STUDIES ON THE CIRRIPEDIAN FAUNA OF JAPAN

VIII. THORACIC CIRRIPEDS FROM WESTERN KYUSYU[1)2)]

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With 12 Text-figures

Introduction

This paper deals with three important collection of the thoracic cirripeds recently gathered from the coastal waters of western Kyusyu. They consist of:

1. The material collected by Mr. Kinzo MATSUBAYASHI of the Nomo Primary School at Nomosaki, Nagasaki Prefecture during the years 1960–1961. (Abbreviation: M)

2. The material collected by Dr. Tadashige HABE during the marine faunal survey conducted in the sea around the Amakusa Marine Biological Laboratory of Kyushu University, Tomioka, Kumamoto Prefecture during the years 1957 to 1959 (Abbreviation: T).

3. The material collected by the general benthonic survey in the Ariake Sea, conducted by the Hama Branch of the Seikai Regional Fisheries Research Laboratory (chief: Mr. Wataru IKEMATSU) during the years 1957–1958. (Abbreviation: A)

Among them, Mr. MATSUBAYASHI's collection is the most significant, as it contains two new species and two unrecorded species. In addition, the description of a hitherto unknown barnacle (*Tetraclita multicostata*) obtained by Dr. Shizuo MAWATARI of the Research Institute for Natural Resources at Makurasaki, Kagosima Prefecture is also included.

In Part VI of this series on the Cirripedian fauna of Japan (UTINOMI, 1949), I summarized all the known species hitherto collected at various localities of Kyusyu and Ryukyu Islands. A large part of them comprized the material which

1) Contribution from the Seto Marine Biological Laboratory, No. 390 and Contributions from the Amakusa Marine Biological Laboratory (Kyushu University), No. 166.

2) Supported in part by a grant-in-aid ('62–4064) from the Scientific Research Fund of the Ministry of Education.

I had collected at Tomioka, where the Amakusa Marine Biological Laboratory is located, and enumerated about thirty five species and varieties in all.

In the past prior to my 1949 paper, some of the papers had appeared dealing in part with the cirripeds from the western Kyusyu. AURIVILLIUS (1892, 1894), WELTNER (1897), PILSBRY (1897, 1907, 1911, 1916, 1928), KRÜGER (1911), NILSSON-CANTELL (1921, 1925) and BROCH (1931) had sporadically contributed to the study of western Kyusyu cirripeds. Most of these earlier references, however, have mainly treated the deep-water forms obtained by dredging or trawling off Kagosima Gulf, Gotô Islands and Hirado Strait.

As a supplement to my former paper, the present collections treated in this paper, on the other hand, represent the intertidal or shallow-water forms (at least down to 30 meters in depth) and contain in all forty one species and varieties, of which three (*Acasta umitosaka*, *Pyrgoma oulastreae* and *Tetraclita pilsbryi*) are described as new species, and four (*Balanus quadrivittatus*, *B. cornutus*, *B. navicula* and *Tetraclita multicostata*) are recorded for the first time from Japanese waters.

Before going further, I like to express my gratitude to the Institutions and persons mentioned above for the opportunity of examining these precious collections.

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Systematic Account

Suborder LEPADOMORPHA PILSBRY

Family Scalpellidae PILSBRY

Genus *Smilium* GRAY

1. *Smilium scorpio* (AURIVILLIUS, 1892)

For synonymy see HIRO, 1933, p. 13.

OCCURRENCE: Tomioka, Amakusa Is. One specimen. 1957. (T-2)

REMARKS: This scalpellid was first described as *Scalpellum scorpio* by AURIVILLIUS (1892, 1894) from Hirado Strait, 80 m in depth and then described as *Scalpellum sexcornutum* by PILSBRY (1897) from Inland Sea (31°31′ Lat. N., 133°44′ Long E.), 40 m. This species seems to be intermediate morphologically between the typical *Smilium* and the typical *Calantica*.

Family Iblidae ANNANDALE

Genus *Ibla* LEACH

2. *Ibla cumingi* DARWIN, 1851

OCCURRENCE: Nomosaki, intertidal. Six specimens. 15-I-1961. (M-43)

Family Oxynaspidae (GRUVEL) NILSSON-CANTELL

Genus *Oxynaspis* DARWIN

3. *Oxynaspis pacifica* HIRO, 1931

OCCURRENCE: Nomosaki. One specimen on *Antipathes japonica*. IX-1960. (M-16)

Family Lepadidae (DARWIN) NILSSON-CANTELL

Genus *Lepas* LINNÉ

4. *Lepas anserifera* LINNÉ, 1767

OCCURRENCE: Nomosaki. 16 specimens on buoys. 18-IX-1960. (M-12)

Family Heteralepadidae NILSSON-CANTELL

Genus *Heteralepas* s. str. PILSBRY

5. *Heteralepas quadrata* (AURIVILLIUS, 1892)

OCCURRENCE: Tomioka. Two specimens on abdomen of *Charybdis japonica*,

infested by a *Sacculina*. 1957. (T-9)

Genus *Paralepas* s. str. (PILSBRY) NEWMAN

6. *Paralepas distincta* (UTINOMI, 1949)

Heteralepas (*Paralepas*) *distincta* UTINOMI, 1949, p. 26, figs. 1, 2 *c-d*.

OCCURRENCE: Nomosaki. Six specimens on legs of a crab *Maja spinigera*. IX-1960. (M-14)

REMARKS: This species was first described from Tomioka, as living on the buccal region of a spiny lobster *Panulirus japonicus*.

Suborder BALANOMORPHA PILSBRY

Family Chthamalidae DARWIN

Genus *Chthamalus* RANZANI

7. *Chthamalus challengeri* HOEK, 1883

OCCURRENCE: Nomosaki, intertidal. Four young specimens. 22-I-1961. (M-45) Wakimisaki, near Nomosaki. A few specimens on *Balanus amphitrite albicostatus*. 16-X-1960. (M-17)

Family Balanidae GRAY

Subfamily Balaninae DARWIN

Genus *Balanus* DA COSTA

Subgenus *Megabalanus* HOEK

8. *Balanus tintinnabulum rosa* PILSBRY, 1916

OCCURRENCE: Nomosaki. Seven specimens on shells of *Turbo cornutus* obtained by a net "Kasiami". 30-XII-1960. (M-43)

Nomosaki. Several specimens on buoys. VIII-1960. (M-44)

Subgenus *Balanus* DA COSTA

9. *Balanus amphitrite hawaiiensis* BROCH, 1922

OCCURRENCE: Nomosaki. Several specimens. 6-VIII-1960 (M-1). IX-1960 (M-2).

10. *Balanus amphitrite krügeri* NILSSON-CANTELL, 1932

OCCURRENCE: Nomosaki. VIII-1960. (M-3)
Hama, Saga Pref. 19-VI-1942. S. INUO coll.

11. *Balanus amphitrite albicostatus* PILSBRY, 1916

OCCURRENCE: Wakimisaki, near Nomosaki. Several specimens. 16-X-1960. (M-18)

12. *Balanus amphitrite communis* DARWIN, 1854

OCCURRENCE: Nomosaki. On angler-ropes. 23-X-1960. (M-21)

13. *Balanus amphitrite cirratus* DARWIN, 1854

OCCURRENCE: Nomosaki. On angler-ropes. 16-X-1960. (M-20)

14. *Balanus poecilotheca* KRÜGER, 1911

OCCURRENCE: Nomosaki. Four specimens obtained by a net "Kasiami". 27-XI-1960. (M-28)

Nomosaki. Four specimens on a hydroid *Eudendrium* obtained by a net "Kasiami". VIII-1960. (M-39)

15. *Balanus trigonus* DARWIN, 1854

OCCURRENCE: Tomioka. Several specimens. 1957 (T-1). Nomosaki, on buoys. IX-1960 (M-9). Nomosaki, intertidal. Attached to reef corals, 3-I-1961. (M-41)

Subgenus *Chirona* GRAY

16. *Balanus tenuis* HOEK, 1883

For synonymy see NILSSON-CANTELL (1925, p. 34) and HIRO (1937, p. 439).

OCCURRENCE: Nomosaki. Eight specimens on dead shells obtained by a net "Kasiami". IX-1960. (M-8)

17. *Balanus amaryllis* DARWIN, 1854

OCCURRENCE: Entrance of Ariake Sea. 30 clusters. 17~23-XII-1957. (A) Ariake Sea, 10-30 m. 6 specimens. 18~22-XI-1958. (A)

Subgenus *Solidobalanus* HOEK

18. *Balanus socialis* HOEK, 1883

OCCURRENCE: Numerous specimens collected at various stations in Ariake Sea, 10–50 m in depth. IX-1957, XII-1957, IX-1958, XI-1958. (A)

Subgenus *Armatobalanus* HOEK

19. *Balanus allium* DARWIN, 1854

For synonymy and description see UTINOMI, 1949, p. 12, fig. 3.

