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STUDIES ON THE CIRRIPIEDIAN FAUNA OF JAPAN. IX.
DISTRIBUTIONAL SURVEY OF THORACIC CIRRIPEDES IN THE
SOUTHEASTERN PART OF THE JAPAN SEA¹⁾

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With Plate XVIII and 12 Text-figures

Introduction and Acknowledgments

In the autumn of 1935, about three decades ago, I made a monthlong trip to the Tohoku and Hokuriku Districts of northern Japan for collecting Thoracic cirripeds (HIRO, 1939a). At that time I was impressed that the littoral biotope and faunal components on the Japan-Sea coast in comparison with the east coast on the Pacific side are much monotonous, although the warm Tusima Current penetrates northerly to the west coast of Hokkaido and to the Tugaru Strait. Besides, R/V Sôyô-maru of the Imperial Fisheries Experimental Station made a general benthic survey on the continental shelf around the Japanese Islands during the years 1926-1930 and succeeded to collect twenty-five species of Thoracic cirripeds at offshore stations (HIRO, 1933). The other collecting data for the Japan-Sea side cirripeds were very few in the pre-war time. Fortunately, afterwards extensive collections and informations have been accumulated to my hand through the courtesies of many personnels (past and present) of the institutions in the concerned districts, as mentioned in the following text, to whom I am deeply indebted in persuing the distributional survey after the Second World War.

Among them, I wish to extend particularly my deepest thanks to Mr. Takehiko KITAMI of the Sado Marine Biological Laboratory for providing with many photographs and to Dr. Saburo NISHIMURA of our Laboratory for preparing a map (Fig. 12) for the present paper in addition to proper collectings.

Systematics

LEPADOMORPHA

Family Scalpellidae PILSBRY

1. *Pollicipes mitella* (LINNÉ, 1767) カメノテ

1) Contributions from the Seto Marine Biological Laboratory, No. 517.

Pollicipes mitella: G.B. SOWERBY, 1833; DARWIN, 1851, p. 316; NILSSON-CANTELL, 1921, p. 163.

Mitella mitella: PILSBRY, 1907, p. 6; KRÜGER, 1911, p. 8; BROCH, 1931, p. 27; HIRO, 1932b, p. 546; HIRO, 1939a, p. 202; KITAMI, 1968, p. 68.

Occurrence.—Interior of Ponsyoro Cave near Osyoro, west Hokkaido, leg. S. MOTODA, 19/X '43; Iwanai, west Hokkaido, leg. S. MOTODA, 29/IX '43; Esasi, west Hokkaido, leg. S. MOTODA, 29/IX '43; Hakodate (WELTNER, 1897: 252); Mutu Bay, Tappi-saki, Nezugaseki and Tôzinbô (HIRO, 1939a: 202); Hukaura, Tugaru Region, leg. K. KONNO, 20/IX '69; Awasima and Sado Is. (KITAMI, 1968: 68); Abugasima in Toyama Bay, leg. K. KIKUCHI; Turuga in Wakasa Bay, leg. M. HIRAGUCHI, '31; Oki Is., leg. T. YAMAMOTO, 27/VIII '64; Cheju-Dô Is., leg. S. OKUDA, 14/VIII '36; Yosu and Mokpo, South Korea, leg. S. OKUDA, 28/VIII '36; Okinosima, Tusima Strait, leg. S. MIYAKE, '32 and leg. Zool. Inst., Tokyo Univ.; Yosimi, west coast of Simonoseki, leg. Y. MIYA, 9/IX '69; Nokozima in Hakata Bay, leg. Y. MIYA, 10/X, '69.

Distribution.—Common all around Japanese Islands far southwards to Malayan waters. Ponsyoro Cave near Osyoro, west Hokkaido is the known northern limit of range.

2. *Smilium scorpio* (AURIVILLIUS, 1894) トゲヒメミヨウガ

Scalpellum scorpio AURIVILLIUS, 1894, p. 46.

Scalpellum (Smilium) sexcornutum PILSBRY, 1897, p. 723; WELTNER, 1922, p. 96.

Calantica scorpio: BROCH, 1931, p. 6; HIRO, 1933, p. 13 (synonymy); HIRO, 1939a, p. 203.

Occurrence.—Off Tango, west of Wakasa Bay, 64–73 m (WELTNER, 1922, p. 96); Toyama Bay, 50–70 m (HIRO, 1939a, p. 203).

Distribution.—Sporadically recorded from deep basin of Japan and southwards.

3. *Scalpellum koreanum* HIRO, 1933 チヨウセンミヨウガ

Scalpellum koreanum HIRO, 1933, p. 36, figs 10–11 and Pl. II, figs. 1–2.

Occurrence.—Off Pusan, Korea Strait (Sôyô-maru Benthic Survey Station 478: 35°12'30" N, 129°21'00" E, 101 m and Station 481: 35°16'38" N, 130°10'00" E, 143 m).

Family Iblidae (LEACH) ANNANDALE

4. *Ibla cumingi* DARWIN, 1851 ケハダエボシ

For description see HIRO, 1937, p. 393, fig. 1.

Occurrence.—Yosimi coast of Simonoseki, attached to the peduncle of *Pollicipes mitella*, leg. Y. MIYA, 9/IX '69; Nokozima in Hakata Bay, leg. Y. MIYA, 10/X '69.

Distribution.—Malay Archipelago, Gulf of Oman, Red Sea and southern Japan.

Family Oxynaspididae (PILSBRY) NILSSON-CANTELL

5. *Oxynaspis pacifica* HIRO, 1951 カクトゲエボシ

Occurrence.—Nezugaseki, Yamagata-ken, attached to *Antipathes* (SUZUKI, 1963, p. 13).

Family Lepadidae (DARWIN) NILSSON-CANTELL

6. *Lepas anatifera* LINNÉ, 1767 エボシガイ

Occurrence.—Asamusi, Mutu Bay (HIRO, 1932b: 546); Hukaura, Aomori-ken, leg. K. KONNO, 20/IX '69; Sado Is. (KITAMI, 1968: 68); Niigata (HONMA, 1968: 34); Toyama Bay (HIRO, 1939a: 204); Turuga, Hukui-ken, leg. T. YASUDA, 23/IX '66; Okinosima, Hukuoka-ken (UTINOMI, 1949: 20).

7. *Lepas anserifera* LINNÉ, 1767 カルエボシ

Occurrence.—Hukaura, Aomori-ken, leg. K. KONNO, 9/XI '68; Nezugaseki, Yamagata-ken (HIRO, 1939a: 204); Niigata (HONMA, 1968: 34); Sado Is. (KITAMI, 1968: 68); Husiki, Toyama-ken (HIRO, 1939a: 204); Sigasima, mouth of Hakata Bay, leg. S. MIYAKE, 27/X '52.

8. *Lepas pectinata* SPENGLER, 1793 ルリエボシ

Occurrence.—Tassya, Sado Is. (KITAMI, 1968: 69).

9. *Lepas fascicularis* ELLIS et SOLANDER, 1786 ウキエボシ

(Pl. XVIII, fig. 1)

Occurrence.—Tassya, Sado Is., leg. T. KITAMI, 24/VII '68.

10. *Conchoderma virgatum* (SPENGLER, 1790) スジエボシ

Occurrence.—Off Siriyazaki, Aomori-ken (HIRO, 1939a: 205); Tassya, Sado, Is. leg. T. KITAMI, 17/VII '63.

11. *Conchoderma virgatum hunteri* (Owen, 1830) コスジエボシ

(Pl. XVIII, fig. 2)

Occurrence.—Tassya, Sado Is., on set net, anchor-buoy and rope, leg. T. KITAMI, 10/XI '67 (KITAMI, 1968: 69); Toyama Bay, on the carapace of the crab *Portunus trituberculatus* (HIRO, 1939a: 205).

Family Heteralepadidae NILSSON-CANTELL

12. *Heteralepas quadrata* (AURIVILLIUS, 1894) ムラサキハダカエボシ

Alepas quadrata AURIVILLIUS, 1894, p. 30, pl. II, figs. 16-17, pl. III, figs. 2, 6 and 12 (Java Sea).

Heteralepas (*Heteralepas*) *quadrata*: HIRO, 1937, p. 406 (Seto; Synonymy).

Occurrence.—Nezugaseki and Kamo, Yamagata-ken, on *Portunus trituberculatus* (SUZUKI, 1963: 13).

13. *Paralepas minuta nipponica* UTINOMI, n. ssp. ウニハダカエボシ

Heteralepas (*Paralepas*) *minuta* (PHILIPPI): HIRO, 1933, p. 51, text-fig. 15, pl. II, fig. 4.

Occurrence.—Sôyô-maru Benthic Survey Station 547 (Off Etizen-misaki, Hukui-ken; 35°56'50" N, 135°54'07" E, 172 m), Station 581 (Toyama Bay; 37°11'30" N, 137°09'15" E, 207 m), Station 582 (Toyama Bay; 37°01'35" N, 137°04'55" E, 176 m), Station 605 (North of Sado Island; 38°31'00" N, 138°31'37" E, 139 m) and Station 652 (Tugaru Strait; 41°27'08" N, 140°23'00" E, 110 m). All attached to spines of Cidarid sea-urchins.

Remarks.—These Japanese specimens, all of which were collected by the Sôyô-maru Benthic Survey from the four stations mentioned above in the Japan Sea, were unfortunately lost, so that could not be re-examined. However, as my previous description shows, they may be actually different from the typical form from the Mediterranean Sea. According to DARWIN (1851, p. 160) and BROCH (1927, p. 18), the typical form is only 4 mm long, oval in shape, lacking any dorsal keel on the capitulum and internally the caudal appendages are only 3-segmented. The Japanese specimens, on the other hand, are uniformly yellowish globular form having a feeble dorsal keel and internally 11-segmented long caudal appendages, notwithstanding their external resemblance.

PILSBRY (1953) reported another variant from off Palm Beach of Florida, North America in 60 to 80 fathoms and named it *Paralepas minuta americana* (n. ssp.) as a separate subspecies. This is a little larger (5.5 mm long, 5 mm wide), bearing red markings on the capitulum and only 3-segmented short caudal appendages internally. Accordingly, it seems best to rename this Japanese specimens collected only by the Sôyô-maru Benthic Survey as a separate variant of the typical *Paralepas minuta* for the time being.

Family Poecilasmatidae (ANNANDALE) NILSSON-CANTELL

14. *Octolasmis orthogonia* (DARWIN, 1851) ウスエボシ

Occurrence.—Tusima Strait: 34°20' N, 130°00' E, 120 m, on hydroids (BROCH, 1931: 38).

Distribution.—Indomalayan waters and Japan, on hydroids.

15. *Octolasmis weberi* (HOEK, 1907) オオウスエボシ

Occurrence.—Northeast of Sado Island (Sôyô-maru Benthic Survey Station 603: 38°41'30" N, 138°42'05" E, 210 m) (HIRO, 1933: 58).

16. *Octolasmis neptuni* (MACDONALD, 1869) カニエラエボシ

(Fig. 1)

Paradolepas neptuni MACDONALD, 1869, p. 442.

Octolasmis Lowei forma *neptuni* MACDONALD: HIRO, 1937, p. 420, 626; HIRO, 1939a, p. 206 (on gills of *Neptunus trituberculatus* from Mutu Bay).

Octolasmis (Octolasmis) neptuni (MACDONALD): NEWMAN, 1961, p. 100, pl. 21 (synonymy).

Octolasmis (Octolasmis) neptuni hiroi NEWMAN, 1961, p. 102 (on gills of *Charybdis japonica* from Hukuyama, Seto Inland Sea).

Octolasmis neptuni (MACDONALD): WU, 1967, p. 276, fig. 2.

Occurrence.—Mutu Bay, on gills of *Portunus trituberculatus* (HIRO, 1939a: 306); Turuga Bay, on gills of *Portunus trituberculatus*, leg. T. YASUDA, 23/IX '66; Pusan, South Korea, on gills of *Portunus trituberculatus*, leg. K. YAMAUCHI, X '69.

