

## **The Chiton Fauna (Mollusca: Polyplacophora) of Korea, Part I: Suborder Lepidopleurina and Ischnochitonina**

dell' ANGELO, Bruno, HONG, Jae-Sang\*, van BELLE, Richard A.\*\*

(Via Follereau 10, 41043 Formigine (MO), Italy)

\* Department of Oceanography, Inha University, Incheon 402-751, Republic of Korea

\*\* Nijverheidsstraat 22, B-2700 Sint-Niklaas, Belgium)

한국산 군부류(연체동물 문, 다판 강)의 분류학적 연구

I. 아기군부 및 연두군부 아목

델안젤로 브루노 · 홍 재상\* · 반벨르 리차드 A.\*\*

(Via Follereau 10, 41043 Formigine (MO), Italy)

\* 인하대학교 이과대학 해양학과

\*\* Nijverheidsstraat 22, B-2700 Sint-Niklaas, Belgium)

---

### 적 요

1980년에서 1983년까지 4년간 한국연안의 93개 지점으로 부터 채집된 한국산 군부류중 아기군부 아목 (Suborder Lepidopleurina) 과 연두군부 아목 (Suborder Ischnochitonina) 의 분류학적 연구 결과, 4과 8속 13종이 동정되었으며 이를 재 기재하였다. 그 중 다음의 2종은 한국에서 처음으로 기록된다 :

*Leptochiton (Leptochiton) rugatus*, *Mopalia schrencki*.

Key words: Taxonomy, Polyplacophora, Korea.

### INTRODUCTION

Chitons (Phylum Mollusca, Class Polyplacophora) generally have a series of eight overlapping valves, situated dorsally, held in place by a tough muscular girdle, which may be either nude or variously ornamented with spicules, scales, bristles, or hairy protuberances. They are a small group of mollusks (approximately

600 species) found as common members of the intertidal rocky community in nearly all the seas of the globe. They are strictly benthic animals ranging in length generally from a few mm to 5cm. Chitons are of considerable importance in the diet of certain sea birds and bottom dwellers such as starfishes. They are sometimes encountered in the stomach of fishes. Some species have been used by man as food in certain regions of Korea.

Korean Polyplacophora has been documented by several authors. Previous major studies are those of Reeve (1847a, b), Taki (1938), Lee (1956), Yoo (1976), Jeong (1983), and Yum (1988). Reeve described four new species from Korea in 1847: *Lepidozona* (L.) *coreanica*, *Leptochiton* (L.) *fuliginatus*, *Acanthochitona* *scutiger*, *Acanthochitona* *circellata*. Ninety years later Taki (1938) reported 7 species from various localities of Korea: *Acanthochitona* *rubrolineata*, *A. achates*, *Cryptoplax japonica*, *Liolophura* (L.) *japonica*, *Chiton* (*Rhyssoplax*) *kurodai*, *Lepidozona* (L.) *coreanica*, and *Ischnochiton* (L.) *comptus*. Lee (1956), in his list of molluscan shells of Korea, recorded seven species, of which two species were reported as new to Korea: *Onithochiton hirasei* and *Acanthochitona defilippii*.

Taki (1962) repeated the previous records from Reeve (1847a, b) and Taki (1938) in the list of the Polyplacophora from Japanese Islands and their vicinity. Since then, Kim and Rho (1971), Yoo (1976), and Kim and Yoon (1985) added *Lepidozona* (*Tripoplax*) *albrechti*, *Placiphorella stimpsoni*, *Lepidozona* (L.) *bisculpta*, *Cryptochiton stelleri*, and *Ischnochiton* (L.) *hakodadensis* respectively as new to Korean waters. Recently Yum (1988) wrote the most comprehensive account of the Korean chiton fauna in his MS thesis which contained 21 species including two species new to Korean waters: *Mopalia retifera* and *Chiton* (*Rhyssoplax*) *tectiformis*. In addition, other fragmentary reports are found from the various regions of the Korean Peninsula (Kim, 1973; Kim and Lee, 1978; Kim *et al.*, 1979; Rho *et al.*, 1979; Kim and Choe, 1981, 1988; Hong, 1982a, 1982b; Kim and Kwon, 1984, 1987; Kim and Kim, 1985, 1986; Choe and Yum, 1989; Choe and Kim, 1989).

In the course of examining the material accumulated by the second author (J.S. Hong) in about four years of collecting in Korean waters, he has come across some species of chitons not hitherto recognized. The present work describes several species of chitons that occur around Korean Peninsula. Two of the species, *Leptochiton* (L.) *rugatus* and *Mopalia schrencki*, are recorded for the first time from Korean waters.

## MATERIALS AND METHODS

The benthic invertebrates of the coastal shelves of Korean Peninsula have been sampled by a continuing program at the Korea Ocean Research and Development Institute. Most of the material examined for this study have been collected by the Korea Ocean Research and Development Institute from thirteen localities along the Korean coast during the period of 1980 to 1983. A map of the collecting sites is given in Fig. 1.

A total of about 950 specimens were studied from 93 substations. These collections would presumably provide a relatively broad representation of materials, owing in large part to the use of SCUBA diving equipments, dredges, and bottom trawls.

Prior to preservation, notes were made whenever possible on their habitats, as these could be useful for ecologists in the field. The substations including its locality at which each species occurred are listed in material examined section.

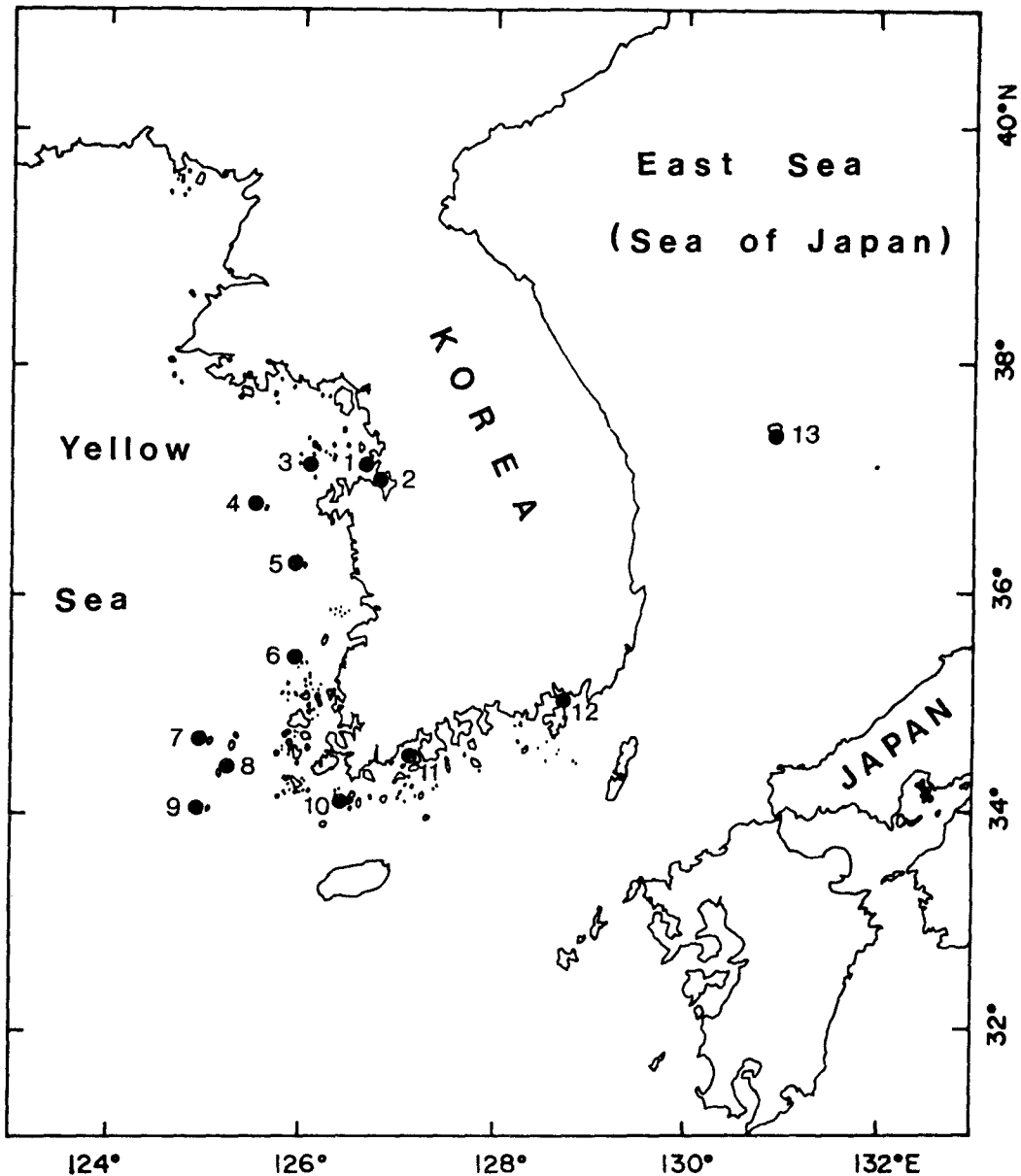


Fig. 1. A map showing the localities from which the specimens were collected. 1, Karorim Bay (intertidal rocky shore, Hwanggumsan); 2, Karorim bay (subtidal, gravelly muddy sand bottom); 3, Tokchok Archipelago (Pudo, Paegado); 4, Kyongnyolbi Yolto (Sokto); 5, Ochongdo; 6, Anmado; 7, Hongdo; 8, Hataedo; 9, Sohuksando (Naptangmal); 10, Wando (Maando, Chagaedo, Sodo, Mirari); 11, Tungnyang Bay (Shirokto); 12, Chinhae Bay (Totumari, Hugimal, Taechukto, Chamdo); 13, Ullungdo (Namyang, Sadong).

## SYSTEMATICS

Class	Polyplocophora Gray, 1821
Order	Neoloricata Bergenhayn, 1955

Suborder	Lepidopleurina Thiele, 1910
Family	Leptochitonidae Dall, 1889
Subfamily	Leptochitoninae Dall, 1889

**1. \* *Leptochiton (Leptochiton) rugatus* (Carpenter in Pilsbry, 1892)**

(P1.1, Figs. 1-6; P1.2, Figs. 1-7; Text Fig. 2)

*Leptochiton cancellatus* Dall, 1879 (pp. 315-316, et auct., non *Chiton cancellatus* Sowerby II, 1840)

*Leptochiton internexus* var. *rugatus* Dall, 1879 (p. 319, nom. nud.)

*Leptochiton internexus* (Carpenter MS), Dall, 1879 (p. 319, nom. nud.)

*Lepidopleurus rugatus* Carpenter in Pilsbry, 1892 (pp. 11-12, pl. 3, figs. 67-70)

*Lepidopleurus internexus* Carpenter in Pilsbry, 1892 (p. 12)

*Lepidopleurus assimilis* Thiele, 1909 (pp. 11-12, p1.1, figs. 30-39)

*Lepidopleurus alascensis* Thiele, 1909 (p. 13, p1.1, figs. 51-60)

*Leptochiton rugatus*: Ferreira, 1979 (pp. 146-149, figs. 1-2, 33-34, bibliography and synonymy); Kaas & van Belle, 1980 (p. 114); Kaas & van Belle, 1985 (pp. 85-87, figs. 37/1-15, map 15)

**Material examined:** 2 specimens, Karorim Bay, subtidal, gravelly muddy sand, dredge, 8m deep, Aug. 1980; 2 specimens, Karorim Bay, subtidal, gravelly muddy sand, dredge, 10m deep, Feb. 1981; one specimen, Karorim Bay, subtidal, gravelly muddy sand, dredge, 8m deep, Apr. 1981; 4 specimens, Karorim Bay, subtidal, slightly gravelly sand, dredge, 12m deep, Oct. 1980; 9 specimens, Karorim Bay, subtidal, gravelly muddy sand, dredge, 7m deep, Oct. 1980; one specimen, Karorim Bay, subtidal, gravelly muddy sand, dredge, 8m deep, Dec. 1980.

**Measurement:** Body length ranged from 3 to 5mm.

**Description:** Animal small (maximum length 5mm), elongate oval, moderately elevated, back evenly rounded, neither carinated nor beaked, girdle rather narrow, colour whitish, often blackened by fuliginous material.

Head valve somewhat less than semicircular. Intermediate valves broadly rectangular, anterior margin slightly convex, posterior margin about straight, apices not indicated, lateral areas inconspicuous, more or less elevated. Tail valve semicircular, mucro central to subcentral.

Tegmental sculpture consisting rounded microgranules linearly juxtaposed forming subgranose riblets, longitudinally disposed on central areas of intermediate valves (about 48-50) and antemucronal area of tail valve (about 40-42), radially oriented on head valve, lateral areas and post mucronal area. Longitudinal riblets practically adjacent, with granules staggered. End valves and lateral areas with several concentric growth ridges, in some specimens hardly evident. Aesthetes with one central macropore and some micropores, located on edge of hypothetical circumference, upper part excluded. Macropores only slightly larger than micropores, some of which not evident. Central macropore with two lateral micropores being put in a row and always well evident.

Articulamentum whitish, apophyses widely separated, small, triangular. Insertion plates not present.