OCCURRENCE: Nomosaki. Three specimens on *Cyathelia axillaris* obtained by a net "Kasiami". 17-IX-1960. (M-11)

Nomosaki. Three specimens on *Dendrophyllia micranthus* obtained by a net "Kasiami". VIII-1960. (M-35)

20. *Balanus cepa* DARWIN, 1854

For synonymy and description see NILSSON-CANTELL, 1938, p. 52 and UTINOMI, 1949, p. 29.

OCCURRENCE: Nomosaki. Three specimens on stones and dead shells obtained by a net "Kasiami". 11-XII-1960. (M-34)

REMARKS: This small balanid was first described by DARWIN (1854) from unknown locality of Japan. Later it was recorded by PILSBRY (1916) from Mogi, Nagasaki Pref. and by UTINOMI (1939) from Tomioka, Kumamoto Pref.

21. *Balanus quadrivittatus* DARWIN, 1854

Balanus quadrivittatus DARWIN, 1854, p. 284, Pl. 8, fig. 1; HOEK, 1913, p. 213, Pl. 21, figs. 15–20, Pl. 22, figs. 1–2; PILSBRY, 1916, p. 229; NILSSON-CANTELL, 1938, p. 54; KOLOSVÁRY, 1947, p. 425.

OCCURRENCE: Nomosaki. Six small specimens attached to the stalk of an alcyonarian *Dendronephthya* taken by a net "Kasiami". 7-XI-1960. (M-24)

REMARKS: The specimens before me measure in mm as follows:

Carino-rostral diameter	1.5	1.8	2	2.9	3
Height	2	2	2	3	3

The surface of parietes are roughened, only slightly ribbed. Their basal circumference is rather serrate as in *Balanus terebratus* and *B. filigranus*. But the wall bears four longitudinal dark gray bands placed crosswise.

Internally, the wall below the sheath is prominently ribbed. The base is thin, but soid.

This species is so far unknown from Japanese waters.

Subgenus *Conopea* SAY

22. *Balanus calceolus* DARWIN, 1854

OCCURRENCE: Nomosaki. One specimen on *Euplexaura* cf. *curvata*, lacking opercular valves. 27-XI-1961 (M-29). Two specimens on *Echinogorgia reticulata*. 4-XII-1960 (M-31). Two specimens on *Acanthogorgia dofleini*. 14-V-1961. (M-52)

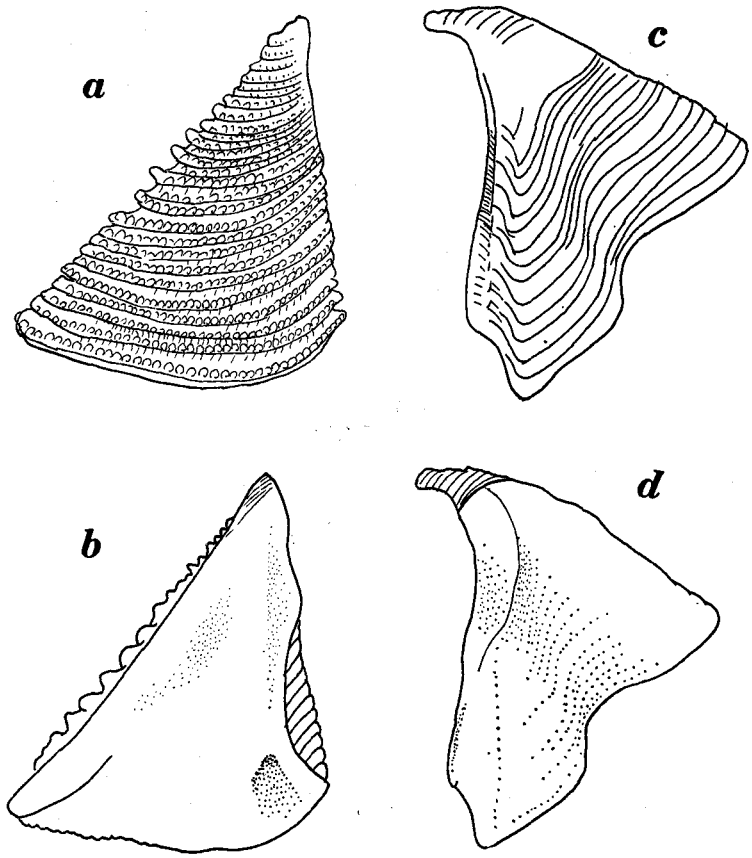

Fig. 1. *Balanus* (*Conopea*) *navicula* DARWIN.
a, Scutum, outer view. *b*, Scutum, inner view.
c, Tergum, outer view. *d*, Tergum, inner view. All ×27.

23. *Balanus navicula* DARWIN, 1854

(Fig. 1)

Balanus navicula DARWIN, 1854, p. 221, Pl. 3, fig. 6 *a-d*; HOEK, 1913, p. 223, Pl. 22, fig. 26, Pl. 23, figs. 1-3; STUBBINGS, 1936, p. 48.

OCCURRENCE: Nomosaki. Three specimens on *Parisis fruticosa* (VERRILL). VIII-1960 (M-38). Abundant specimens on *Parisis fruticosa* (VERRILL). 14-V-1961. (M-53)

REMARKS: In the original description DARWIN (1854) only states that the scutum is externally striated longitudinally. The present specimens which are confined to a particular alcyonarian *Parisis fruticosa* (VERRILL) may be assigned to this species. If this identification is proved, it seems more likely to say that the growth-lines of the scutum are raised and strongly beaded.

Internally, the adductor ridge is obsolete, but a narrow pit for the lateral depressor muscle is distinct. The tergum is about as wide as high and strongly beaked at apex, with a widely truncated spur, about one-half of the basal margin; externally smooth and quite flat.

This species is hitherto unrecorded from Japan.

24. *Balanus* cf. *cornutus* HOEK, 1913

Balanus cornutus HOEK, 1913, p. 227, Pl. 23, figs. 12-16; BROCH, 1931, p. 87, fig. 30.

OCCURRENCE: Nomosaki. Three small specimens on *Acalycigorgia inermis*. 17-III-1961. (M-49)

REMARKS: As discussed by BROCH (1931), the presence or elimination of the narrow carino-lateral compartment seems to be a variable character and it is, moreover, a question of degree. Of three specimens before me, one lacks the carino-lateral compartment, but the other two have it. On the basis of a horn-like lateral outgrowth of the lateral compartments I am inclined to refer them to *Balanus cornutus* HOEK, following BROCH.

Balanus cornutus HOEK is also hitherto unknown from Japanese waters.

25. *Balanus cymbiformis* DARWIN, 1854

(Fig. 2)

Balanus cymbiformis DARWIN, 1854, p. 221, Pl. 3, fig. 5 *a-b*; BROCH, 1931, p. 85, fig. 29*a-b*; NILSSON-CANTELL, 1938, p. 55, Pl. 2, fig. 3.

Balanus proripiens HOEK, 1913, p. 228, Pl. 23, figs. 17-21, Pl. 24, figs. 1-3; NILSSON-CANTELL, 1921, p. 331, fig. 70 *c-d*.

Pyrgoma jedani HOEK, 1913, p. 262, Pl. 27, figs. 3-8 (after NILSSON-CANTELL, 1938, p. 62).

OCCURRENCE: Nomosaki. Two specimens on *Verrucella orientalis*. 2-V-1961. (M-50)

REMARKS: The allied species *Balanus scandens* PILSBRY which has been recorded from off Osezaki, Suruga Bay (PILSBRY, 1916) and from Gotō Islands

(NILSSON-CANTELL, 1921) has a broad tergum similar to that of *B. cymbiformis*, but the wall is oval in contour, something like *B. calceolus* and *B. granulatus*. In *B. cymbiformis*, however, the rostrum and carina are much elongated along the axis of the attaching gorgonarian stem, together with their basis.