Remarks.—All of the specimens from various localities are generally small-sized,

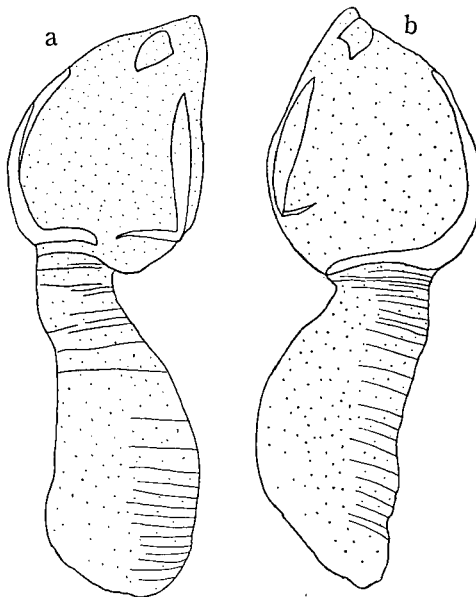


Fig. 1. *Octolasmis neptuni* (MACDONALD), two formae. ($\times 10$)

5–6 mm long; the capitulum 3 mm long, 2 mm wide and the peduncle 4 mm long, 1 mm wide. The integument is opaque white, transparent and studded with extremely minute, blunt spines all over the surface. Of the five capitular plates, the carina forked at base is the most well calcified, sometimes still chitinized apically (Fig. 1a). The tergum is varied in form, being either triangular, lunate or bell-shaped with slight concave basal margin, but never so saddle-shaped as in the typical *Octolasmis lowei* (DARWIN). The scutum is L-shaped; the occludent branch is usually wide and calcified, while the shorter basal branch is either chitinous or moderately calcified. When the basal branch is still chitinous and sharply pointed, it is widely separated from the basal fork of the carina. Although NEWMAN (1961) proposed to separate the form with the calcified basal branch of the scutum as ssp. *hiroii*, it seems to me rather superfluous for the time being, because the degree of chitinization-calcification of valves in such reduced exoskeleton may depend on the growth of individuals living in such less-saline protected habitat as the gill chamber.

17. *Octolasmis angulata* (AURIVILLIUS, 1893)

forma *bullata* AURIVILLIUS, 1893 ソリエラエボシ

(Fig. 2)

Dichelaspis angulata AURIVILLIUS, 1894, p. 22, pl. II, figs. 9–11; pl. VIII, figs. 18–24.

Dichelaspis bullata AURIVILLIUS, 1894, p. 26, pl. II, figs. 12–13; pl. VI, figs. 10–11; pl. VIII, figs. 19,

Octolasmis angulata (AURIVILLIUS): NILSSON-CANTELL, 1934, p. 46, figs. 7–8 (Synonymy).

Octolasmis angulata (AURIVILLIUS): HIRO, 1937, p. 426, figs. 17–18 (Discussion on formae).

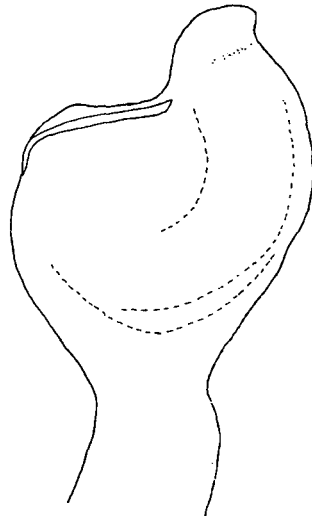


Fig. 2. *Octolasmis angulata* (AURIVILLIUS) form: *bullata* AUR., capitulum. (×9)

Occurrence.—Turuga Bay, Hukui-ken, leg. T. YASUDA, 23/IX '66.

Remarks.—The samples were attached to gill lamellae of the swimming crab, *Portunus trituberculatus* together with the preceding *Octolasmis neptuni*. They are much larger than the latter, 13–15 mm long and 4 mm wide (capitulum), so well differentiated. The integument is much bullate, transparent and studded with minute dots. The orifice is protruded like a hood. The scuta situated below the orifice are simply ski-shaped slender plates. There is no trace of the carina at all.

BALANOMORPHA

Family Chthamalidae (DARWIN) PILSBRY

18. *Chthamalus dalli* PILSBRY, 1916 キタイワフジツボ

Occurrence.—Hakodate, leg. M. TOKUDA, 18/VII '32 (HIRO, 1932a: 406).

Distribution.—So far as known, this boreal chthamalid barnacle is not found along the coasts of northern Honsyu, southwards from the Tugaru Strait (UTINOMI, 1955).

19. *Chthamalus challengerii* HOEK, 1897 イワフジツボ

Occurrence.—Hakodate, leg. M. Tokuda, 18/VII '32 (Hiro, 1932; Weltner, 1897: 273 as *Ch. stellatus*); Osyoro Bay, west Hokkaido, leg. S. MOTODA, 29/X '43 (ICHIKAWA and YAMADA, 1957: 8); Iwanai and Esasi, west Hokkaido, leg. S. MOTODA, 30/X '43; Asamusi, Mutu Bay (HIRO, 1932b: 546; Hiro, 1939a: 207); further southwards.

Distribution.—So far as known, the northern limit of range of this austral chthamalid is Osyoro Bay, west Hokkaido and extends eastwards to Hunka Bay of Hokkaido on the Pacific coast (UTINOMI, 1955, p. 119, fig. 2).

20. *Chthamalus pilsbryi* HIRO, 1936 オオイワフジツボ

For description see HIRO, 1936, p. 227 (Seto) and UTINOMI, 1954, p. 21 (Tokara Islands).

Occurrence.—Katuma, Sigasima, mouth of Hakata Bay, at highest tide level, leg. Y. MIYA, 13/IX '69.

Distribution.—Restricted to southern Japan as far south as the Tokara Islands.

21. *Octomeris sulcata* NILSSON-CANTELL, 1932 コウダカキクフジツボ

(Figs. 3–4 and Pl. XVIII, figs. 3–4)

Octomeris sulcata NILSSON-CANTELL, 1932, p. 8, figs. 3–4 (Kobe, Japan); HIRO, 1939b, p. 207 (Nezugaseki, Yamagata-ken); HIRO, 1939b, p. 254, figs. 5A, 6C–D (Takau, Taiwan).

Occurrence.—Hutagosima, Asamusi, Mutu Bay, leg. T. HOSHIAI, 6/X '63; Nezuga-

seki, Yamagata-ken, on the shell of *Haliotis gigantea*, coll. myself, 20/X '35 (HIRO, 1939a: 207); Awasima and Sado Islands, leg. T. KITAMI, 24/VIII '57, 9/VI '60, 4/VI '67 (KITAMI, 1968: 69, fig. 8); interior of marine caves (Grotta) on the Tazima Coast, Hyogo-ken, leg. A. HOSOMI, 23/VIII '68 (HOSOMI, 1966: 26, fig. 2).

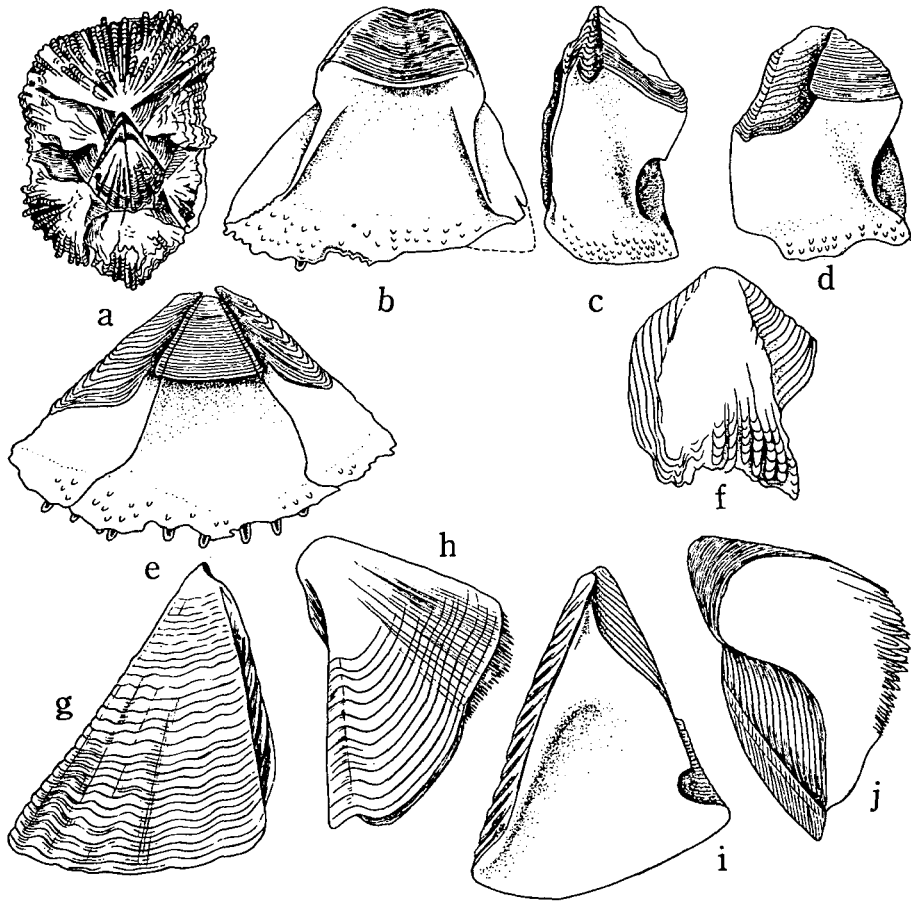


Fig. 3. *Octomeris sulcata* NILSSON-CANTELL from Nezugaseki. *a*, Shell, top view; *b*, carina, inner view; *c*, carino-lateral compartment, inner view; *d*, lateral compartment, inner view; *e*, rostrum and rostrilatera combined together, inner view; *f*, lateral compartment, outer view; *g*, scutum, outer view; *h*, tergum, outer view; *i*, scutum, inner view; *j*, tergum, inner view. (*a* × 8; *b*-*j* × 12)

Distribution.—Grouped on surf-loving rocky reef at the lowest tide level on the warm current washing coasts, from Mutu Bay as far south as Formosan coasts, though occurring locally.

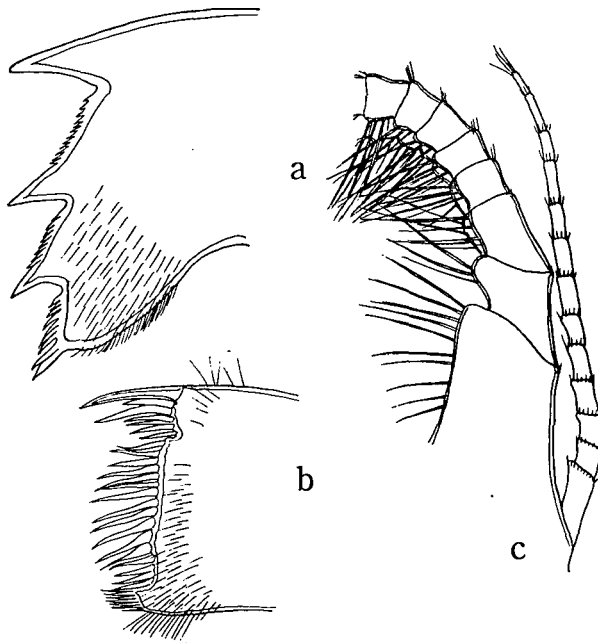


Fig. 4. *Octomeris sulcata* NILSSON-CANTELL. *a*, Mandible; *b*, maxilla I; *c*, basal part of last cirrus with a caudal appendage. (*a*, *b* $\times 50$; *c* $\times 16$)

Family Tetracitidae (NILSSON-CANTELL) ROSS

22. *Tetracitella squamosa japonica* PILSBRY, 1916 クロフジツボ

Occurrence.—Tappi-saki, northernmost cape of Tugaru Peninsula, leg. S. HOZAWA, 22/VII '29; Hutagosima, Asamusi, Mutu Bay, leg. S. HOZAWA (HIRO, 1939a: 213); Hukaura, Aomori-ken, leg. K. KONNO, 20/IX '69; Kuragamura, Akita-ken, leg. S. ONO, 23/VIII '32; Tobi-sima, Hukiura, Kamo and Nezugaseki, all of Yamagata-ken (SUZUKI, 1963: 13); Sado and Awasima Islands (KITAMI, 1968: 70); Hamasaka, Tazima coast, Hyogo-ken, leg. A. HOSOMI, 10/VIII '66; Yosimi coast of Simonoseki, Yamaguti-ken, leg. Y. MIYA, 9/IX '69; Sigasima, Hukuoka-ken, leg. Y. MIYA, 13/IX '69.

Distribution.—Common all throughout the west coast as far north as the Cape Tappi-saki, northernmost end of Honsyu.

23. *Tetracitella chinensis* (NILSSON-CANTELL, 1921) ムツアナヒラフジツボ (Pl. XVIII, fig. 5)

Tetracitella purpurascens chinensis NILSSON-CANTELL, 1921, p. 359, figs. 81–82, pl. III*, fig. 12 (Hong-kong-type locality).

