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Studies on Japanese Anascan Bryozoa 7. Division Malacostega (5)¹⁾

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Abstract

Three species, *Chaperia acanthina*, *Chaperiopsis transversalis* and *Chaperiopsis patula* are described from Japan. The critical limitation of the two genus *Chaperia* and *Chaperiopsis* in the family Chaperiidae are also discussed.

Key words: Bryozoa, systematic description, Chaperiidae

On our serial studies of the Japanese Anascan Bryozoa we have published six papers which are concerned with recent or fossil specimens of Invicellata, Scrupariina and Malacostega (S. Mawatari, 1973 a, 1973 b, 1974 ; S. Mawatari & S. F. Mawatari, 1979, 1980, 1981), and this is the seventh report of the series. The present paper deals with a species of *Chaperia* and two species of *Chaperiopsis* in the family Chaperiidae, Division Malacostega from Japan.

We express here our cordial thanks to Professor Mayumi Yamada of Hokkaido University for his critical reading of the manuscript.

Family CHAPERIIDAE Jullien, 1888

Membraniporidae (part) Waters, 1898.

Bicellariidae (part) Levinsen, 1909.

Chaperiidae, Jullien, 1888, p. 61 ; Canu and Bassler, 1923, p. 49 ; 1929, p. 466 ; Bassler, 1953, p. 166 ; Hayward and Cook, 1979, p. 54 ; Gordon, 1982, pp. 1-24.

Chaperiellidae Strand, 1928, p. 37 ; Harmer, 1957, p. 641.

Chaperiidae Bassler, 1935, p. 70 ; Osburn, 1950, p. 88 ; Prenant and Bobin, 1966, p. 282.

Diagnosis: Zoarium mostly encrusting, unilamellar, but sometimes bilamellar or erect, vicularian, supported by rootlets. Zooecia moderate, sometimes deep. Gymnocyct narrow, vestigial or absent, or obscured by supporting avicularia. Cryptocyst generally well developed, smooth or granular, often depressed or discended distally. Opesia moderate or large, sometimes covered by a cervicorn avicularian column or

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aviculiferous spinous shield. Intraorificial ridges or occlusor laminae associated with excavations for insertion of retractor muscles of operculum usually well developed, but sometimes inconspicuous or absent. Oral spines present or absent, if present generally strong, situated around distal rim. Avicularia ordinal in shape or pedunculate in distal or proximal position, adventitious or vicarious, or absent. Ooecium hyperstomial, endozoecial or absent. Mural septula present.

Note: Above mentioned diagnosis is based on Gordon (1982) who thoroughly revised the limit of this family in proposing four genera. The present family was originally established by Jullien (1888) for *Flustra australis* (synonym of *Flustra acanthina* Lamouroux, 1825) from Falkland. His definition is as follows: "Orifice semilunar or subcircular, very large, entirely closed by the operculum, provided interiorly with one or more calcareous plates serving for the insertion of retractor muscles of the operculum....." Thus the presence of internal calcareous plates within the opesia was determined as the main character of the family. By its membraniporine feature the type genus *Chaperia* was placed under the Membraniporiidae (Waters, 1898) or Bicellariidae (Lebinsen, 1909), and the Chaperiidae was usually placed near the Alderiniidae (Calloporidae) in the Anasca. In 1898 Waters added two species to the family, *Membranipora albispina* MacGillivray 1882 and *Amphiblestrum capensis* Busk 1884, both of which are provided with a hyperstomial ooecium common in *Chaperia*. In 1909, Levinsen included several more forms with ooecia in *Chaperia*. Osburn (1950), then, rewrote the character of this family to have occlusor laminae (renamed by Harmer for calcareous plates of Jullien) and a hyperstomial ooecium. Almost all authors naturally classified the family in the Division Malacostega of the Suborder Anasca on its membraniporine general structure, but Canu and Bassler (1972, 1929) once had placed it in their Suborder Hexapogona along with five Ascophoran families because of the presence of six buds around the ancestrula in spite of five in usual Cheilostomata. Their opinion was unfortunately not accepted by all of the later authors. The family was long thought to have only a single genus *Chaperia* until Bassler (1953) added *Patsyella* Brown 1948 (Oligocene to recent) with an endozoecial ooecium. Uttley (1947) proposed a new genus *Chaperiopsis* for ovicelled *Chaperia*, and Brown (1948) established *Exostesia* along with *Patsyella* in this family, but unfortunately both of them did not attract the attention of other authors. In 1972 Uttley and Bullivant distinguished three new genera *Scutochaperia*, *Clipeochaperia* and *Parmachaperia* from old *Chaperia*, each containing only one species with unique characters. In 1979 Hayward and Cook established a new genus *Notocoryne*, and in 1982 Gordon proposed four new genera *Pyrichaperia*, *Icellozoon*, *Exallozoon* and *Bryopaster* in the family Chaperiidae. Gordon recognized eleven genera here within, newly adding *Hagenowinella* Canu 1900 and *Larnacicus* Norman 1903, and also treating Uttley and Bullivant's three genera as synonyms of *Chaperiopsis*. The following list indicates the chronological arrangement of genera of the Chaperiidae.