Girdle dorsally clothed with rectangular scales, rounded at top, about  $30\text{-}34 \times 28\text{-}30 \mu\text{m}$ , sculptured with 14-16 riblets. Marginal fringe of spicules present, about  $53\text{-}62 \times 19 \mu\text{m}$ , strongly sculptured with 5-6 riblets. Girdle undersurface covered with imbricating, elongate scales, about  $43\text{-}55 \times 14\text{-}20 \mu\text{m}$ , finely striated in

---

\* The generic name *Leptochiton* is from the Greek *lepto* ("fine or slender") in combination with *chiton* so that "Agi Kumbu" in Korean name is newly adopted.

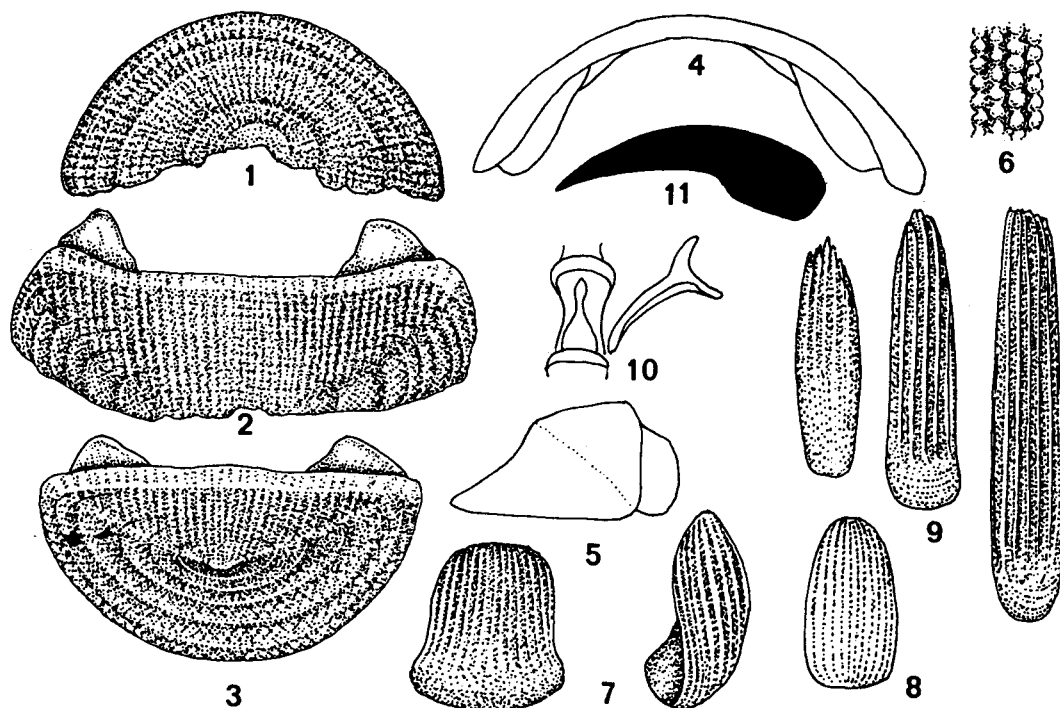


Fig. 2. *Leptochiton (Leptochiton) rugatus* (Carpenter in Pilsbry, 1892), specimen from the gravelly muddy sand subtidal region, Karorim Bay, Korea, 4 × 2mm, disarticulated, (VB 2625b).

1-3, valves I, IV, VIII respectively, dorsal view, × 20; 4, valve IV, rostral view, × 20; 5, valve VIII, lateral view, × 20; 6, tegmental sculpture of central areas, × 40; 7, dorsal girdle scales near the valves' edges, × 400; 8, ventral girdle scale near outer margin, × 400; 9, marginal spicules, × 400; 10, central and first lateral radula teeth, × 800; 11, blade of major lateral tooth, × 800.

upper part, quite smooth in the lower. Girdle scales display a considerable degree of polymorphism in size and shape.

Radula with central tooth narrowing in front to a small blade; first lateral tooth aliform, widest in front; major lateral with a very long, unicuspid head.

**Remarks:** The determination of the specimens available in the material examined was rather debated. First, the only *Leptochiton* species reported in Korean waters is *L. fuliginatus* (Reeve, 1847a), that however displays significant differences, particularly concerning the radula and girdle elements. The characters of our specimens well agree with those described for *L. rugatus*, also in the size of the specimens studied (length between 3 and 5 mm). Ferreira (1979) indicates 15.8 mm as maximum length, pointing out that in its northern range the specimens tend to be appreciably smaller. The rich synonymy confirms the difficulties always present in the identification of small species of *Leptochiton*. The material is available in a small number of specimens (if not only the type material) and hardly ever found living and in good conditions. *L. rugatus* is undoubtedly closely related to the European *L. cancellatus* (Sowerby, 1840) (Ferreira, 1979, p. 149), from which it differs especially in the structure of the radula. *L. rugatus* is a northern Pacific species with a wide geographic distribution, and this is the first record of this species in Korean waters. *L. rugatus* occurs from the intertidal zone to a depth of 458 m (Kaas & van Belle, 1985, p. 87). This species was fairly abundant on the gravels in the subtidal muddy sand bottom in Karorim Bay, Yellow Sea.

**Distribution:** Korea (Yellow Sea), Sea of Japan (Kaas & van Belle, 1985, p. 87), Sea of Okhotsk (Kass & van Belle, 1985, p. 87), Sea of Bering (Kaas & van Belle, 1985, p. 87), western coast of North America from Cohen Island, Alaska, to Magdalena Bay, Mexico (Ferreira, 1979, p. 148), Gulf of California (Ferreira, 1979, p. 149)

## 2. *Leptochiton (Leptochiton) fuliginatus* (Reeve, 1847)

*Chiton fuliginatus* Reeve, 1847a (p. 24); Reeve, 1847b (pl. 26, fig. 174)

*Leptochiton fuliginatus*: Dall, 1879 (pp. 316-318); Kaas & van Belle, 1980 (p. 50)

*Callochiton fuliginatus*: Dunker, 1882 (p. 157)

*Lepidopleurus fuliginatus*: Pilsbry, 1892 (pp. 4, 10, pl.4, fig. 88)

*Lepidopleurus (Lepidopleurus) fuliginatus*: Taki Is., 1962 (p. 31); Higo, 1973 (p. 2)

*Lepidozona fuliginatus*: Yoo, 1976 (p. 146, pl.35, fig.11).

*Leptochiton (Leptochiton) fuliginatus*: Kass & van Belle, 1985 (pp. 93-96, fig.41/1-13, map 33); Yum, 1988 (pp. 11-12)

**Original description** (Reeve, 1847a) is translated here from Latin: Shell oblong, very elevated, terminal valves and lateral areas of the rest somewhat irregularly concentrically striated, striae engraved near margin, central areas smooth or, under lens, minutely reticulated; dead white, more or less sparingly smeared with black; ligament horny, narrow, brown.

**Material examined:** Not found in the present materials examined.

**Remarks:** Kaas & van Belle's (1985) description and illustration of *L. fuliginatus* defines the species adequately. This species has not more been found since his original description (voyage of the "Samarang" under Capt. Belcher). The study of the type material in the British Museum, lectotype (designated by Kass & van Belle, 1985, p. 96) and 6 paralectotypes, confirms the validity of the species. *Leptochiton batialis* Sirenko, 1979 may be a northern deep water subspecies of *L. fuliginatus* (Kass & van Belle, 1985, pp. 96, 110).

**Distribution:** Korea (Capt. Belcher, *vide* Reeve, 1847)

Suborder	Ischnochitonina Bergenhayn, 1930
Family	Ischnochitonidae Dall, 1889
Subfamily	Ischnochitoninae Dall, 1889

## 3. *Ischnochiton (Ischnochiton) hakodadensis* Carpenter in Pilsbry, 1893

*Ischnochiton hakodadensis* Carpenter in Pilsbry, 1893 (p. 147, pl.19, fig.64-66); Thiele, 1910 (pp. 111-112, pl.8, fig.44); Berry, 1917 (pp. 4-5, pl.1, figs 6-7; pl.3 figs. 3-5; pl.4, figs.1-3); Leloup, 1941 (pp. 12-15, textfig.5, pl.2, fig.2); Yakovleva, 1952 (pp. 96-97, textfig.47, pl.8, fig.2); Sirenko, 1973 (pp.342-347, textfigs.1-7); Klimova & Sirenko, 1976 (p. 78, fig.182); Sirenko, 1976 (pp. 88-89); Sirenko & Scarlato, 1983 (p. 3); Sirenko, 1985 (pp. 348-349); Qi *et al.*, 1989 (p. 13, textfig.16, pl.4, fig.4)

*Ischnochiton (Ischnoradsia) hakodadensis*: Nierstrasz, 1905 (p. 22); Berry, 1917 (pp. 4-5, pl.1, figs.6-7; pl.3, figs.3-5; pl.4, figs.1-3); Taki Is., 1962 (p.44); Taki Is., 1964b (p. 409); Kaas & van Belle, 1980 (p. 57); Yum, 1988 (pp. 21-22, pl.2, fig.1, pl.9, pl.23, fig.3-4, pl.28, fig.5); Choe & Kim, 1989 (p. 247)

*Ischnoradsia hakodadensis*: Taki Is., 1938 (pp. 373-375, pl.15, fig.8, pl.26, figs.1-5; pl.27, figs.1-5, pl.28, figs.19-20)

*Ischnochiton (Ischnoradsia) hakodatensis*: Higo, 1973 (p. 6); Taki Is., 1975 (p. 8)

**Material examined:** 3 specimens, Ochongdo, curled, in the infralittoral zone of rocky shore, 18 Aug.

1982; one specimen, Sokto, slightly curled, from *Mytilus* community in the infralittoral zone, 17 Aug. 1982.

**Measurement:** Body length ranges from 19 to 26.5mm.

**Description:** Animal of medium size, maximum length and width 28 and 14 mm respectively, oval to elongate oval, moderately elevated, not carinated, valves not beaked. Colour of tegmentum variable, with white and yellow spots on light or dark gray ground. Tegmentum with fine reticular-costate sculpture. Head valve and postmucronal area of tail valve with only weak radial costae. Central area of intermediate valves with reticulate sculpture, minutely pitted with quincuncial granulation arranged in zigzag successions; lateral areas slightly raised, cut into 6 to 9 low, unequal riblets by radiating impressed lines. Antemucronal area of tail valve reticulate, mucro in front of middle, rather prominent.

Articulamentum blue-white, sinus smooth, slit formula of insertion plates 15-20/2-3/14-15, teeth rather sharp, sometimes slightly roughened.

Girdle with regularly alternating gray and white bands, covered with imbricating scales, wider than long, with rounded margins, sculptured with 12-15 rounded ribs; ventral spicules rectangular and finely striated. Marginal fringe formed by elongate, longitudinally ribbed spines.

Radula with central tooth oblong, weakly cusped, rounded at the tip, truncated at the base with square basal plate; major lateral tooth with bicuspid head, inner denticle slightly larger than outer one.

Gills holobranchial, ctenidia 28-32 in number on each side.

**Remarks:** This species is very variable in colour, in the number of radial riblets (from 5 to 11) on the lateral areas, and in the number of marginal slits. Yakovleva (1952) gives a slit formula of 15-17/2/11-18. The beautiful zigzag sculpture which covers central areas of young specimen, is usually eroded to pitted appearance characteristic of the adults. This species has a tegmental sculpture similar in aspect to that of other Japanese species of *Ischnochiton*, but it is distinguished by radular characters, its closely arranged, nearly smooth, convex girdle scales, and the plurality of side slits in the intermediate valves.

This species lives at a depth of 0-80 m on stony bottoms. It is fairly common in oyster beds and in biocenoses of *Amphiroa* (Yakovleva, 1952). They are present in the infralittoral zone of the rocky shore, Yellow Sea.

**Distribution:** Korea (Yellow Sea, South Sea, East Sea), Japan (Hakodate and Mororan according to the Albatross Expedition, Saghalien, Aomori, Iwate, Miyagi and Fukushima Prefectures, Toyama Bay by Taki Is., 1962, p. 44), Tsingtao, China (Leloup, 1941, p. 13), Sea of Japan (widespread, particularly along the west coast by Yakovleva, 1952, p. 96).

#### 4. *Ischnochiton (Simplischnochiton) comptus* (Gould, 1859)

*Chiton (Leptochiton) comptus* Gould, 1859 (pp. 163-164)

*Ischnochiton comptus*: Pilsbry, 1892 (p. 117); Thiele, 1910 (pp. 111, 113, 114); Taki Is., 1938 (pp. 366-371, pl.14, figs.5, 10; pl.15, figs.6-7; pl.25, figs. 9-16; pl.27, figs.6-7; pl.29, figs.11-16); Leloup, 1941 (pp. 8-12, textfig.4, pl. 1, fig.2); Satyamurti, 1952 (pp. 6, 8, pl.1, fig.5); Lee, 1956 (p. 63); Azuma, 1960 (p. 1); Kira, 1964 (p. 183, pl.67, fig.1); Habe, 1971 (p. 68, fig.6); Arakawa & Mizokami, 1974 (pp. 144, 145, textfig.1b); Itoigawa *et al.*, 1976 (pp. 184-185, pl.45, figs.3-6); Yoo, 1976 (p. 146, pl.35, fig.9); Kass & van Belle, 1980 (p. 29); Hong, 1982b (p. 391); Jeong, 1983 (pp. 11-12, pl. fig.6)

*Ischnochiton (Ischnochiton) comptus*: Nierstrasz, 1905 (pp. 24-26, figs.10, 77-85); Taki Is., 1962 (pp. 43-44); Higo, 1973 (p. 6); Kim & Kim, 1985 (p. 192); Kim & Kim, 1986 (p. 318); Kim & Kwon, 1987 (p. 294); Yum, 1988 (pp. 18-20, pl. fig.3, pl.7, pl.22, fig.5-6, pl.28, fig.3); Choe & Kim, 1989 (p.247)

*Ischnochiton thaanumi* Dall, 1926 (p. 66); Taki Is., 1938 (pp. 367, 369-370); Leloup, 1941 (pp. 11-12); Taki Is.,

1962 (p. 43); Taki Iw., 1964a (p. 342)

*Lepidopleurus comptus* var. *patuloides* (Carpenter MS) Palmer, 1945 (p. 100, nom. nud).

