

SOME OPISTHOBRANCHS FROM SAPELO ISLAND,
GEORGIA, U. S. A.¹Eveline Marcus and Ernst Marcus²

ABSTRACT

The paper deals with 2 pelagic and 10 intertidal and subtidal opisthobranchs from the southeastern coast of the U.S.A. Four species are described: *Okenia sapelona*, *Doridella burchi*, *Tritonia (Candiella) bayeri misa* and *Armina wattla*. This last species differs from the solely American species of *Armina* by its strong caruncle, and from *A. undulata* and the other species with strong caruncle by the radula. *Okenia sapelona* resembles *O. mediterranea*, hence belongs to the opisthobranchs whose range can be traced from the Tertiary Tethys Sea. The remaining 2 new forms are related to species from the warm water region of the western Atlantic. The known littoral species of the present collection are inhabitants of that region too, with the exception of *Doris verrucosa*, which occurs also in the eastern Atlantic.

The subspecies *Pleurobranchaea hedgpethi hamva* is suppressed, because in the present material the direction of the flap over the genital apertures was often found to be oblique, i. e. neither dorsal (*P. hedgpethi hamva*) nor anterior (*P. h. hedgpethi*).

In 1962, Dr. J. B. Burch of the University of Michigan initiated a study of the mollusks of the southeastern U.S.A. for the Sapelo Island Research Foundation and the Institute of Malacology. This paper is based on the specimens collected by Dr. Burch and his students, and by Mr. Milton S. Gray, professional collector for the Marine Institute, University of Georgia. The zoological materials described here are part of the collections housed by the Marine Institute, Sapelo Island, Georgia, U.S.A.

SYSTEMATICS AND DISTRIBUTION

List of species

Order Anaspeida, Superfamily Aplysiacea

Aplysiidae, Aplysiinae

1. *Aplysia (Varria) morio* Ver-rill, 1910

Order Notaspeida, Superfamily Pleurobranchacea

Pleurobranchidae, Pleurobranchinae

2. *Pleurobranchaea hedgpethi* Abbott, 1952

Order Doridoidea,

Suborder Eudoridoidea

Infraorder Cryptobranchiata

Dorididae, Doridinae

3. *Doris verrucosa* Cuvier, 1804, Fig. 1

Infraorder Phanerobranchiata,

Superfamily Suctoria

Goniodorididae

4. *Okenia sapelona*, new species, Figs. 2-6

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²Caixa Postal 6994, São Paulo, Brazil.

Corambidae

5. *Doridella burchi*, new species, Figs. 7-12

Suborder Porostomata

Dendrodorididae

6. *Dendrodoris krebsii* (Mörch, 1863)
7. *Doriopsilla pharpha* Marcus, 1961

Order Dendronotoidea

Tritoniidae

8. *Tritonia (Candiella) bayermisa*, new subspecies, Figs. 13-14

Scyllaeidae

9. *Scyllaea pelagica* Linné, 1758, Fig. 15

Order Arminoidea

Suborder Euarminoidea

Arminidae

10. *Armina wattla*, new species, Figs. 16-20

Order Aeolidioidea

Suborder Acleioprocta

Fionidae

11. *Fiona pinnata* (Eschscholtz, 1831)

Suborder Cleioprocta

Favorinidae, Facalaninae

12. *Dondice occidentalis* (Engel, 1925)

1. *Aplysia (Varria) morio* Verrill, 1901

Aplysia morio Verrill, 1901: 25, pl. 3, figs. 5, 5a.

? *Aplysia modesta* Thiele, 1910: 124, pl. 9, figs. 17, 17a.

Aplysia (Varria) morio Eales, 1960: 328-332, figs. 28-29.

Occurrence: Sapelo Island, 31° 02 min. 00 sec. N, 80° 02 min. 25 sec. W, 42.4 m depth, 1 young specimen, collected on July 9, 1963.

Further distribution: Bermuda (original locality), and from Rhode Island to Florida and Texas.

Since a single young, colorless specimen, 12 mm in length, 8 mm in width, and 6 mm in height cannot be classified

with certainty, the following characters were considered as decisive for the classification: soft skin; large and thin parapodia; short, elliptical tail; closed, invisible mantle foramen; rhachidian tooth with excavated head, long cusp and large basal denticles; details of the denticulation of the lateral teeth; and the caecum lying flat on the surface of the digestive gland.

The juvenile specimen of *Aplysia modesta* was included in the list of synonyms on the authority of Eales. In Thiele's short description nothing contrasts with the characters of *A. morio*. The locality, Lovango Cay, between St. John and St. Thomas, Virgin Islands, was not included in the range of *A. morio* by Dr. Eales.

2. *Pleurobranchaea hedgpethi* Abbott, 1952

Pleurobranchaea hedgpethi Abbott, 1952: 1-2, pl. 1, figs. 1-8.

Pleurobranchaea hamva Marcus, 1957a: 21-27, figs. 40-52.

Pleurobranchaea hedgpethi Marcus, 1960b: 253-254, fig. 6.

Pleurobranchaea hedgpethi hamva Marcus, 1961b: 141; 1967a (in press), fig. 56.

Pleurobranchaea hedgpethi Nijssen-Meyer, 1965: 143-145, figs. 1-2.

Occurrences: Sapelo Island, Georgia, between 31° 33 min. 30 sec. to 30° 55 min. N and 79° 37 min. 30 sec. to 80° 24 min. W., 30-88 m depth; a total of 24 specimens collected in February and October, 1961, May, 1962, and June, July and August, 1963.

Further distribution: Point of Cape Hatteras, North Carolina off Savannah Beach, Georgia, 70-95 m depth; Dry Tortugas, Florida, 51 m depth; Gulf of Mexico from Port Aransas (original locality) to the Bay of Campeche; coast of Surinam, 28 m depth; coast of Rio de Janeiro and São Paulo to 25° S., Brazil.

The preserved specimens are 5-43 mm

in length, 3.5-22 mm in width and 3-13 mm in height. Where the pigment is preserved, the caudal spur is black. In some specimens there are residues of a brown dorsal network. The flap above the genital apertures either has a dorsal direction or a direction intermediate between dorsal (as in *Pleurobranchaea hamva*) and anterior (as in *P. hedgpethi*). This oblique position, also observed in Nijssen-Meyer's slug from Surinam, leads us to abandon a special designation for specimens with a dorsally directed flap.

3. *Doris verrucosa* Cuvier, 1804 (Fig. 1)

Doris verrucosa Cuvier, 1804: 451, 467, pl. 73, figs. 4-7;

Eliot, 1910: 96-98 (incl. var. *mollis*), not the reference (: 147) to Alder and Hancock, 1856, Family 1, Pl. 11;

v. Ihering, 1915: 142;

Pruvot-Fol, 1954: 232-233, figs. 86a-e (*verrucosa*), figs. 87a-h (*januarii*);

Marcus, 1955: 127-131, figs. 102-108; 1957b: 420, fig. 90 (São Paulo).

Staurodoris verrucosa Bergh, 1878: 579-583, pl. 63, figs. 20-23, pl. 64, figs. 2-7;

v. Ihering, 1886: 230-232 (Sta. Catarina);

Bergh, 1894: 161-162, pl. 5, figs. 16-18 (western Florida); 1904: 38-39 (South Carolina);

Eliot, 1906: 337-339 (incl. var. *mollis*);

Bergh, 1907: 46-47, pl. 11, figs. 26-27;

Nobre, 1938-1940: 52, pl. 10, fig. 3.

Staurodoris januarii Bergh, 1878: 583-585, pl. 63, fig. 24, pl. 64, figs. 8-12 (Rio de Janeiro); 1880: 37-40, pl. C, figs. 13-25, pl. D, fig. 22 (Rio de Janeiro);

v. Ihering, 1886: 230 (synonymized with *verrucosa*).

Doridigitata derelicta O'Donoghue, 1929: 763;

Johnson, 1934: 158;

Lange de Morretes, 1949: 116.

Occurrences: 1) Sapelo Sound, Georgia, November 30, 1961, 3 specimens; 2) Sapelo Sound, 12 m depth, January 26, 1962, 2 specimens.

