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ACTINOLOGIA JAPONICA (1)
ON THE ACTINIARIAN FAMILY HALCURIIDAE FROM JAPAN

by

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The suborder Endocoelacteae Carlgren, 1928 is characterized by the peculiar arrangement of mesenteries. The metacnemes (mesenteries developed after 6 pairs of the eldest mesenteries) of the group appeared regularly in the lateral endocoeles, comparing with the other Actiniarians whose metacnemes developed in exocoeles with few exceptions of irregular arrangements for accidental regenerations or asexual longitudinal fission.

The peculiarity was firstly mentioned by Carlgren (1897) on a species of several specimens from Korean Strait, Hirado Strait and Gotoh Islands in Nagasaki Prefecture, Japan. He found mesenterial developments in endocoels of those anemones and proposed new genus *Endocoelactis* and also erected new family Endocoelactidae for the genus, but he proposed no species name for the species. Several years later, McMurrich (1901) noticed that the genus *Halcurias*, which had been proposed by himself (1893) for the species collected from the coast of Chile during the survey of the U.S. Fish Commission steamer *Albatross*, was just same as *Endocoelactis*, after careful anatomical examinations. He treated *Endocoelactis* Carlgren, 1897 as a junior synonym of *Halcurias* McMurrich, 1893, for the latter also has priority. At the same time he proposed *Halcurias carlgreni* for the Carlgren's *Endocoelactis*.

In 1914, Carlgren examined the species of the genus *Porponia* Hertwig, 1882, which had been described based on the materials collected in the *Challenger* Expedition, and found that *Porponia* has mesenterial development in the endocoels, and closely related to *Halcurias*. At the same time he concluded that the endocoelactid nature is fairly phylogenic and those anemones were seemed clearly separable from other anemones on the supra-family rank. Afterwards he (1918) surveyed several forms of sea anemones related to *Halcurias* and *Porponia*, and found that *Actinernus* Verrill, 1879, which had been reported from the east coast of U.S., was the same as *Porponia* Hertwig, 1882.

In 1922, Stephenson proposed the sub-tribe Endocoelactaria for those peculiar anemones, and divided them into two families. Halcuriidae Carlgren, 1918 was the family for the species which has the mesenteries clearly divisible into macro- and microcnemes. Actinernidae Stephenson, 1922 was for the species with the mesenteries not divisible into macro- and microcnemes. Only two genera, *Halcurias* McMurrich, 1893 and *Carlgrenia* Stephenson, 1918, are hitherto known in Halcuriidae. The former is consisted of five species, but the latter is monotypic.

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It was 1928 (over a half century ago) that the last descriptions of new species of the group, and only once appeared that the description of the species by original materials (Carlgren, 1938). Then after, other two occasions appeared, but Carlgren (1949) was only the list without any descriptions of species, and Parry's description (1951) of *Halcurias endocoelactis* Stephenson, 1918 was a repeat of the original. The fine textbook of Cnidaria (Doumenc et Praet, 1987) did also never show any new observations on this group.

The species in the family Halcuriidae, also same as in Actinernidae, live in rather deep water (Uchida, 2001b). The living states have been never observed, but an occasion in the case of *Halcurias capensis* Carlgren, 1928 from South Africa. Carlgren (1928) mentioned color data in the living state of *H. capensis* observed on the board of *Valdivia* during the German Deep Sea Expedition.

Recently I have had a chance to get two specimens of *Halcurias* in living condition. These materials were collected by gill-net at Minabe near Shirahama, and are reared for a period in the aquarium of the Seto Marine Biological Laboratory of Kyoto University. Dr. H. Tanase kindly proposed these anemones for my disposal. There are three other sorts of specimens in my disposal collected several localities around Japan. After examination of those materials, I can identify *Halcurias carlgreni* McMurrich, 1901, which was originally collected in Japanese waters, and other two new species. The nematocyst survey is much important on the systematics and taxonomy of the sea anemones, but it is difficult to do on the preserved specimens. I can check the nematocysts on *Halcurias* in detail by the fresh materials from living specimens. Such detail survey of nematocysts has never hitherto done in this group.

I beg to express here my thanks to Dr. H. Tanase of the Seto Marine Biological Laboratory, Dr. Sh. Ohta of the Ocean Research Institute, University of Tokyo, Mr. Y. Kano and Mr. Sh. Takayama of the Uozu Aquarium, Dr. Ch. Shinya of the Noto Marine Biological Laboratory, Kanazawa University, and Mr. S. Nagai, for placing the specimens at my disposal, and also to Mr. F. Iwase, the Biological Institute on Kuroshio, for his kind procedure on press of this paper.

Order ACTINIARIA

Sub-order ENDOCOELANTHEAINEA Carlgren, 1928
(Jap. name: Naikou Rui Uchida *in* Yatsu et Uchida, 1972)

Family HALCURIIDAE Carlgren, 1918
(Jap. name: Kawari-ginchaku Ka Uchida, 1992)

Endocoelactidae Carlgren 1897, p. 169.
——— 1914, p. 260 (partim).
Stephenson 1918a, p. 13.
Halcuriidae Carlgren 1918, p. 24 (partim).
——— 1921, p. 13 (partim).
Stephenson 1921, pp. 524 & 545.
——— 1922, p. 257.
Carlgren 1938, p. 17.
——— 1949, p. 18.
Doumenc & Van-Praët 1987, p. 351.

Endocoelantheainea with elongate body. Distal margin of column not lobed. Column with or without nematocyst batteries. Tentacles rather few, up to 68 in more than two cycles, without basal swellings on their aboral side. With a single siphonogryph. Mesenteries divisible into macro- and microcnemes. Macrocnemes 6 or 10 pairs. Some of the microcnemes, however, perfect in many species. Retractors of the macrocnemes rather strong, restricted. Macrocnemes fertile with filaments, but microcnemes sterile without filaments. 2 genera.

Macrocnemes 6 pairs. The first cycle of microcnemes appear along whole body
..... *Carlgrenia* Stephenson, 1918
Macrocnemes 10 pairs. Microcnemes appear only in the distal-most part of the body
..... *Halcurias* McMurrich, 1893

The diagnosis of the family is almost same as that of Carlgren (1949), but I have found a species without nematocyst batteries on the column (see below). In the species of regular arrangement of mesenteries, all known species have the tentacles up to 68, and *Halcurias endocoelactis* Stephenson, 1918, being a single species with irregular arrangement of mesenteries, has about 60 tentacles. Furthermore, *Carlgrenia desiderata* Stephenson, 1918 has the tentacles of about 40. Though the maximum number of the tentacles in the family is probably 68, together with the consideration of the structure of the mesenteries described below.

Genus ***Halcurias*** McMurrich, 1893

Halcurias McMurrich 1893, p. 142 : Carlgren 1893, p. 136 : McMurrich 1898, p. 227 : Haddon 1898, p. 411 : McMurrich 1901, pp. 155 & 158 : Carlgren 1914, p. 260 ; 1918, p. 25 : Stephenson 1918a, p. 14 ; 1918b, p. 257 : Carlgren 1938, p. 18 ; 1949, p. 18 : Parry 1951, p. 93 : Dunn 1982, p. 697 : Doumenc & Van-Praët 1987, p. 351.
Endocoelactis Carlgren 1897, p.169.
Halcuriopsis Carlgren 1921, p. 93.

Mesenteries up to 34 pairs arranged in 4 cycles, 6+4+8+16. Macrocnemes 10 pairs, fertile, filamented and with restricted retractors. Microcnemes in only upper part of the body, some of them perfect. Parietobasilar muscles rather well developed to fairly weak. Tentacles up to 68. Dioecous. Cnidom; spirocysts, basitrichs, and microbasic p-mastigophores.

Halcurias carlgreni **McMurrich, 1901**

(Jap. name: Kawari-Ginchaku Uchida, 1992)

(Fig. 1; Pl. 1, figs. A–B)

Endocoelactis sp. Carlgren 1897, p. 169.
Halcurias Carlgreni McMurrich 1901, p. 159.
———— *carlgreni* Carlgren 1918, p. 26 : Stephenson 1922, p. 258 : Carlgren 1940, p. 22 ; 1949, p. 19 : Uchida 1992, p. 128 ; 2001a, p. 17 (partim) ; 2001b, p. 10 ; 2001c, p. 5 (partim).