Tetraclita purpurascens nipponensis HIRO, 1931, p. 155, text-fig. 10, pl. XIV, figs. 3-3d (Seto, Tomioka and Misaki); HIRO, 1932a, p. 473, fig. 5; HIRO, 1937, p. 469.

Tetraclita (Tetraclitella) chinensis (NILSSON-CANTELL): U TINOMI, 1949, p. 36 (Okinosima, Korea Strait, etc.); ZEVINA et TARASOV, 1963, p. 97, fig. 14 (Hainan Island, South China on *B. tintinnabulum*).

Occurrence.—Kitaebisu, Sado Is., Leg. T. KITAMI, 3/VIII '63, 17/II '67 and 18/IV '67 (KITAMI, 1968: 70, fig. 18); interior of Zyuzi marine cave, Tazima coast, Hyôgo-ken, leg. A. HOSOMI, 10/VIII '66 (HOSOMI, 1966: 26, fig. 1); Kazumi, Hyôgo-ken, leg. T. YAMAMOTO, 18/VIII '64; Okinosima, Hukuoka-ken, leg. S. MIYAKE, 14-16/VII '36; Keya-Oto, Hukuoka-ken, leg. S. MIYAKE, 28/VII '56; Hanrin, Cheju-Dô Is., Korea Strait, leg. S. OKUDA, 14-16/VII '36.

Distribution.—Common from northern Honsyu to southern Taiwan and Hainan Is. of South China at lowest tide level, occurring in sheltered habitat.

24. *Tetraclitella darwini* (PILSBRY, 1928) ヨツカドヒラフジツボ

Tetraclita darwini PILSBRY, 1928, p. 314, fig. 4, pl. 25, fig. 1-3a (Hirado, Kyusyu-type locality).

Tetraclita (Tetraclitella) darwini: HIRO, 1939b, p. 277 (Suô, Taiwan).

Occurrence.—Hukaura, Tugaru Region, Aomori-ken, leg. K. KONNO, 20/IX '69; Tobi-sima, Yamagata-ken (SUZUKI, 1963: 13); Tassya, Sado Is., leg. T. KITAMI, 12/IX '69; Abugasima, Toyama Bay (HIRO, 1939b: 214); Hanrin, Cheju-Dô Is., leg. S. OKUDA, 16/VII '36; Sogurpo, Cheju-Dô Is., leg. S. OKUDA, 16/VII '36; Hirado, Nagasaki-ken (PILSBRY, 1928: 314).

Distribution.—Rarely found on all Japanese Islands and Korean coast at the lowest tide level in partly protected habitat.

25. *Tetraclitella pilsbryi* (U TINOMI, 1962) フレイヒラフジツボ(新称)

(Fig. 5)

Tetraclita (Tetraclitella) pilsbryi U TINOMI, 1962, p. 234, figs. 11-12 (Nomosaki, Nagasaki-ken-type locality).

Occurrence.—Off Maizuru, Wakasa Bay, leg. Sh. FUSE, VI '67, on the living shell of *Batillus cornutus*, together with *B. trigonus*; Sigasima, mouth of Hakata Bay, leg. Y. MIYA, 13/IX '69, on the shell of *Batillus cornutus*.

Distribution.—Hitherto found also from Cape Asizuri-saki, southwest of Tosa Bay, Sikoku on the under surface of corallum of the reef coral *Symphyllia recta* (DANA), leg. Sh. FUSE, 1966 (unpublished). From these collecting data, this tetraclitellid seems to inhabit in the lowest tide level or the upper subtidal area in southern Japan only.

Remarks.—Superficially this species is hardly distinguishable from *Balanus trigonus* and *Octomeris sulcata* in the ribbed ornamentation of the shell, but distinguishable from them often occurring together by examining the wall structure at the bottom.

Formerly I (HIRO, 1939b) established *Tetraclitella* for the depressed forms of *Tetraclita* (*T. purpurascens* and its allies) as a subgenus of *Tetraclita* SCHUMACHER. Another subgenus *Tesseropora* PILSBRY (1916) is maintainable for the species of *Tetraclita* whose wall is conical in shape, but internally formed of a 'single layer of square or squarish parietal tubes'. In ordinary *Tetraclitas* parietal tubes are often one-layered and provided with secondary tubes or denticles inside the outer lamina in younger stages, as discussed already by DARWIN (1854) and HENRY (1957). Therefore, the growth and arrangement of parietal tubes of the wall reflect the intergradation from *Tesseropora*-stage to *Tetraclita*-stage. In the case of *Tetraclitella*, however, the parietal tubes are uniformly small, non-septate, cylindrical and then radially arranged from the apex of the parietes to the sides of the radii and alae during all stages of growth. The habitat is also peculiar, being mostly hypobiotic in the

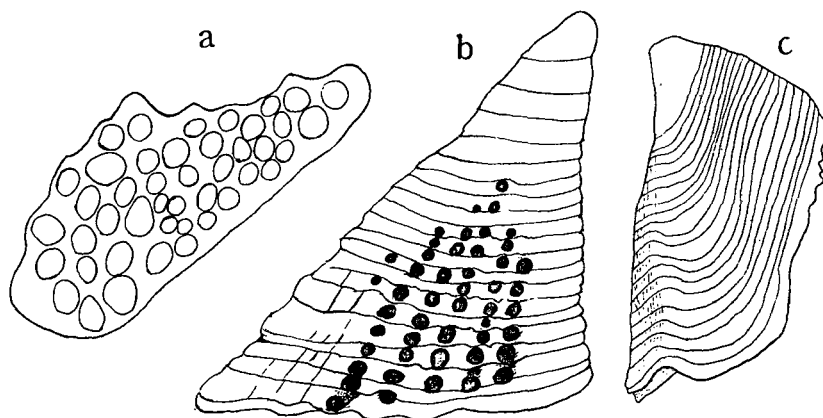


Fig. 5. *Tetraclitella pilsbryi* (UTINOMI) from off Maizuru. a, Section of lateral compartment; b, scutum, outer view; c, tergum, outer view. (a-c $\times 11$)

lower littoral and the distribution is mostly circumtropical. For these reasons *Tetraclitella* is to be raised to the generic rank for the present, inasmuch as the familial level of the Tetraclitidae (NILSSON-CANTELL as subfamily) is duly warranted (ROSS, 1968).

Family Balanidae (LEACH) DARWIN

Subfamily Balaninae DARWIN

26. *Balanus* (*Megabalanus*) *tintinnabulum* rosa PILSBRY, 1916

アカフジツボ

(Pl. XVIII, fig. 7)

Occurrence.—Hutagozima, Asamusi (HIRO, 1932b: 549); Tappisaki, Aomori-ken; Hukaura, Aomori-ken, leg. K. KONNO, 20/IX '69; Hunakawa, Akita-ken (HIRO,

1939a: 208); Tobisima and Nezugaseki, Yamagata-ken (SUZUKI, 1963: 13); Sado and Awasima Islands (KITAMI, 1968: 69); Usetu, Toyama Bay, Isikawa-ken, leg. K. SUZUKI, 6/VII '68; Tôzinbô, Hukui-ken (HIRO, 1939a: 208); Turuga Bay, Hukui-ken (MAWATARI, 1967: 99); Kodomari Hukui-ken, leg. T. YASUDA, 31/VII '68; Maizuru Bay, leg. Sh. FUSE, VI '67; Kazumi, Tazima coast, Hyôgo-ken, leg. T. Yamamoto, 18-19/VIII '64; Iwami, Tottori-ken, leg. T. YAMAMOTO, 18/VIII '64; Sakai Port, Simane-ken, leg. T. IGA, 8/VIII '68; Uragô, Nisinosima, Oki Island, leg. T. YAMAMOTO, 26/VIII '64; Iki Island, leg. Zool. Inst., Tokyo Univ., '49; Tuya-saki, Hukuoka-ken, leg. Y. DOTSU, 6/VI '56; Sigasima, Hukuoka-ken, leg. Y. MRYA, 13/IX '69.

Distribution.—So far as known this well-known barnacle has not been recorded from Hokkaido. Thus its northern limit of range is the Mutu Bay.

27. *Balanus (Megabalanus) tintinnabulum volcano* PILSBRY, 1916

オオアカフジツボ

(Pl. XVIII, fig. 6)

Occurrence.—Sado and Awasima Islands, leg. T. KITAMI, 9/VI '60 (KITAMI, 1968: 69, fig. 10); Tôzinbô, Hukui-ken (HIRO, 1939a: 208); Hirata, east of Hinomisaki Cape, Simane-ken, leg. T. IGA, VIII '68.

Distribution.—Rather occasionally found along the Japan-Sea coast, probably due to the poorness of adequate substrata or hydrographical condition for this surf-loving upper subtidal barnacle. Awasima is thus the northern limit of its known range.

28. *Balanus (Balanus) improvisus* DARWIN, 1854 ヨーロッパフジツボ

(Figs. 6-7)

Balanus improvisus DARWIN, 1854, p. 250, pl. 6, figs. 1a-1c (with var. *assimilis*); PILSBRY, 1916, p. 84, pl. 24, figs. 3-3b, 5-5d, text-figs. 16A and 17; NILSSON-CANTELL, 1921, p. 310; TARASOV and ZEVINA, 1957, p. 168, figs. 58-60; UTINOMI, 1968, p. 171; MAWATARI et al., 1968, pl. V, fig. M-R. ?*Balanus amphitrite vladivostokensis* TARASOV and ZEVINA, 1957, p. 184, fig. 67 (Vladivostok).

Occurrence.—Kodomari, east of Utiura Cove, Wakasa Bay, leg. T. YASUDA, 29/III '68; Otomi in Utiura Cove, Wakasa Bay, attached to celluloid fouling test-panels, 5-9 m deep, leg. T. YASUDA, 30/IV '68; Sakai Port and Esima in Lake Nakaumi and Matue, entrance to Lake Sinzi-ko, leg. T. IGA, 8/VIII, 30/XI '68; Brackish lake Zinzai-ko, Simane-ken, leg. T. KAMITA, 5/VIII '68.

Distribution.—This well-known Atlantic brackish water barnacle had not been recorded from the oriental waters before the World War II. It has invaded into the Pacific coasts of southern Japan in recent years (KAWAHARA, 1963; UTINOMI, 1966; MAWATARI, 1967; MAWATARI et al., 1968).

As shown above, this species was recorded for the first time from the Ise Bay on the Pacific coast of Japan. It shows two distributional patterns on the Japan-Sea coast, namely Izumo Region and Wakasa Bay, but it does not yet extend further northwards.

