STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARIBBEAN ISLANDS: No. 122.

OPISTHOBRANCHS FROM CURAÇAO AND FAUNISTICALLY RELATED REGIONS

by

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The material of the present report – 82 species of opisthobranchs and 2 lamellariids – ranges from western Florida to southern middle Brazil with Curaçao as centre. We thankfully acknowledge the collaboration of several collectors. Professor Dr. DIVA DINIZ CORRÊA, Head of the Department of Zoology of the University of São Paulo, was able to work at the "Caraïbisch Marien-Biologisch Instituut" (Caribbean Marine Biological Institute: Carmabi) at Curaçao from December 1965 to March 1966, thanks to a grant

†) When, as a young student, the editor started a correspondence with a professor MARCUS concerning the identification of some animals from the Caribbean, he did not have any idea that thirty-five years later he would be profoundly moved by the news of the death of the same professor, who in the meantime had become one of the most esteemed contributors to these "Studies".

ERNST MARCUS was a remarkably versatile scientist, and a prolific but utterly reliable author with a preference for animal groups that are generally less popular among systematic zoologists.

When, in 1935 German Nazi-laws forced him to leave his country, he was already an admitted authority on Bryozoa and Tardigrada. After arriving in Brazil his publications in these two fields kept appearing. Moreover, he began the study of other animal groups, especially Turbellaria, Oligochaeta, Pycnogonida, and Opisthobranchiata.

Prof. Dr. ERNST MARCUS was born in Berlin, June 8th, 1893. He obtained his Ph. D. in 1919 and was nominated associate professor in Berlin in 1929. In 1936 he became a professor at the University of São Paulo, where he retired in 1963.

In 1924 he married EVELINE DU BOIS-REYMOND who became his close collaborator, and who, after the death of her husband, took upon herself the task of continuing his work.

Professor MARCUS was a kind man upon whom one could depend. His many students and friends must have been silent for some moments upon receiving the card announcing his death on June 30th, 1968.

EDITOR

OPISTHOBRANCHIA OF PISCADERA BAAI

collected by DIVA DINIZ CORRÊA in 1962 (C1) and 1965/66 (C2), and by P. WAGENAAR HUMMELINCK in 1963/64 (H). — See also our 1963 paper and Fig. 160. All Inner Bay samples of DIVA DINIZ CORRÊA have been collected in a small and shallow mangrove-bordered lagoon (no longer in existence) near the Entrance at the Carmabi side (cf. Sta. 1465).

Species	Outer Bay	Entrance	Inner Bay	Figures in *Studies Fauna Cur.* *19* (1963)	*33* (1970)
Haminoa elegans			C1 C2	9	7–9
Chelidonura hirundinina			C1 C2		11–13
Chelidonura ev. evelinae	C1				
Chelidonura evelinae dica			C2	1–7	20–26
Lapinura divae	C1 C2		C1		27–32
Cylindrobulla beaui	C2				
Aplysia parvula	C1 C2 H				
Aplysia dactylomela	C2 H				
Aplysia juliana	C2				
Dolabrifera dolabrifera	C1 C2				
Phyllaplysia engeli		C2	C1 C2		
Stylocheilus longicauda	C1	H	C1	10–21	
Bursatella leachii pleii			C1 C2 H		
Oxynoe antillarum			C1 C2		34–38
Lobiger souverbiei	C1				
Cyerce cristallina	C2				39–43
Cyerce antillensis	C1 C2 H			22–24	44–47
Phyllobranchillus viridis	C2		C1		48–52
Mourgona murca	C2		C2		53–62
Caliphylla mediterranea			C2		77–78
Placida dendritica	C1 C2		C1		
Stiliger funereus			C2		69–73
Stiliger vanellus	C2		C1 C2		
Stiliger cricetus	C2				74–77
Elysia ornata	C1 C2		C1 C2	27–28, 64	80, 82–83
Elysia cauze	H		H		81
Elysia papillosa	C2				
Elysia tuca	C1 C2			29	81, 84–85
Elysia duis	C2				81, 86–88
Elysia clena	C2				81, 89–90
Tridachia crispata	C1 C2 H				
Bosellia mimetica curasoae	C2	C2			91–98
Berthella agassizii	C1 C2				
Pleurobranchus areolatus	C1 C2				
Chromodoris binza		C1		30–31	
Doris bovena	C1 C2		H		108
Peltodoris hummelincki	C1			32–35	
Anisodoris worki	C2				
Discodoris mortenseni	C1 C2		C1	36–39	116

Species	Outer Bay	Entrance	Inner Bay	Figures in *Studies Fauna Cur.* *19* (1963)	*33* (1970)
Tayuva ketos gila	C2				118–120
Aphelodoris antillensis	C1			40–42	117
Polycera odhneri	C2				
Polycera herthae			C1	43–46	
Dendrodoris krebsii			C1		
Hancockia ryrca	C1				
Doto chica			C1		
Doto caramella wildei	C2				138–141
Janolus comis	C2				
Coryphella dushia			C1	52–54	
Catriona tina			H	68	
Catriona maua	H		C1	55–56	
Learchis poica	C1	C2			
Moridilla kristenseni	C1 C2 H	H	H	57–60	142–143
Phidiana lynceus	C1 C2 H		C2		
Godiva rubrolineata			H		
Dondice occidentalis			H		
Favorinus branchialis	C1		C1 H H	61	
Nanuca sebastiani	C1 C2				
Aeolidiella lurana			C2		144
Berghia creutzbergi	C2				145–147

received from the Royal Government of the Netherlands. Dr. PIETER WAGENAAR HUMMELINCK, of Utrecht, sent us his collection from the Caribbean area and Florida; Mrs. GERMAINE L. WARMKE, M. Sc., of Gainesville, Fla., her specimens gathered chiefly at Puerto Rico, and Professor Dr. FREDERICK M. BAYER, of Miami, continued to present us with animals from Florida, accompanied by admirable kodachromes.

The indications (B), (C), (H), (W) after the date signify the collector. Dr. HUMMELINCK's station numbers (H 1049A, 1057C, etc.), under which a description of the habitat can be found, refer to his list of 1930–1949 localities in the 4th volume of this series, or to a forthcoming paper, in which the 1955–1964 localities will be described.

We are also much obliged to Dr. PHILIP A. BUTLER and Dr. NELSON R. COOLEY, of Gulf Breeze, Fla., Dr. PETER R. BACON, of St. Augustine, Trinidad; Dr. MARC KEMPF, of Recife; and Dr. ANTÔNIO S. FERREIRA DITADI, of São Paulo, for kindly entrusting us with opisthobranchs. Dr. JOHN B. LEWIS, Bellairs Research Institute of McGill University, Barbados, sent a small collection containing specimens which enabled us to establish the new species *Elysia clena*.

For helping us with older Italian literature we are glad to express our cordial thanks to our friend Professor Dr. FLORIANO PAPI, of Pisa.

LIST OF SPECIES CLASSIFIED IN THE PRESENT PAPER

Subclass OPISTHOBRANCHIA

Order CEPHALASPIDEA

Superfamily SCAPHANDRACEA

Family ATYIDAE

1. *Haminoea elegans* (Gray, 1825)

Superfamily PHILINACEA

Family GASTROPTERIDAE

2. *Gastropteron rubrum* (Rafinesque, 1814)

Family AGLAJIDAE

3. *Aglaja felis*, spec. nov. Fig. 1–3
4. *Aglaja hummelincki*, spec. nov. Fig. 4–6
5. *Chelidonura hirundinina* (Quoy & Gaimard, 1833) Fig. 7–9
6. *Chelidonura evelinae dica*, subspec. nov. Fig. 11–13
7. *Chelidonura sabina*, spec. nov. Fig. 14–17
8. *Chelidonura berolina*, spec. nov. Fig. 18–19

Superfamily RUNCINACEA

Family ILDICIDAE

9. *Lapinura divae* (Marcus, 1963) Fig. 20–26

Superfamily CYLINDROBULLACEA

Family CYLINDROBULLIDAE

10. *Cylindrobulla beaui* P. Fischer, 1856 Fig. 27–32
11. *Cylindrobulla ulla*, spec. nov. Fig. 33

Order ANASPIDEA

Family APLYSIIDAE

Subfamily Aplysiinae

12. *Aplysia* (*Pruvotaplysia*) *parvula* Mörch, 1863
13. *Aplysia* (*Varria*) *dactylomela* Rang, 1828
14. *Aplysia* (*Aplysia*) *juliana* Quoy & Gaimard, 1832

Subfamily Dolabriferinae

15. *Dolabrifera dolabrifera* (Rang, 1828)
16. *Phyllaplysia engeli* Marcus, 1955

Subfamily Notarchinae

17. *Stylocheilus longicauda* (Quoy & Gaimard, 1824)
18. *Bursatella leachii pleii* (Rang, 1828)

Order ASCOGLOSSA

Superfamily OXYNOACEA

Family OXYNOIDAE

19. *Oxynoe antillarum* Mörch, 1863 — Fig. 34–38

Superfamily ELYSIACEA

Family CALIPHYLLIDAE

20. *Cyerce cristallina* (Trinchese, 1881) — Fig. 39–43
21. *Cyerce antillensis* Engel, 1927 — Fig. 44–47
22. *Phyllobranchillus viridis* (Deshayes, 1857) — Fig. 48–52
23. *Mourgona murca*, gen. nov., spec. nov. — Fig. 53–62
24. *Mourgona germaineae*, spec. nov. — Fig. 63–68
25. *Caliphylla mediterranea* A. Costa, 1867 — Fig. 77–78

Family HERMAEIDAE

26. *Placida dendritica* (Alder & Hancock, 1843)
27. *Placida nonatoi* (Marcus, 1960) — Fig. 79

Family STILIGERIDAE

28. *Stiliger* (*Stiliger*) *funereus* (A. Costa, 1867) — Fig. 69–73
29. *Stiliger* (*Stiliger*) *vanellus* Marcus, 1957
30. *Stiliger* (*Stiliger*) *cricetus*, spec. nov. — Fig. 74–76

Family ELYSIIDAE

31. *Elysia ornata* (Swainson, 1840) — Fig. 80, 82–83
32. *Elysia cauze* Marcus, 1957 — Fig. 81
33. *Elysia papillosa* Verrill, 1901
34. *Elysia tuca* Marcus, 1967 — Fig. 81, 84–85
35. *Elysia duis* Marcus, 1967 — Fig. 81, 86–88
36. *Elysia clena*, spec. nov. — Fig. 81, 89–90
37. *Tridachia crispata* Mörch, 1863
38. *Bosellia mimetica curasoae*, subspec. nov. — Fig. 91–98

Order NOTASPIDEA

Superfamily PLEUROBRANCHACEA

Family PLEUROBRANCHIDAE

Subfamily Pleurobranchinae

3 . *Berthella agassizii* (MacFarland, 1909)
42. *Berthella tupala* Marcus, 1957 — Fig. 102
41. *Pleurobranchus* (*Pleurobranchus*) *areolatus* Mörch, 1863

Suborder POROSTOMATA

Family DENDRODORIDIDAE

63. *Dendrodoris krebsii* (Mörch, 1863)

Order DENDRONOTOIDEA

Family TRITONIIDAE

64. *Tritoniopsis frydis*, spec. nov. Fig. 134–137

Family DOTOIDAE

65. *Doto chica* Marcus, 1960
66. *Doto caramella wildei*, subspec. nov. Fig. 138–141

Order ARMINOIDEA

Suborder PACHYGNATHA

Family ANTIOPELLIDAE

67. *Janolus comis* Marcus, 1955

Order EOLIDOIDEA

Suborder ACLEIOPROCTA

Family EUBRANCHIDAE

68. *Capellinia conicla* Marcus, 1958

Family CUTHONIDAE

69. *Catriona tina* Marcus, 1957
70. *Catriona maua* Marcus, 1960

Suborder CLEIOPROCTA

Family FACELINIDAE

71. *Learchis poica* Marcus, 1960
72. *Moridilla kristenseni* Marcus, 1963 Fig. 142–143
73. *Phidiana lynceus* Bergh, 1867

Family FAVORINIDAE

Subfamily Facalaninae

74. *Godiva rubrolineata* Edmunds, 1964
75. *Dondice occidentalis* (Engel, 1925)
76. *Austraeolis catina* Marcus, 1967

Subfamily Favorininae

77. *Favorinus branchialis* (O. F. Müller, 1806)
78. *Nanuca sebastiani* Marcus, 1957

Family AEOLIDIIDAE

79. *Aeolidiella lurana* Marcus, 1967 Fig. 144
80. *Berghia creutzbergi*, spec. nov. Fig. 145–147
81. *Limenandra nodosa* Haefelfinger & Stamm, 1958 Fig. 158
82. *Spurilla neapolitana* (Delle Chiaje, 1823)

Subclass PROSOBRANCHIA
Order MONOTOCARDIA
Suborder MESOGASTROPODA
Superfamily LAMELLARIACEA
Family LANELLARIIDAE

83. *Coriocella fella*, spec. nov. Fig. 148–154
84. *Lamellaria perspicua perspicua* (Linnaeus, 1758) Fig. 155–157

1. **Haminoea elegans** (Gray, 1825)

MARCUS 1963, p. 6; JONG & KRISTENSEN 1965, p. 48.

CURAÇAO: Playa Grandi, Wacao, from *Padina*, 23.I.1966 (C), 1 specimen. Piscadera Baai, inner bay, from *Thalassia* and algae, 22 & 28.II.1965, 1.II. 1966 (C), 7 specimens.

Further distribution: Southern Florida; West Indies; Brazil, Recife, Rio de Janeiro, São Paulo.

The present specimens, collected alive, are all small, having 3.5–12 mm long shells. The principal specific characters are independent of this size: spirals all over the body whorl, apex perforated and outer lip inserted on the left side of the apex.

2. **Gastropteron rubrum** (Rafinesque, 1814)

MARCUS 1960a, p. 139 (references).

FLORIDA: Key Biscayne, Bear Cut (Sandra Maxwell), 21.V.1966 (B), 1 specimen.

Further distribution: Florida; Antilles; southern middle Brazil; Gulf of Gascony; Portugal; Mediterranean, including the Adriatic and Aegean Seas; Morocco. – A form with a knob instead of the mantle flagellum (subspec. *manx* MARCUS, 1966, p. 162) was found in the Gulf of Guinea.

The excellently preserved animal is 2.5 mm long; the living animal drawn to scale by the collector is nearly the same size. Her colour notes indicate a creamy yellow head, parapodia with blotches of yellowish white granules around the margins. In the centre deep sepia brown chromatophores lie in the amber conjunctive tissue. Towards the insertions the parapodia are lighter, the amber tissue is transparent, and the sepia brown pigment cells scattered through it are smaller and more scarce. The flagellum is creamy white.

In the preserved specimen the dorsal side and the parapodia are flecked with much-ramified red chromatophores. They lie quite superficially and are smaller on the ventral than on the dorsal side. The flagellum is white.

Aglaja Renier, 1804

Without the original publications we cannot decide which generic name has to be used (O'DONOGHUE 1929b, p. 11; IREDALE & MCMICHAEL 1962, p. 89) and continue to apply RENIER's vernacular form of *Aglaia* (WHITE 1945, p. 91).

3. **Aglaja felis**, spec. nov. Figs. 1-3

PUERTO RICO: La Parguera, Majimo Reef, sand flat with *Cymodocea* (= *Syringodium*) and *Thalassia*, 2–2.5 m, at twilight (not observed in day time), 17.IX.1963 (H 1418a), 7 specimens. Májimo Reef, calcareous bottom, 0.9 m (Peter Glynn & Frank Fernández), VIII & IX.1963, 23.XI.1964 (W), 5 specimens.

In dishes the animal digs and hides under sand; it gives off a brown fluid when disturbed (W). The colour is velvet black all over, or dark reddish brown (W).

Length alive 8–12 mm, breadth 2.5 mm; preserved, 2.5–7 and up to 3 mm. Colour black, a little lighter on sole. Aspect of 2 photographs (W) and 2 preserved specimens cloudy due to a light ring on head shield and a light area on parapodia. Folds of Hancock's organs lighter than the ground. Gill light; 11–13 dorsal plumes.

Shell probably completely calcified; it was dissolved without remaining conchiolin parts.

Head shield a little or much longer than mantle shield. Two low sensory knobs to sides of mouth. Very big eyes (y) between head shield and pedal border; diameter of cup-shaped retina 0.12–0.16 mm; cup includes more than half of lens. Folds of Hancock's organ (h) vertical and simple. Male opening (ma) leads into pigmentfree atrium, medially to which opens pedal gland (oa). Left posterior mantle lobe appears somewhat broader than right one; no flagellum.

Pharynx protruded in 2 biggest specimens of W's collection. In a

preserved 3.2 mm long animal (H) its length is ⅓ that of body. Some scattered melanophores in fundus of atrium, a few pigment cells along seminal groove. Male atrium (a) narrow in front, wide behind. Its fundus forms a deep fold which receives seminal groove and functions as pleurembolic penis (p). Annexed to fundus an up to 1.6 mm long prostate (q), 0.10–0.14 mm in diameter, with simple, not forked, end. Prostatic cells small.

The species was compared with and separated from 16 inhabitants of the Atlantic, Mediterranean, and American Pacific Seas (MARCUS 1967, p. 20).

4. **Aglaja hummelincki,** spec. nov. Figs. 4-6

PUERTO RICO: LaParguera, Májimo Reef, sand flat with *Cymodocea* and *Thalassia*, 2–2.5 m, at twilight (not observed at day time), 17.IX.1963 (H 1418a), 3 specimens together with *A. felis*.

Preserved animals 3–4 mm long and up to 1.5 mm in diameter. They are black and have small pigmentfree blotches on back and parapodia, the inner side of which is lighter. Sensory area under head shield, also gill. Ventral surface dark, not blotchy.

Shell longer (1.52 mm) than broad, only its conchiolin preserved. Spire comprises 1½ whorls; growth lines distinct. As far as outlines are recognizable, a backward directed right wing not, or very weakly, developed.

Length of head shield (2.2 mm) a little more than half of body length. Mantle half as long as head shield. Left caudal lobe bigger than right one; no flagellum. Eyes (y) situated well in front, in light circumbuccal area, half as big as in preceding species. Diameter of retinal cup 70 μ. Pedal gland median under mouth as in other Aglajidae.

Pharynx 0.83 mm long in 3 mm-animal, hence less than ⅓ of body length. Male atrium (a) funnel-shaped, dilated inwards; fundus not set off from lumen of prostate (q). Copulatory organ a pleurembolic penis, the seminal groove of which is brought to the outer side by eversion of the atrium. Prostate 1.5 mm long, 0.2–0.3 mm in diameter,

hence thick, simply rounded, not forked. Prostatic cells cylindrical high.

The species is named for Dr. PIETER WAGENAAR HUMMELINCK, Utrecht.

Eyes, pharynx, male atrium without papilla-like fold, and thick prostate separate *A. hummelincki* from *A. felis*. "The shell gives little assistance" (MACNAE 1962, p. 194), and "the colour of the species of *Aglaja* seems variable and of doubtful value" (WHITE 1946, p. 168). Indications of the size should always be accompanied by the statement "mature" or "immature". We have a 2.5 mm long preserved specimen of *Aglaja* from the coast of São Paulo, the shape and colour pattern of which agree with *A. depicta*, but as the male organ is still primordial, the species cannot be determined.

Chelidonura A. Adams, 1850

The elongated head shield and long mantle lobes, the "tail flagella" of BURN (1966a, p. 102) occur in *Chelidonura* and *Navanax* Pilsbry, and we unite these two genera. The shape of the shell, useful in a key for a restricted region, e.g., western North America (KEEN 1963), is not correlated with the length of the head shield and the mantle lobes. Evidently the shells of *Chelidonura* and *Navanax* can be used for taxonomic purposes on species level.