Body elongate. Column almost smooth, sometimes with longitudinal and horizontal striate. Few small nematocyst batteries scattered on the distal part. The batteries are scarcely observable under binocular microscope. It can not be found that any kinds of longitudinal muscles in ectoderm of the column. Distal margin of column tentaculate.

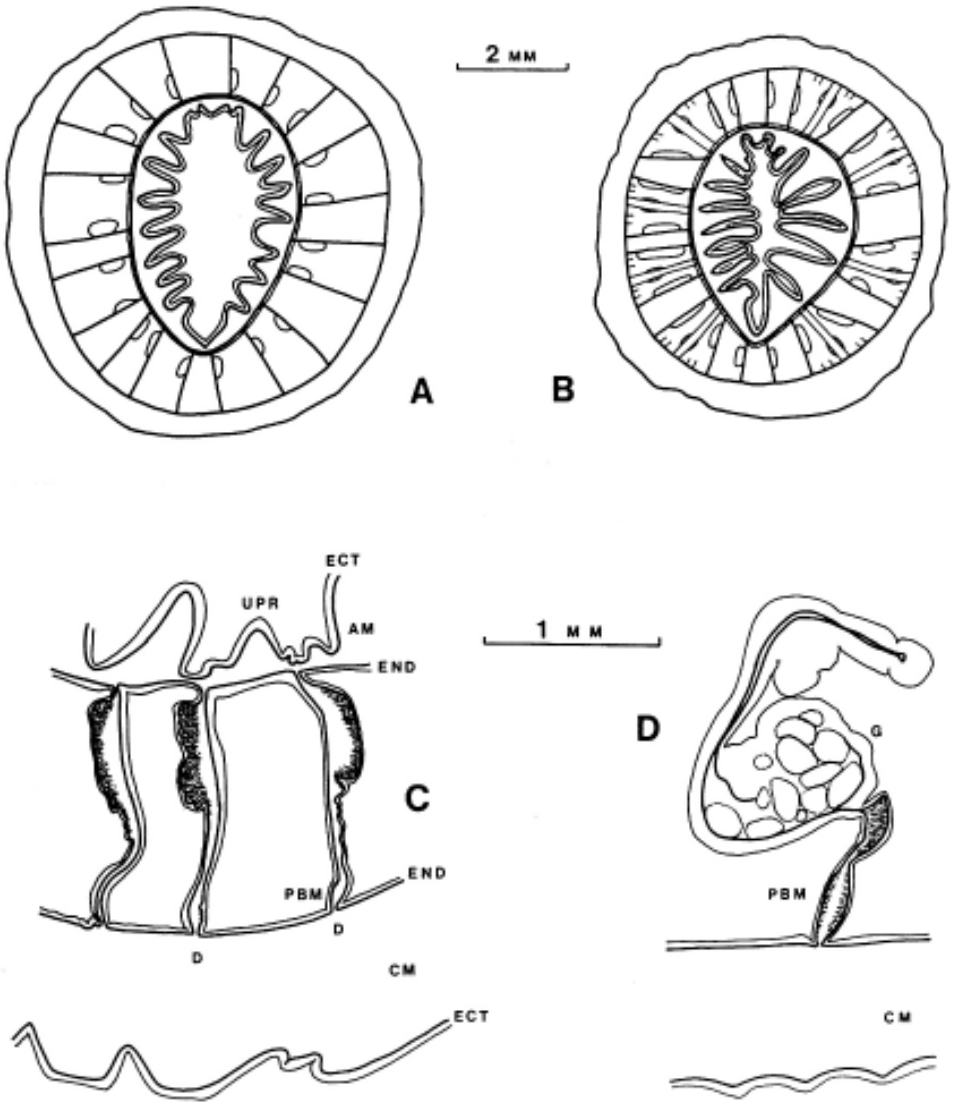

Fig. 1. *Halcurias carlgreni* McMurrich, 1901.
A: Mesenteries and pharyngal ridges at lower actinopharynx; B: Same at upper actinopharynx; C: A pair of directives and a macrocneme at lower actinopharynx showing an unpaired ridge; D: A macrocneme at middle column.
In figs. A-B, drawings are somewhat schematic outside of actinopharynx.
Abbreviations. AM: Mesoglea of actinopharynx, CM: Mesoglea of column, D: Directive mesentery, ECT: Ectoderm, END: Endoderm, G: Gonad, PBM: Parietobasilar muscle, UPR: Unpaired ridge.

Nematocyst batteries of column with many spirocysts of stout type and many basitrichs. Ectoderm of column out of the batteries with only sparsely scattered spirocysts of stout type. Tentacles up to 68 in number, and each tentacle much longer comparing with its body size (Pl. 1, fig. B). Tentacle ectoderm with very numerous spirocysts of stout type and with many slender basitrichs. The composition of nematocysts is just same between proximal parts and tips of tentacles. Actinopharynx with 15−19 well developed longitudinal ridges along its ectodermal surface (Fig. 1, A−B). A single siphonogryph developed more or less distinctly. The ridges don't correspond to the arrangement of mesenteries. Ectoderm of actinopharynx with many spirocysts of stout type together with basitrichs and microbasic p-mastigophores. Mesenteries up to 34 pairs arranged in 4 cycles (6+4+8+16). The first two cycles macrocnemic, developed along whole body from the oral disc to the pedal disc. Macrocnemes (including directives) with filaments and gonads together with the well developed restricted retractors (Fig. 1, D). All 20 macrocnemes with gonads at the same level, where somewhat under the proximal margin of actinopharynx. The last two cycles microcnemic, without filaments nor gonads. The mesenteries of the third cycle perfect and with weak retractor muscles, but those of the 4th cycle imperfect and devoid of muscle pennons (Fig. 1, B). All mesenteries devoid of oral stomata nor marginal stomata. Parietobasilar muscles of macrocnemes developed at the middle of the column (Fig. 1, D). Basilar muscles wanting. Mesenterial filaments with many microbasic p-mastigophores together with few spirocysts and much fewer basitrichs.

Nematocysts (scale in μ, average in parentheses, form of each kind of nematocysts are the same as those in Fig. 5)

Tentacles:
- Basitrichs (tips) 24−(28)−33 × 2.4−(2.7)−3.8 (common)
- (proximal pt.) 24−(28)−36 × 2.6−(2.8)−3.7 (common)
- Spirocysts 32−(37)−48 × 5.0−(6.3)−7.0 (very numerous)
- Spirocysts 22−(24)−31 × 2.8−(3.4)−4.0 (common)

Column (nematocyst batteries):
- Basitrichs 20−(24)−27 × 1.9−(2.2)−2.6 (common)
- Spirocysts 23−(29)−32 × 5.2−(5.9)−6.5 (numerous)

Column (out of nematocyst batteries):
- Spirocysts 22−(28)−34 × 4.2−(5.5)−6.2 (few)

Actinopharynx:
- Basitrichs 24.5−(28)−31 × 2.9−(3.0)−3.0 (common)
- Microbasic p-mastigophores 25−(28)−31 × 4.3−(5.2)−5.8 (common)
- Spirocysts 20−(32)−42 × 4.8−(6.5)−7.7 (common)

Filaments:
- Basitrichs 21 × 3.0−29 × 3.2 (very rare)
- Microbasic p-mastigophores 22.5−(26)−32 × 4.8−(5.5)−6.0 (common)
- Spirocysts 16−(25)−30 × 5.0−(5.6)−6.7 (rare)

Dimension of preserved specimens: height of column 13−70 mm; diameter at middle part of column 11−30 mm; diameter of pedal disc 7−33 mm; length of inner tentacles 6−30 mm; that of outer tentacles 3−24 mm.

Color of living state: column orange in rather shallow water individuals, white with many small speck of orange-red in color in rather deep water ones, proximal border yellowish; tentacles pale orange almost colorless with wide longitudinal orange stripes on both sides of each tentacle, intensity of color of stripes are diverse from deep orange to almost colorless; oral disc colorless with orange radial lines corresponding to color stripes of each tentacle; oral cone of large proximal part same color as oral disc, brilliant lemon yellow at marginal area, and well colored in orange just proximate to the yellow zone. The color relation of orange and yellow is reversed in oral disc and oral cone in a single case (one specimens collected on Jan. 21, 1990).