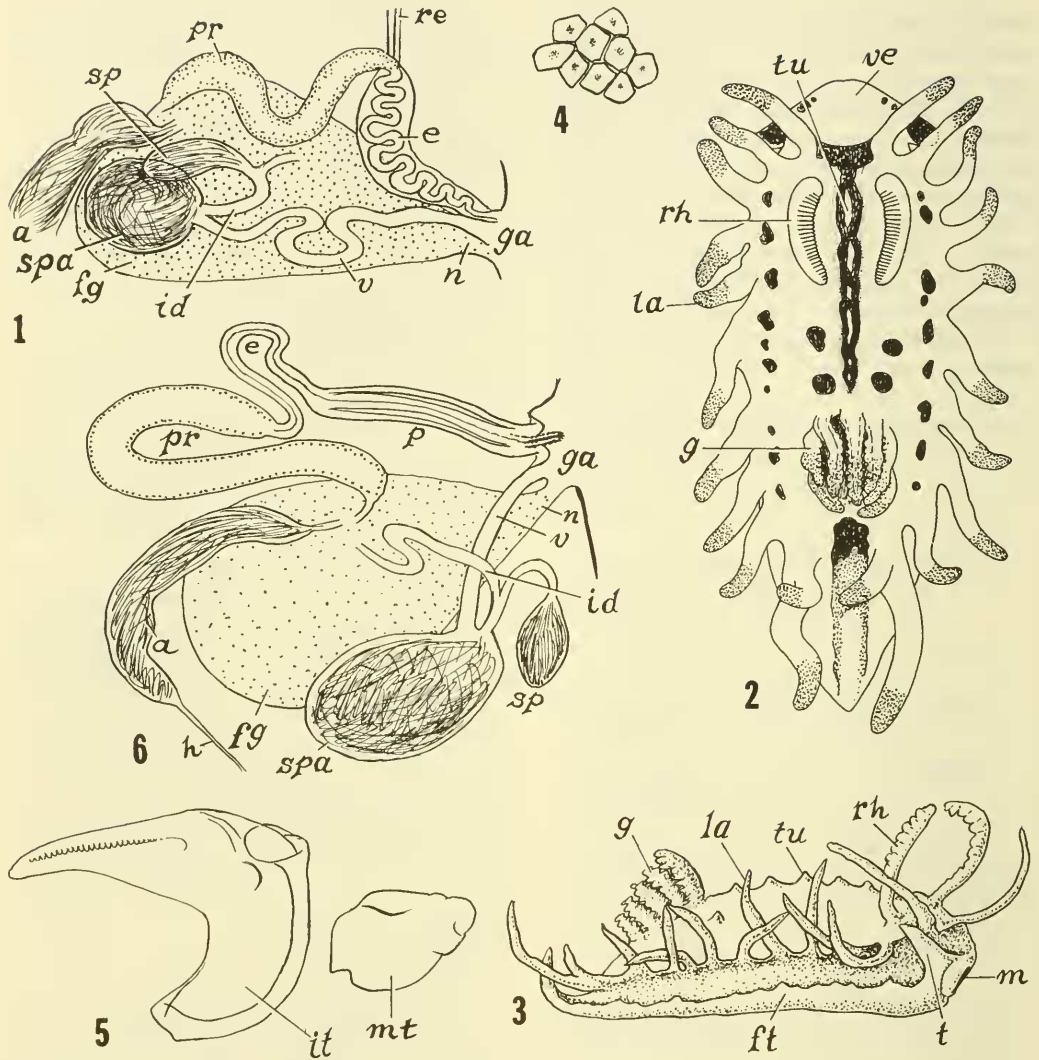
Further distribution: West Atlantic: South Carolina; Manatee Bay, western Florida; Rio de Janeiro, São Paulo, Santa Catarina, Brazil. East Atlantic: British Isles, France, Portugal; Mediterranean; South Africa. Original locality unknown (Bergh, 1878, p 579-580), possibly Mediterranean.

The largest of the present preserved specimens is 35 mm long, 20 mm broad, and 13 mm high. Its sole is 28x14 mm. The big vesicular warts, up to 1.8 mm in diameter, are separated from one another and do not coalesce. The anterior pedal border is bilabiate and slightly notched.

The color of the live animals was brownish-yellow (locality 1) and yellowish-green (locality 2); preserved specimens are whitish. In one slug the spicules are preserved and form ridges between the warts. The tentacles are barrel-shaped and grooved. The rhinophores have 16 perfoliations. The rhinophoral pits bear one large papilla on either side and smaller ones in front and behind. There are up to 14 gills. The rim of the branchial pit has a variable number of papillae, up to 9 big ones and 9 small ones.

The labial cuticle, the radula, and the gut are as previously described.

A major distinction between *Doris* and *Archidoris* Bergh, 1878, lies in the prostatic ental portion (Fig. 1, pr) of the male duct, which is not thickened in *Archidoris*. The latter genus has a pleurembolic penis, while the penis is the acrembolic type in *Doris*. The ectal part of the efferent duct (e) of *Doris* is coiled within a muscular sheath, at the inner end of which inserts a retractor muscle (re). In the present material, and also in a re-examined specimen from São Paulo, we found the disposition of the seminal receptacles slightly different from our earlier diagram (Marcus, 1955, fig. 106). The insemination duct (id) begins at the



FIGS. 1-6. Fig. 1. *Doris verrucosa*. Diagram of reproductive organs. FIGS. 2-6. *Okenia sapelona*, n. sp. Fig. 2. Dorsal view of living slug, drawn by Dr. J. B. Burch; stippled parts: pale yellow; black parts: bright yellow. Fig. 3. Side view of preserved slug. Fig. 4. Polyagonal jaw elements, conical in profile. Fig. 5. Half-row of radula. Fig. 6. Diagram of reproductive organs.

entrance of the vagina (v) into the spermatheca (spa), similar to Bergh's figure 23 (1880, pl. C) of material from Rio de Janeiro.

Discussion of *Doris verrucosa*

Pruvot-Fol (1954: 234) maintains *Doris ocelligera* Bergh, 1881a (p 95-98,

KEY TO LETTERING IN FIGURES

a	ampulla	mu	mucus gland
ag	albumen gland	mt	marginal tooth
an	anus	n	nidamental duct (outer oviduct)
b	brain	no	notum
c	caruncle (wattle)	nr	notal ridges
e	efferent duct	o	ovotestis
fg	female gland mass (i. e. albumen and mucus glands)	p	penis
ft	foot	pr	prostate
ftg	foot gland	r	rhachidian tooth
g	gill	ra	radula
ga	genital aperture(s)	re	retractor muscle
h	hermaphrodite duct	rh	rhizophore
hn	hyponotum	rha	rhizophoral appendage
id	insemination duct	rp	renal pore
io	inner oviduct	sp	spermatocyst
it	intermediate tooth (or inner lateral tooth)	spa	spermatheca
j	jaw	spo	spermoviduct
l	lateral lamellae	t	tentacle
la	lateral appendages	tu	tubercle
lt	lateral tooth (teeth)	v	vagina
m	mouth	va	velar appendage
ma	male atrium	ve	veil

pl. 4, figs. 11-21) as a separate species. The original material came from Trieste; v. Ihering had a specimen 4 mm long from Naples (1886: 232-233), and Pruvot-Fol had several slugs 10-12 mm long from Banyuls, France. The length of the living animals in the original diagnosis, 0.5 cm, is a misprint for 5 cm. The descriptions of Bergh, v. Ihering, and Pruvot-Fol are not quite uniform, but hardly justify a specific separation of *D. ocelligera*. The reproductive organs were recorded only by Bergh.

Staurodoris pseudoverrucosa v. Ihering (1886: 233) from Naples with conical tubercles and 5 bipinnate gills cannot be united with *Doris verrucosa*. Its reproductive organs were not described, so that its generic position remains unknown.

4. *Okenia (Okenia) sapelona*, new species (Figs. 2-6)

Occurrence: Sapelo Island, Georgia, November, 1963; 2 specimens. Holotype, UMMZ 230616; Paratype UMMZ 230617.

The general color is an iridescent pale blue; the rhizophores and some spots on the gills are maroon. The following areas or spots are bright yellow (Fig. 2): dots on the lateral margins and the corners of the veil (ve), a broad fleck between the first appendages, a center stripe excluding the bases of 5 dorso-median pale blue tubercles (tu), 2 pairs of larger roundish spots in front of the gills (g), smaller irregular spots forming a row on each side of the back, and a median blotch behind the gills. The tips of the lateral appendages (la) and of the gills are pale

yellow, and the postbranchial bright yellow area passes into a light yellow one which extends backwards with 2 lines.

The measurements of the 2 live specimens (Holotype and Paratype respectively) were: body length 7.6 and 5.3 mm; width of body 2.2 and 1.9 mm; length of rhinophores 1.7 and 1.4 mm; diameter of rhinophores 0.3 and 0.2 mm; length of the longest gill in both specimens 1.1 mm; length of central pigmented stripe 3.4 and 2.0 mm; Holotype, UMMZ 230616; Paratype, UMMZ 230617.

The shape of the veil is different in the 2 specimens. In the larger specimen its anterior border is convex (Fig. 2); in the smaller one it is straight and slightly concave in the middle. The tentacles are triangular flaps. The foot corners are rounded, not projecting. The tails of the preserved specimens end with a longer point than they showed in life; the foot is narrower than the back. The pallial ridge bears 11 soft appendages on each side in the larger slug, 9 in the smaller slug. These appendages have blunt tips when alive; when preserved they are pointed. The hindmost appendages are double. In the smaller slug the 6th right papilla is also double. Two pairs of the appendages stand in front of the rhinophores and 2 behind the branchiae. The gills are unipinnate, the larger animal has 9, the smaller animal has 7. Five low, pointed tubercles stand on the center stripe (Fig. 3). In front of the gills there is a pair of low bosses, whose position corresponds to the posterior pair of the large, roundish spots mentioned above.

The labial cuticle bears a ring-shaped thickening around the mouth composed of smooth, polygonal elements (Fig. 4), which are conical in side view. Sometimes their tips are slightly curved. The radula (Fig. 5) of the larger slug consists of 12 rows of teeth (radular formula: 1.1.0.1.1). The inner (intermediate or lateral) tooth is 94μ long, the outer (marginal) tooth 28μ long. The

former bears 20-24 denticles on its inner side, of which those near the tip are stronger than those near the base. There is a boss near the root of the cusp similar to Vayssière's figure 15 (1919: pl. 4) of *Okenia dautzenbergi*. The scale-shaped marginal tooth has a single short point.

