascicle; they are trumpet-shaped distally, with about

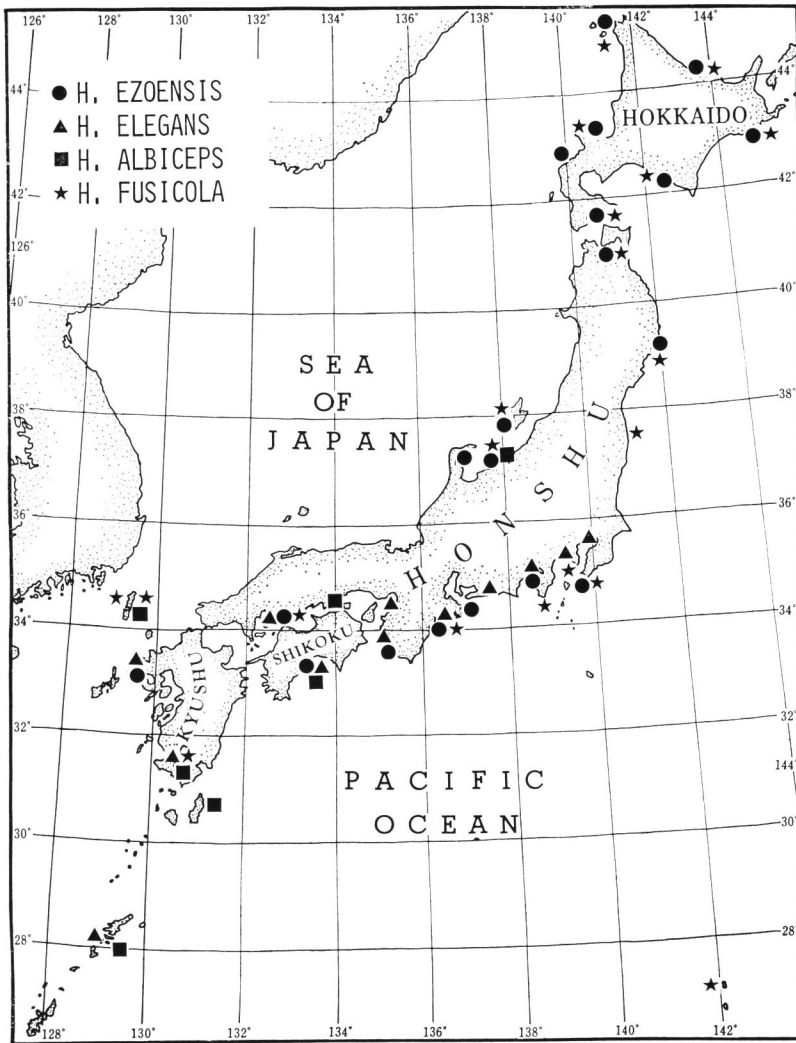


Fig. 7. Distributions of *Hydroides ezoensis*, *H. elegans*, *H. albiceps* and *H. fusicola* in Japan.

20 minute teeth in one row (Fig. 5, q).

The tube is white, irregularly coiled upon itself and is circular in cross-section; there are many transverse growth markings; the longitudinal ridges are absent. It is about 1.5 mm in diameter near the mouth.

Remarks. *Hydroides longispinosa* resembles *H. multispinosa*, in the over-all impression of the operculum. However, *H. longispinosa* has a conspicuous, long central spine in its crown with many spiculate processes, while *H. multispinosa* has a small smooth tooth at the most; moreover, the spines of the crown bear 15–18 accessory

teeth on their inner sides in the former species, instead of 3–5 in the latter.

Type-series. Holotypus, NSMT–Pol. H 122; 1 paratypus, NSMT–Pol. P 123.

Distribution. Southern Japan.

The distributions of 12 species of *Hydroides* in Japanese coasts are shown in the Figures 6 and 7.