Remarks.—All shells newly settled on fouling test-panels set in Utiura Cove of

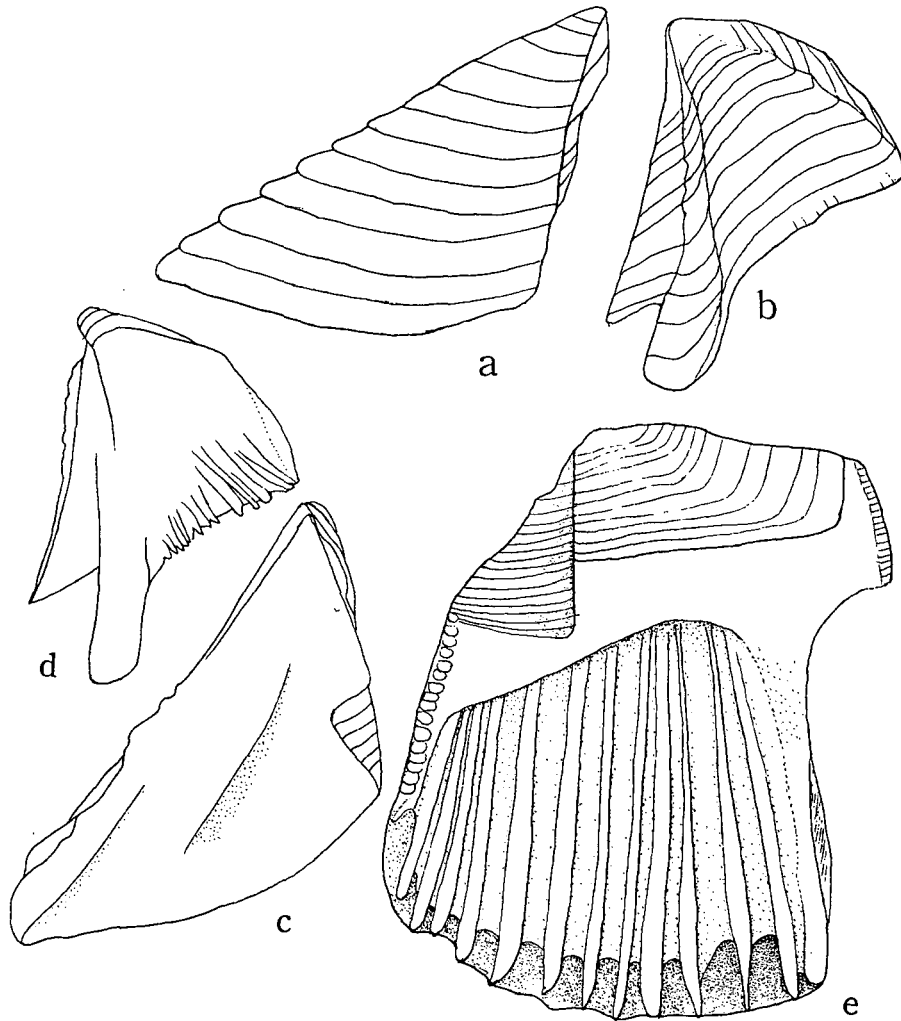


Fig. 6. *Balanus improvisus* DARWIN from Utiura Cove. *a*, Scutum, outer view; *b*, tergum, outer view; *c*, scutum, inner view; *d*, tergum, inner view; *e*, lateral compartment, inner view. (*a-e* $\times 12$)

the southern coast of Wakasa Bay are conical or tubular in form, snowy white and covered with a slightly purplish brown membrane. The alae are broad, with roundly curved apex and the radii are medium in width and obliquely curved marginally. As shown in Fig. 6e, the detailed parietal structure is similar to that of other species

in *B. amphitrite*-series, but there is no secondary riblets or teeth between the internal ribs towards the base of the outer lamina (though present in *B. eburneus*).

The scutum is slightly convex outside and provided only with widely spaced growth ridges; internally the depressions for adductor and depressor muscles are

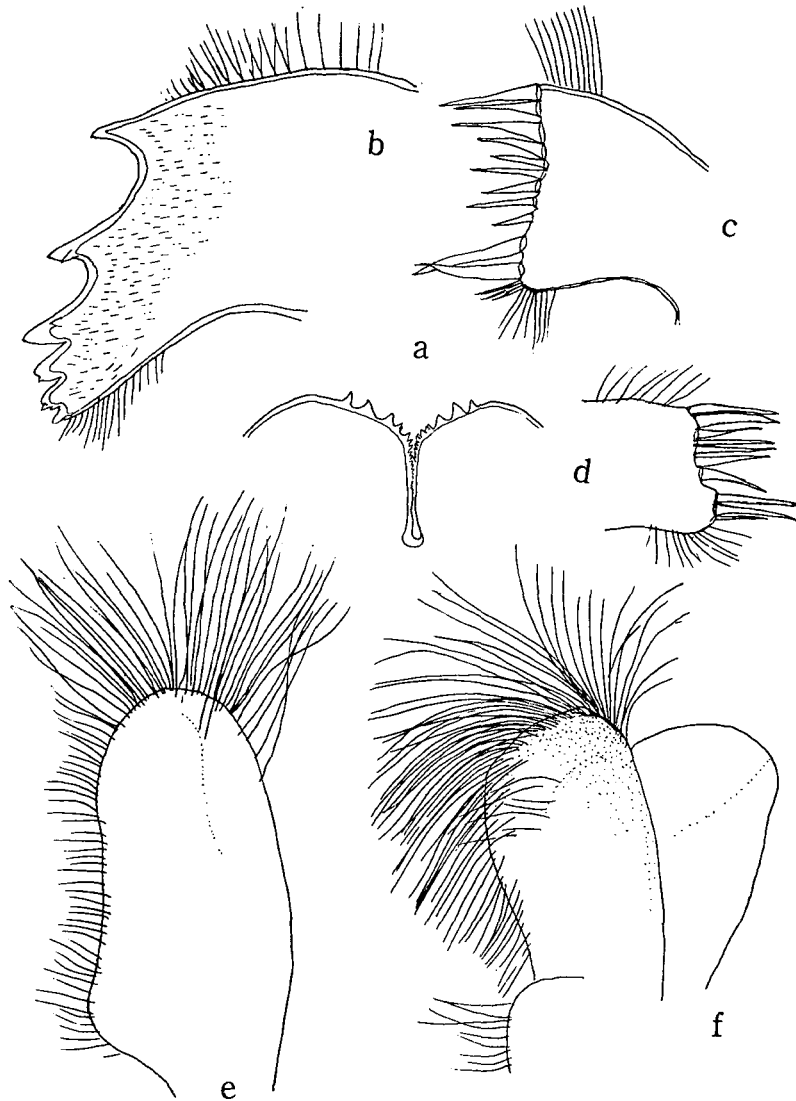


Fig. 7. *Balanus improvisus* DARWIN from Utiura Cove. a, Labrum; b, mandible; c, d, maxilla I; e, palp; f, maxilla II. (a, e, f $\times 43$; b-d $\times 53$)

generally obscure. The tergum is triangular, with a distinctly furrowed, narrow, long or medium, spur and many crests for depressor muscles all along the basal margin.

These opercular peculiarities are shared by *B. amphitrite vladivostokensis* briefly described with only a figure of opercular valves by TARASOV and ZEVINA (1957) from Vladivostok in the pre-war time. For the present I am inclined to feel them as synonymous.

29. *Balanus (Balanus) eburneus* GOULD, 1841 アメリカフジツボ

(Pl. I, figs. 8-10; Text-figs. 8-9)

Balanus eburneus GOULD, 1841, p. 15, pl. I, fig. 6; DARWIN, 1854, p. 248, pl. 5, figs. 4a-4d; WELTNER, 1897, p. 226; PILSBRY, 1916, p. 80, text-figs. 14-15, pl. 24, figs. 1-1c, 2; TARASOV and ZEVINA, 1957, p. 174, fig. 61; NILSSON-CANTELL, 1938, p. 35; MATSUI, SHANE and NEWMAN, 1964, p. 141, fig. 1 (Hawaii); UTINOMI, 1966, p. 36, fig. 1 (Sado); MAWATARI, 1967, p. 99.

Occurrence.—Kamo, Yamagata-ken, leg. M. INABA, X '64 (UTINOMI, 1966: 38); Brackish lake Kamo-ko, Sado Island, on test-panels and bamboo set on an oyster

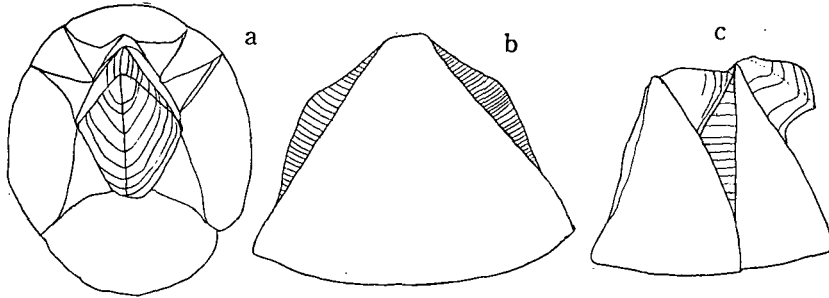


Fig. 8. *Balanus eburneus* GOULD from Utiura Cove, newly settled young. a, Newly settled young, 3 mm wide, top view; b, rostrum, outer view; c, carino-lateral and lateral compartments connected together. (b-c $\times 9$)

farm, leg. T. KITAMI, 11/I '66 (UTINOMI, 1966: 36; KITAMI, 1968: 69); Ryôtu Port, Sado Is., on buoys, leg. H. SAKAI, 15/IX '68; Turuga and Maizuru, Wakasa Bay, on fouling aluminium test-panels, leg. MAWATARI and H. KITAMURA, V-VII '65 (MAWATARI, 1968: 99); Otomi in Utiura Cove, on fouling celluloid test-panels, leg. T. YASUDA, 27/VI-3/VII '68; Kodomari, east of Utiura Cove, leg. T. YASUDA, 31/VII-24/X '68; Sigasima, hull of fishing boats, leg. Y. MIYA, 13/IX '69; Hakozaiki Pier, Hukuoka, Hakata Bay, leg. Y. MIYA and T. ARITA, 25/IX '69.

Distribution.—This recent immigrant from the American Atlantic coast has firstly recorded from a brackish lake Kamo-ko in Sado Is. in the Japan Sea (UTINOMI, 1966). As far as I have confirmed materially, it has hitherto been found in Nagasaki and Sasebo ports in western Kyusyu and Hiroshima and Kure ports in Seto Inland Sea on the Pacific coast. It is probable that this barnacle has invaded into Japanese waters by the transport of American ships successively increased after the World War II and enhanced by the influence of the warm Tusima Current washing the

western coasts of Japan (UTINOMI, 1966; MATSUI, SHANE and NEWMAN, 1964).

Remarks.—The shell is snowy white like the above-mentioned *B. improvisus*, but easily distinguished by having the wider radii closely attached to the parietes of the adjoining plates. The parietal tubes are also one-layered, large and transversely septate to the base and there are many riblets towards the base within the parietal tubes.

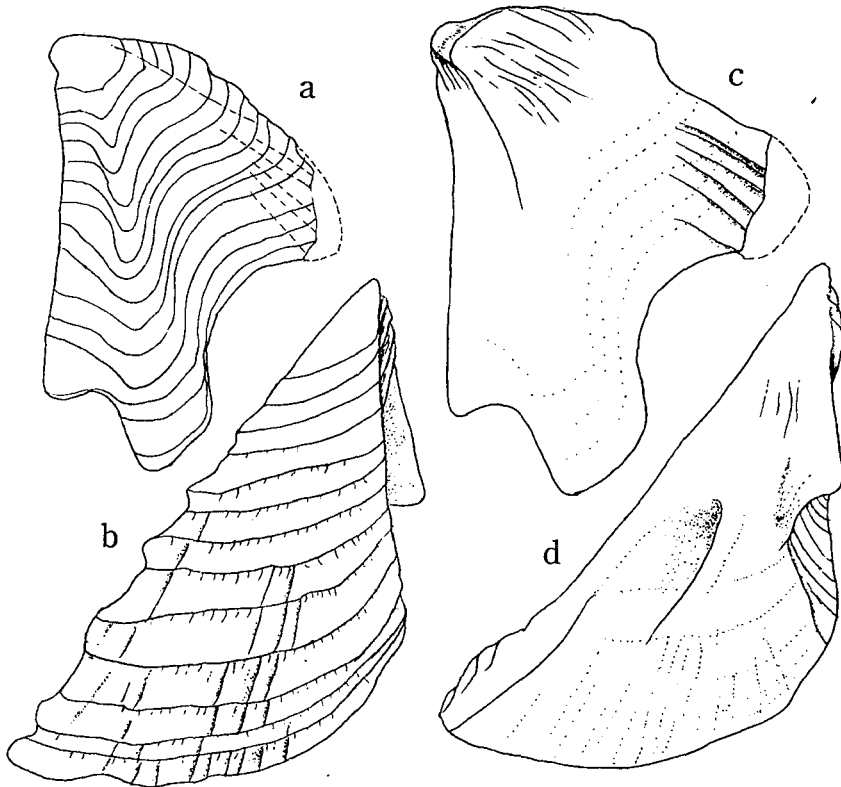


Fig. 9. *Balanus eburneus* GOULD from Utiura Cove, newly settled young. *a*, Tergum, outer view; *b*, scutum, outer view; *c*, tergum, inner view; *d*, scutum, inner view. (*a-d* × 29)

The scutum has externally many longitudinal striae or ridges crossing with the widely spaced growth ridges which are fringed with hairs at younger stages. The tergum is broader than that of *B. improvisus*, without longitudinal striation. The carinal margin of the tergum is highly arched and often ledged in the upper half. Its basal corner is roundly protruded and provided with several long crests for depressor muscles inside. The spur is broad and truncated at the end like a shovel. The basal margin between the spur and carino-basal projection is deeply excavated.

Besides, a prominent peculiarity of this species to distinguish from *B. improvisus*

is that the maxilla I has a series of comb-like smaller spines between the upper and lower simple larger spines along the frontal edge.

30. *Balanus (Balanus) amphitrite amphitrite* DARWIN タテジマフジツボ

For synonymy and description see UTINOMI, 1967, p. 200, pl. VI, fig. 1.