Locality:

off Noto-Kawajiri, Ishikawa Prefecture, by dredging, June 7, 1977, collected by Dr. Ch. Shinya of the Noto Marine Biological Laboratory, Kanazawa University, 1 specimen (mature female).

off Shionomisaki, 250m deep, Kushimoto, Wakayama Prefecture, by dredging, Jan. 15, 1990, collected by S. Nagai, 4 specimens.

off Shionomisaki, 75m deep, Kushimoto, Wakayama Prefecture, by dredging, Jan. 21, 1990, collected by S. Nagai, 2 specimens.

off Shionomisaki, 100m deep, Kushimoto, Wakayama Prefecture, by dredging, Dec. 20, 1991, collected by S. Nagai, 4 specimens.

off Shionomisaki, 250m deep, Kushimoto, Wakayama Prefecture, by dredging, Jan. 20, 1992, collected by S. Nagai, 1 specimen.

off Shionomisaki, 200m deep, Kushimoto, Wakayama Prefecture, by dredging, Dec. 19, 1992, collected by S. Nagai, 1 specimen.

off Satono, 140m deep, Susami, Wakayama Prefecture, by dredging, Feb. 5, 1993, collected by S. Nagai, 6 specimens.

off Shionomisaki, 200m deep, Kushimoto, Wakayama Prefecture, by dredging, June, 6, 1993, collected by S. Nagai, 1 specimen.

off Tanami, 120m deep, Kushimoto, Wakayama Prefecture, by dredging, Jan. 17, 1995, collected by S. Nagai, 4 specimens.

off Tanami, 160m deep, Kushimoto, Wakayama Prefecture, by dredging, Apr. 17, 1995, collected by S. Nagai, 1 specimen.

off Shionomisaki, 90m deep, Kushimoto, Wakayama Prefecture, by dredging, June, 14, 1995, collected by S. Nagai, 1 specimen.

Izu-Oshima, 30m deep, diving, Apr. 7, 1997, collected by I. Soyama, 2 specimens.

off Uozu Harbor, 200m deep, Toyama Prefecture, by fisheries net, Dec. 8, 2000, collected by Sh. Takayama, 1 specimen.

Remarks: This species is characterized by the presence of many spirocysts of stout type in the column ectoderm and in the ectoderm of actinopharynx. The description by Carlgren (1897) (as *Endocoelactis* sp.) and that by Carlgren (1918) are well fitted with my specimens. The size ranges of the nematocysts of the specimen are well fitted with those of *H. carlgreni*, especially with those of Carlgren (1897). It is worthy of note that the absence of the stouter basitrichs in the tips of tentacles.

Right figure on p. 17 (Osezaki in Izu Peninsula, 8m deep) in Uchida (2001a) is not for this species, but other's (see below). The author erroneously used the photo-slide instead of that of Izu-Oshima, 30m deep. The mesh texture of column of the species in

Uchida（1992, Pl. 29, Fig. 4）may be due to long rearing in aquarium.

Halcurias japonicus **sp. nov.**
（Jap. name: Abata-Kawari-Ginchaku Uchida, 2001）
（Fig. 2; Pl. 1, figs. C−E）

Body elongate, but lower cylindrical or spherical form by abrupt fixation. Column with many nematocyst batteries all over the surface. Batteries wart-like, whitish semi-opaque, and larger in size in distal part, easily observable by naked eyes（Pl. 1, fig. D）. Ectoderm of column without longitudinal muscles. Distal margin of column tentaculate. Nematocyst batteries of column with very numerous bastrichs, but without spirocysts. Ectoderm of column out of the batteries almost devoid of nematocysts.

The numbers of tentacles of two specimens are 56 and 68 respectively, and each tentacle conical and relatively short comparing with the body size（Pl. 1, fig. C）. Ectoderm of tentacles with very numerous spirocysts of slender type, together with numerous spirocysts of stout type and basitrichs. The composition of nematocysts being same between proximal parts and tips of tentacles. Actinopharynx with 6 pairs of well developed stout ridges, which reduce great amount of pharyngeal space（Fig. 2, A−B）. A single siphonogryph well developed. Without unpaired ridge. Ectoderm to actinopharynx with numerous spirocysts of stout type together with many microbasic p-mastigophores and few basitrichs.

Mesenteries 28（Fig. 2, B）and 34 pairs respectively, arranged in 4 cycles. These are just same as those in the preceding species. A couple of specimens male. All the macrocnemes with the same form even at the proximal-most part of the column, without

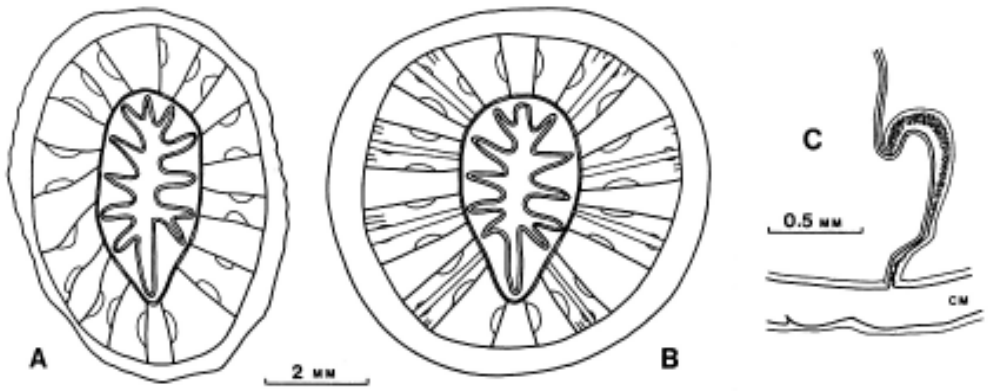

Fig. 2. *Halcurias japonicus*, n. sp.
A: Mesenteries and pharyngal ridges at lower actinopharynx; B: Same at upper actinopharynx; C: A macrocneme at lower column. In figs. A-B, drawings are somewhat schematic outside of actinopharynx. Abbreviations: see fig. 1.

reducing of any members of them. Retractor muscles and parietobacilar muscles of macrocnemes weaker than those of the preceding species (Fig. 2, C). Mesenteries without oral stomata and marginal stomata. Mesenterial filaments with many microbasic p-mastigophores and fewer spirocysts. Spirocysts surely present in the filaments and more than those of the preceding species, who has very few spirocysts in the filaments.

Asexual reproduction commonly takes place by budding from the pedal disc margin.

Nematocysts (scale in μ, average in parentheses, form of each kind of nematocysts are the same as those in Fig. 5)

Tentacles:

Basitrichs (tips)	23−(28)−33 × 2.5−(2.8)−3.3	(numerous)
(proximal pt.)	24.5−(26)−28 × 2.3−(2.5)−2.7	(numerous)
Spirocysts	33−(36)−40 × 5.1−(5.6)−6.0	(numerous)
Spirocysts	26−(33)−39 × 3.2−(3.8)−4.2	(very numerous)

Column (nematocyst batteries):

Basitrichs	27.7−(34)−36.5 × 2.2−(2.6)−2.8	(very numerous)

Actinopharynx:

Basitrichs	26−(28)−30.5 × 2.6−(2.9)−3.1	(few)
Microbasic p-mastigophores	24−(27)−30 × 5.0−(5.2)−5.7	(common)
Spirocysts	31−(36)−38 × 6.0−(7.2)−8.5	(numerous)

Filaments:

Microbasic p-mastigophores	19−(22)−25 × 3.9−(4.8)−5.7	(common)
Spirocysts	20−(27)−32 × 5.3−(5.8)−6.5	(few)

Dimension of fixed specimens: Holotype; height of column 19 mm, breadth at middle part of column 8 mm, length of inner tentacles 4.5 mm, of outer tentacles 3 mm. Paratypes; height of column 5−25 mm, breadth 5−22 mm, inner tentacles 1.5−5 mm, outer tentacles 1−3.5 mm.

Color: Column itself almost colorless in young, but orange in large ones, nematocyst batteries whitish yellow, very abundantly distributed on the column, the column looks like paler. Tentacles and oral disc colorless. Mouth opening edge of oral cone yellow.