*Ischnochiton (Ischnochiton) comptus* forma *comptus* (s. str.) Taki Iw., 1964a, (p. 347); Taki Iw., 1964b (p. 408); Jeong, 1983 (pp. 11-12, pl. fig.6)

*Ischnochiton* (s.s.) *comptus* f. *comptus*: Taki, Iw., 1975 (p. 8)

**Material examined:** One specimen, Namyang, Ullungdo, 9mm, curled, in the infralittoral zone of the rocky shore, SCUBA, 2 Oct. 1981; one specimen, Sohuksando, in the infralittoral zone, 7m deep, SCUBA, 22 Aug. 1982.

**Measurement:** Body length ranges from 9 to 15mm.

**Description:** Chiton of medium size, shell 15-20 mm long, oval or elliptical in outline, not prominently elevated, tegmentum finely granulated. Girdle rather narrow, imbricated regularly with large, solid, smooth scales. Colour very variable, generally light grey, with small round white maculations; girdle alternately suffused in grey and whitish patches.

Head valve semicircular, with about 40 to 60 divaricate radiating, minutely beaded threads. Intermediate valves slightly mucronate, sutural line nearly straight; jugal area not defined, central area with lines of granules either parallel or bending toward acute jugum, intersected by diverging series of grooves, forming zigzag or ripple pattern; lateral areas somewhat elevated, having small radiating furrows, at first 3 to 5, then splitting into 6 to 10, intersected by three or more lines of growth. Tail valve with mucro somewhat elevated, situated slightly in front of the middle; posterior area flat, a little concave, ornamented with 40 to 50 delicate radial threads.

Articulamentum with sutural laminae moderately extended anteriorly with acute edge. Slit formula; 11-17/1/9-13, usually 11-12/1/11.

Perinotum with large scales quite smooth; peripheral scales very small, cylindrical or ovoidal in shape, smooth, containing numerous minute granules; large marginal spines thick, sharply pointed, finely striated; small marginal spines rod-shaped; marginal spinules claviform with acute tip, weakly striated at distal end; ventral scales hyaline, oblong.

Radula with central tooth strongly cusped, slightly sinuated at anterior end; first lateral deeply cusped, straight at front edge; major lateral bicuspidate, inner wing large, major uncinus curving inwardly, dilated at anterior end with cusp, stalk stout, with small, squarish base.

**Distribution:** Korea (East Sea, South Sea, Yellow Sea), Japan (Loo Choo Islands, many localities), Taiwan (Kiirun, Otei by Taki Is., 1938, p.371), Tsingtao, China (Leloup, 1941, p. 8), Philippines (Taki Is., 1938, p. 371), East Indian Island (Great Sangir Island, Kwangdang Bay, North Celebes, Palos Bay, West Celebes, East Java, West Lombok Island, Sapeh Bay, Sumbawa Island, South Timor by Taki Is., 1938, p. 371)

##### 5. *Ischnochiton (Simplischnochiton) boninensis* Bergenhayn, 1933

*Ischnochiton boninensis* Bergenhayn, 1933 (pp. 10-13, textfig. 3, pl.1, figs. 2-3, pl.2, figs.24-29, 32); Taki Is., 1938 (pp. 369, 373, 375, 410); Leloup, 1941 (p. 12); Azuma, 1960 (p. 1); Taki Iw., 1964a (pp. 343-347); Kira, 1964 (p. 183, pl.67, fig.2); Kang et al., 1971 (p. 52); Habe, 1971 (p. 68, fig.5); Kaas & van Belle, 1980 (p. 18)

?*Ischnochiton zebrinus* Bergenhayn, 1933 (pp. 13-15, textfig.4, pl.1, fig.4, pl.2, figs.30-31, 33-39); Taki Is., 1938 (p. 375); Taki Iw., 1964a (p. 342)

*Ischnochiton (Ischnochiton) boninensis*: Taki Is., 1962 (p. 43); Higo, 1973 (p. 6); Yum, 1988 (pp. 20-21, pl.1, fig.4, pl.8, pl.23, fig.1-2, pl.28, fig.4)

?*Ischnochiton (Ischnochiton) zebrinus*: Taki Is., 1962 (p. 43); Taki Iw., 1964b (p.408); Higo, 1973 (p.6)



*Ischnochiton (Ischnochiton) comptus* forma *isaoi* Taki lw., 1964a (p. 348, textfigs.2, 4, 6); Taki lw., 1964b (p. 408); Higo, 1973 (p. 6)

*Ischnochiton (Simplischnochiton) lepidus*: van Belle, 1980 (pp. 33-34, pl.1, fig.2)

*Ischnochiton (Simplischnochiton) boninensis*: van Belle, 1982 (p. 470)

**Material examined:** 8 specimens, Karorim Bay, on the gravels in low intertidal mud flat, Oct. 1980; 6 specimens, Karorim Bay, subtidal, dredge, on the gravels in muddy sand bottom, 7m deep, Aug. 1980; one specimen, Karorim Bay, from mediolittoral zone on the intertidal rocky shore, Oct. 1981; one specimen, Namyang, Ullungdo, from infralittoral zone on the intertidal rocky shore, SCUBA, 2 Oct. 1981; 8 specimens, Sadong, Ullungdo, slightly curled, from infralittoral zone on the intertidal rocky shore, 2 Oct. 1981; 3 specimens, Namyang, Ullungdo, from infralittoral zone on the intertidal rocky shore, associated with *Coralina*, SCUBA, 2 Oct. 1981; 2 specimens, Hongdo, slightly curled, from infralittoral rocky shore, SCUBA, 20 Aug. 1982.

**Measurement:** A total of 29 specimens ranged from 3 to 28mm in body size.

**Description:** Chiton of medium size, attaining a length of over 30mm, elongate oval in outline, moderately elevated, back rounded to subcarinated, valves not beaked. Colour of tegmentum generally dark greenish, sometimes blotched or streaked with white or light roseate.

Head valve semicircular, sculptured with about 50 (bifurcating to almost double number towards periphery) flat, radiating riblets, separated by very fine grooves, riblets becoming obsolete towards apex. Intermediate valves broadly rectangular, front margin slightly convex, hind margin straight, apices inconspicuous, lateral areas little raised, sculptured like head valve, 5-6 riblets, up to 10 by splitting towards side margin, central areas with rows of minute, elongate granules, arranged in fine zigzag-pattern. Tail valve with front margin about straight, mucro slightly antemedian, postmucronal area concave, sculptured like head valve, about 50 riblets.

Articulamentum light greyish blue, often violet-tinted in central part of valves, apophyses short, rounded, slit formula of insertion plates 11-13/1/9-10, teeth sharp.

Perinotum greyish brown, often vaguely banded, dorsally covered with rather small, finely ribbed scales, and, near outer margin, slender spicules, stalked on long chitinous cusp. Marginal spicules cusped, straight, obese, blunt-topped, weakly longitudinally striated. Ventral scales translucent, elongate rectangular.

Central tooth of radula elongate, somewhat pinched in the middle, with rounded blade, first lateral tooth slightly aliform, with narrow, convex blade, major lateral with bicuspid head, inner denticle longer than outer one.

**Remarks:** *I. boninensis* is a common species, easily separated from *I. comptus* by its larger size, the tegmental colour, the elongate form, the greater number of radiating riblets in the end valves and the lateral areas of the intermediate valves, and the smaller, finely ribbed girdle scales.

**Distribution:** Korea (Yellow Sea, South Sea, East Sea), Japan (Misaki, Kanagawa Prefecture, Ito and Izu-Shikito, Shizuoka Prefecture, Bonin Islands, Kushimoto, Wakayama Prefecture, Shikoku, Kyushu by Taki Is., 1962, p. 43), Hong Kong (many localities by van Belle, 1982, p. 470)

## 6. *Lepidozona (Lepidozona) coreanica* (Reeve, 1847)

*Chiton coreanicus* Reeve, 1847a (p. 24)

*Chiton (Leptochiton) craticulatus* Gould, 1859 (p. 164)

*Ischnochiton (Lepidozona) cultratus* Carpenter in Pilsbry, 1893 (pp. 131-132)

*Lepidozona pectinella* Bergenhayn, 1933 (pp. 15-19, textfig.5, pl.1, fig.5, pl.2, figs.40-41, pl.3, figs.42-44, 46)

*Lepidozonia coreanica*: Kamita & Sato, 1941 (p. 3); Taki Is., 1962 (p. 41, bibliography and synonymy); Taki Is., 1964b (p. 409); Kim, 1973 (p. 428); Kim & Rho, 1971 (p. 11); Higo, 1973 (p. 5); Arakawa & Mizokami, 1974 (pp. 144-145, textfig. 1a); Taki, Is., 1975 (p. 8); Itoigawa *et al.*, 1976 (pp. 185-186, pl. 46, figs.1-5); Yoo, 1976 (p. 146, pl.35, fig.10); Itoigawa *et al.*, 1978 (pp. 150-153); Kim & Lee, 1978 (p. 98); Kim *et al.*, 1979 (p. 107); Rho *et al.*, 1979 (p. 113); Kuroda *et al.*, 1980 (pp. 91-96, textfig.2, pl.7, fig.11); Kaas & van Belle, 1980 (p. 31); van Belle, 1980 (p. 33, pl.1 fig.1); Kim & Choe, 1981 (p. 195); van Belle, 1982 (pp. 470-471); Jeong, 1983 (pp. 12-13, pl. fig.7)

*Lepidozonia (Lepidozonia) coreanica*: van Belle, 1982 (pp. 470-471); Kim & Kwon, 1984 (p. 319); Kim & Kwon, 1987 (p. 294); Kaas & van Belle, 1987 (pp. 225-227, fig.102, map 43); Yum, 1988 (pp. 12-15, pl.1, fig.1, pl.5, pl.22, fig.1-2, pl.28, fig.1); Kim & Choe, 1988 (p. 364); Choe & Yum, 1989 (p. 263); Choe & Kim, 1989 (p. 246); Qi *et al.*, 1989 (pp. 10-12, fig.12-13)

**Material examined:** 11 specimens, Karorim Bay, slightly curled, from infralittoral rocky shore, SCUBA, Oct. 1981; one specimen, Namyang, Ullungdo, 13mm, curled, from infralittoral rocky shore, SCUBA, Oct. 1981

**Measurement:** Body length ranges from 2.5 to 16mm from the materials examined.

**Description:** Animal of medium to large size, mostly 30-40mm long, 20-23mm wide, exceptionally specimens can reach a length of 60mm (Taki. Is, 1938, p. 378), oval to elongate oval, moderately elevated, carinated, side slopes slightly convex, lateral areas raised, valves not beaked. Colour of tegmentum generally yellowish brown or greenish, blotched with dark brown or dark green, locally young specimens can be reddish to reddish brown (van Belle, 1982, p. 471).

Head valve, lateral areas of intermediate valves, and postmucronal area of tail valve sculptured with respectively 30-40, 4-6, 20-30 low, not prominent radial ribs, each rib ornamented with varying number of solitary, yellowish brown, medium to rather large, roundish pustules. Central areas finely, longitudinally, granosely ridged, 20-25 ridges per side, intervening spaces about twice as wide, irregularly traversed by numerous narrow grooves.

Articulamentum whitish, apophyses wide, short, connected across shallow sinus by very short, weakly denticulated jugal plate, faintly notched at sides, slit formula of insertion plates 10-17/1/12-15, teeth short, thick, rather acute, eaves solid.

Girdle with alternating bands of light yellowish and dark greenish brown, densely covered with rather large, obliquely implanted, slightly bent scales, scales ornamented with 17-20 fine, longitudinal riblets.

Major lateral tooth of radula with bicuspid head, denticles pointed, inner one much longer than outer one.

Gills holobranchial, abanal, 33-38 ctenidia per side.

**Remarks:** Reeve (1847a) was the first to describe this species based upon the material collected from "Korean Archipelago, under stones", and afterwards the species has been commonly collected in various localities of Japanese coasts. *L. coreanica* is very variable in many characters, principally the number of radial ribs of the head and tail valves. Taki, Is. (1938) reports the number of radial ribs per 1mm in width equal respectively to 2.47 in the head valve and 2.06 in the tail valve. *Ischnochiton (Lepidozonia) cultratus* Carpenter in Pilsbry, 1893, recorded from Hakodate, seems to be a young form of this species. Similarly *Lepidozonia pectinella* Bergenhayn, 1933 shows no difference from *L. coreanica* in sculpture of the tegmentum, in colouration, in structure of the radula and in the girdle elements too. In the material examined, only 12 specimens were found, and the maximum length recorded (16mm) is less than the usual species length, 30-40mm.