THIELE (1931, p. 395) separated *Navanax* by its "rhinophores" from *Chelidonura*, but cephalic sense organs of the same type occur in both; the organs should not be called rhinophores (MARCUS 1961a, p. 8). On either side of the mouth there is a protrusible thickening beset with many tufts of sensory cilia. In most cases these bulges are vertically bipartite, so that an outer and an inner knob are formed. The bipartition may be indistinct, or the outer knob may be bigger. When the thickening is retracted and hidden under the head shield of preserved slugs, these details are difficult to judge, but as far as they are verifiable, they can be used as specific characters.

The male organ of the type-species of *Chelidonura*, *C. hirundinina*, is not known from Indo-Pacific material. BERGH's description

(1900a, p. 220) and figure (pl. 20 fig. 32) are insufficient, because the atrium ("penis sac") had not been clarified nor opened. Also the penis of his *C. velutina* (BERGH 1905a, p. 45), possibly a synonym of *C. hirundinina* (RISBEC 1951, p. 124, note 1), is insufficiently known. The prostate is smooth in the type-species of *Navanax* and in most of the species of *Chelidonura*, racemose in *Navanax aenigmaticus*, *C. e. evelinae* and *C. e. dica*. We consider the smooth fundus of the penial sac in BERGH's *C. hirundinina elegans* as the prostate; the broad gland mass in this region (1900a, pl. 19 fig. 23, a) is the anterior pedal gland.

KEY TO THE AMERICAN SPECIES OF *Chelidonura*

1a. Penis papilla short, not longer than broad (Figs. 10, 13) . 2
1b. Penis papilla longer than broad. 3

2a. Light transverse marks on head shield and mantle shield (Fig. 11), no blue colour marks . . *evelinae dica*, subspec.nov.
2b. No light transverse marks, some blue dots (MARCUS 1955, fig. 13) . . . . . *evelinae evelinae* Marcus, 1955

3a. Prostate smooth 4
3b. Prostate racemose (BERGH 1894, pl. 12 fig. 11) . . . . . *aenigmatica* (Bergh, 1894)

4a. Penis papilla with warts 5
4b. Penis papilla without warts 6

5a. Base of penis with several warts (MARCUS 1961a, pl. 1 fig. 24) . . . . . *phocae* Marcus, 1961
5b. Tip of penis with 2 warts (Fig. 17) . . . . *sabina*, spec.nov.

6a. Penis papilla slender, Z-shaped (MARCUS 1961a, pl. 1 fig. 16) . . . . . *inermis* (Cooper, 1862)
6b. Penis papilla stout, straight or simply bent. 7

7a. Prostate straight (Fig. 8) *hirundinina* (Quoy & Gaimard, 1833)
7b. Prostate crooked (Fig. 19) . . . . . *berolina*, spec. nov.

The length of the pharynx is half or more the body length in *Chelidonura e. evelinae*, *C. inermis* and *C. phocae*; $\frac{1}{3}$ or $\frac{1}{4}$ of the body length in *C. e. dica*, *C. aenigmatica*, and *C. hirundinina*, and much less than $\frac{1}{4}$ of the body length in *C. berolina* and *C. sabina*.

5. **Chelidonura hirundinina** (Quoy & Gaimard, 1833) Figs. 7-9

MARCUS 1963, p. 6 (references); 1967, p. 21.

CURAÇAO: Piscadera Baai, in algae from the inner bay, 3.II.1966 (C), 1 specimen.
PUERTO RICO: Parguera, Májimo Reef, calcareous bottom, 0.9 m (Peter Glynn & F. Fernández), 17.X.1963 (W), 1 specimen.
FLORIDA: Biscayne Bay, Southwest Point, Key Biscayne (Sta. 2, Meyers), 8.III.1967 (B), 1 specimen.

Further distribution: Indo-Pacific, from Mozambique to Japan, New Caledonia and New South Wales. West Atlantic: Curaçao and Florida, Biscayne Bay.

Shape and colour pattern of animal from Florida (from photograph; Fig. 9) very similar to BABA' frontispiece (1958); the blue lines interrupted, the chalk-white crescent on the mantle large, with a chalk-white spot in front of it. Shell solid with brown periostracum.

Specimen from Puerto Rico 12–15 mm long when crawling; preserved, 6 mm long, 2.0 mm broad, 2.5 mm high. Colours alive: dark brown; borders of parapodia with white and blue markings on the edge and a yellow orange line on the outer side of the blue and white. Secretes brown liquid when molested (W). Colours preserved: a black line between blue and orange. Anterior part of mantle shield with granular white crescent; ventral side light; posterior lobes black.

Preserved mature specimen, 5.8 × 2.8 mm, from Curaçao (Fig. 7) with nearly the same colour pattern. Like the animal described in 1963, it has 2 parallel orange streaks directed obliquely forward on corners of head shield. Sensory knobs and gill light; areae of the Hancock's organs black. Head shield and mantle shield each 3 mm long. Mantle shield of living *C. hirundinina* generally half as long as head shield, but its contraction diminished by the underlying shell. A lobe of the head shield overlaps the fore end of the mantle shield.

The 2 tails are of equal length, 1 mm, with pointed ends. Shell calcified, brown. Length of strong pharynx $\frac{1}{4}$–$\frac{1}{3}$ that of body. Cerebral commissure less than diameter of one cerebral ganglion. Pedal gland rather small. Male copulatory organ (Fig. 8) 0.5 mm long. Its inner half a smooth, cylindrical prostate (q), outer half a thin-walled atrium (a) filled by strong, bent penial papilla (p) without warts.

6. **Chelidonura evelinae dica,** subspec. nov. Figs. 11-13

CURAÇAO: Piscadera Baai, inner bay, from *Thalassia*, 1.II.1966 (C), 1 specimen.

Alive: chocolate brown with narrow white longitudinal stripes and 2 transverse white marks, one near anterior border of head shield, one in anterior part of mantle shield. Behind cephalic mark a white, round spot on either side.

Preserved: 25 mm long; maximum breadth 15 mm, at third fourth of length. Cephalic shield and mantle shield each 10 mm long. As in other preserved *Chelidonura* the brown pigment is black. The light marks are distinct, with also a row of light dots along anterior pedal and parapodial borders. White dots on inner surface of parapodia. The ventral side has black net with more or less longitudinal white meshes.

Under head shield 2 ciliate bulges (is, os) on either side of mouth (m); outer bulge curves around black Hancock's organ (h). Small left posterior mantle lobe roundish, right one bipartite, so that animal has practically 3 caudal points, as occurs also sometimes in *C. e. evelinae*. Lateral right point longer than medial one and curling under it. Hind part of body so much contracted that posterior border of sole projects beyond the tails.

Shell 8 mm long, 5 mm broad, calcareous along inner lip and columella, conchinous in outer parts; process in mantle lobe relatively short, rather tightly curled.

Pharynx 7 mm long, reaches rear of head shield. Length of cerebral commissure corresponds to diameter of one cerebral ganglion. Pedal gland small.

Male apparatus 9 mm long. Atrium (a) thick-walled, pigmentfree, with longitudinal folds. In fundus a complicated mass of folds (Fig. 13, p), less distinctly papilla-shaped than in *C. e. evelinae* (Fig. 10). Prostate (q) solid, acinous, its surface somewhat rough.

Colour quite different from *C. e. evelinae*, but anatomy rather similar.

7. **Chelidonura sabina**, spec. nov. Figs. 14-17

CURAÇAO: Spaanse Water, under stone, 14.II.1966 (C), 1 young specimen. FLORIDA: Biscayne Bay, NW side of Virginia Key, on *Thalassia*, 1 m (D. Holmes & D. Opresko), 23.III.1967 (B), 1 specimen. Santa Rosa Sound, in muddy sand of Sabine Island Experimental clam tank, Biological Laboratory Gulf Breeze, 24.VII.1966 (Philip A. Butler), 3 adult specimens.

The following description, based chiefly on living animals contains that of Dr. NELSON R. COOLEY, Fishery Research Biologist, Gulf Breeze.

Total length alive 20 mm, width 5 mm. Head shield elongate, $\frac{1}{4}$–$\frac{1}{3}$ of total length, wider in front than behind. Mantle shield extends beyond rear of foot. Mantle lobes unequal, left one with long tapering point, right one more or less truncate. Gill curves to the left around rear of visceral sac. Extension of foot and parapodia as in other *Chelidonura*. Two tufted, indistinctly bipartite adoral knobs project from beneath head shield when slug crawls, retract when animal is disturbed. Then it produces yellow liquid, probably secreted by pedal gland.

Colour alive a rich dark brown with irregularly scattered light patches of variable size and shape formed by aggregations of tiny buff spots visible at × 10 magnification. Margins of parapodia, rear of head shield and mantle, and edges of posterior lobes bordered with orange band composed of tiny pigment dots closely aggregated but visible at × 10 magnification. Four small orange areae around 2 small black eyes just posterior to translucent pale buff-coloured anterior edge of head shield. A row of iridescent light greenish-blue patches on outer edges of parapodia, close to orange border. Orange and blue colours faded after $2\frac{1}{2}$ days in borax-buffered 10% formalin

in seawater and subsequent transfer to alcohol. During transition from water to 70% ethanol, the latter became transparent yellow, evidently from pigment extracted from animals.

Colour photos of small specimen from Biscayne Bay (preserved 2.5 mm long) show the orange band substituted with spots alternating with the blue patches.

Preserved, the specimens from Sabine Island 9–10 mm long, 4 mm wide. Animal from Curaçao not quite 2 mm long. Head shield of 9 mm-specimen 3.5 mm long, anterior border round, slightly notched in middle or on either side. Mantle shield 5 mm long, caudal lobes curled, left one pointed, right one rounded. Foot 7 mm long, notched in front, its anterior corners blunt. Between head shield and fore end of foot a bulge on either side of the mouth (m); bulge obliquely incised, not completely bipartite (is, os). Hancock's organs (h) inconspicuous, marked by some oblique folds. Big pedal gland (Fig. 17, oa) opens below mouth.

Shell cavity underlies nearly whole mantle shield; shell itself smaller, more long than broad, conchinous in anterior half, calcareous behind, with free projection formed by columellar callus, and distinct sinus at base of extension of outer lip into right mantle lobe.

Pharynx very small, 1.5 mm long in material from Sabine Island, triangular in transverse section, dorsal edge and sides thin-walled, floor thicker. Nerve ring over fore end of pharynx, cerebral commissure as long as diameter of one cerebral ganglion; buccal ganglia and short salivary gland apposed to hind end of pharynx. Oesophagus begins dilated, continues tubular. In dissected, not sectioned, stomach 2 orifices of intestinal gland were seen.

Ovotestis (ov) white, bulkier than black hepatic mass. Spermoviduct begins as wide tube (au), narrows and loops around lobules of albumen gland (ag), emerges from latter and opens into common atrium. Between lobules of albumen gland gonoduct communicates with white, long and flat mucus gland (mu). This extends ventrally to the left side, curves around ovotestis dorsally and to the right, ending with short bend. Vagina (v) begins wide at atrium, leads to globular spermatheca (se). Also spermatocyst (sc) globular; its quite short canal is located far ectally between outer opening of mucus gland and insertion of vagina. There is a small, racemose

vestibular gland (ac). Seminal groove enters thin-walled male atrium (a) on outer side of right sensorial knob. Atrium filled out by thick penis papilla (p) bearing 2 hooked cuticular warts near tip. At fundus of atrium a thick, folded, sausage-shaped prostate (q).

As Dr. NELSON R. COOLEY observed, *Chelidonura sabina* is externally similar to *C. evelinae*, but the blue spots of the latter are bordered with black. Also other colour elements are different, and the head shield of *C. evelinae* is longer than the mantle shield. Distinct Hancock's organ, 2 pairs of sensory knobs, small pedal gland, huge pharynx, small mucus gland, elongate spermatocyst located farther entally, racemose prostate, and smooth penis papilla filling only about $\frac{1}{3}$ of length of male atrium distinguish *C. evelinae* from *C. sabina*.

Dr. PHILIP A. BUTLER, Director of the Biological Laboratory Gulf Breeze, Fla., kindly informed us by letter (25.VII.1966)), that "these are the first specimens I have seen in 18 years of collecting the fauna at this location. The 3 individuals were adjacent to each other crawling on the bottom of a large aquarium which has a continuous supply of unfiltered sea water. Presumably they entered as larvae and grew up in the aquarium. Salinity and temperature data during 2 months prior to the collection were as follows: salinities 20.8–32.2‰, temperatures 21–30°C. The approximate location of the collection site is 30°20'30" N, 87°9'30" W. After collection 2 of the specimens were observed in copulation. Subsequent search has revealed no additional specimen".

8. **Chelidonura berolina,** spec. nov. Figs. 18-19

PUERTO RICO: Parguera, Májimo Reef, calcareous bottom, 0.9 m (Peter Glynn & F. Fernández), 8.VIII.1963 (W), 2 specimens. Same locality, crawling on white, sandy bottom (Peter Glynn), 23.XI.1964 (W), 1 specimen.

Living animals 5, 6, and 8 mm long, including posterior lobes; 1.5, 2, and 3 mm broad (W). Colour chocolate brown speckled with white. Brownish orange colour of margins of parapodia interrupted by patches of sea green speckles. A brownish orange band traverses anterior part of head shield, followed by band of sea green speckles. Underside brown peppered with white and aqua blue. The animal crawls on white sandy bottom; digs into sand. When disturbed it secretes brown liquid (W).

Left posterior mantle lobe long, pointed, right one shorter, rounded; broad fore end and sensory knobs appear on Mrs. WARMKE's sketch and photograph.

The specimen, the pattern of which had paled least through preservation, had a black colour speckled with yellowish white, black posterior lobes and Hancock's organs, but no pigment in the eyes which are situated at bases of sensory knobs. Sole and margins of parapodia light. Head shield and mantle shield of equal length. Shells dissolved. Length of cerebral commissure exceeds diameter of one cerebral ganglion. Pharynx of 8 mm-specimen (4.9 mm preserved) 1 mm long, rather slender. Male copulatory organ has conical penial papilla (p) without warts. Prostate (q) longer than penis and bent downward in inner half.

Colour pattern and copulatory organ distinguish *C. berolina* from the other species of *Chelidonura*.

Superfamily **Runcinacea** Colosi, 1915

Cephalaspidea without separation of the dorsum into head shield and mantle shield, and without parapodia.

Together with COLOSI (1915, p. 33), ODHNER (1939, p. 6), BURN (1963a, p. 21), and BABA (1967, p. 189) we do no longer include the Runcinacea in the Philinacea (TAYLOR & SOHL, 1962, p. 11), but consider them as a separate superfamily. Since PELSENEER (1888, p. 97, note 1; 1894, p. 86) the Runcinacea are defined as belonging to the Order Cephalaspidea; they had been related to the Notaspidea as STARMÜHLNER (1955, p. 217) still continues to do.

For the separation of the families Ildicidae and Runcinidae according to the external shell of the former and the internal or absent shell of the latter, we refer to BURN (1963a). The non-denticulate rhachidian tooth cannot be used as a characteristic of the Ildicidae, because there is an allusive denticle on either side of the rhachidian cusp in *Ildica nana* BERGH (1889a, p. 871), and *Lapinura divae* (MARCUS 1963, p. 7, fig. 6) has a row of small denticles on either side of the rhachidian plate. On the other hand, a "denticulate or cuspidate rhachidian" as a characteristic of the

Runcinidae can hardly be defined in the reduced radula of *Metaruncina setoensis* (BABA 1954, fig. F–H; 1967, pl. 2 f. 7).

Lapinura, gen. nov.

Ildicidae with an exposed larval shell in the adult stage.

Type-species: *Ildica divae* MARCUS (1963, p. 7).

The cup-shaped larval shell forming one whorl and ending with a wide aperture (l.c., fig. 4) distinguishes *Lapinura* from *Ildica* BERGH (1889a, p. 869) with a flat, longish platelet without any spire. BABA (1967, p. 185, 187, 189) is right to question the external location of the shell in *Ildica nana*, because that of the closely allied *Metaruncina setoensis* is kept as a complete internal shell throughout the life of the animal. BABA's species is certainly different from BERGH's, so that the systematic position of the latter according to its external or internal shell can only be settled by new material of *Ildica nana*. If this species had an inner shell, *Lapinura* would be the only runcinacean with an outer shell, and the family would have to be called Lapinuridae.

9. **Lapinura divae** (Marcus, 1963) Figs. 20-26

MARCUS 1963, p. 7 (*Ildica divae*).

CURAÇAO: Playa Grandi, Wacao, from *Padina*, 23.I.1966 (C), 1 specimen. Playa Lagoen, among algae, 30.XII.1965 (C), 1 specimen. Piscadera Baai, outer bay, from algae, 21.XII.1965-9.II.1966 (C), 25 specimens.
BONAIRE: Lac, Cay, 17.IX.1963 (H 1067), 5 specimens.
FLORIDA: Key Biscayne, N point at Bear Cut. Sandy bottom with dense *Cymodocea* and *Thalassia* beds, 0.5–1 m, 1.IX.1963 (H 1410), 5 specimens. Key Biscayne, northeastern tip, surf-swept beach rock on sand beach,rock pools, 0–1.5 m, 7.IX.1963 (H 1411), 3 specimens. Elliott Key, east side, 3 km offshore, small coral reef on sand bottom with *Thalassia*, 2–6 m (H 1414), 3 specimens.

Further distribution: Curaçao, Piscadera Baai.

Corresponding to Hancock's organs a row of clustered sensory cells begins on either side of the head and extends along half the

body length. An anterior and a posterior group are not separated (GHISELIN 1963, p. 392); epithelial folds are hardly visible. Statocysts (sc) apposed to dorsal surface of pedal ganglia (ea). Eyes in the cutis as defined by HOFFMANN (1934, p. 391), are seen only when pallio-pedal sulcus is open. Epithelium of sulcus glandfree (Fig. 25); all other parts of body, also pit in back of foot, have intra-epithelial, sometimes subepithelial glands.

A highly concentrated nerve ring surrounds hind end of pharynx (Fig. 20). Cerebral commissure quite short, also pedal commissure in sections; dissection shows that it is distensible. Buccal ganglia contiguous, located beneath beginning of oesophagus. According to HOFFMANN (1936) a second small pair of dorsal ganglia, closely adhering to the cerebral ganglia of *Runcina coronata* (VAYSSIÈRE 1883, pl. 2 fig. 19) contains the pleural ganglia. *Lapinura divae* has 2 cerebro-pedal connexions (Fig. 23), a more medial cerebro-pedal, and a more lateral pleuro-pedal connective. Hence the cerebral ganglia of *L. divae* are cerebro-pleural. Such are rare in the Cephalaspidea, but occur in *Acteon* and some Philinoglossacea as *Philinoglossa remanei* MARCUS, 1958b (p. 92; 1954, fig. 6: nervous system). Another philinoglossacean, *Pluscula cuica*, has separated cerebral and pleural ganglia (MARCUS 1953, fig. 44). BURN (1966b, p. 46) mentions the cerebro-pleural ganglia of a runcinacean. The 2 visceral ganglia give off 2 nerves each. One on either side must be the beginning of the visceral loop, but neither this loop nor the second nerve could be followed. Near the fertilization chamber a central ganglion with 3 nerves appears in the sections, probably the abdominal ganglion. If it belonged to the visceral loop, this would not be as short as supposed by PELSENEER (1894, p. 17) and questioned by HOFFMANN (1936, p. 689–690), but as indicated by GHISELIN (1963, p. 393) for *Metaruncina setoensis* (Baba).