Locality:

Holotype: off Hayatsuki River, Uozu, Toyama Prefecture, 80m deep, by gill-net, attached on dead oyster shells, June, 17, 1974, collected by Mr. Y. Kanoh of the Uozu Aquarium, (mature male).

Paratypes:

off Hayatsuki River, Uozu, Toyama Prefecture, 80m deep, by gill-net, attached on dead oyster shells, June, 17, 1974, collected by Mr. Y. Kanoh of the Uozu Aquarium, 1 specimen (mature male).

off Aoshima, Uozu, Toyama Prefecture, 100−200m deep, by gill-net, Mar. 1990, collected by Mr. Sh. Takayama of the Uozu Aquarium, 1 specimen.

off Uozu, Toyama Prefecture, 100−200m deep, by gill-net, Oct. 31, 2000, collected by Mr. I. Soyama, 6 specimen.

off Uozu, Toyama Prefecture, 100m deep, by gill-net, Dec. 8, 2000, collected by Mr. I. Soyama, 1 specimen.

Others: ? Izu Osezaki, 15m deep, by diving, Feb. 3, 2001, collected by Mr. I. Soyama, 2 specimens.

Remarks: The new species is characterized by the presence of numerous spirocysts in the ectoderm of actinopharynx, and by the absence of spirocysts in the ectoderm of column. The species is easily distinguished from *H. endocoelactis* Stephenson, 1918, which is devoid of spirocysts in the ectoderm of actinopharynx, and from *H. carlgreni* McMurrich, 1901 and *H. minimus* Carlgren, 1928, both of which have many spirocysts in the ectoderm of column (see preceding species). Moreover, *H. endocoelactis* has a large oral stoma in each macrocneme. The imperfectly known *H. pilatus* McMurrich, 1893 (the type species of the genus) and its related species (see below) are characterized by the presence of longitudinal muscles in the ectoderm of column and the presence of a parapet below the base of tentacles. All other species including the new species lack the longitudinal muscles in column, and are devoid of the parapet.

H. japonicus, n. sp. is undoubtedly closely related to *H. capensis* Carlgren, 1928, but is distinguished from the latter by the presence of many wart-like nematocyst batteries, and by a single sort of nematocysts in the ectoderm of column. *H. capensis* has many nematocyst batteries on the column, but never formed large wart-like process. *H. capensis* with microbasic p-mastigophores in ectoderm of column, but without them in the new species.

The curious point of the species on nematocyst distribution is the presence of spirocysts in the filaments, which are the organ originally from endoderm, and spirocysts are extraordinarily found in ectodermal organs in general. Spirocysts are also found in the filaments of *H. carlgreni* (see preceding species, and also Carlgren, 1914, 1940), and never mentioned on other species of *Halcurias*. Asexual reproduction by budding is also unknown on the other species in the family.

The two specimens from Izu Osezaki are rather small ones (5 mm high, 6 mm in diameter on both) with deep orange column, but color patten are essentially same as those from Uozu. The specimens with rather large number of tentacles comparing with their body size (52 and 58 respectively), and microcnemes never appeared in middle actinopharynx level in cross section. The anemones are found underside of stones in very shallow water (2−15m deep), and the fact is very curious comparing with the deep localities of other species of the family. The nematocyst survey of this shallow water ones show the similarity to *H. japonicus* n. sp. The abundance of spirocysts in filaments also found in this form, but collected materials were all in small size, and with no traces of budding at pedal margin. The author treats this shallow water population as the same species of *H. japonicus* n. sp. with some hesitations.

Right figure on p. 17 as *H. carlgreni* (Osezaki in Izu Peninsula, 8m deep) in Uchida (2001) is the living state of the specimens of this type.

Halcurias levis **sp. nov.**

(Jap. name: Oh-Kawari-Ginchaku Uchida, 2001)
(Figs. 3−5; Pl. 1, fig. F)

Body cylindrical, stout, and not so elongate as the preceding two species (Pl. I, fig.

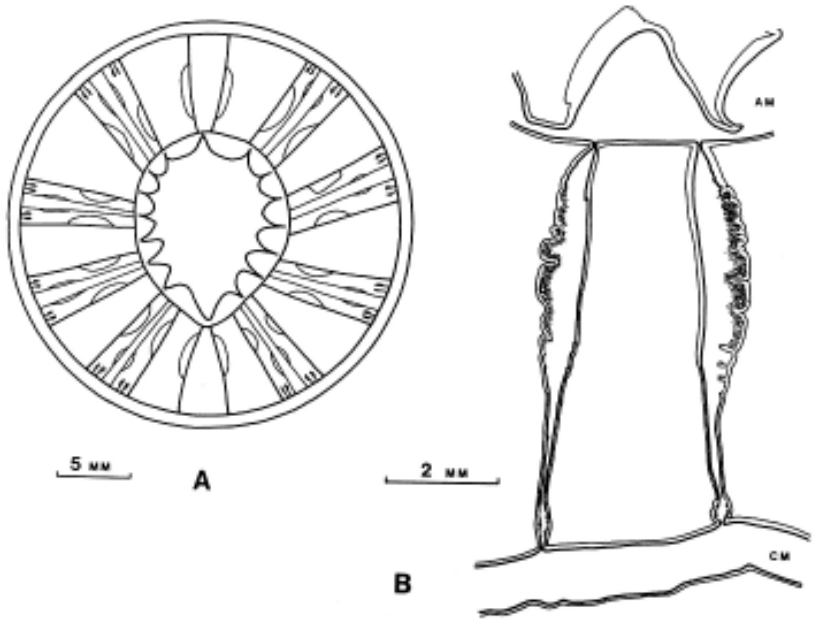

Fig. 3. *Halcurias levis*, n. sp.

A: Mesenteries and pharyngal ridges at upper actinopharynx; drawings are somewhat schematic outside of actinopharynx. B: Two macrocnemes at lower actinopharynx. Abbreviations: see fig. 1.

F). Column smooth, without nematocyst batteries. Ectoderm of column without longitudinal muscles. Distal margin of column tentaculate. Ectoderm of column with numerous basitrichs, but without spirocysts.

Tentacles up to 68 in number, and with ordinary length and form. Tentacles with many spirocysts of two types, together with basitrichs, but tips of those with stout type of basitrichs together with the slender type.

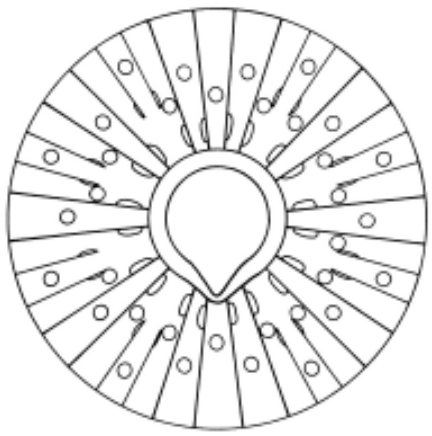

Fig. 4. *Halcurias levis*, n. sp.

Arrangement of mesenteries and tentacles in young specimen with 34 tentacles.

Actinopharynx with eight pairs of ridges and a weak siphonogryph (Fig. 3, A). Ectoderm of actinopharynx with many spirocysts of stout type together with numerous basitrichs and many microbasic p-mastigophores.

Mesenteries 34 pairs, arranged 6+4+8+16 (Fig. 3, A). The arrangement is just same as those in the preceding two species. The first two cycles macrocnemic, and mesenteries of the first three cycles perfect. All the macrocnemes with the same form even at the proximal-most part of the column. Macrocnemes fertile. Retractor muscles and parietobasilar muscles of macrocnemes rather well developed (Fig. 3, B). Mesenteries without oral stomata nor marginal

stomata. Mesenterial filaments with many microbasic p-mastigophores, but without spirocysts. Holotype mature male, and a paratype mature female. Immature specimen (column: height 12 mm, width 10 mm) with only 34 tentacles has the mesenteries of three cycles, 6+4+8=18. The arrangement of mesenteries and tentacles of it are shown in Fig. 4.