**Distribution:** Korea (many localities all along the Korean coasts), Japan (widespread; Bonin Island by Bergenhayn, 1933), Fukien, China by Taki Is., 1962, p. 41), Taiwan (Kiirun, Kosyun by Taki Is., 1938,

p. 381), Hong Kong (commonly distributed by van Belle, 1982, p. 471)

### 7. *Lepidozона (Tripoplax) albrechti* (Schrenck, 1863)

*Chiton albrechti* Schrenck, 1863 (p. 551); Schrenck, 1863 (p. 253); fide Schrenck, 1867 (pp 283-288, pl. 13, fig.7-17)

*Chiton (Lepidopleurus) albrechti*: Smith, 1875 (p. 715)

*Ischnochiton (Ischnoradsia) albrechti*: Pilsbry, 1893 (pp. 147-148, pl.19, figs.70-74); Pilsbry, 1895 (p. 114); Berry, 1917 (p. 4, pl.1, figs. 4-5, pl.3, figs.1-2)

*Gurjanovillia albrechti*: Yakovleva, 1952 (pp. 97-98, pl.9, fig.2, textfig. 1, 48)

*Lepidozона albrechti*: Taki Is., 1938 (pp. 383-390, pl.14, figs.8, 9, 14, pl.28, figs.13-18, pl.29, figs.7-9, 17, pl.30, figs.10-13, pl.31, figs.1-5, pl.32, fig.17, textfig.5); Taki Is., 1962 (p. 42)

*Lepidozона (Tripoplax) albrechti*: Kaas & van Belle, 1980 (p.5); Kaas & Van Belle, 1987 (pp.175-177, fig.76); Yum, 1988 (p.17).

**Material examined:** Not found in the materials examined.

**Remarks:** This species was not found in the materials studied. But, this is fairly abundant in biocenoses of branching *Lithothamnium* and of oysters in shallow waters of the seas of U.S.S.R. around Okhotsk Sea, Sakhalin, and Kurile Islands (Yakovleva, 1952). Taki Is. (1938) has mentioned that this was one of the commonest species in the littoral zone of Hokkaido and Honshu with the southern limit in its distribution at about 37°N on both sides of Honshu in Japanese waters. In Korean waters, however, *L. albrechti* was known only from Cheju Island together with *L. coreanica* by Kim and Rho (1971) so that this finding extends a lot the southern limit of its geographical distribution. But this record requires verification because, as pointed out by Schrenck (1863) and Taki Is. (1938), this species is closely related to *Lepidozона coreanica*.

**Distribution:** U.S.S.R. (Okhotsk Sea, De Castries Bay, South Sakhalin; Aniwa Bay, Kurile Islands), Japan (Hokkaido; Akkesi, Muroran, Hakodate, Risiri-to, Okusiri-zima, to Honshu; Miyako, Kensennuma, Onagawa, Onahama, Mutsu Bay, Toyama Bay)

### 8. *Lepidozона (Lepidozона) bisculpta* (Carpenter in Pilsbry, 1892)

*Ischnochiton bisculptus* Carpenter in Pilsbry, 1892 (p. 119); Pilsbry, 1894 (p. 83, pl.17, fig.60-61); Ferreira, 1978 (p. 39)

*Ischnochiton (Lepidozона) bisculptus*: Leloup, 1941 (p. 4, fig.3, pl.2, fig.1)

*Lepidozона bisculpta*: Ferreira, 1974 (p. 164); Kaas & van Belle, 1980 (p. 17)

*Lepidozона (Lepidozона) bisculpta*: Kaas & van Belle, 1987 (pp. 227-229, fig.103, map 43); Yum, 1988 (p. 15); Choe & Kim, 1989 (p. 247); Choe & Yum, 1989 (p. 263)

**Material examined:** 66 specimens, Karorim Bay, subtidal, on the gravels in muddy sand bottom, 8m, dredge, Oct. 1980; 10 specimens, Karorim Bay, from infralittoral rocky shore, SCUBA, Oct. 1981; one specimen, Karorim Bay, subtidal, on the gravels in sandy bottom, 12m, dredge, Dec. 1980; 2 specimens, Hongdo, from infralittoral rocky shore, associated with *Corallina* community, SCUBA, 20 Aug. 1982.

**Measurement:** A total of 22 specimens range from 2.5 to 15mm in body length.

**Description:** Animal of medium size, lectotype 10.7 × 5.6mm, largest specimen mentioned in literature 18 × 1mm (Leloup, 1941, p. 5), oval, moderately elevated (dorsal elevation 0.33-0.40), carinated, side slopes almost straight, valves not beaked. Colour of tegmentum rather variable, yellowish beige marmorated with dark green, greyish brown maculated with olivaceous, yellowish brown with or without patches of lighter tint, light beige with irregular dark spots, orange brown.

Head valve semicircular, posterior margin widely V-shaped, clearly notched in the middle, tegmentum sculptured with varying number of radiating, irregular rows, 18-20, up to 30 by intercalation, of small cylindrical pustules, rows not reaching apex, growth lines neatly indicated in adult specimens. Intermediate valves

broadly rectangular, front margin straight at both sides of weakly forwardly produced jugal part, side margins rounded, hind margin about straight, apex inconspicuous, lateral areas hardly raised, sculptured like head valve, 4-6 rows of pustules, many of which, especially in median rows, are rubbed off, those of posterior row projecting past valve margin, central areas with 10-16 longitudinal, granulose ribs per side, plus mostly 1 rib on jugal ridge, the ribs widely spaced and regularly, minutely, transversely grooved, on valve II riblets of jugal tract posteriorly converging, forming neat wedge-like figure. Tail valve less than semicircular, about half as long as wide, front margin more or less angular, mucro subcentral, inconspicuous, postmucronal area slightly concave, sculptured like head valve, rows hardly or not discernible, pustules scarce, antemucronal area sculptured like central areas.

Articulamentum bluish white, tegmental colours somewhat showing through, apophyses wide, short, slightly rounded, connected across shallow sinus by concave jugal plate, notched at sides, slit formula of insertion plates 10-12/1/6-13, slit rays weakly (valves II-VIII) or not (valve I) indicated, teeth short, coarsely grooved on outside.

Girdle coloured like tegmentum, with triangular patches of lighter tone, dorsally densely clothed with obliquely implanted, strongly bent scales of unequal sizes, up to 200 $\mu$ m long, 250 $\mu$ m wide, with 7-9 strong longitudinal ribs on upper side, and often with striated, nipple-like prolongation near the top. Marginal fringe composed of three different elements: sturdy, deeply grooved, blunt spicules, up to 100  $\times$  40 $\mu$ m, small, club-shaped, distally grooved spicules, embedded in short chitinous sheath, 48  $\times$  13 $\mu$ m, and slender, smooth, slightly bent, white supra-marginal needles, 250 $\mu$ m long, mounted on long, striated chitinous sheath. Ventrally girdle paved with radiating rows of elongate rectangular, smooth scales, c. 110  $\times$  20 $\mu$ m, rows laterally slightly overlapping.

Central tooth of radula little longer than wide, more or less tulip-shaped, with almost straight blade, first lateral tooth somewhat shorter, slender, with minute appendix at anterolateral corner, no blade, major lateral with bicuspid head, denticles pointed, inner one much longer than inconspicuous outer one.

Gills holobranchial.

**Remarks:** This rather rare species is highly variable in colour and, especially, tegmental sculpture. Until recently it was only known from the type locality, Hong Kong, and Tsingtao, China. The present study extends the geographical distribution range of this species considerably to the East.

**Distribution:** Korea (Karorim Bay and Hongdo, West coast of Korea), Hong Kong, Tsingtao, China (Leloup, 1941, p.4)

### 9. *Lepidozona (Lepidozona) iyoensis* (Taki, Is. & Iw. Taki, 1929)

*Ischnochiton (Lepidozona) iyoensis* Taki Is. & Iw. Taki, 1929a (p. 52, pl.2, fig.4)

*Lepidozona iyoensis*: Taki Is., 1938 (pp. 410, 412); Taki Is., 1955b (p. 21); Taki Is., 1962 (p. 41); Taki Iw., 1964b (p. 409); Higo, 1973 (p. 5); Kaas & van Belle, 1980 (p. 66); Kuroda *et al.*, 1980 (p. 94)

*Lepidozona (Lepidozona) iyoensis*: Kaas & van Belle, 1987 (pp. 237-239, fig.107, map 31); Yum, 1988 (pp. 15-17, pl.1, fig.2, pl.6, pl.22, fig.3-4, pl.28, fig.2)

**Material examined:** 18 specimens, Karorim Bay, some specimens curled or slightly curled, subtidal, on pebbles in muddy sand bottoms, 8m deep, dredge, Oct. 1980; 4 specimens, Karorim Bay, subtidal, on gravels in muddy bottom, dredge, Dec. 1980

**Measurement:** The studied specimens reach a length of 6 to 25mm.

**Description:** Animal of moderate size, holotype 23  $\times$  13mm, largest specimen observed 25  $\times$  16mm, elongate oval, rather elevated (dorsal elevation 0.42), carinated, side slopes slightly convex, valves not beaked.

Colour of tegmentum brownish roseate, with sparse patches and specks of white.

Head valve semicircular, front slope somewhat convex, hind margin widely V-shaped, notched in the middle, tegmentum ornamented with numerous radiating, often bifurcating, granulose riblets, about 60 in number along outer margin, diminishing in strength and becoming obsolete towards apex, growth lines clearly indicated. Intermediate valves broadly rectangular, front margin slightly concave at both sides of somewhat forwardly produced jugal part, side margins rounded, hind margin straight, apex inconspicuous, lateral areas little raised, sculptured like head valve, 7-8 riblets, on posterior riblet a few granules somewhat more outstanding, sparsely dentating suture, jugal area more or less differentiated, sculptured with weak, obliquely crossing riblets, forming wedge-shaped pattern, pleural areas with up to 32 longitudinal granulose riblets, interstices pitted, about as wide as riblets. Tail valve less than semicircular, fairly less wide than head valve, length about half of width, mucro central, somewhat elevated, postmucronal area straight, sculptured like head valve, up to 50 riblets along outer margin, antemucronal area convex, sculptured like central areas. Articulamentum strongly developed, white, apophyses wide, rounded, connected across sinus by short, concave jugal plate, dorsally weakly grooved, notched at sides, slit formula of insertion plates 9/1/9, slits deep, no slit rays, teeth short, coarsely grooved on upper side, eaves narrow, solid.

Girdle of moderate width, coloured in alternating bands of brownish roseate and dirty white, dorsally densely clothed with rather small, obliquely implanted, imbricating practically smooth scales, 156 to 172  $\mu$ m wide, 116 to 132  $\mu$ m long. Marginal spicules straight, bluntly pointed, distally weakly straited, 100  $\times$  16  $\mu$ m. Ventrally girdle paved with radiating rows of elongate rectangular, smooth scales, 176  $\times$  18  $\mu$ m in mid-girdle.

Central tooth of radula narrow at base, gradually widening to strong, slightly convex blade, first lateral tooth almost as long, slender, distal end distorted, major lateral with unicuspid head, denticle somewhat bent, pointed.

Gills holobranchial, adanal with interspace, about 19 ctenidia in a specimen 14mm long.

**Remarks:** For many years, *L. iyoensis* was only known from the holotype, found on a living shell of *Rapana thomasi*. The detailed examination was made from a specimen collected from gravels in the subtidal muddy sand bottom, Karorim Bay, measuring 26  $\times$  16mm. It completely fits the original description of *L. iyoensis*, except for the greater number of longitudinal riblets on the pleural areas, 14 to 20 in the original description, up to 32 here, and the lesser number of radiating riblets on the postmucronal area of the tail valve, about 25 in original description, up to 50 in the Korean specimen. A possible explanation might be the fact that many riblets bifurcate, forming secondary riblets which perhaps have not been counted.

**Distribution:** Korea (Karorim Bay, west coast of Korea), Japan (off Gunchu-machi, Inland Sea of Seto by Taki Is., 1962, p. 41)

#### Family Mopaliidae Dall, 1889

#### 10. *Mopalia retifera* Thiele, 1909

*Mopalia retifera* Thiele, 1909 (p. 30, pl.3, figs.61-64, pl.4, figs.1-3); Taki Is. & Taki Iw., 1929b (pp. 148-153, pl.2, fig.2, textfigs. 32-43); Leloup, 1942a (p.57); Yakovleva, 1952 (p. 79, fig.34, pl.5, fig.2); Taki Is., 1962 (p. 33, bibliography); Taki Iw., 1964b (p. 410); Higo, 1973 (p. 3); Taki, Iw., 1975 (p. 9); Sirenko, 1976 (p. 90); Itoigawa *et al.* 1976 (pp. 191-192, pl.49, figs.1a-b, 2a-c); Klimova & Sirenko, 1976 (p. 79, fig.184); Itoigawa *et al.*, 1978 (p. 150, pl.15, figs.7a-b, 8a-c); Kaas & van Belle, 1980 (p. 110); Kuroda *et al.*, 1980 (pp. 92, 94); Sirenko & Scarlato, 1983 (fig.p. 5)

*Mopalia (Mopalia) retifera*: Taki, Is., 1962 (p. 33); Yum, 1988 (pp. 22-24, pl.2, fig.3, pl.10, pl.23, fig.5-6, pl.28, fig.6); Qi *et al.*, 1989 (pp. 6-7, pl.4, fig.3, textfig.50)

**Material examined:** 6 specimens, Karorim Bay, from infralittoral rocky shores, SCUBA, Oct. 1981; one specimen, Mirari, Wando, subtidal, SCUBA, 23 Aug. 1982.