For radula, gizzard plates, and shell we refer to our first description. Further examined radulae comprised more than 30 rows. Oral tube lined by smooth epithelium with 2 dorsal streaks of pigment; in *Ildica nana* BERGH (1889a, p. 871) it is black all over and thrown into longitudinal folds. Short clusters of pink-staining anterior oral glands flank the vestibular tube. Lobed posterior oral glands (uc), the strongest glands of the fore gut, are basophilous,

open into posterior part of oral tube and reach nerve ring. Also in PELSENEER's species these glands are voluminous (1894, fig. 58, VII). Salivary glands acidophilous, weakly developed; opening dorso-laterally into pharynx. Cuticular platelets of mandibles (MARCUS 1963, fig. 5) top the apices of high cylindrical cells (Fig. 22) as in *Ildica nana* (BERGH, l.c., note 2). According to HOFFMANN (1938, p. 976–977) such jaws are a first step of reduction, which goes farther in other Runcinacea.

Glandular diverticulum on left of anterior oesophagus, known for other Runcinacea, occurs also in *L. divae*. Cuticularization of post-ventricular part of oesophagus (oe), the duodenum of COLOSI's terminology (1915, p. 11), was not described yet for any runcinacean. In *L. divae* it consists of simple conical teeth, about 4–6 in one transverse level. The number of hepatic openings into stomach (so) is not the same in all Runcinacea (HOFFMANN 1939, p. 1126–1127). *L. divae* has 2 very wide apertures lying near to one another, separated by only a quite short stretch of gastric epithelium. Also the entrance of oesophagus (oe) and the exit of intestine (i) are close together. One of the lobes of digestive gland (ia) reaches into apex of shell (xe).

Shell (xe) is dorso-median under the border of the notum. Ventrally to it lies a multicellular subepithelial gland (Fig. 21), which opens in the centre of a pit in back of foot. In one specimen this pit was evaginated. Gland (za) has high cells in globular fundus and a narrow duct. Nuclei of glandular cells basal, farther apical ones belonging to supporting cells. Only the latter seen and drawn by COLOSI (1915, p. 31–32, fig. 18), as HOFFMANN was right in supposing (1935, p. 495). As in *Runcina calaritana* this infra-anal gland of *L. divae* is a simple organ with a single orifice. In other Runcinacea this gland is more complicated (ODHNER 1924, p. 5; BURN 1963a, p. 15, 18; BABA 1967, p. 187, pl. 3 fig. 13). It is called opaline gland or gland of Bohadsch, but topography and histology differ from anaspidean opaline glands (HOFFMANN 1935, p. 595). We call it pallial gland (GUIART 1901, p. 69–70) as in *Pluscula cuica* (MARCUS 1953, p. 178) and other Philinoglossacea (id., 1954, p. 216; 1959b, p. 118). Anus dorsal to pallial gland, farther in front and to right at base of gill. The latter projects on right side of the hind end in

Ildica nana (BERGH 1889a, pl. 82 figs 27–28) and *Metaruncina setoensis* (BABA 1967, p. 186); in *L. divae* it is hidden under notum both in the living and preserved state. Up to 7 branchial plicae in our sections. There is neither a ventral furrow of the tail as in *Ilbia ilbi* BURN (1963a, p. 15) nor a concentrated pedal gland.

In front of the gill the common genital aperture (g) opens into a furrow between notum and foot. Along this furrow sperm is conducted not into this groove but over a strip of high ciliated cells (Fig. 25, sr). The male copulatory organ (Fig. 24) consists of an ectal sinuous tube (a) without penial papilla, the cirrus sac of GHISELIN's terminology (1963, p. 394). The sac is followed entally by the prostate (q), which secretes a fusiform spermatophore, and by a thin-walled, sperm-storing vesicle (sv). This may be curved to one side (Fig. 24) or directed straight backwards. In some Runcinacea there is no widening; e.g., in *Metaruncina setoensis* the vesicle is tubular (BABA 1967, pl. 4 fig. 2–3).

As a rule male and female follicles of ovotestis (ov) are separate but in 1 of 5 sectioned animals some follicles are mixed. Efferent ductules unite and form a thin hermaphrodite duct (eu). In *L. divae* an ampulla is absent; it occurs in *Runcina calaritana*, *Runcinella zelandica*, and *Metaruncina setoensis* (BABA 1967, pl. 5 fig. 10, b). Lobes of albumen gland (ag) spread far through body; gland opens into hermaphrodite duct. Where the latter passes into the pallial spermoviduct there is a widening, presumably the fertilization chamber. Pallial gonoduct (mu) a flat, winding organ; narrows for a stretch and is ectally differentiated into a sac (wo) with high secretory cells with a ciliated, sperm-conducting band on one side. The sac is unlike a bursa copulatrix, for which we have searched in vain. Nor did COLOSI (1915) and BABA (1967, p. 188) find a bursa. Such was recorded as annexed to the pallial gonoduct by ODHNER (1924), BURN (1963a), and GHISELIN (1963).

Heart dorsal and kidney ventral on right side in hind part of body.

10. **Cylindrobulla beaui** P. Fischer, 1856 Figs. 27-32

P. FISCHER 1856, p. 275; PILSBRY 1893–1895, p. 380; WARMKE & ALMODÓVAR 1963, p. 163; JONG & KRISTENSEN 1965, p. 48.

BRAZIL: off Recife, 9°37'05" S, 35°15'40" W, 36 m, 8.IX.1965 (Marc Kempf), and 03°58' S, 35°56' W, 70 m, 16.IX.1965 (Marc Kempf), 2 specimens on calcareous algae.
CURAÇAO: Piscadera Baai, from *Halimeda* in the outer bay, 21.II. 1966 (C), 1 spec.
FLORIDA: Biscayne Bay, off Turkey Point (H. B. Moore), 12.IV.1967 (B), 3 spec.

Further distribution: Puerto Rico, from *Caulerpa racemosa* and *Halimeda opuntia*; Virgin Islands, St. Thomas; Guadeloupe (original locality); Curaçao, NE coast, Boca Canoa, from algae in shallow water (20 cm).

Shell cylindrical, 12, 9, and 9 mm long, greatest diameter 5.5, 3.9, and 3.8 mm (Florida); 4 and 1.5 mm (Curaçao). Surface crackled, periostracum thin, horny. Whorls of spire sunken, surrounded by a crest which begins at the suture and passes to body whorl where it flattens. Body whorl transparent, fragile, with weak growth lines parallel to long axis. Aperture as long as shell, much dilated and obliquely truncate in front, quite narrow behind. A smooth bulge of columellar border separated by a furrow from parietal wall. Suture opens into deep slit-like sinus of outer border. Columellar border of shell free till the apex.

Head shield (cs) short, bipartite into 2 lobes broadly rounded in front and behind. Eyes subepidermal, only seen in clarified animals. Foot (j) broad, shorter than head shield. Brown dots on head and foot correspond to epidermal gland cells staining with carmine. No Hancock's organ recognizable externally, not even in furrow between head shield and foot. Nor in sections were irregular furrows with groups of sensory cells found, which occur in the following species (MARCUS 1956a, p. 120).

Insertion (e) and origin of shell adductor, attachments of the fine folds of the pectinate gill (z), and opaque white hypobranchial gland (w) visible through shell (Fig. 28). Origin of adductor fan-shaped, less concentrated than insertion. On border of mantle a row of small pointed papillae, especially dense at sutural slit, rare on right side and in front.

Oral cavity smooth, pharynx (nx) aşcoglossan-like (Fig. 29) with segmented muscles of dorsal and lateral walls. Radula (r) uniserial, with dorsal and ventral limb of nearly equal size. Snail from Curaçao 80 teeth, biggest from Florida 100. Oldest teeth shed, not retained.

Shape of tooth similar to rhachidian tooth of *Toledonia* (ODHNER 1914b, pl. 1 figs. 6, 8) and *Microhedyle* (MARCUS 1954, fig. 16), not dagger-shaped as in many Ascoglossa. Newest teeth of Curaçao snail (Fig. 31) 34 μ broad, 29 μ high, with central cusp flanked by 4–5 denticles. In biggest animal from Florida (Fig. 30) 4–7 denticles, the innermost of which nearly as high as cusp. Another Floridan specimen has 140 defective teeth with 5–8 denticles only on one side of cusp. Salivary glands bulky with slender ducts in the Brazilian material. In the Floridan specimens (Fig. 29) the massy, glandular part had been lost. Oesophagus (o) much curved, lined with longitudinal folds; bears slightly stalked dorsal pouch (oc).

Nerve ring behind pharynx. Cerebral and pleural ganglia coalesced (ce), as is shown by separate cerebro-pedal and pleuro-pedal connectives. Cerebro-pleural ganglia bigger than pedal ganglia (ea).

Ovotestis (Fig. 32, ov) lobate; ampulla (au) longish, curved. Valve at ectal end of ampulla separates male and female ducts. The male duct beset with glands (q), runs along female gland mass (em) and pallial oviduct (av), completely separated from them. The male duct merges into thick cutaneous musculature (mw) in front of female aperture (fa.) Farther in front the duct (d) curves into body cavity, enters fundus of penis (p) and runs coiled to its tip. Fundus fastened to diaphragm by muscle strands, wall of male atrium pigmented.

Vagina (v) begins immediately inside female opening (fa). Leads to seminal reservoirs, the outer, larger bursa copulatrix (b), and inner, smaller receptaculum seminis (sc). Allosperms stored in receptaculum descend the vagina for fertilization and ascend the pallial oviduct (av) to entrance of inner oviduct (io) into gland mass (em). In front of female opening a shallow groove courses forward between head shield and foot. Corresponding furrow on left side is less pronounced. Whether eggs pass forward through right groove as in *Tamanovalva limax* (KAWAGUTI & YAMASU 1960, p. 135) cannot be said; groove neither ciliated nor especially glandular.

TAYLOR & SOHL (1962, p. 11, 17, note 32) agree with our conclusions (MARCUS 1956a, p. 126) and consider *Cylindrobulla* as a

primitive Cephalaspidean. BABA (1966, p. 201) calls it an intermediate form between Cephalaspidea and Ascoglossa. MORTON (1958, p. 73) and BURN (1966b, p. 52–53) place *Cylindrobulla* at the root of the shelled Ascoglossa due to its anatomical approach to *Volvatella*.

11. **Cylindrobulla ulla,** spec. nov. Fig. 33

MARCUS 1956a, p. 119–123, figs. 1–12.

BRAZIL: Guarujá, E of Santos, in rather muddy algae near low waterline, 1.X.1955 (E. & E. Marcus), 1 specimen.

The description of the anatomy was based upon a series of transverse sections. As shape of radular teeth could be defined by re-examination of original sections, the animal can now be named. Tooth (Fig. 33) with high base and single long cusp, finely serrate along its edges. Lateral denticles are absent.

Cylindrobulla ulla differs widely from preceding type-species of the genus. Its shell is half the size (2 × 1 mm) of the minimum known of *beaui* (4 × 1.5 mm); origin and insertion of shell adductor are concentrated (origin fan-shaped in *beaui*); Hancock's organ vestigial in smaller *ulla* (absent in bigger *beaui*); 19 radular rows (80–140 in *beaui*); tooth with single cusp (cusp flanked by denticles); common genital opening (male and female ducts separate at exit of ampulla); seminal groove (male duct closed for its whole length).

Shell of *C. ulla* is only described summarily, but description and figures are sufficient to distinguish it from shells of the species recorded from middle eastern Atlantic, Mediterranean, and South African localities. Shells of *C. pusilla* G. & H. Nevill 1869, *C. sculpta* G. & H. Nevill 1869, and *C. turtoni* Bartsch 1915 dilated backwards, so that the greatest diameter is near apex. Shell of *C. fragilis* (Jeffreys 1856), similar to that of *ulla*, but striated only at apex, elsewhere very smooth; in *C. ulla* striae do not reach suture (MARCUS 1956a, p. 119, fig. 1).

Also in shells of *C. fischeri* ADAMS & ANGAS (1864, p. 37) from New South Wales and South Australia striae end 2 mm in front of

the suture, and the apex is strongly striate (HEDLEY 1903, figs. 8–9). The shell sculpture of *C. systremma* MELVILL (1918, p. 155, pl. 5 fig. 30) is similar.

12. **Aplysia (Pruvotaplysia) parvula** Mörch, 1863

ENGEL 1936, p. 15; EALES 1960, p. 287–291; JONG & KRISTENSEN 1965, p. 49.

CURAÇAO: Piscadera Baai, outer bay, from *Halimeda* and algae, 16.XII.1965 (C), 5 specimens. Piscadera Baai, outer bay, sandy pebbles, ½–2 m, 5.I.1964 (H 1457), 20 specimens.
PUERTO RICO: La Gata, 15.IV.1963 (W), classified from transparency; size: 45 × 15 mm.

Further distribution: In all warm and warm-temperate seas from approximately 40° N to 40° S; not Mediterranean.

13. **Aplysia (Varria) dactylomela** Rang, 1828

ENGEL 1936, p. 6; EALES 1960, p. 307–310; JONG & KRISTENSEN 1965, p. 49.

CURAÇAO: Piscadera Baai, outer bay under stones and on *Halimeda* and algae, 16.XII.1965–23.II.1966 (C), 3 small specimens kept, but also big ones seen; spawning observed 17.II.1966. Piscadera Baai, outer bay, sandy pebbles, ½–2 m, 5.I.1964 (H 1457), 2 specimens (6 mm).
PUERTO RICO: La Parguera (W), classified from transparency.

Further distribution: World-wide in warm seas; not Mediterranean. Only 1 specimen recorded from American Pacific coast.

14. **Aplysia (Aplysia) juliana** (Quoy & Gaimard, 1832)

EALES 1960, p. 363–369.

CURAÇAO: Piscadera Baai, outer bay, under stones, 18.I.1966 (C), 2 specimens 6.5 and 25 mm long preserved.

Further distribution: World-wide in warm seas, including the Mediterranean, Harbour of Algiers.

15. **Dolabrifera dolabrifera** (Rang, 1828)

ENGEL 1936, p. 29; MARCUS 1963, p. 10 (references).

CURAÇAO: Piscadera Baai, outer bay, 22.XII.1965–21.II.1966 (C), 8 specimens.
SABA: Cove Bay at Flat Point, surf-swept andesitic rocks and boulders, 0–1 m, 5.X.1963 (H 1432), 4 specimens.
PUERTO RICO (W), classified from photo and transparencies.

FLORIDA: Virginia Key, Norris Cut, intertidal rocks (R. Work), 18.VI.1966 (B), 1 specimen and kodachrome.

Further distribution: Circumtropical and circumsubtropical; not yet recorded from American Pacific coast.

16. **Phyllaplysia engeli** Marcus, 1955

MARCUS 1963, p. 11; 1967, p. 40.

CURAÇAO: Piscadera Baai, inner bay, from *Thalassia* and other algae, 22. XII.1965–4.II.1966 (C), 7 specimens. Entrance of outer bay, W, sandy *Halimeda, Thalassia*, 1 m. 14.XII.1963 (H 1463A), 1 specimen.
BARBADOS: on *Thalassia*, 1968 (J. B. Lewis), 16 spec.
ST. MARTIN: Oyster Pond, sandy part of lagoon with some *Rhizophora*, patches of seagrass, 0–1 m, 13.X.1963 (H 1429), 1 specimen.
PUERTO RICO: 18.XI.1964 (W), classified from photographs.
FLORIDA: Virginia Key, sand flat with *Cymodocea* and *Thalassia* beds, ½–2 m, 4.IX.1963 (H 1408), 2 specimens.

Further distribution: Florida, Biscayne Bay; Curaçao, Piscadera Bay; Brazil, coast of Pernambuco, Rio de Janeiro and São Paulo (original locality).

Living specimens from Puerto Rico 10–15 mm long (W). Some were rusty brown with pink and white spots; skin warty with short white papillae. Some were smooth, bright green with longitudinal yellow stripes and brown spots.

17. **Stylocheilus longicauda** (Quoy & Gaimard, 1824)

ENGEL 1936, p. 57; MARCUS 1963, p. 11–15 (references).

CURAÇAO: Piscadera Baai, entrance W, sandy, *Rhizopora* decay, *Halimeda*, 0–1 m, 14.XII.1963 (H 1460A, 1461A, 1463A), 3 specimens.
PUERTO RICO: Desecheo Island, under rocks, 22.IX.1957 (W), 1 specimen. La Parguera, among algae, 16.III.1963 (W). classified from transparency of a 40 mm long living specimen.
BRAZIL: Pernambuco, Recife (Marc Kempf), 30 specimens.

Further distribution: Circumtropical, Gulf of California inclusive.

18. **Bursatella leachii pleii** (Rang, 1828)

MARCUS 1963, p. 15 (references).

CURAÇAO: Piscadera Baai, inner bay, 1.II.1966 (C), 1 big specimen, preserved

80 mm. Inner Bay, northern part, sandy mud, with *Thalassia* and *Ulva*, 2 m, 29.X.1963 (H 1495), 1 specimen.
FLORIDA: Virginia Key, 31.VIII.1963 (H), 20 spec.

Further distribution: From W coast of Florida and Antilles to Trinidad, Curaçao, Aruba, and coast of Brazil, south to about 32° S.

19. **Oxynoe antillarum** Mörch, 1863 Figs. 34-38

ENGEL 1927, p. 111; MARCUS 1963, p. 16; 1967, p. 25 (*O. aguayoi* Jaume, 1945, synonymized); JONG & KRISTENSEN 1965, p. 49.

CURAÇAO: Piscadera Baai, from *Caulerpa*, *Halimeda* and roots of mangrove in inner bay, 13.I.1966 (C), 1 big & 7 small specimens. Awa di Oostpunt, among algae, 4.I.1966 (C), 3 big specimens.

Further distribution: Panamá, Caribbean coast; Curaçao; Virgin Islands, St. Thomas (original locality); Puerto Rico; Cuba; Florida, Key Biscayne.

Living specimens up to 35 mm long; the closely related *O. olivacea* Rafinesque from Mediterranean and Cape Verde Islands (PILSBRY 1895–1896, p. 163; ELIOT 1906a, p. 305) is up to 50 mm (BERGH 1900b, p. 199, note 1). *O. antillarum* has up to 50 radular teeth, *olivacea* up to 60. Shape of teeth (Fig. 37) and male organ (Fig. 38) agree in both species; shells of both are variable.

Colour in both: green or brownish above, pale yellow below; difficult to judge in preserved material. Characteristic for *O. antillarum* are numerous white elements, especially a midline on tail. In a colour photo (B) the rhinophores are flesh-coloured with a pattern of black. Red spots or margins are frequently mentioned for *O. olivacea*.

BERGH's not quite clear (HOFFMANN 1938, p. 903) description of the foregut of *O. olivacea* (1900b, p. 201) is somewhat different from the following one of *O. antillarum*: Folded vestibule, the foremost part of the oral tube, followed by tubular part bearing globular bulge on either side. Bulges consist largely of muscle masses around subdivided lumina (Fig. 36), lined with cuticularized epithelium. Two membranous folds separate lateral lumina from central cavity. Ascus surrounded by semicircular muscular pharyngeal crop (Fig. 34, in) with narrow lumen and flat epithelium.

The oesophagus forms forward loop under pharynx, where it

passes through nerve ring. The central nervous system corresponds to BURN's figure 37 (1966b) of *O. viridis*. Subintestinal and abdominal ganglion on left side of visceral loop smaller than right supraintestinal ganglion.

Penis three-pointed (Fig. 38, p) as in *O. olivacea* (PRUVOT-FOL 1960, fig. 10); lies in male atrium (a), ELIOT's "bag" (1906a, p. 306), which opens beneath right eye. Points of penis supported by pillars of muscular discs. Thick efferent duct hangs into atrium with several convolutions. Atrium prolonged into an appendage (x) with folded epithelium. Course of efferent duct, adjacent to atrium, embedded in body wall as in *O. olivacea* (ELIOT, l.c.). Female papilla approaches male opening, lodging, as in *O. olivacea* (IHERING 1892, pl. 13 fig. 1) vagina and oviduct which open together.