Nematocysts (Fig. 5) (scale in μ, average in parentheses, left parentheses for the immature young specimen, and right for mature adult specimens: Measurements of spirocysts in the proximal parts of tentacles were held only in the adult specimens)

Tentacles (tips):

Basitrichs	24−(27)−(31)−33 × 2.3−(2.6)−(3.1)−3.3 (numerous)
Basitrichs	23−(25)−(33)−38.3 × 2.9−(3.2)−(4.6)−5.3 (common)
Spirocysts	30−(42)−(42)−55 × 5.0−(6.6)−(8.3)−9.3 (numerous)
Spirocysts	19−(23)−(28)−38 × 2.8−(3.4)−(4.3)−6.6 (numerous)

Tentacles (proximal parts):

Basitrichs	24−(25)−(33)−33.7 × 2.1−(2.5)−(3.2)−3.7 (common)
Spirocysts	44−(−)−(48)−55 × 7.2−(−)−(9.1)−11 (numerous)
Spirocysts	25−(−)−(35)−40 × 4.0−(−)−(5.2)−6.0 (very numerous)

Column:

Basitrichs	20.5−(25)−(32)−37 × 2.2−(2.4)−(2.9)−3.3 (numerous)
Spirocysts	very rare, 19−32 × 4.8−6.0 (contamination ?)

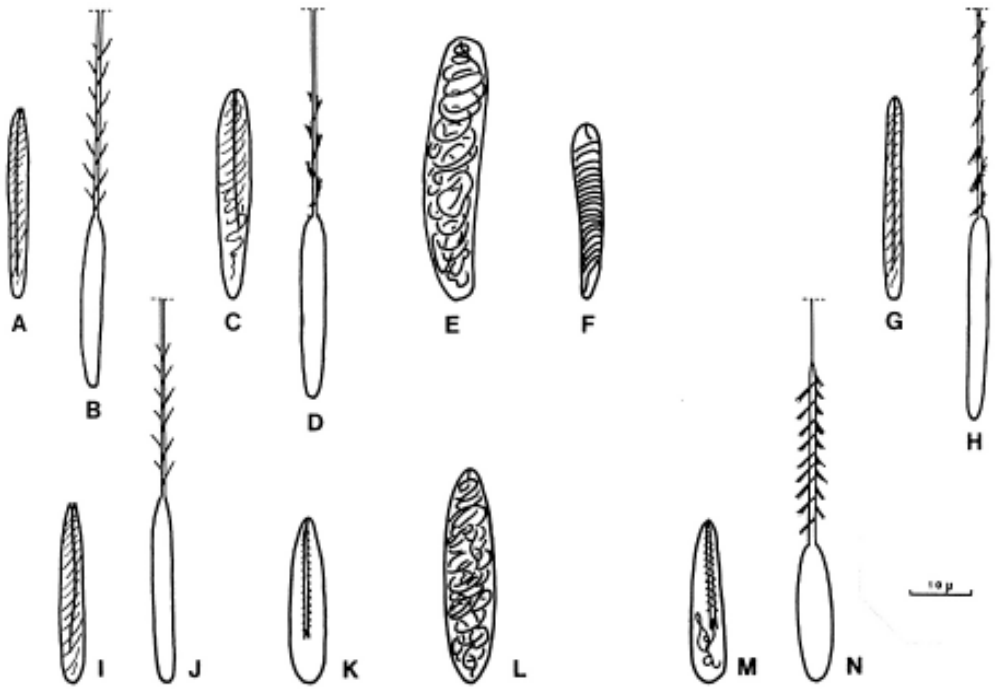

Fig. 5. *Halcurias levis*, n. sp. Nematocysts.

A-F: Tentacles, G-H: Column, I-L: Actinopharynx, M-N: Mesenterial filaments. A-B, G-H, I-J: Basitrichs of slender type; C-D: Basitrichs of stout type; E, L: Spirocysts of stout type; F: Spirocyst of slender type; K, M-N: Microbasic p-mastigophores.

Actinopharynx:

Basitrichs 23−(26)−(29)−32 × 2.8−(3.1)−(3.8)−4.2 (numerous)

Microbasic p-mastigophores

22−(24)−(27)−32 × 4.8−(5.3)−(5.9)−6.6 (common)

Spirocysts 22−(28)−(34)−42 × 5.0−(6.1)−(7.1)−8.0 (common)

Filaments:

Microbasic p-mastigophores

15−(21)−(25)−27 × 4.5−(5.0)−(5.5)−6.3 (numerous)

Each of the slender type of basitrichs in tentacles in discharged condition with a shaft of about the same length as that of capsule, and with 7 turns of spines in a side view (Fig. 5, B). The thread of it about 650 μ long. Those in the column with almost same structure as in the tentacles, but proximal three turns with longer spines than those in distal four turns (Fig. 5, H), and the thread of the greater amount of basitrichs discharged imperfectly. The ratio of the shaft with longer spines to that with shorter ones is 3:5. Those in the actinopharynx almost same as in the tentacles, but with only 5−6 turns of spines (Fig. 5, J), and the thread 720 μ long.

The stout type of basitrichs (Fig. 5, C−D) only found in the tips of tentacles with short shaft (2/3 of the length of capsule) and longer thread (ca. 800 μ long). The shaft with three turns of spines.

Microbasic p-mastigophores in the filaments in discharged condition (Fig. 5, N) with the shaft of a little longer than the capsule, and with 9 turns of spines, whose tips directed backward (p-Rhabdoiden B1a *sensu* Schmidt, 1972).

Dimension of fixed specimens: Holotype; height of column 35 mm, breadth at middle part of column 35 mm, length of inner tentacles 23 mm, of outer tentacles 16 mm, diameter of proximal part of tentacles 4 mm. Paratype No. 1; height of column 50 mm, breadth of it at distal part 32 mm, at basal part 27 mm, length of inner tentacles 30 mm, outer tentacles 19 mm. Paratype No. 2; height of column 12 mm, breadth at middle part of column 10 mm, length of inner tentacles 6 mm, outer tentacles 4 mm. Paratype No. 3; height of column 34 mm, breadth at middle part of column 20 mm, length of inner tentacles 10 mm, outer tentacles 9 mm (tentacles shrunk hard).

Color in living state: All the parts lemon yellow; tentacles paler, semi-transparent; distal margin of the oral cone brilliantly.

Locality:

Holotype; off Minabe, Wakayama Prefecture, by gill-net of fisherman, Feb. 29, 1984, collected by Dr. H. Tanase, the Seto Marine Biological Laboratory of Kyoto University.

Paratype No. 1; same as holotype, Nov. 23, 1983, collected by Dr. H. Tanase. The two specimens mentioned above were probably collected from rocky bottom of ca. 50m deep at 1500m far off Kashima Islet located off Minabe Town, deciding from the explanation of fishermen.

Paratype No. 2; by the beam-trawl, off Port Okada, Izu Ohshima, ca. 100m deep, Oct. 26, 1973, collected by the Ocean Research Institute, University of Tokyo.

Paratype No. 3; Shirahama, Wakayama Prefecture, 35m deep, by diving, Mar. 9, 1997, collected by K. Ito.

Remarks: *H. levis* n. sp. characterized by the absence of nematocyst batteries and spirocysts in the ectoderm of column. It is distinguished from *H. pilatus* McMurrich, 1893,

and its related species (see below) by the absence of longitudinal muscles in the ectoderm of column, and also from *H. endocoelactis* Stephenson, 1918, by the presence of spirocysts in the ectoderm of actinopharynx. Furthermore, it is distinguished from *H. carlgreni* McMurrich, 1893 and *H. minimus* Carlgren, 1928, by the absence of spirocysts in the ectoderm of column. Finally, it is easily distinguished form *H. capensis* Carlgren, 1928, and H. japonicus, n. sp. by the absence of nematocyst batteries in column.

Colonies of many individuals of the new species were found by SCUBA divers, at rocky bottom of ca. 40m deep off Tanabe and Shirahama (Uchida, 2001a). The brilliant yellow color of the species is very conspicuous, and fluorescent cells were recently isolated from this species (Miyawaki, personal com.). The fluorescence activity of the anemone may have a certain function in such dusky deep water habits. Furthermore, brilliant yellow mark of lip margin in other species in the subord. Endocoelantheainea also may have fluorescent cells, and may have the same function as *H. levis*, n. sp.

