Notes on Some Japanese Sea-anemones

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(With 5 Text-figures)

Since Asano's paper (1911), there have been known in Japan three common sea-anemones, widely distributed on shallow tidal coasts, named *Anthopleura japonica* Verrill, *Anthopleura xanthogrammica* (Brandt) and *Cribrina artemisia* Dana respectively. The latter two specific names were given to the Japanese sea-anemones because they had been identified with species which are very common on the Pacific coasts of North America. In 1938 Uchida, the senior writer, making closer observations of the Japanese anemones and referring to the literature on them in detail, came the conclusion that the three Japanese species should be identified as follows: Asano's *C. artemisia* with *Anthopleura stella*, Asano's *A. xanthogrammica* with *A. japonica* and Asano's *A. japonica* with *A. xanthogrammica*. However, there are two defects in his paper; that is, no living American species were observed and no nematocysts of these anemones were described. In 1947 and 1952 Carlgren checked the works of Uchida and suggested that *A. stella* described by him is probably referable to *A. elegantissima* in America. In 1955 Hand published a revised paper on the sea-anemones of the Pacific coasts of the U.S.A. He made comparative studies of them in detail and confirmed the three species of *Anthopleura* on the coasts of California; *A. elegantissima*, *A. xanthogrammica* and *A. artemisia*. He had some doubts about the identification of Japanese *Anthopleura* with the American species.

In March, 1958 Uchida had an opportunity to visit the Scripps Oceanographical Laboratory and also the Pacific Marine Station, both on the coasts of California, and could observe several American sea-anemones in living state. Especially through the courtesy of Dr. H. G. Hedgpeth, the three *Anthopleura* species recognized by Hand were closely observed. In addition, Muramatsu, the junior writer, studied nematocysts of the Japanese species of *Anthopleura* at the suggestion of Uchida. Taking into consideration Uchida's observations and the data of Muramatsu, the following conclusion has been arrived at: The two Japanese sea-anemones which have been identified with American species are quite different from them and are eligible for new species as will be described in the following pages. The morphology and ecology of these sea-anemones, having been given in detail in Uchida's work (1938), here is given mainly information

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on their nematocysts. In addition to the two species just considered, two other Japanese species of *Anthopleura* will be reported in this paper. All the species here described will be redescribed in a monograph of Japanese sea-anemones now in undertaking by the senior writer.

Anthopleura midori n. sp.

Cribrina artemisia; Asano, 1911, p. 138-139.
Anthopleura stella; Uchida, 1938, p. 293-298; 1941, p. 386.
Anthopleura fusco-viridis; Carlgren, 1949, p. 53 (No description).

This species is characterized by the possession of prominent green warts arranged in 96 rows on a blackish brown column. The tentacles are slightly grey and the oral disc dark brown. It attaches itself solitarily on rocks, often bearing pebbles and dead shells on the column. Unlike *Anthopleura elegantissima*, it does not dwell in muddy sand and takes a long shape. As described in the previous paper (1938), the species is different from the three American sea-anemones in coloration, habitat, and shape. Acrorhagi of the species are present only in young stage.

The nematocysts were examined on 15 individuals collected from two localities. The distribution, size and forms of them are summarized in the following table:

Tentacles:	
Spirocysts	7.8–20.9×1.7–3.3 μ
Basitrichs	13.3–20.1×2.2–3.3 μ
Acrorhagi:	
Spirocysts	19.3–27.1×2.2–3.3 μ
Basitrichs	16.5–21.3×2.2–3.3 μ
Holotrichs	49.5–60.9×4.4–5.7 μ
Holotrichs	43.1–52.7×5.5–7.8 μ
Column:	
Basitrichs	9.9–15.9×2.2–3.3 μ
Basitrichs	13.9–19.3×2.2–3.3 μ
Basitrichs	19.0–25.5×1.0–1.7 μ
Holotrichs	21.0–26.5×3.3–4.4 μ
Actinopharynx:	
Basitrichs	13.7–29.0×2.2–3.9 μ
Microbasic p-mastigophores	22.7–26.5×4.4–5.5 μ
Filaments:	
Basitrichs	9.8–14.9×2.0–2.2 μ
Basitrichs	38.5–42.2×4.4–5.5 μ
Basitrichs	21.0–24.8×2.2–3.3 μ
Microbasic p-mastigophores	17.9–23.5×3.9–5.7 μ

This species has the characteristic nematocysts of *Anthopleura*, the narrow basitrichs in the column and filaments being especially typical.

