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NOTES ON OPISTHOBRANCHIA

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(with 8 plates)

The material exposed here by Mrs. EVELINE DU BOIS-REYMOND MARCUS and me comes, with exception of *Elysia lobata* A. Gd., from Brazil, chiefly from the littoral of São Paulo and Rio. Two species are new, some are for the first time recorded from Brazil, and some whose recent descriptions were based on young or few specimens were studied more in detail.

We express our thanks to the Oceanographic Institute São Paulo for hospitality at the Northern Base near Ubatuba and to its Staff for several specimens. Our gratitude is also due to Dr. Libbie H. Hyman who sent us a species from Eniwetok and to Dr. Diva Diniz Corrêa who collected Opisthobranchs during her trips to Cabo Frio and Ubatuba.

Nils Hj. Odhner's system is used in the following list of the species.

CEPHALASPIDEA

Acteonidae: ***Acteon punctostriatus*** **(C. B. Ad.)**
Atyidae: *Haminoea elegans* (John Edw. Gray)
Scaphandridae: *Tornatina candei* (d'Orb.)

ANASPIDEA

Aplysiidae: *Aplysia* (*Tullia*) *juliana* Q. G.
Aplysia brasiliana Rang
Aplysia parvula Mörch

SACOGLOSSA, ELYSIACEA

Elysiidae: *Elysia lobata* A. Gd.

NUDIBRANCHIATA, DORIDACEA, EUDORIDACEA, PHANEROBRANCHIA

Nonsuctoria, Gymnodorididae: *Nembrotha divae*, sp. n.
Polyceridae: *Polycera marplatensis* Franc.
Polycera odhneri Marc.
Polycera aurisula Marc.
Suctoria, Corambidae: *Corambe evelinae*, sp. n.

NUDIBRANCHIATA, DENDRONOTACEA

Hancockiidae: *Hancockia ryrca* Marc.

NUDIBRANCHIATA, ARMINACEA, PACHYGNATHA

Antiopellidae: *Antiopella mucloc* Marc.

Acteon punctostriatus (C. B. Adams, 1840) (Fig. 1-10)

Tornatella puncto-striata Gould 1870, p. 224 f. 515
Actaeon punctostriatus Pilsbry 1893, p. 157 (older synonymy) t. 18 f. 98-99, t. 19 f. 22-23; Abbott 1955, p. 275 t. 26 f. T.

The shell is solid, mat white and smooth; the two measured shells are 4,5 and 6,2 mm long and 2,8 and 3,8 mm wide. One of them has a pale yellow, the other a light brown suture and spiral sculpture. The growth lines look like cracks. The lower third of the body whorl has numerous irregular spiral lines, which are in part pitted grooves, in part more or less wavy furrows.

There are 5-5,5 convex whorls. The spire is rather elevated, the apex flat, the body whorl swollen. The suture is deep and accompanied by a fine subsutural line. The aperture of one of the measured shells is 3 mm, that of the other 4 mm long, narrow above, rounded below. The outer lip is simple and acute. The columella has a strong, simple and spiral fold. The present shells have no parietal callus.

As far as the larval shell can be recognized in the present adult snails, it agrees with that of *A. tornatilis* (L.), as drawn by Lemche (1948, f. 1; text on p. 9).

The corneous operculum (Fig. 3) which was not visible in the creeping snails measures 3,05 to 1,4 mm. It is similar to that of *A. tornatilis* (Bergh 1902, t. 27 f. 4). Its nucleus lies near the left or basal margin, the right or upper end is pointed. An arcuate ridge on which fibres of the columellar muscle insert is yellow and contrasts with the colourless operculum.

The aspect of the living animal resembles the old figures for *A. tornatilis* of Woodward (Fischer 1887, f. 311; Hoffmann 1933, f. 2) and

Sars (Pilsbry 1893, t. 49 f. 3; Pruvot-Fol 1954, f. 4). The head shield is notched, its hind flaps are pointed, and so are the anterior corners which correspond to tentacles, the labial tentacles and the foot corners. The form and the length of the foot vary, it may be round or longitudinally folded and pointed behind, nearly as long as the shell or scarcely half as long. The eyes are big, 0,12 mm in diameter and lie in the body cavity close to its wall.

The pallial cavity (*m*) is large, and the anus lies in its innermost part. Still farther inwards the cavity is drawn out into the pallial caecum discovered by Pelseneer (1894, p. 5-6 t. 1 f. 1). It is shorter than in *A. tornatilis* (see also Fretter and Graham 1954, f. 2 *CM*), where it attains the apex of the visceral hump (p. 568), and accompanies only 1,5 whorls even in our much contracted snails (Fig. 2, *c*). The ciliated ridges are very thick. The glands on the inner edge of the mantle skirt (*e*), of which Fretter and Graham have stressed (p. 570) those lying on the left side (f. 2, 3 *RG*) in front of the ctenidium (*CT*), accompany the whole upper and under border of the mantle. Farther inwards follows a small osphradium (*o*) underlain by its ganglion and groups of sensory cells.

The buccal glands of *A. tornatilis* were discovered by Pelseneer (1894, p. 7-8, f. 7, 11) and discussed by Guiart (1901, p. 85 t. 1, *GB*), Gabe et Prenant (1952b, p. 222), and Fretter and Graham (1954, p. 570). In *A. punctostriatus* they open ventro-laterally into the mouth, as in the European species. Also the huge salivary glands (*u*), the histological structure of which has been described by Fretter (1939, p. 624-625), agree with those of *A. tornatilis;* these tubes discharge into the dorsal and posterior part of the pharyngeal cavity.

The jaws (*j*) are small plates, 0,12 mm long antero-posteriorly and 0,24 mm broad. They stand close together near the floor of the oral tube (*b*). The surface of the platelets composing the jaws (Fig. 5, 6) is spiny as in *A. tornatilis* (Gabe et Prenant 1953, f. 2), and as in this species (Pruvot-Fol 1956, p. 303) the entire top of each platelet bears spines. The radula (*r*) consists of innumerous rows, each consisting of a great number of uniform teeth (Fig. 8, 9). These originate, as in the European species (Gabe et Prenant 1952a, p. 18), in a short radular sac (*x*). The shape of the teeth corresponds to Sars' (1878; Pilsbry 1893, t. 49 f. 2) and Bergh's (1902, p. 317 t. 27 f. 9-10) indications for *A. tornatilis*. They are ten micra long hooks with about 12-15 minute denticles on the inner border, the latter visible only with oil immersion (Fig. 9). In the studied radula all teeth of one longitudinal row are formed abnormally (Fig. 10). The edge of these teeth can be called semilunar (Gabe et Prenant 1952a, p. 17) or horseshoe-shaped (id. 1953, p. 43), hence I suppose that Gabe et Prenant have examined a malformed radula, though they considered (1952a, p. 16) the aspect of their preparations in agreement with Sars' drawings. It is difficult to evaluate Pruvot-Fol's figures of the radula (1956) obtained by dissection (p. 305), clarified in glycerine and examined without oil-immersion (p. 303).

The long and thin oesophagus enters the stomach which extends up the visceral hump as in *A. tornatilis* (Fretter and Graham 1954, p. 572). There are two hepatic ducts. The short intestine leaves the stomach nearly at the same level at which the oesophagus enters. The intestine of our sectioned snail contained bundles of setae of polychaetes.

The mentioned animal is young, it has only a primordium of the gonad on the columellar side of the digestive gland. The little hermaphrodite duct runs forward along the columella and attains the floor of the mantle cavity in front of the anus. A folded primordium of the pallial genital ducts, not differentiated into male and female channels yet, lies on the floor of the cavity and is underlain by a big genital ganglion. The tubular distal part of the male duct is already developed. It enters, as in *A. tornatilis*, the body wall, pierces its musculature obliquely, rises to the non invaginable penis and penetrates the latter to its tip.

The 3 available strongly contracted snails did not allow for a study of the nervous system.

Occurrence: Northern base of the Oceanographic Institute (S. Paulo) near Ubatuba, about 135 km E. of Santos. Three living snails were collected in muddy sand below the low-tide line together with *Cylichnella bidentata* (d'Orb.) and *Tornatina candei* (d'Orb.); February 26, 1957.

Further distribution: Atlantic coast of America, from Cape Cod to the region of Bahia Blanca, Argentina (Carcelles & Parodiz 1938, p. 261).

DISCUSSION OF ACTEON PUNCTOSTRIATUS (C. B. Ad.)

Abbott (l. c.) records the species from Massachussetts to the Gulf of Mexico and the West Indies; Carcelles (1944, p. 262) indicates also Brazil, Uruguay and Argentina southwards to Port Quequén. Lange's catalogue of Brazilian mollusks (1949) does not contain the species.

The *Acteon* described from Brazil (Adams 1854, p. 59), *A. cumingii*, can be separated from our material at first sight by the flesh-coloured strongly sculptured shell. *A. delicatus* Dall, 1889, which occurs from the Antilles southwards to the Magellanic district, may be expected from the Brazilian coast too. The sculpture of the shell of *delicatus* is only a little less coarse than that of the shell of *cumingii*, and its spiral sculpture consists of 20-30 punctate grooves, hence many more than in the present shells. The suture of *delicatus* is appressed, not channeled.

The length of the aperture seems to be somewhat variable in *A. punctostriatus*. In Abbott's photograph it is 57% of the length of the shell against 64,5-67% in our snails. Therewith the greatest width of our shells occupies a more apical level than in Abbott's photograph, and

the general aspect is different. It is possible that further anatomical studies will reveal true differences between the populations of different regions, but in the present state of knowledge it is not advisable to separate species based only on minute diversities of the shells.

Haminoea elegans (Gray, 1825)

(Fig. 11-22)

In a paper in press, in the Journal of the Linnean Society in London, we have described shell, jaws, radula and gizzard plates of dead material of this species obtained in 1954, given notes on four living young snails, and discussed the synonymy. Now we collected living mature animals and can complete our description.

The living snails were 12-22 mm long, preserved up to 13 mm, with an 8 mm long shell and a 7 mm long head-shield. One quite small animal (shell 2,5 mm) withdrew almost completely into its shell, but in the bigger snails head, parapodia, foot, and posterior lobe were not retracted, while they were sifted from the mud. Under the same conditions *Bulla striata* withdrew entirely.

The colour of the body is light grey with black and white stipples; the latter disappear in alcohol. The black colour-marks from a more or less symmetrical pattern on head and parapodia (Fig. 11). Also the mantle cavity is dotted with black. The cephalic shield, the hind end of which is hardly notched, and the parapodia (*va*) cover the greater part of the shell. The foot (*fo*) occupies 10 mm in a preserved snail of 13 mm total length. The straight posterior border of the foot (Fig. 12) connects the hind ends of the parapodia. The infrapallial lobe is prolonged into a thick expansion (*e*), the "expansion épicochléaire" of Perrier et Fischer (1911, p. 9 fig. C), which wraps the hind end of the shell.

As we observed in our previous material, the inner whorls of the shell are dissolved, when the snail grows. As the sections show (Fig. 15), only the calcareous layer is dissolved, while the conchiolin forms a tight lump of folds (*co*).

The pallial aperture extends from the left parapodium to the epicochlear expansion (*e*). The upper and under mantle border bear only few glands except for the posterior region, where there is a concentration of cyanophilous glands. The anterior adherence surpasses the mid-line a little. Here the columellar muscle (*u*) originates at the shell. A posterior adherence is not developed.

The mantle cavity (*mc*) covers only the dorsal side of the visceral cavity. The osphradium (*o*) lies on the right side at the fore end of the anterior adherence. The cells of the broad ciliated ridges (*r*) are disposed in parallel rows. The ridges run in a semicircle and surround fields of cyanophilous glands (*hi*) on roof and floor of the pallial cavity. A pallial caecum is not developed, nor a hypobranchial gland besides the

dorsal glandular area encircled by the ciliated ridges. The gill (*g*) hangs from its dorsal attachment in a half circle into the mantle cavity. Heart (*w*), kidney (*k*), anus (*a*) and common genital aperture (*ge*) occupy their usual position.

The eyes (Fig. 13) lie near the epidermis (*ei*) whose epithelium is low and not pigmented in a circular area over them. The retina consists of pigmented supporting cells with small and longish nuclei (*pi*) and sensory cells (*se*) with big round nuclei. The rods (*ro*) are brush-shaped, so-called "Stiftchenpinsel". Hence the eye agrees with that of *Helix*, and the same type was already observed in Cephalaspidea, viz. *Gastropteron rubrum* (Hesse 1902, t. 35 f. 7). The Hancock's organ (*h*) is bipectinate (Pelseneer 1894, p. 11) with about 30 leaflets on either side. Backwards the organ does by far not attain the beginning of the free part of the head-shield.

The nervous system does not agree completely with that of *H. hydatis* (L.) and *H. navicula* (da Costa, 1778) examined by Vayssière (1880) and Guiart (1901). Their results were synthetized by Hoffmann (1936, p. 657-660). In *H. elegans* neither a right nor a left parietal ganglion is set off from the pleural ganglia, and also the sections do not evidence vestiges of them. The fourth cerebral nerve (Fig. 14, *ho*) is as broad as in Guiart's figure 57 (on p. 104). In the visceral loop the supra-intestinal ganglion is distinctly more dorsal than the subintestinal ganglion. In the supra-intestinal ganglion there are two specially big nerve cells, viz. $110 \times 80 \times 70$ micra. Besides the abdominal and the genital nerve two nerves go out from either side of the visceral loop. On the right side a parietal nerve originates anterior to the supra-intestinal ganglion, and the right pallial or branchio-osphradial nerve goes from the supra-intestinal to the osphradial ganglion. On the left side a parietal nerve arises far in front of the subintestinal ganglion and from the latter a left pallial nerve. There is no ganglion at the origin of the right or of the left parietal nerve.

The alimentary tract of *H. hydatis* was thoroughly studied by Fretter (1939, p. 614-622), and that of the present species agrees with her results. Also the "Vormagen" (Bergh 1901, p. 223 ff.), "pouch of Pelseneer" (Si 1931, p. 34-35) or "mid-dorsal glandular oesophageal pouch" (Fretter, p. 617 ff.) occurs in *H. elegans* (Fig. 14, *oi*). The teeth between the gizzard plates previously described only of young snails of *H. elegans* which had been treated with KOH, were now dissected from specimens preserved in alcohol. Their borders were split into fibres.

The protandrous ovotestis (*he*) is embedded in the digestive gland (*d*). The follicles contain male and female cells, the latter chiefly in the hinder part of the hermaphrodite gland. The long tubular ampulla (*am*) enters the gland mass through which the ciliated inner course of the spermoviduct winds. The albumen gland (*ae*) lies to the left, near the entrance of the ampulla. The inner lobe (*mu*) of the mucus gland is located on the right side; the anterior lobe (*me*) is folded into numerous transverse pouches as in other species of the genus (Guiart 1901, f. 85 on p. 144). The extremely long outer part of the spermoviduct

(*z*) is not ciliated, but strongly muscular. The spacious genital vestibule (*v*) has very long and dense cilia.

The spermatheca (*t*) is situated in front of the folded part of the mucus gland; its wide and muscular duct opens into the genital vestibulum (*v*). Near the limit between albumen (*ae*) and mucus (*mu*) gland there is a small spermatocyst (*s*) which was already observed by Guiart (1901, p. 145 f. 85, *V*).

The seminal groove (*c*) runs ventral to the right Hancock's organ. The groove is flanked by blood sinuses which might close it while sperm is running through it. At the anterior end of the Hancock's organ the groove passes through the male opening (*m*) on to the ventral side of the male atrium (*x*). Near the fundus of the latter the borders of the groove coalesce, and the resulting seminal canal opens on the dorsal side of the atrium. Near this opening there is a peculiar snout-like myo-epithelial organ (*y*) which constitutes the entrance of the prostatic duct (*qe*). This duct is coated with a thick layer of circular muscles. A semicircle of penial retractor fibres (*re*) inserts on the muscle mantle of the duct. This retractor originates on the left body wall. The prostate (*q*) consists of an innermost part containing orange staining secretion and an outer part with central pink and peripheral colourless secretion besides the orange granules. The prostatic duct extends to the left over the oesophagus and turning back the bipartite gland lies on the right side under the gizzard (*j*).