Occurrence.—Hakodate, Hokkaido (MAWATARI, 1967: 99); Ominato, Mutu Bay (MAWATARI, 1967: 99); Awasima and Sado Is., 0–10 m (KITAMI, 1968: 70, fig. 12); Turuga Bay (MAWATARI, 1967: 59); Nyû-ura, west of Turuga Bay (YASUDA, 1968: 27); Kodomari, east of Utiura Cove, Hukui-ken, leg. T. YASUDA, 31/VII '68; Maizuru Bay, on rocky reef, leg. Y. YAMAMOTO, 22/VI '69; Kazumi, Hyôgo-ken, leg. T. YAMAMOTO, 19/VIII '64; Sakai Port, Simane-ken, on anchor, leg. T. IGA, 4/XII '68; Yosimi, Simonoseki, Yamaguti-ken, leg. Y. MIYA, 9/IX '69; Hakozaki and Nazima in Hakata Bay, leg. T. ARITA, 18/IX '69.

Distribution.—Widely distributed as north as Mutu Bay and Tugaru Strait, mostly occurring on intertidal or upper subtidal stones, rocks or moles in quiet bays protected from rough surf.

31. *Balanus (Balanus) venustus venustus* DARWIN アカシマフジツボ(新称)

(Pl. XVIII, fig. 11)

For synonymy and description see STUBBINGS, 1967, p. 280, figs. 17–18.

Occurrence.—Tassya, Aikawa, Sado Is., leg. T. KITAMI, 24/VIII '68; Otomi in Utiura Cove, juveniles newly settled on fouling test-panels, leg. T. YASUDA, 28/V '69.

Remarks.—A sample from Tassya, Sado Is. is a well developed adult, 21 mm in carino-rostral diameter, about 1/3 as large as the base. The parietes are quite smooth, polished pinkish white and ornamented with evenly spaced narrow bright pink stripes longitudinally, about 40 in all (2 in carinolateral, 10 in lateral and carina, and 15 in rostrum). The radii are broad with horizontal apex, colored pink darkly upwards. In a young sample (4.6 mm in carino-rostral diameter) newly settled on fouling test panels at Otomi in Utiura Cove, pink stripes count 3 in carinolateral and 11 in carina, lateral and rostrum respectively.

The radii are broad, bright pink and transversely septate. The parietal tubes are large, transversely septate upwards and only 2 riblets are inserted at base on the inner surface of the outer lamina. The inner surface of the opercular valves is more or less beaded or striated radially upwards. The tergum is flat, triangular, with a short, broad spur, about 1/3 the width of the basal margin, slightly separated from the basi-scutal angle.

This beautiful barnacle may have been confused with the similarly sized roseate

form *B. tintinnabulum rosa*, often occurring together.

In the post-war time I have occasionally obtained this species from the hulls of over-sea going vessels returned from West Africa or Kwait, but never found actually from the Japanese coasts. Therefore, this is evidently a new addition to the fauna of Japan actually as colonized very recently.

32. *Balanus (Balanus) reticulatus* UTINOMI, 1967 サラサフジツボ

For synonymy and description see UTINOMI, 1967, p. 216, text-figs. 9-12 and pl. VI, figs. 7-8.

Occurrence.—Maizuru Bay, from the hull of navy ships' bottoms, leg. T. SAITO, 24/II '38 (SAITO, 1929: 7, fig. 1-1, as *B. amph. niveus*); Nokozima in Hakata Bay, on stranded bamboo, leg. Y. MIYA, 10/X '69.

Distribution.—Probably widespread in the world. In the pre-war time, this barnacle was predominant rather than *B. amphitrite* of fouling barnacles in Japanese bays and harbors, but now apparently not found on the Japan-Sea coast (cf. MAWATARI, 1967). Occurring in stenohaline habitats only.

33. *Balanus (Balanus) uliginosus* UTINOMI, 1967 ドロフジツボ

For the synonymy and description see UTINOMI, 1967, p. 202, text-figs. 1-2, pl. VI, figs. 4-6.

Occurrence.—Esima in Nakaumi Lake, on buoys of anchors, leg. T. IGA, 30/XI '68; Yosu, southern Korea, leg. S. OKUDA, 12/VII '36; Mokpo, southern Korea, leg. S. OKUDA, 10/VII '36; Gônoura, Iki Is., leg. Zool. Inst. Tokyo Univ. (HIRO, 1938: 305).

Distribution.—Hitherto known only from southern Japan, southern Korea, China and Taiwan, usually occurring on various things set on muddy bed in less-saline quiet bays at the lowest tide level.

34. *Balanus (Balanus) albicostatus albicostatus* PILSBRY, 1916

シロスジフジツボ

For the synonymy and description see UTINOMI, 1967, p. 209, text-figs. 4-5, pl. IV, fig. 2.

Occurrence.—Asamusi, Mutu Bay (HIRO, 1939a: 209); Ominato, Mutu Bay (MAWATARI, 1967: 99); Tobisima and Nezugaseki, Yamagata-ken (SUZUKI, 1963: 13); Ryôzu Port and Kamo-ko Lake in Sado Is. (KITAMI, 1968: 70, fig. 13); Sakai Port, Simane-ken, leg. T. IGA, 30/XI '68; Pusan, southern Korea, leg. S. OKUDA, 2/VIII '36; Kunsan, southwestern Korea, leg. S. OKUDA, 10/VII '36; Cheju-Dô Is., Korea Strait, leg. S. OKUDA, 14/VII '36 (HIRO, 1938: 303); Okino-sima, Tusima Strait, leg. S. MIYAKE, 14-18/X '32, 19-29/V '33 (HIRO, 1938: 304; UTINOMI, 1949:

22); Yosimi, Simonoseki, leg. Y. MIYA, 9/IX '69; Nazima in Hakata Bay, leg. T. ARITA, 18/IX '69.

Distribution.—Prevalent on intertidal rock, wharf piles and other harbor installations in bays, as far north as Mutu Bay.

35. *Balanus (Balanus) variegatus cirratus* DARWIN, 1854 アミメフジツボ

For synonymy and description see UTINOMI, 1967, p. 214, text-fig. 8.

Occurrence.—Gônoura, Iki Is., Tusima Strait, on stranded bamboo, leg. M. TOKUDA, III '37; (HIRO, 1938: 303; UTINOMI, 1949: 22); Yosimi, Simonoseki, on submerged concrete block, leg. Y. MIYA, 9/IX '69; Koga Beach, Hukuoka-ken, leg. S. OYOGI, 20/IX '69.

Distribution.—Hitherto recorded from Australia, Indian Coast, Singapore, Malay Archipelago, Philippines, Taiwan, China, northwestern Korea and western Kyusyu (ZEVINA and TARASOV, 1963, p. 91; UTINOMI, 1967, p. 216). Other records from Japan need further confirmation.

36. *Balanus (Balanus) trigonus* DARWIN, 1854 サンカクフジツボ

Occurrence.—Mutu Bay (HIRO, 1932b: 551; HIRO, 1939a: 210); Tappi-saki, Tugaru Pen. (HIRO, 1939a: 210); Nezugaseki, Yamagata-ken (SUZUKI, 1963: 13); Sado Is. (KITAMI, 1968: 70, fig. 14); Toyama Bay and Turuga Bay (HIRO, 1939a: 210; MAWATARI, 1967: 59); Turuga, Kodomari and Otomi, Hukui-ken, on fouling test panels, 0–13 m, leg. T. YASUDA, 24/X '68; Maizuru, on the shell of *Batillus cornutus*, leg. Sh. FUSE, VI '67; Kazumi, Hyogo-ken, on the shell of *Mytilus coruscus*, leg. T. YAMAMOTO, 26/VIII '64; Iwami, Hyôgo-ken, leg. T. YAMAMOTO, 19/VIII '64; Moroyose, Hyôgo-ken, leg. S. NISHIMURA, 28/V '69; Karo, Tottori-ken, leg. T. YAMAMOTO, 26/VIII '64; Sakai Port, on anchors and ropes, leg. T. IGA, 8/VIII '68; Nahisa, Dôgo, Oki Is., leg. T. YAMAMOTO, 23/VIII '64; Kurokigosyo, Oki Is., leg. T. YAMAMOTO, 26/VIII '64; Marutani, Oki Is., leg. T. YAMAMOTO, 26/VIII '64; Iki Is., on stranded bamboo (UTINOMI, 1949: 22); Okinosima, Tusima Strait (UTINOMI, 1949: 22); Yosimi, Simonoseki, leg. Y. MIYA, 9/IX '69; Sigasima, leg. Y. MIYA, 13/IX '69; Tuyasaki, Hukuoka-ken, leg. Y. DÔTSU, 6/VI '56; Koga, leg. S. OYOGI, 20/IX '69; Nokozima in Hakata Bay, leg. Y. MIYA, 10/x '69.

Distribution.—Cosmopolitan, usually on various things in the subtidal zone.

37. *Balanus (Balanus) rostratus* HOEK, 1883 ミネフジツボ

Occurrence.—Off Siriyazaki, Tugaru Strait (Sôyô-maru Benthic Survey Station 76, 41°11'30" N, 141°28'45" E, 128 m) (HIRO, 1933: 71); Hakodate, Hokkaido

(WELTNER, 1897: 268 as *B. porcatus*; HIRO, 1935: 217); Asamusi, Mutu Bay (HIRO, 1933: 551; HIRO, 1939a: 210); Tassya, Aikawa, Sado Is., young on glass buoys, leg. T. KITAMI, 25/VI '67 (KITAMI, 1968: 70, fig. 15, as '*B. rostoratus*'); Usetu, Isikawa-ken, Toyama Bay, young on Octopus pot, leg. K. SUZUKI, 6/VII '68; Noto, Isikawa-ken, Toyama Bay, young on the shell of *Pomgaulax japonicus*, leg. K. SUZUKI, VI '65; Kanaisi, near Kanazawa City, Isikawa-ken, young on the shell of *Pugilina ternatana*, leg. K. SUZUKI, 15/XI '68; Tusima Strait (Sôyô-maru Benthic Survey Station 463, 33° 49'30" N, 128° 40'00" E, 115 m) (HIRO, 1933: 72).

Distribution.—Widely distributed in northern Japan (usually Hokkaido, Sanriku Coast, Sagami Bay and deep basin of Seto Inland Sea). On the west coast of northern Honsyu washed by the warm Tusima Current, this barnacle is rarely found on benthic animals or things in the subtidal zone and small-sized.

38. *Balanus (Balanus) crenatus* BRUGUIÈRE, 1789 ハナフジツボ

For synonymy and description see PILSBRY, 1916, p. 165, pls. 39-40 and HIRO, 1935, p. 219, pl. X, fig. 4 and text-fig. 2.

Occurrence.—Osyoro Bay, Hokkaido, leg. S. MOTODA, 29/IX '43 (ICHIKAWA and YAMADA, 1957: 8); Nezugaseki, Yamagata-ken, on the shell of *Pugilina ternatana* and *Phalium strigatum*, dredged, leg. Sh. SUZUKI, '58 (SUZUKI, 1963: 13).

Distribution.—Although this is an amphiboreal species occurring in northeast and southeast coast of Hokkaido, it is not found on the Pacific coast of northern Honsyu but curiously it penetrates far southwards to the south of the Gotô Islands, western Kyusyu (UTINOMI, 1968, pp. 24, 26) and to Santuao, Tokien, South China (NILSSON-CANTELL, 1925, p. 113).

39. *Balanus (Semibalanus) cariosus* (PALLAS, 1788) チシマフジツボ

For synonymy and description see PILSBRY, 1916, p. 189, pl. 46, pl. 47, figs. 1-1c and HIRO, 1932a, p. 472, fig. 3 and HIRO, 1935, p. 223, pl. X, fig. 3 and text-fig. 4.

Occurrence.—Osyoro Bay, Hokkaido, leg. T. UCHIDA, VIII '34 and leg. S. MOTODA, 29/x '43 (HIRO, 1935: 223; ICHIKAWA and YAMADA, 1957: 8); Hakodate, Tugaru Strait (WELTNER, 1897: 270).

Distribution.—Canadian coast south to Oregon and westwards to Alaska, Kuril Islands (type locality), Hokkaido and Sanriku Coast of northern Honsyu as far south as Matusima Bay (HIRO, 1939; UTINOMI, 1955, p. 119, fig. 2). Along the west coast of northern Honsyu, it is not found. According to TARASOV and ZEVINA (1957, p. 215), it occurs rather rarely on the Maritime coast of Soviet Russia south to Chongjin, North Korea.

