

REPORT OF THE BIOLOGICAL SURVEY OF MUTSU BAY  
(27) NUDIBRANCHIA OF MUTSU BAY<sup>1)</sup>

By

KIKUTARÔ BABA

*The Amakusa Marine Biological Laboratory of the Kyûshû Imperial University.  
Tomioka-machi, Kumamoto-ken*

(With Plates V-VII and 17 text-figures)

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I. INTRODUCTION

The Nudibranchiate mollusks dealt with in this paper are the collection of the biological survey of Mutsu Bay carried out by the Tôhoku Imperial University. They comprise 19 species, of which 2 make a new record of habitat in our territory.

The following is a list of the species identified.

Nudibranchia

Tribe Holohepatica (=Doridacea)

Family Polyceridae

Subfamily Polycerinae

1. *Plocamophorus tilesii* BERGH, 1877
2. *Gymnodoris japonica* (BABA, 1930)

Subfamily Goniodoridinae

3. *Goniodoris* sp.
4. *Drepania japonica* nov. sp.

Family Dorididae

Subfamily Glossodoridinae

5. *Glossodoris festiva* (ADAMS, 1861)
6. *Glossodoris pallescens* (BERGH, 1875)
7. *Glossodoris aureopurpurea* (COLLINGWOOD, 1881)
8. *Cadlina* sp.

Subfamily Thorunninae

9. *Rostanga muscula* (ABRAHAM, 1877)

<sup>1)</sup>Contribution from the Marine Biological Station, Asamushi, Aomori-Ken. No. 128.

## Subfamily Discodoridinae

- 10.
- Peltodoris mauritiana*
- BERGH, 1889

## Subfamily Homoeodoridinae

- 11.
- Homoeodoris japonica*
- BERGH, 1881

## Subfamily Dendrodoridinae

- 12.
- Dendrodoris (Dendrodoris) nigra*
- (STIMPSON, 1855), variety

## Tribe Cladohepatica (=Aeolidiacea)

## Family Arminidae

## Subfamily Armininae

- 13.
- Armina (Armina) japonica*
- (ELIOT, 1913)

- 14.
- Armina (Armina) comta*
- (BERGH, 1880)

## Family Flabellinidae

- 15.
- Coryphella athadona*
- BERGH, 1875

## Family Tergipedidae

- 16.
- Cuthona (Cuthona) bicolor*
- BERGH, 1904

- 17.
- Cuthona (Hervia) ceylonica*
- (FARRAN, 1905)

- 18.
- Cuthona (Hervia) quadrilineata*
- (BABA, 1930), variety

- 19.
- Cuthona (Cuthona) sp.*

Though the Nudibranch fauna in Mutsu Bay consists mainly of tropical and temperate species, yet there is one form that is related to colder waters.

*Glossodoris pallescens* (BERGH), *Glossodoris aureopurpurea* (COLLINGWOOD), *Peltodoris mauritiana* BERGH, *Dendrodoris nigra* (STIMPSON) and *Cuthona ceylonica* (FARRAN) are tropical forms distributed in the Indian and Pacific Oceans.

*Plocamophorus tilesii* BERGH, *Gymnodoris japonica* (BABA), *Glossodoris festiva* (ADAMS), *Armina japonica* (ELIOT), *Armina comta* (BERGH) and *Cuthona bicolor* BERGH are temperate forms found in the warm waters of Japan.

*Coryphella athadona* BERGH is found in the colder seas bordering Japan.

It is not only a duty but a pleasure to offer my sincere acknowledgment to Dr. SANJI HÔZAWA, Professor of the Tôhoku Imperial University, for his kindness in placing the materials at my disposal for study.

## II. DESCRIPTIONS OF THE SPECIES

1. *Plocamophorus tilesii* BERGH, 1877

(Pl. V, figs. 1-2; text-fig. 1)

*Plocamophorus tilesii* BERGH, Malac. Unters., bk. 11, 1877, pp. 433-439, pl. 52, figs. 17-

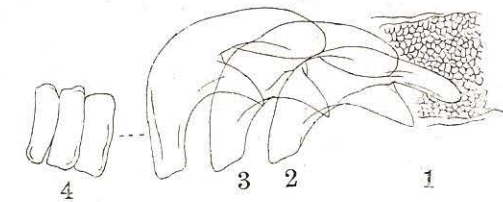
27; pl. 53, figs. 1-4.—Nagasaki; BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 29, 1879, pp. 641-647, pl. 14, figs. 11-24.—Southern Japan; ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, p. 30.—Misaki and elsewhere; BABA, Venus, vol. 2, no. 1, 1930, pp. 5-7, figs. 1, 3.—Tateyama.

*Plocamophorus tilesii* BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, p. 167.—Tomioka.

*Distribution in Japan:* Nagasaki, Tomioka, Toba, Misaki, Tateyama and Mutsu Bay.

The largest animal in life is about 120 mm long (pl. V, figs. 1-2); the head is anteriorly expanded to form a well-developed semicircular frontal veil, the free margin of which is fringed with a large number of branched papillae. The rhinophores are on the frontal veil, retractile into sheaths, and perfoliated at the upper portions. There are 3 pairs of remarkable processes on the dorso-lateral ridges; the 1st pair is the smallest and the 3rd pair the largest. The 2nd and 3rd pairs are often accompanied by semiglobular appendages on their tops. The surface of the frontal veil as well as of the back is nearly smooth, but small, conical and branched papillae are found scattered on the lateral sides of the body. The mouth is on the ventral side of the frontal veil and is provided, on either side, with a large lobe-like tentacle; the anterior end of the foot is truncated and divided by a transverse groove into an upper and a lower lip.

The ground-colour of the body is clear yellowish white; the upper surface is covered with cloud-like chocolate figures, in addition to deep chocolate and chrome-yellow mottles. The rhinophores and branchial plumes are tinged with chocolate.



Text-fig. 1.—*Plocamophorus tilesii* BERGH. Radula ( $\times 80$ ); 1. rachis, 2. 1st lateral tooth, 3. 2nd lateral tooth, 4. outermost lateral teeth.

The labial disk is armed with a pair of triangular jaw-plates. The radula formula is about  $60 \times 25.18.0.18.25$  (text-fig. 1); the inner (18) teeth are large, curved, with a prominent spine below the respective main cusp; the outer (25) teeth are all small, degraded and plate-like; the rachis is very wide, transversely grooved and the surface has irregular reticulations.

*Localities:* Yu-no-shima (May-July 1926; 3 specimens), Gomi-shima (September 1926; 7 specimens).

BERGH (1879) has given full accounts of *Plocamophorus tilesii* BERGH

collected in southern Japan, accounts which in general apply to our specimens.

## 2. *Gymnodoris japonica* (BABA, 1930)

(Pl. V, fig. 3; text-fig. 2)

*Trevelyana japonica* BABA, Venus, vol. 2, no. 2, 1930, pp. 46-47, pl. 2, figs. 8-10.—E-no-shima.

*Gymnodoris japonica* BABA, Annot. Zool. Japon., vol. 14, no. 2, 1933, p. 275.—Tomioka.

*Distribution in Japan*: Tomioka, Toba, E-no-shima and Mutsu Bay.

The body is soft and limaciform, and measures about 35 mm in length in the living state (pl. V, fig. 3). The head is slightly expanded to form a quadrate veil, the free margin of which is provided with conical papillae. The rhinophores are perfoliated at the upper portions and are retractile into sheaths. The branchial plumes are about 12 in number, arranged in a semicircle open behind, and non-retractile into a pocket; the anus is in the centre of this semicircle. The back and sides appear to be smooth, but a closer examination reveals that the surfaces are sparsely covered with small conical tubercles. There is a series of conical tubercles on the dorso-lateral ridges. The genital opening is situated obliquely in front of the branchial semicircle on the right side, and the mouth is guarded by lobe-like labial tentacles.

The upper side of the body is spotted with orange on a translucent pale yellow ground-colour. The upper portions of the rhinophores are tinged with orange and the branchial plumes are veined with the same colour. The sole is uniformly pale yellow.

The radula formula is about  $25 \times 30.0.30$ . The 1st lateral tooth is very large, hamate and smooth; the 2nd lateral tooth is much smaller in size and is provided with a very small side-denticle near the base of the main cusp; the succeeding teeth are all smooth and awl-shaped, and decrease in size towards the outside.

*Localities*: Between Yu-no-shima and Asamushi (August 1926; 1 specimen), Neighbourhood of the Station (July 1927; 1 specimen).

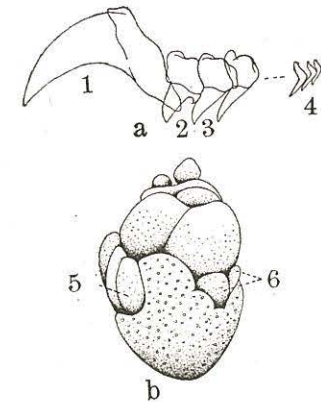
*Gymnodoris citrina* (BERGH, Malac. Unters., bk. 11, 1877, pp. 442-443, pl. 41, fig. 5; pl. 56, figs. 18-25.—Pelew Islands) is an animal that is 11 mm long and yellowish, with ochre-yellow spots on the dorsal surface. Its radula is very like that of the present species, but differs in having no side-denticle on the 2nd lateral tooth.

*Gymnodoris kouaouae* (RISBEC, Faune Colon. Franç., vol. 2, 1928, p. 184, pl. 7, fig. 3; text-fig. 56.—New Caledonia) is 20 mm long, brown

with deep red spots. It differs entirely from the present species in the form of the radula.

*Gymnodoris japonica* (BABA) was first proposed for a specimen from E-no-shima. It is about 37 mm long and is deep yellow, with orange spots on the dorsal surface. The branchial plumes are torn off leaving 4 anterior ones. The radula formula is about  $26 \times 38(-42).0.38(-42)$  and the hermaphrodite glands are separated into 2 groups, each group being formed of 2 lobes.

The specimens collected at Toba (August 1931) differ from the above-said original specimen in the coloration of the body. The back is spotted with yellow on a pure white ground-colour; the perfoliations of the rhinophores are olive-yellow and the branchial plumes (about 9 in number) are tinged with yellow at the top. The radula formula is about  $32 \times 32.0.32$  (text-fig. 2, a); the main characters of the teeth are as in the original specimen. The hermaphrodite glands are separated into 2 groups (text-fig. 2, b); the group at the right side being formed of 3, and that at the left of 2 lobes. A specimen of similar coloration was found at Tomioka in June 1932.