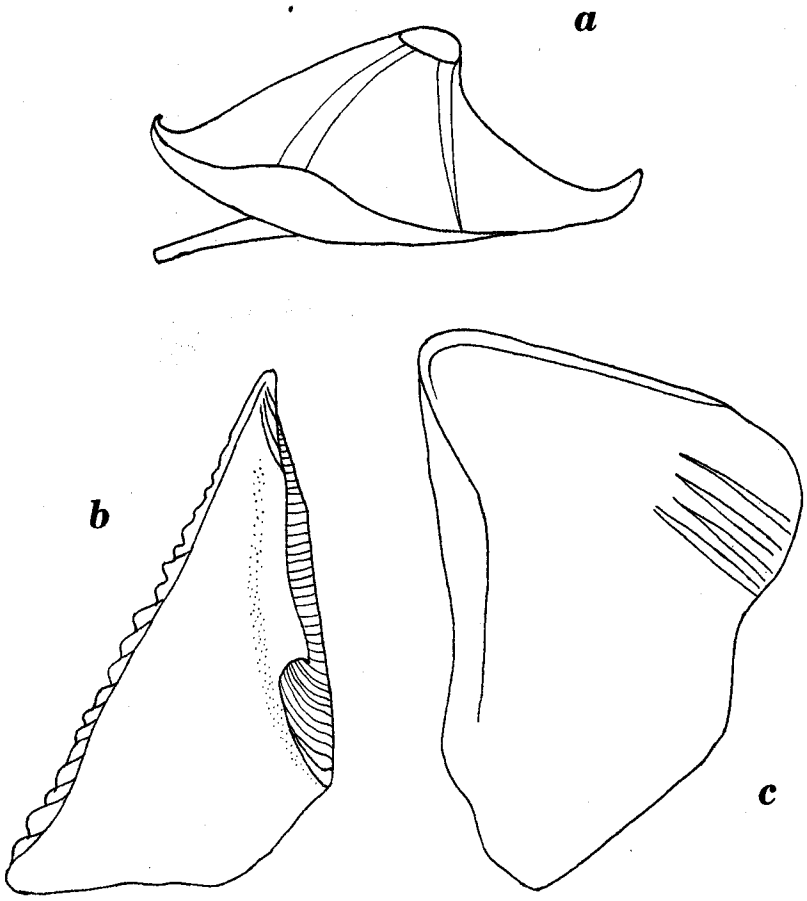

Fig. 2. *Balanus* (*Conopea*) *cymbiformis* DARWIN.
a, Specimen, side view. *b*, Scutum, inner view.
c, Tergum, inner view. *a*×about 5. *b*–*c*×21.

26. *Balanus granulatus* HIRO, 1937

Balanus granulatus HIRO, 1937, p. 444, figs. 29–30.

OCCURRENCE: Nomosaki. On *Antipathes japonica*. 14-V-1961. (M-54)

Off Gotô Islands, 100 fms. (trawled). On antipatharians. XI-1948. I. KUBO coll.

Genus *Acasta* LEACH

27. *Acasta pectinipes* PILSBRY, 1912

For synonymy and description see HIRO (1937, p. 463) and NILSSON-CANTELL (1938, p. 57).

OCCURRENCE: Nomosaki, intertidal. Five specimens in sponges. VII-1960. (M-7)

28. *Acasta dofleini* KRÜGER, 1911

OCCURRENCE: Tomioka, intertidal. Several specimens. 1957 (T-3). Nomosaki. VIII-1960 (M-5). 9-XI-1960 (M-25, 26).

29. *Acasta japonica* PILSBRY, 1911

(Figs. 3-4)

Acasta spongites japonica PILSBRY, 1911, p. 80, Pl. 16, figs. 1-9; HIRO, 1939, p. 213.
Acasta japonica PILSBRY, 1916, p. 243, fig. 78; BROCH, 1931, p. 96; BROCH, 1947, p. 6.

OCCURRENCE: Tomioka. One specimen. 1957. T. HABE coll. (T-4)

DESCRIPTION: The shell is large for the genus and glossy white with a rosy hue at the tip. Its total height is 14 mm and the carino-rostral diameter is 10 mm.

The basal cup is about one-half of the height of the carina, 5 mm in depth and broadly ovate in contour. The compartments of the wall are only loosely connected and provided with many small spines irregularly arranged. Of the compartments, the carino-lateral compartment is the narrowest and has a very narrow parietal area (only 1 mm wide), although the radii and alae are broad as in the other compartments. Internally, the sheath is dark reddish in color and transversely striated. The interior of the parietes below the sheath is slightly ribbed. The basal cup is rather shallow, with fine uneven growth-lines, but such perforation as seen in *Acasta spongites* is never indicated.

Scutum strongly concave outwards, sculptured by radial striae crossed to the growth-lines fringed with hairs. Internally, the articular ridge is rather low and the adductor ridge is prominent; PILSBRY mentions that "There is no adductor ridge" but his figure (Pl. XVI, fig. 4) apparently indicates its presence.

Tergum beaked at apex and has a concave depression from apex to spur; the low, but wide, articular ridge is continued upon the spur, which is confluent with the basi-scutal angle at its end. Internally flat; no crests for the depressor muscles.

Cirri show the following numbers of segments:

	I	II	III	IV	V	VI
Anterior ramus	22	12	16	27	26+	34
Posterior ramus	10	10	14	23+	21	33

In cirrus I, the anterior ramus is longer than twice of the length of the posterior ramus. In cirrus II, the anterior ramus is a little longer than the posterior. In cirrius III, the rami are subequal in length. In cirrus IV, the anterior ramus has a few erect spinules on the ventro-distal face of each segment (as many as 5) and on the distal segment of th eprotopodite. In the remaining posterior cirri, the rami are subequal in length and their protopodite is prominently elongated.

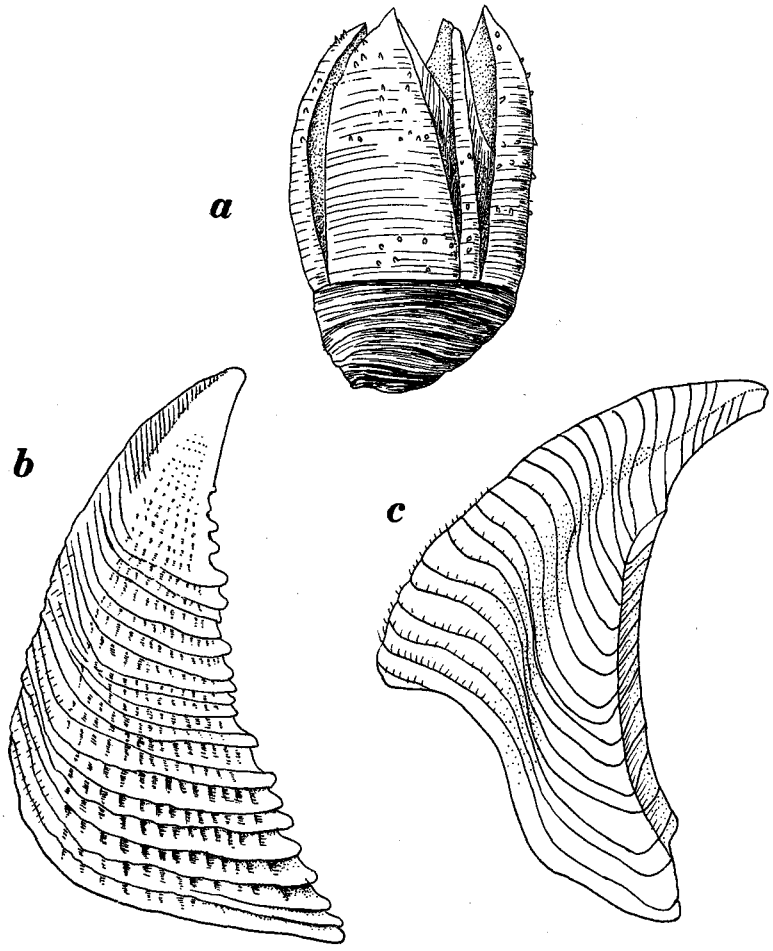

Fig. 3. *Acasta japonica* PILSBRY.
a, Specimen, side view. *b*, scutum, outer view.
c, Tergum, outer view. *a*×about 4. *b*–*c*×12.

The penis is long, annulated all over and hairy; no basi-dorsal point is present.

Mouth-parts. Labrum with one or two denticles on each side of the median notch. Palp elongate, large, covered with long bristles.