The reproductive organs (Fig. 6) are similar to those in other species of *Okenia*. The hermaphrodite duct (h) is thin, the ampulla (a) cylindrical in the dissected slug. A narrow spermoviduct merges into the female gland mass (fg). From there the male duct goes out and soon becomes prostatic (pr). This glandular portion of the duct bends back on itself and is sharply set off from the narrow efferent duct (e), which is sheathed by an outer muscle layer. It functions as an acrembolic penis (p), and its terminal section bears cuticular spines.

The nidamental duct (n) and the vagina (v) open together. The vagina leads to a spacious spermatheca (spa). The long and curved insemination duct (id) leaves the spermatheca near the entrance of the vagina. These 2 spermathecal ducts correspond to what is called the serial type of the seminal receptacles. The canal of the spermatocyst (sp) arises from the insemination duct.

Discussion of *Okenia* (*Okenia*) *sapelona*

For the principal literature and the valid species of *Okenia* Menke, 1830, we refer to our list (Marcus, 1957b: 438). Since then 3 new species, all from Japan, have been added to the genus (Baba, 1960: 80-81; Hamatani, 1961: 363-365). One of these Japanese species, *O. plana*, has recently also been found in San Francisco Bay (Steinberg, 1963: 65, 71). These new Pacific species belong to the subgenus *Okenia*, characterized by appendages on the central area of the back between rhinophores and gills. When these appendages are poorly developed, they can only be seen in side view as low tubercles (Fig. 3). The 2 species of *Okenia* described from western

Atlantic warm waters belong to the subgenus *Okenia* s.s. (Marcus, 1957b: 434-442), while those reported from the New England area (Johnson, 1934: 156) belong to the subgenus *Idaliella* Bergh, 1881. This latter subgenus does not have appendages in the center of the dorsum. The species from western Atlantic warm waters are *Okenia evelinae* and *O. impexa*. *O. evelinae* has been recorded from the southern middle Brazilian coast and Miami (Marcus, 1960a: 162). *O. impexa* has been recorded from Brazil and Beaufort, North Carolina (Marcus, 1961b: 144).

The labial cuticle of *Okenia impexa* is thin and smooth, and its marginal tooth bears a sharp principal cusp and 2 further basal secondary cusps. The thick labial cuticle of *O. evelinae* projects with a kind of bilabiate beak on each side of the mouth; this beak is simple, not composed of separate elements. The lateral appendages do not extend backwards beyond the level of the gills. In front of the latter there are 2 median unpaired papillae and 1 lateral pair. The male copulatory organ is pleurembolic, without spines, and ends with a penial papilla.

Several of the East Atlantic and Mediterranean species of *Okenia* in Pruvot-Fol's classification (1954: 308-311), *O. elegans*, *O. dautzenbergi*, and *O. mediterranea*, must be compared with *O. sapelona*. In Vayssière's last publication (1930) *O. dautzenbergi* is annexed to *O. elegans*. The marginal tooth of *O. elegans elegans* and *O. elegans dautzenbergi*, although 7-8 times smaller than the lateral tooth, is rather similar to it in shape. *O. e. elegans* has 17-22 gills, *O. e. dautzenbergi* 14 gills. The broad foot appears to project beyond the pallial ridge in dorsal view. *O. mediterranea*, the species nearest to *O. sapelona*, has no papillae down the midline, but 2 pairs of tubercles in front of the gills, and the surface of the labial elements bears numerous points and tubercles. Pruvot-Fol (1954: 311) said that *O. mediterranea* and *O. amoenula*,

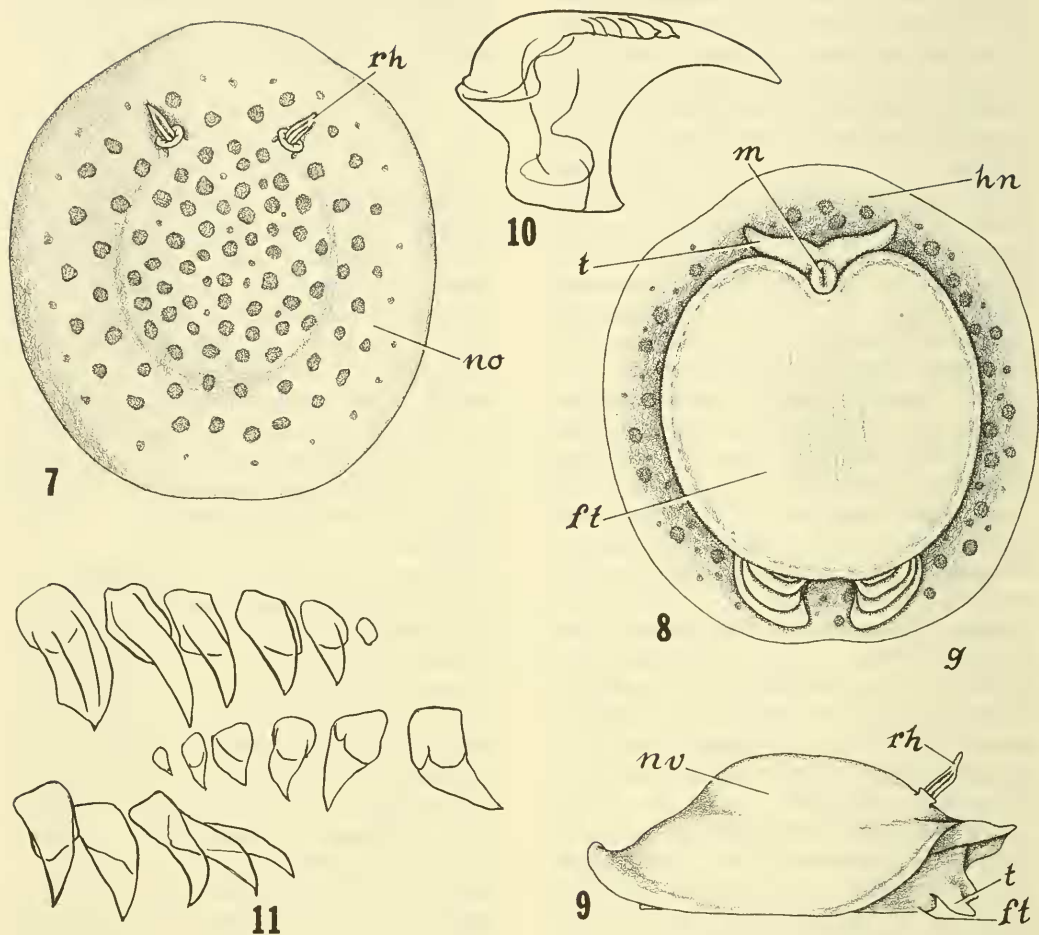
a South African species, are similar, but according to Macnae (1958: 368-369), the latter species belongs to the subgenus *Idaliella*.

5. *Doridella burchi*, new species
(Figs. 7-12)

Occurrences: Georgia, 1) off Cabretta Island, 4.3 m depth, November 28, 1962; 2a) Blackbeard Creek, between Blackbeard and Sapelo Islands, about 1/4 mi. from Raccoon Bluff, tide flat, December 1962; 2b) same locality, May 14, 1964; 3) Sapelo Sound, 16-26 m depth, April 10, 1963; 4) off Nanny Goat Beach, Sapelo Island, May 17, 1963 (type locality). A total of 182 specimens, all on *Alcyonidium* (Bryozoa, Ctenostomata). Holotype, UMMZ 230618; Paratypes, UMMZ 230619.

Living slugs are up to 8 mm long, but the average size of these specimens was somewhat less than 7 mm. The largest preserved specimen was 7 mm in length, 5 mm in width and 3 mm in height. The collection also contained many smaller animals, some as little as 1.5 mm in length. The notum of this species is transparent, slightly opaque, the foot rather opaque. Through the notum the following organs and structures were seen: the pumping heart in the hind part of the visceral mass, the dark brown digestive gland and white lobes around it, which are the follicles of the ovotestis, the yellowish-tan outline of the visceral mass, and the outline of the foot. Round brown spots are numerous in the center (Fig. 7), decreasing in number towards the periphery. Many of these spots are about 150 μ in diameter, but much smaller spots also occur. The ramified pigment cells forming these spots lie in the deepest layer of the notum, and therefore they appear near the surface of the hyponotum in ventral view (Fig. 8). Yellow marks are scattered between the brown spots. In preserved animals the foot, the rhinophores, and the gills are whitish.

The notum is almost circular when



FIGS. 7-11. *Doridella burchi*, n. sp. Fig. 7. Dorsal view of living slug. Fig. 8. Ventral view of same. Fig. 9. Side view of same. Figs. 7-9 drawn by Dr. J. B. Burch. Fig. 10. Intermediate tooth of radula. Fig. 11. Three rows of marginal (or outer lateral) teeth viewed from different angles.

the animal is at rest, but pointed behind in locomotion (Fig. 9). The notal border is not notched behind, but a bundle of muscles that originates between the gills and inserts on the border of the hypnotum, may produce a temporary emargination of the notum. As in other corambids the integument consists of a deciduous cuticle which is known to be periodically shed and renewed (MacFarland & O'Donoghue, 1929: 9), an epidermis which secretes the cuticle and

its pegs, and a thick layer of connective tissue without spicules. The pegs in the present species are broader than those in *Corambe pacifica* MacFarland & O'Donoghue, 1929, (pl. 1, Figs. 3-4). The cells of the connective tissue are scarce. Numerous large glands are sunk into the connective tissue.