Literature Cited

- ALLEN, F. E., & E. J. F. WOOD, 1950. Investigations on underwater fouling. II. The biology of fouling in Australia: results of a year's research. *Austral. J. Mar. Freshwater Res.*, 1: 92–105, 5 figs., 3 pl.
- ARAKAWA, K., 1971. Notes on a serious damage to cultured oyster crops in Hiroshima caused by a unique and unprecedented outbreak of a serpulid worm, *Hydroides norvegica* (GUNNERUS) in 1969. *Venus*, 30: 75–82, 1 pl. (In Japanese.)
- AUGENER, H., 1914. Polychaeta II. Sedentaria. In: MICHAELSEN & HARTMEYER. *Die Fauna Südwest-Australiens*, 5 (1): 1–170, 19 figs., 1 pl.
- 1925 a. Über westindische und einige andere Polychaeten-Typen von Grube (Oersted), Krøyer, Mörch und Schmarda. *Publ. Univ. zool. Mus. Kopenhagen*, 39: 1–47.
- 1925 b. Die Polychaeten der Südsee-Expedition der Hamburgischen Wissenschaftlichen Stiftung 1908–1909. *Mitt. Zool. Staatsinst. Mus. Hamburg*, 41: 53–70, 1 pl., 5 figs.
- 1927. Papers from Dr. Th. MORTENSEN'S Pacific Expedition 1914–16. xxxviii. Polychaeten von Südost- und Süd-Australien. *Vidensk. Medd. Dansk Naturhist. Foren. Kopenhagen*, 83: 71–275, 17 figs.
- CHELEBOVITSCH, V. V., 1961. The polychaetous annelids of the tidal zone of the Kuril Islands. *Explor. Far Eastern Sea, USSR*, 7: 151–260, 14 figs., 7 maps.
- DAY, J. H., 1967. *A Monograph on the Polychaeta of Southern Africa*. Part 2. *Sedentaria*. *Brit. Mus. (Nat. Hist.)*: 459–878, figs. 0.4–38.7.
- DEW, B., 1959. Serpulidae (Polychaeta) from Australia. *Rec. Austral. Mus.*, 25: 19–56, figs. 1–21.
- FAUVEL, P., 1936. Annelides polychètes du Japon. *Mem. Coll. Sci. Kyoto Univ.*, (B), 12: 41–92, 1 fig.
- 1953. Annelida Polychaeta. *The fauna of India, including Pakistan, Ceylon, Burma and Malaya*. Allahabad, The Indian Press Ltd., 1–507, 250 figs.
- GIBBS, P. E., 1971. The polychaete fauna of the Solomon Islands. *Bull. Br. Mus. nat. Hist. (Zool.)*, 21: 101–211, 17 figs.
- GRAVIER, O., 1908. Contribution à l'étude des Annelides Polychètes de la mer Rouge (suite). *Mém. Nouv. Archiv. Mus. Hist. nat. Paris*, (4), 10: 67–168.
- GRUBE, A. E., 1870. Beschreibungen neuer oder weniger bekannter von Hr. EHRENBERG gesammelter Anneliden des Rothen Meeres. *Mber. K. Preuss. Akad. Wiss. Berl.*, 1869: 484–521.
- 1878. Annulata Semperiana. Beiträge zur Kenntniss der Annelidenfauna der Philippinen nach den von Herrn Prof. SEMPER mitgebrachten Sammlungen. *Mem. Acad. Imp. Sci. St. Petersburg*, (7), 25 (8): ix+300 pp., 15 pls.
- HARTMAN, O., 1954. Marine Annelids from the northern Marshall Islands. *Prof. Paper US Geol. Survey*, 260 Q: 615–644, 10 figs.
- 1966. Polychaetous annelids of the Hawaiian Islands. *Bernice P. Bishop. Mus., occ. Pap., Honolulu*, 23: 163–252, 2 figs.
- HASWELL, W. A., 1883. On some new Australian tubicolous annelids. *Proc. Linn. Soc. New South Wales*, 7: 633–638, pl. 12.
- HOVE, H. A. TEN, 1974. Notes on *Hydroides elegans* (HASWELL, 1883) and *Mercierella enigmatica*