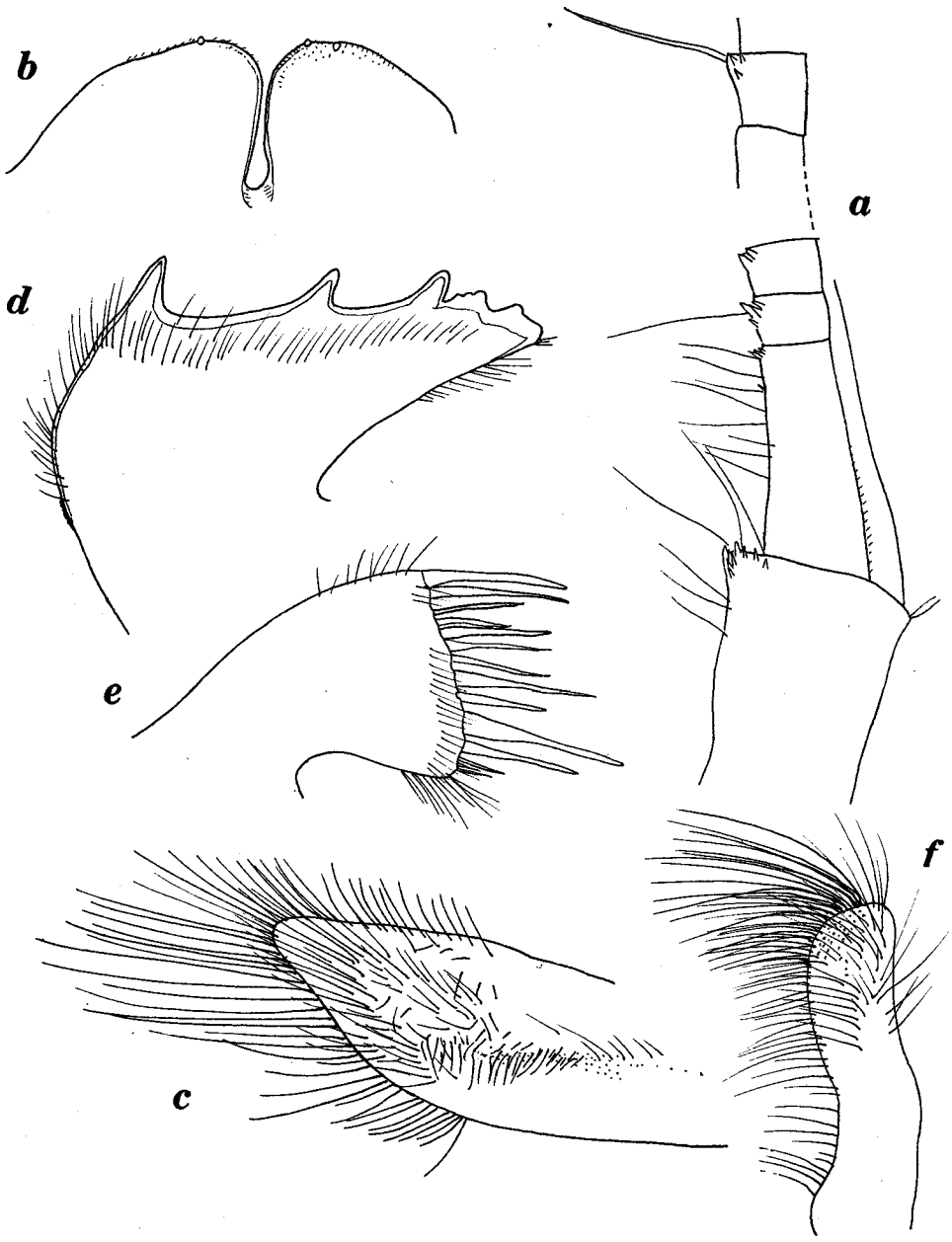

Fig. 4. *Acasta japonica* PILSBRY.
a, Cirrus IV. *b*, Labrum. *c*, Palpus.
d, Mandlble. *e*, Maxilla I. *f*, Maxilla II.
a ×127. *b–f*×67.

Mandible with 4 large teeth and a truncated lower angle.

Maxilla I has 2 large upper spines followed by a row of 7 smaller spines in the upper part and 1-2 larger spines in the lower part and terminally a few spinules all along the almost straight frontal margin without any notch.

Maxilla II with a rodlike distal lobe clothed with numerous bristles.

REMARKS: This species has hitherto been recorded only rarely from Japanese and Malayan waters. The type locality is Albatross Station 4936, off Kagosima Gulf in 103 fathoms. But the description of internal parts has not been given.

30. *Acasta echinata* HIRO, 1937

Acasta echinata HIRO, 1937a, p. 70, fig. 1; BROCH, 1947, p. 23, fig. 5; UTINOMI, 1949, p. 33, fig. 4.

OCCRRENCE: Tomioka. Several perfect specimens imbedded in the stalk of a gigantic alcyonarian *Dendronephthya* (*Morchellana*) *spinulosa*. 1959. T. HABE coll. (T-5)

Nomosaki. One specimen imbedded in the stalk of the same *Dendronephthya*. 4-XI-1960. (M-33)

REMARKS: This species was first described from Tomioka, and further recorded from Condor Island, 15-20 m in Indochina (Vietnum).

31. *Acasta umitosaka* n. sp.

(Fig. 5)

OCCURRENCE: Nomosaki. About five specimens imbedded in the coenenchyme of *Alcyonium gracillimum* KÜKENTHAL obtained by a net "Kasiami". 7-V-1961. (M-51)

HOLOTYPE: SMBL Type 188, deposited in the Seto Marine Biological Laboratory.

DESCRIPTION: Several galls are found on the surface of an orange-colored *Alcyonium gracillimum* which is common in Japanese waters. But their opening is very small and the shells are very brittle and tightly buried within the stiff coenenchyme of the host alcyonarian. Therefore, it is very difficult to remove intact specimens without injury. Thus, it is now impossible to trace the contour of the entire shell with certainty.

As far as could be detected, however, it is likely that this species may be a "window"-forming form, somewhat resembling *Acasta fenestrata* DARWIN, *A. purpurata* DARWIN and *A. foraminifera* BROCH.

The paries of the carina is elongated and furnished externally with two longitudinal rows of flexible chitinous hairs. The paries of the carino-lateral plate is narrower and shorter, and furnished with only one row of flexible chitinous

hairs. The radii and alae are rather broad and transversely striated. Below the radii a large "window" is formed between the carina and carino-lateral plate and the basis. The lateral and rostral plates could not be well outlined because of

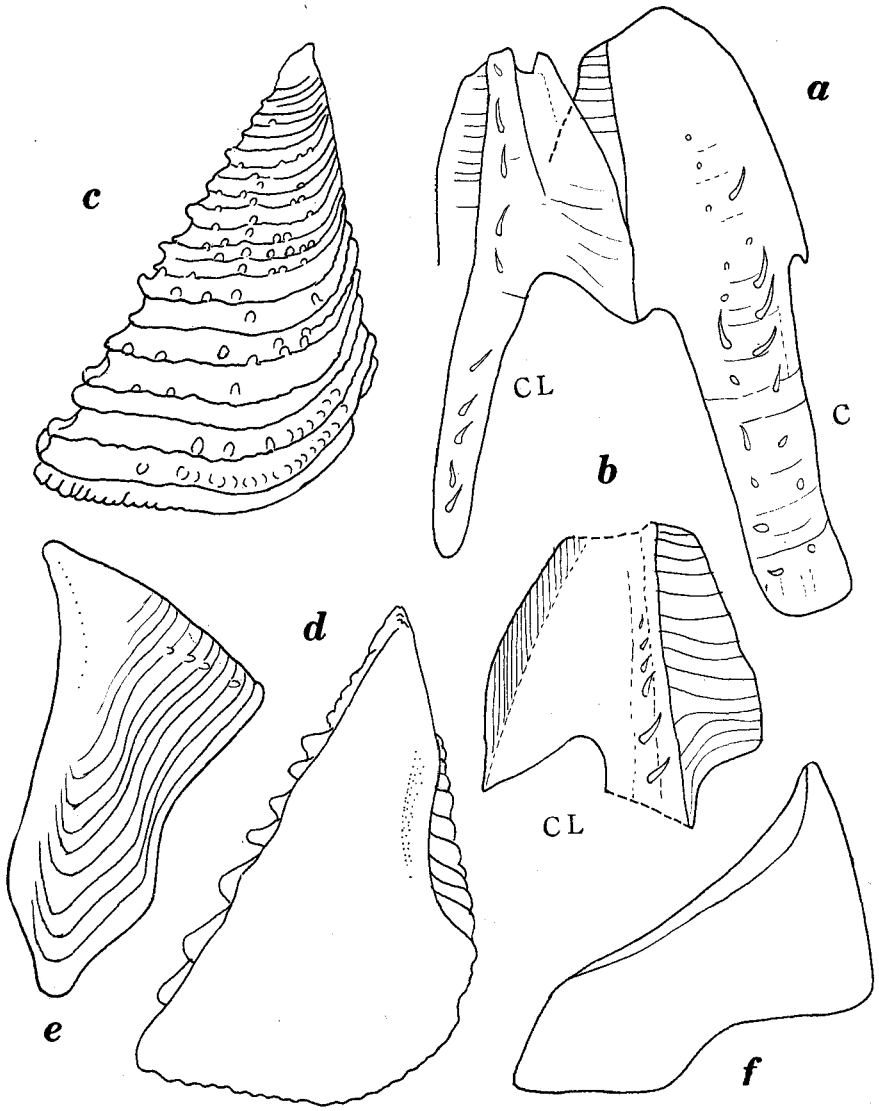

Fig. 5. *Acasta umitosaka* n. sp.
a, Carina (C) and carino-lateral compartment (CL), articulated, outer view. *b*, part of carino-lateral compartment (CL), outer view. *c*, Scutum, outer view. *d*, Scutum, inner view. e, Tergum, outer view. *f*, Tergum, inner view. *a–b*×21. *c–f*×27.

brittleness. These compartments are solid and show no internal ribs below the sheath.