The foot (ft) is cordate and bilabiate in front (Fig. 8), rounded behind, though sometimes narrower, sometimes broader, according to contraction and re-

laxation. At rest the foot and the head and its veil (ve) are covered by the notum. In locomotion (Fig. 9) the head is protruded. In the gliding animal the tentacles touch the substrate. As in most other corambids, the rhinophores bear 2 lamellae on either side. They are similar to those of *Corambella baratariae* (Harry, 1953: fig. 6), which according to Franz (1967, p 75) is a synonym of *Doridella obscura* Verrill, 1870. In the present species, however, the border of the rhinophoral pit is not scalloped in our specimens of *C. burchi*. In these the border is a broad collar whose outer edge is smooth, while the inner edge has some slight radial folds (Fig. 7). In the preserved specimens the rhinophores are completely withdrawn. The eyes lie deep under the skin, a little in front of the cerebral ganglia, on either side of the crop. On account of the coalescence of the cerebral and pleural ganglia, the central nervous system agrees better with that of *Corambe testudinaria* (Fischer, 1889 (Hoffmann, 1936: figs. 554 A, B) than with that of *C. pacifica* (MacFarland & O'Donoghue, 1929: pl. 2, figs. 8, 9).

In the groove between the hind end of the notum and the foot, which represents an extremely reduced mantle cavity (Hoffmann, 1934: 330), a pair of gills (g) lies on either side of the midline (Fig. 8). Each pair consists of a smaller anterior, more ventral, and a larger, posterior, dorsal plate, the former with about 4 dorsal and 4 ventral leaves, the latter with about 9 leaves on either face. The anus opens between the gills, not on a papilla; the renal pore lies beside the anus. The muscle fibres connecting the anal region with the hind margin of the hyponotum have already been mentioned. There are 3 branchial glands at the base of each pair of branchiae. The genital apertures lie on a lobed papilla immediately behind the right tentacle. A high epithelium covers the genital papilla.

The cavity of the mouth is lined with

a thick cuticle. The radula consists of about 40 rows. Each half-row contains 1 inner lateral or intermediate tooth and 5-6 (in the older portion of the radula 4) outer lateral or marginal teeth. The intermediate tooth (Fig. 10) is 88μ long, 47μ high, and bears 3-7 denticles on the inner surface of the hook. The first marginal tooth is 34μ long. The different aspects of the marginal teeth viewed from different angles are shown by the 3 half-rows of Fig. 11.

The male and female follicles of the ovotestis are separate as in *Doridella obscura* and *C. carambola*, but in contrast to *Corambe evelinae*. The hermaphrodite duct (Fig. 12, h) and the ampulla (a) have the usual characters. The spermoviduct (sp) divides outside the female gland mass (fg). The male branch is glandular (pr) in its entire length, from the bifurcation of the spermoviduct to the root of the conical penis (p). The base of the latter is thick, cushion-like, its tip pointed, its epithelium ciliated. The ciliated vagina (v) runs straight inwards from the female genital aperture and has several constrictions. It begins with its own outer opening immediately next to the penis and ends in a spacious spermatheca (spa) containing unorientated sperm. The insemination duct (id) leaves the spermatheca laterally, well away from the entrance of the vagina. Its coiled course before it enters the oviduct is simplified in the diagram (Fig. 12). The spermato-cyst (sp) which lodges orientated sperms is annexed to the ental portion of the inner oviduct (io). The latter passes into the glandular oviduct whose convolutions constitute the so-called female gland mass (fg). The outer oviduct or nidamental duct (n) opens separately from the vagina. As mentioned above, the papilla on which the 3 genital apertures lie, has a high, folded epithelium.

The egg string described by Dr. J. B. Burch (personal communication) corresponds to a single planed coil of clear jelly, similar to that observed in other

corambids, e.g., *Doridella obscura* (Verrill, 1873: 30) and *Corambe pacifica* (MacFarland & O'Donoghue, 1929: 20). The 3 turns observed in the present species sometimes overlap slightly. They contain 2-3 layers of eggs, each egg in its own capsule. The eggs are spaced from one another by distances equal to their own diameter. MacFarland & O'Donoghue calculated 1500 eggs in the egg string of *C. pacifica*.

The corambids feed upon Bryozoa. The bryozoan on which *Doridella burchi* was found was identified as *Alcyonidium* cf. *verrilli* by Mr. Milton S. Gray of the Marine Institute, University of Georgia. As this erect, branching bryozoan species is recognizable by a much firmer consistency than that of *A. gelatinosum* and *A. hirsutum*, both of which grow in a similar form (Osburn, 1932: 444), we presume that this identification is correct, although we are not aware of other records of *A. verrilli* south of Chesapeake Bay (Osburn, 1944: 14).

The species is named for Dr. J. B. Burch, who first recognized it as an undescribed species and who provided drawings of the living animals and many observations which were included in our description.

Discussion of *Doridella burchi*

The family Corambidae comprises 11 species known from the European west coast (Netherlands, France) and the Atlantic and Pacific coasts of North and South America. The bibliographic records up to 1929 can be found in MacFarland & O'Donoghue (1929: 2-3). Further species were described by Harry (1953), Marcus (1955, 1958a, 1959), and Lance (1962a). The 2 genera currently distinguished are *Corambe* Bergh (1869: 359, footnote), and *Doridella* Verrill (1870, p 405). In *Corambe* there is a median notch in the posterior border of the notum, in *Doridella* the border is not notched.

The posterior notch of *Corambe* has been observed in living *C. testudinaria*, *C. pacifica* and *C. evelinae* as a con-

stant structure. In preserved *C. evelinae* and in *C. lucea*, which is not known alive, the notch may be contracted and reduced to a mere suture. In living *Doridella* the contraction of the notal border may produce a temporary emargination, probably for the better flow of water around the gills, but preserved specimens of *Doridella* showing a notch have not been described.

The first corambid described having an entire notal border is "*Doridella obscura* Verrill, 1870, a species which occurs from Vineyard Sound, Massachusetts to New Jersey. (Verrill published a more detailed description in 1873: 307, 400-401, 664, pl. 25, fig. 173a, b). The type species of *Corambella*, *C. depressa* Balch, 1899, was first collected at Long Island, New York, hence within the range of *D. obscura*. The gills of *C. depressa* are plate-like, as probably those of the type species of *Corambe*, *C. sargassicola* Bergh (1871: 1295, pl. 11, fig. 24, pl. 12, fig. 1). The same type of gills occurs in *Doridella obscura* (Franz, 1967, fig. 1A). All other species with posterior notal notches have plume-like gills. If the gills were used for the separation of the genera, *Doridella* would become a synonym of *Corambe*. Then the species with plume-like gills would have to be united under a new name. One species with an entire notal border, *Doridella steinbergae* Lance, 1962a (35), would come under this new genus.

Thiele (1931: 430) mentioned the twisted inner lateral tooth of *Corambella depressa* Balch (1899: pl. 1, fig. 15) in the diagnosis of the genus, but we do not accept it as a specific feature. Evidently this tooth had been deformed by too strong a pressure of the cover glass. The reticulate pattern of the notum, the single pair of lamellae surrounding the central cone of the rhinophore, and the anal opening on a papilla are perhaps specific characters of *C. depressa*; the genital aperture on the left side is an anomaly or a misinterpretation.

Doridella steinbergae differs widely from all other species of *Doridella* by the plume-like branchiae and the smooth rhinophores.

Doridella obscura Verrill, 1870, *D. baratariae* (Harry, 1953), *D. carambola* Marcus, 1955, and *D. burchi* are related to one another; Franz (1967: 74) even united *D. obscura* and *D. baratariae*. The minute penial papilla of *D. carambola* and its 2 pairs of branchial glands separate this species from the others. The shape of the marginal teeth can hardly be used for specific separation, because their aspect varies when viewed from different angles. Both *D. carambola* and *D. baratariae* are smaller species than *D. burchi*. A preserved specimen of *D. baratariae* from Biscayne Bay, Florida, is 3 mm long and 2.25-2.4 mm wide. Its penis is 0.3 mm in length and does not have the dilated base (Marcus, 1960b: fig. 13) of *D. burchi* (Fig. 12). The vagina of *D. carambola* is narrow and the margins of the rhinophoral pits are scalloped. The discrepancy in the length of the lateral and first marginal tooth is less in *D. baratariae* (Harry, 1953: fig. 5) than in *D. burchi*.

The entire notal margin of *Doridella batava* (Kerbert, 1886; van Benthem Jutting, 1922: 400-401, figs. 5-6a, b) led Engel (1936: 106-107) to the correct generic allocation, but this species is still placed in the genus *Corambe* by some authors (e.g., Swennen, 1961: 205). *Doridella obscura* and *D. batava* are probably different species, because the former is pointed behind, while the latter is broadly rounded. But the data available are hardly sufficient for separating the remaining species of *Doridella* from *D. batava*. However, the very weak denticulation of the intermediate tooth and the broad irregularly shaped marginal teeth without cusps seem to be peculiar characters of *D. batava*.

6. *Dendrodoris krebsii* (Mörch, 1863)

- Rhacodoris Krebsii* Mörch, 1863: 34.
- Doriopsis Krebsii* Bergh, 1875a: 87-91, pl. 11, figs. 8-23.
- Doriopsis Krebsii* var. *pallida* Bergh,

1879: 44-49.