Text-fig. 2.—*Gymnodoris japonica* (BABA). Toba specimen. a. Radula ( $\times 100$ ); 1. 1st lateral tooth, 2. 2nd lateral tooth, 3. 3rd lateral tooth, 4. outermost lateral teeth. b. Ventral view of the visceral organs ( $\times 1.5$ ); 5. right hermaphrodite glands, 6. left hermaphrodite glands.

## 3. *Goniodoris* sp.

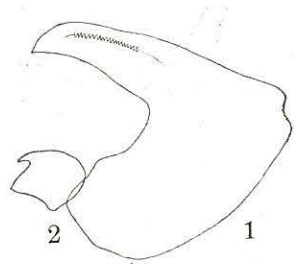
(Pl. VII, fig. 2; text-fig. 3)

*Distribution in Japan*: Mutsu Bay.

The body is rather small and about 20 mm in length (pl. VII, fig. 2). The mantle is indistinctly carinated in the mid-dorsal line; its margin is rather ample and reflected upwards all round excepting behind, where it is notched. The rhinophores are not provided with sheaths; the non-retractile branchial plumes, 8 in number, are arranged round the anus. The head forms a pair of horn-like tentacles and the tail has a mid-dorsal crest. The back and sides of the body are almost smooth, and conical tubercles are nowhere visible. The anterior end of the foot is

rounded, with a clear transverse groove.

The coloured drawing represents a *Goniodorid* that is yellowish with a trace of chocolate brown on the back.



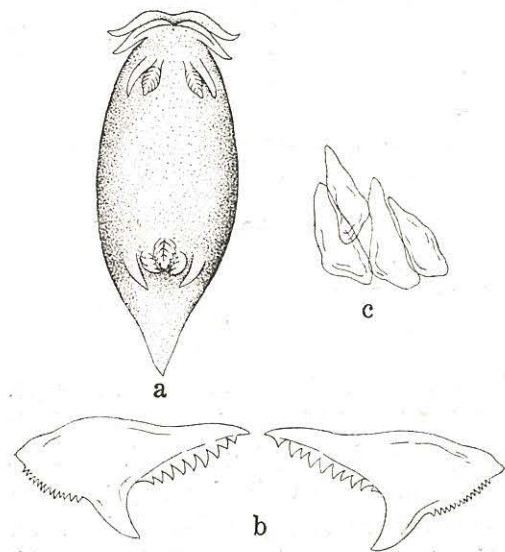
Text-fig. 3.—*Goniodoris* sp. Radula ( $\times 180$ ); 1. inner lateral tooth, 2. outer lateral tooth.

The radula formula is  $35 \times 1.1.0.1.1$  (text-fig. 3); the inner lateral tooth is very large, hamate and with a series of minute denticles on the blade; and the outer lateral tooth is much smaller, scale-like with a curved apical spine.

*Locality*: Neighbourhood of the Station (August 1927; 1 specimen).

This specimen resembles *Goniodoris castanea* ALDER and HANCOCK in the form of the teeth, and differs from it mainly in having no conical tubercles on the sides of the body.

As the present specimen is not well preserved, a further observation on coloration and form of the body is desirable for a satisfactory identification.



Text-fig. 4.—*Drepania japonica* nov. sp. a. Dorsal view of a preserved specimen ( $\times 3$ ). b. Radula ( $\times 180$ ); c. Elements of the labial armature ( $\times 250$ ).

#### 4. *Drepania japonica* nov. sp. (Text-fig. 4)

*Distribution in Japan*:  
Mutsu Bay.

The ashy animals in the preserved and contracted state measure about 10 mm in length, but they may attain 20 mm in the living condition (text-fig. 4, a). The rhinophores are perfoliated, non-retractile into sheaths and guarded by horn-like exo-basal processes. The branchiae are trifoliate, simply pinnate and non-retractile into a pocket; a single horn-like exo-branchial

process lies on either side of the branchiae. The antero-lateral corners of the head are produced into 2 horn-like processes. The back and sides are all smooth; the foot is narrow and bears a pointed process at each antero-lateral corner.

There is a pair of labial armatures; the elements are small and spine-like in formation (text-fig. 4, c). The radula formula is about  $30 \times 1.0.1$  (text-fig. 4, b); the tooth is triangular with a curved median cusp on the upper side. Its inner edge bears a series of rather large denticles and the outer edge is finely serrulated.

*Locality*: Off Okidate (September 1926; 5 specimens).

The following 3 *Drepanids* have previously been described:

- 1) *Drepania fusca* LAFONT (Jour. Conchyl. Paris, vol. 22, 1874, pp. 369–370.—Arcachon; CUÉNOT, Bull. Stat. Biol. Arcachon, vol. 24, 1927, p. 266, fig. 1—Arcachon).
- 2) *Drepania graeffei* BERGH (Verh. k. k. zool.-bot. Gesell. Wien, vol. 30, 1880, pp. 636–638, pl. 10, figs. 10–15.—Trieste; IHERING, Malak. Blätt., vol. 8, 1886, p. 37.—Naples). syn. *Drepania tartanella* IHERING (ibid., 1886, pp. 37–39, pl. 1, fig. 2; pl. 2, figs. 8–9.—Naples).
- 3) *Drepania velox* (COCKERELL, Jour. Malac., vol. 8, no. 3, 1901, p. 87.—La Jolla; MACFARLAND, Proc. Calif. Acad. Sci., ser. 4, vol. 18, no. 15, 1929, pp. 485–496, pl. 35, figs. 1–15.—La Jolla).

The present species is distinguished from the Mediterranean and Pacific species mentioned above in the form of the radula.

*Drepania fusca* LAFONT is 15–22 mm in length, grayish brown and spotted with white; the horn-like processes, rhinophores and branchiae are all yellow-tinted. The jaws and radula are unknown (LAFONT, 1874).

*Drepania graeffei* BERGH is diagnosed as follows: The living specimen measures 7 mm in length; the upper side of the body is rose-red and sprinkled with blackish brown mottles. The horn-like processes on the lateral sides of the rhinophores and of the branchiae are tinged with rose colour. The anterior edges of the jaw-plates have spines. The radula formula is  $51 \times 1.0.1$ ; the tooth is saw-like and has 22–24 denticles on one margin (BERGH, 1880).

*Drepania tartanella* IHERING is characterized as follows: The body is 7 mm long and whitish; the rhinophores, branchiae, tail and horn-like processes are all tinged with yellow. The jaw-plates are formed of irregular spines; the radula is much as in *Drepania graeffei* BERGH (IHERING, 1886).

*Drepania velox* (COCKERELL) is about 16 mm long, gray with 5 black

longitudinal streaks on the back. The rhinophores, branchiae and horn-like processes are tinged with orange on the upper portions. The jaw-plates are formed of short pointed spines. The radula formula is  $24 \times 1.0.1$ ; the tooth is convex in front and provided with 8–11, irregular, sharp denticles on one side of a prominent cusp (MACFARLAND, 1929).

5. *Glossodoris festiva* (ADAMS, 1861)

(Pl. VI, fig. 1; text-fig. 5)

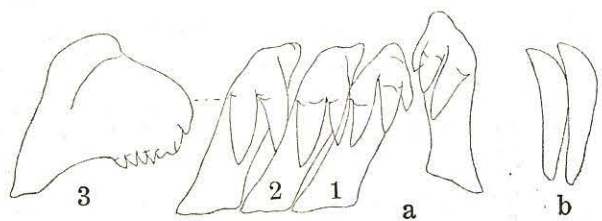
*Doriprismatica festiva* ADAMS, Ann. Mag. Nat. Hist., ser. 3, vol. 8, 1861, p. 140.—Tsu-shima.

*Chromodoris marenzelleri* BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 31, 1881, pp. 3(219)–6(222), pl. 6, figs. 1–10.—Nagasaki; FUJITA, Dōbutsugaku Zasshi, vol. 5, no. 53, 1893, pp. 95–96, fig. 1.—Misaki; ELIOT, Jour. Coll. Sci. Imp. Univ. Tōkyō, vol. 35, art. 1, 1913, p. 29, pl. 2, fig. 9.—Misaki; HIRASÉ, Mollusca, 1927, p. 1471, fig. 2829.—Nagasaki, Misaki.

*Glossodoris marenzelleri* BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, pp. 168–169.—Tomioka.

*Distribution in Japan*: Nagasaki, Tomioka, Tsu-shima, Toba, Misaki, Tateyama and Mutsu Bay.

The body in the living state is about 30 mm long (pl. VI, fig. 1). The rhinophores are perfoliated at the upper portions and retractile into sheaths, the margins of which are entire. The branchiae are about 12 in number, simply pinnate and arranged in a semicircle open behind. The anal papilla is in the centre of the branchial semicircle and the genital opening is found on the antero-lateral (right) side of the body. There is a pair of digitate oral tentacles on the lateral sides of the mouth; the foot is narrow and with a transverse groove anteriorly.



Text-fig. 5.—*Glossodoris festiva* (ADAMS). a. Radula ( $\times 550$ ); 1. 1st lateral tooth, 2. 2nd lateral tooth, 3. outermost lateral tooth. b. Elements of the labial armature ( $\times 550$ ).

The ground-colour of the body is deep blue; the mantle above bears 1 median yellow streak running down from between the rhinophores to

the base of the branchiae, in addition to 2 lateral discontinuous lines of the same colour. The free margin of the mantle is tinged with yellow. The perfoliated portions of the rhinophores are orange; the branchial plumes are orange outside and pale inside. There are also broken yellow lines on the dorsal side of the foot.

The elements of the labial armature are rod-like, bent and simple (text-fig. 5, b). The radula formula is  $60 \times 80.0.80$  (text-fig. 5, a); the 1st lateral tooth is provided with 3 cusps at the top, the succeeding teeth have 2 large cusps each and the outer teeth are all jagged at the edges.

*Locality*: Benten-shima (August 1926; 1 specimen).

This species is wide-spread in Japanese waters and individuals with various markings are frequent. Several specimens from Misaki (June 1929) have black mottles in addition to the coloration mentioned above. A specimen obtained at Tomioka (January 1935) is deep blue excepting a yellow border and a median yellow streak. The rhinophores and branchial plumes are orange-tinted and the foot is uniformly deep blue without markings.