Remarks. This sea-anemone is generally known in Japan as "green sea-anemone" from its prominent green warts, because it looks like a green ball in oral

view when well contracted. The specific name is due to the Japanese name.

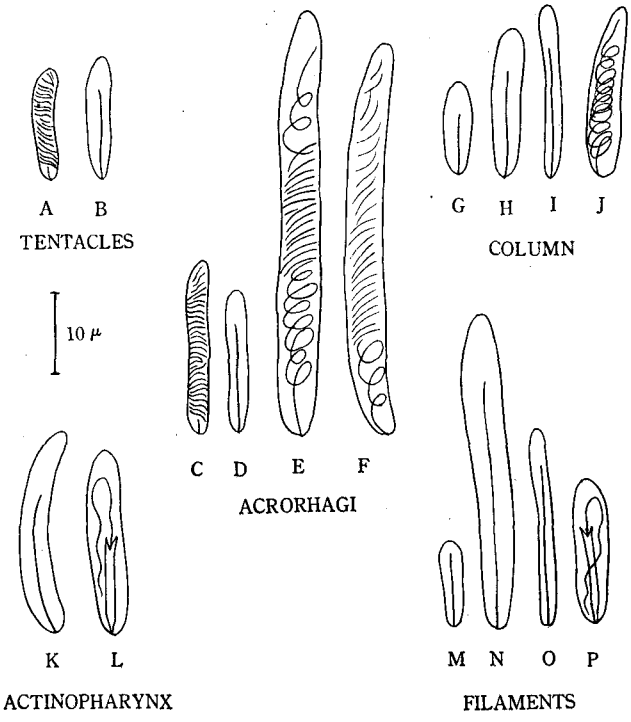

Fig. 1. Nematocysts of *Anthopleura midori* n. sp. (All nematocsyts drawn to same scale), (A, B, tentacles; C to F, acrorhagi; G to J, column; K, L, actinopharynx; M to P, filaments.) (A) Spirocyst, (B) Basitrich, (C) Spirocyst, (D) Basitrich, (E) Holotrich, (F) Holotrich, (G) Basitrich, (H) Basitrich, (I) Basitrich, (J) Holotrich, (K) Basitrich, (L) Microbasic p-mastigophore, (M) Basitrich, (N) Basitrich, (O) Basitrich, (P) Microbasic p-mastigophore.

Anthopleura kuroganė n. sp.

Anthopleura japonica; Asano, 1911, p. 140.
Anthopleura xanthogrammica; Uchida, 1936, p. 298–302; 1940, p. 269–270.

This species is generally found in crevices of rock under the tidal line, buried in sand, bearing pebbles on the upper part, and stretching the body in an elongate form as is seen in *A. elegantissima* in California. When it is brought into an aquarium, it becomes slightly wider than long. The warts of the column are thickly distributed only on the upper half. The tentacles are greyish brown, usually with white spots and sometimes slightly pink colored. The oral disc is greyish

brown. The column is greyish brown in the upper portion and yellowish brown, flesh color or bluish in the lower part. The acrorhagi are clearly seen in young individuals but gradually disappear in large ones. The species is very common from the middle to the northern coasts of Japan.

The distribution and size of nematocytsts are as follows:

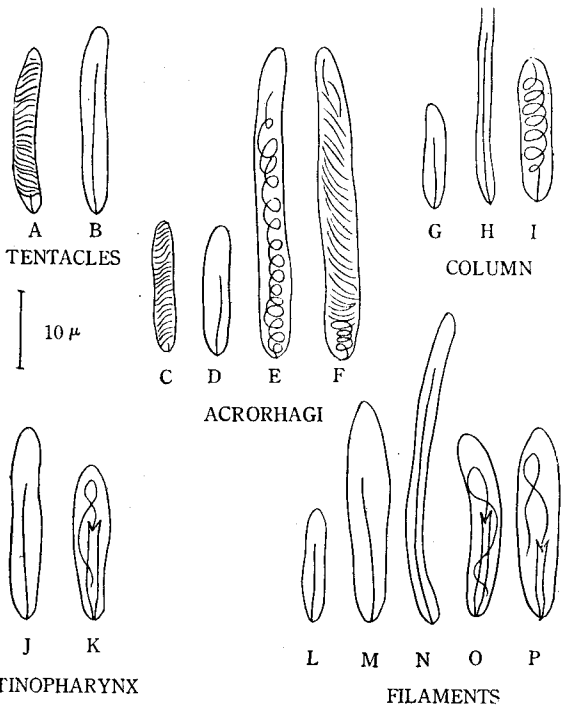

Fig. 2. Nematocysts of *Anthopleura kurogané* n. sp. [All nematocysts drawn to same scale.) (A, B, tentacles; C to F, acrorhagi; G to I, column; J, K, actinopharynx; L to P, filaments.) (A) Spirocyst, (B) Basitrich, (C) Spirocyst, (D) Basitrich, (E) Holotrich, (F) Holotrich, (G) Basitrich, (H) Basitrich, (I) Holotrich, (J) Basitrich, (K) Microbasic p-mastigophore, (L) Basitrich, (M) Basitrich, (N), Basitrich, (O) Microbasic p-mastigophore, (P) Microbasic p-mastigophore.

Tentacles:
- Spirocysts ..... 11.1–23.2×1.7–3.8 μ
- Basitrichs ..... 17.8–27.8×2.0–2.8 μ

Acrorhagi:
- Spirocysts ..... 13.7–26.7×1.5–2.2 μ
- Basitrichs ..... 9.0–18.9×1.5–3.0 μ
- Holotrichs ..... 66.7–98.4×3.3–4.4 μ

Holotrichs	87.8–119.1×4.4–6.7 μ
Column :	
Basitrichs	8.0–19.0×1.5–3.0 μ
Basitrichs	30.5–32.0×1.5–2.0 μ
Holotrichs	13.0–25.0×2.5–4.6 μ
Actinopharynx :	
Basitrichs	17.2–35.7×2.4–4.1 μ
Microbasic p-mastigophores	18.5–31.5×3.5–5.0 μ
Filaments :	
Basitrichs	9.0–15.7×2.0–3.0 μ
Basitrichs	25.0–42.9×3.0–6.5 μ
Basitrichs	25.0–42.7×7.5–2.0 μ
Microbasic p-mastigophores	13.7–39.0×2.5–4.0 μ
Microbasic p-mastigophores	19.7–30.5×3.7–5.1 μ

Remarks. The species had been formerly identified by the writer with *A. xanthogrammica* widely distributed from Kamchatka to California.

However, on close observation of the American species, it has been made clear that the two species are, though closely allied, distinguishable. The species are different in color. The coloration of the American species is as follows: Oral disc brownish blue with many faint radial stripes, tentacles bluish green in the lower half and brownish purple in the upper half; column with many papillae which are brownish olive as in *A. japonica*. The specimens observed at La Jolla are more brownish, and the bluish tint is not so remarkable. Some specimens have the oral disc, brownish in color, with yellowish brown patterns. Moreover, the American species does not live buried in sand but attaches to rocks washed by waves. Besides, though the two species have a generally similar distribution of nematocysts, the Japanese species has a long basitrich in the column, which is lacking in the American species. Thence, the separation of species.

Anthopleura pacifica Uchida

Anthopleura pacifica; Uchida, 1938, p. 305–309; 1941, p. 386.

This sea-anemone, living in crevices of rocks, is generally found attached to rocks, aggregating in groups in coastal pools. Judging from the arrangement of mesenteries, the species reproduces asexually by binary fission and then aggregates forming flat beds. The column of this species is reddish brown and slightly greenish in the upper portion. The tentacles are reddish brown on the oral side and greenish on the aboral side, with small white spots. On the column small warts are arranged in more than 40 vertical rows, which are more prominent near the oral margin than at the base. This species is rather small in size in the genus and is distributed on coasts slightly influenced by cold current, such as the southern coasts of Korea, through Mutsu Bay to Hokkaido, such as Hakodate, Oshoro and Muroran.

The distribution and size of nematocytsts are as follows:

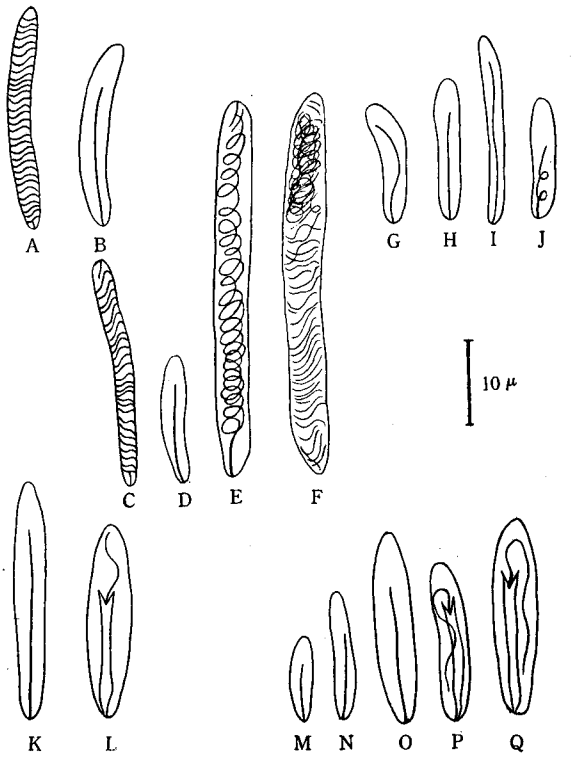

Fig. 3. Nematocysts of *Anthopleura pacifica* Uchida. (All nematocysts drawn to same scale.) (A,B, tentacles; C to F, acrorhagi; G to J, column: K. L, actinopharynx; M to Q, filaments.) (A) Spirocyst, (B) Basitrich, (C) Spirocyst, (D) Basitrich, (E) Holotrich, (F) Holotrich, (G) Basitrich, (H) Basitrich, (I) Basitrich, (J) Holotrich, (K) Basitrich, (L) Microbasic p-mastigophore, (M) Basitrich, (N) Basitirich, (O) Basitrich, (P) Microbasic p-mastigophore, (Q) Microbasic p-mastigophore.

Tentacles :	
Spirocysts	7.8–15.6 × 1.7–2.2 μ
Basitrichs	8.9–20.0 × 1.7–2.2 μ
Acrorhagi :	
Spirocysts	14.4–21.1 × 1.7–3.3 μ
Basitrichs	11.1–20.0 × 2.2–3.3 μ
Holotrichs	41.1–56.7 × 2.8–3.3 μ
Holotrichs	41.1–56.7 × 4.4–5.6 μ
Column :	
Basitrichs	10.0–13.3 × 1.1–1.7 μ
Basitrichs	16.7–22.3 × 2.0–2.5 μ
Basitrichs	20.0–21.2 × 1.1–1.5 μ
Basitrichs	12.7–22.0 × 1.7–2.8 μ

Change Fig. 3 (p. 116) and Fig. 5 (p. 118) each other.

Actinopharynx :
- Basitrichs ..... 12.2–31.1×1.7–4.4 μ
- Microbasic p-mastigophores ..... 21.1–32.2×2.2–5.6 μ

Filaments :
- Basitrichs ..... 10.0–25.6×1.0–2.6 μ
- Basitrichs ..... 24.4–28.9×3.3–5.6 μ
- Basitrichs ..... 33.3–41.1×3.3–4.4 μ
- Microbasic p-mastigophores ..... 23.3–25.6×3.3–4.4 μ
- Microbasic p-mastigophores ..... 23.3–24.4×5.6–6.7 μ

Remarks. Though Carlgren (1952, p. 382–384) suggested that this species might be referable to *A. elegantissima* presumably on account of the asexual reproduction, the habit of aggregation and the smallness of size, the two species are easily distinguished by their coloration. Moreover, this species does not attach to substratum so firmly as do other species of *Anthopleura.* The species is also clearly different from *A. elegantissima* in the distribution, size and form of nematocysts in the column, actinopharynx and filaments.

Anthopleura asiatica n. sp.

This species is generally columnar in shape and rather small in size in the genus generally 10 mm high and slightly wider than high. But it reaches 20–25 mm high and 15–20 mm wide or 15–20 mm high and 20–25 mm wide in some localities. The column is liable to be flaccid. The tentacles and oral disc are greyish brown. The column is greyish green, with many small reddish brown warts arranged in 48 vertical rows. (There were found some individuals with reddish brown column.) Of these rows, 12 are comparatively distinct, corresponding to the tentacles of the first and second series. The others correspond to the other tentacles. The tentacles are 48 in number, arranged in the formula 6 : 6 : 12 : 24. In larger individuals acrorhagi are found. The mesenteries are 48 pairs which are divided into 12 primary, 12 secondary and 24 tertiary cycles. Only the primary 12 are perfect.