- Doriopsis atropos* Bergh, 1879: 49-64.
- Dendrodoris atropos* Marcus, 1957b: 443-447, figs. 146-154; 1962, fig. 19.
- Dendrodoris krebsii* Marcus, 1963: 35 (*D. atropos* synonymized).
- Dendrodoris atropos* Collier & Farmer, 1964: 389-391, figs. 2 G-H and pl. 5.
- Dendrodoris krebsii* Marcus, 1967a; 1967b: figs. 62, 63 (in press).

Occurrence: Dredged of Sapelo Island, Georgia, September 12, 1963; 1 specimen.

Further distribution: Atlantic Ocean: Florida; Bahamas; Virgin Islands (original localities); Antilles; Curaçao; coast of southern middle Brazil. Pacific coast of Lower California; Gulf of California; mainland of Mexico.

At present, Sapelo Island and Puerto Peñasco, Sonora, Mexico, are the northernmost localities for *D. krebsii*, whose range testifies to the central American marine continuity admitted even for the Lower Pliocene (Ekman, 1953: 37).

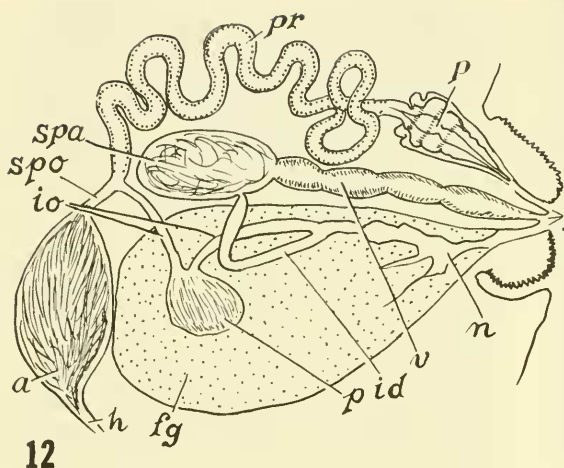
The preserved slug is 30 mm long, 15 mm broad and 14 mm high. Its notum and foot have frilled borders. The rhinophore has about 20 leaves; there are 6 tripinnate gills. The surface of the notum and the borders of the rhinophoral and branchial pockets are smooth.

Collier & Farmer found the base of the penis thickened in their east Pacific material. We also found this part to be thicker in specimens from the Gulf of California, collected by Dr. Peter E. Pickens, than in our Atlantic specimens from the Lesser Antilles and Brazil. This character could not be examined in the present specimen, because part of the hook-bearing section of the penial papilla is protruded, and only completely retracted penes are comparable.

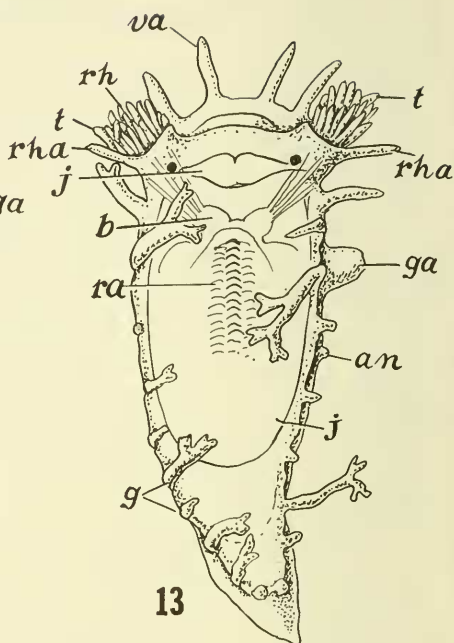
7. *Doriopsis pharpha* Marcus, 1961

- Doriopsis pharpha* Marcus, 1961b: 146, figs. 19-21.

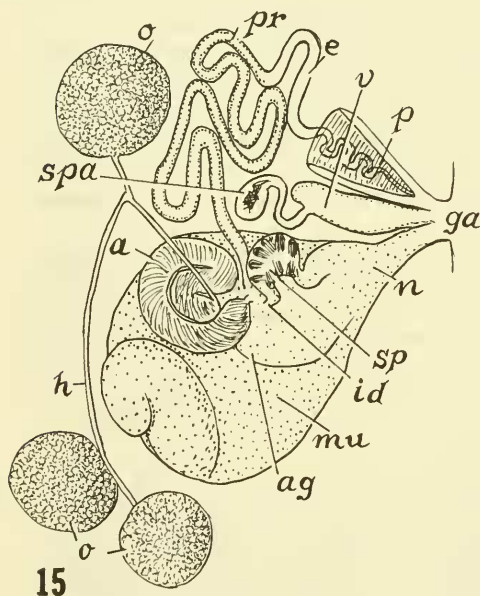
Occurrences: Georgia, 1) Sapelo



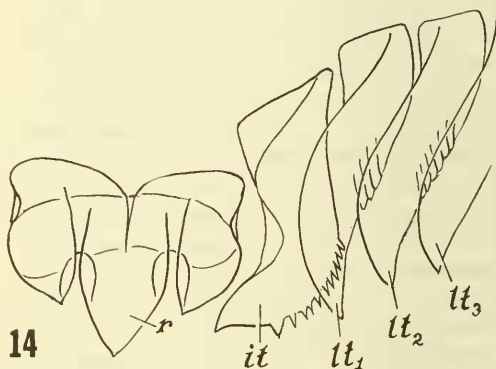
12



13



15



14

FIGS. 12-15. Fig. 12. *Doridella burchi*, n. sp.. Diagram of reproductive organs. FIGS. 13-14. *Tritonia bayeri misa*, n. ssp. Fig. 13. Preserved slug, dorsal view. Fig. 14. Inner teeth of radula. Fig. 15. *Scyllaea pelagica*. Diagram of reproductive organs.

Sound, November 30, 1961, 1 specimen;
2) Wallburg Creek, 18-23 m depth,
February 20, 1962, 4 specimens; 3)
Sapelo Island, 1-2 miles east of sea
buoy, dredged from 18-23 m depth, 2
specimens.

Further distribution: Beaufort, North

Carolina.

The biggest of the preserved speci-
mens is 18 mm long, 10 mm wide and
4 mm high. The foot is 16 mm long,
7 mm broad. The living slugs were
yellow, but in the preserved specimens
this ground color had disappeared. How-

ever, in preserved specimens the dark brown chromatophores of the connective tissue, mentioned in the first description, were visible. The present material agrees with that from Beaufort, N. C., except that the spermatheca is larger and the prostatic section of the efferent duct is considerably wider. These characters are functional and not of systematic value.

The dark specks and the 12 rhinophoral perfoliations distinguish *D. pharpha* from the 2 other species of *Doriopsilla* found in American Atlantic warm waters, *D. leia* Marcus (1961b: 144) and *D. areolata* Bergh, 1880. The latter 2 species lack the specks, and have 8 (*D. leia*) and 20-25 (*D. areolata*) perfoliations. Moreover, *D. leia* is soft and smooth, *D. pharpha* firm and slightly bossed on the notum. The pedal commissure of *D. leia* is distinct, and in *D. pharpha* the pedal ganglia are contiguous. The notal bosses of *D. areolata* are more distinctly set off than those of *D. pharpha*, and the hindmost muscular section of the oesophagus (Marcus, 1962: fig. 18, zi) is only half as long. When the white epidermal net of *D. areolata* is present, this species is easily identified. But sometimes this net is absent, making identification more difficult, as was the case in the single specimen of *D. areolata* reported from the West Atlantic Ocean (Marcus, 1962: 472).

In *Dendrodoris* and *Doriopsilla*, which suck their food, the anterior gut is so much modified that the term "oral tube" and "buccal bulb" are inadequate and should be replaced by "oral vestibule" and "pharynx" respectively. In both genera the oral vestibule is more or less dilatable, and the anterior portion of the tubular pharynx often protrudes into the posterior part of the vestibule. In *Dendrodoris*, a bilobed posterior oral gland (ptyaline gland, Bergh), or a pair of glands, opens into the vestibule. In *Doriopsilla* such glands are absent. Where ptyaline glands have been erroneously described for species of *Doriopsilla*, they are really the ductless

lymphatic blood glands. The buccal ganglia lie far from the nerve ring in *Dendrodoris*, whose cerebro-buccal connectives are long, while they are apposed to the pedal ganglia in *Doriopsilla*.

Other morphological characters frequently mentioned in the literature are subject to variations and therefore cannot be used as diagnostic taxonomic characters. They are: soft consistency of the body in *Dendrodoris* and a stiff, leathery one in *Doriopsilla*; a nearly smooth (*Dendrodoris*) or strongly warty notum (*Doriopsilla*); spicules scarce (*Dendrodoris*) and abundant (*Doriopsilla*). The pharyngeal or salivary glands cannot be used taxonomically in view of Pruvot-Fol's (1952: 414) and our (Marcus, 1962: 474) negative search for them in east and west Atlantic material of the type species of *Doriopsilla*.

8. *Tritonia* (*Candiella*) *bayeri* *n. sp.*,
new subspecies
(Figs. 13-14)

Occurrences: Off Sapelo Island, Georgia, 1) 31° 33 min. 30 sec. N, 79° 37 min. 30 sec. W, 77 m depth, August 4, 1962, 1 specimen; 2) 31° 26 min. 32 sec. N, 79° 42 min. 13 sec. W, 89-77 m depth, August 4, 1963, 2 specimens (type locality). Holotype, UMMZ 230620; Paratype, UMMZ 230621.