40. *Balanus (Solidobalanus) hesperius* PILSBRY, 1906

アラスカフジツボ (新称)

For description see PILSBRY, 1916, p. 193, text-figs. 60-61, pl. 49, figs. 1-1d, 7-7b, 8 and HIRO, 1935, p. 225, fig. 5.

Occurrence.—Kugurizaka near Asamusi, Mutu Bay, on the shell of *Fulgoraria rupestris* inhabited by a hermit crab and 2 other localities in the same bay (HIRO, 1939a: 212).

Distribution.—Alaska, Bering Sea, British Columbia, Kurile Islands, Hokkaido, Saghalin. Subspecies *nipponensis* PILSBRY is recorded southwards from off Daikoku-saki (? Bôso Peninsula).

41. *Balanus (Solidobalanus) socialis* HOEK, 1883 ムレフジツボ

For synonymy and description see HIRO, 1937, p. 442, fig. 26 (off Tanabe Bay).

Occurrence.—Ryôtu, Sado Is., on the shell of *Batillus cornutus*, leg. M. TOKUDA, 18/VII '32 (HIRO, 1932a: 473, fig. 4 as *Balanus* sp. undet.); NNE 10 miles off Niigata Port, 35 m deep muddy bottom, attached in group on a human skull, obtained by trawl-net in June of 1961 (KOSEKI and YAMANOUCHI, 1962: 295, fig. 4; KITAMI, 1968: 70, fig. 16; HONMA, 1968: 35, fig. 7; all listed only).

Distribution.—Southern Japan (Kii district, western Kyusyu), Malay Archipelago, Bay of Bengal and Iranian Gulf, occurring on benthic animals living on soft bottom, about 10-50 m in depth.

42. *Balanus (Conopea) granulatus* HIRO, 1937 ウミカラマツフジツボ

Occurrence.—Off Noto-saruyama, Isikawa-ken, 90 m, on *Antipathes japonica*, 90 m, leg. K. SUZUKI, 9/IX '65.

Distribution.—Southern Japan, on antipatharians.

43. *Acasta japonica* PILSBRY, 1906 ヤマトカイメンフジツボ

For synonymy and description see UTINOMI, 1962, p. 221, figs. 3-4.

Occurrence.—Toyama Bay, leg. K. KIKUCHI (HIRO, 1939a: 213).

Distribution.—Rarely recorded from Japanese and Malayan waters, inhabiting in silicious sponges.

Subfamily Chelonibiinae PILSBRY

44. *Chelonibia testudinaria* (LINNÉ, 1758) カメフジツボ

For synonymy and description see PILSBRY, 1916, p. 264, pl. 62, figs. 1-4 and HIRO, 1937, p. 470, fig. 41.

Occurrence.—Kamo and Nezugaseki, Yamagata-ken (SUZUKI, 1963: 13); Tassy, Aikawa, Sado Is., on the carapace of *Caretta caretta* (KITAMI, 1968: 70, fig. 19); Toyama Bay (HIRO, 1939a: 214); Hakata Bay (UTINOMI, 1949: 24).

Distribution.—All tropical and subtropical seas, on sea-turtles.

Subfamily Coronulinae (LEACH) PILSBRY

45. *Platylepas hexastylus* (O. FABRICIUS, 1798) サラフジツボ

For synonymy and description see PILSBRY, 1916, p. 285, pl. 67, figs. 1-1c, 3 and HIRO, 1937, p. 472, fig. 43.

Occurrence.—Tassy, Aikawa, Sado Is., on the carapace of *Caretta caretta* and *Dermochelys coriacea*, leg. T. KITAMI, 14/VIII '66 and 14/II '69 (KITAMI, 1968: 71, fig. 20); Hakui, west of Noto Pen., Isikawa-ken, on the carapace of *Dermochelys coriacea*, leg. T. SUZUKI, 2/II '66; off Cape Kyôga-misaki, west of Wakasa Bay, on the carapace of *Dermochelys coriacea*, leg. T. YASUDA, 28/II '68.

Distribution.—All tropical and subtropical seas, on turtles, manatees and dugong. A variety on *Lepisosteus*.

46. *Platylepas ophiophila* LANCHESTER, 1902 ウミヘビフジツボ(新称)

(Text-figs. 10-11; Pl. XVIII, figs. 12-15)

- ?*Platylepas*?—DARWIN, 1854, p. 430 (Imbedded in the skin of a seasnake from off Borneo).
Platylepas ophiophilus LANCHESTER, 1902, p. 371, pl. 35, figs. 5-5b (Imbedded in the skin of the sea-snake, *Enhydrus curtus* from an unknown locality of the Malay Peninsula).
Platylepas ophiophilus LANCHESTER: GRUVEL, 1905, p. 277, fig. 301 bis, A and B (Reproduced only from LANCHESTER, 1902).
Cryptolepas ophiophilus KRÜGER, 1912, p. 12, pl. 3, figs. 7-8 (Attached to the tail of a sea-snake *Hydrophis* (?) *gracilis* (?) from Gwadar, Baluchistan (=Baluchistan), Arabian Sea).
Platylepas krügeri PILSBRY, 1916, p. 285 (Renamed for KRÜGER's *Cryptolepas ophiophilus*, without new locality).
? *Platylepas decorata* DARWIN: NILSSON-CANTELL, 1921, p. 376, fig. 89 (On the sea-snake from the east coast of Australia).
Platylepas krügeri PILSBRY (?): BROCH, 1931, p. 122 (On *Enhydris hardwicki* (GRAY) from 1°-2° S, 105°-107° E, between Sumatra and Borneo Islands).
Platylepas ophiophilis (sic) LANCH.: NILSSON-CANTELL, 1938, p. 77 (On the sea-snake *Enhydrina valakadyn* (BOIE) from Karachi and from Ganjam Coast, Madras Presidency, India).

Occurrence.—Imbedded in the skin of a large sea-snake *Hydrophis cyanocinctus* DAUDIN stranded at Kodatu Beach in Mano Bay on the west coast of Sado Island captured by T. KITAMI on December 11, 1965 (KITAMI, 1968: 71, fig. 21 as *Platylepas krügeri* PILS.).

Description.—About 50 complete specimens were obtained from the sea-snake *Hydrophis cyanocinctus* DAUDIN (about 110 mm long). Some of them preserved for the museum collection are measured as follows:

Outline	Carino-rost. diam.	Lateral diam.	Height	Orificial diam.
ovoid	9 mm	6 mm	4 mm	5 mm
ovoid	7.5	4.0	4.0	partly damaged
hexagonal	6.4	4.0	2.5	4.0
ovoid	6.2	5.0	2.5	4.1
hexagonal	6.0	5.2	2.5	4.0

It is very difficult to obtain any good intact specimens technically, as they are wholly covered with the chitinous membrane of the snake's skin, tightly fitting together with the ribbed ornamentation over the compartments.

The wall is subconical, not so depressed as that of *Pl. hexastylus*. The outer surface of the wall fully denuded is longitudinally ribbed, crossing by transverse

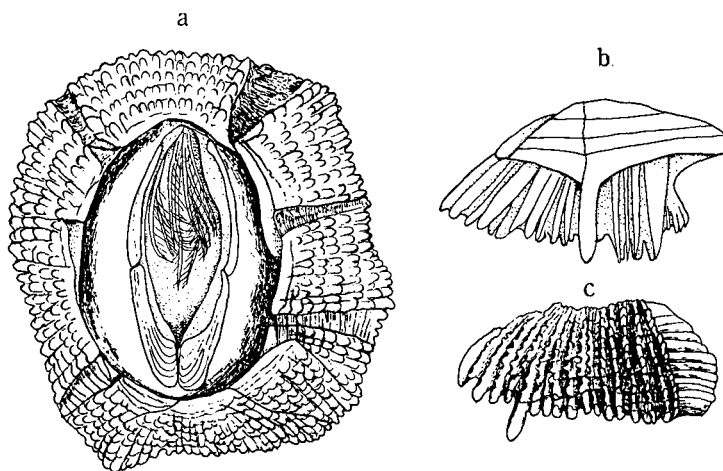


Fig. 10. *Platylepas ophiophila* LANCHESTER from Mano Bay, Sado Is. *a*, Animal, top view; *b*, lateral compartment, inner view; *c*, lateral compartment, outer view. (*a* × 8.5; *b*, *c* × 16)

grooves (or growth annuli) and the ribs are profusely beaded or spinose along the annuli, just like the valves of *Xenobalanus globicipitis* STEENSTRUP (dolphin barnacle) and *Lepas pectinata* LINNÉ (goose barnacle). Internally, the sheath is approximately one-half the height of the compartment. Below the sheath the infolding of the wall is reflected by many strong inner ribs, one primary and 3–7 secondary. On each side of the large midrib bluntly ended, secondary and tertiary riblets from below the sheath extend downwards and sharply ended inside the bluntly ended outer ribs. Externally, each of the compartments is apparently solid and has a more or less distinct median sulcus. The sutural surface between the compartments is deep, either medium or narrow and transversely grooved (Figs. 10a-c).

The development of the opercular valves greatly varies irrespective of the

growth of the outer wall (Figs. 10a, 11f). They are seated on the outer surface of the projecting opercular hood near the orificial edge; the scutum is moderately developed, oblong or spoon-shaped, while the tergum is less developed or rudimentary, elongate, both ends being truncate and bent inwards.

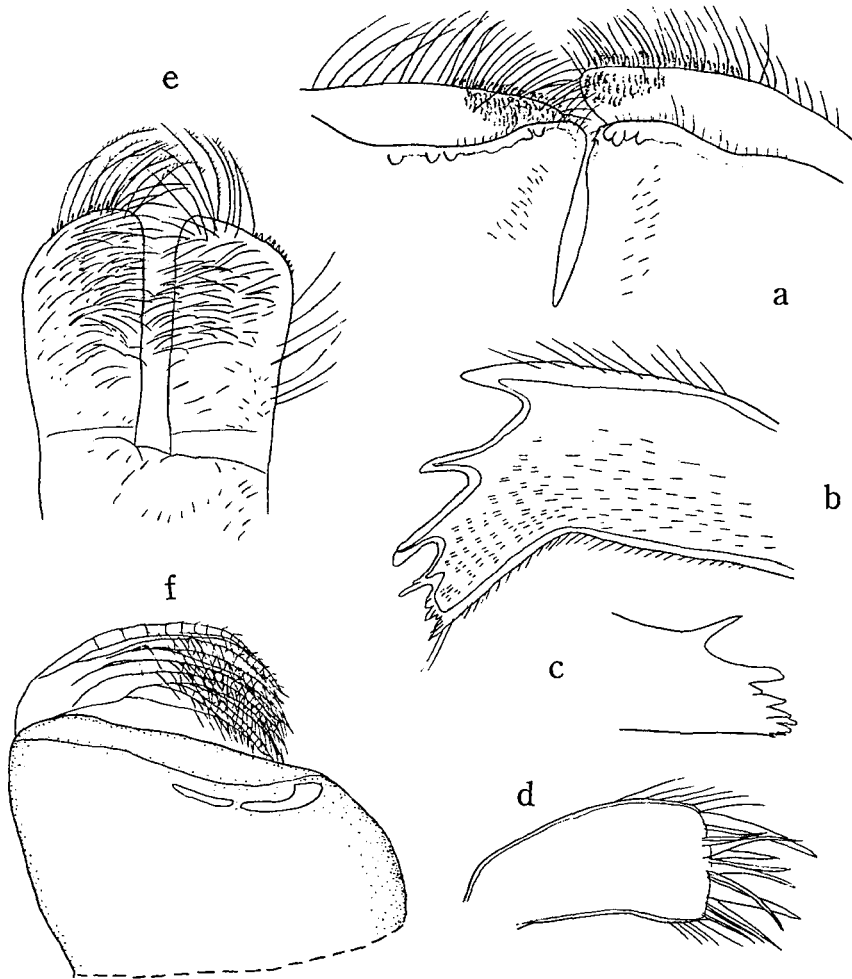


Fig. 11. *Platylepas ophiophila* LANCHESTER from Mano Bay, Sado Is. a, Labrum and palpi; b, c, mandible; d, maxilla I; e, maxilla II, paired; f, opercular hood with rudimentary opercular valves and cirri, side view. (a, e $\times 53$; b-d $\times 80$; f $\times 13$)

The mouth-parts (Fig. 11a-e) almost conform to the characters of the related *P. hexastylus* (cf. HIRO, 1937, p. 472, fig. 43), but differ in details. The palp is small, elongated in parallel with the cutting edge of the labrum, and fringed with a number of incurved pectinate bristles and covered densely with long, simple bristles on the

outer surface. The labrum is bullate and provided with 3 obtuse teeth on each side of a deep notch in the middle on the inner surface of the hairy outer rim. The mandible is narrow and has four strong teeth and a pectinated lower angle. The maxilla I is narrower, with 10 spines along the straight frontal edge. The maxilla II is large, bilobed, and terminally armed with long, comb-like bristles and a series of spinules at the truncated distal end.