Cyerce Bergh, 1871

Genus belongs to family Caliphyllidae, that is, shell-less Ascoglossa with radula, flattened cerata, and distinct tentacles. *Cyerce* characterized by furrow behind first third of sole, cerata without hepatic diverticula, and anal papilla slightly to right of midline, about halfway between eyes and reno-pericardial eminence.

SWENNEN (1961, p. 56–58) justified the name of the genus.

20. **Cyerce cristallina** (Trinchese, 1881) Figs. 39-43

TRINCHESE 1881b, p. 116 (*Lobiancoia cristallina*); PELSENEER 1892, p. XIX; 1894, p. 50 (*Cyerce Jheringi*); PRUVOT-FOL 1954, p. 176 (*Lobifera iheringi*), p. 179 (*Lobiancoia cristallina*); PORTMANN 1958a, p. 407 (*Lobifera cristallina*); SWENNEN 1961, p. 54 (*Cyerce jheringi*); MARCUS 1967, p. 38, pl. 1 fig. 5.

CURAÇAO: Piscadera Baai, under a stone in outer bay, 28.I.1966 (C), 2 specimens.

FLORIDA: Margot Fish Shoal, off Eliott Key, 5 m (R. C. Work), 20.IV.1967 (B), 1 specimen. Biscayne Bay, Cape Florida Flats (Chris Dermott), 25. VI. 1967 (B), 1 specimen.

Further distribution: Western and Eastern Mediterranean Sea.

As the present records of *C. cristallina* are the first from the Caribbean, the following notes stress the differences between *C.*

cristallina (*c*) and *C. antillensis* (*a*). Not every single slug, not even alive, can be determined by external characters, but frequently occurring features can be indicated.

Border of ceras smooth (*c*, Fig. 43), often indented or papillary (*a*, Fig. 45). Frequent pigment pattern in cerata of *c*: central patch of different size either connected with apical one or not. Colour of patches brownish violet when alive (SWENNEN 1961, fig. 9); violet preserved (specimens from Curaçao); preserved black (Biscayne Bay). Colour photos of living slug from Elliott Key: cerata transparent, orange spots and white stipples on margin, delicate black marginal rim, distinct also in preserved condition. Feeble brownish midline (photos, Elliott Key), blackish in preservation and sometimes with blackish central area. Small cerata nearly transparent in *c* and *a*. The living 9 mm long *c* (PORTMANN 1958 a, p. 408) had vitreous cerata with slightly yellowish green apical border and base. Absence of dark base, alive and preserved, characteristic for cerata of *c*. In *a* a dark basal spot is frequent (Fig. 45), though not constant. Apical dark zone and one or more central black spots often in *a*. The material of first description of *a*, preserved for 7–11 years, had lost all its colour. Metachromatism in liquid of preservation invalidates systematic significance of colours of head, rhinophores, and reno-pericardial eminence. Colour of hind part of body depends upon contents of digestive gland.

Maximum body length of living animals, 30 mm (*c*), 35 mm (*a*), has no systematic value.

Sure differential characters are: 1) shape of pharyngeal crop (Figs, 42, 46), saddle-shaped in *c*, pouch-like in *a*; 2) penial stylet (Figs. 41, 47), curved in *c*, straight in *a*; 3) radula. Measurements (in micra): length of tooth 400 (*c*), 65 (*a*), height 50 (*c*), 21 (*a*), length of base 130 (*c*), 26 (*a*). Number of denticles on either side of cusp: 23 (*c*), 11 (*a*); breadth of largest denticles (micra): 12 (*c*), 2 (*a*). Fundus of dorsal concavity of tooth indented in *c*, smooth in *a*.

Specific name of *Cyerce cristallina*, see PORTMANN (1958a).

21. **Cyerce antillensis** Engel, 1927 Figs. 44-47

ENGEL 1927, p. 117; MARCUS 1963, p. 17; 1967, p. 37.

CURAÇAO: Piscadera Baai, outer bay, from *Halimeda* and under a stone, XII. 1965–II.1966 (C), 30 specimens. Piscadera, outer bay, swimming pool, rocky shore with sand, 0–1 m, 29.I.1949 (H 1029), 1 specimen.
PUERTO RICO: Enrique Reef, under rocks, 20.XI.1964 (W), 1 specimen. Parguera, Mágimo, SE of Isla Magueyes, sand flat with *Cymodocea* and scattered *Thalassia*, 1½–2½ m, 12.IX.1963 (H 1418), 1 specimen. Bahía Fosforescente, SW part, muddy sand with algae, 4–5 m, 17.IX.1963 (H 1423A), 1 specimen.

Further distribution: Curaçao; Tobago (original localities); Florida, Virginia Key and Elliott Key.

In material from Puerto Rico the reno-pericardial eminence and ceratal borders are opaque white as in recently described specimen from Florida, Elliott Key (MARCUS 1967). Black spots of *C. antillensis* and *C. cristallina* consist of black granules in epidermal cells, nuclei and limits of which are free from pigment.

We confirm PELSENEER'S indication (1894, p. 52, fig. C) of an anterior vaginal and a posterior oviducal opening in *C. cristallina;* SWENNEN (1961, p. 56, fig. 10 b) mentioned and figured only a single female pore.

Phyllobranchillus Pruvot-Fol, 1933

Caliphyllidae with undivided foot, distinct tentacles, bulky lateral anal papilla, pharyngeal crop, and long penis, also when retracted.

Type-species: *Phyllobranchillus orientalis* (Kelaart, 1858), well described by ALDER & HANCOCK (1864, p. 145) as *Phyllobranchus orientalis*.

As *Phyllobranchus* is preoccupied, and *Polybranchia* Pease, 1861, and *Lobifera* Pease, 1866, are both invalid (SWENNEN 1961, p. 56–57), PRUVOT-FOL's name (1933, p. 93, note 2) must be used.

22. **Phyllobranchillus viridis** (Deshayes, 1857) Figs. 48-52

DESHAYES 1857, p. 141 (*Hermaea v.*); MÖRCH 1863, p. 37–38; BERGH 1871, p. 92 (*Phyllobranchus v.*); ENGEL 1927, p. 115; MARCUS 1963, p. 17 (*Polybranchia v.*).

CURAÇAO: Piscadera Baai, outer bay, under stones, 3.I. & 14.II.1966 (C), 4 specimens.

Further distribution: Curaçao, inner and outer parts of Piscadera Baai, from various algae; Caracas Baai; Spaanse Water, from *Porites furcata*; Bonaire: Kralendijk, near Pasanggrahan; Windward group; Guadeloupe; Virgin Islands: St. Thomas.

Alive up to 70 mm long, preserved, 35 mm measured over the back. Green colour of living material is partially preserved or not. Areae of epidermis in midline of cerata contain black granules. Small white warts on back, cerata, and rhinophores. Cerata lodge many hepatic diverticula touching one another (Fig. 48). Borders of cerata bear regular row of papillae with glands. Hungry animals and older ones have narrower hepatic diverticula in cerata than well fed and younger ones. Cerata up to 5 mm high and broad.

Radular teeth (Fig. 49) thick, base half or more of total length of tooth. Denticles of cusp blunt, somewhat irregular, thicker in present and in BERGH's material than in ENGEL's. Ascus forms a spiral. Example of measurements (in micra): length of tooth 360; length of base 230; length of cusp 130; breadth of biggest denticles 13; height of tooth 164; 13 denticles on either side.

Pharynx very large; the crop, a flattened tube, courses to left of oesophagus and reproductive organs, extending into posterior half of body as in BERGH's Indo-Pacific species (1871, p. 69, 90). Anal papilla bulky, beneath outermost row of cerata.

The male copulatory organ (Fig. 50, 51) is the most important diagnostic feature of *Phyllobranchillus viridis*. In examined specimens it is 10 mm long, 0.7 mm thick in retracted state. Contained in thin atrium, begins with basal bulb, on which fibres of retractor insert. Papilla long, curved backward over viscera. Bears warts with cuticular spines in ectal half. Warts in 2 rows, and several in between in ectal fourth.

After exit from ampulla (au) spermoviduct bifurcates immediately into male and female duct with prostate (q) and albumen gland (ag) respectively (Fig. 52). Female duct divides into wider glandular oviduct (mu) and narrower muscular, winding canal (oi). The latter probably leads allosperm inwards, as GHISELIN's (1965, fig. 5) vaginal duct. Narrow inner section of glandular oviduct might be GHISELIN's "membrane gland", outer wide one is mucus gland. Mucus gland and vaginal duct (oi) join where latter bears longish diverticulum, spermatocyst (sc). Duct (xs) from spermatocyst leads to site of fertilization. Connexions somewhat resemble those in *Limapontia* (GHISELIN 1965, fig. 5 E). Roundish bursa (b) connected with female duct rather near to single female aperture (fa).

MÖRCH's specimen from St. Thomas studied by BERGH can be united with ENGEL's and our material, and DESHAYES is considered as author of the species, because MÖRCH identified his animal with DESHAYES'.

Mourgona, gen. nov.

Caliphyllidae without pharyngeal crop; with undivided foot; hepatic diverticula in the leaflike cerata; slit rhinophores and simple tentacles, both rolled in; bulky anal papilla lateral under cerata; radular teeth without terminal discoidal lamina; male organ with cuticular stylet.

Type-species: *Mourgona murca*, spec. nov.

The absence of a crop renders it difficult to include *Mourgona* in the Caliphyllidae. But species with foliaceous cerata, distinct tentacles, and a *Phyllobranchillus*-like anal papilla belong even less to the Hermaeidae.

THIELE (1931, p. 413) allotted *Phyllobranchopsis enteromorphae* COCKERELL & ELIOT (1905, p. 52) with leaflike cerata and without crop to the Hermaeidae. *P. enteromorphae* has no tentacles, a discoidal lamina of the tooth, and an unarmed penis. The rhinophores seem to be simple and pointed; the anal papilla was not found by COCKERELL & ELIOT. MACFARLAND's *P. enteromorphae* (1966, p. 46) is not COCKERELL & ELIOT's species, but has spindle-shaped cerata and auriculate rhinophores. It is similar to *Hermaeina smithi* MARCUS (1961a, p. 12). However, the penial papilla is drawn as a simple knob (MACFARLAND 1966, pl. 10 fig. 27), and two seminal receptacles do not occur in *H. smithi* (GONOR 1961, fig. 9).

Possibly *Phyllobranchus borgninii* TRINCHESE (1895, p. 376) from Naples belongs to *Mourgona*. But the most important characteristic of the 2 present species of *Mourgona*, the absence of a pharyngeal crop, was not mentioned by TRINCHESE. On the contrary, he asserted that his animal has all the characters of *Phyllobranchus*, except the thin, hollow penial spine. Of the fore-gut only the nerve ring and the radula were described (p. 381); the shape of the teeth is compatible with *M. murca*, not with *M. germaineae*.

23. **Mourgona murca,** spec. nov. Figs. 53-62

CURAÇAO: Piscadera Baai, under a stone in the outer bay and among algae and *Thalassia* in the inner bay, 1. & 2.II.1966 (C), 5 specimens.

Length in alcohol 5 mm. A 1.5 mm-specimen (Fig. 53) was transparent alive, with a little dark pigment at bases of cerata. Near tips of cerata a group of opaque white glands. A few light brown hepatic diverticula in cerata. Preserved, bigger slugs with brown pigment on back and rhinophores. Behind the latter 1 or 3 white spots (Fig. 55). Big black eyes at bases of rhinophores. One animal almost colourless with 3–5 groups of opaque white glands on tips of cerata. Both halves of the rhinophores rolled inward; tentacles less than half as long as rhinophores, simple and rolled in on underside. Anal papilla club-shaped beneath outermost right row of cerata, approximately in middle of body.

Skin smooth, without warts. Cerata up to 2 mm high, their border with irregular row of papillae containing glands. Hepatic diverticula straighter than in *Phyllobranchillus viridis*. In some cerata distinct main hepatic stem gives off regular lateral branches, sometimes bifurcate at tips. In others (Fig. 58) diverticula swollen, irradiating from central cavity. Smallest specimen with only few diverticula.

Radular teeth (Fig. 57) measure in micra: length 140, base 55, much less than half total length of tooth. Breadth of blunt denticles 8, there are 7 on either side. Upper limb 8 teeth, lower limb 11, in spiral ascus 26. Length of pharynx 750. Longitudinal outer muscles form thick ventral pad (Figs. 56, 59, 60) to sides of lower radular limb. Pad is no crop but belongs to the "Radulastützpolster" (HOFFMANN 1938, p. 961).

Retracted male organ a thick muscular tube traversed by winding efferent duct and tucked into short male atrium (Fig. 62). Tip of penis with straight stylet, 40 μ long, 4 μ wide. Only one female aperture.

24. **Mourgona germaineae,** spec. nov. Figs. 63-68

PUERTO RICO: in aquarium of Institute of Marine Biology, Magueyes Island, 16.XI.1961 (W), 1 specimen.

Living slug approximately 12.5 mm long (W), preserved specimen 4 mm; cerata up to 2 mm high and 1 mm broad. Body in life transparent, yellowish green, liver diverticula in cerata green, some reddish brown pigment on head and back (W). Traces of pigment preserved in alcohol; a number of single pigment cells on the sole are a rather uncommon feature. Split rhinophores, grooved tentacles, and claviform lateral anal papilla as in preceding species.

Skin smooth. Papillae with glands rim cerata. Scattered glands and a dense patch of glands in upper part of cerata. Hepatic diverticula in ceras as in *M. murca*; ceras of Fig. 64 as in type-species: distinct stem and regular lateral branches. Liver reaches tip of some cerata.

Oral tube with dorsal muscular pouch (Fig. 68, ms). Two pairs of buccal glands (uc, uo) as in most Ascoglossa (HOFFMANN 1938, p. 914). Second pair (uo) evidently corresponds to posterior glands of oral tube; first pair (uc) rather to anterior than to middle glands (ibid., p. 907, 915). Pharynx (nx) very large, 1.4 mm long, without crop nor supporting pad. Oesophagus (o) strongly muscular.

Radula greatly different from that of *murca*. About 20 teeth; small oldest ones (Fig. 67) in fundus of ascus resemble slender bread knives, later teeth up to 750 μ long (Fig. 65, 66). Their cusp 500 μ long with numerous denticles on convex surface of distal half, besides row of denticles on either side of ventral concavity. This denticulation may be very efficient for tearing up cell membranes.

Male copulatory organ (Fig. 68, p) similar to that of *M. murca*. Its opening far in front of female aperture and neighbouring anal papilla.

The species is named for Mrs. GERMAINE L. WARMKE, M. Sc., of Gainesville, Fla.

25. **Caliphylla mediterranea** A. Costa, 1867 Figs. 77-78

TRINCHESE 1870, p. 1 (*Beccaria*); BERGH 1877a, p. 742 (older references); TRINCHESE 1877–1879, pls. 1–4 A (*C. tricolor*, *C. mediterranea*; identical species); BRÜEL 1904, p. 1–116 (reproductive and digestive organs); ENGEL 1927, p. 116 (first record from western hemisphere); MARCUS 1958c, p. 11.

CURAÇAO: Piscadera Baai, from algae in inner bay, 2.II.1966 (C), 2 specimens.

Further distribution: Mediterranean, Italy, France; West Africa, Morocco and Senegal; Virgin Islands, St. John; Brazil, Bay of Santos.

Recognizable by shape of cerata (Fig. 77), minute tentacles, in literature often given as absent, and smooth teeth of radula. Long male organ (ENGEL 1927, fig. 37, j), its tip cuticularized. In small previously examined specimen (MARCUS 1958c, p. 13) the network of hepatic capillaries which accompanies the lateral liver ducts (TRINCHESE 1870, pl. 7 fig. 1) was not seen, but found now in 6 mm-animal. Female aperture single.

26. **Placida dendritica** (Alder & Hancock 1843)

MARCUS 1963, p. 19 (*Hermaea* (*Placida*) *dendritica*).

CURAÇAO: Piscadera Baai, from algae and *Thalassia* in outer bay, I.–II.1966 (C), 13 specimens.

Further distribution: Curaçao; North Carolina; coast of New England; Mediterranean; eastern Atlantic, northwards to southern Norway, Bergen.

BABA's *Hermaea dendritica* (1955, text-fig. 9 B) has a radular tooth with straight cutting edge (concave in Atlantic species) and rather blunt tip (slender and pointed), and should be separated from the Atlantic form (BURN 1966a, p. 105).

Branches of the albumen gland in the cerata beside the hepatic diverticula in *Placida*, and only hepatic branches in *Doris bifida* Montagu, 1815, the type-species of *Hermaea* Lovén, 1844, justify a generic separation.

27. **Placida nonatoi** (Marcus, 1960) Fig. 79

MARCUS 1960a, p. 149 (*Costasiella nonatoi*).

PUERTO RICO: Montalva Bay, on algae, 6.IX.1963 (W), 4 specimens.

Further distribution: Brazil, São Paulo.

Present slugs were correctly determined by collector who described live animals: "size 3–5 mm, cream speckled with brown or black, cerata speckled with black or brown, tips light. Eye region, sole of foot, tail light colour. Rhinophores short and broad".

Preserved animals little more than 2 mm long; cerata up to 1 mm

high. Our previously indicated characteristics were confirmed, also the unarmed penis. Fore-gut needs an addition valid for present and Brazilian material. Short ascus projects from anterior end of pharynx (Fig. 79), containing a few rather big teeth. Immediately behind ascus the pharynx is clasped by a horizontal muscular bulge. This pharyngeal crop contains a small lumen. Pharynx 150 μ long, 175 μ broad, 150 μ high; bulge 120 μ long, 200 μ broad.

The species belongs to *Placida* Trinchese, 1876. *P. nonatoi* differs from the congeneric species (BURN 1966a, p. 105) by large, nearly contiguous eyes between rhinophores. This characteristic is not sufficient to place *P. nonatoi* in the little-known genus *Costasiella* Pruvot-Fol, 1951, the 2 species of which have tentaculiform foot corners, median eyes (PRUVOT-FOL 1951, p. 73; 1954, p. 198; BABA 1959, p. 329; 1961, p. 371; ABE 1964, pl. 7 fig. 26), and, as *Placida*, ercolanian rhinophores. Somewhat protruding though not tentaculiform foot corners occur also in *Stiliger bellula* (MEYER & MÖBIUS 1865, p. 14), the small eyes of which are lateral. The foot corners of *Doto ocellifera* SIMROTH (1895, p. 168) with costasiellan eyes are somewhat protruding too. This species was considered to be a young eolidoidean (ODHNER 1934, p. 301) or an ascoglossan (MARCUS 1960a, p. 151). Costasiellan eyes alone, as in *Placida nonatoi*, *Stiliger* (*Ercolania*) *illus* MARCUS (1965, p. 267), and *(Stiliger) lilianae* MARCUS (1969, p. 7) do not justify an incorporation of these species in *Costasiella*.

28. **Stiliger (Stiliger) funereus** (A. Costa, 1867) Figs.69-73

A. COSTA 1867, p. 36 (*Embletonia funerea*); VAYSSIÈRE 1888, p. 122 (*Ercolania funerea*); 1913, p. 213; 1929; CUÉNOT 1927, p. 261 (*Stiliger funerea*).

CURAÇAO: Piscadera Baai, from algae in inner bay, 1.–10.II.1966 (C), 6 specimens.

PUERTO RICO: Guayacan Bay, from algae on mangrove roots, 24.XI.1964 (W), 1 specimen. Turrumote Reef, on *Caulerpa*, 23.XI.1964 (W), 1 specimen.

Further distribution: Mediterranean, Italy and France; Bay of Biscay, Arcachon.