The preserved animals are 2.4, 3.0, and 3.5 mm in length, the last one is 2 mm broad without the short gills. The back is smooth. The foot is nearly as broad as the body, round and bilabiate in front, tapering behind.

The cephalic veil is entire, not bilobed. There are 4 digitiform velar appendages (Fig. 13, va) between the grooved tentacles (t). The smooth rim of the rhinophore sheath bears a single process (rha). The 9 branchial tufts (g) on either side alternate in length, the longer gills dichotomize. The genital aperture (ga) lies under the 3rd right tuft, the anus (an) between the 4th and 5th, behind the middle of the body.

The length of the jaws (j) is more than half that of the body. The masticatory

border is set with several rows of conical teeth. The radula (Fig. 14) comprises 26 rows with 10 teeth per half-row (radular formula: 9.1.1.1.9). The median cusp of the tricuspidate rhachidian tooth (r) is a little larger than the lateral cusps. The intermediate tooth (it) has an inner concavity and a row of outer denticles. The outermost of these is stronger than the others. The following teeth (lt) are hook-shaped, but the 1st of them (lt 1), sometimes also the 2nd, (lt 2), bears a small denticle between cusp and base.

In spite of the small size of the slugs, their reproductive organs contained mature sperms. The genital system agrees with that of *T. (C.) bayeri bayeri* Marcus, 1967a, found in the area of Miami. The longish form of the ampulla (curved, sausage-shaped) differs from the globular one in *T. (C.) b. bayeri*.

The name of this subspecies is the latinized form of the French *Mise*, an abbreviation of *Marquise*, wife of a *Marquis*.

Discussion of *Tritonia (Candiella) bayeri mise*

The new form has 4 velar appendages against 2 in the larger *T. (C.) b. bayeri*, which is preserved 7-11 mm in length. Since, in the tritoniids, the number of these appendages is known to increase with growth, the larger number in the smaller form is a distinctive character. Minor peculiarities of *T. (C.) b. mise* are the strong 1st denticle of the intermediate tooth (it) and the occasional occurrence of denticles on the 2nd lateral tooth (lt 2). The (longish, not globular) shape of the ampulla is a functional character with no systematic importance.

9. *Scyllaea pelagica* Linné, 1758 (Fig. 15)

Alder & Hancock, 1848: family 2, pl. 5 (anatomy); 1855: pl. 46, suppl. fig. 27 (radula);

Bergh, 1875b: 319-342 (including the

varieties *marginata*, *ghomfodensis*, *sinesis*, *orientalis*), pls. 40, 42-43, 44, figs. 1-18, pl. 45, figs. 16-18;

Odhner, 1936: 1097 (color after Verrill, 1878), 1098 (synopsis of species of *Scyllaea*), figs. 7, 30, 31a;

Baba, 1949: 89, 168-169, figs. 112-113, pl. 36, fig. 130 (colored);

Pruvot-Fol, 1954: 367-368, figs. 143a-j;

Marcus, 1963: 36-37, figs. 65-66;

Abe, 1964: 87, pl. 29, fig. 101 (colored).

Occurrence: Off Georgia coast in Gulf-weed drift, 31° 04 min. N, 80° 28 min. W, 4 specimens.

Further distribution: Pelagic in warm and warm-temperate waters, clinging to floating seaweed and feeding on hydroids. Occasionally farther north (Marcus, 1961b: 148).

Living slugs reach 60 mm in length (Barnard, 1927: 210) when extended; the largest preserved specimen at hand is 30 mm long, 16 mm high including the lobes, and 8 mm broad.

As 2 figures (Odhner, 1936; Baba, 1949) of the reproductive organs of *S. pelagica* are published in papers not easily accessible, and the reproduction of the 3rd figure (Pruvot-Fol, 1954) is mediocre, we give a new diagrammatic drawing (Fig. 15) of this peculiar system. The hermaphrodite glands (o) are globular. The specimen we dissected had 3 of these glands, but up to 6 have been recorded (Baba, 1949). The hermaphrodite ducts (h) unite, so that a single duct enters the tubular, coiled ampulla (a). The short spermoviduct (spo) goes into the female gland mass (albumen gland, ag), in which the male and female ducts separate.

The male duct is glandular, prostatic (pr) in its inner, and muscular in its outer course (e). The outermost part, the ejaculatory duct, winds through a muscular, unarmed, conical penis (p) lodged in a narrow male atrium.

The wide vagina (v) leads to the spermatheca (spa) which is small, though bigger than in Odhner's figure (1936:

fig. 30). It contains debris, probably remains of sperm and male secretion, so that it is not functionless (loc. cit.: 1068). The chambered spermatocyst (sp) is a small organ, apposed to the albumen gland (ag). It is connected with the gland mass by a short insemination duct (id) near the entrance of the sperm-oviduct (spo). Some folds of the glandular oviduct project as a spiral over the surface of the mucus gland (mu). The genital apertures lie between the right rhinophore and the first dorsal lobe on the side of the body.

10. *Armina wattla*, new species
(Figs. 16-20)

Occurrences: Sapelo Island, Georgia, 11-19.5 miles from sea buoy, 16.5-19 m depth, January 31, February 13 and March 13, 1961; a total of 6 specimens. Holotype, UMMZ 230622; Paratype, UMMZ 230623.

The largest of the animals was 24 mm long, 15 mm broad and 8 mm high. The sole measured 20 mm in length, 9 mm in width. The smallest slug measured 15 mm. The preserved slugs were whitish with black pigment in the furrows between the notal ridges, on the base of the rhinophores, in the folds of the caruncle, in the middle of the veil, on the sides of the foot, and on the sole. Preserved, the crests of the notal ridges are white, but they may have been yellow alive, as some vestiges indicate.

There are about 36 notal ridges (nr) in the biggest animal, which run parallel to the mid-line. Broad and narrow ridges generally alternate on the sides, while in the middle the narrow ridge is often absent. On the anterior border of the notum there begin 20-24 broad and narrow ridges, the rest originate farther behind.

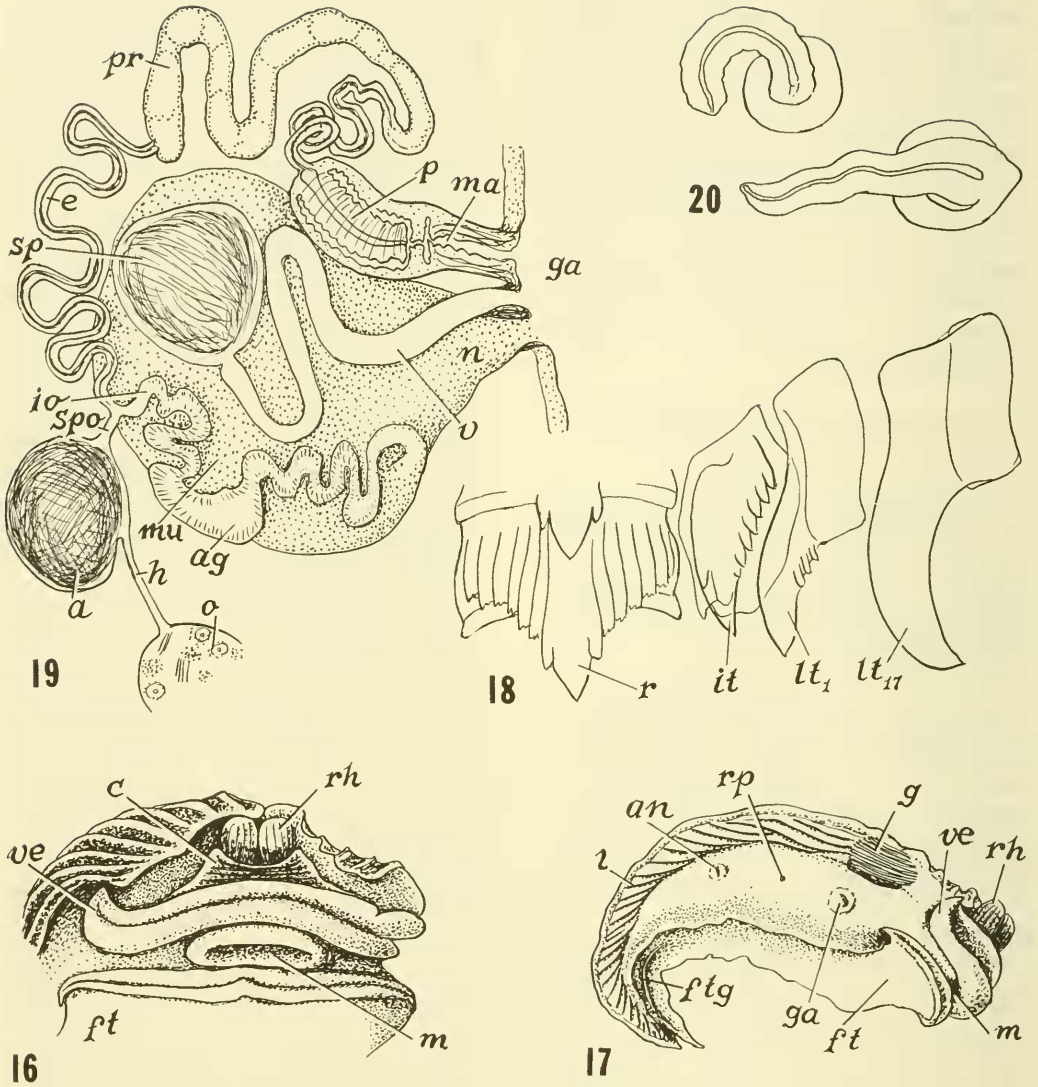
In front (Fig. 16) the notum is frilled by the ridges and notched in the middle; it is pointed behind. The pores of the marginal glands, Bergh's cnidopores, are numerous, but in most specimens they are difficult to see.