The scutum is rather thick, triangular, a little longer than wide, and the growth-line are slightly beaded. Internally, there is no indication for any ridge or depression.

The tergum is narrow, with a widely truncated spur, which is about one half as wide as the basal margin. Internally, it is quite smooth and flat.

The internal body could not be examined.

REMARKS: As formerly reviewed (UTINOMI, 1953, 1959), we know only three species of the genus *Acasta* living commensally with alcyonaceans.

In general appearance, this new species is rather more related to the species living in sponges such as *Acasta fenestrata*, *A. foraminifera*, etc. than to those living in octocorals such as *Acasta echinata* and *A. alcyonicola*. The trivial name given here means the Japanese name of the host alcyonacean.

Genus *Pyrgoma* LEACH

(Including *Creusia* LEACH)

The opinion expressed recently by BROOKS and ROSS (1960) for combining together the coral-inhabiting genera *Creusia* and *Pyrgoma* of LEACH seems to be generally accepted. Certainly DARWIN (1854) himself suspected the validity of *Creusia* as a generic rank. Indeed, it is very difficult to draw any distinct line of demarcation between individuals within the same species in respect to the degree of fusion of the compartments of the wall. Moreover, the most distinct character, namely, whether or not the walls are permeated by pores, seems quite variable between individuals, as noted by DARWIN.

Indeed, several species variously referred to *Creusia* or *Pyrgoma* are known which are characterized by an intermediate stage in the connection between the compartments, showing a connecting link between the typical forms of *Creusia* and *Pyrgoma*. In the material before me I find in some cases only two more or less distinct sutures between the compartments, especially between the carina and lateralia, as seen in *Pyrgoma anglicum*, *Pyrgoma conjugatum* and *Pyrgoma indicum* (=*Creusia spinulosa* forma *angustiradiata*). *Pyrgoma oulastreae* here described may also be applied to the same category.

For further detailed discussion on the classificatory problem of *Cresia-Pyrgoma* refer to DARWIN (1854), ANNANDALE (1924), WITHERS (1926, 1928, 1929), HIRO (1935, 1938), NILSSON-CANTELL (1938), BROOKS and ROSS (1960) and ZULLO (1961).

32. *Pyrgoma spinulosum* forma *euspinulosa* (BROCH, 1931)

Creusia spinulosa var. (1) DARWIN, 1854, p. 377, Pl. 13, fig. 6 *a–d*; ANNANDALE, 1924.
Creusia spinulosa forma *eu-spinulosa* BROCH, 1931, p. 118; HIRO, 1935, p. 49, fig. 1; HIRO, 1938, p. 393, fig. 1 *a–c*; NILSSON-CANTELL, 1938, p. 59, textfig. 20, Pl. 2, figs. 4–5.

OCCURRENCE: Nomosaki. Two specimens imbedded in *Goniopora* sp. (?). 16-XI-1960. (M-23)

33. *Pyrgoma spinulosum* forma *secunda* (BROCH, 1931)

Creusia spinulosa var. (2) DARWIN, 1854, p. 378, Pl. 13, fig. 6 *e-g*.
Creusia spinulosa forma *secunda* BROCH, 1931, p. 118; HIRO, 1938, p. 397, fig. 5 *a-e*; NILSSON-CANTELL, 1938, p. 60; KOLOSVÁRY, 1947, p. 425.

OCCURRENCE: Nomosaki. Three specimens on *Acropora* sp. 27-XII-1960 (M-27). Two specimens on *Montipora* sp. 27-XII-1960 (M-36). 3-I-1961 (M-40).

34. *Pyrgoma spinulosum* forma *acuta* (HIRO, 1938)

Creusia spinulosa var. (6)-2nd subvariety DARWIN, 1854, p. 379, Pl. 14, fig. 6 *m-o*.
Creusia spinulosa forma *acuta* HIRO, 1938, p. 398, fig. 6 *c-f*.

OCCURRENCE: Nomosaki. On *Acropora* sp. 4-XII-1960 (M-32). 27-XII-1960 (M-37).

35. *Pyrgoma indicum* ANNANDALE, 1924

Creusia spinulosa var. (11) DARWIN, 1854, p. 381, Pl. 14, fig. 6 *U-u*.
Pyrgoma indicum with phases *merulinae* and *symphylliae* ANNANDALE, 1924, p. 64.
Creusia spinulosa forma *angustiradiata* BROCH, 1931, p. 118; HIRO, 1935, p. 51, fig. 3 *a-d*; HIRO, 1937b, p. 466; NILSSON-CANTELL, 1938, p. 62, Pl. 3, fig. 1; UTINOMI, 1943, p. 15, figs. 1-4 (larval stages).

OCCURRENCE: Nomosaki. One specimen on dead stock of *Favia speciosa* (?). 5-I-1961 (M-41).

36. *Pyrgoma cancellatum* LEACH, 1824

Pyrgoma cancellatum DARWIN, 1854, p. 362, Pl. 12, fig. 5 *a-f*; WELTNER, 1897, p. 255; HIRO, 1935, p. 54, fig. 5; NILSSON-CANTELL, 1938, p. 67, textfig. 25, Pl. 3, figs. 2-3.
Pyrgoma cancellatum var. *japonica* WELTNER, 1897, p. 255.

OCCURRENCE: Nomosaki. Ten specimens on *Dendrophyllia sibogae* VAN DER HORST. 14-X-1960. (M-19)

37. *Pyrgoma oulastreae* n. sp.

(Figs. 6-8)

Creusia spinulosa forma *quarta* UTINOMI, 1949, p. 35, fig. 6.

OCCURRENCE: Nomosaki, intertidal. Many specimens on *Oulastrea crispata*

2-IV-1961, 3-V-1961 (M-46). 19-III-1961 (M-47).

HOLOTYPE: SMBL Type 187, deposited in the Seto Marine Biological Labortory.

DESCRIPTION: Shell oval, almost depressed or low conical, grayish purple in color, with many prominent radial ridges, which are not visible externally, as they are usually overgrown thickly by spinous septa of corallites of the host coral *Oulastrea crispata* (LAMARCK).

They measure in mm as follows:

	Carino-rostral diameter	Longest diameter of orifice
Holotype	7	1.2
Paratype	9	2
"	10	2

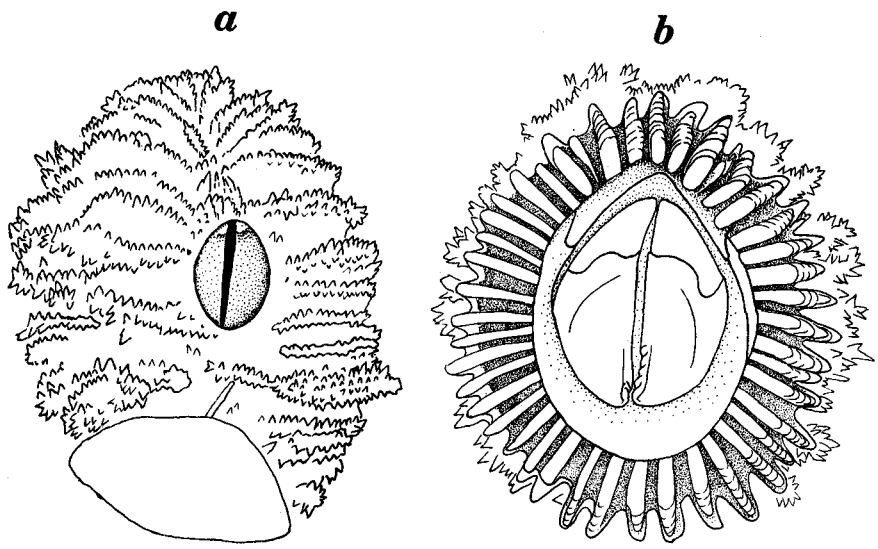

Fig. 6. *Pyrgoma oulastreae* n. sp.
a, Holotype, overgrown by spinous septa of host corallite, upper view. *b*, the same, inner view. All ×9.

Externally, the radii and the sutures between the four compartment are apparently absent. Internally, however, a suture between the carina and lateralia is invariably distinct, while a suture between the lateralia and rostrum is either distinct or indistinct on both sides. When the suture is distinct, the inside of the narrow radius is provided with a series of interlocking denticles, about 10 in number. The sheath is glossy, finely striated transversely and its lower edge is quite free and continuous. The interior of the paries below the sheath is about one-half as high as the sheath and strongly ribbed from the base of the wall. These longitudinal ribs are all high and finely denticulate on both sides

and at the base. The connection between the external and internal ribs of the compartments at the base of the wall is strongly denticulate. These ribs and the outer lamina are poreless.