Length of living, stretched specimens from Puerto Rico 6 mm. Preserved animals about 4 mm long, 3 mm broad, cerata included.

These up to 1.5 mm long, 1 mm in diameter. Height of back 1.3 mm without cerata. Tail white, 1.5 mm long, seems to be regenerated in most of present slugs; in one specimen wanting, probably bitten off.

One of living slugs from Puerto Rico blackish with clear rhinophores, tail, and pericardial area; cerata black with reddish brown tips; a patch of reddish brown on centre of head (W). Other Puerto Rican specimen (Turrumote Reef) alive yellow with green livers (W), the lateral trunks shine dark through skin in photograph; in preserved state 2 pigmented stripes along back. Cerata dark green (W) with light tips. Preserved specimens from Curaçao brownish black in different intensity due to epidermal pigment. Mamillate tips of cerata (Fig. 69) not pigmented, nor rhinophores and anterior border of foot. Pigmentation of oral disc and sole varies. Scars of lost cerata white. Reno-pericardial prominence white, sometimes with dark midline. Anal and renal pores circled with black. Eyes behind rhinophores, far distant from one another.

Rhinophores finger-shaped, neither flattened nor auriculate; when pigmented they have no longitudinal white line on outerside. Reno-pericardial prominence rounded in front, very high, continuing backwards as dorso-median bulge beyond middle of body. Anus and renal pore to its left lie together, sometimes a little in front and to right of prominence (Fig. 69), sometimes in middle of anterior swollen part (Fig. 70). Anterior border of foot furrowed, straight, with rounded corners. Sole broadest in front, narrowing gently backwards.

Cerata bulbar with pointed tips, containing hepatic diverticulum giving off nearly horizontal branches in all directions (Fig. 73). Droplets of secretion emitted by big light glands sometimes stand out over surface, assuming appearance of papillae. The 4–5 longitudinal rows of about 10 cerata each begin far in front, leaving broad median area free. Several exceptions from rule that innermost cerata are highest. No albumen glands in cerata.

About 20 radular teeth in the 2 limbs and more than 20 heaped up in ascus. Total length of tooth up to 145 μ, length of base 45 μ. Cutting edge smooth. Cusp with high crest, rounded in front (Fig. 71), farther behind with concavity into which following tooth fits. Underside of cusp slightly curved. Aspect varies in different views, so that actually round crest may appear pointed.

Penis located immediately behind right rhinophore. Stylet 44 μ long, angled between base (22 × 13 μ) and terminal tube (24 × 4.2 μ). Farther behind vagina opens on large white papilla to which nidamental aperture is annexed.

When TRINCHESE (1872, p. 86) introduced *Ercolania*, he only mentioned one species of *Stiliger* Ehrenberg, 1831, the type *ornatus* from Tor, Gulf of Suez. The original description, copied by TRINCHESE (p. 88), indicates the external features of *ornatus* very clearly. However, in his anatomical study TRINCHESE distinguishes *Ercolania* much more from *Hermaea* and *Placida* than from *Stiliger*. He did not refer to *Embletonia*, nor to the 3 species which A. COSTA (1866; 1867) allotted to that genus. BERGH (1878, p. 813) had received *Embletonia viridis* and *E. nigrovittata* from COSTA, and transferred them to *Ercolania*. He distinguished *Ercolania* from *Stiliger* by the posterior tubular prolongation of the reno-pericardial prominence, and by a groove or flattening on the outer side of the rhinophores.

Both features are unreliable and can at most justify a subgeneric separation (MARCUS 1956b, p. 6). ELIOT (1910, p. 177) and THIELE (1931, p. 414) only maintained the rhinophoral characteristic. In fact, TRINCHESE's 2 characteristics do not always occur combined in one and the same species. Our material of *funereus* has a prolonged reno-pericardial prominence and finger-shaped, stiligeridan rhinophores. Also living specimens of *funereus* have such rhinophores (VAYSSIÈRE 1888, p. 123, 126). *Stiliger* (*Ercolania*) *noto* BABA (1959, p. 33) has ercolanian rhinophores and a short cardiac bulge. If the subgenera continue to be distinguished, the rhinophores must be decisive, though in preserved material their flattening, PRUVOT-FOL's "méplat", may appear (MARCUS, 1965, p. 267) or not (PRUVOT-FOL 1951, p. 70). The dorsal prominence is still less reliable. In 1 out of 6 specimens of *S.* (*S.*) *fuscatus* (A. Gould, 1870) we found an ercolanian prominence (MARCUS 1958c, p. 16).

In our opinion BERGH (1886a, p. 34, note 1) is right to allot *Embletonia funerea* to *Stiliger* (*Stiliger*). His note contains the lapsus "Hermaeinen" for "Ercolanien". VAYSSIÈRE's description of *Ercolania funerea* (1888; 1913; 1929) is good; his synonymies are differ-

ent in 1888 (p. 122) and 1929 (under *Ercolania pancerii*). He modified TRINCHESE's diagnosis of *Ercolania*, and suppressed BERGH's characteristics of 1878. *Stiliger* (*Ercolania*) *nigrovittatus* (A. Costa, 1866) and *Stiliger* (*E.*) *viridis* (A. Costa, 1866) are identical species. The first name must be used, because there is an older *S. viridis* (KELAART 1859, p. 492; ELIOT 1906 b, p. 686). *S. nigrovittatus* Rao & Rao (1963), evidently a true *Stiliger*, must receive a new name. We call it *Stiliger (Stiliger) raorum*, nom. nov.

29. **Stiliger (Stiliger) vanellus** Marcus, 1957

MARCUS, 1957, p. 402; 1963, p. 19; EDMUNDS 1966b, p. 73 ff.

CURAÇAO: Piscadera Baai, among algae from outer bay, II. 1966 (C), 4 specimens.

Further distribution: Brazil, São Paulo; Curaçao; Puerto Rico: among *Caulerpa verticillata* and other algae from mangrove root (Mrs. GERMAINE L. WARMKE det., letter of February 15, 1966); Jamaica, on *Caulerpa verticillata*; Florida, Virginia Key.

Colour forms of present material: spotted all over (MARCUS 1960a, fig. 15), and black with spotted cerata.

30. **Stiliger (Stiliger) cricetus,** spec. nov. Figs. 74-76

CURAÇAO: Piscadera Baai, among algae from outer bay, I.–II.1966 (C), 16 specimens.

Preserved animals up to 3 mm long, 2 mm broad, 1.3 mm high without cerata, these up to 1.0 mm high. Light brown hepatic diverticula in cerata, numerous opaque white ceratal glands, and black eyes are the only colourific elements in preservation. In most specimens the tail is bitten off; where present it is leaflike and ends pointed.

Eyes 70 μ in diameter, lying behind rhinophores far distant from one another. Rhinophores digitiform, neither furrowed nor flattened. Oral veil large. Diverticula of liver do not enter rhinophores nor veil. Swelling over reno-pericardial complex not distinctly delimited. Occupies middle third of back, is not prolonged backwards. Anal papilla together with renal pore to its left projects more or less far

backwards over swelling. Foot with furrowed, slightly notched anterior border; sole narrows evenly to hind end.

Shape of cerata varies: most of them approximately bulbar, in some specimens rather slender. Hepatic diverticulum a smooth sac or slightly lobed, generally near its base. Leaves tip of ceras free, where many glands occur. Cerata in 4–5 longitudinal rows each with about 10 cerata; outermost cerata smallest. Rows begin immediately behind rhinophores, leave broad middle free and meet behind.

Radula contains only 2 teeth in ascending, 4 in descending limb, and 4 heaped up in ascus. Biggest teeth 270 μ long with 92 μ long base. Crest of cusp round; cutting edges smooth and concave in peculiar manner (Fig. 75) near tip. Pharynx 350 μ long, without special muscular thickening. No oesophageal pouch.

Penis (Fig. 76) behind right rhinophore; stylet curved, 65 μ long, 13 μ wide at base. Vaginal aperture on a papilla and near it the small opening of oviduct.

Shape of cerata and penial stylet of *Stiliger* (*S.*) *vossi* MARCUS (1960a, p. 144) similar to present species, but in *vossi* cutting edge of radular tooth with denticles, and border of crest opposite to edges finely serrulate near tip.

Topographic relation between anal papilla and dorsal prominence, and paucidentate radula of *S. costai* PRUVOT-FOL (1951, p. 70) agree with *S. cricetus*; the penial stylet (MARCUS 1960a, fig. 25) differs. More weighty differences are long radular teeth, up to 0.4 mm, in *costai*, and extension of hepatic diverticula into rhinophores and oral veil.

Elysia Risso, 1818

Systematic characteristics Fig. 81

The value of the colours alive is somewhat restricted by the variability of greenish and yellowish tones and by the more or less rich development of melanophores. These may conceal other

colourific elements and so modify the general aspect. Strong papillosity is a valuable characteristic but a sparsely papillose surface and a smooth one may occur in specimens of one and the same species.

The radula is important for the taxonomy of *Elysia*. However, a straight and a curled row of discarded teeth in the ascus may be influenced by the treatment with potassium hydroxide (MARCUS 1963, p. 22). Teeth like those of *E. halimedae* with denticles along the lateral crests of the cusp (MACNAE 1954, fig. 2) are exceptional, hence useful for determination. The same holds for teeth with a median crest bearing coarse denticles, e.g., *E. papillosa* (MARCUS 1967, fig. 23). The frequent records of smooth cusps or cusps with very fine denticles only seen with immersion restrict the classificatory value of the radula.

The further parts of the gut of small species must be studied in sections, e.g., the exceptional presence of a pharyngeal crop in *Elysia duis* (Fig. 88), and the oesophageal pouch, often salient but sometimes flattened out (MARCUS 1967, fig. 32, mu; Fig. 84, ou), or absent (*E. evelinae*, *E. serca*; see MARCUS 1957, p. 413).

The reproductive organs, difficult to reconstruct from sections, are certainly important for classificatory purposes, e.g., the monoecious or dioecious follicles of the ovotestis and the ectal or ental location of the bursa. Cuticular penial structures are exceptional (MARCUS 1967, figs. 25, 31); the shape of the soft, contracted male organ tucked into the atrium hardly offers clear-cut features for differential specific distinctions.

We now realize the taxonomic value of the circulatory organs in *Elysia*. The reno-pericardial bulge, a post-cephalic pad sometimes continued backwards as a roll (MARCUS 1957, p. 407), is frequently mentioned in the descriptions. Connected with this elevation are the vascular ridges, BERGH's "Rückenschnüre". Generally they are described as "going out" from the central eminence, but actually they run towards it, proceeding from the lateral folds, the parapodia. They are afferent vessels or "veines branchiales" (PELSENEER 1894, p. 58). As BERGH observed (1872, p. 179), their number and mode of ramification do not vary individually, at least not considerably in the central part of the back. Certainly they are not specific to such

a degree that every species has its peculiar type. *E. evelinae* (MARCUS 1957, fig. 50) and *E. clena* (Fig. 81), e.g., have similar vascular ridges, but in several cases the veins are useful, when adult specimens of a reasonably well inventoried fauna are determined.

31. **Elysia ornata** (Swainson, 1840) Figs. 80-83

MARCUS 1957, p. 414 (references); 1963, p. 20.

CURAÇAO: Public aquarium of the Carmabi, 16.XII.1965 (C), 1 specimen. Piscadera Baai, outer and inner bay, from algae and *Thalassia*, 7.I.–12.II. 1966 (C), 12 specimens. Santa Marta Baai, under stone, 27.XII.1965 (C), 1 specimen.

Further distribution: Curaçao; Tobago; St. Vincent; Bermudas.

Two living specimens from the inner bay (4.II.1966) measured 5 cm between extended parapodia. Diameter of black spots varies in 2 slugs of equal size, maximum in one 90 μ, in the other 200 μ.

Anterior foot gland (Fig. 82, oo) strongly developed. Gut corresponds to typical pattern of *Elysia* by absence of pharyngeal crop and presence of dorsal oesophageal pouch (ou). Salivary glands (sa) rather compact; epithelium of ental section of intestine (i) folded longitudinally.

Central follicles of ovotestis (ov) contain female, peripheral ones male germ cells. Exceptionally, the wall of some central follicles shows small area of spermatogenesis. Between gonad and ampulla (au) which is small and empty in our sections, voluminous vesicles full of sperm, accessory ampullae (aa), are inserted in efferent ductules. Near outlet of ampulla male (d) and female (io) ducts separate.

A short distance from its origin male duct receives canal from ramified prostate (q). Large male copulatory organ (Fig. 83, p) 660 μ long and 840 μ in diameter. Its muscle mantle 180 μ thick, its core of dense connective tissue pierced by winding efferent duct. Epithelial glands pass through muscle layer and reach connective tissue. Cuticular structures are absent. For copulation the organ is probably elongated and stiffened. Penial sac (male atrium, a) has spacious diverticulum (x) with glandular epithelium.

Innermost canal entering oviduct (io) is the long stalk of bursa

(b). In sectioned specimen bursal lumen lodges crumbling sperm and prostatic secretion. Cells of bursal wall vacuolized; their surface irregular due to detached apices of cells. Branches of albumen gland (ag) unite and open into inner oviduct shortly before its entrance into folded mucus gland (mu). Only a single female aperture (fa).

Some accumulations of material in conjunctive tissue of body cavity might be degenerated spermatozoa, suggesting insemination by hypodermic impregnation. Such occurs in *Alderia* (ADAM & LELOUP 1939; HAND & STEINBERG 1955), the hollow penial stylet of which resembles a hypodermic needle, and in *Elysia maoria* with unarmed penis (REID 1964, p. 377). New Zealand species also has a glandular diverticulum of male atrium, the secretion of which might function during copulation.

In the dioecious *Ganitus evelinae* spermatozoa pierce skin and penetrate into ovary from spermatophores fastened to skin; female has no sperm-storing vesicle (MARCUS 1953, p. 175). The path of injected allosperms to site of fertilization not known in any of the cases of hypodermic injection into body cavity. Permanent passages from cavity to bursa, bursae in *E. maoria*, not observed. REID (p. 380) admits a temporary breakdown of bursal walls allowing entrance of sperm. Bursa of our sectioned *E. ornata* does not contain vigorous spermatozoa. Seems to function as bursa resorbiens, but might have stored sperm for fertilization in earlier stage.

32. **Elysia cauze** Marcus, 1957 Fig. 81

MARCUS 1957, p. 405; 1967, p. 28 (*E. cauze scops*).

CURAÇAO: Piscadera Baai, outer bay, and 29.XI.1963 (H 1453a), 1 specimen. Piscadera Baai, inner bay, central part, *Rhizophora*, muddy, 0–1 m, 25.XI. 1963 (H 1489), 3 specimens.
ST. MARTIN: Étang aux Poissons, embouchure, inlet near *Rhizophora*, scanty seagrass, tidal flow, muddy sand, 0–1 m (H 1428), 1 specimen.
PUERTO RICO: Guayacan Bay, from algae on mangrove roots, 24.XI.1964 (W), 1 specimen.
FLORIDA: Florida Keys, Big Pine Kay, on algae, 14.VIII.1964 (W), 1 specimen. Virginia Key, sand flat with pieces of coral and concrete, 0.5–2 m, 4.IX.1963 (H 1408A), 1 specimen. Key Biscayne, N Point at Bear Cut, sandy bottom with dense *Cymodocea* and *Thalassia* beds, 0.5–1 m, 1.IX.1963 (H 1410), 1 specimen.

Further distribution: Aruba; Curaçao; Bonaire. Brazil to Florida. KAY (1964 p. 195) reported *E.* aff. *cauze* from Hawaii.

Specimen from Puerto Rico greenish tan with brown speckling, brown line on edge of parapodia; up to 20 mm long (W). Present preserved specimens up to 8 mm long, whitish or brownish, all with

black edge of parapodia, black lips, and small black rings around pores of cutaneous glands, also on head. Rhinophores and head a little darker than rest of body. Papillae distinct in large slugs, not in smaller ones. Short pericardial bulge and following long renal roll receive about 8 equally spaced afferent vessels on either side and 1 from behind. Course of these veins varies, transverse or oblique, depending on more contracted or more stretched body.

Pharynx very large, 1.2 mm long in 5 mm-animal. Teeth up to 170 μ long, their base 57 μ; denticles on median crest of cusp small (1 μ). Oesophagus with dorsal pouch.

In a previous paper (MARCUS 1967, p. 28) we separated populations of small specimens with minutely denticulate radular teeth as distinct subspecies, but as its range coincides with that of the typical form, at least in the Caribbean area, we do no longer maintain this separation.

33. **Elysia papillosa** Verrill, 1901

VERRILL 1901, p. 31; MARCUS 1957, p. 410, 415; non 1963, p. 21 (see 1967, p. 31).

CURAÇAO: Piscadera Baai, outer bay, coming up from *Halimeda*, 1.III.1966 (C), 1 specimen.

Further distribution: Florida; Biscayne Bay; Bermudas.

Separated by the collector from her rich material of *E. tuca*; she noted: "has light brown, blue, and white colour marks, rhinophores with dark, nearly black tips, and papillate parapodial borders".

Differs from *E. tuca* by large rhinophores, generalized papillosity, undulate borders of parapodia, and coarse serrulation of radular teeth, even in such small specimens as present preserved 3 mm-animal.

E. cauze is similar with regard to papillae and shape of renopericardial eminence. *E. papillosa* differs from *cauze* by large rhinophores with transverse bands, white area extending from head to heart, white border of parapodia, and penial armature.

34. **Elysia tuca** Marcus, 1967 Figs. 81, 84-85

MARCUS 1963, p. 21 (*Elysia papillosa*); 1967, p. 29.

CURAÇAO: Piscadera Baai, outer bay, coming up from *Halimeda*, 14.XII. 1965–1.III.1966 (C), 60 specimens.
PUERTO RICO: Enrique Reef, on *Caulerpa racemosa*, 30.X.1963, 4.XI.1964 (W), 4 specimens. Gata Island, on *Halimeda opuntia*, 12.IX.1963 (W), 1 specimen.
FLORIDA: Florida Keys, Big Pine Key, on algae, 14.VIII.1964 (W), 2 specimens. Elliott Key, east side, 3 km offshore, small coral reef on sand bottom with *Thalassia*, 2–6 m, 5.IX.1963 (H 1414), 1 specimen.

Further distribution: Curaçao; Florida, Biscayne Bay.

From a specimen from Florida (MARCUS, 1967) that agreed perfectly with *E. papillosa* Verrill, 1901, in colour, general aspect and sculpture, we realized that our first material from Curaçao, called *papillosa*, is not VERRILL's species.

The lighter areae on green ground colour are iridescent spots in some specimens from Puerto Rico (W). These slugs have occasional papillae on rhinophores, head, neck, and border of parapodia. Alive they are up to 15 mm long (W).

No pharyngeal crop. In sectioned specimen from Curaçao anterior part of oesophagus remarkably wide (Fig. 84, o), but narrowing before it passes through nerve ring (ce). This dilatation a physiological, not a morphological feature, as our earlier figure (1967, fig. 32) shows. The salivary glands (sa) extend far backward. Muscular portion of oesophagus (l.c., fig. 32, mu) forms a distinct pouch in present material (Fig. 84, ou); evidently it can be flattened out. Stomach (so) smooth; intestinal epithelium thrown into longitudinal folds (i).

Reno-pericardial pad receives 2 afferent vessels from parapodia (Fig. 81). These veins originate by confluence of an anterior and a posterior branch. Branches collect a great number of short looping vessels. These wide veins stand out as leaflets on inner surface of parapodia.