Chaperia Jullien, 1888 (5 recent and 4 fossil species)

Hagenowinella Canu, 1900 (2 fossil species)

Larnacicus Norman, 1903 (1 recent species)

Patsyella Brown, 1948 (1 recent and 1 fossil species)

Exostesia Brown, 1948 (1 recent species)

Chaperiopsis Uttley, 1949 (30 recent and 10 fossil species)

Notocoryne Hayward and Cook, 1979 (2 recent species)

Pyrichaperia Gordon, 1982 (1 recent species)

Icellozoon Gordon, 1982 (1 recent species)

Exallozoon Gordon, 1982 (1 recent species)

Bryopaster Gordon, 1982 (2 recent and 3 fossil species)

Chaperiellidae and Chapperiidae are to be treated as synonyms of Chaperiidae. The discussion on the selection of the proper name will subsequently appear in the remarks of the genus *Chaperia*.

One of the most interesting features of this family is seen in the structure of the species *Chaperiopsis* (*Clipeochaperia*) *funda* Uttley and Bullivant 1972, in which the frontal shield is formed just like that of Cribrimorpha by the fusion of avicellegous frontal spines, partly interpreting the phyletic links between two Divisions, Malacostega and Cribrimorpha.

Genus *Chaperia* Jullien, 1881

Chaperia Jullien, 1881, pp. 163, 164; 1888, p. 61; Waters, 1898, p. 674; Calvet, 1904, p. 12; Levinsen, 1909, p. 115; Kluge, 1914, p. 673; Canu and Bassler, 1923, p. 49, 51; 1927, pp. 9, 22; 1929, p. 466; Harmer, 1926, p. 229; Brown, 1952, p. 115, Bassler, 1935, p. 166; Maruro, 1957, p. 40; Gautier, 1961, p. 39; Gordon, 1982, p. 2, 20.

Membranipora (part) Busk, 1884.

Amphiblestrum (part) Busk, 1884.

Chapperia Willey, 1900, p. 5 (miscopy); Osburn, 1950, p. 89; Prenant and Bobin, 1966, p. 283.

Omoiosia (part) Canu and Bassler, 1927.

Chaperiella Strand, 1928, p. 37; Harmer, 1957, p. 641.

Type species: *Flustra acanthina* Lamouroux, 1825

Diagnosis: Zoarium encrusting or erect and bilamellar or vincularian. Zooecia moderate, membraniporine, closely arranged quincuncially or in parallel series. Gymnocyst little developed or absent. Zooecial border usually salient distally, having two or three pairs of basally articulated spines. Cryptocyst extensive, typically granular, leaving subcircular or oval opesia distally. Opesia wholly covered by operculum with a pair of thickenings. Suborificial occlusor laminae conspicuous within opesia, composed of two calcareous plates projecting from lateral to distal walls, sometimes fused distally forming a horse-shoe shaped arch. Avicularia and oecia absent. Multiporous or uniporous mural septula present.

