Notes on the Nematocysts of Japanese Hydroids, I

By

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(*With 5 Text-figures and 1 Table*)

Beginning with Weill's elaborate classical work (1934), the nematocysts have been regarded to be an important character for the taxonomic and phylogenetic treatment of cnidarians. The nematocysts of a considerable number of species have been described up to the present, but it is obvious that many species yet remain unknown for their nematocysts. Moreover, it seems necessary to elucidate the degree of variations of constitution of nematocyst kinds and of their size, according to body portion, developmental stage and locality, but it has been very poorly studied. Having these problems in mind, the author has examined the nematocysts of twenty species of Hydrozoa from Hokkaido.

Observations were made on fresh material collected from Oshoro, Muroran and Akkeshi from April to July in 1975 by means of so-called squash method. The shape and structure of undischarged and discharged nematocysts were drawn under a phase contrast microscope with an Abbe's drawing apparatus. The size (length and width of undischarged capsules) was measured on twenty or thirty for each kind of the nematocysts sampled from several individuals per one species. Fiducial ranges (95%) of mean values of the size (length $\times$ width), mean L/W ratio and the number of the nematocysts measured (showed in parentheses) were given.

Results and discussions

Climacocodon ikarii Uchida

(Fig. 1, 1–8)

Mature medusae, Muroran, 22–V–1975. Two kinds: microbasic euryteles and stenoteles (on tentacle).

Microbasic euryteles: 7.5–9.2 $\times$ 2.8–3.9μ, L/W=2.5 (30)

Stenoteles: large type, 8.5–10.7 $\times$ 8.5–8.8μ, L/W=1.1 (30); medium type, 7.6–8.9 $\times$ 4.7–6.4μ, L/W=1.5 (30); small type, 5.4–7.1 $\times$ 3.8–4.7μ, L/W=1.5 (30)

Large type stenoteles are spherical, while the other types stenoteles are slender in shape. Small type stenoteles are abundant, but large and medium types stenoteles and microbasic euryteles are not abundant on the distal part of the manubrium. This constitution of nematocysts is peculair in Hydrozoa.

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Stauridiosarsia japonica Nagao
(Fig. 1, 9–12)

Polyps, Akkeshi, 3–VII–1975. One kind: stenoteles (on tentacle).

Stenoteles: large type, 25.5–26.9×17.6–20.0 μ, L/W=1.4 (20); small type, 15.2–17.6×9.8–12.1μ, L/W=1.5 (20)

Small type stenoteles examined are a little larger than those examined by Nagao (1962), while large type ones the same as them. It is noted that the locality of the materials here examined is the same as that of Nagao (1962).

Coryne pusilla Gaertner
(Fig. 1, 13–18)

Mature polyps, Oshoro, 9–V–1975. In addition to the adult polyps, planulae and a young polyp obtained by culture were also examined. One kind: stenoteles.

Stenoteles (on tentacle of adult polyp): large type, 21.7–26.5×13.0–16.2 μ, L/W=1.6 (30); small type, 13.4–16.1×6.8–10.0 μ, L/W=1.8 (30)

Stenoteles (on whole body of planula): 8.0–10.4×4.9–6.6 μ, L/W=1.6 (30)

Stenoteles (on whole body of young polyp): 7.6–11.5×4.5–7.1 μ, L/W=1.7 (19)

Stenoteles of planula are the same as those of young polyp in size and structure. Stenoteles of adult polyp are larger than those of planula and young polyp. In spite of the different size, stenoteles of three stages of the life cycle are same in shape, which indicates the uniformity of the shape of stenoteles as studied by Itô (1949a, b, and '51). Such uniformity of the shape is recognized also in all the species of Capitata examined, though the shape of the large type in *Climacocodon ikarii* is an exceptional case. Stenoteles of planula and young polyp examined are the same as the small type stenoteles examined by Itô and Inoue (1962) in size and structure. Small type stenoteles of adult polyp examined are smaller than the medium type stenoteles examined by Itô and Inoue (1962) and large type stenoteles of adult polyp examined are slender in shape than the large type stenoteles (L/W=1.3) examined by Itô and Inoue (1962). It is noted that the materials here examined came from northern Japan, while those examined by Itô and Inoue (1962) from southern Japan.

Cladonema uchidai Hirai
(Fig. 2, 1–7, 21–22)

Medusae, Oshoro, 28–V–1975. Two kinds: desmonemes and stenoteles.