On *Halcurias pilatus* McMurrich, 1893

H. pilatus, the type species of *Halcurias*, has been hitherto recorded only two times. The original collection was three specimens from the Pacific off southern Chile (McMurrich, 1898). Another record was 6 specimens from Bahama Islands (McMurrich, 1898). But it seems to me that these two are not the same species. The same idea was mentioned by Carlgren (1928). However, he simply wrote as follows, "Möglicherweise stecken übringens unter *pilatus* zwei verschieden Spezies"(p. 134). Both have the longitudinal muscles in the ectoderm of column, and the parapet around the base of the tentacles. The column of Chile specimens have a color pattern of longitudinal stripes. Actinopharynx with a weak siphonogryph and more than 20 weak ridges. Column "possesses no warts or tubercles"(p. 142), but the ectoderm of column "contains very closely crowded together"(p. 143). This means the presence of scattered minute nematocyst batteries. Tentacles are about 70 in number, and macrocnemes all fertile, therefore these are mature adult (full-grown adult has 68 tentacles in *Halcurias*, see diagnosis of the genus). "Below, however, it is seen that four of the pairs (of mesenteries), as in *Peachia*, are much narrower than the other six, these narrow pairs being situated in the sulco-lateral and lateral intermesenterial spaces."(p. 143) These descriptions clearly shows that the second cycle of macrocnemes reduced in the lower column even in adults.

On the other hand, Bahama specimens without color markings on the column. Actinopharynx with a well-developed siphonogryph, and with 12−20 stout ridges. Nematocyst batteries in Bahama's "seemed to be especially abundant at the edge of the parapet."(p. 228) Tentacles are ca. 40−over 60, and "only a few scattered ova were to be found in the specimens examined"(p. 229), therefore, the specimens seemed to be youngs and adults. All the mesenteries not reduced in proximal part of the column. He described in the definition of the genus (p. 227) as follows; "In my original definition of this genus I laid stress on the fact that four pairs of mesenteries were less developed than the other six; this deference is by no means evident in the specimens I have found in the present collection and is probably due to the stage of development of the individual." His conclusion seems not to be correct. The Chile's was older in age than the Bahama's, because of the numbers of tentacles, and of the condition of gonads. Furthermore, the small

specimen of *H. levis* n. sp. (Paratype No. 2) has no reduction of mesenteries on its proximal part of the column in spite of its tentacles of 34 in number. Therefore, the reduction of mesenteries in proximal part of the column in the Chile's is not due to the age, but specific.

McMurrich (1901) again described *H. pilatus*. In this paper, he dealt with *Endocoelactis* as a junior synonym of *Halcurias*. His material in this paper (1901) had an actinopharynx with a weak siphonogryph and weak ridges, according to his figure 1. Therefore, it is certain that *H. pilatus* in his 1901 paper was the type specimens collected off Chile. In that paper, he described the presence of oral stomata and marginal stomata on the macrocnemes, and 68 mesenteries. The mesenterial stomata of the Bahama specimens have been unknown. Finally, the type locality was nearly antarctic zone of Pacific, but that of the second record was subtropical coral seas in the Atlantic. According to those mentioned above, the two sorts of anemones seemed to be distinct two species, and here I propose *Halcurias macmurrichi*, nom. nov. for the Bahama specimens.

These two species have longitudinal muscles in the ectoderm of column, and distinct parapet just under the base of tentacles. *H. pilatus* easily distinguished from *H. macmurrichi* by the reduction of the second cycle of mesenteries in the lower column, scattered minute nematocyst batteries, and color stripes on the column.

Additionally, it has been considered for a long time that *H. pilatus* has many spirocysts in its ectoderm of column (Carlgren, 1914, p. 260; Stephenson, 1918a, p. 17). However, McMurrich (1893) didn't describe on spirocysts at anywhere, but only "numerous nematocysts". Judging from the figure in McMurrich (1893, fig. 15, Pl. 21), nematocysts of the ectoderm of column were very slender, so that they seemed to be bastrichs. McMurrich (1898) described that the nematocysts in the ectoderm of column in Bahama specimens were same as those in type specimens. Therefore, it seems to me that *H. pilatus* and *H. macmurrichi* have not numerous spirocysts in the ectoderm of column.

Key to the species of *Halcurias*

1. Column with longitudinal muscles in the ectoderm, and with a parapet at the distal margin 2
1. Column without longitudinal muscles in the ectoderm 3

2. Column with scattered minute nematocyst batteries and color stripes: 8 macrocnemes reduced in lower column: Actinopharynx with a weak siphonogryph and with more than 20 weak ridges: Macrocnemes with oral stomata and marginal stomata ..... *H. pilatus* McMurrich, 1893
2. Column with remarkable nematocyst batteries near its distal margin, but without color markings: All 20 macrocnemes not reduced at lower column: Actinopharynx with a well-developed siphonogryph, and with 12−20 much stouter ridges ..... *H. macmurrichi*, nom. nov.

3. Ectoderm of actinopharynx without spirocysts: With large oral stomata: Microcnemes arranged irregularly ..... *H. endocoelactis* Stephenson, 1918
3. Ectoderm of actinopharynx with big spirocysts: Without oral stomata, nor marginal stomata of mesenteries 4

4. Ectoderm of column with spirocysts, and with not so many nematocyst batteries 5
4. Ectoderm of column without spirocysts, or if present very rare 6

5. Tentacles long with a single sort of basitrichs: Ectoderm of column with numerous spirocysts ..... *H. carlgreni* McMurrich, 1901
5. Tentacles not so long with two sorts of basitrichs: Ectoderm of column with sparse spirocysts ..... *H. minimus* Carlgren, 1928

6. Column without nematocyst batteries ..... *H. levis*, sp. nov.
6. Column with nematocyst batteries 7

7. The third cycle of mesenteries (the elder microcnemes) never reach to the actinopharynx: Column with two sorts of basitrichs ..... *H. capensis* Carlgren, 1928
7. The third cycle of mesenteries perfect: Column without stouter basitrichs ..... *H. japonicus*, sp. nov.

Developmental manner of mesenteries and tentacles in *Halcurias*

Manner of development of mesenteries and tentacles can be considered from Figs. 2−B and 4−D, together with Fig. 2 of Carlgren (1897) and Fig. 2 of McMurrich (1901). The manner is shown in Fig. 6. There may be two ways from C to D. Fig. 4 of *H. levis* suggests to D in Fig. 6, but Fig. 2−B of *H. japonicus* suggests that ⑤ with exclamation mark in Fig. 6 substituted with ③ in the same sector. Finally, tentacles are arranged in 5 cycles as follow; 18 (6 ① + 4 ③ + 8 ⑤) + 10 (6 ① + 4 ②) + 24 (8 ⑧ + 8 ⑨ + 8 ④) + 16 (8 ⑥ + 8 ⑦) = 68. Manner of development before the stage A is unknown, for the lack of anatomical study (and also the lack of materials) of such young stage from embryos. Developmental manner of tentacles is also very peculiar, comparing with the Nynanthean species. A newly developed microcnemic pair does not hold an elder tentacle between own endocoels, but accompanies with the development of a new tentacle in its endocoel. Therefore, exocoelic tentacles always remain exocoelic (③, ⑤, ⑧, ⑨). The exception is in the case of four tentacles of the primary lateral endocoel. These tentacles change the position to exocoelic (not from exocoelic to endocoelic as in the case of usual anemones) at the stage from A to B in Fig. 6. New exocoelic tentacles (③, ⑤, ⑧, ⑨), which make pairs with the elder exocoelic tentacles, are developed after the development of their mesenterial pairs, and of their endocoelic tentacles. Each of the ③ and ⑤ tentacles is formed as one of a pair of each lateral endocoelic tentacles or ③ tentacles, and the tentacles of the pairs are situated on the equivalent position on the oral disc. Eight tentacles of the ⑧ are made paired with four primary lateral endocoelic tentacles and four ③, and eight tentacles of the ⑨ are with eight ⑤. However, these tentacles of 16 pairs are not situated on the equivalent position. One of a pair consists of the first cycle, but another belongs to the third cycle.