The basis is usually only slightly embedded in the corallum and thus cup-shaped, the host coral being an encrusting form. The interior of the basal cup is quite smooth, only slightly folded radially towards the basal center. Its wall is permeated by longitudinal tubes of which the section is irregularly oval and denticulate on both sides; the outline of the section coincides with the space

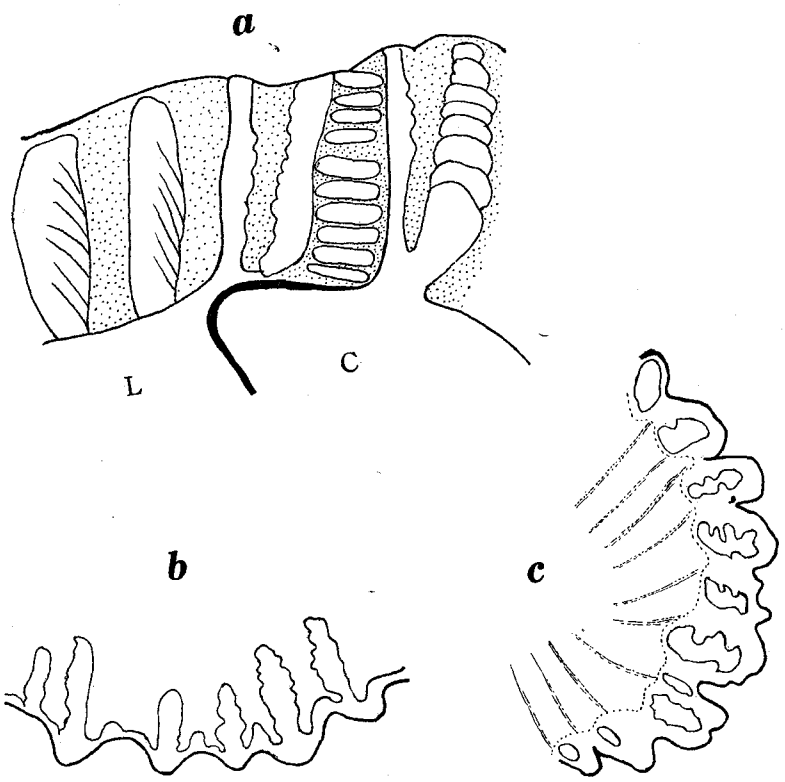

Fig. 7. *Pyrgoma oulastreae* n. sp.
a, Juncture between carina (C) and lateralia (L), with a series of articulating denticles, inner view. *b*, Section of outer lamina of wall. *c*, Section of basal wall, showing a row of tubes. *a*×21. *b–c*×18.

between the internal ribs of the compartments connected with the basis.

The scutum is wider than high and strongly convex outwards. Externally, many growth-lines run closely parallel to the basal margin. Internally, the adductor ridge is prominent and long, reaching to the basal margin. The articular ridge is low and almost straight.

The tergum is triangular. Externally, the growth-lines are coaser than those of the scutum, and a prominent, deep and broad spur-fasciole is defined. The spur is moderately short, obliquely rounded at the end, and slightly separated

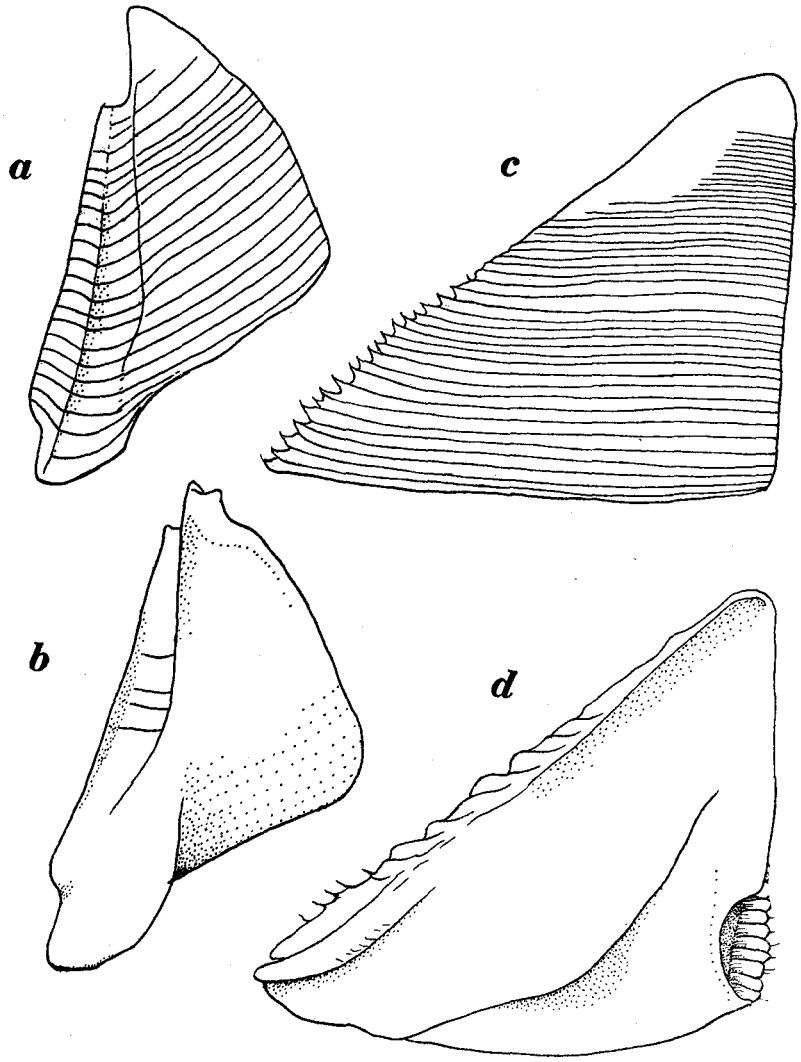

Fig. 8. *Pyrgoma oulastreae* n. sp.
a, Tergum, outer view. *b*, Tergum, inner view.
c. Scutum, outer view. *d*, Scutum, inner view.
All ×21.

from the basi-scutal angle. There is no crest for the depressor muscles.

REMARKS: This species is apparently a nearest ally of DARWIN's *Creusia spinulosa* var. (4) (cf. p. 378, Pl. 14, fig. 6*i*-1). The tergum resembles his fig. 6*i*

most closely among variable forms. According to him, the walls in specimens taken from the same coral are either porous or solid. As to the distribution, DARWIN only mentions as "Philippine Archipelago and West Indies", but none as to the host coral.

It is more doubtful whether the present species found on *Oulastrea crispata* which is confined to the littoral of the West-Indo-Pacific is the same as one of DARWIN's *Creusia spinulosa* var. (4), which was renamed by KOLOSVÁRY as forma *quarta*, since the tergum of the present specimens is not so considerably variable as shown in DARWIN's figures. Thus I propose that the present specimens found only on *Oulastrea crispata* represent an independent species of *Pyrgoma* in a wide sense.

This species is also found on the same coral commonly occurring in the littoral of Tanabe Bay, Kii Province, middle Japan.

Subfamily Tetraclitinae NILSSON-CANTELL

Genus *Tetraclita* SCHUMACHER

Subgenus *Tetraclitella* HIRO

38. *Tetraclita chinensis* NILSSON-CANTELL, 1921

Tetraclita purpurascens NILSSON-CANTELL, 1921, p. 359, textfigs. 81–82, Pl. III*, fig. 12; HIRO, 1939, p. 273, fig. 14.
Tetraclita purpurascens nipponensis HIRO, 1937b, p. 469.
Tetraclita chinensis UTINOMI, 1949, p. 36; UTINOMI, 1954, p. 23.

OCCURRENCE: Nomosaki, intertidal. 27 specimens under stones. 3-XI-1960 (M-22). 14 specimens on the shells of *Septifer virgatus*. 4-XII-1960 (M-30).

39. *Tetraclita multicostata* NILSSON-CANTELL, 1930

(Figs. 9–10)

Tetraclita purpurascens var. *multicostata* NILSSON-CANTELL, 1930, p. 18, fig. 5.

OCCURRENCE: Makurasaki, Kagosima Pref. About ten specimens attached to a wood stranded on shore, S. MAWATARI coll. VIII-1960.

DESCRIPTION: The shell is depressed, dirty white and covered with a pale purplish epidermis. The contour of the wall is oval to round, with strongly toothed basal margin. The orifice is rather quadrangular in outline, not exactly diamond-shaped.

The four compartments are provided with numerous prominent ribs radially. In the rostrum and carina, the parietes have usually three principal ribs and also 2-3 indistinct ribs are marked on both sides of the rostrum. In the lateral com-

partments, the parietes have four principal ribs, usually accompanied by a few secondary riblets near their ends. These numerous ribs and riblets extend well beyond the shell circumference, and bear chitinous hairs densely along the growth-lines. Also the radii have longitudinal growth-lines which are fringed with chitinous hairs, though shorter and sparser than those on the ribs of the parietes.