Desmonemes (on marginal tentacle): 7.3–8.8×3.6–4.4 μ, L/W=2.0 (30)

Stenoteles: large type (on oral tentacle), 15.0–20.9×10.8–14.1 μ, L/W=1.4 (30); medium type (on oral tentacle), 10.6–13.2×7.0–9.0 μ, L/W=1.5 (30); medium type (on marginal tentacle), 10.6–15.3×7.9–11.1 μ, L/W=1.4 (30); small type (on oral tentacle), 8.7–11.0×5.9–7.7 μ, L/W=1.5 (18)

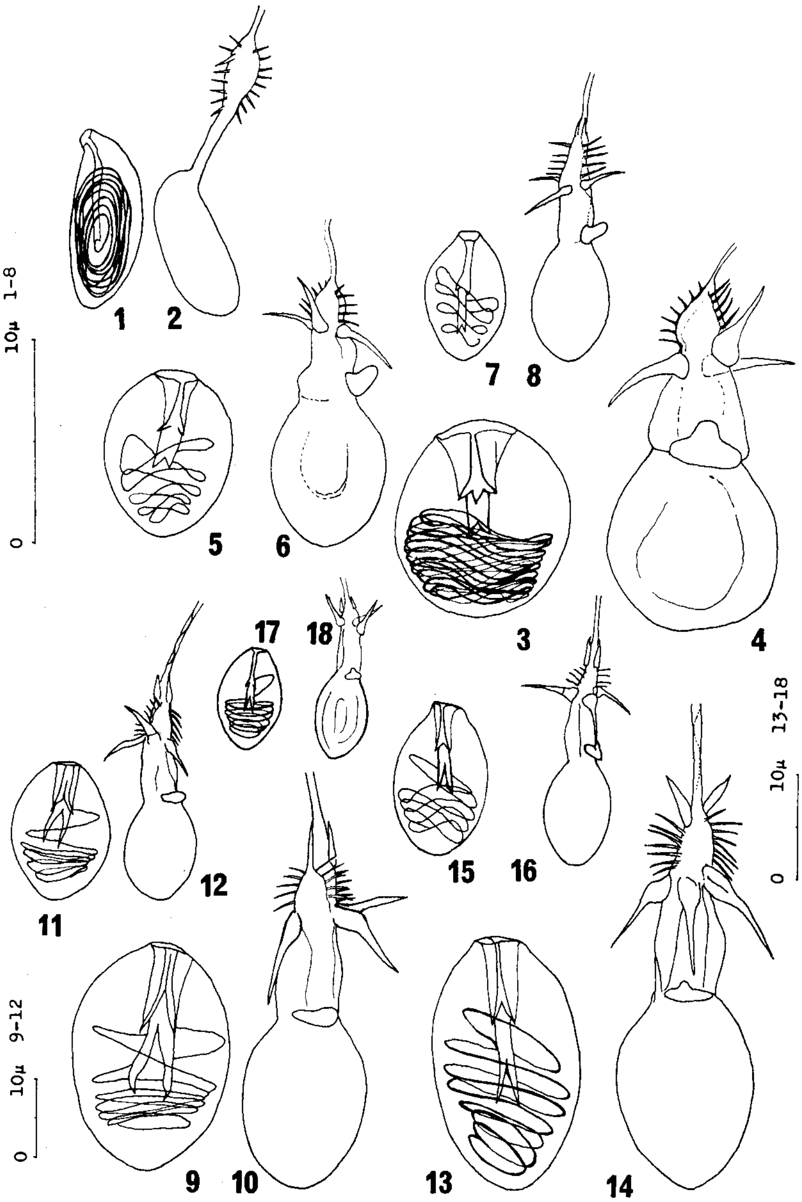

Fig. 1. 1–8. *Climacocodon ikarii* (medusa): 1–2, microbasic euryteles; 3–8, stenoteles. 9–12. *Stauridiosarsia japonica*: stenoteles. 13–18. *Coryne pusilla*: stenoteles. 13–16, adult polyp; 17–18, planula and young polyp.