Sectioned specimen was in young male fase. Follicles of ovotestis with spermatozoa, but ampulla (au) still empty. Prostate (q) incipient, but copulatory organ (p) bears cuticular needles described and drawn before (MARCUS 1967, fig. 31). A single female opening

(fa) immediately in front of anus. Mucus gland (mu) a folded epithelial sac, still without glandular differentiation. Narrow outlet of mucus gland receives long canal of spherical bursa (b). Evidently slug had not copulated, as bursa contains only some coagulated matter, no sperms nor prostatic secretion.

Mucus gland has 2 inner connexions. One of them (co) begins as wide tube which receives still incomplete albumen glad (ag) at its fundus. This wide section of oviduct probably site of fertilization and place where membranous shell of egg is formed. From fundus of wide tube a narrow inner oviduct (io) courses to point where spermoviduct divides. Prostatic canal joins it at same point. Second connexion of pallial oviduct with coelomic oviduct a straight channel. Its ental opening lies at outlet of ampulla (au), its ectal aperture into mucus gland beside that of fertilization chamber. Possibly it takes an excess of autosperms out.

35. **Elysia duis** Marcus, 1967 Figs. 81, 86-88

MARCUS 1967, p. 31.

CURAÇAO: Piscadera Baai, outer bay, coming up from *Halimeda*, 15. & 25.II. and 1.III.1966 (C), 4 specimens.

Further distribution: Florida: Biscayne Bay.

Living slugs of present material up to 9 mm long, preserved up to 4 mm. General aspect black due to pigment which hides light body colour. Dark pigment of back extends onto parapodia leaving free a light margin rimmed with dark red. On outer (ventral) side of parapodia (Fig. 86) follow a light line, a black line, and a row of roundish yellow areae. These areae are bordered with blue in living animals (C) and alternate with marginal folds. Ventral surface dark with white dots. A yellow band on neck continues onto medial side of rhinophores. Tip of latter with apical black and subapical red ring. One specimen had white dots in red ring (Fig. 87).

Florida material has less dense pigment. The 4 present specimens show individual variations of colour pattern.

Pharynx with muscular crop (Fig. 88, in) smaller than in *Bosellia mimetica curasoae* (Fig. 93, in), but essentially with same charac-

teristics: is latero-ventral, sessile, and contains 2 pigmented lumina (l) as continuations of pharyngeal cavity. Total length of pharynx 320 μ including crop (217 μ); width of pharynx 164 μ, of crop 280 μ. Oesophageal pouch small. Retracted penis nearly globular, tipped with short cone.

Pharyngeal crop of *E. duis*, drawn (1967, fig. 35) but not mentioned in first description, separates *E. duis* from the other species of *Elysia*. The type-species, *E. timida* (Risso, 1818) has no pharyngeal crop (VAYSSIÈRE 1888, p. 143), and treatises indicate absence of "ingluvies buccalis" for the genus. However, a generic or subgeneric separation of *E. duis* is premature, because absence of pharyngeal crop is rarely mentioned in earlier descriptions.

In *Elysia evelinae* MARCUS (1957, p. 410), now re-examined, the radular pouch forms 2 lateral diverticula, the musculature of which is much weaker than in the crop of *E. duis* and *Bosellia mimetica curasoae* (Fig. 93). In *E. vatae* Risbec, 1928, radular sac especially salient (id., 1953, p. 171). Type-species of *Thuridilla* BERGH (1872, p. 199), perhaps only species of genus (PRUVOT-FOL 1954, p. 203), has globular crop. Its shape (BERGH 1872, pl. 24 figs. 8–11) differs from dorso-ventrally flattened crop ot *E. duis* and *Bosellia*. What little attention has been paid to the pharyngeal crop is shown by RISBEC's figure (1928, fig 97, 4) of a doubtless *Plakobranchus* without crop, though this organ of *Plakobranchus* was indicated by BERGH repeatedly (1872, p. 146, 150, 159, 174).

It is not known whether the type-species *E. timida* has an oesophageal pouch. Therefore the pouch can only be used on species level, not for a subdivision of the genus. In many cases occurrence of oesophageal pouch and absence of pharyngeal crop might be correlated, e.g., in *E. viridis* (Montagu, 1804), *E. lobata* Gould, 1852, *E. maoria* Powell, 1937, and others (FRETTER 1941, p. 188; MARCUS 1957, p. 413; 1958a, p. 46; 1966, p. 173; REID 1964, p. 368). But *E. duis*, *Thuridilla*, and *Bosellia* have crop as well as pouch; *E. evelinae* has a crop-like structure but no pouch, and *E. serca* Marcus, 1955, neither crop nor pouch (MARCUS 1957, p. 413). HOFFMANN's figure (1938, fig. 739 D) of *Plakobranchus caminguinus* with pharyngeal crop and oesophageal pouch differs from the original figure

(BERGH 1872, pl. 19 fig. 15), explained as "pharynx, oesophagus and stomach seen from the side".

In our first description of *E. duis* from Florida we separated it from the Bermudian *E. picta* VERRILL (1901, p. 30) by the colour patterns. The yellow element of the parapodia in the present material diminishes this difference, but not sufficiently to unite *E. picta* and *E. duis*. ENGEL's dark *Elysia* spec. (1927, p. 115, fig. 31) with black rimmed parapodia from Curaçao, Spaanse Water, cannot be *E. duis*, because the cusp of its radular teeth is 1½ times the length of the base.

36. **Elysia clena**, spec. nov. Figs. 81, 89-90

CURAÇAO: Piscadera Baai, outer bay, between algae, 27.I.1966 (C), 1 specimen.
BARBADOS: on *Thalassia*, 1968 (J. B. Lewis), 4 specimens.

Preserved 2 mm long, 1 mm broad, with minute melanophores. Appearance generally grey, except for short white rhinophores and white haloes around eyes. Some light spots along parapodial borders. Sole without melanophores, lighter than back. In some places digestive gland shines brownish through skin. Parapodia short and thick, with nearly straight borders.

Reno-pericardial eminence ovate, strong, ending in middle of body. On either side of reno-pericardial pad 5 vessels (Fig. 81). They are simple, not ramified on back. A line of pigment accompanies each vein.

Radula (Fig. 90) comprises 27–29 teeth. Length of tooth 100 μ, height 26 μ; cusp smooth in adult. Teeth differ in several characteristics from typical teeth of *Elysia* (PRUVOT-FOL 1926, fig. VI on p. 241). Antero-posterior axis of basal plate (pb in quoted fig.) not parallel to long axis or tooth but at right angles to it. Anterior concavity (ca in quoted fig.) absent, also posterior spur, PRUVOT-FOL's "éperon postérieur". A slight convexity corresponds functionally to anterior spur.

This radula differs from those known in other species of *Elysia*.

37. **Tridachia crispata** Mörch, 1863

MARCUS 1960a, p. 153; 1963, p. 23; 1967, p. 33.

CURAÇAO: Playa Grandi (Plantage Wacao); Sta. Marta Baai; Valentijn Baai; Piscadera Baai, outer bay; Spaanse Water; Awa di Oostpunt, from algae, between dead corals, and crawling on a stone, XII.1965–II.1966 (C), a total of 20 specimens. Piscadera outer bay, observed, 1963/64 (H).
BONAIRE: Paloe Lechi, and Kralendijk, 1948 (H 1056C), 4 specimens.

Further distribution: From the coast of Venezuela and British Honduras to the S and W coasts of Florida.

38. **Bosellia mimetica curasoae,** subspec. nov. Figs.91-98

CURAÇAO: Piscadera Baai, outer bay and entrance of inner bay, coming up from tufts of algae, principally *Halimeda*, sponges, and Hydrozoa. Shallow water, III. and IV.1962, XII.1965–III.1966 (C); more than 50 specimens.
BONAIRE: Lac, Boca, reef debris, 1.X.1948 (H 1068a), 1 specimen.
PUERTO RICO: Enrique Reef, under rocks, 20.XI.1964 (W), 1 specimen.

Living animals from Curaçao up to 8 mm long (C), biggest preserved slugs 4 × 4 mm. Colour alive (C) brownish green with opaque white flecks, especially on rhinophores. Sometimes a dark line interrupted by white spots around edge of body. Resemblance of living slug at rest with leaf of *Halimeda* noted (W); this specimen was green with white speckling. Most of white distributed in 3 patches, 1 on head, 2 long ones below eyes (W). Preserved animals from Curaçao colourless, except for small black eyes behind rhinophores and ring of dark pigment around tip of rhinophores.

Head set off from body by a dorsal and a ventral pair of broad lateral folds (Fig. 91). Apertures close together on right side; male opening (Fig. 91, ma) in dorsal furrow, female (fa), anal (ar), and renal (ne) pores in ventral furrow. In moving slug (Fig. 94) body not broader than head. Body shortens and broadens at rest or floating upside down at surface film (C), still more when anesthetized and preserved (Fig. 95). Then 6 dorsal veins visible; arise from peripheral branches and lead to heart. Rhinophores rolled in; in collector's sketch (Fig. 94) of living slug they are longer than in the figures of Mediterranean animals. Epidermis of back and foot with numerous blue and red-staining glands. Anterior pedal gland (Fig. 91, oa) strongly developed; tail blunt.

Central nerve ring (Fig. 98) highly concentrated. Cerebro-pleural (ce) and pedal (ea) ganglia of equal size; cerebral and pedal commissures short. Length of buccal commissure inferior to diameter of 1 buccal ganglion (cc). In visceral loop left subintestinal (su), abdominal (ao), and right supra-intestinal (si) ganglion united by very short connectives.

Mouth surrounded by clusters of buccal glands (Fig. 93, uc). Radula (Fig. 93, ra) forms close spiral of 26 thick teeth (Fig. 96) with few pointed denticles along edge of cusp. Dorsal food channel of buccal mass (Fig. 93, nx) receives openings of long salivary glands (sa). Pharyngeal crop (sessile ingluvies, in) surrounds pharynx latero-ventrally, projecting backward far beyond it. Lateral pockets of pharyngeal cavity continued into 2 lumina of crop (Fig. 91, 93, l). Dorsal to crop buccal ganglia (cc) flank anterior part of oesophagus (o). Oesophagus wall has in postcerebral part several big nerve cells with large nuclei and dense cytoplasm, as described by FRETTER (1941, p. 189, fig. 2). Long, wide pouch (Fig. 93, oc), already seen in Mediterranean slugs (TRINCHESE 1891, figs. 3, 4, c) near hind end of oesophagus. Small stomach (so) between oesophagus, intestine (i), and right and left ducts of digestive gland (ia).

Gonad (Fig. 92, ov) has mixed, globular follicles. Preserved 1.8 mm-slug had 18 follicles, another of 2.6 mm 21, and two of 2.5 and 3.0 mm 24 follicles. Hermaphrodite ductules unite into hermaphrodite duct which forms voluminous ampulla (au) containing eggs and sperms simultaneously. Spermoviduct bifurcates at certain distance from ampulla. Efferent duct (d) receives looping duct of rather thick, bilobed prostate (q), courses forward winding to where male atrium (a) opens (ma) immediately behind right rhinophore (Fig. 95). Muscular penis (p) curled in atrium with hollow, curved stylet (Fig. 97) directed inwards. Stylet 55 μ long, consists of 16 μ long, 20 μ wide basal funnel and 7 μ wide terminal tube.

Inner oviduct (Fig. 92, io) receives the 2 main ducts of albumen gland (ag) and divides into 2 channels with especially long cilia. Narrow channel (oi), the oviducal loop in GASCOIGNE's (1956, p. 142), the vaginal duct in GHISELIN's (1965, p. 355, fig. 5) terminology; wide glandular channel (co), the focal chamber, presumable site of fertilization and formation of membranous egg shell. Sperms

were found in focal chamber. Loop and chamber reunite, open into large mucus gland (mu). Canal of copulatory bursa (b) annexed to outer part of mucus gland; bursal lumen contains debris of sperms and prostatic secretion. Outermost portion of oviduct narrow, not glandular; its function nidamental and vaginal. Female aperture (fa) beneath anus (Fig. 91, ar).

A few small, sperm-containing vesicles (us) in connective tissue of body, possibly the testes of the first description (TRINCHESE 1891, p. 776; PORTMANN 1958b, p. 79). Origin and function of these sperms not revealed by present material, but stated by BECKER (1960, see below). Sometimes a vesicle close to a branch of albumen gland, in other cases away from it, never in open communication with albumen gland or with gonad.

Stylet curved, not straight like mouth of flute as in *B. m. mimetica* TRINCHESE (1891, p. 776 fig. 10). Possibly also albumen gland different in *B. m. curasoae* to *B. m. mimetica* (see below). TRINCHESE found 3 slugs on *Halimeda tuba* in the Gulf of Naples in about 100 m. PORTMANN (1958a; 1958b) rediscovered the species on *Halimeda*, exceptionally on *Udotea*, on the Mediterranean coast of France. BECKER studied (1960) the reproductive organs. She observed living animals and examined 85 series of sections. She found that the penis, the stylet of which is not mentioned, is inserted into the female aperture. Sperms pass to the bursa, inner oviduct, and a system of channels with terminal ampullae which function as seminal receptacles. On height of female phase sperms return to meet female germ cells in inner oviduct. In this phase cells lining channels function as apocrinous glands. If, as it seems, our albumen gland corresponds to BECKER's "Gangsystem", her observation indicates a double function of the albumen gland.

We studied several preserved clarified slugs and 3 series of sections. Our negative result with regard to an entrance of sperms into the vesicles (us) or an exit from there by means of albumen gland branches may be due to a different reproductive phase or may reveal a systematical difference between the Caribbean and the Mediterranean forms. Allosperms (THOMPSON 1966, preferable to exogenous sperms, GHISELIN 1965), occur in body tissue of several Ascoglossa (see discussion of *Elysia ornata*) and *Ganitus evelinae*

MARCUS (1953, p. 175), but in no other species with a terminal oviduct functioning both as vagina and nidamental duct.

PRUVOT-FOL (1954, p. 176) considered the glandular pores as marks of caducous cerata and therefore allotted *Bosellia* to the Polybranchiata, but it belongs to the Pellibranchiata without appendages. Among these the Plakobranchidae BERGH (1872, p. 146) still mentioned as a family by PRUVOT-FOL (1954) are better united with the Elysiidae (ELIOT 1910, p. 77). Only this family or the Limapontiidae can receive *Bosellia*. The auriculate rhinophores, the head set off from the body, and the respiratory vessels of the dorsum are elysiidan; the absence of lateral folds (parapodia) is limapontiidan. A pharyngeal crop occurs in Elysiidae (*Elysia duis*, *Thuridilla*, *Plakobranchus*) and Limapontiidae, an oesophageal pouch only in Elysiidae. The general aspect of the gut is more elysiidan than limapontiidan. The central nervous system agrees with that of the Elysiidae; *Limapontia depressa* has no subintestinal ganglion (PELSENEER 1894, p. 62, pl. 21 fig. 186). A doubly-divided oviduct (GHISELIN 1965, p. 356) and a stylet (in *Plakobranchus*) occur in both families. In *Limapontia depressa* the bursal pore is distant from the oviducal opening. The spawn is elysiidan, not limapontiidan.

We agree with TRINCHESE (1891, p. 773) and PELSENEER (1894, p. 72) as to the systematic position of *Bosellia* among the Elysiidae.

39. **Berthella agassizii** (MacFarland, 1909)

MARCUS 1963, p. 24 (references).

CURAÇAO: Piscadera Baai, outer bay, under stones and from *Halimeda*, 10.I.–21.II.1966 (C), 4 specimens from 2–8.5 mm preserved.

Further distribution: Curaçao, Piscadera and Caracas Bay, Spaanse Water; Brazil, Alagoas (original locality), São Paulo.

We maintain the specific name, though anus lies in front of branchial membrane, not above its posterior end (MACFARLAND 1909, p. 60: material from Alagoas; ENGEL 1927, p. 110: 1 specimen from Curaçao). The anterior position occurs in young and adult animals of our material, so that it cannot be related with length

of gill, known to increase with age. *B. agassizii* has no spicules.

Situation of anus (ODHNER 1939, p. 19) in *B. plumula* (Montagu) agrees with our material of *agassizii*, but the broad shell (l.c., fig. 9) and the number of teeth per half-row (75) are different. Position of anus is similar, though still farther in front, in the spiculate (MARCUS 1959a, p. 25) *B. platei* (Bergh), found in southern Chile and the antiboreal SW Atlantic. Spicules are evidently absent (BERGH 1898a, p. 498) in *B. patagonica* (d'Orbigny) from middle Argentina and Chile. This absence is probably real, in spite of the fixation in acid alcohol, because organic remains of spicules continue to be visible. As foot of *patagonica* stands out over mantle, the aspect of that species (VAYSSIÈRE 1898, pl. 15 fig. 32) differs widely from that of *agassizii*.

ENGEL supposed that *agassizii* was identical with *aurantiaca* (Risso), but the shell of latter occupies nearly entire extension of mantle (VAYSSIÈRE 1885, p. 118), it has spicules, and the anus is located behind branchial membrane (ODHNER 1939, p. 20).

The difficulties concerning place of anus are also revealed by *B. sideralis* (Lovén), restored by BERGH (1898b, p. 126) without mention of anus. In fact this lies in front of middle of branchial membrane in *sideralis* (ODHNER 1939, p. 21); MACFARLAND's indication (1966, p. 70): "anal opening at the end of the gill attachment" is incompatible with ODHNER's statement.

40. **Berthella tupala** Marcus, 1957 Fig. 102

MARCUS 1957, p. 416; 1967, p. 43.

PUERTO RICO, 18.XI.1964 (W), 1 specimen.

Further distribution: Florida; Brazil, Rio de Janeiro and São Paulo.

Present animal increases range of intraspecific variation. Alive it was clear white with opaque white speckling (W). Mandible relatively broader (0.8 × 0.56 mm) than in first material (0.525 × 0.25 mm); the up to 5 denticles of the platelets more pointed (Fig. 99) than blunt. Also in now re-examined original material cusps of platelets and number of denticles differ from one mandibular area to the other.

B. tupala characterized best by radular details: innermost tooth of half-row with basal denticle (MARCUS 1967, fig. 52); outer part of row contains straight teeth with small secondary cusp. Shell of present specimen 4.5 mm long, 3 mm broad, 1.8 mm high, hence well vaulted, agrees with original material (5 × 2.8 × 1 mm) in outline and sculpture (1957, figs. 61–63). Gill has 11 plumules; anus at end of branchial membrane.

One of the photographs (W) shows about 2 mm broad fragment of egg ribbon.

41. **Pleurobranchus (Pleurobranchus) areolatus** Mörch, 1863

MARCUS 1963, p. 25 (references); 1967, p. 44 (synonyms), 163.

CURAÇAO: Boca Sta. Marta Baai, outflow of the bay (J. S. Zaneveld), 20.IX. 1954 (H), 1 specimen. Piscadera Baai, outer bay, 22.XII.1965 (C), 2 specimens. Spaanse Water, under an asbestine roofing sheet in shallow water, 14.II.1966 (C), 1 specimen.
PUERTO RICO (W): photograph with note of size: 40 × 22 mm.

Further distribution: Gulf of California, Puerto Peñasco; Pacific coast of Panamá; Florida, from W coast through Florida Keys to area of Miami; Antilles (origina locality: Virgin Islands, St. Thomas), south to Barbados, Los Roques (E of Bonaire), and Curaçao; Ghana, West Africa (EDMUNDS, 1968b, p. 85).

Alive the animal from Spaanse Water was 120 mm long, hence bigger than the hitherto recorded maximum (75 mm). Its shell measures 9 × 6.5 mm, the conchinous border inclusive. Gill comprises 26 pinnules; the maximum is 27. Anus over hind end of branchial membrane, which leaves 10 very small pinnules free. Flat big notal warts of different diameter in specimen from Boca Sta. Marta Baai surrounded by dark rings; a glandular pore in centre of each wart.