The basis is essentially membranous, but tends to be thinly calcareous.

The scutum is transversely elongated with a broad median depression on the external surface. The basal margin is almost straight and a little shorter than the occludent margin which is denticulate in the lower part, as indicated by 3–7 teeth. Internally, the adductor ridge is prominent and distinctly separated from

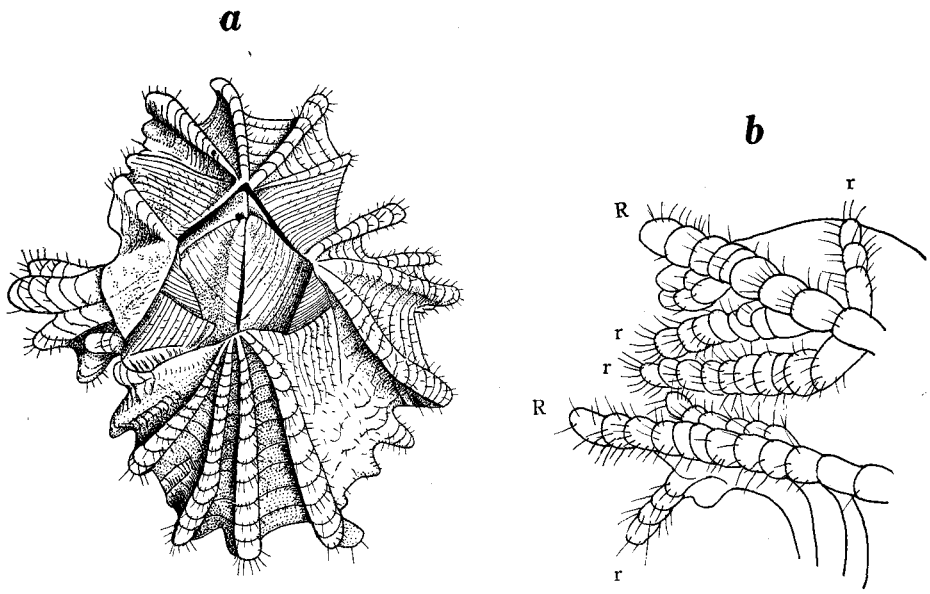

Fig. 9. *Tetraclita* (*Tetraclitella*) *multicostata* NILSSON-CANTELL.
a, Specimen, upper view. *b*, Ramification of parietal ribs, showing a few secondary riblets (r) near the end of principal ribs (R), magnified. *a*×about 4. *b*×18.

the high, straight articular ridge. The articular ridge is narrow but deep. The adductor muscle depression is not delimited.

The tergum is subtriangular, narrow and externally flat. The scutal margin is slightly concave, with a narrow articular furrow. The upper margin is strongly convex and the shortest of all the margins. The spur is short and obliquely rounded, occupying about one-half of the basal margin, and it is slightly separated from the basi-scutal angle. There are 4–7 crests for the insertion of the tergal depressor muscles.

The mouth-parts and cirri are not much differentiated from those of the other species in this subgenus.

Measurement of some specimens in mm.

Carino-rostral diameter	11.2	10	10	8	7.4
Transverse diameter	8	8.5	10	9	6
Diameter of orifice	3.8	4	3.2	3.2	2.8
Height	3	4.5	3	3	3

REMARKS: In general appearance the present material may be assigned to

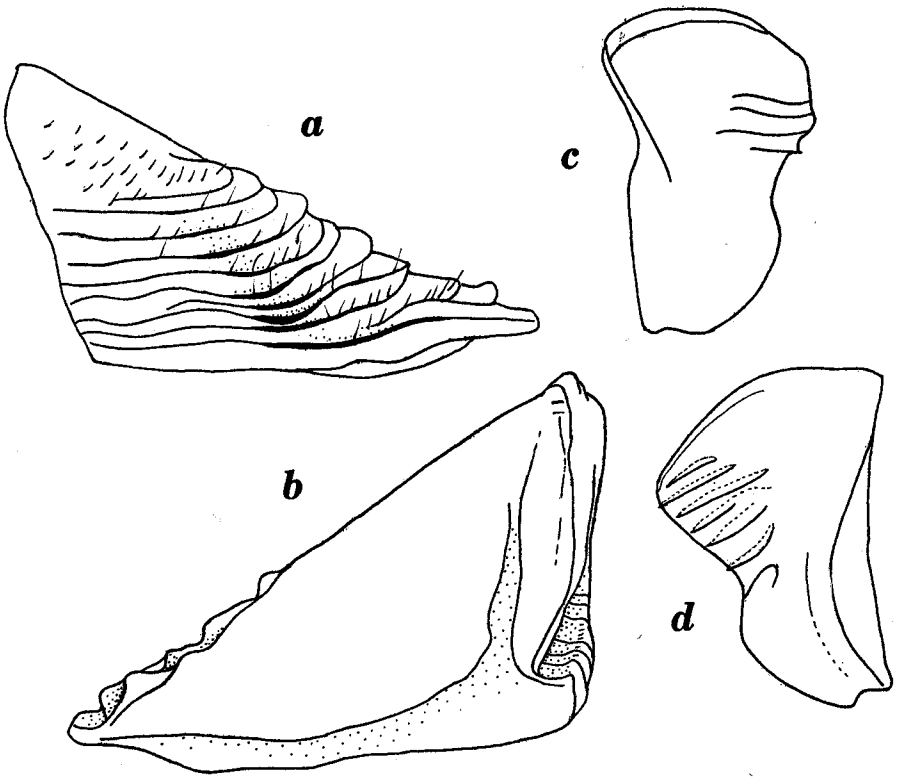

Fig. 10. *Tetraclita* (*Tetraclitella*) *multicostata* NILSSON-CANTELL. *a*, Scutum, outer view. *b*, Scutum, inner view. *c*, *d*, Tergum, inner view. All ×27.

Tetraclita purpurascens var. *multicostata* NILSSON-CANTELL (1930) which was ever reported from Jefbi, Misoöl Archipelago of Indonesia, based on one small specimen. NILSSON-CANTELL assigned it to the Australian species *Tetraclita purpurascens* (WOOD) and considered only as a variety of the typical species. However, comparison with the descriptions and figures of the real *T. purpurascens*, given by DARWIN (1854) and POPE (1945) indicates that NILSSON-CANTELL's *multicostata*

as well as the present material may be specifically valid. Of all the peculiarites the ramification of the compartmental ribs seems to be the most characteristic.

40. *Tetraclita pilsbryi* n. sp.

(Figs. 11-12)

OCCURRENCE: Nomosaki. Many specimens on the inside of dead shells of *Dendostraea imbricata* (LAMARCK) obtained by a net "Kasiami", probably from 10-30 fathoms. 14-IX-1960 (M-6)

HOLOTYPE: SMBL Type 186, together with paratypes, deposited in the Seto Marine Biological Laboratory.

DESCRIPTION: All the specimens here examined are seated upon the smooth inner surface of dead shells of *Dendostraea imbricata* (LAMARCK), together with many sedentary polychaetes (*Spirorbis*, *Hydroides*), bryozoans (*Lichenopora*) and boring sponges (*Cliona*), and none on the imbricated outer surface.

The shell is remarkably depressed, almost round in outline and generally dirty white, though the radial tubes within the radii are colored purplish brown, which are visible through the transparent shell.

The four compartments are approximately of the same size and furnished with prominent ribs, usually three in the carina and rostrum, and two in the lateralia as in *Tetraclita costata* DARWIN. These radial ribs are widely separated from one another and extend to the basal margin and project slightly beyond the circumference. The surface of the parietes are finely striated transversely with delicate growth-lines, and that of the radii also striated longitudinally. Internally, the wall of the parietes and radii is rather thin and similarly permeated by a number of parietal tubes, which are usually hexagonal in transverse section. The sheath is rather high and occupies approximately the upper half of the inner lamina.

The orifice is diamond-shaped and its margin is horizontal. The basis is entirely membranous.

The scutum is triangular, higher than wide, and externally provided with five longitudinal row of pits crossed by the growth-lines along the slight median depression. Internally, a prominent adductor ridge is present, blindly ended before reaching to the basal margin. The articular ridge is reflexed and evenly rounded. The adductor muscle depression is not delimited. The occludent margin is almost straight.

The tergum is subtriangular, the carinal margin being about one-half as long as the scutal margin. Externally it is flat and internally provided with a broad articular furrow and 8-10 prominent crests for the insertion of depressor muscles. The spur is short and rounded and confluent with the basi-scutal angle.

Mouth-parts. Labrum with a median notch which is much deeper than usual

in the genus; its edge is shortly hairy and there are 2 or 3 denticles on each side of the median notch.

Palpus elongate lobe-like, densely fringed with long feathered bristles all along the rounded end.

Mandible has three strong teeth, followed by three smaller teeth, each with a few spinules along the upper border. The lower angle is sharply pointed.