BERGH (1881) has given an accurate description of a specimen from Nagasaki and established a new name, *Chromodoris marenzelleri*. His specimen preserved in alcohol measures 13 mm in length; the mantle above is blue-green and the border, median streak and lateral broken lines are all whitish in colour. The branchiae are formed of 11 simply pinnate plumes; the elements of the labial armature are not bifid at the ends. The radula is  $73 \times 80(76).0.80(76)$ ; the 1st lateral tooth is bicuspid with an inner accessory spine, the succeeding teeth are all bicuspid and the outermost teeth have denticulated edges (BERGH, 1881).

The same name has been adopted by many authorities, but I think it is identical with *Doriprismatica festiva* ADAMS. ADAMS' specimen was collected at Tsu-shima, about 200 kilometres north of Nagasaki. It is flat; the mantle is ultramarine-blue and bordered with yellow. The mid-dorsal streak, 2 lateral rows of 6 maculae, rhinophores and branchial plumes are all of a yellow colour. The foot is ultramarine-blue and ornamented, on both sides, with 5 oblong whitish maculae (ADAMS, 1861).

*Glossodoris gracilis* (DELLE CHIAJE, Memorie, vol. 1, 1823, pl. 104, figs. 22–23.—Naples; VON IHERING, Malak. Blätt., vol. 2, 1880, pp. 11–15, pl. 1, fig. 3; pl. 2, figs. 1–3.—Naples) resembles *Glossodoris festiva* (ADAMS) in the coloration of the body, but differs from it greatly in the following points: (1) the rods of the labial armature are bifid at the

ends; (2) the lateral teeth of the radula have each 2 cusps in addition to a row of several denticles.

*Glossodoris festiva* (ADAMS, 1861) claims priority to *Glossodoris festiva* (ANGAS, Jour. Conchyl. Paris, vol. 12, 1864, pp. 53-54, pl. 4, fig. 12.—Port Jackson).

#### 6. *Glossodoris pallescens* (BERGH, 1875)

(Pl. VI, fig. 4; text-fig. 6)

*Chromodoris pallescens* BERGH, Jour. Mus. Godeffroy, bk. 8, 1875, pp. 81-82, pl. 7, fig. 4; pl. 9, figs. 11-18.—Tahiti; ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, pp. 28-29, pl. 2, fig. 8.—Misaki, Tsu-shima; HIRASÉ, Mollusca, 1927, p. 1470, fig. 2828.—Misaki, Tsu-shima.

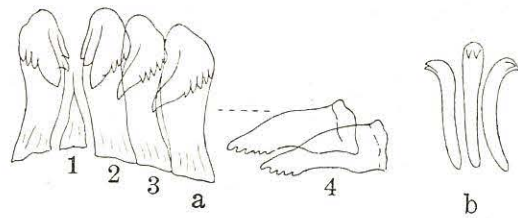
*Chromodoris* sp. FUJITA, Dôbutsugaku Zasshi, vol. 5, no. 53, 1893, pp. 96-98, fig. 2.—Misaki.

*Glossodoris pallescens* BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, p. 169.—Tomioka.

*Distribution in Japan*: Tsu-shima, Tomioka, Misaki and Mutsu Bay.

The size of the body in life is about 40 mm in length by 15 mm in width (pl. VI, fig. 4). The rhinophores are retractile into sheaths and their upper portions are obliquely perfoliated. The branchial plumes are about 10 in number, simply pinnate and arranged in a semicircle open behind, the hindmost ones being subdivided into 3-4 branches. The branchiae are retractile into a sheath and the anal papilla is situated in the centre of the branchial semicircle. There is a small digitate oral tentacle on either side of the mouth.

The upper surface of the mantle bears dark chocolate mottles on a yellowish white background; these mottles are unequal in size, oval or rounded and vary from 12 to 14 in number. The mantle-border, rhinophores and branchial plumes are tinged with yellow; the lateral sides of the body are yellowish white with a moderate number of dark chocolate mottles.



Text-fig. 6.—*Glossodoris pallescens* (BERGH). a. Radula ( $\times 300$ ); 1. rachis, 2. 1st lateral tooth, 3. 2nd lateral tooth, 4. outermost lateral teeth. b. Elements of the labial armature ( $\times 400$ ).

is about  $85 \times 55.0.55$  (text-fig. 6, a); the rachidian plate is small and

The elements of the labial armature are bent and bifid at the ends (text-fig. 6, b). The radula formula

triangular in shape, the 1st lateral tooth has 2-3 denticles on each side of the median cusp, the succeeding teeth carry 6-7 denticles and the outermost, several in number, are small with jagged edges.

*Localities*: Moura-shima (August 1926; 1 specimen); Obi-shima (June 1929; 1 specimen).

The Japanese Glossodorids with the above-mentioned characters are identified by ELIOT (1913) with *Glossodoris pallescens* (BERGH), a species established by BERGH (1875) on one specimen from Tahiti. It is about 15 mm in length, whitish and covered with violet mottles on the back; these mottles are areolated with brown-yellow. The mantle-margin, rhinophores and branchial plumes (8 in number) are all tinged with orange. The elements of the labial armature are curved and bifid at the ends. The radula formula is  $56 \times 31.0.31$ ; the 1st lateral tooth has 2 denticles on both sides, the succeeding teeth have 5-7 denticles on the outer edges and the several outermost teeth are provided with 5-7 denticles each.

#### 7. *Glossodoris aureopurpurea* (COLLINGWOOD, 1881)

(Pl. V, fig. 4; text-fig. 7)

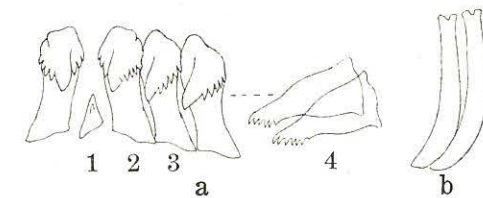
*Chromodoris aureopurpurea* COLLINGWOOD, Trans. Linn. Soc. London, Zool., vol. 2, 1881, pp. 129-130, pl. 9, figs. 18-22.—Slut Island (China).

*Chromodoris aureopurpurea* var? FUJITA, Dôbutsugaku Zasshi, vol. 5, no. 55, 1893, pp. 164-165, fig. 4.—Misaki.

*Distribution in Japan*: Toba, Misaki and Mutsu Bay.

The body is 20-35 mm in length (pl. V, fig. 4); the rhinophores are perfoliated at the upper portions and retractile into sheaths. The branchiae are formed of about 11, simply pinnate plumes which are arranged round the anus. The mouth bears a small labial tentacle on either side; the anterior portion of the foot is rounded and transversely grooved.

The upper surface of the mantle is yellowish white and covered with a large number of chrome-yellow spots; there is also a series of clear purple mottles arranged inside the mantle-border. The rhinophores and brachial plumes



Text-fig. 7.—*Glossodoris aureopurpurea* (COLLINGWOOD). a. Radula ( $\times 300$ ); 1. rachis, 2. 1st lateral tooth, 3. 2nd lateral tooth, 4. outermost lateral teeth. b. Elements of the labial armature ( $\times 400$ ).

are tinged with clear purple.

The labial armature is formed of bent rods, the ends of which are bifid (text-fig. 7, b). The radula formula is about  $48 \times 45.0.45$  (text-fig. 7, a); the rachidian plate is small and triangular, the 1st lateral tooth has 4 denticles on each side, the succeeding teeth have 5-8 denticles and the outermost teeth are jagged at the edges.

*Locality*: Neighbourhood of the Station (August 1927; 2 specimens).

*Glossodoris aureopurpurea* (COLLINGWOOD) was first established on 2 specimens, about 33 mm in length. The upper surface is of a general yellow tinge and covered with small irregular blotches of bright yellow. The mantle bears an irregular row of deep violet-shaded spots running all around upon the faint edging of violet. The rhinophores and branchial plumes (10, arranged in a small double ring) are all violet-tinted (COLLINGWOOD, 1881).

In my opinion the specimens in hand are to be identified with the above-said species which differs, in some points of body-coloration, from the following species.

- 1) *Glossodoris rufomaculata* (PEASE, Amer. Jour. Conch., vol. 7, pt. 1, 1871, p. 17, pl. 8, fig. 1.—Huaheine).
- 2) *Glossodoris tryoni* (GARRETT, Proc. Acad. Nat. Sci. Philadelphia, 1873, p. 232, pl. 4.—Society Islands; BERGH, Malac. Unters., bk. 11, 1877, pp. 490-492, pl. 54, figs. 1-4.—Tahiti).

*Glossodoris rufomaculata* (PEASE) is creamy white and has numerous, slightly elevated orange dots on the back. The mantle-margin is ornamented with a series of oblong violet spots; the rhinophores are chocolate with white laminae and the branchiae are formed of 9 colourless plumes (PEASE, 1871).

*Glossodoris tryoni* (GARRETT) is said to be 70 mm long, creamy white on the mantle above and studded with spots that are deep black ocelli surrounded by white. The mantle-margin is violet; the umber or tawny flesh-coloured branchial plumes and rhinophores are tipped with violet (GARRETT, 1873).

#### 8. *Cadlina* sp. (Text-fig. 8)

The ashy animal in the preserved state is about 10 mm long, depressed and oblong in outline (text-fig. 8, a). The whole upper surface of the mantle is covered with small rounded granules which do not coalesce into folds. The sheath of the rhinophore and of the branchiae is guard-

ed by small granules set along the aperture. The upper portions of the rhinophores are perfoliated and the branchiae are formed of several plumes arranged round the anal papilla. The under surface of the mantle and the sole of the foot are smooth; a pair of short swollen oral tentacles is present immediately in front of the foot.

The elements of the labial armature are rod-like, curved and bifid at the ends (text-fig. 8, c). The radula formula is about  $35 \times 40.1.40$  (text-fig. 8, b); the central tooth is small and triangular and bears several denticles on the top. The 1st lateral tooth is hamate and provided with denticles on both sides of the main cusp; the succeeding teeth are hamate with 4-5 denticles on the outer sides and the outermost ones are jagged at the edges.