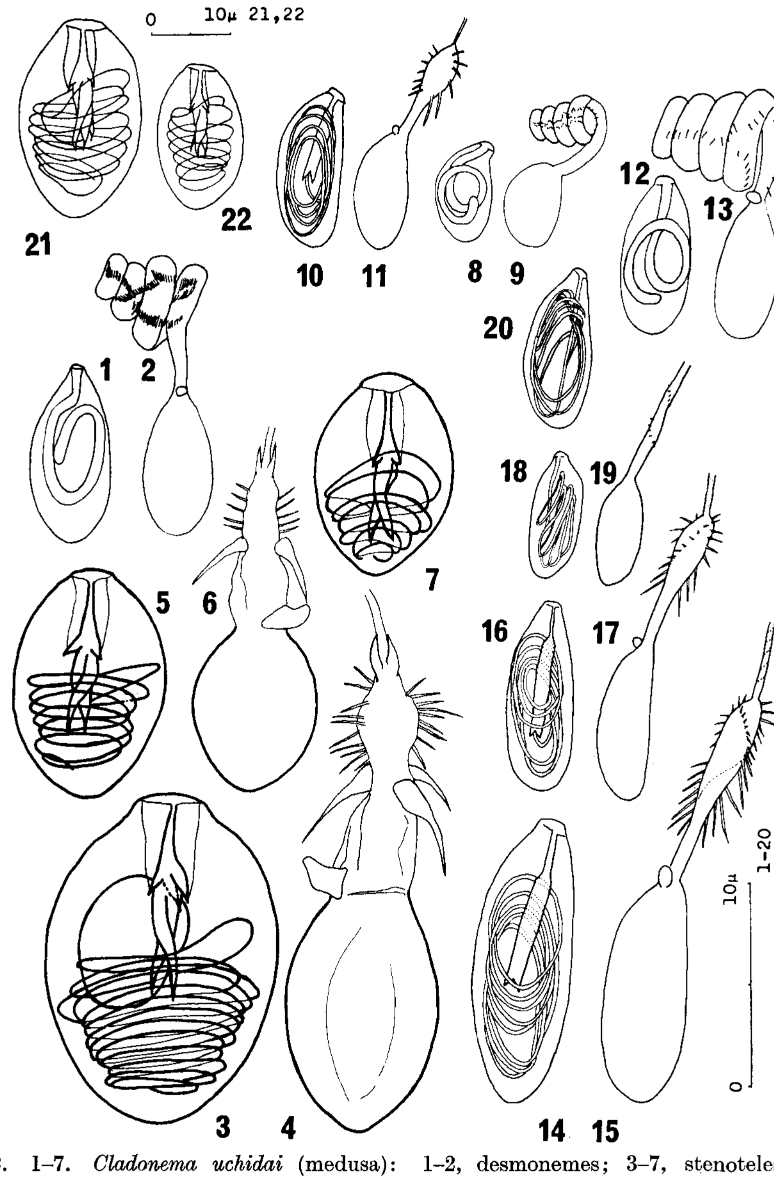

Fig. 2. 1–7. *Cladonema uchidai* (medusa): 1–2, desmonemes; 3–7, stenoteles. 8–11. *Turritopsis nutricula* (medusa): 8–9, desmonemes; 10–11, microbasic euryteles. 12–20. *Hydractinia uchidai*: 12–13, desmonemes; 14–17, microbasic euryteles; 18–20, ? atrophied nematocysts. 21–22. *Cladonema uchidai*: stenoteles.

Desmonemes are not located in oral tentacles. Three types of stenoteles are located in oral tentacles. In marginal tentacles medium one is only located. The constitution of nematocysts of this species is the same as that found in medusa of *C. radiatum* (Brinckmann and Petersen, 1960).

The polyps of this species obtained in course of culture were given for me, and the nematocysts of these polyps without medusa-buds were examined on October 2, 1975.

One kind: stenoteles (on tentacle). large type, 21.4–26.7×13.3–17.1 μ, L/W=1.6 (30); small type, 15.5–17.9×9.0–11.9 μ, L/W=1.6 (30)

Small type stenoteles of polyps are the same as large type ones of medusae in size and structure. Large type ones of polyps are larger than all types of stenoteles of medusae. The constitution of nematocysts of polyps is different from that of medusae. The polyps of *C. radiatum* have macrobasic euryteles in addition to stenoteles (Brinckmann and Petersen, 1960), but macrobasic euryteles are not found in *C. uchidai.*

Turritopsis nutricula McCrady
(Fig. 2, 8–11)

Mature medusa, Akkeshi, 4–VII–1975. Two kinds: desmonemes and microbasic euryteles.

Desmonemes (on tentacle): 4.3–5.6×2.5–3.3 μ, L/W=1.7 (20); ditto (on manubrium), 3.8–5.1×2.4–2.6 μ, L/W=1.8 (20)

Microbasic euryteles (on tentacle): 6.0–7.6×2.8–3.3 μ, L/W=2.2 (20); ditto (on manubrium), 7.2–9.6×2.8–3.5 μ, L/W =2.6 (20)

Desmonemes on tentacle are the same as those on manubrium in size and structure. Microbasic euryteles on manubrium are a little longer than those on tentacle. These two kinds of nematocysts examined are a little smaller than those examined by Russell (1940) on the material from Plymouth, but the same as those of the mature polyp (Yamada and Nagao, 1971) collected from Akkeshi on July 9, 1970.

Rhizogeton ezoense Yamada
(Fig. 3, 1–4)

Polyps, Muroran, 28–IV–1975. Two kinds: desmonemes and microbasic euryteles (on tentacle).

Desmonemes: 4.3–5.4×2.7–2.9 μ, L/W=1.7 (30)

Microbasic euryteles: 6.7–7.8×2.6–3.2 μ, L/W=2.5 (30)

Hydractinia uchidai Nagao
(Fig. 2, 12–20)

Polyps, Akkeshi, 3–VII–1975. Two kinds: desmonemes and microbasic euryteles.