Note: Three generic names were proposed by old and modern authors. *Chapperia* was established by Jullien (1881) with a reference to the Zoological Record in 1900 (for 1899) compiled by Willey. Later Harmer (1957) clarified their unfortunate error on the Willey's miscopy of Waters' species *Chaperia annulus* var. *bilaminata*. In 1928 Strand proposed a new name *Chaperiella* for *Chaperia* in finding the older name having been preoccupied by Munier-Chalmas (1875?), and

Harmer (1957) followed his opinion. Most of the authors, however, accepted the older name *Chaperia* recognizing that the Willey's *Chapperia* was based upon the simple misprint of Waters, and that the Strand's *Chaperiella* was very incomplete in his delimitation. Based upon the opinion of Brown (1952), Gordon (1982) accepted also the Jullien's oldest name in his thorough study of the family Chaperiidae. We agree with Gordon's opinion after studies on specimens and literature.

Three family names Chaperiidae, Chapperiidae and Chaperiellidae were naturally derived from the generic names *Chaperia*, *Chapperia* and *Chaperiella*, respectively; then the Chaperiidae on *Chaperia* is to be most suitable for future use.

The above mentioned diagnosis is based upon the recent study of Gordon, and we can accept it as the characters of *Chaperia* sensu stricto. According to his opinion, the wider definition of the original paper may be accepted as *Chaperia* sensu lato because numerous genera were introduced after Jullien. The most fundamental change proposed was the separation of *Chaperiopsis* for the forms with avicularia and ooecia by Uttley (1949). When Jullien established the present genus, he selected his new species *Chaperia australis* as the type-species; but later, it was determined as a synonym of the older species *Flustra acanthina* Lamouroux 1825, which was erroneously recognized as a species of Quoy and Gaimard by some authors (Canu and Bassler, 1923 and Osburn, 1950).

As the type species had no ooecium, the non-ooecial structure was accepted as one of the important characters of the genus, but later numerous species with ooecia were included in the same genus, naturally causing some confusion of the limitation of the original genus.

In 1923 Canu and Bassler divided the genus into two groups; the first *Chaperia* of Jullien (1881) and the second *Chaperia* of Levinsen (1909). Members of the former group usually without ooecia and avicularia were of the original *Chaperia*, while species of the latter with developed ooecia and avicularia were transferred to *Chaperiopsis* by Uttley in 1949.

Chaperia spinosissima Calvet 1904 was recently rejected and was placed near Electridae by Gautier (1961). The following recent species may be included within *Chaperia* sensu stricto of Gordon (1982).

Flustra acanthina Lamouroux, 1825, Magellanic South America, Antarctic Seas, South Africa, Indian Ocean, Malay Archipelago, Japan, Australia, New Zealand. (Oligocene to recent)

Membranipora albispina MacGillivray, 1882, Victoria.

Amphiblestrum capensis Busk. 1884, South Africa.

Membranipora ciliata MacGillivray, 1869, Victoria.

Lepralia judex Kirkpatrick, 1888, Mauritius. (Pleistocene to recent)

Chaperia judex var. was recorded by Kataoka (1961) from "Ryukyu Limestone" (Pleistocene) of Kikai-jima, Kagoshima-ken; but we have not yet collected it from recent Japanese seas.

***Chaperia acanthina* (Lamouroux, 1825) (Fig. 1)**

Flustra acanthina Lamouroux, 1825, p. 605, pl. 89, figs. 1, 2.