The muscular penis (*p*) is carrot-shaped and attached to the fundus of the male atrium by a stalk (Fig. 17). The penial epithelium (*es*) forms about 28 transverse folds each bordered with a row of cuticular pegs, about 10 micra in length and 3,5 micra thick (Fig. 20). On the outer side the folds are interrupted by a groove which leads sperm and prostatic secretion to the tip. Pilsbry's conchological (1893, p. 356) opposition against a union of *H. elegans* with European species is confirmed by the armature of the penis.

Occurrence: Northern base of the Oceanographic Institute (São Paulo) near Ubatuba, about 135 km E. of Santos. Twelve snails were found in muddy sand below low-tide line, in the end of February and beginning of March, 1957. The species of *Acteon* and *Tornatina* treated in this paper as well as *Cylichnella bidentata* (d'Orb.) were caught in the same biotope.

Tornatina candei (d'Orbigny, 1842)

(Fig. 23-32)

Bulla candei d'Orbigny 1853, p. 128 t. 4 bis, f. 1-4.
Tornatina candei Pilsbry 1893, p. 185 (older synonymy) t. 22 f. 21-22, t. 50 f. 27-29.
Acteocina candei Johnson 1934, p. 145; Carcelles 1944, p. 262; Lange de Morretes 1949, p. 114; Haas 1953, p. 204.
Retusa candei Abbott 1955, p. 280, 521.

The solid shell is cylindrical, generally tapering below, 2,05-4,1 mm long and 1,0-1,8 mm wide. Empty and dry shells are opaque white with more or less shining surface; those with the colourless or yellow periostracum are glossy. The surface is quite smooth, or the body whorl is marked with curved growth lines which are convex towards the right side. The spire is conoidal and terraced, the tilted apex projecting, and the suture slightly channelled. The about four whorls are concave with a deepened subsutural line. Aperture 1,65-3,35 mm long, narrow above, broadly rounded below. Outer lip thin, arched in the middle, retracted at base. Columella short, concave, with a moderately strong fold which separates it from the thin callus of the inner lip.

The head shield which is notched in front and the foot are ciliated, with exception of the lateral cephalic folds, where the Hancock's organs lie, and the dorso-median line between the rounded posterior flaps of the head shield. The broad outer crest of the infrapallial lobe (*j*) is ciliated too. The pale blue staining glands of the head are much less numerous than in *Cylichnella bidentata* (d'Orb.), but small, dark blue staining glands occur everywhere in the epidermis. As in *Cylichnella* the Hancock's organs are smooth, not folded; pigmentation was not seen. The small eyes are located approximately at equal distance from one another and from the sides and the anterior border, in the body cavity (type 4 of Hoffmann 1935, p. 626), in front of the cerebral ganglia, not as near these as in *Cylichnella*.

The foot (*f*) is broad and not set off from the small round parapodia. Its glands are inconspicuous, also those of the ciliated suprapedal fold, whose depth is so small (30 micra) that it cannot be called a pouch.

The pallial opening accompanies the entire shell aperture. The infrapallial lobe (*j*) or ventral mantle skirt bears red-staining glands with coarse secretion on its upper and lower edge along a longitudinal furrow. The anterior adherence extends beyond the mid line to the right, where the small, button-shaped osphradium lies at the end of the anterior mantle commissure. Red granular glands (*r*) and some blue staining ones border the mantle in front, on the right (dorsal) and the left (ventral) side; the mantle groove is inconspicuous.

The mantle cavity is more roomy than in *Cylichna* (Lemche 1956, p. 21, f. 338), it extends from the osphradium (*o*) far to the left over the gizzard (*z*), penetrates into the spire, and ascends to the right again, where it ends with the anus (*a*). Different from *Cylichna* and *Cylich-*

nella a posterior adherence does not exist, but only a junction of the mantle borders where suprapallium and infrapallium meet. The ciliated ridges (*c*) begin nearly at the borders of the mantle. They run almost parallel to the suture straight inwards, where they become narrower and at the end of the cavity continuous with one another. Both ridges are accompanied by bands of mucous glands (*oi*). This part of the mantle cavity (*q*) corresponds to a pallial caecum.

Further pallial organs are on the roof: the compact hypobranchial gland (*h*) with a common duct as in *Cylichnella*, and colourless secretion; a very short gill (*g*) with about 5 folds on either side; and the broad, flat kidney (*t*) extending from the gill to the anus and opening by a wide pore (*n*) behind the inner end of the gill. The anus (*a*) lies between roof and floor of the cavity. The floor of the latter bears the genital opening on a prominence located under the gill. From the genital pore the seminal groove (*w*) runs to the right cephalic flap.

On the whole the central nervous system agrees with that of *Cylichnella bidentata;* a very small left parietal ganglion is present at the origin of the left anterior pallial nerve; and the genital ganglion is nearer to the abdominal than to the supra-intestinal ganglion. The torsion of the visceral cord is less pronounced than in *Cylichnella;* the right pleural ganglion, though contiguous with the cerebral ganglion, is more distinctly separated from it; and the right parietal ganglion is less advanced.

The anterior border of the head and the Hancock's organs are richly supplied with secondary ganglions.

An anterior thin-walled part of the oral tube with glands is followed by a strongly muscular portion, located behind the nerve ring. On either side this muscular part contains a small mandibular field, about 60 µ wide and 40 µ long. Each jaw (Fig. 27) consists of 30-40 platelets, larger ones in front and smaller ones behind. Their anterior margin is beset with 4-6 pointed spines (Fig. 28). These platelets are more like those of *Acteon* than the rodlets of *Cylichna* and *Cylichnella.*

The small radula lies at the inner end of the long pharynx and comprises 13 rows with the formula 1.1.1. The median tooth is 15 µ broad, notched in the middle and armed with 4-6 denticles on each side. The lateral tooth measures 40 µ, it is hook-shaped with a wing-like expansion on the inner side. This wing bears 5-8 sharp denticles (Fig. 29). Hence the radula is very similar to that of *Cylichnella bidentata,* though much smaller.

The salivary glands are small. The oesophagus (*e*) is folded and dilated in the portion that enters the gizzard. The three plates of the gizzard (Fig. 30) are rather similar in shape to those of *Retusa canaliculata* (Hoffmann 1938, f. 742 *K*), while the insertion of the musculature agrees with *Cylichnella bidentata* (Marcus 1958, f. 7). The centre of the calcareous plates is covered with a brown cuticular cap. The azygous (dorsal) one is trifoliate, 440 µ long, 370 µ broad, those of the ventral pair are longish, roughly whetstone-shaped, 530 µ long, 150 µ broad.

The oesophagus enters the stomach (*m*) from behind and from the left, while the intestine (*i*) leaves it on the right side and in front. Three liver ducts open into the stomach. Contrary to *Cylichna* (Lemche 1956, t. 2 f. 23) the intestine of *Tornatina candei* is nearly straight. Its contents are a mash without recognizable elements.

The pericardium (*p*) with the heart (*b*, *v*) lies to the left of the gizzard; a blood gland, as occurs in *Cylichnella,* was not seen. The blood is thicker than in *Cylichnella* and consists of eosinophilous granules. The renal folds (*t*) are parallel to those of the ctenidium (*g*).

The hermaphrodite gland (*k*) and the digestive gland (*l*) interpenetrate, and both organs extend from the hind end of the body to the posterior border of the stomach. Already behind the stomach the hermaphrodite duct dilates into a winding tubular ampulla. The female gland mass consists of the bigger mucous and the smaller, though distinct, albuminous part. The spermatocyst communicates with the sperm-oviduct rather far entally. The ectal course of the genital duct with the female glands (*ge*) produces a ridge on the floor of the mantle cavity.

From the genital opening the seminal groove runs to the right. Near the right Hancock's organ it pierces the body wall and goes on as a thin duct. This duct dilates entally into a folded sac (*u*), followed by a tubular glandular portion, the prostate (*y*), and a longish seminal vesicle (*x*) which is also glandular and contains sperm. Between the sac and the prostate, and between the latter and the vesicle, there are valve-like folds. The male copulatory organ of *Tornatina* is directed to the dorsal side at the level of the brain, and thence it extends still farther backwards. It differs from that of *Cylichna,* which does not store sperm (Lemche 1956, p. 144-145), and from that of *Cylichnella,* which has a true penis rimmed with papillae (Marcus 1958, f. 9). In the present species we suppose that the outer duct and the folded sac (*u*) are everted and intromitted into the vagina, functioning as an acrembolic penis.

At the common genital pore a long, thin vagina opens, which comes from the left anterior side. The duct (*d*) of the spermatheca (*s*) runs between the gizzard (*z*) and the pericardium (*p*); the spherical spermathecal vesicle is recognizable by its generally dark contents in the dissected snail.

Occurrence: Northern base of the Oceanographic Institute (São Paulo) near Ubatuba, about 135 km E. of Santos; 40 empty shells and 20 living snails. The latter were found below the low water-line in muddy sand together with a hundred *Cylichnella bidentata* (d'Orb.) and three *Acteon punctostriatus* (C. B. Ad.).

The locomotion of *Tornatina candei* is a combination of glide effected by undulation of the sole and "steps". The snail stretches its head forwards gradually and attaches it to the substratum, and then draws

the shell after it with a jerk. The gliding movement of the sole continues while the body is drawn forward.

Anesthetized together, the *Cylichnella* could be preserved well stretched, while all specimens of *Tornatina* contracted, and still more so the *Acteon*.

FURTHER DISTRIBUTION: Antilles; Middle Brazil (Rio de Janeiro); Southern Brazil (Sta. Catharina); Argentina, Port Quequen, Lat. 38°34′ S. (Carcelles & Parodiz 1938, p. 256).

DISCUSSION OF *Tornantina candei* (d'Orb.)

The present species and *Volvaria canaliculata* Say, 1822, have very similar shells and were therefore allocated to one and the same genus, either to *Tornatina* A. Adams, 1850 (Pilsbry 1893, p. 184-185) or to *Acteocina* Gray, 1847 (Johnson 1934, p. 145 and many others) or to *Retusa* Brown, 1827 (Abbott 1955, p. 280).

Tornatina and *Acteocina* have been declared as synonyms (Dall 1915, p. 32), and this opinion has been adopted by Bartsch (1915, p. 4), Strong (1921, 1922), Thiele (1931, p. 390), Pruvot-Fol (1934, p. 24) and many others. Odhner (1924, p. 45) however maintains *Tornatina*.

The classification of *Volvaria canaliculata* and *Bulla candei* once in *Tornatina* or *Acteocina*, and another time in *Retusa*, proves that the conchological characters, suture channeled or deeply channeled (*Tornatina, Acteocina*), and suture slightly channeled or accompanied by a channel (*Retusa*) do not permit safe generic separation. If one had to make a conchological decision, one would allocate both species to *Retusa*, as Abbott (l. c.) did. But conchology should always be completed by malacology, as Pilsbry (1893, p. 204), Annandale (1924, p. 872) and many others stressed. In the present case the conchological classification is invalidated: *canaliculata* has no radula (Thiele 1925, p. 268) and therefore belongs to the Retusidae, while *candei* has one (Fig. 29) and must hence be assigned to the Scaphandridae.

The oldest name, *Acteocina* Gray (1847, p. 160) is, in my opinion, not recommendable for a recent scaphandrid snail, because the type, *A. wetherellii* Lea, 1833, a fossil, can never be examined with regard to the radula. The past of the radula-less *canaliculata*, once attributed to *Tornatina*, another time to *Retusa*, warns against the conclusion that *Acteocina wetherellii* had a radula, because "the shell appears to be a typical *Tornatina*" (Dall, l. c.).

It is true that also for the type of *Tornatina*, *Tornatina voluta* (Quoy et Gaimard, 1833) which Finlay (1927, p. 520) renamed *T. gaimardi*, the presence or absence of a radula has not been published. An examination of the typical material or of snails from Guam (Marianas), now a U. S. naval station, might however decide this question. According to Thiele's results (1925, p. 273) it is probable that *Tornatina gaimardi*

has a radula, and therefore its generic name is used for *candei* here. If a genus is desirable, the type of which is known conchologically and malacologically, *Didontoglossa* Annandale (1924, p. 871) is available for snails with *Retusa*- or *Tornatina*-like shells and with radula.

Aplysia (*Tullia*) *juliana* Quoy et Gaimard, 1832 (Fig. 33-34)

The following discussion refers to specimens of *A. juliana* collected on the coast of the State of Rio de Janeiro. Four middle-sized ones were caught by Mr. Eduardo Ramos at the Ponta de Itapebuçú, about 170 km N. E. of Niteroi, on December 16, 1956. They are placed in the collection of the Oceanographic Institute, São Paulo. Lic. Plinio Soares Moreira brought two big animals from the Ilha de Marambaia, about 70 km W. of Rio de Janeiro, where he collected them on March 18, 1957. One of them is kept in the mentioned Institute, the other was dissected.

The biggest specimen in the material from Itapebuçú, preserved in formalin and strongly contracted was about 60 mm long, 28 mm broad and 34 mm high. The colour consists of some dark pigment over the light greyish transparent flesh; the border of the parapodia is a little lighter; their inner side and the mantle are pigmented. The tentacles and rhinophores are light and connected by a light stripe, the insides of the auriculate tips are dark.

The adhesive areas are not distinctly delimited on the contracted sole, nor is a tail set off. A light border surrounds the posterior part of the foot. The aperture of the shell chamber is middle-sized, about one sixth of the lenght of the mantle. The shell of the biggest specimen is 24 mm long and 15 mm broad, with a sinus of 9 mm. The spiral larval shell (Fig. 33) is distinct, the calcareous layer was broken, but not specially thin. The smooth parapodia are confluent behind, forming a high, straight edge; in front the parapodia are inserted widely separate, farther laterally than the rhinophores, but approach one another.

The radula of the largest specimen has 60 rows and 30 lateral teeth. The rhachidian tooth has the specific shape; 1-3 marginals have no cusp. These plates are quite irregular in the various rows of one and the same radula, sometimes they are fused, sometimes separated, and either small or big.

In the roof of the mantle cavity whitish glands, which are homologous to the purple glands, occur as in our material from Ubatuba (Marcus 1955, p. 16).

The male copulatory organ, exserted in one of the present slugs, is black. The black penial sheath has a colourless base which bears compound warts (Fig. 34). These are higher than broad in the middle, where they are contiguous, and become lower, broader, and farther distant from one another outwards. They are covered with numerous, probably cuticular cones.

The examined sea-hare from the Island of Marambaia is about 12 cm long. Its colour is dark brown, almost black. The head is a little more contracted than the rest of the anterior and middle region of the body; the hind part is strongly contracted, and its skin appears coriaceous with black concentrated pigment. The sole is a little lighter. The distribution of the pigment is nearly uniform over the whitish flesh. The inner border of the parapodia, the mantle, and the gill are black. Thin white streaks exist on the inner side of the parapodial borders and lighter radiate spots on the mantle.

The base of the parapodia is 6 cm long and limited against the foot by a constriction. In front the parapodia are separated by a distance of 4,5 cm from one another, their upper borders are thin and united behind to their entire height.

The sole is 6 cm broad, little set off from the foot, and strongly contracted behind forming a round area of 3 cm diameter. The anterior margin of the foot is notched. The tentacles are very broad and short, the rhinophores 15 mm distant from one another.

The shell aperture of the mantle measuring 2,5 to 1,5 mm is large for an adult animal. The overhang is 4 mm broad. The anal spout is contracted and 1,6 cm high. The shell is almost completely decalcified and the horny layer folded by the contraction of the body; it is about 46 mm long and 30 mm broad with an 18 mm long sinus.