42. **Chromodoris ponga,** spec. nov. Fig. 99-101

CURAÇAO: entrance of Sta. Marta Baai, 10 m (Peter de Wilde), XI.1965 (C), 1 specimen.

Living slug creeping and stretched 10 mm long, 3 mm wide, 1.5 mm high. Collector indicated a red notum surrounded by broad

white margin (Figs. 99–100). Behind rhinophores and in front of gills longish white areae with yellow spots. In front, behind, and on sides red colour projects into white margin. Part of projections reach notal border. Rhinophores white, tipped with red, gills white. Pointed foot white with red longitudinal streak. Preserved specimen 7 × 3 mm, has notum with irregular opaque white meshes over creamy, more transparent, background.

Notum smooth; tentacles grooved; rhinophores bear about 10 leaves. Eight unipinnate gills. Anterior border of foot bilabiate, not notched.

Brown labial grasping ring of curved rodlets, thicker towards bases and with cleft tips. Radula 1.16 mm long, 0.67 mm broad, 52 rows, each with 33.1.33 teeth. Rhachidian tooth triangular (Fig. 101), 18 μ high, cusp 5 μ long. First lateral 31 μ with 1 inner and 4 outer denticles. Height of lateral teeth increases to 40 μ; they have up to 10 outer denticles. In some teeth denticle next to cusp stronger than following ones, producing a bifid, somewhat *Hypselodoris*-like aspect, e.g., tooth 20 in Fig. 101. Up to 8 of outermost teeth denticulate on both sides. Salivary glands long, thin, smooth.

Reproductive organs of type common in genus: a long, thin, coiled prostatic, a muscular, and a sheathed section of the efferent duct; a short, straight vagina, a vaginal disposition of sperm-reservoirs, the globular spermatheca and the smaller, sausage-shaped spermatocyst, and a rather long insemination (allosperm) duct. No vestibular gland.

Of the American species of *Chromodoris* only *C. aila* MARCUS (1961b, p. 141) from North Carolina approaches *C. ponga*. Differences are: blue marks besides the yellow ones on the red notum; 15–18 rhinophoral leaves; 13 gills; radula 57 rows with 43.1.43 teeth; up to 16 denticles on lateral teeth; knobby, though also long, salivary glands. We prefer to maintain the separation of the two species, because the possible intraspecific variation cannot be evaluated from 2 single specimens.

43. **Chromodoris dictya,** spec. nov. Figs. 103-104

PUERTO RICO: Vega Bay (L. Arnow & F. St. Clair), 12.XI.1960 (W), 1 specimen.

Preserved slug 12.5 mm long, 5 mm wide, 4 mm high. Body whitish transparent with silvery white net of small meshes on notum and hyponotum (Fig. 103). Liver dark brown. Thick margin containing glands surrounds smooth notum. Spicules absent. Tentacles grooved; pointed rhinophores bear about 20 leaves. Nine unipinnate gills. Anterior border of foot bilabiate, entire.

Large rhinophoral ganglia tightly apposed to cerebral ganglia have certain systematic value, as have the eyes, the retina of which has very little pigment.

Light brown, up to 40 μ high labial rodlets with cleft tips. Radula 1.6 mm long, 0.9 mm wide, with 48 rows and 35 teeth per half-row. Flat triangular pseudotooth of rhachis 33 μ high, has 6 μ long cusp. First lateral tooth bears 1 inner and 4–6 outer denticles. Farther outwards up to 70 μ high teeth with up to 13 outer denticles. Outer part of each half-row contains 2 teeth with cusps denticulated on both sides, and 2–3 outermost teeth without denticles.

Reproductive organs of common *Chromodoris* type: Ampulla a dilated tube, prostate coiled, and none-glandular sections of male duct, muscular and sheathed one, are long. Vagina opens into atrium to side of male duct, leads to wide bursa and sausage-shaped spermatocyst. At this point a wide insemination duct begins, courses inwards, and enters female gland mass at bifurcation of spermoviduct. Nidamental duct opens behind common male and vaginal atrium. No atrial or vaginal glands.

By the white net, the measurements, the number of gills, of radular rows and teeth, *C. mörchii* BERGH (1879b, p. 3; 1879c, p. 99) from St. Thomas is very near to *dictya*, but the location of the rhinophoral ganglia, the pigmentation of the eyes, and particularities of the radula are different. *C. mörchii* has a rhachidian thickening without cusp, 3–5 outermost teeth with denticles around the cusp, and no further smooth teeth. Negligible differences are the grooves of the tentacles, not mentioned for *mörchii*, and its 50

rhinophoral leaves, which BERGH often counted from both sides of the rhachis.

44. **Hypselodoris sycilla** (Bergh, 1890) Figs. 105-107

BERGH 1890, p. 165.

FLORIDA: Biscayne Bay, Virginia Key, Norris Cut, intertidal rocks (R. C. Work), 14.VI.1966 (B), 1 specimen.
PUERTO RICO: off Punta Jiguera, 18–24 m, 1.XII.1961 (W), 1 specimen.
BRAZIL: Pernambuco, 1–2 m, stones and algae (Marc Kempf), 1 specimen.

Further distribution: N coast of Yucatán, 20 km N of Holbox Island (21°31′ N, 87°16′ W), about 26 m.

Preserved specimens (in mm): length 24 (Brazil), 22 (Florida); height 13 (Brazil), 7 (Florida). Sole contracted. Crawling slug from Puerto Rico about 10 mm long, 1.5 mm broad (W). Pointed tail projects beyond hind end of notum in living and preserved slugs.

Colour photograph from Florida (Fig. 105) shows dark purplish blue as background colour, which appears on head, in 2 nuchal spots, on tail, on margin of notum, on foot. Whole back covered with dense chrome yellow pattern of longitudinal lines, interrupted and accompanied by longish and irregularly shaped spots, and united by short transverse bridges, especially on head. Marginal yellow line is nearly continuous. Pattern of hyponotum consists mostly of short streaks; only along limit against light purplish blue foot a continuous yellow line. In Florida specimen preserved for 6 months yellow markings are chalky white as in BERGH'S slug.

Pattern of Puerto Rico animal less elaborate, but fundamentally the same as in BERGH'S and Florida specimens. Sole purplish blue with yellow spots (W). Colour of Brazilian slug faintly preserved. About 20 light stripes on notum, 12 on sides of body; narrow lines or rows of dots between stripes.

Tip of short conical tentacles curves over groove on its outer side. Rhinophores have brownish bases, blue clubs, and about 35 leaves (Florida). Small slug from Puerto Rico about 12 perfoliations. Animal from Florida with 12 unipinnate gills, one of which bifurcate, so that 13 tips result. Ground colour of branchiae purplish blue;

afferent and efferent vessels yellow, in preserved state white. In Brazilian slug 9 unipinnate gills, several of which with divided tips; branchial rhachis dark. Slug from Puerto Rico has 7 gills. Yellowish hyponotal glands around whole border of notum in Florida specimen, 3 posterior ones ("am Schwanzsegel" BERGH, p. 166) especially large. In animal from Puerto Rico 6 conspicuous glands around hind end. Anterior border of foot bilabiate, not notched.

Labial ring of Florida slug consists of 2 areae, 2.3 mm long and 3 mm broad, and a much narrower third (0.7 mm) between them. In specimen from Puerto Rico corresponding measurements are 0.5 × 0.5 and 0.5 × 0.1 mm. This animal has 2 further, outer areae with 2- and 3-cuspidate platelets, less regularly arranged in the Floridian slug. Height of yellow labial hooks up to 55 μ (Florida) and 22 μ (Puerto Rico). Their rhomboidal surface with long point flanked by short corners which appear as secondary cusps in Puerto Rican specimen (Fig. 106). Quincunxial arrangement of bases very regular.

Radula from Florida (Fig. 107) 5.6 mm long, 5.0 mm broad, has about 100 rows with 200 teeth per half-row. All teeth bicuspidate, have a longer upper cusp and up to 7 short denticles on under border of lower cusp. For description of these denticles teeth must be examined in side view. Cusps of outermost teeth blunt. Radula of animal from Brazil has 72 × 200 teeth; denticles very weak, often absent. Small slug from Puerto Rico: 47 × 35; teeth have up to 5 denticles. Of the 47 rows 12 are incipient.

Reproductive organs firmly packed in mesenteria. Globular spermatheca and female gland mass of equal size. Muscular efferent duct silky; vagina very wide. Semiserial arrangement of seminal reservoirs as in *H. edenticulata* (MARCUS 1967, fig. 71). The only, evidently fortuitous, difference lies in the exit of the insemination duct on level of short duct of spermatocyst in present *sycilla* from Florida, farther ectal in our *H. edenticulata*, not in WHITE's (1952, fig. 15). Small size and longish shape of spermatocyst is the same, and so are the 2 openings on the genital papilla, a nidamental one and one in common for efferent duct and vagina. No vestibular gland.

Colour pattern of *H. edenticulata* (White, 1952) with its rings

(MARCUS 1967, fig. 67) the most striking character to distinguish that species from *H. sycilla*. Labial elements of same fundamental type in both, but lateral corners or secondary cusps beside long median cusp are a peculiarity of *H. sycilla*.

45. **Doris bovena** Marcus, 1955 Fig. 108

MARCUS 1955, p. 131; 1963, p. 26.

CURAÇAO: Piscadera Baai, outer bay, under stones, 27.I. & 10.II.1966, and from *Halimeda*, 1.III.1966 (C), a total of 4 specimens. Piscadera, central part of inner bay, muddy, on *Rhizophora*, 0–1 m, 25.XI.1963 (H 1489), 1 specimen.

Further distribution: Aruba; Curaçao; Brazil, São Paulo.

Papillae of notum rather flat warts, big ones and smaller ones mingled. Preserved slug from second locality 11 mm long, 9 mm broad, 7 mm high. Has 11 gills, one of which with 2 tips. Radula has about 40 rows and 44 teeth per half-row, hence somewhat more than hitherto recorded.

New figure of reproductive organs of dissected slug (Fig. 108) shows bifurcation (io, q) at outlet of ampulla (au) better than first drawing (1955, fig. 118), a reconstruction from sections with ampulla much distended and deformed by autosperms.

46. **Siraius bicolor** (Bergh, 1884) Figs. 109-110

BERGH 1884, p. 655–657; ODHNER 1914a, p. 166 (*Doris bicolor*).

FLORIDA: Biscayne Bay, Norris Cut, under rocks (R. C. Work), 25.I.1967 (B), 1 specimen, 3 Kodachromes.

Further distribution: Adriatic, Trieste, Rovigno.

Preserved animal 7 mm long, 3.8 mm broad, 3 mm high; sole 6.5 × 2 mm. Colour alive a transparent white skin with brownish viscera shining through. Rhinophores white. On tip of dorsal warts some yellowish brown pigment. The bigger of these warts often frosted with opaque white glandular secretion.

Notum beset with warts of different size, the biggest are in the centre. Their distance from one another approximately equal to

their height. Between big warts many smaller ones, most densely set on sides; borders of notum jagged by projecting small warts, the yellow tips of which appear on the photographs examined with low power. Some spicules stand out from warts, others up to 0.7 mm long form horizontal pattern between tubercles. Rhinophores with about 12 perfoliations, flanked by 2 strong, round tubercles each. Ten slightly brownish unipinnate gills; the 3–4 anterior ones considerably bigger than hind ones. Branchial pocket surrounded by 6 big tubercles. Tentacles triangular; a groove not seen. Anterior border of foot bilabiate, notched in middle.

Labial cuticle has no rodlets, but some hexagonal markings as in *S. ilo* (MARCUS 1955, p. 136). Radula has 34 rows, its formula 4.44.0.44.4. Marginal teeth flat with brushy edges. Lateral hooks 26 μ high on either side of rhachis, increasing to 75 μ (40th tooth). Stomach large, free from digestive gland; right liver (caecum) free, small as in *S. kyolis* (MARCUS 1967, fig. 83, r).

The reproductive organs are similar to those of the other species of *Siraius*.

The warts of the notum and the rhinophoral and branchial valves distinguish *S. bicolor* from *S. ilo* and *S. kyolis*. In *Doris verrucosa* Cuvier these structures are stronger (MARCUS 1955, figs. 103, 108) than in *S. bicolor*; moreover all teeth of *D. verrucosa* are hamate. The colour of the Mediterranean specimens of *S. bicolor* differs from that of the present slug, but the colours are known to vary intraspecifically in many genera of doridids. The 3 specimens of *Doris ocelligera* (BERGH 1881, p. 95), for example, were coloured quite differently. That species has the same bosses around the pits of rhinophores and gills as the present one, but no pectinate marginal teeth.

47. **Siraius ilo** Marcus, 1955

MARCUS 1955, p. 135.

TRINIDAD: Caroni Swamp, mouth of the Blue River, from among sponges on the roots of *Rhizophora*, salinity about 25‰, 27.XI.1965 (Peter R. Bacon), 4 specimens.

Further distribution: Brazil, São Paulo and Rio de Janeiro; 19 specimens were seen.

The number of gills in *S. ilo* is 22, twice as many as in the 2 other species, *S. bicolor* and *S. kyolis*.

48. **Anisodoris worki** Marcus, 1967

MARCUS 1967, p. 66.

CURAÇAO: Piscadera Baai, outer bay, under a stone, 24.XII.1965 (C), 1 specimen.
FLORIDA: Biscayne Bay, Norris Cut, Virginia Key, under rocks, intertidal (R. C. Work), 5.III.1966 (B), 1 specimen.

Further distribution: Florida: Biscayne Bay, east end of County Causeway.

Colour of living specimen from Florida (photograph) as in holotype, measurements greater: length 45 mm, width 33 mm, against 28.5 and 16 mm. Preserved new slug from Florida 35 mm long, 16 mm broad, 10.5 mm high; holotype was 20.5, 11.5, and 6.5 mm. Preserved specimen from Curaçao 13 mm long, 8 mm broad, 4.5 mm high.

The colour, especially the large dark spots on the hyponotum, the cauliflower-like sculpture of the back, the strong muscular penial papilla, and the vaginal gland with spikelets in its duct characterize this species.

49. **Discodoris hedgpethi** Marcus, 1959 Figs. 111-114

MARCUS 1959c, p. 254; 1967, p. 75.

PUERTO RICO: Culebra Island, under a rock, 13.XI.1964 (W), 1 immature specimen. Vega Bay (L. Arnow and F. St. Clair), 12.XI.1960 (W), 1 juvenile nearly mature specimen. Cayo Májimo, under stone, 15.XI.1964 (W), 1 adult specimen.

Further distributions: Texas, Port Aransas; Florida, Biscayne Bay.

The following notes refer to the Puerto Rican specimens: Size of living animals 108 × 44 mm (crawling) and 54 × 34 mm (W); no notes available for middle-sized slug. Preserved specimens were 85 (measured over back) × 50 mm, 27.5 × 18, and 25 × 20 mm. Colour alive tan with brown spots and blotches (W). Photographs

show dark blotches irregularly distributed on notum of adult slug (Fig. 114) and in 2 rows of 3 between rhinophores and gills in youngest animal (Fig. 111). Spots on hyponotum bigger than on sole. Pigment also in rhinophores and gills.

Papillae on notum and smaller ones on back of foot are mamillate tubercles or blunt warts, according to more or less strong contraction. Spicules numerous, in less contracted papillae principally vertical and parallel, in more contracted ones converging toward tip and projecting. White pointed tentacles longer than broad. Rhinophores have about 25 leaves; 6 tripinnate or bipinnate gills. Anterior border of foot thickened, bilabiate, notched in middle of upper lip.

As in other species of *Discodoris* labial armature of simple rodlets, often somewhat rough, thickened toward tip; measure 100–120 × 8–12 μ, without relation to body length. Radulae 7 × 6, 2.4 × 2.7, 2.3 × 2.3 mm; have 50, 32, 22 rows, and 80, 52, 47 teeth per half-row, respectively. Teeth are smooth hooks; about 15 inner and about 4 outer teeth smaller than the others, the size of which reaches 240 μ. Stomach free.

Male and female reproductive organs of smaller specimen immature. Prostate (Fig. 112) a widened ental section of efferent duct. Thick clusters of glands form smooth outer surface. A 1.8 mm long penial papilla with blunt tip in globular male atrium. Pointed warts on penis papilla not cuticularized, those on its base larger. Female gland mass quite small, 0.8 mm long, 0.7 mm broad, 0.5 mm high. Seminal reservoirs empty. Vagina with principally circular musculature; epithelium thrown into spiral folds. Specimen from Vega Bay only little larger than that from Culebra Island, has massed prostate and some cuticularized spines on blunt, still small, penial papilla (3 mm). Prostate of large slug massed (Fig. 113), more voluminous than that of juvenile animal. Blunt penial papilla 11 mm long, beset with spines, especially strong at base. Gland mass big, 12 × 8 × 7 mm; seminal reservoirs filled. Vaginal epithelium with high folds, interrupted here and there, possibly torn.

50. **Discodoris pusae** Marcus, 1955 Fig. 115

MARCUS 1955, p. 147; 1967, p. 82.

FLORIDA: Biscayne Bay, Virginia Key, Norris Cut, under rocks, intertidal (R. C. Work), 16.II. & 5.III.1966 (B), 3 specimens.

Further distribution: Florida; Brazil, São Paulo (original locality).

Photograph of one slug (III.1966) shows ochre ground colour, darker in centre, stippled with greyish brown dots. Largest dots with white tips, possibly secretion. Rhinophores and gills dark with white tips. Preserved specimens 24 × 12 × 8 mm (II.) and 35 × 23.5 × 10 mm (III.). Notum nearly smooth with low gibbosities. Tentacles conical, in one specimen club-shaped; rhinophores have at least 20 leaves. Eight tripinnate gills.

Labial rodlets indistinctly stratified, 65 μ long, 10 μ thick (II.), and 30 × 6 μ (III.). Radulae measure 2.1 × 1.4 mm and 2.2 × 1.8 mm; and have 21 and 25 rows. Number of marginal teeth 12 (II.) and 8 (III.) per half-row, corresponding lateral teeth 23 and 40. Maximum height of lateral teeth 140 μ and 200 μ. Stomach indistinctly separated from central cavity of digestive gland.

Prostate (Fig. 115) clearly set off from efferent duct; its massed central part 5 × 3 × 2 mm. Material of III. contains 20 cm long, up to 4 mm high, egg string; capsules with 1–3 eggs (diameter 100 μ). As capsules and eggs lie over one another, their total was not counted but calculated to be about 100.000 eggs.

As previously (MARCUS 1955, p. 150) we compared *D. pusae* with 2 species from American Atlantic warm waters with similar radula and identical labial armature, *Geitodoris immunda* BERGH (1894, p. 167) from west Florida and Pacific coast of Panamá, and *G. mollina* BERGH (1905b, p. 66) from Puerto Rico. The latter, described from 1 specimen with mature germ cells, has no prostate. Also S-shaped prostate of *G. immunda* must be understood to be glandular part of efferent duct (ODHNER 1926a, p. 80, note), not as a massive organ. Fine serrulation on outer border of marginal teeth in *G. mollina* and *G. immunda*.

51. **Discodoris mortenseni** Marcus, 1963 Fig. 116

MARCUS 1963, p. 30.

CURAÇAO: Playa Grandi, Wacao, under stone, 23.I.1966 (C), 1 slug. Sta. Marta Baai, seepage in wall of coral debris between boulders, 22.XII.1963 (H 1504A), 1 specimen. Piscadera Baai, outer bay, under stones, 28.I. & 4.II.1966 (C), 3 specimens. Spaanse Water, under stone, 14.II.1966 (C), 1 specimen.
PUERTO RICO: Gata Island, under rock, 21.XI.1964 (W), 1 specimen.

Further distribution: Curaçao; Tobago.