There are about 28 branchial leaves (Fig. 17, g), the innermost of which lie in an open pocket over the viscera; 3-4 lateral lamellae (l) arise from the branchiae. Farther behind there are 18-22 or, when all primordia are counted, up to 29 lamellae. They all run obliquely outwards, the posterior ones in a more pronounced way.

The semilunar veil (Fig. 16, ve) is as broad as the foot, its corners are bent upwards. Its upper border is weakly undulate. The dark middle of the veil contrasts with the colorless margins. Nuchal papillae are not developed, but a strong caruncle (c) arises from the upper or posterior border of the veil. The caruncle is folded transversely, is concave behind, where it borders the rhinophoral pits, and ends with a point on either side of the rhinophores (rh). These have 12 longitudinal leaves which are confluent on the tip and further divided downwards.

The anterior border of the foot (ft) is bilabiate and notched; its corners are slightly prominent and rolled upwards. The pedal gland (ftg, Fig. 17) is marked by a furrow 5 mm long. The shape of the buccal lip (m) varies, being either trapezoid or elliptic. The genital aperture (ga) lies under the gills, the anus (an) behind the middle or in the 2nd third of the body. The renal pore (rp) is between the anal and genital openings, about equally distant from both.

The yellow jaws are small, about 3x 1.5 mm; the masticatory process is undulate after treatment with KOH. The cutting edge has 3-4 rows of denticles in front. These denticles look like corn (maize) on the cob. The rows are more numerous in the rear; on the free process there are about 10 rows of pointed denticles measuring up to 40 μ in length. The radula (Fig. 18) comprises 40 rows with about 46 lateral teeth (lt) per half-row. The rhachidian tooth is 140 μ broad, 90 μ high. The median cusp is flanked by 5-7 denticles, 1-2 of which sit on the central cusp. The intermediate tooth (it)



FIGS. 16-20. *Armina wattla*, n. sp. Fig. 16. Anterior end of animal, frontal view. Fig. 17. View from the right side. Fig. 18. Inner teeth of radula. Fig. 19. Diagram of reproductive organs. Fig. 20. Two everted penes.

has a broad base and about 7 outer denticles. Furthermore there are 1-2 big inner points which lie farther behind than the outer denticles. They are difficult to see, because they are overlapped by the cusp. The 3 first lateral teeth may bear up to 4, exceptionally 5,

denticles. There are, however, many half-rows without any denticles. The lateral teeth increase in size towards the middle of the half-row and then decrease outwards.

The hermaphrodite duct (Fig. 19, h) is rather short, the ampulla (a) globular.

The short spermoviduct (spo) bifurcates into the inner oviduct (io) and the sperm duct. The latter begins as a long, winding efferent duct (e) followed by a prostatic portion (pr). The ectal, 3rd part is convoluted and thin; it reaches the muscular penis (p). The penis is lodged in the male atrium (ma); in 2 specimens it was protruded. The shape of the everted male organs (Fig. 20), conical in one animal, cylindrical in the other, shows that it cannot be used as a specific character.

The inner oviduct (io) passes into the inner portion of the glandular oviduct, the albumen gland. This organ is simplified in the diagram (Fig. 19, ag); it is tubular as in the species examined previously (Marcus, 1960a, fig. 67; 1961a, figs. 148, 154). The mucus gland (mu) is wide and richly folded. The long vagina (v) leads from the external aperture to an ample, spherical seminal receptacle, the spermatocyst (sp). From there the sperm descend again, enter the nidamental duct (n) and pass inwards to the inner oviduct, where the eggs are fertilized (Marcus, 1960a, fig. 67, f).

The broad bicuspid caruncle (wattle) suggested the name of this species.

Discussion of *Armina wattle*

The only previously known *Armina* of the Atlantic coasts of the Americas is *A. mülleri* (v. Ihering, 1886: 223-230, pl. 9, fig. 1) from Santa Catarina, São Paulo, and north of Rio de Janeiro (Marcus, 1960a: 170; 1967a). Evidently Nijssen-Meyer's specimen from Surinam also belongs to that species; differences she mentioned (1965: 149) can be considered as intraspecific variations. For the intermediate tooth Nijssen-Meyer (: 148) indicates: "...at least 6 denticles on the inner side of the cusp". As her figure 4 shows, this is a lapsus for "outer side". *A. mülleri* has 2 small but recognizable caruncles and a median boss between them. Therefore we can not unite it with *A. semperi* (Bergh, 1866: 37-42, pl. 3), whose caruncle is so minute (:39) that it is almost invisible

on the cited figure 1. Pruvot-Fol (1933), the only one of the later authors who dealt with *A. semperi* and mentioned the caruncle, also called it "presque nulle". The original locality of *A. semperi* lies on the southwestern coast of Mindanao; it has been further reported from Japan, the Arabian Sea (Gulf of Oman), the Gulf of Aden, and the northern Red Sea.

Armina mülleri differs from *A. wattle* by the shape of the caruncle, which in the former, consists of 2 swellings without folds that are separated by a median boss. The rhachidian tooth of *A. mülleri* has a width ranging from 0.2 mm in a preserved slug 31 mm long, to 0.25 mm in preserved animals 39 and 16 mm long, against 0.14 mm in a 24 mm specimen of *A. wattle*. In the latter species, the lateral denticles of the rhachidian tooth are a little more numerous. In Nijssen-Meyer's and in our material of *A. mülleri* the reduction of the denticulation of the lateral teeth is less pronounced than in *A. wattle* (see Fig. 18). However, v. Ihering's description of *A. mülleri* does not show this difference.

A species of the Pacific South American coast, *Armina cuvieri* (d'Orbigny, 1837: 198, pl. 17, figs. 1-3) from Valparaiso is practically unknown; its pyriform male copulatory organ cannot be evaluated, because the above description of *A. wattle* as well as the literature (v. Ihering, 1886: 225; Marcus, 1960a: 173; 1961a: 44) show that the shape of the penis is variable, at least in preserved animals, probably due to contraction.

In an earlier exposition (Marcus, 1961a: 44) we discussed the 4 following species of *Armina* from the west coast of North America and indicated their bibliography: *A. californica* (Cooper, 1862), *A. vancouverensis* (Bergh, 1876), *A. columbiana* O'Donoghue, 1924, and *A. digueti* Pruvot-Fol, 1955. Lance (1962b: 51-54) has since described *Armina convolvula* from the northern part of the Gulf of California, and has recognized the isolated position of that species. In

fact, *A. convolvula* belongs to *Histiomena* Mörch, 1859, known from the Pacific coast of Nicaragua (Marcus, 1966: 189). While Bergh (1881b: 172), v. Ihering (1886: 226), Eliot (1905: 238), and Pruvot-Fol (1933: 114) did not admit a broad intra-specific variability of the radula in *Armina*, Steinberg (1963: 65) does. She unites the 4 species of *Armina* of the North American Pacific coast from Panama to Vancouver Island under the oldest name. Her opinion will probably be accepted, though a comparison of the reproductive organs of several specimens is still desirable. For our purposes, i.e. the distinction of *A. wattla* from the warm temperate western Atlantic, which has so many faunal relationships with the eastern Pacific, it will be sufficient to note the weak caruncles of the 3 first Pacific species. As for *A. digueti* Pruvot-Fol, 1955, whose caruncle is not described, it differs from *A. wattla* by its coarse white ridges, among the broad interspaces of which there course thin black ridges.

Comparing the further species of *Armina* with *A. wattla*, we found a strongly developed caruncle with transverse folds in *A. tigrina* Rafinesque, Bergh's *Pleurophyllidia undulata* Meckel, 1823 (1866: 18-19, pl. 1). This species is recorded from the western, central (Sargasso Sea) and eastern warm and warm temperate Atlantic Ocean (for range see Marcus, 1966: 191). The radula of *A. tigrina* differs widely from that of *A. wattla*, especially by the high and narrow rhachidian tooth with 15-30 lateral denticles on either side of the median cusp. Another species that should be compared with *A. wattla* is *A. natalensis* (Bergh, 1866: 34; Barnard, 1927: 213) from the coast of Natal. It has a similar strong caruncle, but its rhachidian tooth (Bergh, 1866: pl. 6 B, fig. 7) is very broad, and the number of lateral lamellae is much higher than in *A. wattla*. Lateral teeth nearly without denticles, as in *A. natalensis*, occur also in several other species (Bergh, 1907: 102-103), but all of these have small caruncles, or (Baba,

1949: 162, *A. major*) longitudinal ridges on the veil.

11. *Fiona pinnata* (Eschscholtz, 1831)

Marcus, 1961a: 50-51, figs. 173-179, references, distribution, description;

Bayer, 1963: 460-465, figs. 5-7, behavior, feeding, growth and reproduction.