The pores of the whitish purple gland are recognizable only with a lens; their rich secretion is black, as the collector informed. This colour contrasts with the "white mantle gland exudate" (Dr. Nellie B. Eales: letter of May 24, 1957) characteristic for *A. juliana* and also verified in our young specimens at Ubatuba (Marcus 1955, p. 16). All other characters, however, high fused parapodia, broad sole, foot disc, plain radula (Bergh 1905, p. 10), aperture in mantle also in adult animals, simple multiporous opaline gland, and spiny wharts of the penial sheath, guarantee the determination of the present "tinteiro" (inkwell), as it is popularly called. We had already noted (Marcus 1955, p. 13) for *A. brasiliana* that the colour of the secretion of the purple gland varies, it is true, not to the degree now stated for *A. juliana*.

NOTES ON *Aplysia* (*Tullia*) *juliana* and *A. brasiliana*

To the above mentioned characters of *A. juliana* Q. et G. Dr. Nellie B. Eales-Reading (England) in her letter of May 24, 1957 added: broad, flat salivary glands and crozier-shaped caecum. The adhesive anterior lobes and posterior disc of the sole do not differ histologically from the soft and thin middle region, hence their systematic value is restricted. Sometimes the sole of preserved specimens is completely unmodified (Macnae 1955, p. 238).

Dr. Alice Pruvot-Fol-Sceaux (France) kindly sent us her revision of Quoy et Gaimard's Opisthobranchs (1934). Her textfigure 4, radular

teeth of the original material of *A. brasiliana* Rang, agrees well with the radulae of our variously coloured *brasiliana*.

During the new moon spring tides at the end of June 1957 we found very many sea-hares at the rocky coast of Ubatuba. They were chiefly half-grown, 5-12 cm-long *A. brasiliana*, while the much less numerous *A. juliana* were smaller (1-3 cm). Whether larger ones occurred in deeper water, could not be seen due to the movement of the water. The zone with stones and algae is however so narrow that it does not offer much substratum for the slugs, and farther down the bottom consists of fine sand.

While the youngest *A. juliana* are bottle-green, and the larger, 2-3 cm long ones sometimes have light blotches, the *A. brasiliana* begin pink (1-2 cm), and later acquire their definitive, highly variable colouring. The half-grown specimens that we observed this time were grass- or bottle-green, more or less mottled with white, others dark brown.

Above the low-water level the Aplysiae hung on the boulders covered with Ulva fasciata and Enteromorpha like bats with the heads downwards, the parapodia wrapping neck and back, the sole free, and only the hind end of the foot clinging to the substratum. When we removed them gently, the tip of the sole lengthened, till it finally lost its hold. Then one saw sand shell fragments sticking to the hind end, while the latter shortened rapidly to assume its regular length.

Aplysia parvula Mörch, 1863

For synonyms, literature and distribution see: Engel und Hummelinck (1936, p. 15-29) and add: Macnae 1955 (p. 235-237): *A. spuria* Krauss, 1848.

The last name is not used here, because Dr. Nellie B. Eales kindly informed us by letters that *A. spuria* can not be defined univocally, and its type is lost.

To our friend Mr. João de Paiva Carvalho of the Oceanographic Institute of São Paulo we owe a sea-hare of this circumtropical species. As it is the first representative from the Brazilian coast, it was not dissected and is kept in the collection of the mentioned Institute. The preserved animal is 8,5 mm long, 7 mm high and 4 mm broad. Its general colour is light reddish. Mouth, tentacles, the auriculate tip of the rhinophores, the free edge of the paradopia, the anal spout, the 4 mm broad mantle aperture and the sole are rimmed with black. The shell is 6,5 mm long.

Occurrence: Lixa Reef, about 18 km off the coast of Bahia, among fragments of corals, 1 specimen collected by Dr. Luiz Pini Netto in February 1957.

Elysia lobata Gould, 1852
(Fig. 35-40)

Elysia lobata Gould 1852, p. 308; 1856, t. 26 f. 405, 405a.
Elysia elsieae Ostergaard 1955, p. 122 f. 9 and t. 1.

Dr. Libbie H. Hyman-New York has sent uns three sexually mature specimens, the biggest and the smallest of which were preserved in wintergreen oil with spread parapodia, the medium-sized one is in alcohol. The biggest slug (Fig. 36) is 10 mm long, 9 mm broad, the smallest 4 mm long and 6 mm broad. The animal in alcohol (Fig. 35) is 6 mm long with about 4 mm high parapodia, with spread parapodia it would be about 10 mm broad.

The colour of the clarified slugs is orange yellow, that of the specimen in alcohol ochre. The outside of the parapodia is stippled with black, more or less round spots (*r*). With high power these appear as rings, because their centre is occupied by the colourless outlet of a skin gland. These glands (*g*) are rather big, 150 micra long and 80 micra thick in the sections, in the slug preserved in alcohol they are recognizable as yellow vesicles. The black eyes and some dark glands on either side of the oral tube are visible in the clarified animals, but the colour marks indicated for living slugs of the above-mentioned synonyms have disappeared.

The shaft of the strongly contracted rhinophores and the outer side of the parapodia of the animal in alcohol bear slight warts. The wavy border of the parapodia is papillose (Fig. 37) in the two smaller of the present slugs, while it is smooth in the biggest. The inner surface of each parapodium shows about five ramified and anastomosing vessels (*v*). The swelling of the pericardium (*h*) behind the eyes and the roll along the middle of the back that contains the kidney (*k*) are distinct. The inner renal folds are seen in sections. The renal opening is located to the right of the auricle, the single reno-pericardial communication a little farther behind.

The male pore (*m*) lies close behind the right rhinophore. Farther backwards and ventrally, near the edge of the sole, the female aperture and the anus (*a*) open into the same pit. As far as the topography can be judged in preserved and contracted specimens, the position of anus and female opening is unusually far in front; it corresponds to the level of the anterior part of the pharynx.

The foot has no transverse furrow, the epithelium of its sole is thick, its glands were recognizable but did not stain.

The nerve-ring (*c*) surrounds the the hindmost part of the pharynx (*f*), hence does not lie behind it.

The histological state of the material does not allow for details. Eosinophilous labial glands and thick clusters of glands (*y*) on either side of the oral tube occur. The radula has seven teeth in the dorsal and ten in the ventral limb. Further 15-20 teeth are irregularly heaped

in the ascus (*x*), neither disposed in a straight series nor in a spiral. The biggest teeth are about 0,25 mm long, with the base occupying two fifths of its total length. The cusp is pointed, and its border provided with 1,2-1,6 micra broad, blunt denticles. The entrance of the oral tube into the one mm long pharynx is cuticularized. The salivary glands (*z*) agree with those of *Elysia viridis* (Fretter 1941, p. 187-188).

After leaving the hind end of the pharynx, the oesophagus (*n*) curves forward under the pharynx. At the level of the middle of the buccal mass, the oesophagus enters the wide stomach (*so*) which has numerous longitudinal folds. From the left a 0,5 mm long muscular pouch (*oe*) opens into the oesophagus immediately in front of the cardia. Backwards this thick-walled pouch extends beyond the pharynx. Of the digestive gland (*l*) the two posterior branches and a smaller anterior pair were seen. The stomach extends backwards far to the left; on the right and in front it passes gradually into the intestine (*i*). The anus (*a*) lies in a cutaneous fold which also contains the female aperture.

The follicles of the gonad are disposed in different levels, not in a single layer. Every follicle contains the male cells dorsally, the female cells ventrally. The ciliated efferent tubules unite to wide tubes (*j*) and these to the ciliated ampulla (*u*). A short common spermoviduct leaves the ampulla. The prostatic (*q*) and albumen glands (*b*) were seen, but not their communication with the genital ducts.

The male duct (*d*) is thickly coated with cilia and coils through a voluminous penial papilla (*p*) to its tip. This papilla projects into a spacious male atrium, the fundus of which has a long ventral diverticulum (*e*) with muscular wall and high epithelium. In *Lobiger souverbiei* P. Fischer, 1856, we observed a similar glandular appendage.

The ciliated female duct (*o*) passes into a rather small mucus gland (*w*) which is situated near the ampulla. The spermatheca (*t*) which lies left to the stomach opens by a long duct (*s*) into the inner part of the mucus gland. Hence the long outer canal (*ov*) between mucus gland and female aperture functions as oviduct as well as vagina.

Occurrence: Eniwetok Atoll, Marshall Islands, three specimens collected by Mr. Donald Reish from the Allan Hancock Foundation on August 20 and September 2 and 7, 1956. The slugs were taken from coral of reef flat or on algal fronds growing on the reef (letter of Dr. Libbie H. Hyman, New York).

Further distribution: Oahu, Sandwich Islands.

DISCUSSION OF *Elysia lobata* Gould

Ostergaard (l. c.) was right to ponder the identity of his species with *lobata*, but he considered Gould's descriptions and figures inadequate. However, only the size distinguishes *elsieae* (15 mm) from *lobata* (25 mm), both from Oahu. The present slugs were measured only in

preserved state, and hence they are much shorter. It is true that Gould did not mention black rings, but with low power these appear only as spots. Species with black-edged parapodia or with smooth edge of the radular teeth should be maintained apart from *lobata*, but on the whole the present classification of *Elysia* (Pruvot-Fol 1946, p. 33-34; Macnae 1954, p. 54) is inclined to far-going union of Indo-West Pacific species.

The radula is rather uniform in *Elysia*, the colour highly variable, and, as the present material shows, even an apparently good specific character, viz. the papillae of the parapodial border, is taxonomically without value. Hence only the study of the anatomy, principally the reproductive organs and the alimentary tract, makes a safe separation of the species possible.

Nembrotha divae, spec. nov.
(Fig. 56-65)

The single preserved specimen is colourless, about 12 mm long, 3,2 mm broad and 5,5 mm high including the gills. The sole is folded and hence appears quite narrow. The colour of the living slug was scarlet with white gills and white dots. Three tri-pinnate gills lie in the middle of the notum; their anterior border is 5 mm distant from the tip.

The living animal was extremely sticky, and the great number of cutaneous glands let the skin swell very much, when the preserved slug was transferred to water for dissection. The spicules are up to 0,22 mm long, up to 40 micra thick, straight or curved (Fig. 59), with blunt ends and sometimes slightly nodulous. The surface of the notum, observed as quite smooth in the living, was irregularly bossed in the preserved state, due to the swelling of the skin glands.

The tail of the living slug was very long. The foot is anteriorly truncated with somewhat prolonged corners (Fig. 58). The mouth is narrow and overhung by short refolded labial tentacles linked together by a bilobed frontal veil. The stout rhinophores have about 17 perfoliations. Between the rhinophores the skin forms a slight comb. To the sides of the rhinophores low crests run backwards and separate the notum from the sides. They unite behind the gills, and the resulting posterior median crest ends on the tip of the tail. The gonopore lies on the right side (Fig. 57, *g*), two thirds of its height from the sole and 4 mm behind the fore end. The anus is mid-dorsal, in the centre of the gills.

The cuticle of the labial disc (Fig. 60) is folded and smooth, not composed of rods. The colourless radula is 2 mm long and consists of 16 rows with the formula 5-6.1.1.1.5-6. The rhachidian tooth is a 0,15 mm long, 0,12 mm broad, delicate and quite flat plate. It is certainly of little use (Eales 1938, p. 96). Its anterior edge is neither recurved

nor denticulated. The lateral tooth is a 0,4 mm long hook with a strong cusp and irregular processes between cusp and base. The marginal teeth decrease in size outwards, they are plates of irregular shape. The oesophagus has a small diverticulum.

The ovotestis which coats the digestive gland consists of many central male follicles each covered by numerous smaller female ones. The ductules of the various follicles unite to the hermaphrodite duct (*h*) which leads to the reniform ampulla (*a*). The spermoviduct (*s*) leaves the ampulla and enters the gland mass composed of a big, nearly spherical mucus gland (*m*) of vitreous appearance and the smaller yellow albumen gland (*b*). The mucus gland is chiefly ventral and most of the other reproductive organs are embedded in its dorsal surface (Fig. 62); the albumen gland lies rather more behind.

The ciliated thin male duct (*d*) arises from the gland mass and then becomes coated with a thick muscle mantle. The duct runs in a narrow spiral of two and a half whorls which begin with a slightly elevated centre. This spiral contains the prostatic part (*q*) of the male duct whose ciliated epithelium stores big eosinophilous droplets (Fig. 63). Where the outer whorl straightens, the duct is sheathed by a muscle tube, as in *Polycera odhneri* Marcus (1955, f. 200) and others. Between the muscular wall of the duct and the sheath there is a cavity; the lumen of the duct is narrow and its epithelium low. The distal, about 0,4 mm long part of the male duct contains small cuticular spines. Its outermost portion is richly folded (Fig. 64) and hangs as a penial papilla (*p*) into the male vestibule (*w*) whose epithelium is partly glandular. The male vestibule opens to the exterior together with the female one.

The ciliated nidamental duct (*n*) leads to a folded muscular pouch, the female vestibule. One part of the latter, still more folded and ciliated, is the entrance of the vagina (*v*) which is strongly muscular on its whole length. Farther inwards the crumpled vaginal epithelium is cuticularized (Fig. 65). The innermost part is ciliated again and passes to the spermatheca (*t*) the wall of which is no longer muscular. The uterine or fertilizing duct (*f*) goes out from the cuticularized portion of the vagina (Fig. 65). This fine ciliated duct winds through the thick muscular wall of the vagina and runs with a much thinner musculature to the gland mass. Only a slight dilatation of the duct represents a spermatocyst (*u*). The fertilizing duct enters the gland mass near the albumen gland (*b*).

The aorta passes under the intestine and runs over the genital mass. At this point the blood gland inserts, which lies over the central part of the genital organs as a flat lobed organ. Lobed blood glands are known to occur in several species of *Nembrotha* (Bergh 1877, p. 453, 456; 1907, p. 69). A separate prostate however has not been found; since 1883 (p. 165) Bergh has several times among the characters of the genus indicated: "prostata discreta nulla." Therefore the distinct and lobed

prostate of *Nembrotha lineolata* Bergh (Eales 1938, text-fig. 16, gl. pr.) is exceptional, but I do not feel competent to take it for the blood gland.

Occurrence: Cabo Frio in the State of Rio, Lat. 22°57′ S., Long. 42°1′ W., Arraial do Cabo, praia do Forno. One mature specimen collected by Dr. Diva Diniz Corrêa under a stone in the tidal zone; July 15, 1957.

DISCUSSION OF *Nembrotha divae*

Nembrotha Bergh (1877, p. 450; 1883, p. 164) includes 20 species, 19 of which are reported from the Indo-West Pacific Ocean, where they occur on the coasts of South and East Africa; in the Red Sea and eastward to Japan and Australia. Of these *N. limaciformis* Eliot (1908, p. 98) has a similar, not the same, colour pattern as the present species. It differs by the rhachidian tooth of the radula which is reflexed and bifid or indistinctly jagged. The variety of *Nembrotha nigerrima* Bgh. from the Laccadives that Eliot (1903, p. 549) described may have been red alive. Its rhachidian tooth however has an upwards turned front edge which bears 4-5 denticles. One Atlantic species is *N. gratiosa* Bergh (1890a, p. 172; 1890b, p. 981). It was dredged by the "Blake" in the Gulf of Mexico, in about 66 m. Bergh later on (1892, p. 1145) indicated this species from Amboina, but this is a lapse; a still later reference (Bergh 1907, p. 68) is correct again. N. *gratiosa* has a caudal crest like *N. divae*, but the median tooth of its radula is broader than long, the cusp of the lateral tooth is bifid, and there are only three marginal teeth.