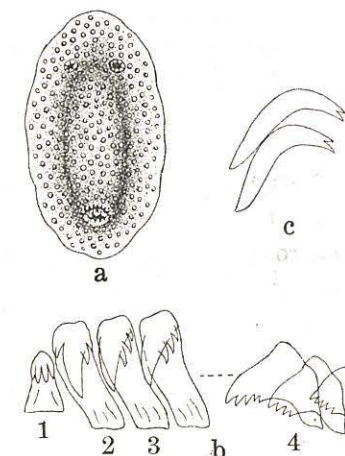
*Locality*: Gomi-shima (March 1927; 1 specimen).

The present specimen differs from the following Pacific species in every character whether external or internal, but more observation in the living state is desirable before it is regarded as a distinct species.

- 1) *Cadlina* (or *Tyrinna*) sp. (ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, p. 21.—Ago Bay).
- 2) *Cadlina pacifica* BERGH (Proc. Acad. Nat. Sci. Philadelphia, 1879, pp. 176(120)-181(125), pl. 7, figs. 19-20; pl. 8, figs. 7-18.—Captain's Bay, Unalaska, Coal Harbour, Shumagin Islands).
- 3) *Cadlina marginata* MACFARLAND (Proc. Biol. Soc. Washington, vol. 18, 1905, p. 43.—Monterey Bay of California).
- 4) *Cadlina flavomaculata* MACFARLAND (ibid., 1905, pp. 43-44.—Monterey Bay).

#### 9. *Rostang muscula* (ABRAHAM, 1877) (Pl. VII, fig. 4; text-fig. 9)

*Doris muscula* ABRAHAM, Proc. Zool. Soc. London, 1877, p. 256, pl. 29, figs. 6-7.—New Zealand.



Text-fig. 8.—*Cadlina* sp. a. Dorsal view of a preserved specimen ( $\times 3$ ). b. Radula ( $\times 180$ ); 1. rachis, 2. 1st lateral tooth, 3. 2nd lateral tooth, 4. outermost lateral teeth. c. Elements of the labial armature ( $\times 300$ ).

*Rostanga muscula* ELIOT, Proc. Malac. Soc. London, vol. 7, 1907, pp. 339-341, pl. 28, fig. 3.—New Zealand; ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, p. 20. Misaki; SUTER, Manu. New Zeal. Moll., 1913, pp. 566-567, p. 23, fig. 23, a-d.—New Zealand; BABA, Annot. Zool. Japon., vol. 14, no. 2, 1933, p. 277.—Tomioka.

*Doris rubicunda* CHEESEMAN, Trans. Inst. New Zeal., vol. 13, 1881, p. 222.—Auckland Harbour.

*Rostanga pulchra* MACFARLAND, Proc. Biol. Soc. Washington, vol. 18, 1905, pp. 40-41.—Monterey Bay; O'DONOGHUE, Jour. Ent. Zool. Claremont, vol. 19, 1927, p. 83, pl. 1, figs. 10-12.—Laguana Beach (California).

*Distribution in Japan:* Tomioka, Misaki and Mutsu Bay.

The animal in the living state is of a uniform orange, elongated, depressed and about 12 mm long by 6 mm broad. Its mantle above is spinigerous, and covered on the whole surface with closely-set, very fine granules. The rhinophores are perfoliated at the upper portions and retractile into sheaths, the margins of which are guarded by granules. The branchiae are formed of several plumes which are simply pinnate and arranged round the anus. The branchial opening is rounded in outline and the edge is covered with very fine granules. The under side of the body is smooth; the mouth is provided with a pair of finger-like labial tentacles. The anterior edge of the foot has a transverse groove and the upper lip is notched in the middle line.

The labial armatures are formed of simple rods which are combined into bands. The radula formula is  $50 \times 50.0.50$ ; the 1st lateral tooth has a series of minute denticles at the edge, the succeeding teeth are all hamate with no denticles and the 20 outermost are slender, thin and splitted at the ends.

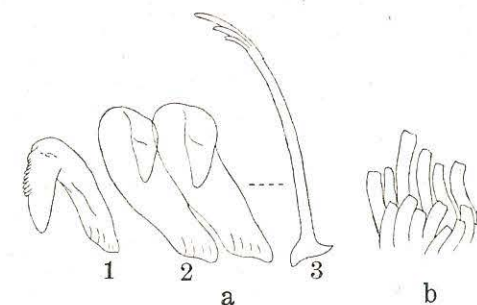
*Locality:* Takaiso-zaki (August 1927; 1 specimen).

ELIOT (1907, 1913) states that the labial armature in his specimens is indistinct and bears granules which are not collected into a plate. But I am convinced of the presence of the labial armatures as described above.

My observation on the radula agrees with that of ELIOT (1913); he says that the radula formula in his specimen from Misaki does not exceed  $33 \times 51.0.51$ . The 1st lateral tooth next to the rachis is hamate and bears 20-30 denticles. Then follow about 30 teeth without denticles, hamate but gradually becoming more erect. The last 15 or 20 teeth towards the end of the row are long, erect, thin and split at the top into 2-4 long brush-like denticles. This description agrees also with that of *Rostanga muscula* (ABRAHAM) from New Zealand (see ELIOT, 1907).

A living specimen which is identifiable with *Rostanga muscula* (ABRA-

HAM) was collected at Tomioka in February 1935 (pl. VII, fig. 4). It is about 20 mm long by 9 mm broad and orange-yellow with dark mottles on the back. The labial disk has a pair of crescentic bands which are made up of irregular rods (text-fig. 9, b). The radula formula is about  $50 \times 70.0.70$  (text-fig. 9, a); the 1st lateral tooth has a series of (15) denticles on the inner edge, the 45 succeeding teeth are hamate and simple, and the 25 outer teeth are spatulate with split ends.



Text-fig. 9.—*Rostanga muscula* (ABRAHAM). Tomioka specimen. a. Radula ( $\times 250$ ); 1. 1st lateral tooth, 2. 2nd lateral tooth, 3. outermost lateral tooth. b. Elements of the labial armature ( $\times 250$ ).

	<i>Rostanga muscula</i> (ELIOT, 1907)	<i>Rostanga pulchra</i> (MACFARLAND, 1905)	<i>Rostanga rubicunda</i> (CHEESEMAN, 1881)
Body length	13 mm.	18 mm.	—
Coloration of the back	Grayish with an indistinct brownish longitudinal band (dead specimen).	Bright red (varying from light yellowish red to deep scarlet), spotted with brown and black.	Bright scarlet, sometimes with a median darker line or a few black specks.
Back	Covered with minute cylindrical tubercles.	Closely papillated.	Closely tuberculated.
Branchiae	9, simple or bipinnate.	10-12.	8, bipinnate.
Oral tentacles	Linear.	Slender and tapering.	Linear.
Labial cuticle	With small granules or columns which are not arranged in a plate.	With crescentic bands, the elements of which are arranged in 5 rows.	—
Radula	$69 \times 82.0.82$ ; 1st lateral tooth provided with (30 or more) fine denticles; succeeding inner teeth hamate, smooth; outer ones pectinated at the ends.	$65-68 \times 81.0.81$ ; 1st lateral tooth hamate with (8-11) denticles; succeeding inner teeth hamate, smooth; outer ones divided into (1-6) very long denticles.	—



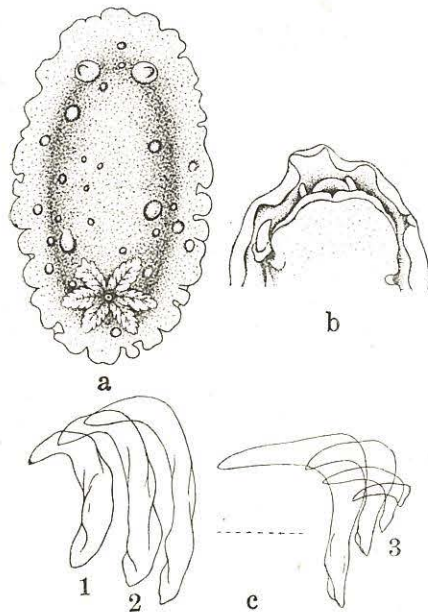
10. *Peltodoris mauritiana* BERGH, 1889

(Text-fig. 10)

*Peltodoris mauritiana* BERGH, Malac. Unters., bk. 16, pt. 2, 1889, pp. 815-817.—Mauritius; ELIOT, Trans. Linn. Soc. London, Zool., vol. 13, 1910, p. 420.—Salmon (Indian Ocean).

*Distribution in Japan*: Mutsu Bay.

The body is elliptical, very convex dorsally and soft in texture and measures 30-40 in length when preserved (text-fig. 10, a). The upper portions of the rhinophores are perfoliated and the margins of the rhinophore-sheaths are elevated. Around the anus are 6 branchial plumes, much divided and retractile into a large rounded pocket, the margin of which is elevated and 6-lobed. The back appears to be nearly smooth, but under a lens it is found to be covered with very fine granules. There



Text-fig. 10.—*Peltodoris mauritiana* BERGH. a. Dorsal view of a preserved specimen (natural size). b. Ventral view of the mouth and foot. c. Radula ( $\times 95$ ); 1. 1st lateral tooth, 2. 2nd lateral tooth, 3. outermost lateral teeth.

is a finger-like labial tentacle on either side of the mouth (text-fig. 10, b); the foot at its anterior end is transversely grooved and the upper lip is notched in the middle line.

The colour of the body after preservation is gray with several dark brown mottles on the back.

There is a cuticular labial disk in the pharynx. The radula formula is  $15 \times 35.0.35$  (text-fig. 10, c); the teeth are all hamate and smooth, and grow large as they approach the middle of the half-rows.

*Localities*: Asamushi (February 1921; 1 specimen); Neighbourhood of the Station (May 1926, 5 specimens).

Our specimens are identified with *Peltodoris mauritiana* BERGH which was established on a specimen from Mauritius. It is about

20 mm long by 15 mm broad in the dead condition; the colour of the finely granulated back is pale yellow with large ashy gray mottles. The

branchial opening is star-like in outline; the branchial plumes, 6 in number, are tripinnate. The teeth of the radula are simply hamate as in *Peltodoris atromaculata* BERGH and are arranged in a formula  $23(-26) \times 34(-40).0.34(-40)$  (BERGH, 1889).