Occurrences: Off the Georgia Coast in Gulf Stream Drift, 31° 01 min. N, 79° 52 min. W, May 1, 1962; numerous specimens together with a pre-adult male of the pycnogonid, *Anoplodactylus brasiliensis* Hedgpeth, 1948 (: 222, 224).

Further distribution: Pelagic and gregarious in warm and temperate seas, original locality: Sitka, Alaska, on a piece of wood washed ashore. Dr. Wolfram Noodt and Rudolf Röttger collected this species and its egg masses on floating feathers with barnacles about 250 km off Peru in October, 1965 while on board the research ship "Anton Bruun".

The largest of the preserved specimens at hand is 17 mm long, which corresponds to the maximum length known of living animals, 25 mm.

12. *Dondice occidentalis* (Engel, 1925)

Caloria occidentalis Engel, 1925: 73-76, figs. 7-15;

Dondice occidentalis Marcus, 1958b: 62-65, figs. 97 (:54), 98-104 (: 63); 1960a: 186-187, figs. 87-90; 1963: 48; Edmunds, 1964: 27-28.

Occurrences: Georgia, 1) Sapelo Sound, 16-26 m depth, April 16, 1963, 2 specimens; 2) 17 1/2-15 1/2 mi. 102° from Sea buoy, 15 m depth, 11 specimens.

Further distribution: Beaufort, North Carolina; Miami, Florida; Jamaica; St. Martin, Bonaire, Lesser Antilles; Guanta, Venezuela; São Paulo, Brazil.

The preserved specimens reach 20 mm in length. The jaws are covered with a

black epithelium. The radula has 17 teeth (radular formula: 0.1.0), whose median cusp is flanked by 4-7 denticles. As in Edmunds' material, the gonopores lie immediately behind the arch of cerata from the anterior liver, at the front of the interhepatic space.

ZOOGEOGRAPHIC REMARKS

Two species of the present collection, *Scyllaea pelagica* and *Fiona pinnata*, are widely distributed pelagic species and occur in all seas of middle and low latitudes. Seven are littoral species peculiar to the warm western Atlantic region, which extends from Cape Hatteras to southern Brazil, probably to northern Santa Catarina. The new form *Tritonia bayeri misa* belongs to this West Indian group, because it is related to *I. b. bayeri* from the Miami area, Florida. *Doridella burchi* is near the widely distributed *D. obscura*, whose range extends, according to Franz (1967: 75), from Massachusetts to Texas. Only 1 species of the present West Indian element, *Dendrodothis krebsii*, is also known from the tropical west coast of North America. Relicts of the Tethys Sea, which existed up to Middle Tertiary times, are *Doris verrucosa* and *Okenia sapelona*. The former is known from South Carolina to Santa Catarina, and from the British Isles to South Africa. The latter is related to a species, *O. mediterranea*, known from Naples and the French Mediterranean coast.

One species of the present collection cannot be allotted to any of these groups: *Armina wattla*. It differs by its caruncle from the solely American species of the genus, and is separated from the remaining species of *Armina* by its radula.

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ADDENDUM

The disposition of the holotype and paratype specimens of the opisthobranchiate mollusks described in Marcus & Burch (1965, Marine euthyneuran Gastropoda from Eniwetok Atoll, western Pacific, MALACOLOGIA, 3(2): 235-262) is as follows [catalogue numbers are those of the Museum of Zoology, University of Michigan, Ann Arbor, Michigan, U. S. A.]

- Haminoea musetta* Marcus & Burch, Holotype, UMMZ 230624
- Haminoea musetta* Marcus & Burch, Paratypes, UMMZ 230625
- Haminoea linda* Marcus & Burch, Holotype, UMMZ 230626
- Haminoea linda* Marcus & Burch, Paratypes, UMMZ 230627
- Chromodoris briqua* Marcus & Burch, Holotype, UMMZ 230629
- Herviella mietta* Marcus & Burch, Holotype, UMMZ 230630
- Herviella mietta* Marcus & Burch, Paratype, UMMZ 230631
- Onchidella evelinae* Marcus & Burch, Holotype, UMMZ 230632
- Onchidella evelinae* Marcus & Burch, Paratype, UMMZ 230633

RESUMEN

ALGUNOS OPISTOBRANQUIOS DE LA ISLA SAPELO,
GEORGIA, ESTADOS UNIDOS

E. Marcus and E. Marcus

Este trabajo trata sobre 2 opistobranquios pelágicos, y otros 10 de las zonas entre mareas y sub-mareas, de la costa sudeste de Estados Unidos. Se describen cuatro especies: *Okenia sapelona*, *Doridella burchi*, *Tritonia (Candiella) bayeri misa*, y *Armina wattla*. La última especie difiere de la única conocida *Armina* americana por su fuerte carúncula, y de *undulata* y otras especies por su rádula. *Okenia sapelona* se asemeja a *O. mediterranea*, y por lo tanto pertenece a los opistobranquios cuya existencia puede trazarse desde el Mar Tethys del Terciario. Las dos restantes son de la región de aguas cálidas del Atlántico occidental. Las especies litorales de la presente colección habitan también aquellas aguas, con excepción de *Doris verrucosa* que aparece también en el Atlántico oriental.

La subespecie *Pleurobranchaea hedgpethi hamva* se elimina, porque en el presente material, la dirección del plegado sobre los orificios genitales es con frecuencia oblicua, no dorsal (*P. h. hamva*) ni tampoco anterior (*P. h. hedgpethi*).

ZUSAMMENFASSUNG

ÜBER EINIGE OPISTHOBRANCHIER VON DER SAPELO INSEL,
GEORGIA

E. and E. Marcus

Die Arbeit behandelt 2 pelagische Opisthobranchier und 10 aus der Gezeitenzone und dem Sublitoral von der Sapelo Insel, Georgia. Neu sind: *Okenia sapelona*, *Doridella burchi*, *Tritonia (Candiella) bayeri misa* und *Armina wattla*. Die letzte unterscheidet sich durch die starke Karunkel von den rein amerikanischen *Armina*-Arten sowie durch die Radula von *A. undulata* und den anderen Arten mit starker Karunkel. *O. sapelona* ähnelt der *O. mediterranea*, gehört also zu den Opisthobranchiern, deren Verbreitung auf das tertiäre Tethysmeer zurückgeführt werden kann. Die 2 übrigen neuen Formen sind mit Arten der westatlantischen Warmwasserregion verwandt. Gleichfalls Bewohner dieser Region sind die bekannten litoralen Arten der vorliegenden Sammlung, mit Ausnahme von *Doris verrucosa*, die auch im Ostatlantik vorkommt.

Die Unterart *Pleurobranchaea hedgpethi hamva* wird aufgegeben, weil im vorliegenden Material der Fortsatz über den Geschlechtsöffnungen oft schräg gerichtet ist, d. h. weder nach oben (*P. h. hamva*), noch nach vorn (*P. h. hedgpethi*).

RESUMO

SOBRE ALGUNS OPISTOBRANQUIOS DE ILHA DE SAPELO,
GEORGIA

E. e E. Marcus

O trabalho trata de dois opistobrânquios pelágicos e dez litorais, da zona das marés e abaixo desta, da ilha de Sapelo, Georgia. Formas novas são: *Okenia sapelona*, *Doridella burchi*, *Tritonia (Candiella) bayeri misa*, e *Armina wattla*. A última difere das

espécies puramente americanas de *Armina* pela carúncula forte e pela rádula de *A. undulata* e das outras espécies com carúncula forte. *O. sapelona* assemelha-se a *O. mediterranea*, por isso pertence aos opistobrânquios cuja distribuição pode ser reconduzida ao mar Terciário da Tethys. As duas novas formas restantes são aparentadas com espécies da região quente do Atlântico ocidental. Também as espécies já conhecidas da presente coleção são habitantes desta região, com exceção de *Doris verrucosa* que ocorre no Atlântico ocidental e oriental.

A subespécie *Pleurobranchaea hedgpethi hamva* foi suprimida, porque a direção do lóbulo em cima das aberturas genitais é frequentemente oblíqua, nem para cima (*P. h. hamva*), nem para diante (*P. h. hedgpethi*).

АБСТРАКТ

О НЕКОТОРЫХ ОПИСТХОБРАНЧИА ИЗ РАЙОНА О. САПЕЛО (ДЖОРДЖИЯ, С. Ш. А.)

Э. МАРКУС И Э. МАРКУС

В работе рассматриваются 2 пелагических и 10 литоральных и сублиторальных видов *Opisthobranchia* из вод, омывающих восточное побережье С. Ш. А. Описываются 4 вида: *Okenia sapelona*, *Doridella burchi*, *Tritonia (Candiella) bayeri missa* и *Armina wattle*. Последний вид отличается от американского вида рода *Armina* сильно развитым карункулом, а от *A. undulata* и других видов, имеющих большой карункул - радулой. *Okenia sapeloma* похожа на *O. mediterranea*, следовательно относится к *Opisthobranchia*, распространение которых прослеживается, начиная с третичного моря Тетис. Остальные 2 новых формы родственны видам из тепловодного района западной Атлантики. Все известные литоральные виды настоящей коллекции - также обитатели этого района, за исключением *Doris verrucosa*, который встречается также и в восточной Атлантике. Подвид *Pleurobranchaea hedgpethi hamva* - закрывается, поскольку в настоящем материале кожный вырост над генитальными отверстиями часто был направлен косо т.е. ни дорзально (как у *P. hedgpethi hamva*), ни кпереди (как у *P. h. hedgpethi*).