In the neighbourhood of the Atlantic area *Nembrotha capensis* Bergh (1907, p. 68; Barnard 1927, p. 196) has been found. It is reported from two localities in False Bay whose sea temperatures are higher than those immediately west (Cape of Good Hope) and east (Sandown Bay). As in *N. divae* the back of *N. capensis* is limited by a low rim, but the African species differs from the present one by dark colour, size (38-67 mm), and a broader than long rhachidian tooth.

Nembrotha diaphana Bgh. from the Moroccan Atlantic coast (Pruvot-Fol 1927, p. 47, t. 5, f. 1-9), whose specific name was questioned by the author later on (ead. 1953, p. 18), has 4 dark lines on the back.

Since Bergh (1881, p. 659, note 2) *Angasiella edwardsi* Angas (1864, p. 49) from Port Jackson is considered as the possible first *Nembrotha* by several authors, also by Thiele (1931, p. 425). This slug is described as spinous and distinctly drawn so (t. 4 f. 9), while the species of *Nembrotha* are smooth. Hence I do not think that *Angasiella* must substitute *Nembrotha.*

Polycera marplatensis Franceschi, 1928
(Fig. 41-44)

Polycera quadrilineata var. *marplatensis* Franceschi 1928, p. 580, f. 1-7.
Polycera marplatensis Odhner 1941, p. 14, 16.

The present animal is young and immature; it was 6 mm long alive, while adult slugs from Argentina attain 33 mm in length (Carcelles 1944, p. 264). The measurements in preserved state are: length 4,2 mm, breadth 1,8 mm, height 2,2 mm. The velum has six appendages, each rhinophore eight lamellae. There are seven unipinnate gills, the anterior one is nearly as long as the processes which flank the branchiae.

The white animal had yellow velar appendages, yellow rhinophores and brick red streaks and spots, chiefly disposed in longitudinal rows which are not exactly symmetrical. The yellow elements disappeared in the liquids of preservation, "susa" and alcohol, while the red colour was still preserved a fortnight after the slug was collected. The gills and the extra-branchial appendages contain some dark pigment.

The jaws (Fig. 42) have very broad wing-like expansions. The radula has 11 rows of 4.2.0.2.4 teeth. The inner of the two hamate teeth is smaller and thinner than the second and its spur lies above the middle. A smaller spur approximately in the middle and two denticles on the inner side of the cusp are further characters of the innermost lateral tooth. The following tooth is the biggest, it has a very broad basal spur. The four marginal teeth decrease in size outwards and do not bear any cusps.

Occurrence: One specimen collected at Ubatuba (23°27′ S.) under a stone, near low-water line; June 1957.

Further distribution: Argentina, ports of Mar del Plata (37°59′ S.) and Quequén (38°34′ S.) (Franceschi 1928; Carcelles 1944). The specimens of Mar del Plata were gathered in the months June to September.

DISCUSSION OF *Polycera marplatensis*

The shape of the hamate lateral plates of the radula and the broad expansions of the mandibles already stressed by Franceschi (p. 583) justify the specific separation of *marplatensis*, as Odhner (l. c.) had proposed. It is true that Pruvot-Fol (1954, p. 315) does not even attribute varietal rank to *marplatensis*, but I think that it is as good an "espèce vicariante" (l. c., p. 317) of *quadrilineata* (O. F. Müll.) as *capensis* (Q. G.). *P. atra* MacFarland, 1905, which Pruvot-Fol (l. c. and 1934, p. 76) mentioned in this connection, does not belong to the *quadrilineata*-group, as Odhner's key (1941) shows.

Polycera odhneri Marcus, 1955
(Fig. 45-47)

In September 1956 we found three 18 mm long adult and several smaller slugs near Ubatuba at the Northern Base of the Oceanographic Institute São Paulo. This material allows to complete our first description (Marcus 1955, p. 158-161) based on not quite adult specimens.

The big animals had more black colour elements than the smaller ones. The rhinophores have up to 15 lamellae. There are up to seven gills (*g*), the big ones of which are bipinnate. The greatest number of radular rows is 11. With regard to the caecum (*c*) our first description must be emended, because the adult specimens have an only 0,2 mm long caecum. The intestine (*i*) is ciliated and has longitudinal folds in its pyloric portion. The limit between stomach and digestive gland (*h*) is indistinct; they are connected by numerous ducts. The undivided blood gland (*b*) lies as a compact body on the right side over the male duct, as Bergh (1880, p. 609) described.

The ovotestis (*j*) is composed of several big male follicles, each surrounded by a number of small female acini. The hermaphrodite ductules unite to a hermaphrodite duct (*l*) which dilates into the bean-shaped ampulla (*u*). The spermoviduct which leaves the ampulla is short, touches the female gland mass (*y*), bifurcates and opens with a very short female branch, the oviduct (*r*), into the gland mass.

The male branch (*e*) becomes glandular, i. e. prostatic (*q*), immediately, and runs around the spermatheca (*t*), as previously drawn (Marcus 1955, f. 200). The cells of this glandular part contain eosinophil secretion. The outer muscular part (*p*) of the male duct bears cuticular hooks in its 0,37 mm long terminal portion.

The "peculiar tube" (l. c., p. 159 f. 200, *z*) that opens between the prostatic and the muscular part of the male duct is much bigger in the mature slug. It is a broad and flat, lobed glandular pouch (Fig. 47, *z*) which is ventrally attached to the spermatheca (*t*) and communicates with the male duct at the end of the prostatic portion. It is homologous with the "prostates" drawn by Pohl (1905, t. 25 f. 1, 2, *prd*) and Pruvot-Fol (1951, text-fig. 18, *pr.;* 1954, text-fig. 123, *pr.*). Its cells stain blue with haematoxylin-eosin in the present species.

The female organs (*w*) with sphincter (*n*) and seminal receptacles (vesicles) are as previously described. The aspect of the dissected slugs varies according to the contents of these receptacles. In the drawn animal the spermatocyst (*s*) is so much distended that it projects in front beyond the other reproductive organs. This distension includes parts of the fertilizing or uterine duct (*x*), both between spermatheca and spermatocyst and between the latter and the gland mass (*y*). Therefore these appear much shorter than in younger specimens.

The folded gland mass opens with several nidamental pores into the common genital aperture (*o*) which also receives the male and the vaginal vestibule.

Polycera aurisula Marcus, 1957
(Fig. 48, 49)

The original description of this species, in press in the Journal of the Linnean Society of London, was based on young specimens. In September 1956 we found six slugs, up to 10 mm long alive, near Ubatuba at the Northern Base of the Oceanographic Institute São Paulo. Preserved they were up to 6 mm long and 3,5 mm high including the branchiae. They are much less colourful than the young slugs; evidently the blue and orange marks do not accompany the growth and are proportionally less conspicuous. The general colour is more grey, not as brown as the small animals were. The velum bears two to three processes on either side. The rhinophores have up to 15 leaflets.

There are nine gills (*g*), the foremost biggest of which are bipinnate, the smaller ones unipinnate. An irregular number of branchial glands (*c*) lies at the bases of the gills. The two biggest slugs have two extra-branchial appendages (*k*) and only an allusive foremost third. The hindmost, longest of these processes is longer than the velar appendages.

The radula is about 1 mm long and composed of 11 rows with the formula 3.1.1.0.1.1.3, hence with one of the uncinate marginal teeth less than the material of the first description. The biggest tooth, the outer lateral one, is 0,22 mm high. The caecum is minute and does not project on the surface of the intestinal gland. The intestine is much longer than in *P. odhneri;* its course is winding.

The hermaphrodite gland consists of long tubes (*h*) containing male cells and beset with female follicles (*f*). The organ lies on the dorsal surface of the digestive gland and extends from the posterior left to the anterior right. A long hermaphrodite duct (*l*) leads to the ampulla (*u*) which is reniform as in *P. odhneri.* The spermoviduct bifurcates into two short branches, a female (*r*) which enters the gland mass and a male (*d*) which becomes prostatic.

The prostate (*q*) is attached to the albumen gland and is a slightly lobate dilated part of the male duct; its shape is that of a folded balloon as in Odhner's figures (1941, text-figs. 4, 9). The muscular part of the efferent duct (*e*) is very strong, and its hook-bearing outer portion (*p*) 0,85 mm long. Also the male vestibule (*m*) is rather large, about 0,5 mm long.

The mucus gland occupies the left posterior and ventral region of the female gland mass (*y*). The albumen gland which has small folds lies farther in front under the prostate (*q*). The vagina (*n*) is long and lined with strong cilia. The seminal vesicles (receptacles) were empty in the examined slugs and therefore small (*s*, *t*), and the uterine (fertilizing) duct (*x*) correspondingly long, contrary to the proportions found in mature *P. odhneri.* The entire duct that unites the spermatocyst (*s*)

with the uterine duct certainly belongs to the wall of the spermatocyst when this organ becomes distended by sperm. The serial position of spermatheca (*t*) and spermatocyst (*s*) is the arrangement typical in *Polycera*. Nidamental, vaginal and male opening communicate with the exterior by a common genital aperture (*o*).

DISCUSSION OF *Polycera aurisula* Marc.

As was mentioned in our first description, the species is very closely related with *Polycera hummi* Abbott, 1952, from North Carolina to Florida. The small, but incisive, difference between the two species concerns the innermost of the outer lateral (or marginal) uncinate teeth, the cusp (or anterior edge) of which bears 5 denticles in *hummi*, and is smooth in *aurisula*. Less significant are the following differences: *P. hummi*, the bigger species, has up to 14 rhinophorial perfoliations, *aurisula* up to 15. The velar processes are four in *hummi*, four to six in *aurisula*. *Polycera hummi* has three to four extra-branchial appendages on each side of the gills, and these processes are blunt club-shaped, dilated above, contracted at the base. *P. aurisula* has two to three conical, carrot-shaped appendages, the smallest foremost of which may be reduced to a minute boss.

Corambe evelinae, spec. nov.

(Fig. 50-55)

The biggest of the 3 present slugs was 7 mm long alive, anesthetized and preserved 6,5 mm long, 5,8 mm broad, and 2,9 mm high. The foot of this slug was about 4 mm long, 3,5 mm broad.

The animals are more or less transparent except for light yellow lines which form a net around vesicle-shaped bosses. The deep layer of the notal connective tissue contains red and black spots. The latter are preserved in the sections where they appear as arborescent melanophores (*m*). Also the red pigment lies in such uni-nucleate cells, but this colour is dissolved in the sections. Rhinophores and foot contain no pigments.

The notum has a deep notch in the middle of the posterior margin. The foot is concealed by the notum, is emarginate in front, rounded behind and bears cyanophilous glands, especially on its sides.

The notum consists of a thin epidermis and a very thick layer of connective tissue. Except for the glands which stain red and blue the epidermal cells are of equal size (Fig. 52). They secrete a thin cuticle which is at irregular intervals provided with peg-shaped thickenings. These small pegs do not stain darker than remaining cuticle, contrary to those of *C. testudinaria* H. Fischer (Hoffmann 1934, p. 398 f. 296 A) and *C. pacifica* MacFarland and O'Donoghue (1929, t. 1 f. 3-4). The

connective tissue is a solid dense and staining ground-substance with few nuclei and scarce fibres. There are numerous blood sinuses (*c*) and no spicules.

The head is covered by the notum. The tentacles are united by a fan-shaped velum with a straight border. Their tips do not show beyond the notal margin, when the slug is crawling. The rhinophores are like those of the other species of the genus: to the club one pair of lateral expansions is attached up to the tip. An outer membrane with free anterior border envelops the club with its expansions. The eyes are located in the body cavity.

The genital apertures lie on a papilla under the notum, at the right side and in front; the anus (*a*) behind, between notum and foot; to the right of and dorsal to the anus the kidney (*ni*) opens (*n*). The long reno-pericardial duct has a cardiac, strongly ciliated (*r*) and high--celled, renal part. Only the anterior portion of the latter was drawn (Fig. 54); its entire course runs within the flat-celled renal sac (*ni*), not outside the kidney as in *C. pacifica* (MacFarland and O'Donoghue 1929, t. 3 f. 17).

There are seven lateral gills (*j*) on each side, decreasing in size forwards. The biggest, hindmost, has eleven, the smallest, foremost, four lamellae which are disposed alternately upon the sides of the rhachis. A branchial gland (*b*) lies at the base of each gill. The wide distance between the two hindmost branchiae is occupied by two or three median and much farther dorsal gills (*ji*) which project from under the notal notch, as in *C. pacifica*. These gills have specially big branchial glands. In one of our specimens a bigger mid-dorsal gill is flanked by two quite small ones, in the other a pair of dorsal gills of different sizes is developed. Topographically these on the whole small dorsal gills correspond to the median gland of *C. testudinaria* (Hoffmann 1939, p. 1220 f. 828, dr). As such gland does not exist in *C. pacifica* (MacFarland and O'Donoghue 1929, p. 12) and *C. evelinae*, it is perhaps not quite impossible that also in *C. testudinaria* median gills, not a branched gland, occur.

The muscular crop is globular and connected with the pharyngeal bulb by a quite short pedicel as described in *Goniodoris* (Forrest 1953, p. 233). The striated muscles of the crop are chiefly radial; the epithelium is cuticularized. The radula (Fig. 53) has 33 rows with the formula 5.1.0.1.5. The cusp of the lateral tooth has a blunt point and 3-5 denticles on its inner side. The marginal teeth are broad plates, some of which have a notch on the inner border and a keel in the middle, evidently a rudimentary cusp. The radula of *C. pacifica* (Mac Farland and O'Donoghue 1929, t. 3 f. 12-16) differs more from the present species than that of *C. testudinaria* (H. Fischer 1889, text-fig. on p. 381). The alimentary tract from the oesophagus to the anus is ciliated, with exception of the cardia, the epithelium of which is covered with a cuticle. While *C. pacifica* has no "biliary cyst", a short folded caecum occurs in the present species. As far as can be judged from one series of

sections, five ducts of the digestive gland enter the stomach. The red-staining grumose contents of the intestine could not be analyzed.

The hermaphrodite gland (*h*), the follicles of which are mixed, lies dorsal and lateral to the liver (*d*). A long thin hermaphrodite duct runs around the hind wall of spermatheca (*t*) and mucus gland (*g*) down to the ventral side, where a long and wide ampulla (*w*) extends forward to the level of the brain. The spermoviduct (*x*) leaves the ampulla 0,3 mm behind its tip and curves to the right side dividing into the male duct and the oviduct.

The male duct becomes prostatic (*q*) immediately, curves to the ventral side and runs backwards under ampulla and female gland-mass. Below the spermatheca (*t*) the prostatic part of the male duct turns forward to the level of the genital papilla. Its continuation, the thin and muscular efferent duct (*e*) coils towards the right body-wall, where its unarmed termination, the penis (*p*), projects into the ciliated and folded male vestibule. The outer opening of the latter is the foremost and most dorsal pore on the genital papilla.

The oviduct (*o*) originated by the bifurcation of the spermoviduct (*x*) is a winding ciliated canal, to which a small spermatocyst (*s*) is attached. A short duct (*l*) of the albumen gland (*ae*) enters the oviduct just before the latter passes (*k*) into the mucus gland (*g*).

Immediately behind the male pore, not in front of it as in the diagram (Fig. 55), lies the vaginal aperture (*z*). The vagina (*v*) is muscular, ciliated and very long. It leads into the ample, globular spermatheca (*t*). The uterine or fertilizing duct (*u*) goes out from the spermatheca at a point far from the entrance of the vagina. The uterine duct opens into the oviduct (*o*) together with the albumen gland-duct (*l*). The position of the spermatocyst differs from that in *Corambe pacifica* (MacFarland and O'Donoghue 1929, t. 2 f. 7) and *Corambella carambola* (Marcus 1955, t. 23 f. 217) where the seminal vesicles (or receptacles) are arranged serially (Odhner 1926, p. 51). The inward position of the spermatocyst in *C. evelinae* is probably the same in *C. sargassicola* and *C. testudinaria*. It may be the cause that the spermatocyst has not been found in these species, though Bergh (1892, p. 1159) presumed it to be present. Perhaps the vesicle (sp. c.) in the figure (Pruvot-Fol 1954, f. 118 m), it is true, connected with the spermoviduct, is the spermatocyst of *C. testudinaria*.