Desmonemes (on tentacle of gastrozooid): 6.2–7.7×2.9–3.6 μ, L/W=2.1 (20); ditto (on whole body of dactylozooid), 5.0–6.3×2.7–3.2 μ, L/W=2.0 (20)

Microbasic euryteles: large type (on hypostome of gastrozooid), 12.4–15.0×4.5–5.0 μ, L/W=2.9 (20); ditto (on whole body of dactylozooid), 11.3–13.3×4.6–4.9 μ, L/W=2.6 (20); small type (on tentacle of gastrozooid), 8.8–10.1×2.8–3.7 μ, L/W=2.9 (20); ditto (on whole body of dactylozooid), 7.4–9.7×2.5–3.3 μ, L/W=3.0 (20)

? Atrophied nematocysts (on whole body of dactylozooid): 5.2–6.9×2.3–3.3 μ, L/W=2.2 (20); ditto (on whole body of spine), 5.6–6.9×2.1–3.1 μ, L/W=2.4 (20)

Microbasic euryteles are abundant on the distal end of dactylozooids, while desmonemes and atrophied (?) nematocysts are found in a small number on whole body of dactylozooids including the distal end of those. Atrophied (?) nematocysts larger than those described above are located in a considerably small number on dactylozooids and spines. Large type microbasic euryteles are abundant, but desmonemes are not located on hypostome of gastrozooids. Desmonemes of gastrozooids are longer than those of dactylozooids. Two types microbasic euryteles of gastrozooids are the same as those of dactylozooids in size and structure. The constitution of nematocysts of gastrozooids is the same as that of dactylozooids except the presence of atrophied (?) nematocysts on dactylozooids, which are also located in spines.

Eudendrium capillare Alder

(Fig. 3, 5–8)

Polyps, Oshoro, 23–IV–1975. Polyps, Muroran, 28–IV–1975. One kind: microbasic euryteles (on tentacle).

Microbasic euryteles (Oshoro): 7.3–8.6×2.7–3.3 μ, L/W=2.7 (30); ditto (Muroran), 5.7–7.5×2.6–4.1 μ, L/W=2.0 (30)

Microbasic euryteles are slender in shape at Oshoro, while stumpy at Muroran.

Eudendrium boreale Yamada

(Fig. 3, 9–13)

Polyps, Akkeshi, 10–VII–1975. One kind: microbasic euryteles.

Microbasic euryteles: large type (on hypostome and hydranth groove), 23.3–28.1×9.0–10.9 μ, L/W=2.6 (20); medium type (on tentacle); 7.2–8.3×3.0–3.9 μ, L/W=2.2 (20); small type (on tentacle); 6.3–6.7×2.6–3.0 μ, L/W=2.3 (20).

The location on body portions and the value of L/W ratio of large type stenoteles are different from those of medium and small types stenoteles.

Clytia edwardsi (Nutting)

(Fig. 3, 14–17)