*Peltodoris atromaculata* BERGH (Mittlg. Zool. Stat. Neapel, bk. 2, no. 2, 1880, pp. 224-231, pl. 11, figs. 1-15.—Naples) differs from *Peltodoris mauritiana* BERGH in the coloration of the body; it is described to be milky white with black mottles on the back, sides and foot above.

11. *Homoeodoris japonica* BERGH, 1881

(Text-fig. 11)

*Homoeodoris japonica* BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 31, 1881, pp. 7 (223)-11(227), pl. 6, figs. 11-19; pl. 7, figs. 1-3.—Southern Japan.

*Doris (Homoeodoris) japonica* ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, pp. 4-5.—Tsu-shima, Yokohama, Misaki, etc.; HIRASÉ, Mollusca, 1927, p. 1469, fig. 2826.—Tsu-shima, In-no-shima, Yokohama, Misaki.

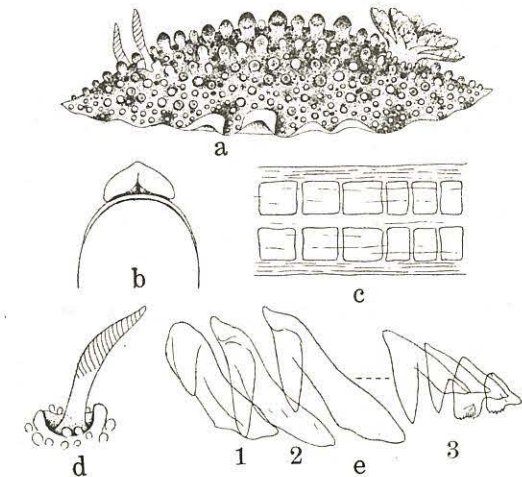
*Homoeodoris japonica* BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, p. 171.—Tomioka.

*Distribution in Japan*: Tomioka, Tsu-shima, In-no-shima, Misaki, Yokohama and Mutsu Bay.

The length of the dead specimens ranges from 40 to 70 mm.

*Locality*: Yu-no-shima (May 1926; 3 specimens).

Here follows an observation on a living animal captured at Tomioka (February 1935). It is about 55 mm long by 25 mm broad, spiculated and covered, on the mantle above, with many tubercles of various sizes, the larger ones being arranged mainly on the central region (text-fig. 11, a). The rhinophores are slender, perfoliated at the upper portions and retractile into sheaths. The opening of the rhino-



Text-fig. 11.—*Homoeodoris japonica* BERGH. Tomioka specimen. a. Lateral view (natural size). b. ventral view of the mouth and foot. c. Armatures of the vagina ( $\times 7$ ). d. Rhinophore with its sheath. e. Radula ( $\times 250$ ); 1. 1st lateral tooth, 2. 2nd lateral tooth, 3. outermost lateral teeth.

phore-sheath is guarded by 2 lateral valves in addition to several small tubercles (text-fig. 11, d). The branchial plumes are 7 in number, tri-pinnate and retractile into a large pocket, the margin of which is armed with small tubercles; the anal papilla lies immediately behind the branchiae. The oral tentacles are lobe-like in form and the anterior edge of the foot is divided by a transverse groove into an upper and a lower lip (text-fig. 11, b).

The upper side of the mantle is dark bluish yellow with cloud-like, irregular figures of a dark colour. The rhinophores are dark yellow and the branchial plumes are dark bluish yellow. The under side of the mantle looks bluish yellow and the sole of the foot is orange.

There is a cuticular labial disk in the pharynx. The radula is arranged in a formula  $38 \times 80.0.80$  (text-fig. 11, e); almost all of the lateral teeth are hamate and simple, but the outermost 2-3 teeth are small, degraded and jagged at the edges.

The vas deferens is a simple longish tube accompanied by a large prostate gland; the vagina, on the other hand, is armed with plate-like scales which are arranged in 2 parallel series (text-fig. 11, c).

12. *Dendrodoris (Dendrodoris) nigra* (STIMPSON, 1855), variety  
(Pl. VI, fig. 2; text-fig. 12)

*Doridopsis nigra* ELIOT, Proc. Zool. Soc. London, vol. 2, 1904, pp. 275-277.—East Africa; ELIOT, Jour. Linn. Soc. London, Zool., vol. 31, 1908, pp. 119-120.—Suez; ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, pp. 33-34, pl. 2, fig. 13.—Misaki; HIRASÉ, Mollusca, 1927, p. 1474, fig. 2835.

*Doridopsis nigra* var. *coerulea* BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 30, 1880, pp. 29(181)-32(184).—Southern Japan.

*Dendrodoris nigra* BARNARD, Ann. S. Afric. Mus., vol. 25, pt. 1, 1927, p. 188.—Mozambique; O'DONOGHUE, Proc. Malac. Soc. London, vol. 20, pt. 3, 1932, p. 163.—Gulf of Manaar (India); BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, p. 172.—Tomioka.

*Doridopsis indacus* TAPPARONE-CANEFRI, Zool. Viag. Magenta, 1874, pp. 114-115, pl. 1, fig. 16—Yokohama.

*Doridopsis arborescens* COLLINGWOOD, Trans. Linn. Soc. London, Zool., vol. 2, 1881, pp. 134-135, pl. 10, figs. 15-17.—Slut Island.

*Distribution in Japan:* Tomioka, Yokohama, Misaki, Tateyama and Mutsu Bay.

The body is soft, smooth and about 70 mm long by 45 mm broad in the living state (pl. VI, fig. 2); the mantle is very wide and extends beyond the foot all around. The rhinophores are perfoliated at the upper portions and retractile into sheaths. There are 7 branchial plumes round

the anal papilla; they are much branched and retractile into a branchial pocket. The mouth is in the form of a small pore and provided, on either side, with a ridge-like tentacle (text-fig. 12).

The back, sides and foot are all of a black colour, but their edges are tinged with yellowish brown. The rhinophores are black excepting the yellowish brown tops; the branchial plumes are black and tipped with pale yellowish brown. There is neither labial armature nor radula in the pharynx.

*Locality:* Yu-no-shima (June 1925; 1 specimen: July 1926; 1 specimen).

I think this is a colour variety of *Dendrodoris nigra* (STIMPSON, Proc. Acad. Nat. Sci. Philadelphia, 1855, p. 380.—Kikai-ga-shima, Okinawa Islands), to which belong the specimens recorded by ELIOT (1904, 1908, 1913), BERGH (1880), BARNARD (1927) and O'DONOGHUE (1932).

BERGH's (1880) specimen is 25 mm long in the preserved state; it is dark black-blue; the mantle and foot are bordered with white. The tops of the rhinophores and of the branchial plumes are also white.

I think *Doridopsis indacus* of TAPPARONE-CANEFRI is identical with the present species; it is 12-14 mm long, smooth, blue-black and bordered with gray. The mantle is ample with a wavy margin; the branchiae are formed of 6 plumes arranged round the anal papilla (TAPPARONE-CANEFRI, 1874).

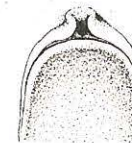
*Doridopsis arborescens* COLLINGWOOD is identical also. It is 45 mm in length; the mantle is blackish brown with a light chestnut border and the foot is light brown, shading to chestnut along the margin (COLLINGWOOD, 1881).

13. *Armina (Armina) japonica* (ELIOT, 1913)  
(Pl. VII, fig. 1; text-fig. 13)

*Pleurophyllidia japonica* ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, pp. 37-39, pl. 2, fig. 12.—Misaki; HIRASÉ, Mollusca, 1927, p. 1474, fig. 2836.—Nagasaki, Misaki.

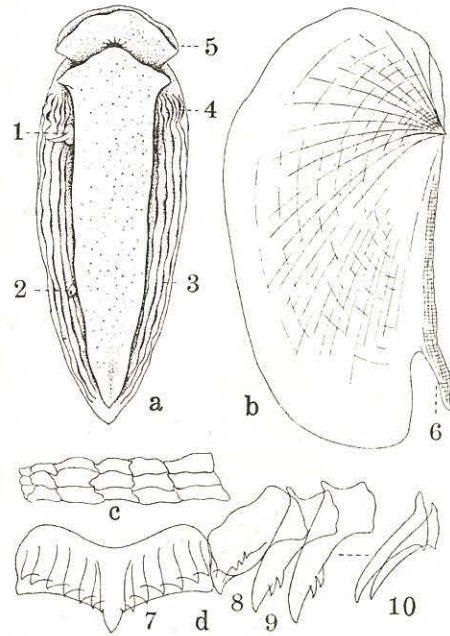
*Distribution in Japan:* Nagasaki, Misaki, Tateyama and Mutsu Bay.

The body in life is about 35 mm long (pl. VII, fig. 1); the head-shield is expanded in the form of a half-circle, smooth above and clearly separated from the mantle. There is a pair of rhinophores on the head-



Text-fig. 12.—*Dendrodoris nigra* (STIMPSON), variety. Ventral view of the mouth and foot.

shield; they are club-shaped and longitudinally perfoliated at the upper portions. The mantle is truncated in front and narrowed to a point behind; it is covered with longitudinal ridges of various sizes. The anterior gills on each side of the body are formed of delicate longitudinal folds,



Text-fig. 13.—*Armina japonica* (ELIOT). a. Ventral view ( $\times 1.5$ ); 1. genital opening, 2. anus, 3. side-lamellae, 4. anterior gill-folds, 5. head-shield. b. Jaw-plate ( $\times 12$ ); 6. masticatory process. c. Scale-like armatures on the masticatory process ( $\times 250$ ). d. Radula ( $\times 150$ ); 7. median tooth, 8. 1st lateral tooth, 9. 2nd lateral tooth, 10. outermost lateral teeth.

each side of the median spine. The 1st lateral tooth is clumsy in formation and bears a series of 3 denticles on the outer side. The succeeding teeth, about 24 in number, are hamate with 3-1 denticles on their edges, the number of denticles diminishing from the inside outward. The outer teeth, about 16 in number, are also hamate and smooth, and decreasing in size as they pass outwards.

*Locality:* Yu-no-shima (August 1927; 1 specimen).

The specimen described here agrees well with *Armina japonica* ELIOT,

some of which are continuous behind with 3 large longitudinal side-lamellae or posterior gills (text-fig. 13, a). The antero-lateral corners of the foot are produced into horn-like processes.