The multiple nidamental canals or outer oviducts open into a nidamental vestibule which is separated from the male and vaginal pores by a muscular flap. The nidamental aperture (*y*) is the hindmost and most ventral of the three genital orifices on the genital papilla.

Occurrence: Ubatuba, approximately 145 km N. E. of Santos, two specimens under stones above low-water line, June; one September 1957.

DISCUSSION OF *Corambe evelinae*

Only three species with a posterior notch in the notum (Marcus 1955, p. 166-167) can be assigned to *Corambe* Bergh, 1869. Though the material of the new species is too small for a thorough comparison with *C. testudinaria* and *C. pacifica*, its most obvious differences allow for the arrangement in the following key:

1 Two plate-like gills on each side ... *sargassicola* Bergh, 1871.
– At least four plume-like gills on each side ... 2.

2 Up to 14 gills on each side; branchial lamellae opposite on the rhachis ... *pacifica* MacFarland and O'Donoghue, 1929.
– Up to seven gills on each side; branchial lamellae alternate on the rhachis ... 3.

3 No more than four branchial lamellae on each side of the rhachis ... *testudinaria* H. Fischer, 1889.
— Up to 7 branchial lamellae on each side of the rhachis ... *evelinae*.

In this key the gills of the original description of *C. sargassicola* (Bergh 1871, p. 1295) are considered. After a later examination of material from the European Atlantic coast Bergh (1892, p. 1158-60) did no longer refer to plate-like branchiae in *sargassicola*, as MacFarland and O'Donoghue (1929, p. 12) have already noted. According to our finding in *Corambella carambola* Marcus (1955, p. 164) we think it is probable that Bergh's original description of the branchiae of *Corambe sargassicola* was on the whole correct.

Hancockia ryrca Marcus, 1957

In a paper in press in the Journal of the Linnean Society of London this species was described from one specimen obtained in September 1955 among Padina near the low-water line at the Northern Base of the Oceanographic Institute of São Paulo. In September 1956 we found further 13 slugs at the same locality. Some of them had yellow cutaneous pigment, others were green due to the digestive gland shining through the colourless skin. The oesophageal diverticulum known from *Hancockia uncinata* (Hesse, 1872) and *H. californica* MacFarland, 1923, had not been found in our first specimen, and with reservation we had indicated it as absent. In the present specimens it is well developed and had evidently been cut out when the radula was prepared from our first specimen. The specific separation of *H. ryrca* from the three other species of the genus is not affected by this correction.

Antiopella mucloc Marcus, 1958

The description of this species, in press in the American Museum Novitates, was based on a single mature, 20 mm long specimen. In June 1957 we obtained two 26 mm long slugs at Ubatuba among tufts of the ctenostomatous bryozoon *Anguinella palmata* Van Beneden. Preserved, the animals were 12 mm long, 7 mm high, and 6 mm broad.

The rhinophores have 12 complete and 12 intercalary shorter perfoliations. An anterior anastomosis between the right and left liver is not developed. The cerata form four to six rows. The colour of the spots on the cerata was brick red. The liver branches within the cerata have a nodulous aspect due to diverticula.

Already in our first specimen we had found the strong curved mandibular spur only on the left jaw and now verified the same in one of the present animals. The second was not dissected in order to keep one complete specimen. Also on Trinchese's plate 40 (1882) the corresponding inner spur of *Antiopella cristata* (Chiaje) appears only on the left jaw (f. 9, b). Bergh's thorough description (1874, p. 601-602) of the mandibles of *A. cristata* does not mention any asymmetry. We must wait for further material, before the question of this spur can be settled.

The radula of the present examined specimen has 22 rows of 29.1.29 teeth.

We add a list of the species taken at Cabo Frio (Lat. 22°57′ S. Long. 42°1′ W.) by Dr. Diva Diniz Corrêa, 450 km farther East than our usual collecting grounds.

Aplysia brasiliana Rang.

Dolabrifera dolabrifera (Rang), new to Brazil. Further distribution: circumtropical and circum-subtropical. For references see: Engel and Hummelinck 1936, p. 30 ff.

Berthella agassizii (MacFarl.).

Berthella tupala Marc.

Glossodoris neona Marc.

Siraius ilo Marc.

Peltodoris greeleyi MacFarl.

Taringa telopia Marc.

Awuka spazzola Marc.

Nembrotha divae, sp. n. (Fig. 56-65).

Okenia evelinae Marc.

Phidiana selenkai Bergh.

RESUMO

Acteon punctostriatus (C. B. Ad.), ainda não indicado do Brasil, parece ser vastamente distribuído, do Cabo Cod até à região de Bahia Blanca, Argentina. As plaquinhas mandibulares e os dentes da rádula assemelham-se às estruturas correspondentes de *A. tornatilis* (L.). *Haminoea elegans* (Gray) tem olhos do tipo de *Helix* e *Gastropteron*. O órgão copulador masculino é armado, em oposição às espécies européias. *Tornatina candei* (d'Orb.) possui rádula e, por isso, não pode continuar no mesmo gênero como *Retusa canaliculata* (Say). O tipo de *Acteocina* Gray é uma espécie fóssil. Destarte, não é possível decidir se *Acteocina* deve substituir *Tornatina*, como Dall quiz, ou se é um sinônimo de *Retusa*. A locomoção de *T. candei* combina o movimento por ondulações da sola com "passos".

"Tinteiros" quase pretos da Ilha de Marambaia, ca. de 70 km ao oeste do Rio, pertencem a *Aplysia* (*Tullia*) *juliana* Q. G., apesar da secreção preta da glândula de púrpura. Durante a vasante, numerosos exemplares de *Aplysia brasiliana* Rang foram encontrados pendurados nas pedras, na posição de morcegos em repouso. Os parapódios envolvem o corpo; a ponta posterior da sola prende-se à pedra. *Aplysia parvula* Mörch, ainda não encontrada no Brasil, foi verificada provinda do Recife da Lixa, diante da costa da Baía.

Elysia lobata A. Gd., do atol de Eniwetok, possui sòmente um receptáculo seminal, a espermateca. A espécie é diáulica. O átrio masculino tem um divertículo como *Lobiger souverbiei* P. Fisch. Os dentes da rádula são irregularmente amontoados no ascus.

Nembrotha divae, sp. n., que pertence a um gênero conhecido, principalmente, do Índico e Pacífico Ocidental, caracteriza-se pela côr escarlate e pelo dente mediano da rádula. *Polycera marplatensis* Franc. é uma das poucas espécies do nosso litoral até agora sòmente conhecida da costa argentina. Mandíbula e rádula justificam a separação específica (Odhner 1941) de *quadrilineata* (O. F. Müll.). *Polycera odhneri* Marc. tem uma parte glandular no duto masculino e, além disso, uma glândula accessória (próstata). *Corambe evelinae*, sp. n., difere de *C. testudinaria* H. Fisch., a espécie mais próxima, pelo número (até 7) das lamelas branquiais (*testudinaria* até 4). O espermatocisto comunica-se com o oviduto internamente à entrada do duto uterino nêste. *Hancockia ryrca* Marc. possui o mesmo divertículo esofágico como *H. uncinata* (Hesse) e *H. californica* MacF. As descrições de *Polycera aurisula* Marc. e *Antiopella mucloc* Marc. foram completadas pelo exame de novo material.

Foi dada uma lista de 12 espécies provindas do Cabo Frio (Dra. Diva Diniz Corrêa leg.).

REFERENCES

ABBOTT, R. T. — 1952. Two new Opisthobranch Mollusks from the Gulf of Mexico belonging to the genera Pleurobranchaea and Polycera. Florida State Univ. Studies n.º 7, p. 1-7 t. 1-2. Gainesville, Fl.

— 1955. American Seashells. XIV + 541 p., 40 t. New York (D. van Nostrand Co., Inc.).

ADAMS, ARTHUR — 1854. Monographs of Actaeon and Solidula, two genera of gasteropodous Mollusca, with description of several new species from the Cumingian collection. Proc. Zool. Soc. part 22 (1854), p. 58-62. London.

ANGAS, G. F. — 1864. Descriptions d'espèces nouvelles appartenant à plusieurs genres de Mollusques Nudibranches .... Traduit de l'anglais sur le manuscrit original et annoté par H. Crosse. Journ. Conchyliol. (sér. 3 v. 4) v. 12, p. 43-70, t. 4-6. Paris.

ANNANDALE, N. — 1924. Fauna of the Chilka Lake. Mollusca Gastropoda (Revision). Mem. Ind. Mus. v. 5 (1915-1924) n.º 12 (July, 1924), p. 854-873, 16 text-figs. Calcutta.

BARNARD, K. H. — 1927. South African Nudibranch Mollusca, with description of new species; and a note on some specimens from Tristan d'Acunha. Annals South Afr. Mus. v. 25 (1927-1929) art. 6 (1927), p. 171-215, t. 19-20. Edinburgh.

BARTSCH, P. — 1915. Report on the Turton collection of South African marine Mollusks, with additional notes on other South African shells contained in the United States National Museum. Smithson. Inst. U. S. Nat. Mus. Bull. v. 91, p. 1-305, t. 1-54. Washington, D. C.

BERGH, R. — 1871. Beiträge zur Kenntniss der Mollusken des Sargassomeeres. Verh. zool. bot. Ges. v. 21, p. 1272-1308, t. 11-13. Wien.

— 1874. Beiträge zur Kenntniss der Aeolidiaden. I. Verh. zool. bot. Ges. v. 23 (1873), p. 596-628, t. 7-10. Wien.

— 1877. Malacologische Untersuchungen, Heft 11, p. 429-494, t. 54-57. Wiesbaden.

— 1880. Beiträge zu einer Monographie der Polyceraden. I. Verh. zool. bot. Ges. v. 29 (1879), p. 599-652, t. 9-14. Wien.

— 1881. Beiträge zu einer Monographie der Polyceraden. II. Verh. zool. bot. Ges. v. 30 (1880), p. 629-668, t. 10-15. Wien.

— 1883. Beiträge zu einer Monographie der Polyceraden. III. Verh. zool. bot. Ges. v. 33, p. 135-180, t. 6-10. Wien.

— 1890a. Report on the Nudibranchs. Results of dredging ... in the Gulf of Mexico and in the Caribbean Sea ... by the "Blake". Bull. Mus. Comp. Zool. Harvard v. 19 (1885-1890) n.º 3 (1890), p. 155-182, t. 1-3. Cambridge, Mass.

— 1890b. Die Nudibranchien des Sunda-Meeres. Malacologische Untersuchungen, Heft 17, p. 873-973, Appendix p. 974-991, t. 85-89. Wiesbaden.

— 1892. System der Nudibranchiaten Gastropoden. Malacologische Untersuchungen, Heft 18, p. 995-1165. Wiesbaden.

— 1901. Malacologische Untersuchungen, 5. Theil, 4. Abtheil., 3. Abschnitt (Bullacea), Lieferung 1-2, p. 209-312, t. 17-24. Wiesbaden.

— 1902. Malacologische Untersuchungen, 5. Theil, 4. Abtheil., 4. Abschnitt (Ascoglossa, err. pro Acteonidae, und Aplysiidae), p. 313-382, t. 25-29. Wiesbaden.

— 1905. Die Opisthobranchiata der Siboga Expedition. Siboga Exped. part 50, p. 1-248, t. 1-20. Leiden (E. J. Brill).

— 1907. The Opisthobranchiata of South Africa. Transact. South Afric. Philos. Soc. v. 17, part 1, p. 1-144, t. 1-14. Cape Town.

CARCELLES, A. R. — 1944. Catalogo de los Moluscos marinos de Puerto Quequén. Rev. Mus. La Plata, n. ser. Zool. v. 3, p. 233-309. La Plata.

CARCELLES, A. & PARODIZ, J. J. — 1938. Moluscos del contenido estomacal de Astropecten cingulatus Sladen. Physis v. 12, p. 251-266, t. 1-2. Buenos Aires.

DALL, W. H. — 1889. Report on the Mollusca ("Blake") II. Gastropoda and Scaphopoda. Bull. Mus. Comp. Zool. Harvard v. 18, p. 1-492, t. 10-40. Cambridge, Mass.

— 1915. A monograph of the Molluscan fauna of the Orthaulax pugnax zone of the Oligocene of Tampa, Florida. Smithson. Inst. U. S. Nat. Mus. Bull. v. 90, XV + 173 p., 26 t. Washington, D. C.

EALES, N. B. — 1938. A systematic and anatomical account of the Opisthobranchiata. John Murray Exped. (Brit. Mus. Nat. Hist.) Sci. Rep. v. 5 n.º 4, p. 77-122, t. 1, text-figs. 1-28. London.

ELIOT, CH. — 1903. Nudibranchiata, with some remarks on the families and genera and description of a new genus, Doridomorpha. The Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. 2, p. 540-573, t. 32. Cambridge.

— 1908. Notes on a collection of Nudibranchs from the Red Sea (Rep. Mar. Biol. Sudanese Red Sea n.º 11). Journ. Linn. Soc. v. 31 (1907-1915) n.º 204 (1908), p. 86-122. London.

ENGEL, H. UND WAGENAAR HUMMELINCK, P. — 1936. Ueber westindische Aplysiidae und Verwandte anderer Gebiete. Capita Zool. v. 8, part 1, p. 1-75, 43 text-figs. The Hague.

FINLAY, H. J. — 1927. New specific names for Austral Mollusca. Transact. Proc. New Zeal. Inst. v. 57, p. 488-533. Wellington, N. Z.

FISCHER, H. — 1889. Note préliminaire sur le Corambe testudinaria. Bull. Soc. Zool. France v. 14, p. 379-381. Paris.

FISCHER, P. — 1887. Manuel de Conchyliologie. XXIV + 1369 p., 23 t. Paris (Librairie F. Savy).

FORREST, J. E. — 1953. On the feeding habits and the morphology ... of the alimentary canal in ... Dorid Nudibranchiate Mollusca. Proc. Linn. Soc. Sess. 164 (1951-1952), part 2, p. 225-235. London.

FRANCESCHI, G. J. — 1928. Una nueva forma de Nudibranquio de la Argentina. An. Mus. Nac. Buenos Aires v. 34, p. 577-586, 1 t. Buenos Aires.

FRETTER, V. — 1939. The structure and function of the alimentary canal of some Tectibranch Molluscs, with a note on excretion. Transact. Roy. Soc. Edinb. v. 59, part 3, n.º 22, p. 599-646, 22 text-figs. Edinburgh.

— 1941. On the structure of the gut of the Ascoglossan Nudibranchs. Proc. Zool. Soc. ser. B, v. 110, parts 3-4 (1940), p. 185-198. London.

FRETTER, V. AND GRAHAM, A. — 1954. Observation on the Opisthobranch Mollusc Acteon tornatilis (L.). J. Mar. Biol. Ass. Un. Kingd. v. 33, p. 565-585, 9 text-figs. Cambridge.

GABE, M. ET PRENANT, M. — 1952a. Recherches sur la gaine radulaire des Mollusques. L'appareil radulaire d'Acteon tornatilis Linné. Arch. Zool. expér. génér. v. 89, Notes et Revue n.º 1, p. 15-25, 7 text-figs. Paris.

— 1952b. Quelques particularités histologiques d'Acteon tornatilis L. Bull. Soc. Zool. France v. 77, p. 220-228. Paris.

— 1953. Données morphologiques sur la région antérieure du tube digestif d'Acteon tornatilis L. Bull. Soc. Zool. France v. 78, p. 36-44, 3 text-figs. Paris.