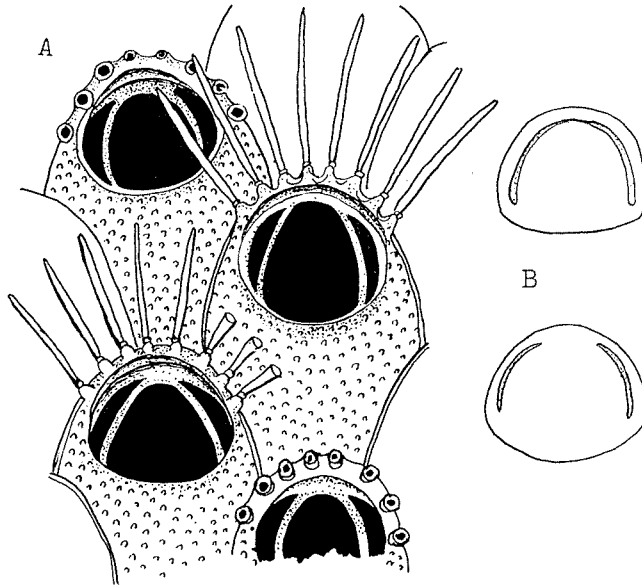


Fig. 1. *Chaperia acanthina* (Lamouroux).

A, zooecia showing inner opesiular lamina; B, two types of opercular sclerites.

Callopora acanthina: d'Orbigny, 1852, p. 403.

Lepralia acanthina: Kirkpatrick, 1890, pp. 612, 617, pl. 16, fig. 6.

Chaperia acanthina: Waters, 1898, pp. 656, 659, 664, pl. 47, fig. 10; Calvet, 1904, p. 11; Kluge, 1914, p. 675, fig. 46; Marcus, 1921, p. 88; Harmer, 1926, p. 229, pl. 14, figs. 9, 10; Hastings, 1932, p. 412; Silén, 1941, p. 46; Bassler, 1953, p. 166, fig. 126-1; Hayami, 1974, p. 222, pl. 69, fig. 1; 1975, p. 102, pl. 13, fig. 6; 1980, p. 38; Hayward, 1980, p. 702; Sakagami, Arakawa and Hayami, 1980, p. 320; Gordon, 1982, p. 2, fig. 1 A.

Chaperiella acanthina: Harmer, 1957, p. 641; Mawatari, 1965, p. 602, fig. 58 a.

Diagnosis: Zoarium encrusting, unilamellar. Zooecia moderate, elongate subhexagonal, arranged quincuncially. Gymnocyst invisible. Cryptocyst developed, granular, flat, more or less depressed distally. Opesia large, subcircular, extending over a half of zooecial length. Zooecial rim narrow, smooth, carrying several pairs of tall, strong, basally articulated spines. Occlusor laminae well developed, forming horse-shoe shape, oblique, sloping shelf beneath opesia. Avicularia and oecia absent. A number of small septula present on distal and distolateral walls. Ancestrula small, similar to ordinary zooecia but with transversely oval opesia and encircling spines.

Note: Zoarium is whitish, grayish or yellowish in colour. Zooecia are usually subhexagonal, but in some cases they are elongate oval with narrowed proximal ends, or quadrangular. Marginal spines are limited around the opesia and vary in number according to the size of zooecia and distance from ancestrula. Jullien recorded their numbers 6 to 7; Harmer (1926) counted 6 and 8 in Torres Strait and Indonesia materials respectively, and 9 to 10 in Japanese specimens. Gordon

(1982) reported 6 to 9 in New Zealand specimens. These spines are characterized by the presence of a dark coloured basal chitinous articulation. In our specimens, the spine number is 8 and the distal-most pair is much smaller than the others. Opesium generally occupies more than half of the frontal, estimated 50–65% by Gordon (1982), but in some cases less than a half. Cryptocyst extends a little beyond the distal margin of the opesium. Occlusor laminae for the attachment of retractor muscles of the operculum develop from the lateral walls and fuse at their distal ends to form a horseshoe shaped calcareous plate within the opesia. Operculum is subcircular and is provided with a pair of lateral chitinous thickenings for the insertion of occlusor muscles.

Jullien figured a small circular ancestrula encircled by six autozoecia; based upon this figure, Canu and Bassler (1927) erroneously classified the genus and its family in his suborder Hexapogona. The species is close to *Chaperia albispina* (MacGillivray, 1882) but differs from it in granular cryptocyst, in not-exposed gymnocyst, and in zooecia not separated by deep furrows.

Distribution: Kerguelen Island (Busk, Kluge); Australia (Waters, MacGillivray); New Zealand (Waters); Indian Ocean (Kirkpatrick); Malay Archipelago (0–45 m. Harmer); Japan, South Africa (Harmer, Jullien); South America, Antarctic Seas.