**Measurement:** Body length ranges from 3 to 9.5mm. Only 7 specimens were found in the material examined, all very small. However, Taki, Is. & Iw. Taki (1929b) noted a maximum length and width of 26.8mm and 15.5mm respectively.

**Description:** Shell elongate oval, with moderately elevated ridge, slightly encroached at sutures, maximum length 26.8mm, valves beaked. Colour of tegmentum generally brownish or dark yellow-ochre. Girdle usually dark yellow-ochre throughout. Head valve semicircular, with highly elevated apex; tegmentum with 6-8 rows of radiate tubercles, interspaces between these sculptured into reticulum, each component thread intersecting obliquely with each other, and forming rhomboid depressions. Intermediate valves oblong, smoothly arcuated on both corners of anterior margin, beaked, carinated, jugum inconspicuous; lateral area separated from central area by diagonal row of round tubercles; central area with regularly reticulated sculpture producing rhomboid or square depressions, which become deeper and smaller toward side; lateral area with reticulation similar to that of head valve. Tail valve wide and short, scarcely elevated, with mucro at about posterior third of tegmentum; diagonal ribs, which divide area into two regions, rather obsolete; postmucronal area slightly concave, with sculpture quite obsolete and irregular.

Articulamentum uniformly pale; insertion plate of head valve well developed, faintly striated; sutural laminae of intermediate valves broad and short, with slight inclination on both sides, sinus rather narrow, deep, teeth prominently protruded; slit formula 8/1/1-4.

Girdle narrow, leathery, wholly covered with minute, brown spicules ( $60 \times 10 \mu\text{m}$ ) and with chitinous bristles of peculiar form, flexible and usually curved, finely striated across, maximum length 3mm, they give attachment to certain number of slender, transversely grooved, glassy spicules, deeply imbedded, with proximal portion invested by cup-like body, which connected by small nodule to fine slender branch of axial thread of bristles.

Radula with central teeth nearly oblong, with wide, reversed and smooth cusp, slightly swollen at base; major lateral well developed, tricuspid, each cusp big and with sharp point, stalk ridged, slightly winged.

Gills merobranchial, abanal, 16-19 ctenidia on each side.

**Remarks:** The original description (Thiele, 1909) is rather incomplete. Moreover, the tegmental surface of the intermediate and tail valves shown in his figures (pl. 3, figs. 61-62) is far from a reticulum, although he named the species *retifera* with reference to this remarkable sculpture. In many specimens the tegmental sculpture may be so much eroded that only the smooth, faint diagonal ribs are discriminable, leaving the fine reticular sculpture quite obsolete. Only 7 specimens were found in the material examined, all very small (maximum length 9.5mm). Taki Is. & Iw. Taki (1929b, p.152) give a maximum length of 26.8mm, but Yakovleva (1952, p.78) gives 22mm.

**Distribution:** Korea (Wando, Southern coast, Karorim Bay, West coast, East coast), Japan (Hojo, Chiba Prefecture, Yokosuka, Misaki and Enoshima, Kanagawa Prefecture, Izu-Ito, Shizuoka Prefecture, Shirahama, Wakayama Prefecture, Mukaishima, Hiroshima Prefecture, Mitsu, Matsuyama City, Ehime Prefecture, Shimonoseki, Kagoshima by Taki Is., 1962, p.33), China (Gulf of Amur, Tsingtao by Thiele, 1909, p.3), Sea of Japan (Peter the Great Bay by Sirenko & Scarlato, 1983; Vostok Bay by BDA collection; Possjet Bay by RVB & BDA collections).

### 11. *Mopalia schrencki* Thiele, 1909

(Pl. 3, Figs. 1-4)

*Mopalia schrencki* Thiele, 1909 (p. 30, pl.4, figs.4-10); Taki Is., 1938 (pp. 349, 410); Leloup, 1942b (p. 57); Yakovleva, 1952 (p. 78, fig.33, pl.5, fig.1); Taki Is., 1955a (pp. 203, 208, fig.3); Taki Is. 1962 (p. 33); Taki Iw., 1964b (p. 410);

Itoigawa *et al.*, 1976 (p. 192, pl.49, figs. 3a-b, 4-7); Sirenko, 1976 (p. 90); Klimova & Sirenko, 1976 (p. 79, fig.185); Itoigawa *et al.*, 1978 (p. 150, pl.15, figs.9, 10a-c); Kaas & van Belle, 1980 (p. 117); Sirenko & Scariato, 1983 (fig.p.6); Sirenko, 1985 (pp. 356-357)

*Mopalia (Mopalia) schrencki*: Taki, Is., 1962 (p. 33); Qi *et al.*, 1989 (p. 6, fig. 4).

**Material examined:** 3 specimens, Karorim Bay, subtidal, on the gravels in muddy sand bottom, 6m deep, dredge, Oct. 1980; 11 specimens, Karorim Bay, from infralittoral rocky shore, SCUBA, Oct. 1981; one specimen, Pudo, Tokchok Archipelago, associated with oysters, 11 Aug. 1982; one specimen, Sadong, Ullungdo, from infralittoral rocky shore, SCUBA, 2 Oct. 1981; 2 specimens, Hongdo, from the infralittoral rocky shore, associated with *Corallina* community, SCUBA, 20 Aug. 1982; one specimen, Sodo, Wando, from infralittoral rocky shore, SCUBA, 23 Aug. 1982.

**Measurement:** Body length ranges from 1.5 to 13.5mm.

**Description:** Shell elongate oval, maximum length 20mm, valves beaked. Colour of tegmentum generally greenish blue with brown spots, girdle brownish.

Head valve similar to that of *Mopalia retifera*, ribs coarse, in interspaces tegmentum sculptured like network. Intermediate valves finely longitudinally striated on jugum, while greater part of pleural areas sculptured with rows of pits, which neatly separated by longitudinal ribs, radial ribs and posterior margins (of lateral areas) granulose, interspaces net-like. Tail valve less wide than in *Mopalia retifera*, posteriorly only weakly notched, apex somewhat before posterior margin; antemucronal area sculptured like in intermediate valves, ribs marking postmucronal area clearly granulose.

Articulamentum white; apophyses fairly wide, roundish. Girdle rusty brick, with dense cover of long, light-brown chitinous bristles. Large spines most closely implanted near outside margin, sutural ones larger than those nearby. At distal end small spinules about 750µm long, with a small calcareous spicule which is only 25µm long. Spicules clothing dorsal side about 65µm long, distally sharply pointed, with chitinous cup at base.

Radula with central teeth much widened medially; major lateral tricuspid, median denticle larger than outer ones.

**Remarks:** This species is clearly separated from *Mopalia retifera* by the longitudinal folds between rows of pits, the different form of the tail valve, less elevated valves, and more particularly by the outlook of the girdle spines. 19 specimens found in the material examined were generally small (maximum length 13.5mm).

**Distribution:** Korea (West and South Coast of Korea, East Sea), Sea of Japan (widespread by Yakovleva, 1952, p.78), Vostok Bay and De Castries Bay (BDA collection), Possjet Bay (RVB collection), Sea of Okhotsk (widespread by Yakovleva, 1952, p.78).

## 12. *Placiphorella stimpsoni* (Gould, 1859)

(Pl.4, Figs.1-3)

*Chiton (Mopalia) stimpsoni* Gould, 1859 (p. 165)

*Placiphorella stimpsoni*: Pilsbry, 1893 (pp. 307-309, pl.62, figs.84-87); Berry, 1917 (pp. 12-13, pl.8, figs.1-2, pl.9, figs.1-8); Leloup, 1942 (p.13, fig.5); Saito & Okutani, 1989 (pp. 219-226, figs.28-46, 50-52 by bibliography and synonymy)

*Langfordiella japonica* Dall, 1925 (p. 96)

*Placiphorella japonica*: Taki Is., 1962 (p. 34, bibliography); Taki Iw., 1964b (p. 411); Higo, 1973 (p. 3); Taki, Iw., 1975 (p. 10); Itoigawa *et al.*, 1976 (pp. 192-193, pl. 49, figs.12a-b, 13 a-c); Yoo, 1976 (p. 147); Kaas & van Belle, 1980 (p. 67); Kuroda *et al.*, 1980 (pp. 93, 94, 95); Kim *et al.*, 1979 (p. 107); Kim & Lee, 1978 (p. 98); Jeong, 1983 (pp. 6, 8, pl.fig.1); Kim & Kim, 1986 (p. 318); Kim & Kwon, 1987 (p. 294); Kim, & Choe, 1988 (p. 364)

*Placiphorella (Placiphorella) japonica*: Yum, 1988 (pp. 24-26, pl.2, fig.2, pl.11, pl.24, fig.1-2, pl.29, fig.1); Choe & Yum, 1989 (p. 263); Choe & Kim, 1989 (p. 247)

**Material examined:** 10 specimens, Karorim Bay, some specimens curled or slightly curled, from the infralittoral rocky shore, SCUBA, Oct. 1981; 2 specimens, Pudo, Tokchok Archipelago, associated with *Corallina* community or oysters, 11 Aug. 1982; one specimen, Hongdo, in the infralittoral zone of rocky shore, SCUBA, 20 Aug. 1982; 3 specimens, Sokto, from the infralittoral rocky shore, associated with *Mytilus* community, SCUBA, 17 Aug. 1982; one specimen, Hataedo, from the infralittoral rocky shore amongst algae, SCUBA, 22 Aug. 1982.

**Measurement:** 3-26mm in body length from the materials examined.

**Description:** Recent description and illustration by Saito & Okutani (1989) defines the species well. Some informations on the end valves, the girdle and the radula can be added here.

Head valve: 8 slits on head valve as pointed out by Yum (1988). There are some accessory denticles above regular teeth, much shorter, thinner, and irregular in arrangement.

Tail valve: the mucro of very young specimens is situated at a little distance from the posterior edge, just like that of *P. stimpsoni*. But, the posterior area grows larger so as to lie under the central area, thus the mucronal area is posteriorly produced, and the slope in front of the mucro is slightly concave in profile.

Perinotum covered with minute, hyaline, pointed spinules, 40-55 $\mu$ m long, deeply striated over nearly entire length, and large, thick bristles, composed of brownish spines, 250-300 $\mu$ m long, about 16 or more spines in row around axis. Marginal spines hyaline, pointed at tip, with a few exceedingly fine striations on surface. Ventral scales hyaline, pointed at the tip, finely striated on the whole surface, 80-100 $\mu$ m in length.

Central tooth of radula oblong in outline, major lateral tooth much thickened, with tricuspid head, central denticle largest, outer one smallest, major uncinus slightly curved, with long, narrow cusp along outer and anterior edge.

**Remarks:** *Placiphorella stimpsoni* has already been considered by some authors (for example Taki, Is., 1938) as a synonym of *P. japonica* (Dall, 1925). For a discussion see Taki, Is (1954, pp.24-26). In Taki, Is. (1938, pp.350-355), figures and description are entirely correct for *P. stimpsoni*, but *P. japonica* was mixed with *P. stimpsoni* in its distribution.

Recently Saito and Okutani (1989), after an examination of the type specimens of *Placiphorella stimpsoni* and *P. japonica*, reached the conclusion that the two species are conspecific.

*P. "stimpsoni" sensu* Taki, Is (1938, 1954) is a different species (*P. borealijaponica* Saito & Okutani, 1989).

The species recorded by Wu & Okutani (1985) as *P. "stimpsoni"* from Mikura Island, at a depth of 1210-1235m, is a quite different species (*Placiphorella* sp.), closely related to *P. pacifica* Berry, 1919 (Saito & Okutani, 1989).

**Distribution:** Korea (West and South Coasts of Korea), Japan from southern part of Hokkaido to Kyushu (Pacific coast, Japan Sea), East China Sea.