GOULD, A. — 1852; 1856. Exploring Expedition v. 12: Mollusca and Shells. XV + 510 p.; Atlas: 52 t. Boston, Mass. and Philodelphia, Pa.

— 1870. Report on the Invertebrata of Massachusetts. Second ed., comprising the Mollusca. V. + 524 p., t. 16-27. Boston, Mass.

GRAY, J. E. — 1847. A list of the genera of recent Mollusca, their synonyma and types. Proc. Zool. Soc. part 15 (1847), p. 129-219. London.

GUIART, J. — 1901. Contributions à l'étude des Gastéropodes Opisthobranches. Mém. Soc. Zool. France v. 14, p. 5-219, t. 1-7. Paris.

HAAS, F. — 1953. Mollusks from Ilha Grande, Rio de Janeiro, Brazil. Fieldiana-Zoology v. 34 n.º 20, p. 203-209. Chicago, Illin.

HESSE, R. — 1902. Untersuchungen über die Organe der Lichtempfindung bei niederen Thieren. VIII. Zeitschr. wiss. Zool. v. 72, p. 565-656, text-figs. 1-7, t. 35. Leipzig.

HOFFMANN, H. — 1932-1940. Opisthobranchia. Bronn's Klassen und Ordnungen des Tierreichs, v. 3, II. Abtlg., 3. Buch. Teil 1 (1932-1939), XI + 1247 p., 830 text-figs., 1 t.; Teil 2 (1940), 90 p., 70 text-figs. Leipzig (Akadem. Verlagsgesellsch.).

JOHNSON, CH. W. — 1934. List of marine Mollusca of the Atlantic coast from Labrador to Texas. Proc. Boston Soc. Nat. Hist. v. 40 (1934-1935) n.º 1, p. 1-204. Boston, Mass.

LANGE DE MORRETES, F. — 1949. Ensaio de catálogo dos Moluscos do Brasil. Arqu. Mus. Paranaense v. 7, art. 1, p. 5-216. Curitiba.

LEMCHE, H. — 1948. Northern and Arctic Tectibranch Gastropods. Kongel. Dansk. Vid. Selsk. Biol. Skrifter v. 5, n.º 3, p. 1-136, 80 text-figs. Köbenhavn.

— 1956. The anatomy and histology of Cylichna (Gastropoda Tectibranchia). Spolia Zool. Mus. Hauniens., v. 16. (Skrifter udgivet af Univers. Zool. Mus.), p. 1-278, t. 1-46. Köbenhavn.

MACFARLAND, F. M. AND O'DONOGHUE, C. H. — 1929. A new species of Corambe from the Pacific coast of North America. Proc. Calif. Acad. Sci. ser. 4 v. 18 (1929-1930) n.º 1, p. 1-27, t. 1-3. San Francisco.

MACNAE, W. — 1954. On four Sacoglossan Molluscs new to South Africa. Ann. Natal Mus. v. 13, part 1, p. 51-64, t. 3. Pietermaritzburg.

— 1955. On four species of the Genus Aplysia common in South Africa. Ann. Natal Mus. v. 13, part 2, p. 223-241, text-figs. 1-7. Pietermaritzburg.

MARCUS, E. — 1955. Opisthobranchia from Brazil. Bol. Fac. Fil. Ci. Letr. Univ. S. Paulo, Zoologia n.º 20, p. 89-200, t. 1-30. São Paulo.

— 1957. On Opisthobranchia from Brazil (2). Journ. Linn. Soc. London, v. 43, n.º 292, p. 390-486, 246 figs. London.

— 1958. On West Atlantic Opisthobranchia. American Museum Novitates New York, in press.

MARCUS, EVELINE AND ERNST — 1955. Sea-Hares and Side-Gilled Slugs from Brazil. Bol. Inst. Oceanogr. v. 6, fasc. 1-2, p. 1-49, 52 figs. São Paulo (1957).

ODHNER, N. HJ. — 1924. New Zealand Mollusca. Vidensk. Meddel. Dansk naturh. Foren. v. 77, p. 1-90, text-figs. 1-24, t. 1-2. Köbenhavn.

— 1926. Die Opisthobranchien. Further Results Swed. Antarct. Exped. 1901-1903, v. 2 n.º 1, p. 1-100, text-figs. 1-83, t. 1-3. Stockholm.

— 1939. Opisthobranchiate Mollusca from the Western and Northern coasts of Norway. Kgl. Norske Vidensk. Selsk. Skrifter 1939, n.º 1, p. 1-93, text-figs. 1-59. Trondheim.

— 1941. New Polycerid Nudibranchiate Mollusca and remarks on this family. Göteborgs Kgl. Vet. och Vitterh. Samh. Handl. 6. Följden, Sr. B., v. 1, n.º 11, p. 1-20, text-figs. 1-9. Göteborg.

ORBIGNY, A. D' — 1853. Mollusques de l'île de Cuba. Ramon de la Sagra, Histoire physique, politique, et naturelle de l'île de Cuba. Vols. 1-2, Atlas: 29 t. Paris.

OSTERGAARD, J. M. — 1955. Some Opisthobranchiate Mollusca from Hawaii. Pacific Science v. 9, p. 110-136, t. 1-2, text-figs. 1-17. Honolulu, Hawaii.

PELSENEER, P. — 1894. Recherches sur divers Opisthobranches. Mém. couronnés Académ. Roy. Belgique (Sci. natur.) v. 53, III + 157 p., 25 t. Bruxelles.

PERRIER, R. ET FISCHER, H. — 1911. Recherches anatomiques et histologiques sur la cavité palléale et ses dépendances chez les Bulléens. Ann. Sci. natur. sér. 9, v. 14, p. 1-190, t. 1-9. Paris.

PILSBRY, H. A. — 1893. George W. Tryon, Jr., Manual of Conchology; structural and systematic, v. 15, Order Opisthobranchiata, p. 134-436, t. 18-61. Philadelphia, Pa.

POHL, H. — 1905. Ueber den feineren Bau des Genitalsystems von Polycera quadrilineata. Zool. Jahrb. Anat. v. 21 fasc. 3, p. 427-452, t. 25-26. Jena.

PRUVOT-FOL, A. — 1927. Sur quelques Mollusques Nudibranches de la côte Atlantique du Maroc récoltés principalement par M. M. J. Liouville et R.-Ph. Dolfus. Bull. Soc. sci. natur. Maroc v. 7, p. 39-49, t. 5. Rabat.

— 1934. Les Opisthobranches de Quoy et Gaimard. Arch. Mus. Hist. Natur. sér. 6 v. 11, p. 13-92, text-figs. 1-30, t. 1. Paris.

— 1946. Révision critique de la famille des Elysiadae. Journ. Conchyol. v. 87 n.º 1, p. 29-44. Paris.

— 1951. Études des Nudibranches de la Méditerranée (2e partie). Arch. Zool. expér. génér. v. 88 fasc. 1, p. 1-79, text-figs. 1-42, t. 1-4. Paris.

— 1953. Étude de quelques Opisthobranches de la côte Atlantique du Maroc et du Sénégal. Trav. Institt. scientifique Chérifien n.º 5, p. 1-105, 35 text-figs., t. 1-3. Tanger.

— 1954. Faune de France, v. 58, Mollusques Opisthobranches, p. 1-460, text-figs. 1-173, t. 1. Paris (Paul Lechevalier).

— 1956. Note à propos de l'Acteon. Bull. Soc. Zool. v. 80 (1955) n.º 5-6 (1956), p. 301-307. Paris.

SI, TCHANG — 1931. Contributions à l'Étude des Mollusques Opisthobranches de la côte Provençale. Thèse du Laborat. de Zool. de la Faculté des Sciences de Lyon et station maritime de Biol. de Tamaris, p. 1-221, text-figs. 1-67, t. 1-8. Trévoux (Rhône).

STRONG, A. M. — 1921; 1922. Notes on the genus Acteocina. Nautilus v. 35, p. 44-48; 122-123. Philadelphia, Pa.

THIELE, J. — 1925. Gastropoda der Deutschen Tiefsee-Expedition. II. Teil. Wiss. Ergebn. Deutschen Tiefsee-Exped., v. 17 Heft 2, Opisthobranchia, p. 257-288, 348-352, t. 30-34. Jena.

— 1931. Handbuch der systematischen Weichtierkunde, v. 1, VI + 778 p., 783 text-figs. Jena (G. Fischer).

TRINCHESE, S. — 1882. Per la fauna marittima Italiana: Aeolididae e famiglie affini. Mem. Cl. Sci. Fis. Atti R. Accad. Lincei, ser. 3, v. 10, 142 p., 80 t. Roma.

VAYSSIÈRE, A. — 1880. Recherches anatomiques sur les Mollusques de la famille des Bullidés. Ann. Sci. natur. Zool. sér. 6 v. 9 (1879-1880), p. 1-123, t. 1-12. Paris.

PLATE 1

Acteon punctostriatus (C. B. Ad.)

Fig. 1 — Living snail.

Fig. 2 — Shell.

Fig. 3 — Operculum.

Fig. 4 — Combined section of buccal mass.

Fig. 5 — Part of jaw.

Fig. 6 — Platelet of jaw, side view.

Fig. 7 — The same, basal view.

Fig. 8 — Part of radula.

Fig. 9 — Normal radular tooth.

Fig. 10 — Abnormal radular tooth.

b — oral tube. *c* — end of pallial caecum. *e* — glands of mantle border. *f* — pharynx. *g* — cerebro-pleural ganglion. *j* — jaw. *m* — mantle cavity. *o* — osphradium. *p* — pedal ganglion. *r* — radula. *s* — statocyst with statocones. *u* — salivary gland. *w* — body wall. *x* — radular sac.

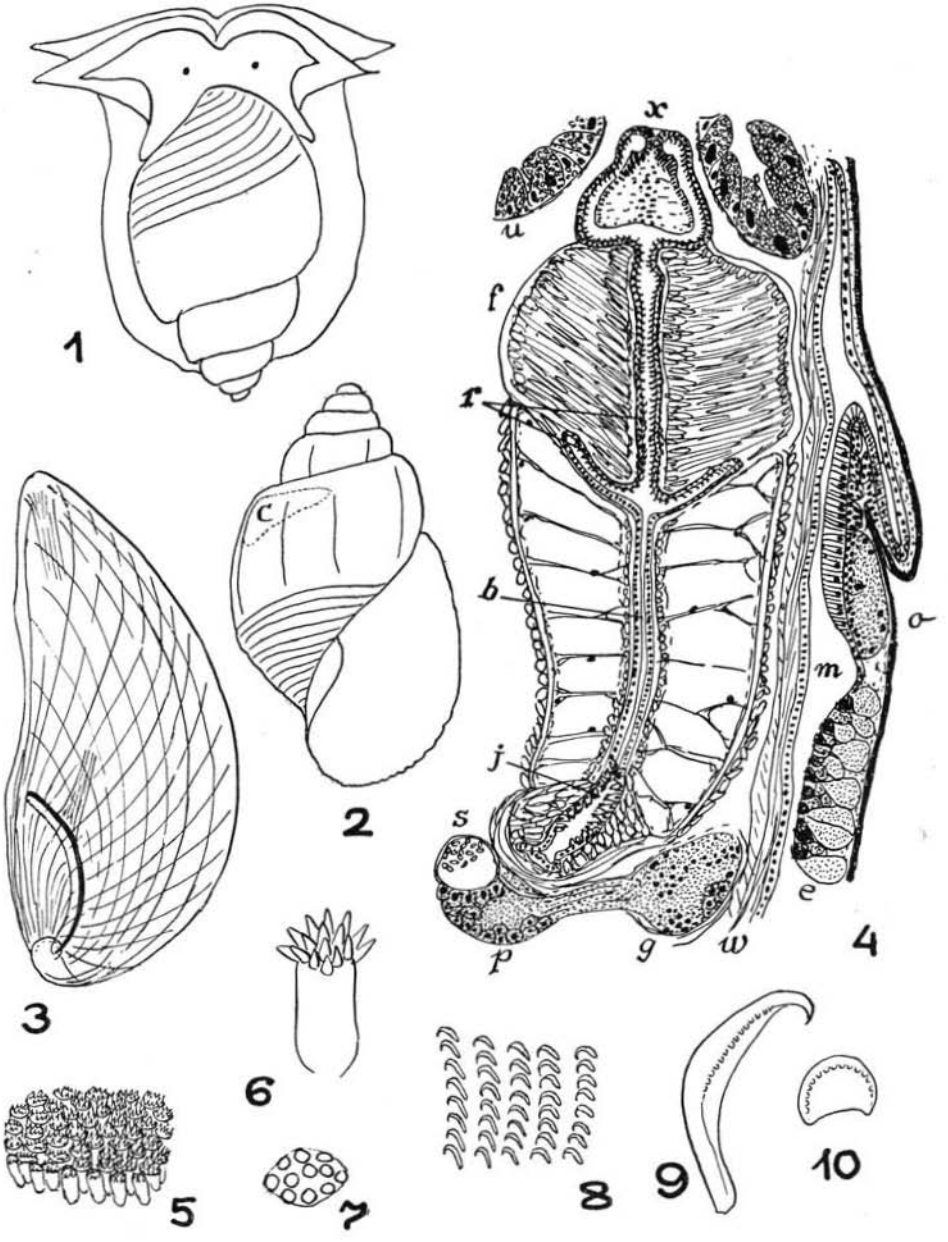
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PLATE 2

Haminoea elegans (Gray)

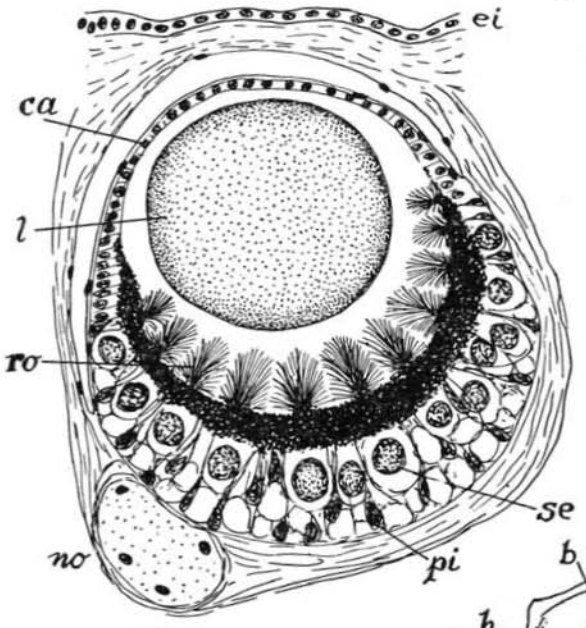
Fig. 11 — Sketch of living snail.

Fig. 12 — Same, underside.

Fig. 13 — Organization with uncoiled intestinal gland (*d*).

Fig. 14 — Section of eye.