Localities: Off Tokyo (40 fms. Owston coll.), Tokyo Bay (5–20 m. Mawatari coll.), Bonin Island (Tokyo-To); Misaki, Sagami Bay (0–3 m. Silén coll.) (Kanagawa-Ken); Kominato (10–20 m. Mawatari coll.) (Chiba-Ken); Kii Peninsula (5–25 m. Mawatari coll.) (Wakayama-Ken); Osumi Peninsula (5–15 m. Mawatari coll.) (Kagoshima-Ken). (10–150 m in depth).

The species was recorded from Pleistocene and Pleiocene of Ishikawa-Ken, Aomori-Ken and Kochi-ken by Hayami (1974, 1975, 1980).

Genus *Chaperiopsis* Uttley, 1949

Membranipora (part) Busk, 1852.

Amphiblestrum (part) MacGillivray, 1881.

Electra (part) Busk, 1884.

Chaperia (part) Waters, 1898.

Chaperiopsis Uttley, 1949, p. 172; Gordon, 1982, pp. 4, 20.

Chapperia (part) Osburn, 1950.

Chaperiella (part) Harmer, 1957.

Scutochaperia Uttley and Bullivant, 1972.

Clipeochaperia Uttley and Bullivant, 1972.

Parmachaperia Uttley and Bullivant, 1972.

Type species: *Membranipora galeata* Busk, 1852.

Diagnosis: Zoarium encrusting and unilamellar, or erect and bilamellar, or vincularian. Zooecia distinct, arranged in quincuncial or linear fashion. Gymnocyst slight and negligible or well developed proximally, smooth, often obscured by well developed avicularian chambers. Cryptocyst usually well developed, smooth or granular, but frequently somewhat reduced. Opesia subcircular, large or small. Occlusor laminae variously developed, or negligible in some cases. Spines present,

simple or forked, variable in number, bordering distal and distolateral zooecial rim. Adventitious avicularia distoterminal or proximal, or both representing in the same zooecium. Vicarious avicularia occasionally present. Ooecium constant, typically with a frontal or proximal fenestra of various forms, frequently surmounted by one or more distal avicularia. In some cases several wide frontal spines supporting avicularia extended over the frontal membrane and fused to form a calcareous shield like that of the Cribrimorpha. Multiporous mural septula present.

Note: In 1949 Uttley separated this genus from *Chaperia* for the chaperiids with developed ooecia and avicularia of any type. The old genus *Chaperia* was then much restricted, and numerous species were transferred to the present group. In 1972 Uttley and Bullivant established three genera *Scutochaperia*, *Clipeochaperia* and *Parmachaperia*; but Gordon (1982) treated *Scutochaperia* as a synonym of *Chaperiopsis*, *Clipeochaperia* as a subgenus of *Chaperiopsis*, and *Parmachaperia* as a synonym of *Clipeochaperia*. Gordon (1982) enumerated 24 recent and 10 fossil forms in this genus. The following recent species may be included in the genus *Chaperiopsis*.

Membranipora annulus Manzoni, 1870, South Africa, Mexico, Europe. (Pleiocene to recent).

Chaperia arcifera Levinsen, 1909, New Zealand.

Chaperia annulus var. *bilamellata* Waters, 1898, South Africa.

Scutochaperia serrata biporosa Uttley and Bullivant, 1972, New Zealand.

Chapperia californica Osburn, 1950, California. (Pleiocene to recent)

Membranipora cervicornis Busk, 1854, p. 60, Australia, South Africa, Antarctic Seas.

Parmachaperia chathamensis Uttley and Bullivant, 1972, New Zealand.

Chaperia colensoi Brown, 1952, Tasmania.

Chaperia condylata Canu and Bassler, 1930, Galapagos Islands, California, Mexico, Panama.

Amphiblestrum cristatum Busk, 1884, Kerguelen Islands.

Electra cylindracea Busk, 1884, Prince Edward Islands, Antarctic Seas.