Polyps with gonangia, Muroran, 24–VI–1975. Two kinds: basitrichous isorhizes

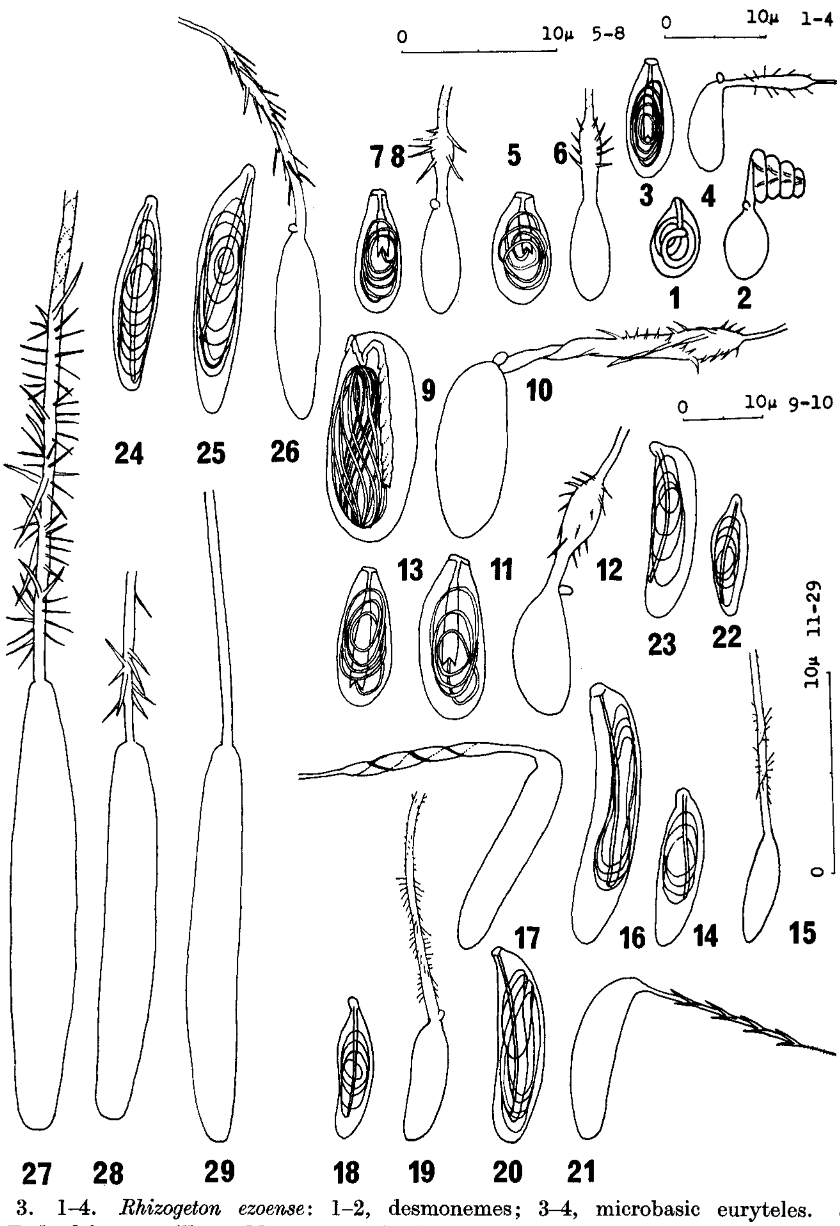

Fig. 3. 1–4. *Rhizogeton ezoense*: 1–2, desmonemes; 3–4, microbasic euryteles. 5–6. *Eudendrium capillare* (Muroran): microbasic euryteles. 7–8. *Eudendrium capillare* (Oshoro): microbasic euryteles. 9–13. *Eudendrium boreale*: microbasic euryteles. 14–17. *Clytia edwardsi*: 14–15, basitrichous isorhizes; 16–17, microbasic mastigophores. 18–21. *Obelia plana*: 18–19, basitrichous isorhizes; 20–21, microbasic mastigophores. 22–23. *Obelia plana* (medusa): 22, basitrichous isorhizes; 23, microbasic mastigophores. 24–29. *Eutonina indicans* (medusa): 24–26, microbasic mastigophores; 27–29, basitrichous isorhizes.

and microbasic mastigophores.

Basitrichous isorhizes (on tentacle): 6.6–7.5×1.8–2.0 μ, L/W=3.8 (20)

Microbasic mastigophores (on hypostome): 11.3–13.1×2.4–3.2 μ, L/W=4.4 (20)

The constitution and size of nematocysts examined are different from those examined by Itô and Inoue (1962) on the material collected from southern Japan.

Obelia plana (M. Sars)

(Fig. 3, 18–23)

Polyps with gonangia, Oshoro, 9–V–1975. Two kinds: basitrichous isorhizes and microbasic mastigophores.

Basitrichous isorhizes (on tentacle): 6.7–7.8×1.8–2.0 μ, L/W=3.9 (30)

Microbasic mastigophores (on the basal part of the hydranth): 8.6–9.7×1.7–2.6 μ, L/W=4.3 (30)

Microbasic mastigophores are not so abundant. No nematocysts are found on hypostome.

Many newly liberated medusae were obtained in course of culture. The nematocysts of these medusae were examined. Two kinds: basitrichous isorhizes and microbasic mastigophores.

Basitrichous isorhizes (on tentacle): 5.0–7.8×1.6–2.1 μ, L/W=3.6 (30)

Microbasic mastigophores (on tentacle): 7.3–9.2×1.8–2.1 μ, L/W=4.3 (10)

The constitution and size of nematocysts of medusae are the same as those of polyps. While some medusae have a few microbasic mastigophores, other medusae have not. No nematocysts are found on manubrium.

Eutonina indicans (Romanes)

(Fig. 3, 24–29)

Mature medusa, Muroran, 22–V–1975. One or two ? kinds: basitrichous isorhizes and microbasic mastigophores.