For lettering see plate 3.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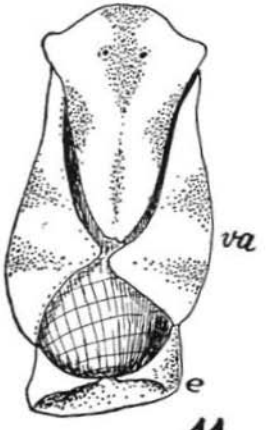
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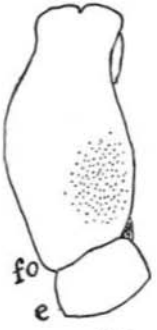
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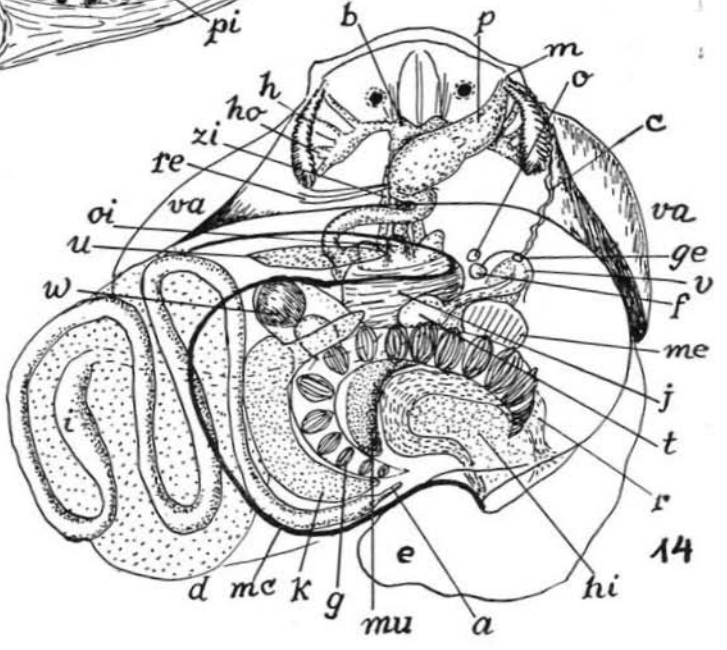
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PLATE 3

Haminoea elegans (Gray)

Fig. 15 — Combined transverse section at level of gill (g) and anus (a).

Fig. 16 — Diagram of reproductive organs.

Fig. 17 — Male copulatory organs.

Fig. 18 — Penis.

Fig. 19 — Penial spines in transverse section.

Fig. 20 — Penial spines in tangential section.

Fig. 21 — Section of myo-epithelial organ.

Fig. 22 — Transverse section of outer part of prostate.

a — anus. *ae* — albumen gland. *am* — ampulla. *b* — brain. *c* — seminal groove. *ca* — cornea. *co* — folds of conchiolin. *d* — digestive gland. *e* — epicochlear expansion. *ei* — epidermis. *es* — epithelium of penis. *f* — genital ganglion. *fo* — foot. *g* — gill. *ge* — genital aperture. *h* — Hancock's organ. *he* — ovotestis. *hi* — glandular fields encircled by *r*. *ho* — fourth cerebral nerve. *i* — intestine. *j* — gizzard. *k* — kidney. *l* — lens. *m* — male opening. *mc* — limit of mantle cavity. *me* — folded lobe of mucus gland. *mu* — inner lobe of mucus gland. *n* — nerve. *no* — optic nerve. *o* — osphradium. *oi* — dorsal oesophageal pouch. *p* — penis. *pi* — pigmented cells. *q* — prostate. *qe* — prostatic duct. *r* — ciliated ridge. *re* — retractor of penis. *ro* — rods of optic sensory cells. *s* — spermatocyst. *se* — optic sensory cells. *si* — blood sinuses. *t* — spermatheca. *u* — columellar muscle. *v* — common genital vestibule. *va* — parapodia. *w* — heart. *x* — male atrium. *y* — myo-epithelial organ. *z* — spermoviduct. *zi* — salivary glands.

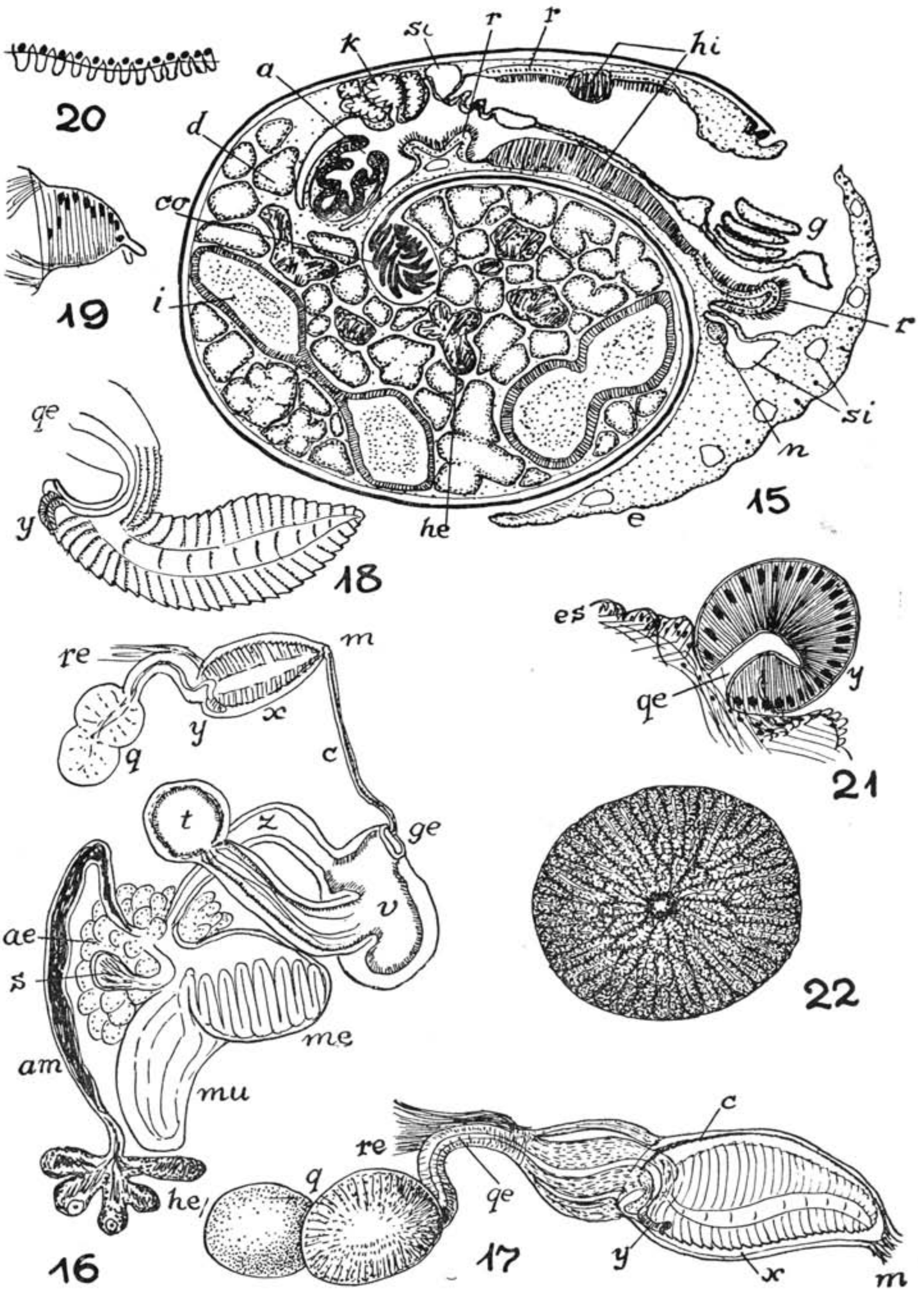
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PLATE 4

Tornatina candei (d'Orb.)

Fig. 23 — Dorsal view of living snail.

Fig. 24 — Right side view of same.

Fig. 25 — Ventral aspect of preserved snail.

Fig. 26 — Empty shell.

Fig. 27 — One jaw.

Fig. 28 — Two jaw platelets.

Fig. 29 — Median and lateral radula tooth.

Fig. 30 — Two of the gizzard plates.

Fig. 31 — Diagram of anatomy of the unrolled snail.

Fig. 32 — Male organ.

a — anus. *b* — auricle. *c* — ciliated ridges. *d* — duct of spermatheca. *e* — oesophagus. *f* — foot. *g* — gill. *ge* — genital duct. *h* — hypobranchial gland. *i* — intestine. *j* — infrapallial lobe. *k* — hermaphrodite gland. *l* — liver. *m* — stomach. *n* — renal pore. *o* — osphradium. *oi* — glands of the pallial caecum. *p* — pericardium. *q* — pallial caecum. *r* — glands of mantle border. *s* — spermatheca. *t* — kidney. *u* — penial sheath. *v* — ventricle. *w* — seminal groove. *x* — seminal vesicle. *y* — prostatic part of male duct. *z* — gizzard.

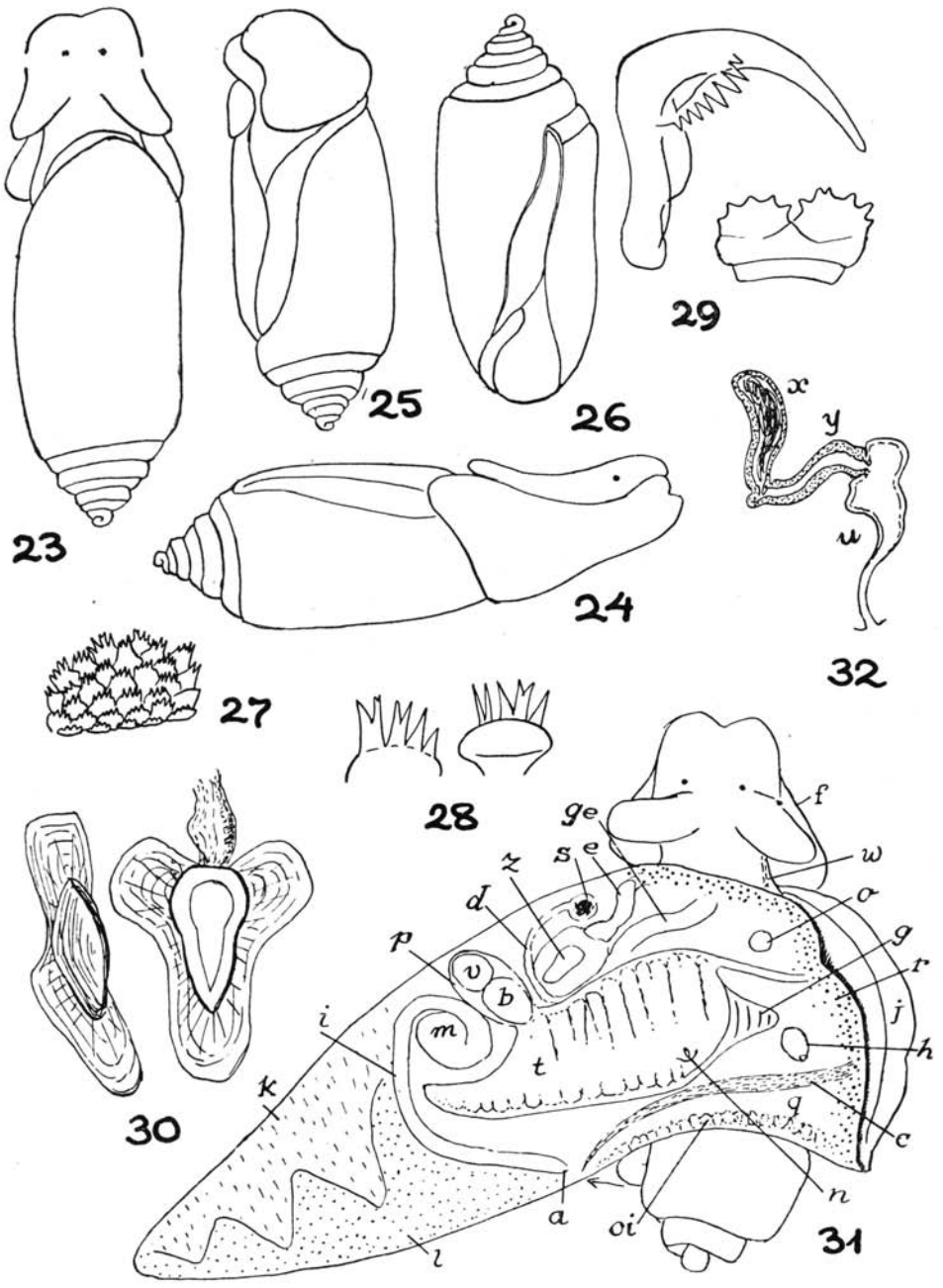
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PLATE 5

Aplysia (*Tullia*) *juliana* Q. G.

Fig. 33 — Spire with larval shell.

Fig. 34 — Two warts with cones from base of penis sheath.

Elysia lobata Gould

Fig. 35 — Preserved specimen with papillose borders of parapodia.

Fig. 36 — Dorsal view of flattened slug with smooth parapodial borders.

Fig. 37 — Details of parapodium of first animal.

Fig. 38 — Radular tooth and its denticles highly magnified.

Fig. 39 — Reconstruction of alimentary tract.

Fig. 40 — Diagram of reproductive organs.

a — anus. *b* — albumen gland. *c* — brain. *d* — male duct. *e* — appendage of male atrium. *f* — pharynx. *g* — skin gland. *h* — heart. *i* — intestine. *j* — hermaphrodite ducts. *k* — kidney. *l* — ducts of digestive gland. *m* — male opening. *n* — oesophagus. *o* — oviduct. *oe* — oesophageal pouch. *ov* — oviduct and vagina. *p* — penis. *q* — prostate. *r* — pigment rings. *s* — spermathecal duct. *so* — stomach. *t* — spermatheca. *u* — ampulla. *v* — vessels. *w* — mucus gland. *x* — ascus. *y* — glands of oral tube. *z* — salivary gland.

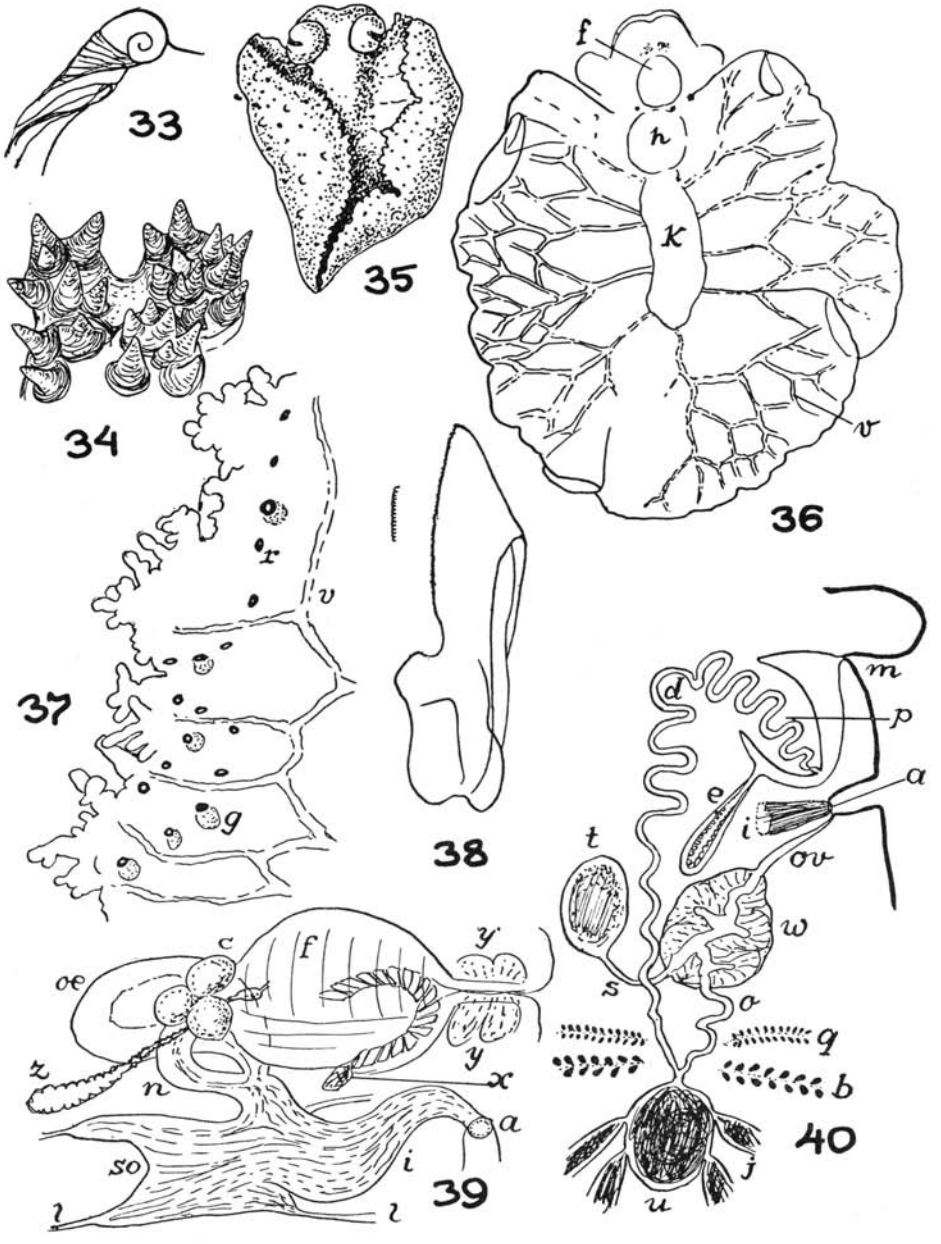
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PLATE 6

Polycera marplatensis Franceschi

Fig. 41 — Dorsal view of preserved slug.