Chaperia cylindracea var. *protecta* Waters, 1904, Prince Edward Islands, Antarctic Seas.

Chaperia frontalis Osburn, 1950, Galapagos.

Clipeochaperia funda Uttley and Bullivant, 1972, New Zealand.

Membranipora galeata Busk, 1854, Kerguelen Islands, Magellan, Tierra del Fuego, Montevideo, Falkland.

Membranipora galeata var. *erecta* busk, 1884, Argentina.

Membranipora galeata var. *furcata* Busk, 1884, Marion Islands.

Membranipora galeata var. *multifida* Busk, 1884, Indian Ocean, South Africa.

Chaperia gaussi Kluge, 1914, Antarctic Seas.

Hiantopora halli MacGillivray, 1895.

Chaperia imbricata Busk, 1884.

- Chapperia longispina* Osburn, 1950, California.
Membranipora patula Hincks, 1881, California, Japan. (Pleistocene to recent).
Chaperia patulosa Waters, 1904, Antarctic Seas.
Chaperia paulensis Kluge, 1914, St. Paul Island.
Chaperia pyriformis Canu and Bassler, 1929, Borneo.
Chaperiella quadrispina Soule, 1959, California.
Chaperia quadrispinosa Kluge, 1914, Antarctic Seas.
Membranipora rubida Hincks, 1881, Australia, New Zealand.
Scutochaperia serrata Uttley and Bullivant, 1972, New Zealand.
Amphiblestrum spinosa MacGillivray, 1881.
Chaperia stephensoni O'Donoghue and Watteville, 1935, South Africa.
Chaperia transversalis Canu and Bassler, 1929, Malay Archipelago, Japan.
Chaperia transversalis var. *boninensis* Silén, 1941, Japan.
Chaperia tropica Waters, 1909, Red Sea.
Chaperiopsis sp. Gordon, 1982, New Zealand.

Japanese fossil species *Chaperiopsis octspinosa* was first recorded by Kataoka (1961) from "Ryukyu lime stome" (Pleiocene); but we have collected no material of it from recent Japanese seas.

***Chaperiopsis transversalis* (Canu and Bassler, 1929) (Fig. 2)**

Chaperia transversalis Canu and Bassler, 1929, p. 473, pl. 64, fig. 5-9, text-figs. 201 a-c, 202 a-d.

Chaperia transversalis: Silén, 1941, p. 46, figs. 58-64.

Chaperiopsis transversalis: Gordon, 1982, p. 4.

Diagnosis: Zoarium unilamellar, encrusting or attached by basal tubules.

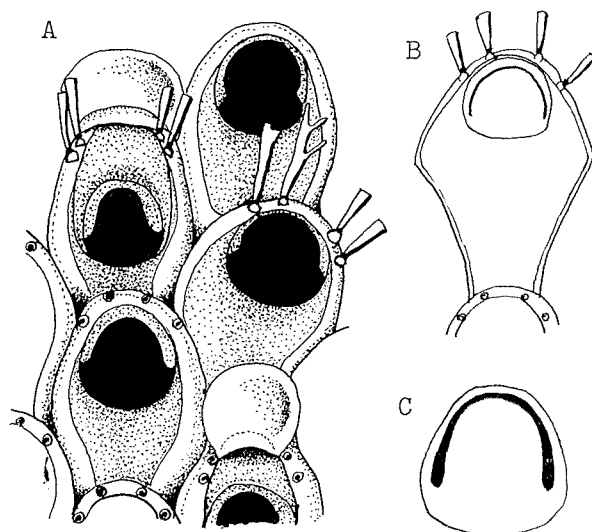


Fig. 2. *Chaperiopsis transversalis* (Canu and Bassler).

A, zoecia showing internal opesiular lamina, oecia and bifurcating oral spines;
 B, zoecium with frontal membrane and opercular valve; C, operculum.