Family	Chitonidae Rafinesque, 1815
Subfamily	Chitoninae Rafinesque, 1815

### 13. *Chiton (Rhyssoplax) kurodai* Taki, Is. & Iw. Taki, 1929

*Chiton kurodai* Taki, Is. & Iw. Taki, 1929a (pp. 52-53, textfigs.8-11, pl.2, fig.3)

*Chiton (Clathropleura) bocki* Bergenhayn, 1933 (pp. 26-29, textfig.9, pl.1, fig.8, pl.3, fig.55)

*Chiton bocki*: Taki Is., 1938 (p. 395)



*Rhyssoplax kurodai*: Taki Is., 1938 (pp. 393-396, pl.15, fig.5; pl.31, fig.11; pl.32, figs.1-7); Taki Is., 1962 (p. 45); Taki Iw., 1964b (p. 411); Higo, 1973 (p. 7); Arakawa & Mizokami, 1974 (pp. 144-145, textfig.1d); Taki, Iw., 1975 (p. 10); Kuroda *et al.*, 1980 (p. 96, pl.7, figs.9a, b); Kim & Kim 1985 (p. 192); Kim & Kim, 1986 (p. 318)

*Chiton (Rhyssoplax) kurodai*: Kaas & van Belle, 1980 (p. 70); Yum, 1988 (pp. 26-28, pl.2, fig.4, pl.12, pl.24, fig.3-4, pl.29, fig.2)

**Material examined:** One specimen, Sadong, Ullungdo, from the infralittoral rocky shore, SCUBA, 2 Oct. 1981; Namyang, Ullungdo, from the infralittoral rocky shore, associated with *Corallina* community, SCUBA, 2 Oct. 1981; 5 specimens, Hongdo, from the infralittoral rocky shore, SCUBA, 20 Aug. 1982; 7 specimens, Sohuksando, from the infralittoral rocky shore, associated with *Undaria*, *Corallina*, and oyster communities, SCUBA, 21 Aug. 1982; 5 specimens, Hataedo, from the infralittoral amongst algae, SCUBA, 22 Aug. 1982; 5 specimens, Mirari, Wando, from the shallow subtidal amongst algae, SCUBA, 23 Aug. 1982; one specimen, Maando, Wando, from the mediolittoral rocky shore, 23 Aug. 1982; 4 specimens, Chagaedo from the infralittoral rocky shore, SCUBA, 23 Aug. 1982.

**Measurement:** 3-14mm in body length from the materials examined.

**Remarks:** This species is distinguishable from the related species *Chiton (Rhyssoplax) tectiformis* (Taki, Is., 1938) by its larger size, and the greater number of longitudinal grooves on the pleurae. In the material examined, many specimens are juvenile (length 3-6mm), and the maximum length recorded (14mm) is less than that of the type species (19.2mm).

**Distribution:** Korea (Island of Quelpart, West Coast, South Coast, East Sea), Japan (many localities)

#### Subfamily Acanthopleurinae Dall, 1889.

#### 14. *Liolophura (Liolophura) japonica* (Lischke, 1873)

*Chiton japonicus* Lischke, 1873 (pp. 22-23)

?*Chiton defilippii* Tapparone-Canefri, 1874 (p. 77); Pilsbry, 1893 (p. 243)

*Liolophura japonica* var. *tessellata* Pilsbry, 1893 (pp. 243-244, pl.53, figs. 45-46)

*Ornithochiton* (sic!) *caliginosus* Carpenter MS, Pilsbry, 1893 (p. 244, pl.54, figs.41-45)

?*Nuttallina allantophora* Dall, 1919 (p. 502); Smith A.G., 1977 (p. 253)

*Liolophura japonica* forma *tenuispinosa* Leloup, 1939 (pp. 1-3, textfigs.1,3,4); Leloup, 1961 (pp. 38-39, pl.3, figs.1A-B); van Belle, 1980 (p.34, pl.1, fig.4); van Belle, 1982 (pp. 473-474)

*Liolophura japonica*: Taki Is., 1962 (p. 46, bibliography and synonymy); Taki Iw., 1964b (p. 412); Kim & Rho, 1971 (p. 11); Higo, 1973 (p. 7); Taki, Iw., 1975 (p. 11); Yoo, 1976 (p. 145, pl.35, figs.5-6); Rho *et al.*, 1979 (p. 113); Kim *et al.*, 1979 (p. 107); Kaas & van Belle, 1980 (p. 67); Kuroda *et al.*, 1980 (pp. 96-97, pl.7, figs.1a-7c); van Belle, 1982 (pp. 473-474); Hong, 1982b (p. 391); Jeong, 1983 (pp. 13-14, pl.fig.8); Kim & Kwon, 1984 (p. 319); Kim & Kim, 1985 (p. 192); Kim & Kim, 1986 (p. 318); Kim & Kwon, 1987 (p. 294)

*Liolophura japonica* forma *unispinosa* Taki Is., 1962 (p. 46, nom. nud.)

*Liolophura japonica* forma *planispinosa* Taki Is., 1962 (p. 4, nom. nud.)

*Acanthopleura japonica*: Ferreira, 1986 (pp. 250-254, figs.68-72, 115, bibliography and synonymy)

*Liolophura (Liolophura) japonica*: van Belle, 1982 (pp. 473-474); Yum, 1988 (pp. 29-32, pl.3, fig.1, pl.14, pl.25, fig.1-2, pl.29, fig.4)

**Material examined:** One specimen, Sadong, Ullungdo, from intertidal rocky shore, 2 Oct. 1981; one specimen, Chamdo, Chinhae Bay, from the infralittoral rocky shore, Mar. 1983; 27 specimens, Hongdo, from the mediolittoral rocky shore, associated with *Septifer* community, 20 Aug. 1982; 18 specimens,

Sohuksando, from the mediolittoral rocky shore, frequently associated with *Septifer* community, 21 Aug. 1982; 5 specimens, Mirari, Wando, from the mediolittoral rocky shore, 23 Aug. 1982; one specimen, Maando, Wando, from the mediolittoral rocky shore, 23 Aug. 1982; 2 specimens, Chagaedo, Wando, associated with *Septifer* community in the mediolittoral rocky shore, 23 Aug. 1982; 7 specimens, Shirokto, Tungnyang Bay, from intertidal rocky shore, July 1981.

**Measurement:** 2.5-45mm in body length from the material examined.

**Remarks:** The descriptions and illustration of *Liolophura japonica* made by Ferreira (1986) and Yum (1988) define the species adequately. Largest specimen examined in this study, 45 mm long, is shorter than maximum size reported by Ferreira (80mm). The plates are often eroded in adult specimens.

In a recent revision of the genus *Acanthopleura*, Ferreira (1986) considers *Liolophura* as a synonym of *Acanthopleura*. This interpretation is not accepted here. Many varieties of *L. japonica* were described by many authors, all based on variations of no systematic value in size, colour and width of girdle spinelets. In the present material examined, many specimens (about 55% of the total number) are juvenile (length between 2.5 and 5mm), with the colour of tegmentum very dark and the girdle upper surface without the characteristic brown-white bands, typical of the adult specimens.

**Distribution:** Korea (many localities), Japan (widespread), Hong Kong (Hong Kong, Wu Kwai Sha, Ping Chau by van Belle, 1982, p. 473), Taiwan (many localities by Ferreira 1986, p. 251), Thailand (many localities by Ferreira, 1986, p. 251).

#### Subfamily Tonicinae Pilsbry, 1893

#### 15. *Onithochiton hirasei* Pilsbry, 1901

*Tonicia* sp.: Pilsbry, 1898 (p. 50, *vide* Pilsbry, 1901, p. 204)

*Onithochiton hirasei* Pilsbry, 1901 (pp. 203-204); Lee, 1956 (p. 63); Taki Is., 1960 (p. 197, pl.90, fig.1); Habe, 1965 (p. 216, pl.66, fig.4); Habe, 1971 (p. 68, fig.2); Higo, 1973 (p. 8); Leloup, 1974 (pp. 5-7, textfig.2, pl.1, fig.1, pl.2, fig.3); Taki, Iw., 1975 (p. 11, fig. sp.18); Yoo, 1976 (p. 146); Kaas & van Belle, 1980 (p. 59); Kim & Kim 1986 (p. 318); Kim & Kwon, 1987 (p. 294); Yum, 1988 (pp. 32-34, pl.3, fig.2, pl.15, pl.25, fig.3-4, pl.29, fig.5)

*Onithochiton (Onithoplax) hirasei*: Taki Is., 1962 (pp. 47-48, bibliography)

**Material examined:** Not found in the present material but one specimen collected from Pusan was examined (RVB collection); Japanese specimens-Haiky Prefecture, 6 specimens (BDA Collection 2208); Wakayama Prefecture, Kusui-Nada cho, 1 specimen (BDA Collection 3257); Hino Point, 1 specimen (BDA Collection 3447); Chiba Prefecture, Tateyama City, 1 specimen (BDA Collection 3448).

**Remarks:** *O. hirasei* is the only species of the genus reported for Korean and Japanese waters. Though this species seems to be commonly distributed in the Japanese waters, it has not been found in the present materials. *O. hirasei* has a sculpture similar to those of *O. maillardi* (Deshayes, 1863) and *O. lyelli* (Sowerby, 1832), very variable. This species has a girdle different from that of the other *Onithochiton* species.

**Distribution:** Korea (Yellow Sea, South Sea, and East Sea), Japan (Sagami Bay, Izu-Shikito, Hachijo-jima, Shirahama, Wakayama Prefecture, Yawatahama, Ehime Prefecture, Saganoseki, Oita Prefecture, Aoshima, Miyazachi Prefecture, Yakushima, Yoron-jima, Ryukyu by Taki Is. (1962, p.48) and Haiky Prefecture, Chiba Prefecture, BDA collection), Formosa (Taki Is., 1962, p.48).

## ABSTRACT

In the course of the study program of benthic invertebrates of the coastal shelves of Korean Peninsula, the shallow-water chitons (Mollusca: Polyplacophora) are studied based on the collections of the Korea Ocean Research and Development Institute made between 1980 and 1983. A total of sixteen species belonging to the Orders Lepidopleurina and Ischnochitonina, are now recognized from Korean waters, of which the following two species are newly recorded: *Leptochiton (Leptochiton) rugatus* (Carpenter in Pilsbry), and *Mopalia schrencki* Thiele. Illustrations, description and complete synonymies are provided for each of them.

## ACKNOWLEDGEMENTS

The Korean Ministry of Science and Technology supported in part the field trip expenses by a continuing program under several grants through Korea Ocean Research and Development Institute.

The writers are grateful to the SCUBA diving members, Messrs. J.G. Je and C.B. Song, of the Biological Oceanography Laboratory of this Institute, for their aid in collecting and processing samples in the arduous and risky field work. The illustration was made by Mr. P. Kaas to whom the writers are deeply indebted. Helpful comments and reference from anonymous reviewers are gratefully acknowledged. We also wish to give special thanks to Mr. J.G. Song for typing and editing the manuscript.

## REFERENCES

- Arakawa, K.Y. and A. Mizokami, 1974. Some chitons collected from the stomach of a black sea bream, *Acanthopagrus schlegeli* (Bleeker). *Venus*, **33**, 3: 144-146.
- Azuma, M., 1960. A catalogue of the shell-bearing mollusca of Okinoshima, Kashiwajima and the adjacent area (Tosa Province), Shioku, Japan.
- Baba, K., 1929. On the body structure of several species of Japanese chitons. *Zool. Mag. Tokyo*, **41**: 108-121.
- Bergenhayn, J.R.M., 1933. Die Loricaten von Prof. Dr. Sixten Bocks Expedition nach Japan und den Bonin-Inseln 1914. *Kungl. svenska Vetensk. Akad. Handl.*, **12**, 4: 3-58.
- Berry, S.S., 1917. Chitons taken by the United States Fisheries Steamer "Albatross" in the Northwest Pacific in 1906. *Proc. U.S. natn. Mus.*, **54**, 2223: 1-18.
- Choe, B.L. and S.S. Yum, 1989. Marine invertebrate fauna of Oeyon Islands. Report on the survey of natural environment in Korea. No. 8. The Oeyon Archipelago. Korean Central Council for Nature Preservation: 257-278. (in Korean)
- Choe, B.L. and Y.J. Kim, 1989. Marine invertebrate fauna of Anma Islands. Report on the survey of natural environment in Korea. No.9. The Anma Archipelago. Korean Central Council for Nature Preservation: 239-275. (In Korean)
- Dall, W.H., 1879. Report on the limpets and chitons of the Alaskan and Arctic regions, with descriptions of genera and subspecies believed to be new. *Proc. U.S. Natn. Mus.*, **1**: 281-344.
- Dall, W.H., 1925. New shells from Japan. *Nautilus*, **38**, 3: 95-97.
- Dall, W.H., 1926. New shells from Japan and the Loochoo Islands. *Proc. Biol. Soc. Wash.*, **39**: 63-66.
- Dunker, W., 1882. *Index Molluscorum maris Japonici*. Marburg.
- Ferreira, A.J. 1974. The genus *Lepidozona* in the Panamic Province, with the description of two new species. *Veliger*,

17, 2: 162-180.