Basitrichous isorhizes (on exumbrella): 16.6–21.3×2.0–2.8 μ (discharged capsules): L/W=7.8 (30)

Microbasic mastigophores: large type (on tentacle), 10.4–12.5×2.0–3.0 μ, L/W =4.6 (30); ditto (on oral lip), 10.0–12.4×2.3–3.1 μ, L/W=4.1 (30); small type (on tentacle), 8.7–10.2×1.8–2.0 μ, L/W=5.1 (30); ditto (on oral lip), 8.7–9.9×1.7–2.2 μ L/W=4.8 (30)

The constitution and size of nematocysts on tentacle are the same as those on oral lip. Basitrichous isorhizes on exumbrella were all discharged, and the spines of basal part of the thread were sloughed off partly or wholly. This kind of the nematocysts may be derived from any other species accidentally. Although the constitution of nematocysts examined is different from that of Werner (1968), large type microbasic mastigophores are the same as basitrichous isorhizes examined by Werner (1968) in size. Small type microbasic mastigophores are a little stumpier than the large type ones in shape.

Mitrocomella sp.
(Fig. 4, 1–5)

Polyps, Akkeshi, 3–VII–1975. Two kinds: basitrichous isorhizes and macrobasic mastigophores.

Basitrichous isorhizes (on tentacle): 6.0–6.8×1.8–2.1μ, L/W=3.3 (20)

Macrobasic mastigophores (on the basal part of the hydranth): 19.0–21.9×4.5–6.4μ, L/W=3.7 (20)

? Undeveloped macrobasic mastigophores (on the basal part of the hydranth): 7.8–9.1×1.8–2.1μ, L/W=4.3 (20)

In addition to basitrichous isorhizes, there are found macrobasic mastigophores which are one of the remarkable kind cnidarian nematocysts distributed within Pteronematoid genera such as *Rosalinda*, *Teissiera* and *Millepora* (Bouillon, 1974). Although the constitution of nematocysts of this species is peculiar in Hydrozoa, identification of this species is difficult on account of having no gonangia, thus the author tentatively treats this species as *Mitrocomella* sp.

Calycella syringa (Linné)
(Fig. 4, 6–7)

Polyps with gonangia, Akkeshi, 9–VII–1975. One kind: basitrichous isorhizes (on tentacle).

Basitrichous isorhizes: 5.3–6.4×1.6–2.0μ, L/W=3.3 (20)

Basitrichous isorhizes examined are a little larger than those examined by Weill (1934) on the materials from Wimereux.

Sertularella miurensis Stechow
(Fig. 4, 8–9)

Polyps with gonangia, Oshoro, 12–VI–1975. One kind: microbasic mastigophores (on tentacle).

Microbasic mastigophores: 6.2–7.0×1.9μ, L/W=3.6 (30)

Microbasic mastigophores examined are smaller than those examined by Itô and Inoue (1962). It is noted that the materials here examined came from northern Japan, while those examined by Itô and Inoue (1962) from southern Japan.

Sertularella sagamina Stechow
(Fig. 4, 10–11)

Polyps with gonangia, Oshoro, 12–VI–1975. One kind: microbasic mastigophores (on tentacle).

Microbasic mastigophores: 5.8–6.7×1.9μ, L/W=3.4 (30)