- FAUVEL, 1923, alien serpulid polychaetes introduced into the Netherlands. *Bull. Zool. Mus., Univ. Amsterdam*, **4** (6): 45–51, 9 figs.
- ICHIKAWA, A., & N. TAKAGAKI, 1942. The reversible asymmetry in the opercula of *Hydroides ezoensis*. I. Observations on the intact opercula. *J. Fac. Sci. Hokkaido Imp. Univ.*, (VI–Zool.), **8**: 1–8, 1 figs.
- IMAJIMA, M., 1976. Serpulid polychaetes from Tanega-shima, southwest Japan. *Mem. Natn. Sci. Mus., Tokyo*, (9): 123–143, 11 figs.
- & O. HARTMAN, 1964. The polychaetous annelids of Japan. Part 2. *Allan Hancock Fdn., Publ. Occ. Paper*, **26**: 239–452, pls. 36–38.
- & K. HAYASHI, 1969. Seasonal changes of polychaetes living among the attaching organisms. *Proc. Jap. Soc. syst. Zool.*, **5**: 2–15, 1 fig., 3 pls. (In Japanese.)
- KAWAHARA, T., 1961. Regional differences in the composition of fouling communities in Ago Bay. *Rept. Fac. Fish., Mie Pref. Univ.*, **4**: 65–80.
- 1965. Studies on the marine fouling communities. III. Seasonal changes in the initial development of test block communities. *Ibid.*, **5**: 319–364, 15 figs.
- 1969. Studies on the marine fouling communities. IV. Differences in the constitution of fouling communities according to localities. a. Nagasaki Harbor. *Ibid.*, **6**: 109–125, 2 pls., 6 figs.
- & H. IIZIMA, 1960. On the constitution of marine fouling communities at various depths in Ago Bay. *Ibid.*, **3**: 582–594.
- KAZIHARA, T., 1964. Ecological studies on marine fouling animals. *Bull. Fac. Fish. Nagasaki Univ.*, **16**: 1–138. (In Japanese with English summary.)
- KOHN, A. J., & M. C. LLOYD, 1973. Polychaetes of truncated reef limestone substrates on eastern Indian Ocean coral reefs: diversity, abundance, and taxonomy. *Int. Revue ges. Hydrobiol.*, **58**: 369–399, 4 figs.
- KUMARASWAMY ACHARI, G. P., 1969. Catalogue of Polychaetes in the reference collections of the Central Marine Fisheries Research Institute. *Cent. mar. Fish. Res. Inst. Bull.*, **7**: 31–40.
- MCINTOSH, W. C., 1885. Report on the annelida polychaeta collected by H.M.S. Challenger during the years 1873–76. *Rep. Sci. Res. Challenger (Zool.)*, **12**: 554 pp., pls. 1–55, 1A–39A.
- MARENZELLER, E. VON, 1884. Südjapanische Anneliden. II. *Denkschr. Akad. Wiss. Wien.*, (Math. Nat. Kl.), **49**: 197–224, pls. 1–4.
- MAWATARI, S., & S. KOBAYASHI, 1954. Seasonal settlement of animal fouling organisms in Ago Bay, Middle part of Japan, I. *Misc. Rep. Res. Inst. Nat. Resources Tokyo*, **35**: 37–47.
- MOHAMMAD, Murad-B. M., 1971. Intertidal polychaetes from Kuwait, Arabian Gulf, with descriptions of three new species. *J. Zool. London*, **163**: 285–303, 4 figs.
- MÖRCH, O. A. L., 1863. Revisio Critica Serpulidarum. Et bidrag til røromenes Naturhistorie. *Naturh. Tidsk. Henrik Krøyer, København*, (3), **1**: 347–470, 1 pl.
- OKUDA, S., 1934. Some tubicolous annelids from Hokkaido. *J. Fac. Sci. Hokkaido Imp. Univ.*, (VI–Zool.), **3**: 233–246, 11 figs.
- 1937. Annelida polychaeta in Onagawa Bay and its vicinity. I. Polychaeta Sedentaria. *Sci. Rept. Tohoku Imp. Univ.*, (4), **12**: 45–69, pl. 2, 12 figs.
- 1938. Polychaetous annelids from the vicinity of the Mitsui Institute of Marine Biology. *Jap. J. Zool.*, **8**: 75–105, 15 figs.
- 1939. Annelida Polychaeta in Onagawa Bay and its vicinity. II. Polychaeta Errantia with some addenda of Polychaeta Sedentaria. *Sci. Rept. Tohoku Imp. Univ.*, (IV–Biol.), **14**: 219–244, 14 figs.
- & M. YAMADA, 1954. Polychaetous annelids from Matsushima Bay. *J. Fac. Sci. Hokkaido Univ.*, (VI–Zool.), **12**: 175–199, figs. 1–10.
- PILLAI, T. G., 1960. Some marine and brackish-water serpulid polychaeta from Ceylon, including new genera and species. *Ceylon J. Sci. (Biol. Sci.)*, **3**: 1–40, 15 text-figs., 2 pls.