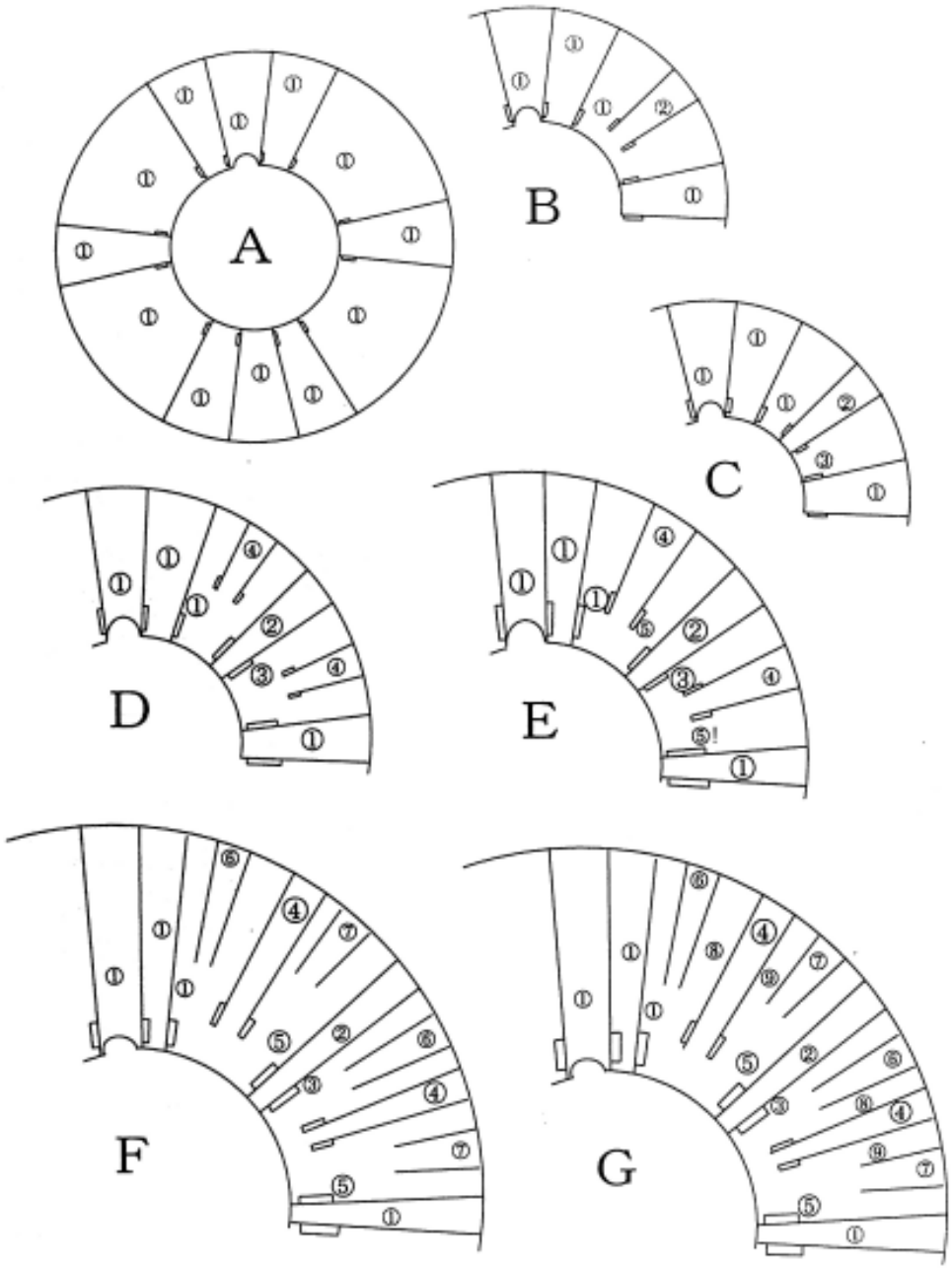

Fig. 6. Developmental manners of mesenteries and tentacles in *Halcurias*.
①－⑨: Tentacles showing their developmental order. A: *Halcampa*-stage with the trace of two pairs of endocoelic mesenteries. C: Completion of 10 pairs of macrocnemes. D: Development of primary microcnemes. F: Development of secondary microcnemes. G: Full-grown adult stage. There may be another way from the stage D to E. The tentacle ⑤ with the exclamation mark exchange its position to the tentacle ③ in the same sector in some species.

Distribution of species of Halcuriidae

There is, now, 8 species of *Halcurias* and a species of *Carlgrenia* in the family Halcuriidae. But only a few capture of the species has been recorded. 7 species out of 9 have been recorded once for all (original collection). Other two species, which have been recorded more than twice, are *Halcurias carlgreni* and *H. capensis*. The latter was collected at two stations in Agulhas Basin, South Africa, by the Deutschen Tiefsee-Expedition, and once more at the point off Cape of Good Hope, at where Mortensen probably collected it during his visit to South Africa in 1929 (cf. Carlgren, 1938). On the other hand, *H. carlgreni* have ever been collected several times around Japan. In his earliest paper (1897), Carlgren wrote simply that the materials collected "in den chinesischen und japanischen Meeren" (p. 159). However, he afterwards described (1918) the exact localities of the materials as follows, "Korea — Koreastrasse 65 Faden — Hirudostrasse 33° 5' N 129° 16' O, 33° 15' N 129° 15' O, 45 Faden. — Kin shin, Gote Hirudostrasse 33° 5' N 129° 16' O, 33° 15' N 129° 15' O, 45 Faden. — Kin shin, Gote Inseln 75 Faden (Bock), China See 30 Faden." The locality of the specimen(s) collected by Bock must be read as Kiu Shiu, Goto Islands. According to other papers on the collection of Sixten Bock (such as Carlgren, 1943, Aurivillius, 1931, and Johansson, 1922), he collected it (or them) at Gotoh Islands on May 15, 1914. It seems that the other three sorts of specimens were his materials for 1897's paper. Therefore, the specimens "in der chinesischen Meeres" in his 1897's paper may correspond to "China See 30 Faden" in 1918's, and "in der japanischen Meeres" may correspond to "Koreastrasse 65 Faden" and "Hirudostrasse 45 Faden". The exact locality in China Sea is uncertain, but it may be Hong Kong, collected by J. Petersen (cf. Aurivillius, 1931, p. 235). The exact locality of Korean Strait is also uncertain, but it may be east off the north part of Tsushima Island, supposing from the depth and "in der japanischen Meeres". Finally, "Hirudostrasse" must be read as Hirado Strait located between Hirado Island and Gotoh Islands. The specimens from here were certainly collected by Capt. Svenson in 1890 (cf. Aurivillius, 1931, p. 185). The

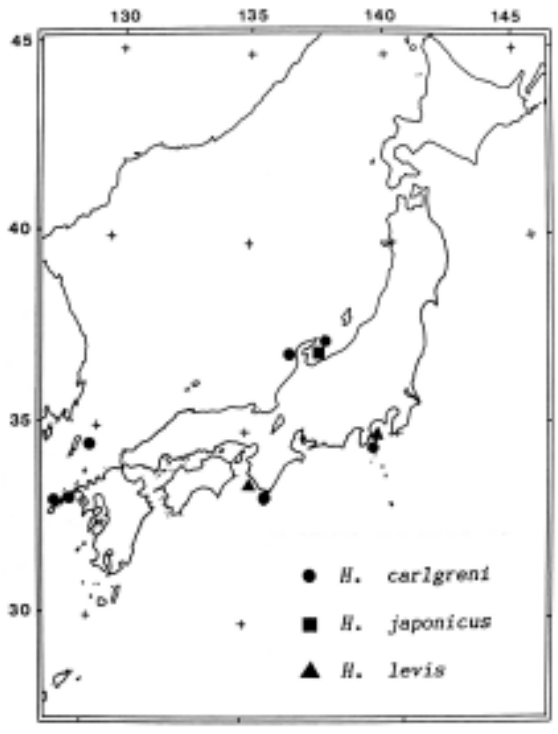

Fig. 7. Distribution of species of *Halcurias* in Japan. Three occations of *H. carlgreni* around the Korean Strait were by Carlgren (1897 and 1918), and the other records are by this paper.

distribution of species of *Halcurias* in Japan is shown in Fig. 7.

In nine species of the family, four were recorded from circum- antiboreal region (*H. pilatus*, *H. endocoelactis*, *H. capensis*, *H. minimus*), three from the west Pacific (around Japan, see Fig. 7), one from the West Indies (*H. macmurrichi*), and remaining one from Ireland (*Carlgrenia desiderarta* Stephenson, 1918).