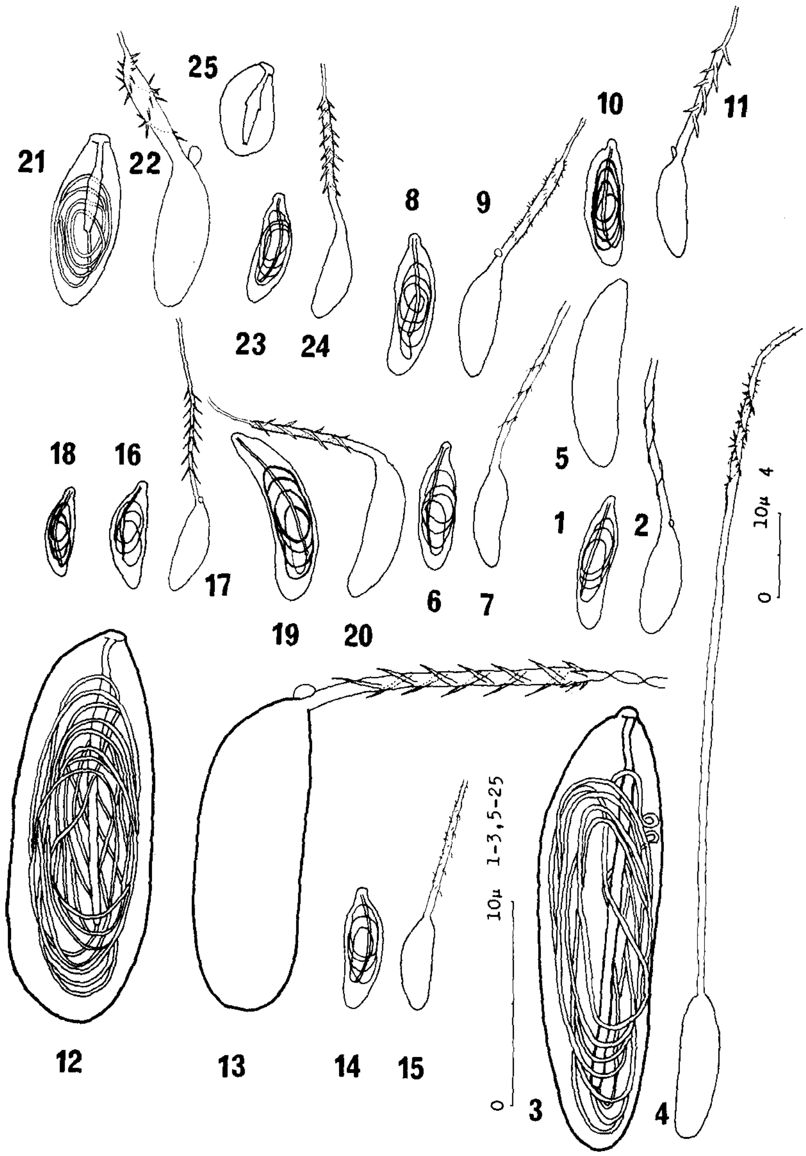

Fig. 4. 1–5. *Mitrocomella* sp.: 1–2, basitrichous isorhizes; 3–4, macrobasic mastigophores; 5, ? undeveloped macrobasic mastigophores. 6–7. *Calycella syringa*: basitrichous isorhizes. 8–9. *Sertularella miurensis*: microbasic mastigophores. 10–11. *Sertularella sagamina*: microbasic mastigophores. 12–15. *Abietinaria costata*: microbasic mastigophores. 16–20. *Amphisbetia pacifica*: 16–18, basitrichous isorhizes; 19–20, microbasic mastigophores. 21–25. *Plumularia undulata*: 21–24, microbasic mastigophores; 25, ? atrophied nematocysts.

Abietinaria costata (Nutting)

(Fig. 4, 12–15)

Polyps with gonangia, Akkeshi, 10–VII–1975. One kind: microbasic mastigophores.

Microbasic mastigophores: large type (on sarcostyle), 16.9–19.8×6.2–7.1 μ, L/W=2.8 (20); small type (on tentacle), 5.5–5.9×1.8–2.0 μ, L/W=3.1 (20)

The thread of small type microbasic mastigophores is a little narrower in width than that of the butt. Thus this nematocysts resemble basitrichous isorhizes.

Amphisbetia pacifica Stechow

(Fig. 4, 16–20)

Polyps with gonangia, Oshoro, VI–1975. Two kinds: basitrichous isorhizes and microbasic mastigophores.

Basitrichous isorhizes (on tentacle): large type, 5.5–5.7×1.9 μ, L/W=3.0 (20), small type, 4.1–5.0×1.6–2.0 μ, L/W=2.6 (20)

Microbasic mastigophores (on the distal end of the tentacle): 7.1–8.0×1.9–2.4 μ, L/W=3.5 (20)

Small type basitrichous isorhizes examined are stumpier than those examined by Itô and Inoue (1962) in shape. Large type basitrichous isorhizes and microbasic mastigophores examined are larger than those examined Itô and Inoue (1962). It is noted that the materials here examined came from northern Japan, while those examined by Itô and Inoue (1962) from southern Japan.

Plumularia undulata Yamada

(Fig. 4, 21–25)

Polyps with gonangia, Akkeshi, 10–VII–1975. One kind: microbasic mastigophores.

Microbasic mastigophores: large type (on nematophore), 7.6–9.3×3.1–3.8 μ, L/W=2.5 (20); small type (on tentacle), 5.0–6.0×1.6–2.0 μ, L/W=3.1 (20)

? Atrophied type (on nematophore): 4.4–4.9×2.4–3.0 μ, L/W=1.7 (5)

Large type microbasic mastigophores slightly resemble microbasic euryteles on account of that the proximal portion of the butt is a little narrower than that distal portion.

Gonionema oshoro Uchida

(Fig. 5, 1–9)

Medusae, Oshoro, V–1975. Three kinds: basitrichous isorhizes, microbasic euryteles and macrobasic euryteles.

Basitrichous isorhizes (on exumbrella): 4.7–8.6×2.3–3.6 μ, L/W=2.2 (30); ditto (on tentacle), 7.6–9.3×2.8–3.9 μ, L/W=2.5 (30)

Microbasic euryteles: large type (on tentacle), 13.5–15.9×5.3–9.4 μ, L/W=2.0 (30); small type (on manubrium), 6.9–10.2×3.4–5.3 μ, L/W=2.0 (30)

Macrobasic euryteles (on exumbrella): 15.1–18.8×7.8–9.9 μ, L/W=1.9 (30)

Basitrichous isorhizes on exumbrella are a little shorter than those of tentacles. Undeveloped type basitrichous isorhizes are located on exumbrella. Large type microbasic euryteles mainly located on tentacle are also located on manubrium in a small number. Large type microbasic euryteles is the same as the small type ones in shape. The stylets are observed on the butt of the microbasic euryteles. The thread of large type microbasic euryteles is slightly tapering toward the tip. The constitution and size of nematocysts are the same as those examined by Nagao (1969) on the material from Asamushi. It is noted that this medusa has been known as causing injuries to man in Japan.