Fig. 42 — Jaws.

Fig. 43 — Half-row of radula.

Fig. 44 — Inner lateral tooth seen from inner side.

Polycera odhneri Marc.

Fig. 45 — Dorsal view of inner organs.

Fig. 46 — Dorsal view of reproductive organs.

Fig. 47 — Ventral view of male organs, vagina (w) and spermatheca (t).

a — anus. *ao* — aorta. *b* — blood gland. *c* — caecum. *d* — auricle. *e* — male duct. *f* — pericardium. *g* — gills. *h* — digestive gland. *i* — intestine. *j* — ovotestis. *k* — oesophagus. *l* — hermaphrodite duct. *m* — sphincter of male vestibule. *n* — sphincter of vagina. *o* — genital opening. *p* — muscular part of male duct. *q* — prostatic part of male duct. *r* — oviduct. *s* — spermatocyst. *t* — spermatheca. *u* — ampulla. *v* — ventricle. *w* — vagina. *x* — uterine (fertilizing) duct. *y* — female gland mass. *z* — prostate.

Polycera aurisula Marc.

Fig. 48 — Gills with branchial glands and extra-branchial appendages.

Fig. 49 — Diagram of reproductive organs.

a — anus. *b* — cavity between muscle coat and efferent duct. *c* — branchial gland. *d* — male duct. *e* — efferent duct. *f* — female follicles. *g* — gills. *h* — male follicle. *k* — extra-branchial process. *l* — hermaphrodite duct. *m* — male vestibule. *n* — vagina. *o* — common genital aperture. *p* — hook-bearing part of efferent duct. *q* — prostatic part of male duct. *r* — oviduct. *s* — spermatocyst. *t* — spermatheca. *u* — ampulla. *x* — uterine (fertilizing) duct. *y* — female gland mass.

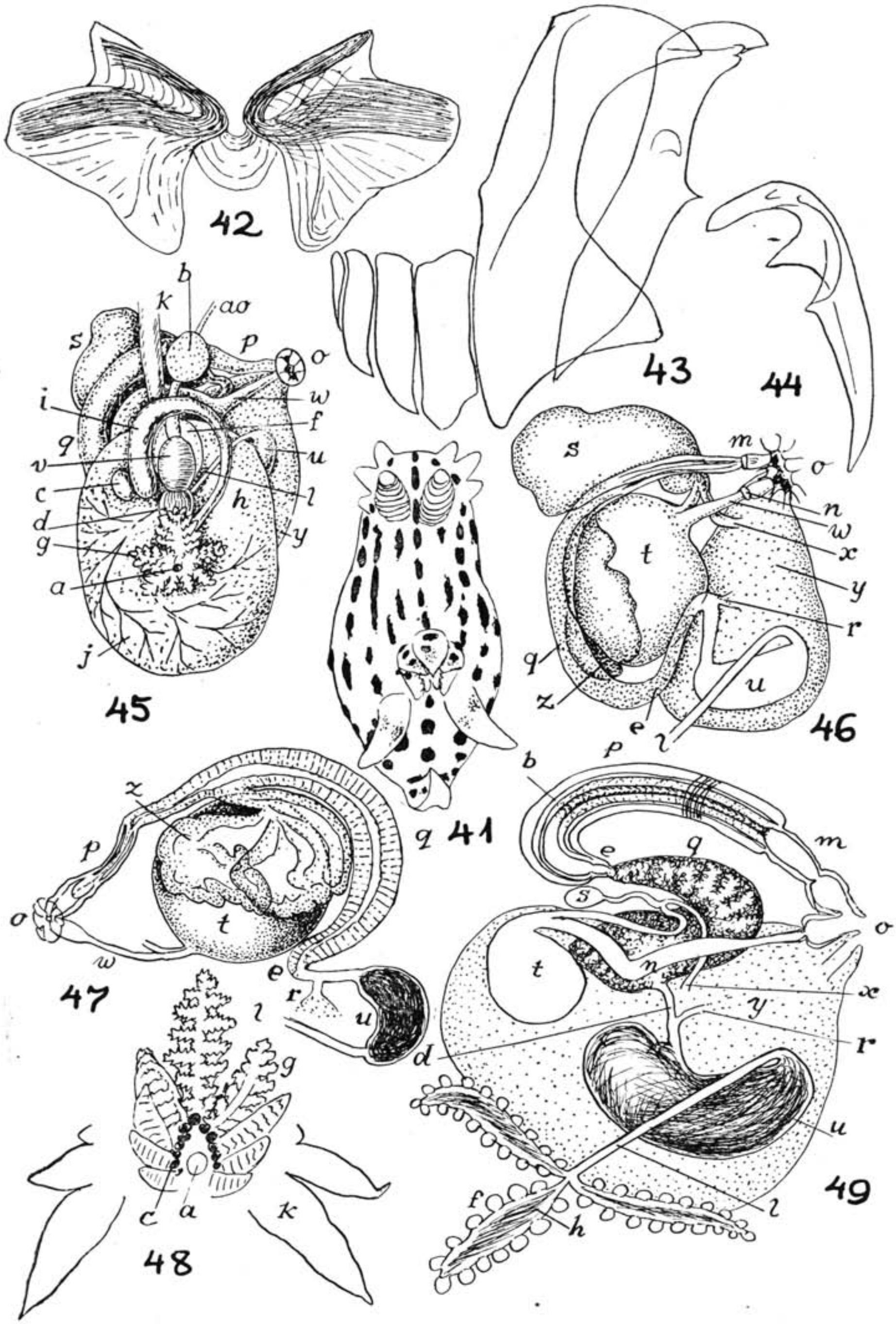
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PLATE 7

Corambe evelinae, sp. n.

Fig. 50 — Dorsal view of living slug.

Fig. 51 — Ventral view of hind end with stained branchial glands (b).

Fig. 52 — Section of notum.

Fig. 53 — Half-row of radula.

Fig. 54 — Combined sagittal section of hind end.

Fig. 55 — Diagram of reproductive organs.

a — anus. *ae* — albumen gland. *b* — branchial gland. *c* — blood sinuses. *d* — digestive gland. *e* — efferent duct. *f* — foot. *g* — mucus gland. *h* — hermaphrodite gland. *he* — heart. *i* — intestine. *j* — gill. *ji* — mid-dorsal gill. *k* — oviduct entering mucus gland. *l* — duct of albumen gland. *m* — melanophore. *n* — renal pore. *o* — oviduct. *p* — penis. *q* — prostatic part of male duct. *r* — renopericardial duct. *s* — spermatocyst. *t* — spermatheca. *u* — uterine duct. *v* — vagina. *w* — ampulla. *x* — spermoviduct. *y* — nidamental opening. *z* — vaginal aperture.

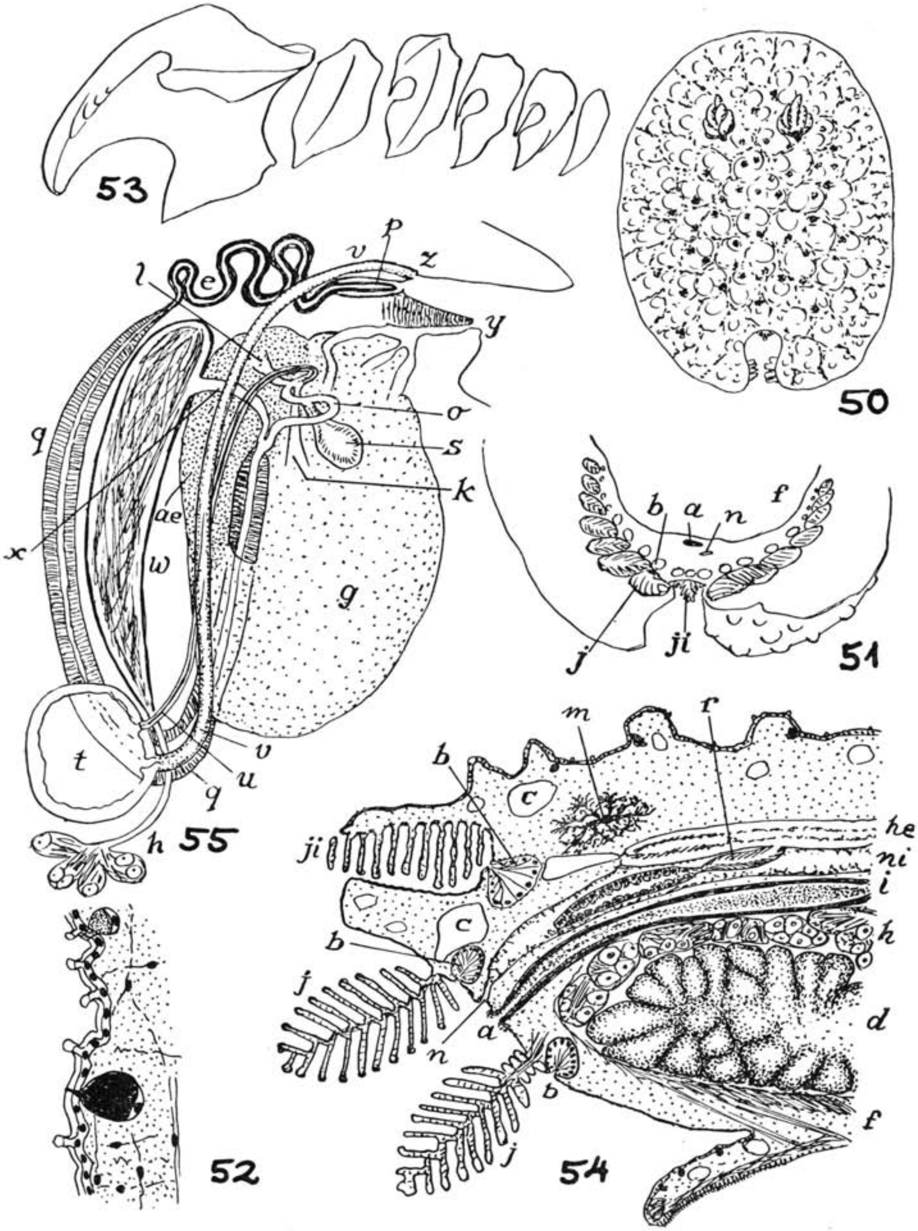
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PLATE 8

Nembrotha divae, sp. n.

Fig. 56 — Dorsal view of preserved slug.

Fig. 57 — Lateral view of same.

Fig. 58 — Ventral view of fore end.

Fig. 59 — Spicules.

Fig. 60 — Labial disc.

Fig. 61 — Half row of radula.

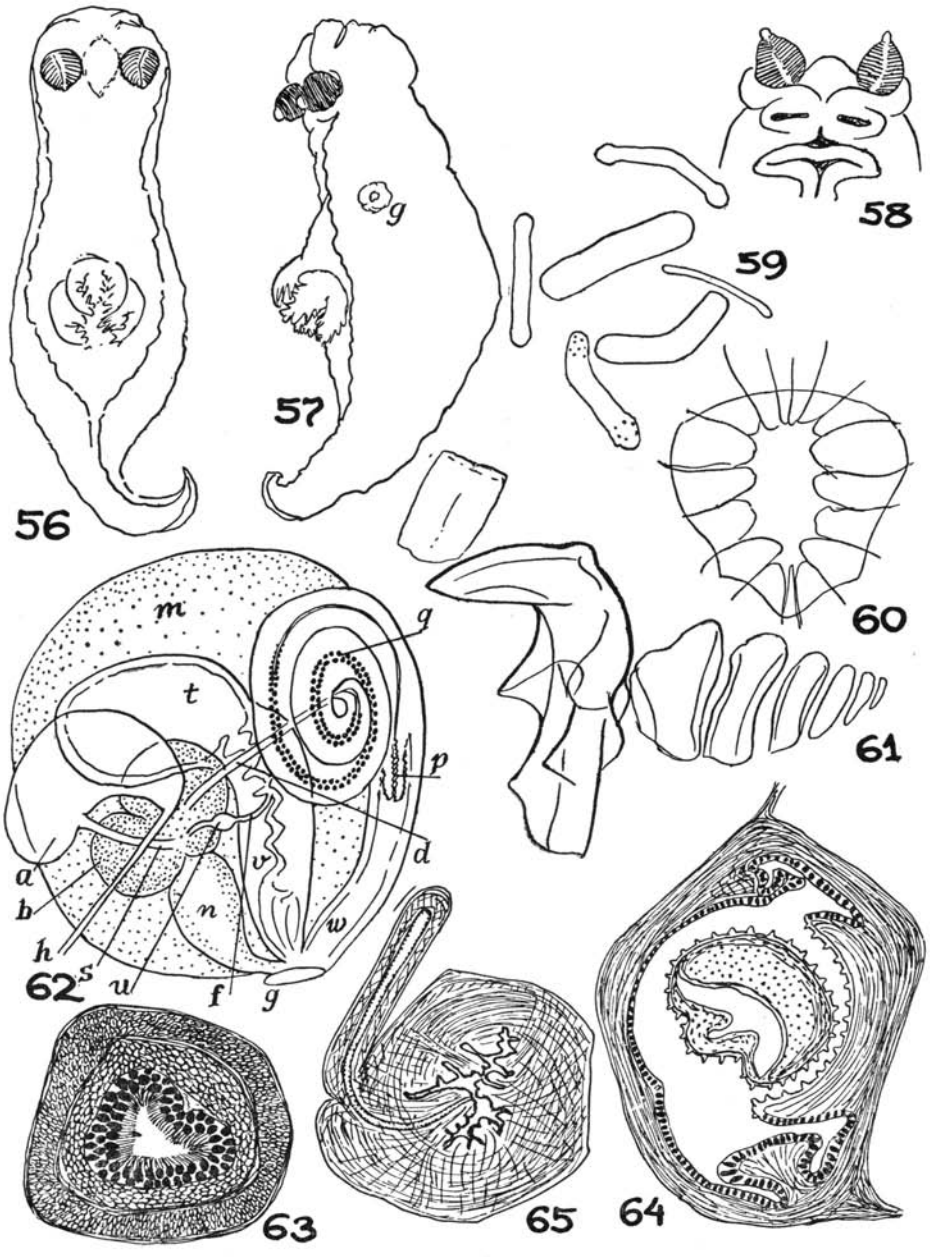
Fig. 62 — Diagram of reproductive organs.

Fig. 63 — Section of prostatic part of male duct.

Fig. 64 — Section of penial papilla.

Fig. 65 — Section of origin of fertilizing duct from vagina.

a — ampulla. *b* — albumen gland. *d* — male duct. *f* — fertilizing duct. *g* — genital aperture. *h* — hermaphrodite duct. *m* — mucus gland. *n* — nidamental duct. *p* — penial papilla. *q* — prostatic part of male duct. *s* — spermoviduct. *t* — spermatheca. *u* — spermatocyst. *v* — vagina. *w* — male vestibule.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