According to the few records of captures, species of *Halcurias* were collected from the depth of 15–820m. The majority was from 50–200m. However, *H. pilatus* and an individual of *H. capensis* were from 820m and 290m, respectively, and some individuals of *H. japonicus*, n. sp. observed at 2m deep. On the other hand, *Carlgrenia desiderata* was from 1247–1333m deep. *Carlgrenia* may be the deeper form.

REFERENCES

Aurivillius, M. 1931. The gorgonarians from Dr. Sixten Bock Expedition to Japan and Bonin Islands 1914. Kongl. Svenska Vetenskaps-Akad. Handl., Ser. 3, 9(4): 337 pp., 6 pls.

Carlgren, O. 1893. Studien über Nordische Actinien. I. Ibid. 25(10): 148 pp., 10 pls.

————. 1897. Zur Mesenterienentwicklung der Aktinien. Öfvers. Kongl. Vetenskaps-Akad. Förhandl., (1897): 159–172.

————. 1914. On the genus *Porponia* and related genera, Scottish National Antarctic Expedition. Trans. Roy. Soc. Edinburgh, 50: 49–71.

————. 1918. Die Mesenterienanordnug der Halcuriiden. Lunds Univ. Arsskrift, N. F. Avd. 2, 14(29): 37 pp., 1 pl.

————. 1921. Actiniaria. I. The Danish Ingolf-Expedition, 5(9): 241 pp., 4 pls.

————. 1928. Actiniaria der Deutschen Tiefsee-Expedition. Wiss. Ergebn. d. Deutschen Tiefsee-Exped., 22: 123–266, pls. 10–13.

————. 1938. South African Actiniaria and Zoantharia. Kungl. Svenska Vetenskaps-Akad. Handl., 17(3): 147 pp., 3 pls.

————. 1940. A contribution to the knowledge of the structure and distribution of the cnidae in the Anthozoa. Lund Univ. Arsskrift, N. F. Avd. 2, 36(3): 62 pp.

————. 1943. East-Asiatic Corallimorpharia and Actiniaria. Kungl. Svenska Vetenskaps-Akad. Handl., Ser. 3, 20(6): 43 pp., Pl. 2.

————. 1949. A survey of the Ptychodactiaria, Corallimorpharia and Actiniaria. *Ibid*. Ser. 4, 1(1): 121 pp., 4 pls.

Doumenc, D. A. and M. Van Praët. 1987. Ordre des Actiniaires, Ordre des Ptychodactiniaires, Ordre des Corallimorphaires. Traité de Zool., 3(3): 257–401.

Dunn, D. F. 1982. Cnidaria. Sy. P. Parker, ed. Synopsis and classification of living organisms. 1: 669–706. McGraw-Hill Inc., U.S.A.

Haddon, A. C. 1898. The Actiniaria of Torres Straits. Sci. Trans. Roy. Dublin Soc., Ser. 2, 6: 393–498, pls. 22–32.

Hertwig, R. 1882. Report on the Actiniaria dredged by H. M. S. *Challenger* during the years 1873–1876. Challenger Rep., Zool. 6: 1–136, pls. 1–14.

Johansson, K. E. 1922. On some new tubicolous annelids from Japan, the Bonin Islands and the Antarctic. Ark. Zool., 15(2): 11 pp., 4 pls.

McMurrich, J. P. 1893. Report on the Actiniae collected by the United States Fish

Commission steamer *Albatross* during the winter of 1887–1888. Proc. U. S. Nat. Mus., 16: 119–216, pls. 19–35.

————. 1898. Report on the Actiniaria collected by the Bahama Expedition of the State University of Iowa, 1893. Bull. Lab. Nat. Hist., Univ. Iowa, 4: 225–249, 3 pls.

————. 1901. Contributions on the morphology of the Actinozoa. VI. *Halcurias pilatus* and *Endocoelactis*. Biol. Bull. 2: 155–163.

Parry, G. 1951. The Actiniaria of New Zealand. A check-list of recorded and new species, a review of the literature, and a key to the commoner forms. Part 1. Rec. Cant. Mus., 6: 83–119.

Schmidt, H. 1972. Prodromus zu einer Monographie der Mediterranean Aktinien. Zoologica, Stuttg.（121）: 146 pp.

Stephenson, T. A. 1918a. Coelenterata. Part I. Actiniaria. British Antarctic "*Terra Nova*" Expedition, 1910, Nat. Hist. Rep., Zool. 5: 1–68, pls. 1–6.

————. 1918b. On certain Actiniaria collected off Ireland by Irish Fishery Department during the years 1899–1913. Proc. Roy. Irish Acad., 34B: 106–164, 7 pls.

————. 1921. On the classification of Actiniaria. Part 2. Consideration of the whole group and its relationships, with specieal reference to forms not treated in part 1. Quart. Jour. Micr. Sci., 65: 493–576.

————. 1922. On the classification of Actiniaria. Part 3. Definitions connected with the forms dealt with in part 2. *Ibid*., 66: 247–319.

Uchida, H. 1992. Hexacorallia（ex. Scleractinia）. S. Nishimura, *ed*. Guide to Seashore Animals of Japan, pp. 118–147, pls. 27–35, Hoikusha, Osaka.（in Japanese）

————. 2001a. Sea anemones in Japanese waters. 158 pp. TBS Britanica, Tokyo, Japan.（in Japanese）

————. 2001b. The richness of Endocoelanthean sea anemone in Japanese waters. 1. Umiushi Tsushin（Newsletter on Nudibranches）, （32）: 8–10（in Japanese）

————. 2001c. The richness of Endocoelanthean sea anemone in Japanese waters. 2. Ibid.,（33）: 4–6（in Japanese）

Verrill, A. E. 1879. Notice of recent additions to the marine fauna of the eastern coast of North America. No. 5. Amer. Jour. Sci. Art., 17: 432–434.

Yatsu, N. and T. Uchida. 1972. A dictionary of the animal taxa. 1411 pp., Nakayama Shoten, Tokyo, Japan.（in Japanese）

EXPLANATION OF PLATE 1

Fig. A *Halcurias carlgreni* McMurrich, 1901 (deep color type), off Uozu Harbor, 200m deep, Dec. 8, 2000, photo by Mr. I. Soyama.

Fig. B *Halcurias carlgreni* McMurrich, 1901 (pale type), off Shionomisaki, 250m deep, Jan. 20, 1992.

Fig. C *Halcurias japonicus*, n. sp. (paratype), off Aoshima, Uozu, 100-200m deep, May, 1990.

Fig. D *Halcurias japonicus*, n. sp. (paratype), off Uozu, 100-200m deep, Oct. 31, 2000, photo by Mr. I. Soyama. Show asexual budding at pedal margin.

Fig. E *Halcurias* (?) *japonicus*, n. sp. Izu Osezaki, 15m deep, Feb. 3, 2001, photo by Mr. I. Soyama

Fig. F *Halcurias levis*, n. sp. (holotype), off Minabe, Feb. 29, 1984.

Fig. A *Halcurias carlgreni* McMurrich, 1901

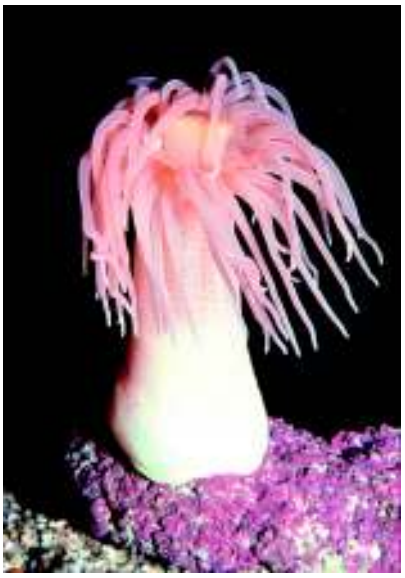

Fig. B *Halcurias carlgreni* McMurrich, 1901

Fig. C *Halcurias japonicus*, n. sp.

Fig. D *Halcurias japonicus*, n. sp.

Fig. E *Halcurias* (?) *japonicus*, n. sp.

Fig. F *Halcurias levis*, n. sp.