The dorsal surface of the mantle bears longitudinal yellow lines on the blackish background; the upper side of the head-shield is pale purple and anteriorly margined with yellow. The rhinophores are black, but their upper extremities are tinged with yellow. The anterior gill-folds are yellow and the side-lamellae are dark brown.

The masticatory edge of the jaw-plate is covered with 6-7 series of plate-like scales (text-fig. 13, b-c). The radula formula is about  $40 \times 40.1.1.1.40$  (text-fig. 13, d); the central tooth is broad and provided with 6-7 denticles on

in its external as well as internal characters.

In May 1929, I captured at Tateyama 7 specimens 25-40 mm in length; the side-lamellae of them vary from 3 to 5 in number.

#### 14. *Armina (Armina) comta* (BERGH, 1880)

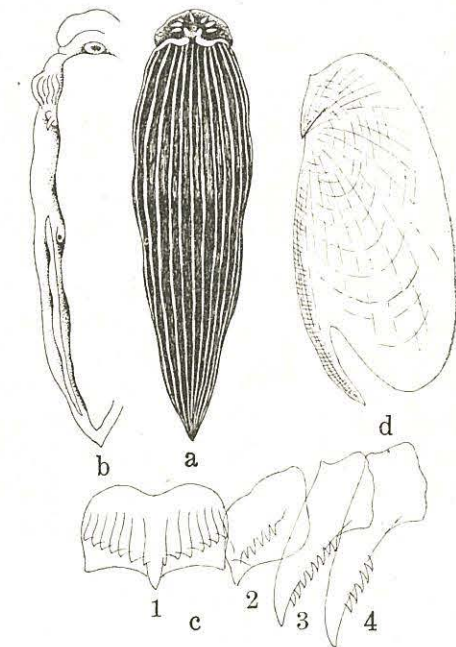
(Text-fig. 14)

*Pleurophyllidia comta* BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 30, 1880, pp. 21 (173)-24(176), pl. 2, fig. 12; pl. 3, figs. 7-12, pl. 4, figs. 1-3.—Nagasaki.

*Distribution in Japan:* Nagasaki and Mutsu Bay.

The body after preservation is about 30 mm in length; the head-shield is semicircular in form and, on its upper surface, are found several (11) short conical papillae (text-fig. 14, a). The rhinophores are much contracted, but several longitudinal folds are visible on their upper portions.

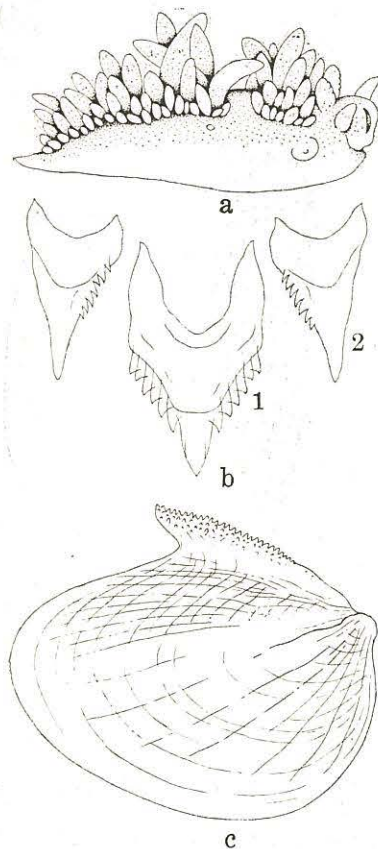
There are about 15 longitudinal ridges on the upper side of the mantle. The anterior gills are formed of delicate longitudinal folds; there is only one side-lamella on each side of the body (text-fig. 14, b). The antero-lateral corners of the foot are rounded. The back is blackish with longitudinal whitish streaks. There is a pair of jaw-plates, the masticatory edges of which are covered with several rows of scale-like armatures (text-fig. 14, d). The teeth of the radula are arranged in a formula  $30 \times 20.1.1.1.20$  (text-fig. 14, c); the central tooth has 5-6 denticles on each side of the median cusp and the 1st lateral tooth is clumsy in formation, bearing a series of 4-5 denticles on the outer side. The succeeding lateral teeth are all hamate; the inner 4-5 teeth have 7-2 denticles on their edges and the outer ones are simple.



Text-fig. 14.—*Armina comta* BERGH. a. Dorsal view of a preserved specimen ( $\times 2$ ). b. Ventral view. c. Radula ( $\times 180$ ); 1. central tooth, 2. 1st lateral tooth, 3. 2nd lateral tooth, 4. 3rd lateral tooth. d. Jaw-plate ( $\times 12$ ).

*Locality:* Between Yu-no-shima and Utô-zaki (June 1927; 1 specimen).

This specimen is identified with *Armina comta* (BERGH) which is reported as follows. An preserved specimen is about 32 mm long; the back is black with yellow longitudinal lines. The head-shield above is covered with a large median tubercle in addition to 14 short papillae. A single side-lamella is found on either side of the body. The masticatory edge of the jaw-plate has 10–13 rows of armatures. The radula formula is about  $44 \times 34(-36).1.34(-36)$ ; the central tooth has 6–12 (usually 8–9) pointed denticles on each side of the median cusp; the 1st lateral tooth has 7–8 denticles on the outer side; the 2nd lateral tooth has 7–9–12, the 3rd tooth has 9–10–13 and the next 3–4 have a few denticles on the edges; the succeeding outer teeth are all smooth (BERGH, 1880).



Text-fig. 15. — *Coryphella athadona* BERGH. a. Right-side view of a preserved specimen ( $\times 8$ ). b. Radula ( $\times 250$ ); 1. central tooth, 2. lateral tooth. c. Jaw-plate ( $\times 80$ ).

### 15. *Coryphella athadona*

BERGH, 1875

(Text-fig. 15)

*Coryphella athadona* BERGH, Verh. k. k. zool.-bot. Gesell. Wien, vol. 25, 1875, pp. 635–638, pl. 13, figs. 1–13.—Japan Sea ( $39^{\circ}40'–40^{\circ}N$ . Lat.;  $133^{\circ}30'–134^{\circ}W$ . Long.).

*Distribution in Japan:* Japan Sea, Mutsu Bay and Akkeshi Bay.

The preserved specimens range from 7 to 12 mm in length (text-fig. 15, a); the oral tentacles and rhinophores are of equal length, slender and simple. The dorso-lateral sides of the back are crowded with papillae, the largest being on the inside and the smallest outside. The foot is rounded at the antero-lateral corners; its anterior end is divided by a transverse groove into an upper and a lower lip.

There is a pair of jaw-plates in the pharynx and their masticatory edges are covered with several rows of denticles (text-fig. 15, c). The radula formula is about  $15 \times 1.1.1$  (text-fig. 15, b); the central tooth is horseshoe-shaped with 5–6 denticles on each side of the median cusp, and the lateral tooth has 6–8 denticles on the inner edge of the apical cusp.

*Locality:* Hadaka-shima (March 1927 and 1928; 24 specimens).

The present specimens are referred to *Coryphella athadona* BERGH which has the following characters. The length of the body is 5.5 mm; the branchial papillae on each side of the back are arranged in 3–4 groups containing in all 25–30 oblique rows. The 1st group has 4 rows, the 2nd 8–10 rows and the 3rd 3 rows. The foot is rounded in front. The masticatory edges of the jaw-plates are covered with scale-like armatures. The radula formula is  $19(-22) \times 1.1.1$ ; the central tooth has 2–6 (usually 3–4) denticles on each side of the median cusp, and on the inner edge of the lateral tooth are found 2–9 (usually 7) denticles (BERGH, 1875).

### 16. *Cuthona* (*Cuthona*) *bicolor* BERGH, 1904

(Pl. VII, fig. 5)

*Cuthona? bicolor* BERGH, Semper's Reisen, vol. 9, pt. 6, no. 1, 1904, pp. 3–5, pl. 1, figs. 32–36.—Between Vladivostok and Nagasaki.

*Cuthona bicolor* BABA, Annot. Zool. Japon., vol. 14, no. 2, 1933, pp. 279–280, fig. 6.—Tomioka.

*Distribution in Japan:* Tomioka and Mutsu Bay.

The specimens after preservation are about 10–15 mm long and ashy in colour. The oral tentacles and rhinophores are of equal length and simple; the antero-lateral corners of the foot are produced in obtuse points. The branchial papillae are arranged in about 17–19 oblique rows on each side of the back, the number of papillae in each row ranging from 2 to 8. The anus is situated between the 8th and 9th rows and the genital opening is below the 7th row on the right side.

The jaw-plate has a masticatory process, the edge of which is armed with a series of denticles. The radula formula is  $82 \times 0.1.0$ ; the tooth is horseshoe-shaped and its anterior edge is divided into 8–9 denticles.

*Locality:* Hadaka-shima (September 1927; 2 specimens).

Though there exist several points of disagreement in the teeth of the radula and in the number of the branchial rows, the identification of these specimens with *Cuthona? bicolor* BERGH seems to be quite justifiable.

	Mutsu specimens	BERGH's specimen
Length of the body (after preservation)	10-15 mm.	25 mm.
Coloration	—	Body yellowish; branchial papillae reddish gray with yellow tops.
Branchial papillae	17-19 in oblique rows.	22 in oblique rows.
Position of the anus	Just in front of the 9th row.	Just in front of the 13th row.
Antero-lateral corners of the foot	Produced in obtuse points.	Produced and rounded.
Cutting edge of the jaw-plate	With a series of denticles.	With a series of denticles.
Radula	82×0.1.0; tooth comb-like, bearing 8-9 denticles on the anterior margin.	67×0.1.0; tooth with 7-8 denticles on each side of a weak median cusp, the whole appearance being comb-like.

I have given elsewhere (BABA, 1933) a short description of a specimen obtained at Tomioka (Pl. VII, fig. 5). It is orange-yellow in colour; the oral tentacles bear a whitish streak and the branchial papillae are orange-yellow with a dark blue vein and a white top. The external as well as internal characters are much as in the Mutsu specimens.

#### 17. *Cuthona (Hervia) ceylonica* (FARRAN, 1905)

(Pl. VII, fig. 3; text-fig. 16)

*Hervia ceylonica* FARRAN, Ceylon Pearl-Oyster Fish., Suppl. Rep., 1905, p. 331, pl. 1, figs. 1-5.—Gulf of Manaar; BABA, Annot. Zool. Japon., vol. 14, no. 1, 1933, p. 178.—Tomioka.