- PILLAI, T. G., 1961. Annelida polychaeta of Tambalagam Lake, Ceylon. *Ibid.*, **4**: 1–40, 12 figs.
- 1971. Studies on a collection of marine and brackish-water polychaete annelids of the family Serpulidae from Ceylon. *Ibid.*, **9**: 88–130, 10 figs.
- 1972. A review and revision of the systematics of the genera *Hydroides* and *Eupomatus* together with an account of their phylogeny and zoogeography. *Ibid.*, **10**: 7–31, 6 figs.
- PIXELL, H. L. M., 1913. Polychaeta of the Indian Ocean, together with some species from the Cape Verde Islands. The Serpulidae, with a classification of the genera *Hydroides* and *Eupomatus*. *Trans. Linn. Soc. (Zool.) London*, **16**: 69–92, pl. 8–9.
- REISH, D. J., 1968. Polychaetous Annelids of the Marshall Islands. *Pacif. Sci.*, **22**: 208–231, figs. 1–5.
- STRAUGHAN, D., 1967 a. Marine Serpulidae (Annelida: Polychaeta) of Eastern Queensland and New South Wales. *Austral. J. Zool.*, **15**: 201–261, 16 figs.
- 1967 b. Some Serpulidae (Annelida: Polychaeta) from Heron Island, Queensland. *Univ. Queensl. Papers*, **1** (2): 27–45, 5 figs.
- UCHIDA, H., 1968. Polychaetous annelids from Shakotan (Hokkaido). I. The collection in 1967. *J. Fac. Sci. Hokkaido Univ.*, (Zool.), **16**: 595–612, 12 figs., 1 tab.
- UCHIDA, T., M. YAMADA & others, 1963. The zoological environs of the Akkeshi Marine Biological Station. *Publ. Akkeshi Mar. Biol. Stat.*, **13**: 1–36, 7 figs., 4 pls.
- USCHAKOV, P. V., 1955. Polychaeta of the Far Eastern Seas of the USSR. *Akad. Nauk SSSR*, **56**: 1–445, 164 figs. (In Russian.) Translated by Israel Program for Scient. Translations, Jerusalem 1965, 419 pp., 164 figs.
- WILLEY, A., 1905. Report on the polychaeta collected by Professor HERDMAN, at Ceylon, in 1902. *Rep. Pearl Fish Manaar*, (Suppl. 30), **4**: 243–324, pls. 1–8.
- YAMAMURA, Y., 1972. Ecological studies of marine fouling communities in pearl culture ground. II. Seasonal changes in the constitution of marine fouling communities at various depths in Ago Bay. *Bull. Natn. Pearl Res. Lab.*, **16**: 2038–2051, 3 tables. (In Japanese.)
- ZAKS, I., 1933. Polychaeta of the North-Japanese Sea. *Inst. Hydrobiol. Explor. Mers URSS*, **14**: 125–137. (In Russian with German summary.)
- ZIBROWIUS, H., 1971. Les espèces méditerranéennes du genre *Hydroides* (Polychaeta Serpulidae). Remarques sur le prétendu polymorphisme de *Hydroides uncinata*. *Tethys*, **2**: 691–745, 64 figs.
- 1972. *Hydroides norvegica* GUNNERUS, *Hydroides azorica* n. sp. et *Hydroides capensis* n. sp. (Polychaeta Serpulidae), espèces vicariantes dans l'Atlantique. *Bull. Mus. Hist. nat. Paris*, (3), **39** (Zool. 33): 434–446, 3 figs.
- 1973 a. Serpulidae (Annelida Polychaeta) des côtes ouest de l'Afrique et des archipels voisins. *Ann. Kon. Mus. Midden-Afrika Tervuren*, (Zool.), **207**: 1–93, 6 figs.
- 1973 b. Remarques sur trois espèces de Serpulidae acclimatées en Méditerranée: *Hydroides dianthus* (VERRILL, 1873), *Hydroides dirampha* MÖRCH, 1863, et *Hydroides elegans* (HASWELL, 1883). *Rapp. Comm. int. Mer Médit.*, **21**: 683–686.