- Ferreira, A.J., 1979. The family Lepidopleuridae (Mollusca: Polyplacophora) in the eastern Pacific. *Veliger*, **22**, 2: 145-165.
- Ferreira, A.J., 1986. A revision of the Genus *Acanthopleura* Guilding, 1829 (Mollusca: Polyplacophora). *Veliger*, **28**, 3: 221-279.
- Gould, A.A., 1859. Description of shells collected by the North Pacific Exploring Expedition. *Proc. Boston Soc. nat. Hist.*, **7**, 11: 161-165.
- Gray, J.E., 1847a. On the genera of the Family Chitonidae. *Proc. zool. Soc. Lond.*, **15**: 63-70.
- Gray, J.E., 1847b. Additional observations on Chitons. *Proc. zool. Soc. Lond.*, **15**: 126-127.
- Gray, J.E., 1847c. A list of the genera of recent Mollusca, their synonymy and types. *Proc. zool. Soc. Lond.*, **15**: 129-219.
- Habe, T., 1965. Shells of the Western Pacific in color. Vol. II. Hoikusha Publ. Co., Osaka: 233pp.
- Habe, T., 1971. Shells of Japan. Hoikusha Publ. Co., Osaka, Japan: 140pp.
- Herrmannsen, A.N., 1846-1849. *Indicis generum malacozoorum primordia. Sumptibus & Typis Theodori Fischeri, Cassellis*, vol.1: I-XLII + 1-232 (1846): 233-637 (1847): vol.2: 1-352 (1847): 353-492 (1848): 493-717 (1849).
- Herrmannsen, A.N., 1852. *Indicis generum malacozoorum. Supplementa et Corrigenda. Sumptibus Theodori Fischer, Cassellis*: V + 140pp.
- Higo, S., 1973. A catalogue of molluscan fauna of the Japanese Islands and the adjacent area. *Biol. Soc. Nagasaki Prefecture*.
- Hong, J.S., 1982a. On the distribution pattern of intertidal organisms in Deogjeog Islands, Western coast of Korea. Report on the Survey of Natural Environment in Korea. No.1. The Deogjeog Archipelago. Korean Central Council for Nature Preservation: 307-324. (In Korean)
- Hong, J.S., 1982b. Vertical zonation of intertidal organisms in Bogil Island, Southern coast of Korea. Report on the Survey of Natural Environment in Korea. No.2. The Islands adjacent to Wando. Korean Central Council for Nature Preservation: 383-399. (In Korean)
- Itoigawa, J., M. Kuroda, A. Naruse and H. Nishimoto, 1976. Polyplacophora assemblage from the Pleistocene formations of Boso and Miura Peninsulas, environs of Tokyo, Japan. *Bull. Mizunami Fossil Mus.*, **3**: 171-204.
- Jeong, H. P., 1983. A study on the classification and the distribution of the chitons in Southwest coast of Korea. M.S. Thesis, Chunnam National University, 26 p. (In Korean)
- Kaas, P. and R.A. van Belle, 1980. Catalogue of living chitons (Mollusca: Polyplacophora). W. Backhuys, Rotterdam: VI + 144pp.
- Kaas, P. and R.A. van Belle, 1983. Catalogue of living chitons. *Addenda et Corrigenda*: 28pp. (No official publication, for private use only)
- Kaas, P. and R.A. van Belle, 1985. Monograph of living chitons (Mollusca: Polyplacophora). Vol.1. Order Neoloricata: Lepidopleurina. Ed. E.J. Brill, Leiden: 244pp.
- Kaas, P. and R.A. van Belle, 1987. Monograph of living chitons (Mollusca: Polyplacophora). Vol.3 Suborder Ischnochitonina. Ischnochitonidae: Chaetopleurinae & Ischnochitoninae (pars). Ed. E.J. Brill/W. Backhuys, Leiden: 302pp.
- Kamita, T. and T.N. Sato, 1941. Marine fauna at Jinsen Bay, Corea. *J. Chosen Nat. Hist. Soc.*, **8**, 30:1-3. (In Japanese)
- Kang, Y.S., C.H. Kim, H.S. Kim, K.Y. Paik, P.H. Won, T.S. Lee, P.S. Cho, K.C. Choi and I.B. Yoon, 1971. *Nomina Animalium Koreanorum*, (3) Invertebrata. The Zoological Society of Korea. Hyangmun-sa, 180p. (In Korean)
- Kim, H.S., 1973. Report on a collection of animals from Baegryeong I. and Daechong I. *Proc. Coll. Nat Sci., Seoul Nat. Univ.*, No. **19**: 427-436. (In Korean)
- Kim, H.S. and B.L. Choe, 1981. The fauna of marine invertebrate in Ulreung Is. and Dogdo Is.. Report of the Korean Association for Conservation of Nature, No. **19**: 193-200. (In Korean)
- Kim, H.S. and B.L. Choe, 1988. Marine benthic fauna of Paengnyong-Do I., Taecheong-Do I., and Sochong-Do Island.

- Report on the survey of natural environment in Korea. No. 7. The Islands adjacent to Paengnyongdo. Korean Central Council for Nature Preservation: 355-396. (In Korean)
- Kim, H.S. and I.H. Kim, 1985. Marine invertebrate fauna of Komundo I., Taesambudo I. and Sangbaekdo Island. Report on the survey of natural environment in Korea. No. 4. The Islands adjacent to Komundo and Paekdo. Korean Central Council for Nature Preservation: 181-206. (In Korean)
- Kim, H.S. and I.H. Kim, 1986. Marine invertebrate fauna of Chujado Islands. Report on the survey of natural environment in Korea. No. 5. The Chuja Archipelago. Korean Central Council for Nature Preservation: 309-332. (In Korean)
- Kim, H.S. and D.H. Kwon, 1984. Marine invertebrate fauna in the vicinity of Jindo Island. Report on the survey of natural environment in Korea. No.3. Jodo Area, Dadohae Marine National Park. Korean Central Council for Nature Preservation: 313-336. (In Korean)
- Kim, H.S. and D.H. Kwon, 1987. Marine invertebrate fauna of Huksan Islands. Report on the survey of natural environment in Korea. No.6. Huksan Archipelago. Korean Central Council for Nature Preservation: 285-314. (In Korean)
- Kim, H.S. and K.S. Lee, 1978. Report on a collection of marine animals from Donggyeogreolbi I., Seogdo I., and Gungsi I. Report of the Korean association for conservation of Nature, No. 12: 97-101. (In Korean)
- Kim, H.S. and B.J. Rho, 1971. On the distribution of the benthic animals of Korean coastal seas. I. Jeju Island region. Report for the IBP. No.5: 7-27.
- Kim, H.S., B.J. Rho, S.Y. Hong, I.H. Kim, S. Shin, and C.H. Han, 1979. The marine invertebrate fauna in the Southern part of Geoje Island and its adjacent five Islands. Report of the Korean association for conservation of Nature, No.14: 103-126. (In Korean)
- Kim, H.S. and S.M. Yoon, 1985. The marine mollusks and arthropods in Hujing, Kang-won-do. Nature Conservation, **50**: 35-42.
- Kira, T., 1962. Shells of the Western Pacific in color. Hoikusha Publ. Co., Osaka: Vii + 224pp.
- Kira, T., 1964. Coloured illustrations of the shells of Japan. Hoikusha Publ. Co., Osaka, Japan: 240pp.
- Klimova, V. and B.I. Sirenko. 1976. Loricata. In: AA.VV., Animals and Plants of Peter the Great Bay (Sea of Japan). Hayka: 77-79. (In Russian)
- Lee, B.D., 1956. The catalogue of molluscan shells of Korea. Bull. Pusan Fish. Coll., **1**, 1: 53-160.
- Leloup, E., 1939. A propos des amphineures *Liolophura japonica* (Lischke, 1873) et *L. gaimardi* (Blainville, 1825): deux nouvelles formes. Bull. Mus. r. Hist. nat. Belg., **15**, 1: 1-7.
- Leloup, E., 1940. Les chitons du genre *Cryptoplax* Blainville, 1818. Bull. Mus. r. Hist. nat. Belg., **16**, 33: 1-32.
- Leloup, E., 1941. Quatre Ischnochitons de Tsingtao (Chine). Bull. Mus. r. Hist. nat. Belg., **17**, 18: 1-15.
- Leloup, E., 1942a. A propos de quelques acanthochitons peu connus ou nouveaux. IV. région pacifique occidentale. Bull. Mus. r. Hist. nat. Belg., **18**, 53: 1-10.
- Leloup, E., 1942b. Contribution à la connaissance des Polyplacophores. I. Famille Mopaliidae Pilsbry, 1892. Mem. Mus. r. Hist. nat. Belg., **2**, 25: 3-64.
- Leloup, E., 1974. Quelques espèces du genre *Onithochiton* Gray, 1847. Bull. Inst. r. Sci. nat. Belg., **50**, 5: 1-17.
- Lischke, C.E., 1873. Diagnosen neuer Meeres-Conchylien aus Japan. Malakozool. B1. 21: 19-25.
- Nierstrasz, H.F., 1905. Die Chitonen der Siboga Expedition. Siboga-Exped., Uitkomst., Ed. Brill, Leiden, **48**: 1-114.
- Palmer, K. and van Winkle. 1945. Molluscan types in the Carpenter collection in the Redpath Museum. Nautilus, **58**, 3: 97-102.
- Pilsbry, H.A., 1892-1894. Monograph of the Polyplacophora. In: G.W. Tryon, Manual of Conchology, 14: 1-128, pls. 1-30 (1892); I-XXXIV, 129-350, pls. 31-68 (1893); 15: 1-64, pls. 1-10 (1893); 65-133, pls. 11-17 (1894) (Academy of Natural Sciences, Philadelphia).
- Pilsbry, H.A., 1898. Notes on a few chitons. Nautilus, **12**, 5: 50-51.

- Pilsbry, H.A., 1901. New Mollusca from Japan, the Loo Choo Islands, Formosa and the Philippines. Proc. Acad. nat. Sci. Philad.: 193-210.
- Qi, Z., *et al.*, 1989. Mollusca of Huanghai and Bohai. Agricultural Publishing House, Peking. 309p. (In Chinese)
- Reeve, L., 1847a. Descriptions of new species of shells collected in the Eastern Archipelago by Capt. Sir Edward Belcher and Mr. Adams during the Voyage of H.M.S. Samarang. Proc. zool. Soc. Lond., **15**: 24-26.
- Reeve, L., 1847b-1848. Conchologia Iconica or illustrations of the shells of molluscous animals. Monograph of the genus *Chiton*. London: 64pp.
- Rho, B.J., S.Y.Hong, S.Shin, and C.H.Han, 1979. The marine invertebrate fauna in Ui Island and its adjacent three Islands. Report of the Korean Association for Conservation of Nature, No.16: 109-119. (In Korean)
- Saito, H. and T. Okutani., 1989. Revision on shallow-water species of the genus *Placiphorella* (Polyplacophora: Mopaliidae) from Japan. Veliger, **32**, 2: 209-227.
- Satyamurti, S.T., 1952. The Mollusca of Krusadai Island (in the gulf of Manaar). 1. Amphineura and Gastropoda. Bull. Madras Govt. Mus (N.S.), Nat. Hist. Sect., **1**, 2: 1-267.
- Schrenck, L., 1867. Reisen und Forschungen in Amur-lande in den Jahren 1854-1856. II. Mollusken des Amur-landes und des Nordjapanischen Meeres, **2**: 259-374.
- Sirenko, B.I., 1973. Ecology and productive properties of *Ischnochiton hakodadensis* (Chitonidae, Ischnochitonidae) in the Posset Bay, Sea of Japan. Zool. Zh., **52**, 3: 342-347. (In Russian)
- Sirenko, B.I., 1976. Chitons from the Vostok Bay (Sea of Japan). Biol. Issled. Zaliva Vostok: 87-92. (In Russian)
- Sirenko, B.I., 1985. Polyplacophora of the shelf of south Sakhalin. Hayka, **30**, 38: 346-367. (In Russian)
- Sirenko, B.I. and O.A. Scarlato. 1983. Chitoni della regione Nord-Occidentale del Pacifico. La Conchilogia, **15**, 166-167: 3-7.
- Smith, A.G., 1977. Retification of west coast of chiton nomenclature. Veliger, **19**, 3: 215-258.
- Taki, Is., 1938. Report of the biological survey of Mutsu Bay. 31. Studies on chitons of Mutsu Bay with general discussion on chitons of Japan. Sci. Rep. Tohoku imp. Univ., **12**, 3: 323-423.
- Taki, Is., 1954. Fauna of chitons around Japanese Islands. Bull. Nat. Sci. Mus., **34**: 22-28.
- Taki, Is., 1955a. Distribution of Mopalioid chitons in the Pacific. Rec. Oceanogr. Wks. Japan, **2**, 1: 202-209.
- Taki, Is., 1955b. Fauna of chitons around Japanese Islands. *Lepidozona* of Japan. Bull. nat. Sci. Mus. Tokyo, **2**, 1: 20-25.
- Taki, Is., 1960. Polyplacophora. In Encyclopedia Zoologica illustrated in colors. Ed. By Okada *et al.*, Vol.3, Hokuryukan Publ. Co., Tokyo: 197-200. (In Japanese)
- Taki, Is., 1960. Polyplacophora, In Okada *et al.*, (ed.) Encyclopedia Zoologica, Illustrated in colors, Vol.3, Hokuryukan Publ. co., Tokyo: 197-200. (In Japanese)
- Taki, Is., 1962. A list of the Polyplacophora from Japanese Islands and vicinity. Venus, **22**, 1: 29-53.
- Taki, Is., and Iw. Taki, 1929a. Studies on Japanese Chitons (1). Venus, **1**, 2: 47-54.
- Taki, Is., and Iw. Taki, 1929b. Studies on Japanese Chitons (2). Venus, **1**, 4: 141-153.
- Taki, Is., and Iw. Taki, 1929c. Studies on Japanese Chitons (3). Venus, **1**, 5: 157-453.
- Taki, Is., and Iw. Taki, 1930. Studies on Japanese Chitons (4). Venus, **2**, 3: 99-107.
- Taki, Is., and Iw. Taki, 1931. Studies on Japanese Chitons (6). Venus, **2**, 5: 215-220.
- Taki, Iw., 1964a. On the chiton fauna of Japan. (1) The status of *Ischnochiton comptus* and *I. boninensis*. Venus, **22**, 4: 341-350.
- Taki, Iw., 1964b. Classification of the Class Polyplacophora, with a list of Japanese chitons. Venus, **22**, 4: 401-414.
- Taki, Iw., 1975. New illustrated encyclopedia of the fauna of Japan. Polyplacophora. Hokuryu-Kan Publ. Co., vol.2: 5-13. (In Japanese)
- Tapparone-Canefri, C., 1874. Zoologia del viaggio intorno al globo della Regia fregata "Magenta" durante gli anni 1865-1868.