The distribution and size of nematocysts are summarized as follows :

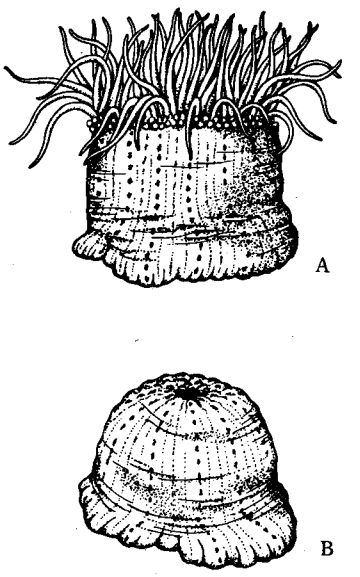

Fig. 4. *Anthopleura asiatica* n. sp. Side views. A, a well-developed specimen, B, a contracted specimen.

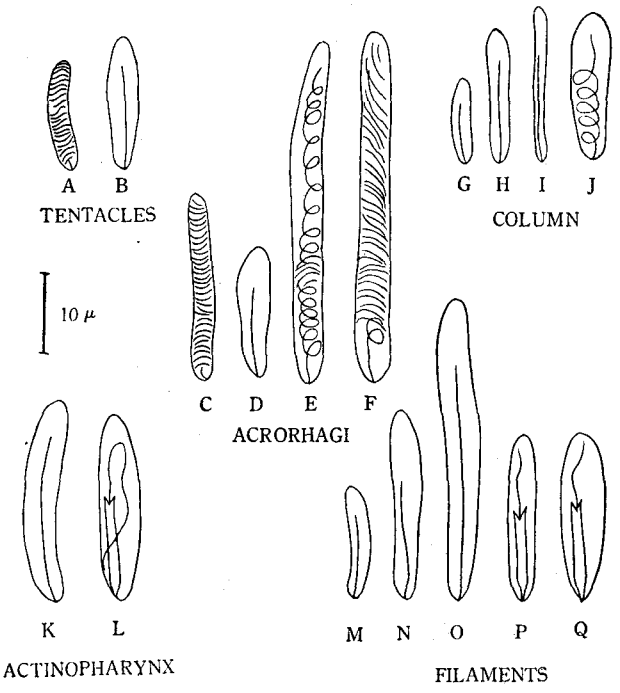

Fig. 5. Nematocysts of *Anthopleura asiatica* n. sp. (All nematocysts drawn to same scale.) (A,B tentacles; C to F, acrorhagi ; G to J column; K, L, actinopharynx; M to Q, filaments.) (A) Spirocyst, (B) Basitrich, (C) Spirocyst, (D) Basitrich, (E) Holotrich, (F) Holotrich, (G) Basitrich, (H) Basitrich, (I) Basitrich, (J) Holotrich, (K) Basitrich, (L) Microbasic p-mastigophore, (M) Basitrich, (N) Basitrich, (O) Basitrich, (P) Microbasic p-mastigophore, (Q) Microbasic p-mastigophore.

Tentacles :
- Spirocysts ..... 14.4–30.0 × 1.7–3.3 μ
- Basitrichs ..... 17.8–25.6 × 2.2–3.3 μ

Acrorhagi :
- Spirpcysts ..... 17.8–31.1 × 1.7–3.3 μ
- Basitrichs ..... 13.3–15.6 × 1.7–2.2 μ
- Holotrichs ..... 43.3–54.4 × 3.3–5.6 μ
- Holotrichs ..... 45.6–50.0 × 4.4–6.7 μ

Column :
- Basitrichs ..... 8.9–12.2 × 2.2–2.8 μ
- Basitrichs ..... 13.3–17.8 × 1.1–2.2 μ
- Basitrichs ..... 20.0–24.4 × 1.7–2.2 μ
- Holotrichs ..... 8.2–12.0 × 1.7–2.3 μ

Actinopharynx :
- Basitrichs ..... 24.4–28.9×1.7–2.3 μ
- Microbasic p-mastigophores ..... 21.1–24.4×4.4–5.6 μ

Filaments :
- Basitrichs ..... 10.0–13.3×1.7–2.2 μ
- Basitrichs ..... 15.6–18.8×1.7–2.2 μ
- Basitrichs ..... 15.6–23.2×3.5–5.7 μ
- Microbasic p-mastigophores ..... 15.3–20.2×1.8–2.8 μ
- Microbasic p-mastigophores ..... 17.8–25.0×3.3–5.6 μ

Remarks. This species is common and widely distributed on the coasts of the Pacific and Japan Sea from the middle part of Honshu to Kyushu. It abounds near Okayama City in the Inland Sea. From the distribution and shape of nematocysts, there is no doubt that this species belongs to the genus *Anthopleura*, though acrorhagi are not found sometimes. In distribution and size the nematocysts are unlike those of any other species in the genus.

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