*Hervia ceylonica*? ELIOT, Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. 35, art. 1, 1913, p. 42.—E-no-ura (Suruga Bay).

*Distribution in Japan*: Tomioka, E-no-ura and Mutsu Bay.

The preserved specimens, ashy in colour, are each about 15 mm long. The oral tentacles and rhinophores are smooth; the branchial papillae are arranged in 5 groups on either side of the back and in each group they stand on a horseshoe-shaped base opening outward. The gap between the 1st and 2nd branchial groups is rather remarkable. The anus is in the centre of the 2nd branchial group on the right side, and the genital opening below it. The antero-lateral corners of the foot are produced and angulated (text-fig. 16, a).

The masticatory edge of the jaw-plates has a series of denticles (text-

fig. 16, d). The radula formula is about  $15 \times 0.1.0$ , and the tooth bears 4-6 denticles on each side of the median cusp (text-fig. 16, b-c).

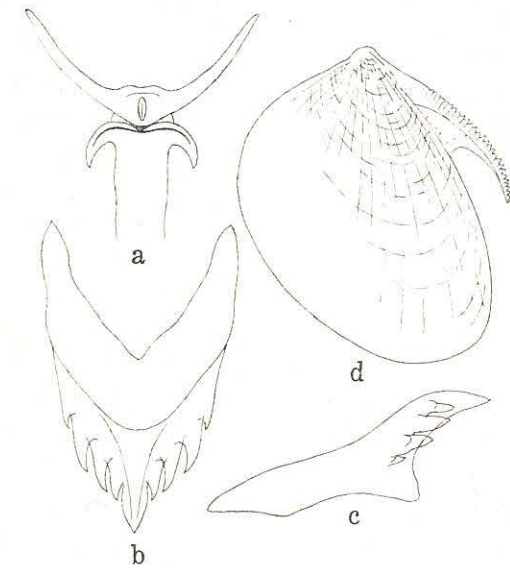
*Locality*: Moura-shima (August 1926; 2 specimens).

This kind of Aeolids in Japan is referred by ELIOT to *Hervia ceylonica* of FARRAN which is characterized originally as follows. The specimen after preservation is 8 mm long, pale and semi-transparent; the branchial papillae are slender, veined with a fawn-colour and arranged in 5-6 irregular transverse rows on each side of the back, the first row being widely separated from the second. The oral tentacles together with the rhinophores are slender and smooth; the antero-lateral corners of the foot are moderately produced and pointed at the ends. The

jaw-plate has a short (due to an injury?) cutting edge with a single row of irregular denticles. Each tooth of the radula is armed with 5 strong denticles on each side of a pointed apex (FARRAN, 1905).

In April 1933 and February 1935, I captured at Tomioka several living specimens which are referable to the above-said species (pl. VII, fig. 3). They are from 12 to 30 mm in length; the branchial papillae on the dorso-lateral sides are very long, pointed and laid in 5-6 groups on the horseshoe-shaped bases opening outward. The anus is in the centre of the 2nd group on the right side, and the genital opening below it. The oral tentacles and rhinophores are very slender, pointed and smooth; the anterior end of the foot is transversely grooved, and the upper lip is notched in the middle line. The antero-lateral corners of the foot are much produced into horn-like processes.

The ground-colour of the body is yellowish white; the head, basal



Text-fig. 16.—*Cuthona ceylonica* (FARRAN). a. Ventral view of the mouth and foot. b. Radula, dorsal view ( $\times 160$ ). c. Ibid., side-view. d. Jaw-plate ( $\times 20$ ).

portions of the oral tentacles as well as of the rhinophores and the anterior margin of the foot above are stained with orange-yellow. The coloration of the veins (=liver diverticula) in the branchial papillae varies in individuals; they are tinged with reddish brown, yellowish brown, deep orange-yellow or sometimes with chrome-yellow. The whole upper surface of the body (including the oral tentacles, rhinophores and branchial papillae) is covered with opaque white spots.

The jaw-plate has a long, curved masticatory process which is armed with a single row of 35-40 denticles. The teeth of the radula are arranged in a formula of  $20 \times 0.1.0$ ; each tooth is horseshoe-shaped and bears several denticles on each side of the median cusp. The number of the lateral denticles varies in different individuals; I counted 3-4 in one case and 5-7 in another.

18. *Cuthona* (*Harvia*) *quadrilineata* (BABA, 1930), variety  
(Pl. VI, fig. 3; text-fig. 17)

*Distribution in Japan*: Mutsu Bay.

The specimen in life is about 23 mm in length (pl. VI, fig. 3); the oral tentacles and the rhinophores as well are slender, smooth and pointed at the ends. The branchial papillae are rather short, fusiform and arranged on each side in about 17 oblique rows containing 2-6 papillae each. The genital orifice is found below the 5th row and the anus is between the 8th and 9th rows on the right side. The antero-lateral corners of the foot are produced into horn-like processes.



Text-fig. 17.—*Cuthona quadrilineata* (BABA), variety. Radula ( $\times 250$ ).

The basal portions of the oral tentacles as well as of the rhinophores are brown-tinted and the branchial papillae have dark veins and red tops. The ground-colour of the body appears to be translucent white and no traces of dark streaks are visible on the sides.

The masticatory edges of the jaw-plates have a single row of denticles. The radula formula is  $15 \times 0.1.0$  (text-fig. 17); the tooth is horseshoe-shaped and bears 4-5 denticles on each side of the median cusp.

*Locality*: Urata (July 1926; 1 specimen).

The specimen in hand agrees in many points, both external and internal, with *Cuthona* (*Harvia*) *quadrilineata* (BABA, Venus, vol. 2, no. 3, 1930, pp.

119-121, pl. 4, fig. 3, text-figs. 2a-2c.—Tateyama), a slight difference between the two being found only in the coloration of the body.

	<i>Harvia quadrilineata</i> , variety	<i>Harvia quadrilineata</i> , type
Length of the body	23 mm.	13 mm.
Number of the branchial rows	17.	16.
Position of the genital orifice	Below the 5th row.	Below the 4th row.
Position of the anus	Between the 8th and 9th rows.	Between the 7th and 8th rows.
Antero-lateral corners of the foot	Produced into horns.	"
Radula	$15 \times 0.1.0$ ; tooth with 4-5 lateral denticles.	$21(-23) \times 0.1.0$ ; tooth with 6 lateral denticles.
Coloration of the body	Body whitish, with no streaks on sides; oral tentacles and rhinophores brown-tinted; branchial papillae with dark veins and red tops.	Body yellowish white with 2 chocolate streaks on sides; oral tentacles and rhinophores chocolate-tinted; branchial papillae with chocolate veins and orange yellow or yellow tops.

This specimen is regarded provisionally as a variety of *Cuthona* (*Harvia*) *quadrilineata* (BABA), but further observation of the coloration and form of the body is desirable.

19. *Cuthona* (*Cuthona*) sp.

*Distribution in Japan*: Mutsu Bay.

The body after preservation is about 5 mm long, much damaged and ashy in colour. The branchial papillae on the dorso-lateral sides are arranged in several oblique rows. The oral tentacles and rhinophores are simple; the antero-lateral corners of the foot are rounded.

The masticatory edges of the jaw-plates are armed with a single row of denticles. The radula formula is about  $30 \times 0.1.0$ ; the tooth is horseshoe-shaped with about 7 denticles on each side of the median cusp which is rather prominent.

*Locality*: Off I-no-kama (July 1929; 1 specimen).

This Aeolid appears to be a species of the genus *Cuthona* (subgenus *Cuthona*), but specific identification is to be reserved until the form and coloration of the body in the living state are known.

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## EXPLANATION OF THE PLATES

## PLATE V.

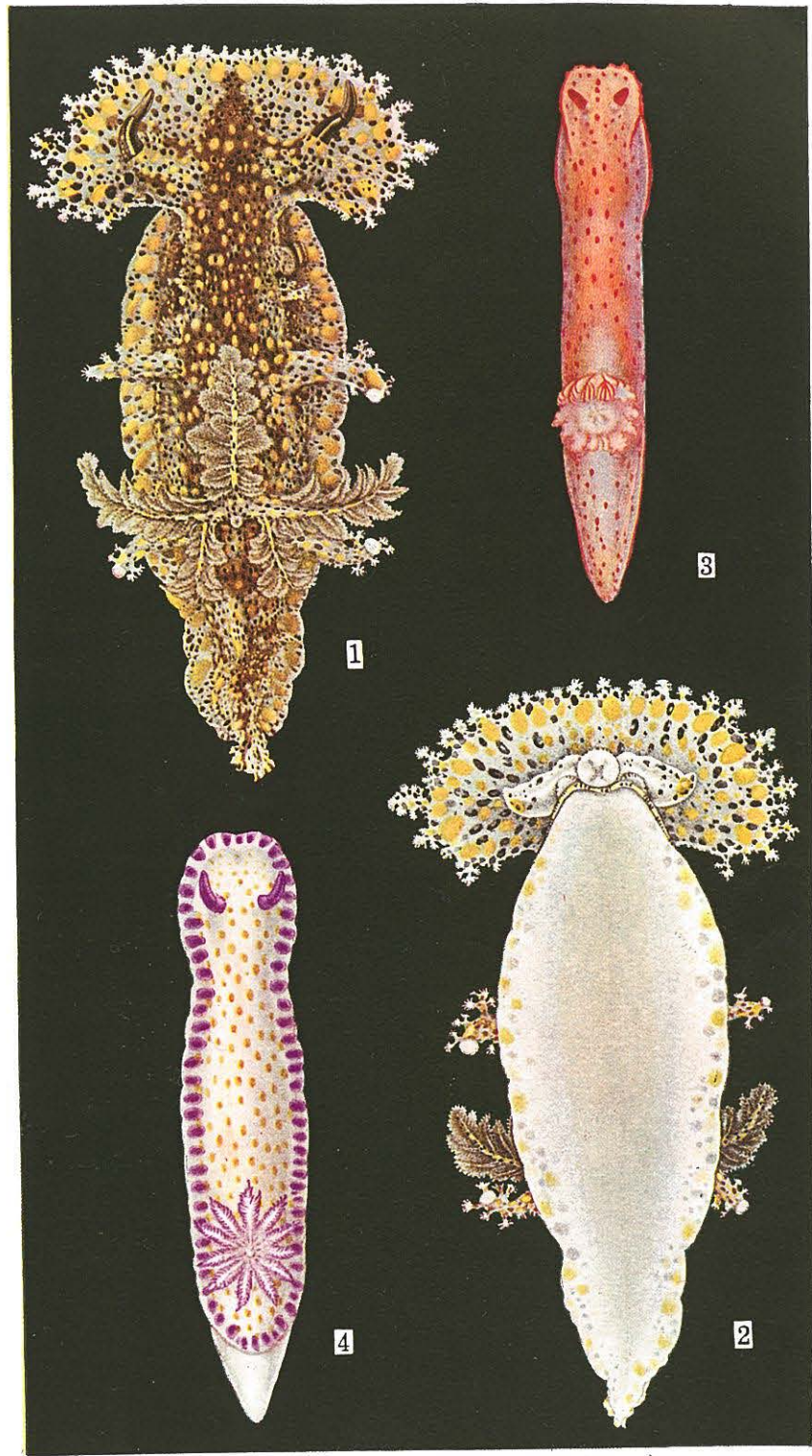
- Fig. 1. *Plocamophorus tilesii* BERGH. Dorsal view, natural size (SAKUMA del.).
- Fig. 2. The same. Ventral view.
- Fig. 3. *Gymnodoris japonica* (BABA).  $\times 2$  (SAKUMA del.).
- Fig. 4. *Glossodoris aureopurpurea* (COLLINGWOOD).  $\times 3$  (SAKUMA del.).