The cirri are much developed and laterally flattened and have 5 pairs of long, stout setae along the ventral edge of each segment. The numbers of segments in the cirri for a 7.5 mm long specimen are as follows:

I	II	III	IV	V	VI
12 15	13 13	14 8+	17 17	15 16	18 19

The penis is very long, finely annulated and scarcely hairy and gradually tapers to the truncated end, extending far beyond the end of the last cirri in the preserved state.

Remarks.—Presumably, this sea-snake harboring barnacle may be practically scarce as museum specimens in the world, so that it might have hitherto been variously named by previous authors (*Platylepas ophiophilus* LANCHESTER, *P. krügeri* PILSBRY, *Platylepas decorata* NILSSON-CANTELL and *Cryptolepas ophiophilus* KRÜGER). It seems likely that the apparent disagreement between the description and illustration of LANCHESTER's original *Platylepas ophiophilus* from Malay Peninsula and those of KRÜGER's *Cryptolepas ophiophilus* (= *Platylepas krügeri* PILSBRY) from the Bay of Bengal may be due to their rough dissection and careless observations or drawings. All of the various names cited above are thus possibly synonymous, as I now concluded.

This conclusion is based partly on re-examination on materials on the skin of *Enhydria* (= *Lapemis*) *hardwicki* GRAY caught in South China Sea on June 19th, 1898 which might be the same source as Broch (1931) previously identified as *Platylepas krügeri* (?) and asked me by Dr. Torben WOLFF of the Zoological Museum of Copenhagen for identification, and examination on the materials from an unknown sea-snake from Dhanushya Kodi, South India which was presented by Dr. A.B. WAGH of the Bombay Institute of Oceanographic Research for identification.

PILSBRY's *Platylepas hexastylus* var. *ichthyophila* from *Lepisosteus* caught in brackish water of Florida may be a valid species, closely resembling this *P. ophiophila*, rather than *P. hexastylus*. Another fossil (?) *Platylepas wilsoni* ROSS (1963) recently discovered from Florida Pleistocene bed may also be a valid species, closely related to *P. ophiophila*.

47. *Stomatolepas elegans* (COSTA, 1838) サカヅキフジツボ(新称)

For synonymy and description see HIRO, 1936, p. 312, figs. 1-5.

Occurrence.—Tassya, Aikawa, Sado Is., on the carapace of *Dermochelys coriacea*,

together with *Platylepas hexastylus*, leg. T. KITAMI, 14/II '69.

Distribution.—Recorded only from Italy (Mediterranean), Florida and Nova Scotia (North Atlantic), Seto, Kii Pen. Japan (North Pacific) and New Zealand (South Pacific), imbedded in the skin of sea turtles (*Caretta*, *Chelonia* and *Dermochelys*).

Regional Fauna and Collecting Data

1. West coast of HOKKAIDO
 - Osyoro Bay (Collected by Dr. T. UCHIDA, VIII '34, Dr. S. MOTODA, 29/X '43)—
Pollicipes mitella, *Chthamalus challengerii*, *Balanus crenatus* and *B. cariosus*
 - Iwanai and Esasi (Collected by Dr. S. MOTODA, 29/IX '43)—
Pollicipes mitella, *Ch. challengerii*, and *B. cariosus*
- (2) Tugaru Strait
 - Hokodate, Hokkaido (Collected by Dr. M. TOKUDA, 18/VII '32 and WELTNER's record)—
Pollicipes mitella, *Chthamalus challengerii*, *Ch. dalli* and *B. cariosus*
 - Cape Tappi-saki (Collected by the late Dr. S. HOZAWA, 22/VIII '29; Dr. N. ABE, 6/V '32)—
Tetraclita squamosa japonica, *Balanus tintinnabulum rosa* and *B. trigonus*
 - Off Siriya-zaki (Collected by the Sôyô-maru Benthic Survey 1926-1930)—
Octolasmis minuta nipponica, *B. rostratus*
- (3) Mutu Bay (Collected by the late Dr. S. HOZAWA, the late Dr. T. TAMURA, Dr. HOSHIAI, Dr. Sh. MAWATARI and myself).
 - Asamusi and Nohezi—
Pollicipes mitella, *Lepas anatifera*, *Octolasmis neptuni*, *Ch. challengerii*, *Octomeris sulcata*, *T. sq. japonica*, *B. tin. rosa*, *B. trigonus*, *B. rostratus*, *B. hesperius*
 - Ominato Port—
B. amphitrite and *B. albicostatus*
- (4) Northwest coast of TOHOKU District
 - Hukaura, Tugaru Region (Collected by Mr. K. KONNO, 29/IX '69)—
Pollicipes mitella, *Lepas anatifera*, *L. anserifera*, *Ch. challengerii*, *Tet. sq. japonica*, *Tetraclitella darwini* and *B. tint. rosa*
- (5) Southwest coast of TOHOKU District
 - Kamo (Coll. by Mr. M. INABA, X '64, Dr. S. SUZUKI '58)—
B. eburneus and *B. crenatus*
 - Nezugaseki and Tobi-sima, Yamagata-ken (Collected by S. SUZUKI and myself)—
Oxynaspis pacifica, *L. anatifera*, *L. anserifera*, *Het. quadrata*, *Ch. challengerii*, *Octomeris sulcata*, *B. crenatus*, *B. trigonus*, *B. albicostatus*, *Tet. sq. japonica*, *Tetraclitella darwini*
- (6) HOKURIKU District
 - Awasima and Sado Islands (Collected by Dr. M. TOKUDA, Mr. S. SAKAI, Mr. Y. MORIYA and Mr. K. KITAMI)—
Poll. mitella, *L. anatifera*, *L. anserifera*, *L. pectinata*, *L. fascicularis*, *Octolasmis weberi*,

Par. minuta nipponica, *Conch. virgatum*, *Conch. virgatum hunteri*, *Ch. challengeri*, *Oct. sulcata*, *T. sq. japonica*, *B. eburneus*, *B. venustus venustus*, *B. amphitrite*, *B. albicostatus*, *B. rostratus*, *B. socialis*, *Chel. testudinaria*, *Platylepas hexastylus*, *Pl. ophiophila*, *Stomatolepas elegans*

Niigata Port (Collected by the late K. IKEDA and the late K. HIRASAKA, Dr. HONMA and Dr. KOSEKI)—

P. mitella, *L. anatifera*, *L. anserifera*, *Ch. challengeri*, *B. tintin. rosa*, *B. eburneus*, *B. socialis*

Toyama Bay (Collected by Mr. K. KIKUCHI, '35 and Mr. K. SUZUKI, '65-'69)—

P. mitella, *Smilium scorpio*, *L. anatifera*, *Conchoderma virg. hunteri*, *Paralepas minuta nipponica*, *Tetraclitella darwini*, *B. tin. rosa*, *B. trigonus*, *B. rostratus*, *Acasta japonica*, *Chelonibia testudinaria*

West coast of Noto Peninsula (Collected by myself '35 and Mr. K. SUZUKI, '65-'69)—

B. rostratus, *B. granulatus*, *Platylepas hexastylus*

(7) KINKI District

Wakasa Bay (Collected by Mr. M. HIRAGUCHI, Mr. Y. YAMAMOTO, H. KITAMURA, late Dr. S. SAITO, Mr. T. YASUDA, Dr. Sh. FUSE and myself)—

P. mitella, *Smilium scorpio*, *Paralepas minuta nipponica*, *Ch. challengeri*, *B. improvisus*, *B. eburneus*, *B. venustus venustus*, *B. reticulatus* (now perished), *B. trigonus*, *B. amphitrite*, *Platylepas hexastylus*, *B. tin. rosa*, *B. tin. volcano*, *L. anatifera*, *Oct. angulata*, *Oct. neptuni*, *Tet. sq. japonica*.

Tango—Tazima Region (Collected by Messrs. A. HOSOMI, S. NISHIMURA and T. YAMAMOTO and WELTNER's record)—

P. mitella, *Smilium scorpio*, *Ch. challengeri*, *Oct. sulcata*, *Tlla. chinensis*, *Tlla. pilsbryi*, *Tet. sq. japonica*, *B. tin. rosa*, *B. trigonus*

(8) SAN-IN District (Collected by Dr. T. KAMITA, Mr. T. IGA and T. YAMAMOTO).

Lakes Nakaumi and Zinzai-ko, Simane-ken—

B. tintin. rosa, *B. tint. volcano*, *B. improvisus*, *B. uliginosus*, *B. albicostatus*

Oki Islands—

Ch. challengeri, *B. tin. rosa*, *Tet. sq. japonica*

(9) Tusima Strait and Northern KYUSYU

Yosimi, Simonoseki (Collected by Mr. Y. MIYA, '69)—

Pollicipes mitella, *Ibla cumingi*, *Ch. challengeri*, *T. sq. japonica*, *B. albicostatus*, *B. amphitrite*, *B. trigonus*, *B. variegatus cirratus*

Tuyasaki, Hukuoka-ken (Collected by Dr. Y. DOTSU and Mr. H. MINEI)—

B. tin. rosa, *B. trigonus*

Sigasima, mouth of Hakata Bay (Collected by Mr. K. ARAKAWA and Y. MIYA)—

Pollicipes mitella, *Ch. challengeri*, *Ch. pilsbryi*, *B. amphitrite*, *B. tin. rosa*, *B. tin. volcano*, *B. albicostatus*, *B. eburneus*

Hakata Bay and environs (Collected by Dr. S. MIYAKE, Mr. Y. MIYA, Mr. S. OYOGI and Mr. T. ARITA)—

Pollicipes mitella, *Ibla cumingi*, *Tetraclitella chinensis*, *B. eburneus*, *B. reticulatus*, *B. amphitrite*, *B. albicostatus*, *Chelonibia testudinaria*

Iki Island (Collected by Dr. M. TOKUDA and Zool. Inst. of Tokyo Univ.)—

T. sq. japonica, *B. tin. rosa*, *B. uliginosus*, *B. trigonus*, *B. variegatus cirratus*

Nakanosima and Okinosima Islands, Tusima Strait (Collected by Dr. S. MIYAKE, '33, '58)—

Tusima Island (Collected by Zool. Inst. Tokyo Univ., Mr. H. MINEI and Mr. Y. MIYA, VIII '69)—

Pollicipes mitella, *B. trigonus*, *B. amphitrite*

(10) SOUTH KOREA (Collected by the late Dr. S. OKUDA, VII '36 and Mr. K. YAMAUCHI, X '69 and BROCH's and Sôyô-maru Survey's records).

Southern insular Region—

Scalpellum koreanum, *Octolasmis orthogonia*, *Oct. neptuni*, *Ch. challengerii*, *T. sq. japonica*, *Tetraclitella chinensis*, *B. amphitrite*, *B. uliginosus*

Cheju-Dô (Querpart Is.)—

Pollicipes mitella, *Ch. challengerii*, *T. sq. japonica*, *Tetraclitella chinensis*, *Tetraclitella darwini*, *Balanus albicostatus*

Discussion and Summary

Analyzing the faunal composition of the coastal Cirripedia in the southeastern part of the Japan Sea, it is composed of the following elements:

(1) Boreal form

e.g. *Chthamalus dalli*, *Balanus crenatus*, *B. cariosus*, *B. hesperius* and *B. rostratus*

(2) Austral form

e.g. *Pollicipes mitella*, *Ibla cumingi*, *Octomeris sulcata*, *Chthamalus challengerii*, *Ch. pilsbryi*, *Tetraclitella squamosa*, *Tetraclitella* spp., *Balanus tintinnabulum*, *B. variegatus* and *B. socialis*

(3) Widespread warm-water form (*Recent invaders of occidental origin)

e.g. *Balanus eburneus**, *B. improvisus**, *B. reticulatus*, *B. amphitrite*, *B. trigonus*, *B. venustus**

(4) Endemic warm-water form of oriental origin

e.g. *Balanus albicostatus*, *B. uliginosus*

Most of these littoral barnacles are common in Japanese coastal waters and locally abundant. Among them, the boreal cirriped fauna appears to be fairly well established around Hokkaido (HIRO, 1935) and some of the boreal species penetrate southwards into middle Honsyu along the Pacific coast by means of the cold Oyasio Current (HIRO, 1939a; UTINOMI, 1955).