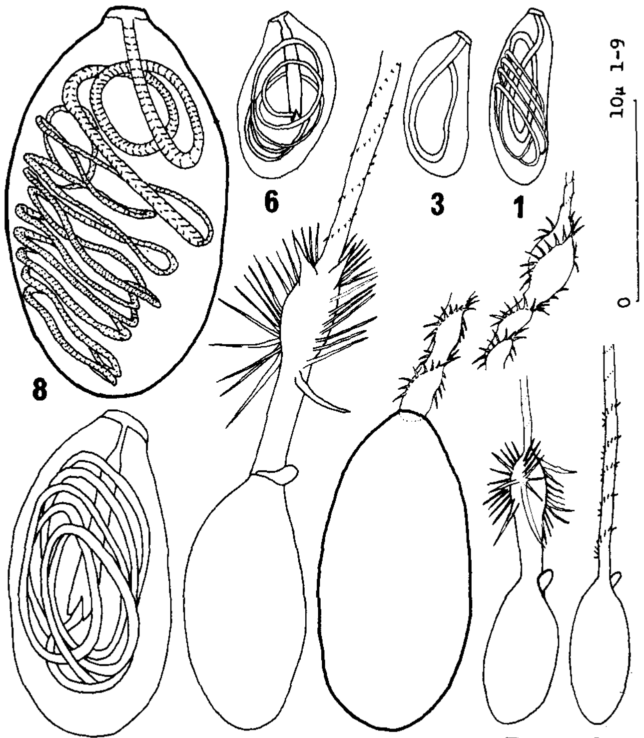

Fig. 5. 1–9. *Gonionema oshoro* (medusa): 1–2, basitrichous isorhizes; 3, undeveloped basitrichous isorhizes; 4–7, microbasic euryteles; 8–9, macrobasic euryteles.

Table 1 shows the distribution of the different kinds of the nematocysts of twenty species of Hydrozoa examined in this paper. Basitrichous isorhizes found

Table 1. Distribution of the different kinds of the nematocysts.

	Des.	Ba.i.	Mi.m.	Ma.m.	Mi.e.	Ma.e.	St.
*Climacocodon ikarii**					+		+
Stauridiosarsia japonica							+
Coryne pusilla							+
Cladonema uchidai							+
*Cladonema uchidai**	+						+
*Turritopsis nutricula**	+				+		
Rhizogeton ezoense	+				+		
Hydractinia uchidai	+				+		
Eudendrium capillare					+		
Eudendrium boreale					+		
Clytia edwardsi		(+)	+				
Obelia plana		(+)	+				
*Obelia plana**		(+)	+				
*Eutonina indicans**			+				
Mitrocomella sp.		(+)		+			
Calycella syringa		(+)					
Sertularella miurensis			+				
Sertularella sagamina			+				
Abietinaria costata			+				
Amphisbetia pacifica		(+)	+				
Plumularia undulata			+				
*Gonionema oshoro**		+			+	+	

Des. : Desmonemes, Ba.i.: Basitrichous isorhizes, Mi. m.: Microbasic mastigophores, Ma.m.: Macrobasic mastigophores, Mi.e.: Microbasic euryteles, Ma.e.: Macrobasic euryteles, St.: Stenoteles * Medusae,

in Thecata-Leptomedusae are not always disernible from microbasic mastigophores (see, Russell, 1938; Itô and Inoue, 1962; Werner, 1965, '68), so this dubitable situation is represented by parentheses in Table 1. Of these twenty species, all of Capitata have stenoteles, all of Filifera have microbasic euryteles and all of Thecata-Leptomedusae except *Mitrocomella* sp. have basitrichous isorhizes and/or microbasic mastigophores. But, we must take into consideration these qualitative and quantitative variations related to body portion, developmental stage and locality in the systematic and phylogenetic study of cnidarians in terms of the nematocyst character.

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Summary

The nematocysts of twenty species of Hydrozoa from Hokkaido were examined and the variation of their constitution and size are described.

Climacocodon ikarii has microbasic euryteles and stenoteles, that is a peculiar constitution of the nematocysts in Hydrozoa.

A remarkable kind of the nematocysts in Cnidaria, macrobasic mastigophores, is located in *Mitrocomella* sp. in addition to basitrichous isorhizes, and this constitution of the nematocysts is peculiar in Hydrozoa.

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