## PLATE VI.

- Fig. 1. *Glossodoris festiva* (ADAMS).  $\times 3$  (SAKUMA del.).
- Fig. 2. *Dendrodoris nigra* (STIMPSON), variety. Natural size (SAKUMA del.).
- Fig. 3. *Cuthona quadrilineata* (BABA), variety.  $\times 4$  (SAKUMA del.).
- Fig. 4. *Glossodoris pallescens* (BERGH). Natural size (SAKUMA del.).

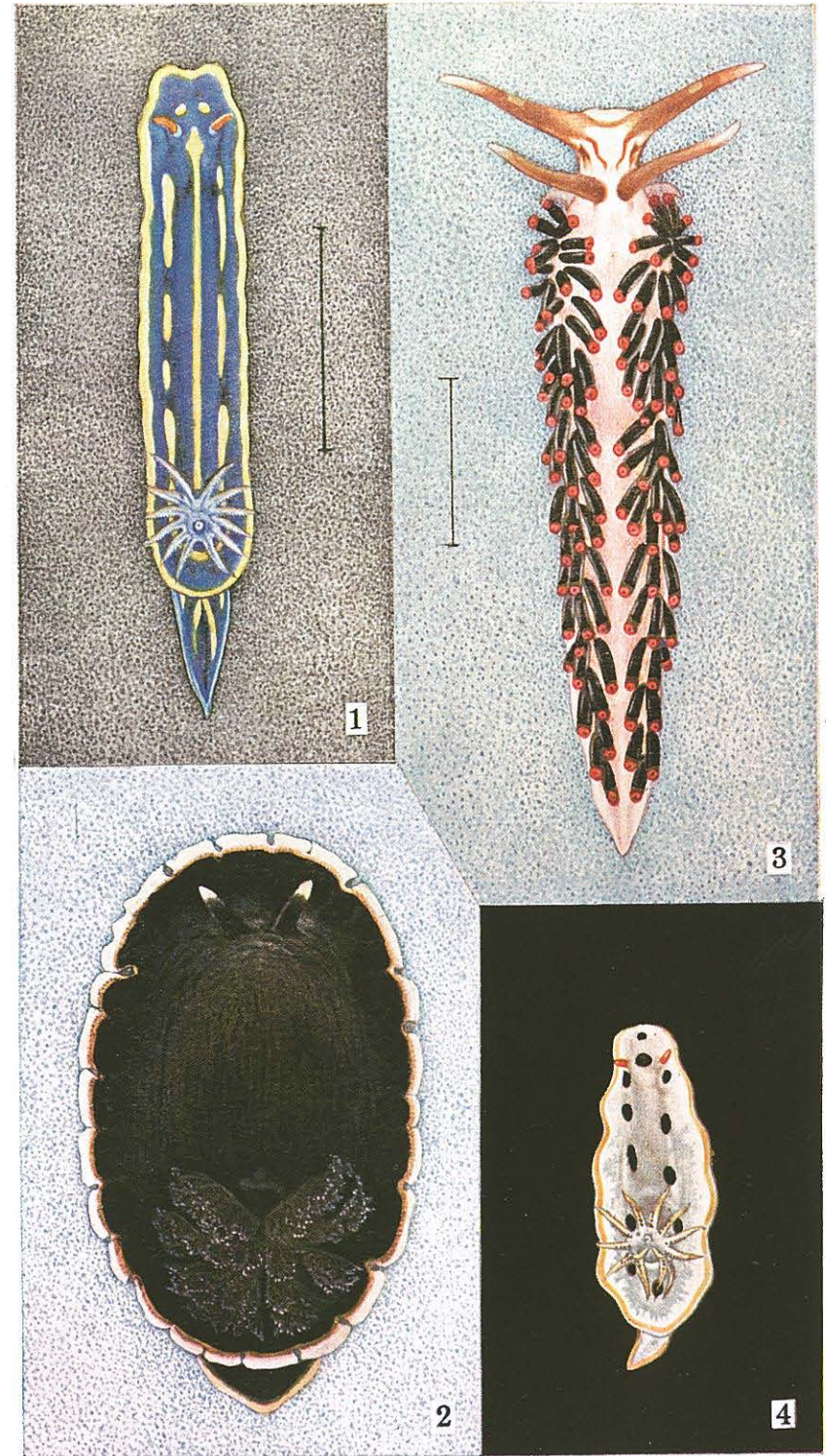
PLATE VII.

- Fig. 1. *Armina japonica* (ELIOT). ×2 (SAKUMA del.).
- Fig. 2. *Goniodoris* sp. ×3 (SAKUMA del.).
- Fig. 3. *Cuthona ceylonica* (FARRAN). ×2 (drawn by me from a Tomioka specimen).
- Fig. 4. *Rostanga muscula* (ABRAHAM). ×2 (drawn by me from a Tomioka specimen).
- Fig. 5. *Cuthona bicolor* BERGH. ×3 (drawn by me from a Tomioka specimen).

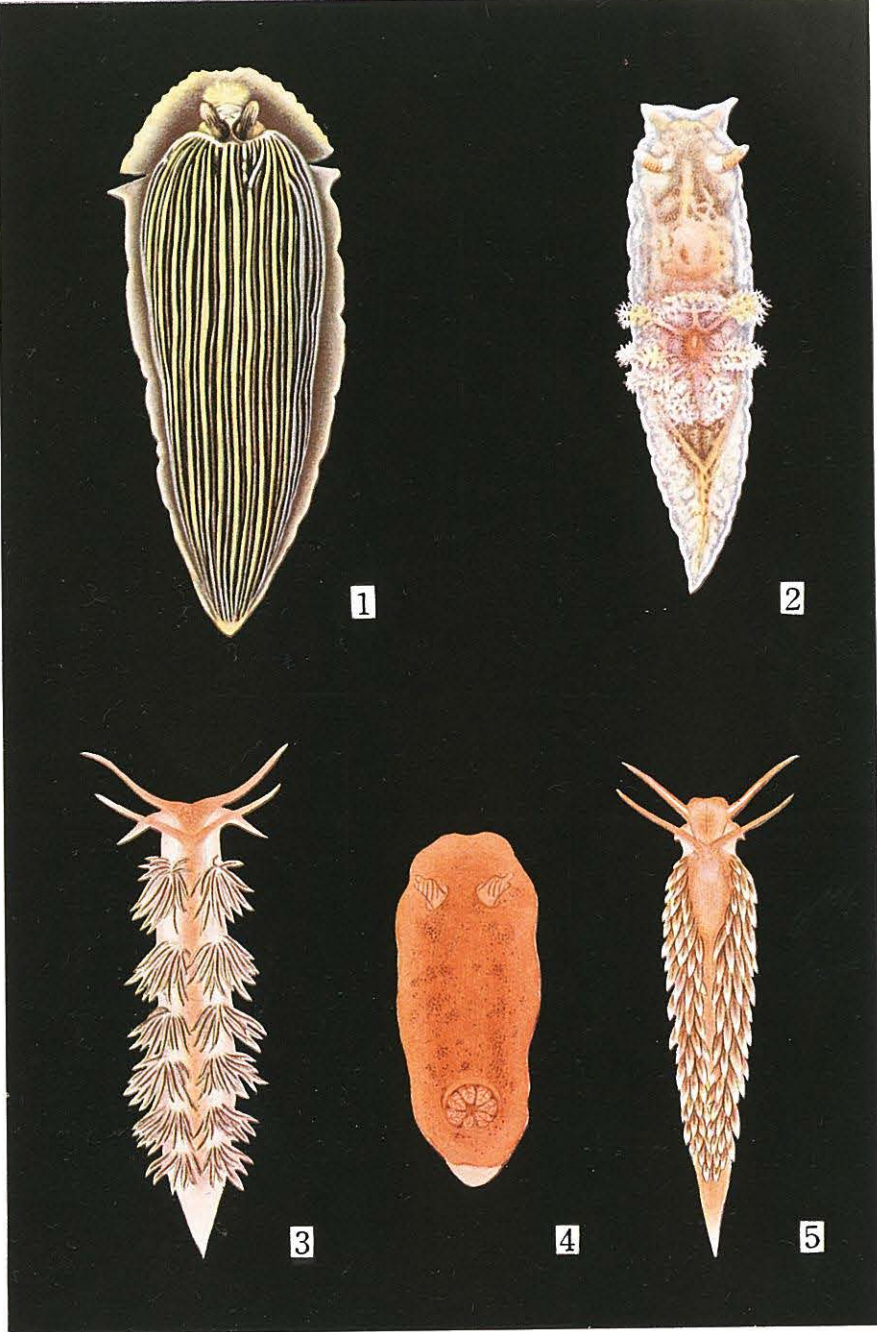


K. BABA: Nudibranchia of Mutsu Bay.





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