On the other hand, the west coast of Japan is fairly washed by the warm Tusima Current, a branch northerly going from the west of Kyusyu through Tusima and Korea Straits, in contrast to the west coast of the Japan sea, namely the maritime region of Soviet Russia and North Korea under the influence of the cold Liman

Current. Therefore, the boreal forms are little found on the west coast of Japan, except the west coast of Hokkaido. In fact, only 2 species (*Balanus crenatus* and *B. rostratus*) were obtained in this survey, as occurring on benthic animals or things in the upper subtidal zone and not growing to such a large size as in those found on the Pacific coast of Tohoku District (northern Honsyu) and Hokkaido.

Most interesting is the fact that has been elucidated by this distributional survey carried out to witness the range extension of coastal barnacles in recent years in connection with the direction of currents and the change of hydrographical

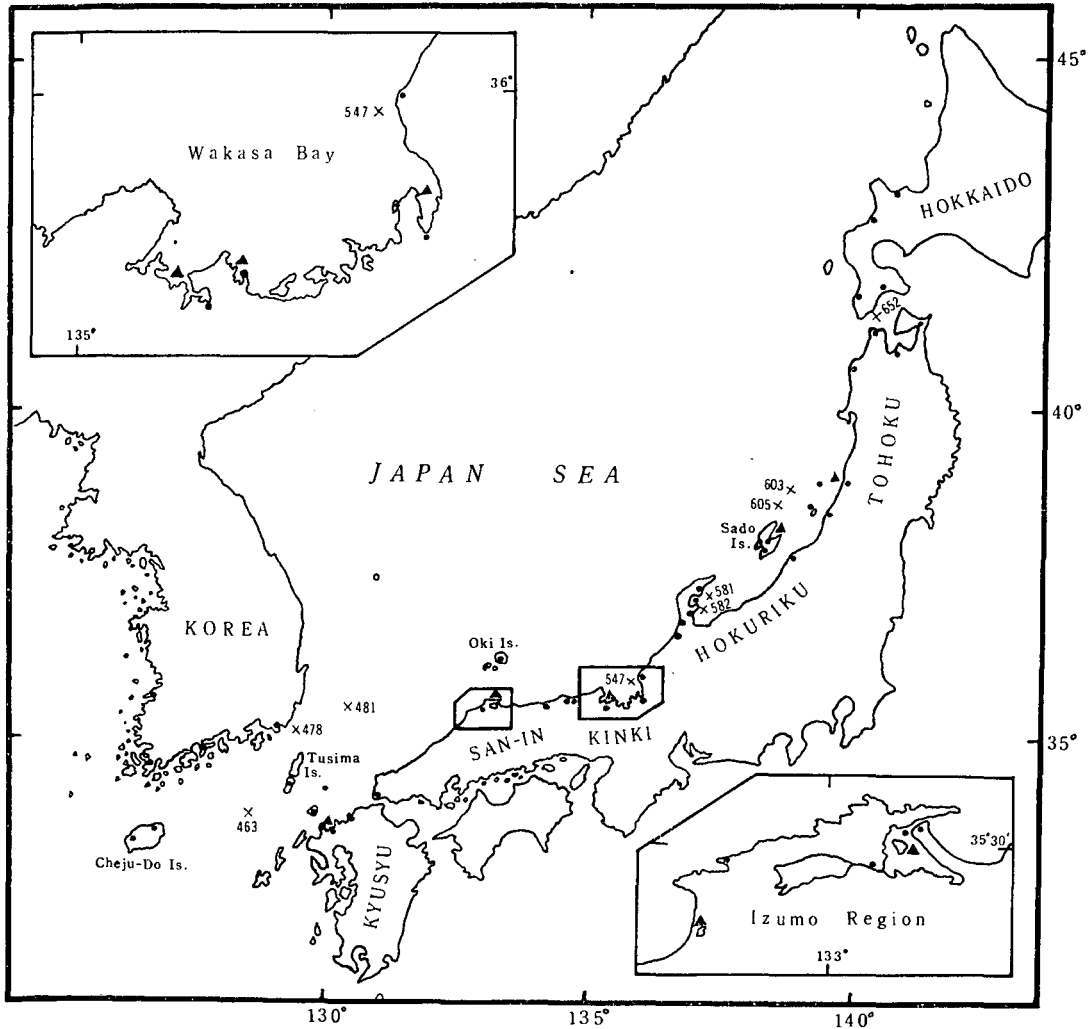


Fig. 12. Map of the Japan Sea surrounded by Japanese Main Islands and Korean Peninsula, showing the collecting sites (●) and the offshore stations of the Sōyō-maru Benthic Survey 1926-30 (×) (those on the Pacific coast are omitted).

▲ Localities of recent invaders (*B. eburneus* or *B. improvisus*)

circumstances occurred before and after the Second World War; namely I have confirmed the evidences of recent introduction of at least three occidental barnacles (*B. eburneus*, *B. improvisus*, and *B. venustus*) into the southeastern part of the Japan Sea (UTINOMI, 1966). It seems likely that the invasion of these occidental fouling barnacles has been made by ships and further extension of their range in new regions may attribute to the dispersal of the nauplius larvae accomplished primarily by water currents. The pertinent water currents in the geographic range in the Japan Sea are the northerly-going warm Tusima Current and stable inshore current and eddy systems (cf. MATSUI, SHANE and NEWMAN, 1964; MAWATARI, KITAMURA and KAWASHIMA, 1968). In the concerned area there are recognized 4 distributional patterns, namely Hakata Bay, Izumo Region, Wakasa Bay and Sado Region (Fig. 12).

It is probable that their recolonization in these new regions has become established successfully or has been proceeding presently after the Second World War. Before the War time, Maizuru Cove on the southern coast of Wakasa Bay, which was an important one of the old Japan's navy ports, had been dominated by *B. reticulatus* but now is replaced by other domestic barnacles such as *B. tintinnabulum rosa*, *B. trigonus* and new invaders such as *B. amphitrite* and *B. eburneus* and *B. improvisus*. During the present survey I have found *B. reticulatus* only in Hakata Bay, a south-westernmost port where the water may be more saline as in ports facing on the Pacific coast.

Indeed, the comparison between data for the fouling investigations in Japanese harbors made in the pre-war time (SAITO, 1929) and in the post-war time (MAWATARI, 1967) suggests that the stenohaline barnacle like *B. reticulatus* may have declined to survive in the Japan Sea and have successively been replaced by euryhaline widespread forms such as *B. amphitrite*, *B. trigonus*, *B. eburneus* and *B. improvisus* in recent years.

In the insular inshore regions of southern Korea and inland waters of Izumo Region of San-in District, on the other hand, many domestic inshore forms are still prevalent as in the pre-war time.

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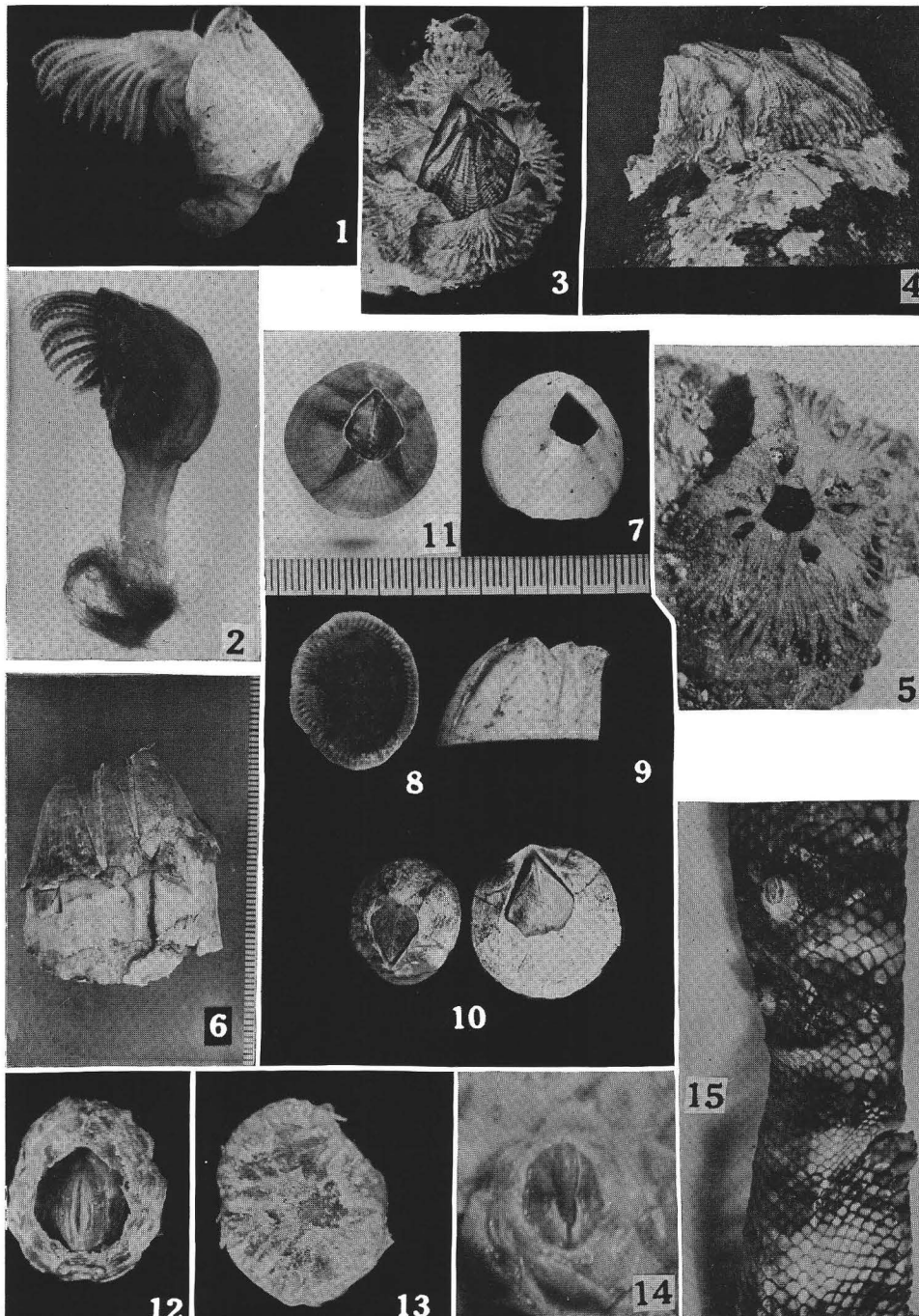
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EXPLANATION OF PLATE XVIII

- Fig. 1. *Lepas fascicularis* ELLIS et SOLANDER from Aikawa, Sado Island.
 Fig. 2. *Conchoderma virgatum hunteri* (OWEN) from Aikawa, Sado Island.
 Fig. 3. *Octomeris sulcata* NILSSON-CANTELL from Hutagosima, Asamusi, top view. $\times 1.3$
 Fig. 4. The same, side view. $\times 1.3$
 Fig. 5. *Tetraclitella chinensis* (NILSSON-CANTELL) from Kitaebisu, Aikawa, Sado Island, Top view. $\times 3$
 Fig. 6. *Balanus tintinnabulum volcano* PILSBRY from Awasima, side view. $\times 1$
 Fig. 7. *Balanus tintinnabulum rosa* PILSBRY (white form) from Aikawa, top view. $\times 0.8$
 Fig. 8. *Balanus eburneus* Gould, from Kamo-ko, Sado Is., bottom view (basis removed). $\times 0.8$
 Fig. 9. The same, side view. $\times 0.8$
 Fig. 10. The same, top view. $\times 0.8$
 Fig. 11. *Balanus venustus venustus* DARWIN from Kitaebisu, Aikawa, Sado Is., top view. $\times 0.8$
 Fig. 12. *Platylepas ophiophila* LANCHESTER from Mano Bay, Sado Is., top view. $\times 3$
 Fig. 13. The same, bottom view (basal membrane retained). $\times 3$
 Fig. 14. The same, top view (intact specimen covered wholly with the snake's skin).
 Fig. 15. Part of trunk of a sea-snake, with some specimens of *Platylepas ophiophila*, captured in Mano Bay, Sado Is. $\times 0.6$

Photo: Dr. T. HOSHIAI (3, 4) and Mr. T. KITAMI (others).



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