Malagologia. Torino.

- Thiele, J., 1909-1910. Revision des Systems der Chitonen. Zoologica Stuttg. 7,22: 1-70, pls.1-6 (1909): 71-132, pls.7-10 (1910).
- van Belle, R.A., 1980. On a small collection of chitons from Hong Kong (Mollusca: Polyplacophora). Proc. First Int. Workshop on Malacofauna of Hong Kong and Southern China: 33-35.
- van Belle, R.A., 1982. Supplementary notes on Hong Kong chitons (Mollusca: Polyplacophora). Proc. First. Int. Mar. Biol. Workshop. Hong Kong: 469-483.
- van Belle, R.A., 1983. The systematic classification on the chitons (Mollusca: Polyplacophora). Inf. Soc. belge Malac., **11**, 1-3: 1-178.
- van Belle, R.A., 1985. The systematic classification of the chitons (Mollusca: Polyplacophora). Addenda 1 (with the description of the genus *Incisiochiton* gen. n.) Inf. Soc. belge Malac., **13**, 2: 49-59.
- Wu, S. and T. Okutani, 1985. The deep-sea chitons (Mollusca: Polyplacophora) collected by the R./V. Soyo-Maru from Japan. II. Mopaliidae and Ischnochitonidae. Venus, **44**, 3: 123-143.
- Yakovleva, A.M., 1952. Shell-bearing Mollusks (Loricata) of the Seas of the U.S.S.R.. Fauna U.S.S.R., 45: 1-107, figs.1-53, pls.1-11 (Zool. Inst. Acad. Sci. U.S.S.R) (English transl.: Israel Program for Scientific Translations, 1965).
- Yoo, J.S., 1976. Korean shells in colour. Ilji-Sa: 196pp. (In Korean)
- Yum, S.S., 1988. Classification and distribution of the Korean Polyplacophora (Mollusca). M.S. Thesis, Sung Kyun Kwan University, 104p. (In Korean)

RECEIVED: 5 FEBRUARY 1990

ACCEPTED: 28 APRIL 1990

## Explanation of plates

### PLATE 1

- Figs. 1-3.** *Leptochiton* (*Leptochiton*) *rugatus*, close-up of girdle scales of the specimen from Karorim Bay.
- Figs. 4-6.** *Leptochiton* (*Leptochiton*) *rugatus*, radula of same specimen.

### PLATE 2

- Figs. 1-5.** *Leptochiton* (*Leptochiton*) *rugatus*, close-up of valves of the specimen from Karorim Bay.
- Figs. 6-7.** *Leptochiton* (*Leptochiton*) *rugatus*, close-up view of the tegmental sculpture of the valve.

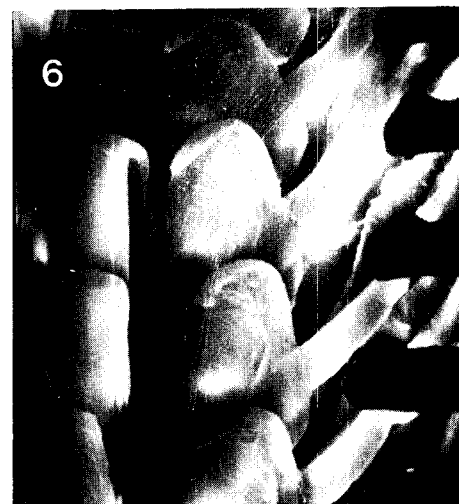
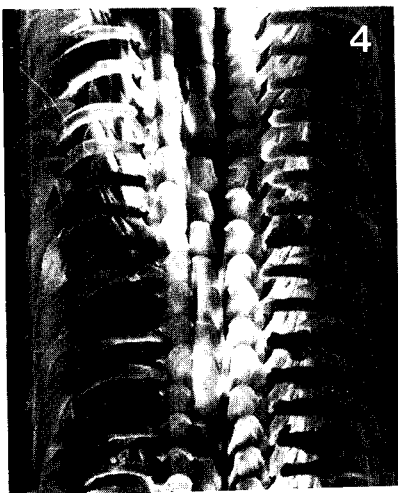
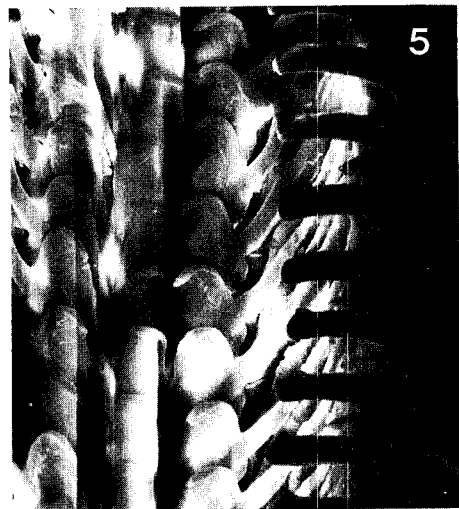
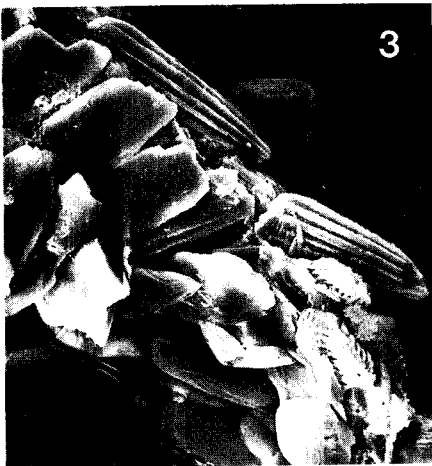
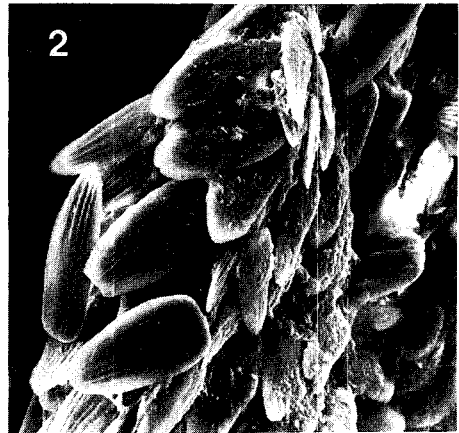
### PLATE 3

- Fig. 1.** *Mopalia schrencki*, whole animal of the specimen from infralittoral rocky shore, Hwanggumsan, Karorim Bay, Oct. 1981, J.S. Hong.
- Figs. 2-4.** *Mopalia schrencki*, tegmental sculpture, girdle scale and bristles.

### PLATE 4

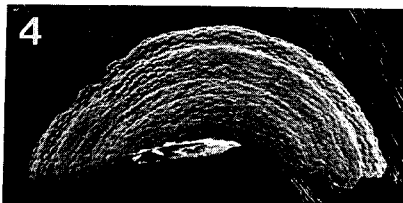
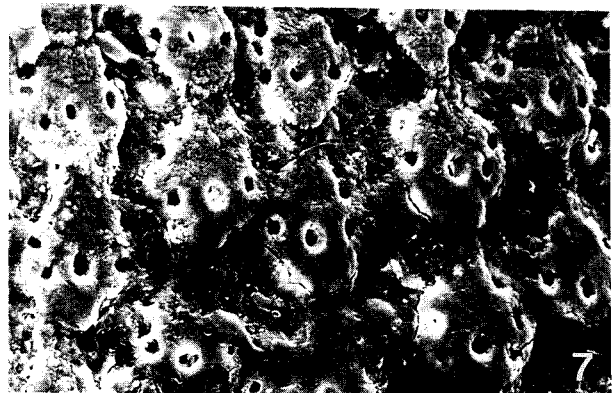
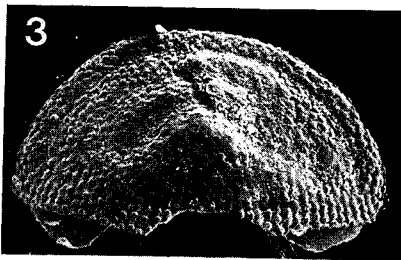
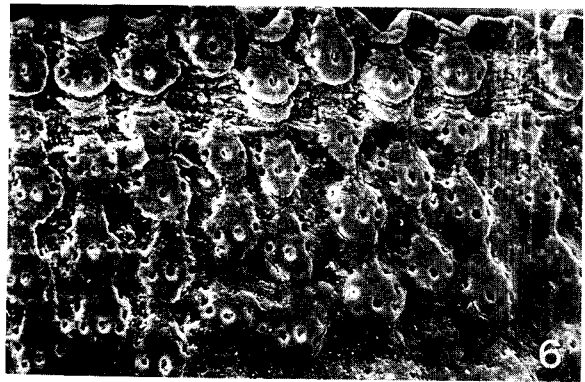
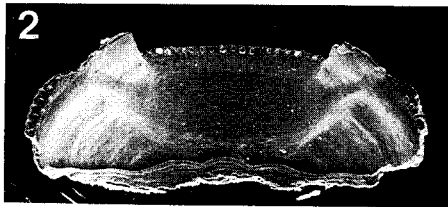
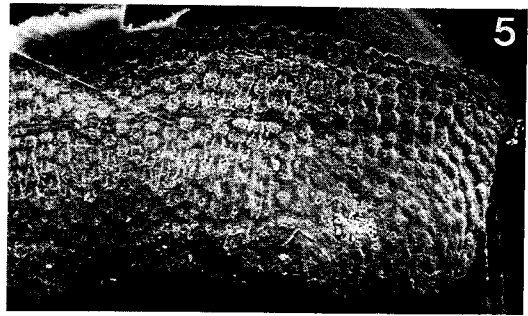
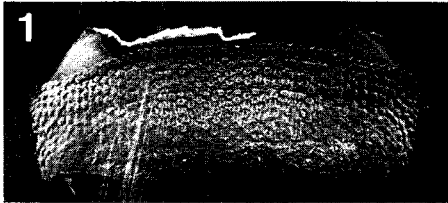
- Figs. 1-3.** *Placiphorella stimpsoni*, close-up view of radula.

## P L A T E 1

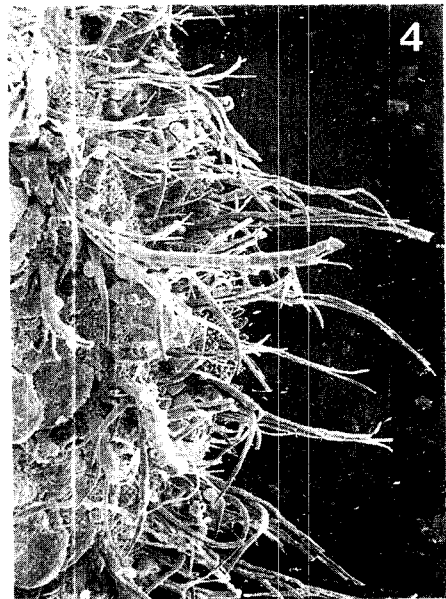
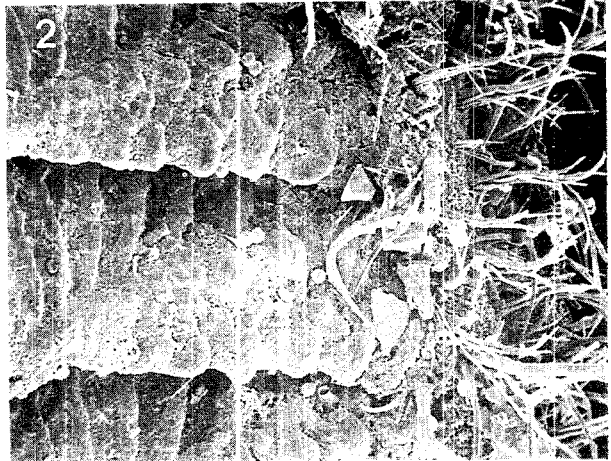
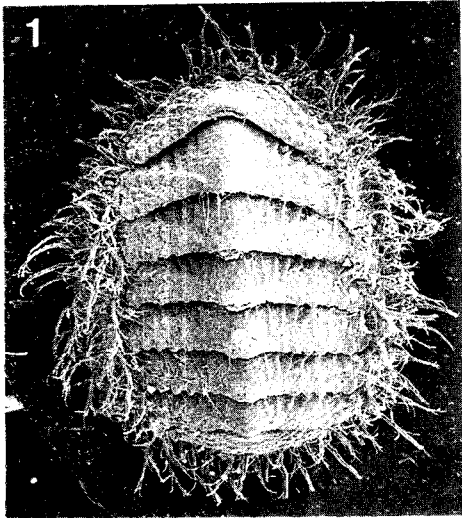




## PLATE 2



## P L A T E 3



## PLATE 4