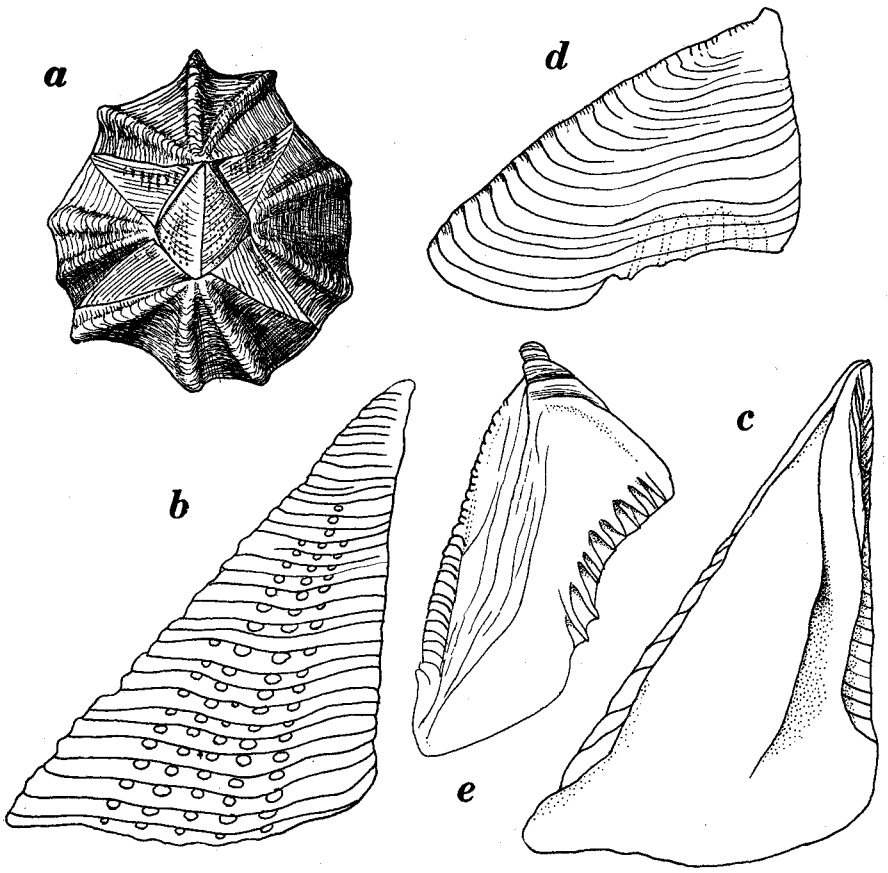

Fig. 11. *Tetraclita* (*Tetraclitella*) *pilsbryi* n. sp.
a, Holotype, upper view. *b*, Scutum, outer view. *c*, Scutum, inner view. *d*, Tergum, outer view. *e*, Tergum, inner view. *a*×about 4. *b*–*e* ×21.

Maxilla I has a shallow notch on the frontal margin; two large spines above the notch and three smaller and two largest spines are planted in a series. At the lowest angle a tuft of short spines is seen.

The cirri have no characteristic feature. The posterior cirri have the rami of about 15 segments, most of which bear 3 pairs of bristles on the ventral face,

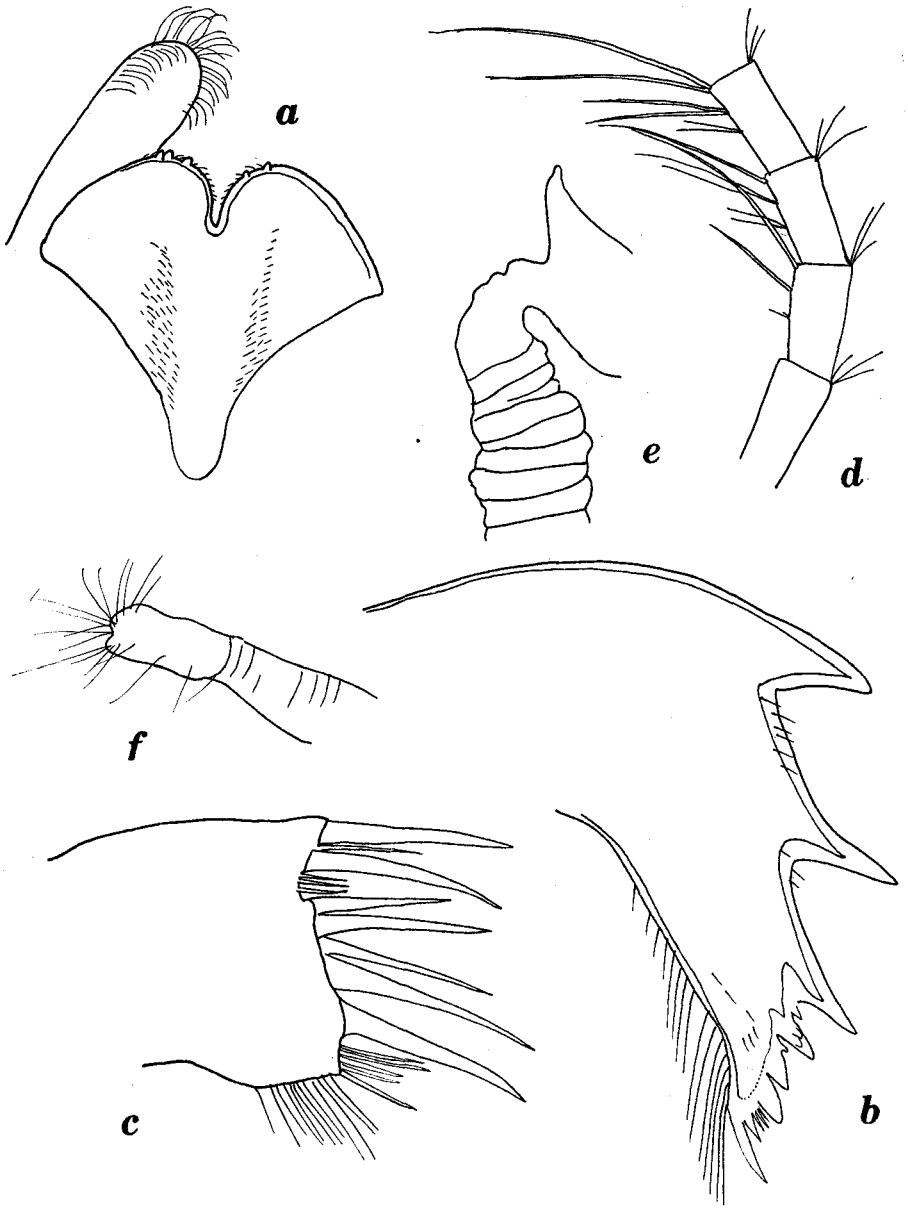

Fig. 12. *Tetraclita* (*Tetraclitella*) *pilsbryi* n. sp.
a, Labrum and palpus. *b*, Mandible. *c*, Maxilla I. *d*, Median part of cirrus. *e*, Basi-dorsal point at base of penis. *f*, End of penis. *b–c* ×150. *a*, *d–f* ×80.

The penis is long, finely annulated; a well developed basi-dorsal point or spur is present.

Measurements of Type specimens in mm.

	Holotype	Paratype 1	Paratype 2
Carino-rost. diam.	9	11.2	10
Transverse diam.	10	11.2	8
Height	3	3	4

REMARKS: In external appearance, this species is closely related to *Tetraclita costata* DARWIN. According to DARWIN (1854, p. 340), the scutum of *T. costata* is externally striated longitudinally, and in many specimens there is a median depression or a row of very small pits. The tergum seems to be wider than that in this species. NILSSON-CANTELL (1930) recorded *T. costata* from Jefbi, Misoöl Archipelago, but did not give detailed description on his material. This pecies, however, can be separated from *T. costata* by the presence of five longitudinal rows of pits in the scutum and of many crests for the depressor muscles. Further, it should be noted that this species was found in the subtidal zone, instead of intertidal, though the habitat is similarly sheltered.

41. *Tetraclita darwini* PILSBRY, 1928

Tetraclita darwini PILSBRY, 1928, p. 314, textfig. 4, Pl. 25, figs. 1-3 *a*; HIRO, 137b, p. 469.
Tetraclita (*Tetraclitella*) *darwini* HIRO, 1939, p. 277; UTINOMI, 1949, p. 24.

OCCURRENCE: Nomosaki, intertidal. Three specimens. 9-III-1961. (M-48)

REMARKS: Since PILSBRY (1928) first reported from Hirado, Nagasaki Pref., this peculiar species has often been recorded from various localities of Japan, but none from elsewhere. The habitat of this species is not always under rocks, but apparently it may prefer a shaded or wetted situation like other Tetraclitellas in the intertidal zone.

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