Zooecia distinct, large, subquadrangular or short elliptical with raised distal margin carrying four strong, jointed distal spines. Cryptocyst developed in proximal half, extending around the subcircular opesia. Gymnocyst slight distally, a little developed proximally with a sessile pointed median avicularium. Another small avicularium situated on the slight gymnocyst just in front of the raised margin. Occlusor laminae developed along the distal half within the opesia, forming a wide horse-shoe shaped calcareous sclerite. Ooecia large, cuculate or ladle-shaped, convex distally with aperture directed proximally and closed by a thin membrane.

Note: Zoarium is faintly rosy or light red in colour, sometimes loosely fixed to stones. Zooecia are sometimes a little broader than long, distinctly separated by furrows. One or two of the distal spines are somewhat cervicorn, branching in varying number. Proximal gymnocyst is short and slight, sometimes with a small pore indicating the trace of the median proximal avicularium. The cryptocyst is distinct, depressed, smooth, wider in the proximal half.

Subcircular opesia is transverse or more or less narrowed distally and is covered completely by the operculum of the same form and size. Occlusor laminae are clearly visible within the opesia. Another small avicularium is situated at the distal-most part of the zooecial gymnocyst, and is usually concealed by the extended, raised zooecial margin. Ooecia cover the distal ends of the fertile zooecia. The proximal margin is concave, trimmed with a transverse thin fenestra. In the ovicelled zooecia the distal spines are separated into two lateral pairs.

The present species was established upon many specimens collected at stations of Philippines and Cape Tsiuka, Sea of Japan. Cape Tsiuka may be well interpreted as Cape Tsugaru near the western end of Tsugaru Strait, Aomori-ken. This species differs from *Chaperiopsis galeata* Busk in its horse-shoe shaped occlusor laminae, in the absence of a constant large frontal avicularium, and in its rather transverse opesia.

Silén (1941) also proposed *Chaperia transversalis* var. *boninensis* for the specimen collected from Chichijima, Ogasawara (Bonin Islands), Tokyo-to. According to his original description, this variety differs from original *Chaperia transversalis* only in its strikingly smaller size of the zooecia and in its long pedunculated proximal avicularium. Recently this variety was listed up as a related species of the type species of *Chaperiopsis* by Gordon (1982). Unfortunately we have collected no specimen corresponding to Silén's variety.

Distribution: Philippines (20–340 fms. Canu and Bassler); Japan.

Localities: Tsugaru Strait (Canu and Bassler) (Aomori-ken); Tateyama, Kominato (5–20 m. Mawatari coll.) (Chiba-ken); Goto, Hirado (135–300 m. Silén, '–20 m. Mawatari coll.) (Nagasaki-ken); Amami-oshima (15–35 m. Mawatari coll.) (Kagoshima-ken).

Chaperiopsis patula (Hincks, 1881)

Membranipora patula Hincks, 1881, p. 150.

Membranipora patula: Robertson, 1908, p. 263; O'Donoghue, 1923, p. 25.

Amphiblestrum patulum: O'Donoghue, 1926, p. 37.

Chapperia patula: Osburn, 1950, p. 89, pl. 10, figs. 1, 2.

Chapperia patula: Soule and Duff, 1957, p. 96; Kataoka, 1961, p. 232, pl. 26, fig. 2; Sakagami, Arakawa and Hayami, 1980, p. 321.

Diagnosis: Zoarium encrusting, rather rough, reddish brown in colour. Zooecia distinct, oval or subcircular with thick, raised distal margin. Gymnocyst vestigial or moderate. Cryptocyst developed, granular, extended a little beyond opesia. Opesia subcircular, about half of the frontal. Occlusor laminae developed laterally, much below the operculum. Spines around distal rim, 5-6 in number, rarely bifurcated, and basally articulated. Avicularium single, triangular, situated on disto-terminal margin, pointed forward, but often wanting especially on ooecium. Ooecia large, hyperstomial, cucullate with crescentic ectooecial fenestra.

Note: Above mentioned diagnosis is based upon Kataoka (1961) who found Pleistocene specimens from "Ryukyu limestone" of Kikaijima, Kagoshima-ken, and also recent form shallow water around the island. We have, however, not found the present species in Japanese seas. The species was recorded to distribute widely along the western coast of North America ranging from Queen Charlotte Island to lower California in shallower water than 47 fms.

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