Living specimen from Puerto Rico 28 mm long, 17 mm broad, hence bigger than slugs of first description. Colour alive greyish pink with opaque white speckling (W). Preserved, length is 28 mm, breadth 15 mm, height 5 mm. Sole white, 21 × 4.5 mm. Notum light greyish brown, slightly flecked. Rhinophores dark. Gills white, 8 mm from hind end, relatively far in front. Long slender tentacles are specific. Radula varies, though not beyond limits of first description; maximum number of rows 23 (Sta. Marta Baai). Slug from Spaanse Water (preserved 12.5 mm) has 18 radular rows, 35 teeth per half-row, and 1–2 outermost with subdivided cusps. In youngest animal (6 mm) 16 rows, 20 teeth per half-row, 3–4, exceptionally 5 marginal teeth thinner than others (Fig. 116) and with up to 7 points in oldest as well as in newest rows. Penis with a few spines (Sta. Marta Baai).

52. **Tayuva ketos gila,** subspec. nov. Figs. 118-120

CURAÇAO: Piscadera Baai, outer bay, under stones, 22.XII.1965 & 26.I.1966 (C), 2 specimens.

Preserved slugs have grey back with dark blotches, and white underside, sole with small dark spots. Shaft of rhinophores uniformly grey, foliations flecked.

Lengths 26 and 15 mm. Bigger slug 14.5 mm broad, 6.5 mm high. Width of hyponotum 6 mm; sole 24 × 7 mm. Six pluripinnate gills; rhinophores have about 20 leaves. Tentacles white pointed

cones. Anterior border of foot bilabiate with notch in upper lip.

Notal papillae not caryophyllidan, densely set, different in size, bigger and smaller ones mingled; higher than thick, contain numerous spicules projecting over tip of papillae.

Labial cuticle bears 2 triangular areae of rodlets, 0.8 mm wide, 0.3 mm long. Rodlets stratified, up to 90 μ high, 8 μ diameter at thickened tips. Radulae 2.7 × 2.8 and 2.17 × 2.16 mm. Teeth hook-shaped. Radula of bigger slug has 22 rows, 32 teeth per half-row; that of smaller animal 18 and 28. In both radulae innermost teeth coalesced with irregular denticles (Fig. 119). Height of hooks increases from rhachis outward reaching 230 μ a little beyond middle of half-row. Then height decreases to the 3–4 small outermost teeth. Peritoneum and blood glands dark; stomach and caecum free.

Winding ampulla (Fig. 120, au) contains long undulate autosperms. At exit of ampulla inner oviduct (io) and spermatic duct separate. Female duct merges into gland mass (em), male duct becomes prostatic (q) immediately. Prostate large, bent. Coiled muscular portion of efferent duct (d) ends in carrot-shaped, 0.5 mm long penial papilla (p) lodged in deep vestibule.

Vestibule contains also opening of vagina (v) and a 0.3 mm thick bundle of spicules in a diverticulum (x). Spicules 1.7 mm long, 6 μ thick.

Vagina (v) courses straight to ovoid spermatheca (se). Insemination (allosperm) duct (iu) leaves spermatheca near entrance of vagina, coils and receives duct of spermatocyst (sc) shortly before it enters gland mass (em). Consequently disposition of sperm-storing vesicles is serial type. Both vesicles contain allosperms, those in spermatocyst parallel. Nidamental opening (g) neighbouring to common male and vaginal aperture.

Present material differs from *Tayuva ketos ketos* MARCUS (1967, p. 192) from N E Gulf of California by penial papilla which is straight, while crooked in typical subspecies. The radular peculiarity of the Caribbean subspecies, though present in 2 animals, may be an anomaly.

53. **Aphelodoris antillensis** Bergh, 1879 Fig. 117

MARCUS 1963, p. 32; 1967, p. 92.

PUERTO RICO: Magueyes Island, living in *Porites*, 26.X.1957 (W), 1 specimen. Puerto Rico (no locality indicated), 3.III.1963 (W), photographs of 3 specimens and egg string.

Further distribution: Florida: near Alligator Reef Light; Virgin Islands, St. Thomas (original locality); Puerto Rico; Curaçao.

Living specimens of 1963 were approximately 15 mm long, 5 mm wide, tan, and speckled with brown and white (W). In one of them dark pigment in single concentration slightly in front of centre, in 2 others several dark blotches (Fig. 117). Black dots and short stripes in all specimens we have seen, but faded out in slug collected in 1957, as in original material described 20 years after preservation (BERGH 1879b, p. 108, 109). Melanins in preserved doridids often less resistant than in many other opisthobranchs.

Preserved specimen yellowish, 13 × 4.5 × 4 mm; sole 2 mm wide. Useful external specific characteristics, already mentioned by BERGH (1879c), are smooth notum with narrow, thin border, high sheaths of rhinophores, foot round and narrow in front. Present radula 42 rows, 66 teeth per half-row. From innermost 36 μ-high tooth size increases gradually to 160 μ in middle of half-row. Outwards teeth decrease gradually again. Spiral spawn with about 320 eggs.

54. **Platydoris angustipes** (Mörch, 1863) Fig. 121

BERGH 1877b, p. 503; WHITE 1952, p. 118 (*P. rubra*); MARCUS 1957, p. 422; 1967, p. 93.

ST. JOHN (Virgin Islands): Ram Head Bay, Poison Station (John Randall), 15.VIII.1962 (W), 1 specimen.

Further distribution: Dry Tortugas; Florida; Jamaica; Virgin Islands, St. Thomas and St. Croix (original localities, also of var. *alaleta*); St. Barts; Brazil, Pernambuco, Bahia.

Present preserved slug 35 mm long, 25 mm broad, 7 mm high. Sole 25 × 8 mm, hyponotum 8 mm broad. Body flat; yellowish

grey notum leathery, beset with minute spiculate papillae, appearing as granules. Epidermis rubbed off here and there as in a Brazilian specimen and in other species of genus (MARCUS 1957, p. 422). Dark border of notum rimmed with and interrupted by outer opaque white line. Tentacles long, digitiform, with lateral grooves. Lobed or crenulated openings of rhinophoral pits and stellate outline of branchial pocket as in other *Platydoris*.

Cuticle of labial disc smooth. Radula 40 rows with 72 smooth, hook-shaped teeth per half-row. Generally 2, occasionally 3 outermost teeth bear many short denticles, also in young rows (Fig. 121), hence not produced by wear. This denticulation, absent in original specimen from St. John, does not justify a special name (var. *alaleta* Bergh from St. Croix), as denticles occur also in *P. argo* (Linné) and other species of genus (BERGH 1877b, p. 501, 516; 1888, p. 803), the outermost teeth of which are rather variable. Oesophageal crop (MARCUS 1957, fig. 83, oi) distended by Hydrozoa, algae, sand, and small stones. The 2 blood glands dark grey; those of *alaleta* were slate-coloured, in the original material of *angustipes* yellowish, in Brazilian specimen brown. These differences systematically irrelevant.

Reproductive organs as in our first description (MARCUS 1957, p. 425). Efferent duct and vagina with spine-bearing cuticular discs; ectal penial gland as in congeneric species.

With ODHNER (1932, p. 36) we suppress BERGH's var. *alaleta*, but still hesitate to consider *angustipes* as a mere colour form of *argo*. The radulae, 33 rows and 44 teeth per half-row in *argo* (PRUVOT-FOL 1954, p. 248) and 45 × 85 in *angustipes* (MARCUS 1957, p. 424) differ considerably, but PRUVOT-FOL's formula is not the maximum of *argo*: 56 × 94 (BERGH 1877b, p. 501). The serrulation of the marginal teeth, generally present in *argo*, absent in *angustipes*, was stressed as a difference by BERGH (l.c., p. 504), but cannot be used for the separation of both species. The size, the shape of the body, and the narrow sole are similar in *argo* and *angustipes*, but the border of the notum, as recently described and figured of *P. angustipes* (MARCUS 1967, p. 94, fig. 112) is evidently distinctive of the West-atlantic species. The entrance of the vagina into the spermatheca,

and the exit of the insemination duct from it, are far from one another ("die Ausführungsgänge ziemlich weit von einander entspringend" BERGH 1877b, fig. 7) in *argo*. In *P. angustipes* these ducts are close together (MARCUS 1957, fig. 86). For this comparison RISBEC's *P. argo* (1956, fig. 5) must be left aside. We do not believe that RISBEC's species from Viet-Nam is actually *P. argo*, which occurs in the Mediterranean and the neighbouring E. Atlantic. BERGH (1905a, p. 135) mentioned 2 Indomalayan specimens as *P. argo*?, but the colours of the preserved slugs are not specific, and his conclusion "among the species of *Platydoris* this form seems to be nearest to the Mediterranean *P. argo*" does not justify the classification of another Indic specimen, also without notes of the colours alive.

55. **Hexabranchus morsomus** Marcus, 1962 Fig. 122

MARCUS 1962, p. 468.

PUERTO RICO: 11 km off La Parguera, 33 m (John Randall), 3.III.1963 (W), 1 specimen. Negro Bank, 15–18 m (John Randall), 3.XII.1961 (W) colour photograph.

Further distribution: Virgin Islands, Virgin Gorda, harbour of Spanish Town.

Preserved flat specimen 18 mm long, 9 mm broad, 4 mm high, hence much smaller than type-specimen (30 × 17 × 3 mm). Sole 16 × 3 mm. Colour photograph from Negro Bank (Fig. 122) shows 22.5 × 15 mm-slug with cream back ground colour, extensive yellow middle area with lateral radiations, red spots, and frilled red rim. Preserved specimen, from off La Parguera, yellowish with dark digestive gland shining through skin.

Tentacles large, flat flaps; rhinophores bear about 25 perfoliations. Radula 3.0 mm long, 2.7 mm broad, comprises 37 rows with 80 hook-shaped teeth per half-row.

This is the only Atlantic *Hexabranchus* and the first with rhachidian pseudo-tooth, i.e., a thickening without cusp, present in all rows.

56. **Aegires** cf. **sublaevis** Odhner, 1932 Figs. 123-124

ODHNER 1932, p. 39.

FLORIDA: E side of Soldier Key, 0.3 km off shore, muddy sand with scattered *Thalassia* and gorgonids, 1½–2½ m, 5.IX.1963 (H 1413), 1 specimen.

Distribution of *A. sublaevis*: Canary Islands, Tenerife, Puerto Orotava.

Animal (Fig. 123) 4 mm long, 2.5 mm high, about 1.5 mm broad. Uniformly brown, unspecific, as many invertebrates preserved in alcohol for a long time. Skin slightly rough, without papillae; a pallial ridge on either side from gills to pointed tail. Behind each short rhinophore an undivided lobe; 3 gills with a protective leaf in front of each.

Labial cuticle with belt of rodlets. Jaw (Fig. 124) light yellow, 280 μ long, 350 μ broad, semicircular with median projection on edge. Radula 530 μ long, 460 μ broad, with 13 rows of 13–16 teeth per half-row. Rhachis naked; teeth simple hooks. Height of 6 inner teeth increases from 35 to 80 μ, continues to 2 outermost teeth which are smaller.

Only species of *Aegires* without dorsal tubercles, *A. sublaevis* (*canariensis* ODHNER 1934, p. 242 is a lapsus) is similar to present slug, but single specimen of *A. sublaevis* considerably larger than that from Florida, which seems to be juvenile. Its differences from *sublaevis* might be due to different age. Shape of jaw, systematically important in *Aegires*, not known of original *A. sublaevis*. Jaw of present specimen similar to that of *A. protectus* ODHNER (1934, fig. 8), an Antarctic species, papillate all over.

57. **Polycerella conyna** Marcus, 1957

MARCUS 1957, p. 429; 1963, p. 33.

FLORIDA: Virginia Key, piling of Marine Laboratory, concrete pools in muddy water, tidal flow, 0–1½ m, 1.IX.1963 (H 1409), 3 specimens.

Further distribution: Florida; mainland of Venezuela; Brazil, São Paulo (original locality).

58. **Polycera odhneri** Marcus, 1955

MARCUS 1955, p. 158; 1958a, p. 51.

CURAÇAO: Piscadera Baai, outer bay, from *Halimeda*, 1.III.1966, (C), 1 specimen.

Furher distribution: Brazil, coast of São Paulo.

Living slug 10 mm long. Detailed description of external morphology and colours (C) together with radula guarantees the indentification.

59. **Polycera rycia,** spec. nov. Figs. 125–126

FLORIDA: Biscayne Bay, from mud flat south of Seaquarium (R. C. Work & W. J. Rees), 5.IV.1967 (B), 1 specimen.

Preserved slug 5 mm long, 3 mm broad, 4 mm high, including extrabranchial processes. General colour on photographs white. Region behind rhinophores, and tail transparent white, anterior part and middle region of body opaque white. Quite superficial brown, on tail black, chromatophores form irregular spots and threads. Some rare spots orange, principally on tail. Small white papillae all over body, also on extrabranchial processes.

Five velar processes with pointed tips and 2 rings, 1 more basal one of orange dots, 1 more apical entire ring black. There are obliquely united median processes, 2 on right and 1 on left side. On either side about 5 minute white papillae on pallial ridge in front of gills, further 8 on its caudal extension. Extrabranchial processes 2, blunt and longer than gills; second twice as high as first; they have white papillae and brown and orange dots. Such dots also on the 7 short gills.

Antero-lateral corners of foot protruding. Rhinophores with 9 leaves and terminal knob. Genital papilla of preserved slug salient in anterior third of right side.

Jaws very delicate, have upper, wing-like expansions. Radular formula 12 × 2.2.0.2.2. Innermost tooth 80 μ high, has 2 cusps on tip and a spur at base. Second lateral tooth 120 μ high, has apical

cusp and basal spur. Of first marginal tooth (52 μ) the inner tip is round, the outer angulate and a little lower. Outer marginal tooth 42 μ high, scaleshaped.

P. rycia is principally characterized by the prickly extrabranchial processes. Their general shape distinguishes *P. rycia* at once from *P. hummi*, *P. hedgpethi*, and *P. gnupa*, all with cylindrical smooth processes. *P. aurisula* with smooth, carrot-shaped processes is less different, but has 3–4 marginal teeth, and diverse colour pattern.

Lophodoris G. O. Sars, 1878

Small Goniodoridiidae with a broad notum which covers the head and passes to the large, undivided frontal veil. Long spicules in the skin. Oral tentacles short; gills unipinnate. Notum without pallial ridges and without appendages. Outer lateral (marginal) radular tooth with a hook. Ejaculatory duct with spines.

Type-species: *Lophodoris danielsseni* (Friele & Hansen, 1876).

Though the type-species and the present one differ in important characteristics, rhinophores and labial armature, we think that they have enough features in common to be united in one and the same genus. In *Goniodoridella* PRUVOT-FOL (1933, p. 117; BABA 1960, p. 81; ABE 1964, p. 85, coloured figure 67) the notum projects into 2 antero-lateral processes and bears 2 *Okenia*-like, long post-branchial appendages; the gills are bipinnate.

60. **Lophodoris scala,** spec. nov. Figs. 127-133

BRAZIL: Coast of São Paulo, 22°50′ S, 45°20′ W, Sept.–Oct. 1967, in tubes of muddy sand agglutinated by the mucus of an echiurid worm (Family Thalassemidae; Dr. A. S. Ferreira Ditadi coll. and det.), in the intertidal zone, 15–30 cm. Probably the slugs feed upon entoproctan Bryozoa (2 species of *Loxosomella*) attached to the wall of the tube (MARCUS 1968). About 50 specimens.

Living animals 2–2.5 mm long, 1 mm broad, transparent whitish with yellowish intestinal gland. Eyes not visible in living slug, they

lie between bases of rhinophores (ri). Skin contains refractive globular gland cells and nodose spicules (Fig. 129). These single, not united in bundles, up to 350 μ long, 17 μ thick. Lie around veil, borders of notum, to sides of centre of notum in parallel rows, and radially in the tail (Figs. 127, 128). Notum broad, smooth, without crest; stands out over foot on the sides; narrows in front of rhinophores and passes unbounded to wide, movable, semicircular veil (ve). Posterior corners of notum distinct. Foot broad, concave in front, narrow in middle and behind. Pointed hind end projects from under notum.

Beside mouth the labial tentacles (t), nearly as broad as long and high. Are strongly ciliated, as is seen in sections. Rhinophores (ri) smooth cones, located far behind anterior end, at a great distance from one another. The 3 gills (z) straight, peg-shaped or slightly lobed knobs situated between postero-lateral corners of notum, near hind margin of notum.

Labial armature (Fig. 131) consists of few platelets, the wide border of which bears several sharp cusps. Pharyngeal crop (in) broadly connected with buccal mass, not pedunculate. Radula (Fig. 132) has 19 rows of 1.1.0.1.1 teeth; their shape as in many Goniodorididae: inner tooth big, pointed hook with a series of about 30 tiny denticles on the outer side; outer tooth with 2 sharp points. Oesophagus enters folded stomach from ventral side. Pylorus dorsal. Intestine narrow, opens under central gill. Renal pore between base of this gill and anus. The expected Entoprocta or other contents of gut were not seen. Digestive gland mingled with ovotestis.

In spite of their smallness the slugs are mature and were seen in reciprocal copulation which lasts for about an hour in the aquarium at 22°C. Hermaphrodite gland (ov) interwoven with liver and followed by voluminous ampulla (au) filled with sperm. Male duct begins with a prostatic part (q) directed backward, turns forward, first thin, then thick and muscular. Under central nervous system the muscular portion runs to the right with cuticular spines in its outermost part. Small papilla projects into male atrium. Atrium, female gland mass (mu) and vagina (v) open (g) close together. Sphincter (zn) of vagina corresponds to that of *Goniodoris mimula* (MARCUS 1955, fig. 208, w). Spermatheca (se) empty. Entrance of

vagina into spermatheca and duct leading to spermatocyst lie side by side. Spermatozoa in spermatocyst (sc) arranged as is typical in receptaculum seminis. Insemination duct (iu) joins gland mass near entrance of inner oviduct (io).

Lophodoris danielsseni, the only other species of the genus, is best described by ODHNER (1922, p. 25–28). It has stronger labial tentacles; rhinophores of the general *Goniodoris*-type, viz. perfoliated behind and with a wide, smooth rhachis in front; 4–5 gills; notum jagged all around the margin and with a high, longitudinal crest; labial cuticle smooth, not composed of spinous elements. Except for the hooked ejaculatory duct the reproductive organs of *L. danielsseni* were not described.

61. **Okenia (Okenia) impexa** Marcus, 1957

MARCUS, 1957, p. 434; 1961b, p. 144.

PUERTO RICO: Mayagüez, 4 km off Añasco River, in deeper water, 14.IX.1963 (H 1416), 1 specimen.

Further distribution: Brazil, São Paulo; North Carolina, Beaufort.

62. **Okenia evelinae** Marcus, 1957

MARCUS 1957, p. 438; 1960a, p. 162.

FLORIDA: Biscayne Bay, Crandon Park Marina (R. C. Work & W. J. Rees), III.1967 (B), 12 specimens.

Further distribution: Brazil, São Paulo (original locality); Florida, Virginia Key.

Present preserved slugs up to 4 mm long, 1.7 mm high, and 4 mm broad. On photo animal is transparent white with yellow liver; skin contains opaque white flecks and some brown and pink tones.

63. **Dendrodoris krebsii** (Mörch, 1863)

MARCUS, 1963, p. 35; 1967, p. 95, 203.

CURAÇAO: Spaanse Water, under stone, 14.II.1966 (C), 1 specimen.
ST. KITTS: Frigate Bay, 20.VII.1955 (H 1397), 1 specimen.

Further distribution: West Atlantic Ocean: Virgin Islands (original locality); St. Kitts, Curaçao; Brazil, Rio de Janeiro and São Paulo. East Pacific Ocean: Lower California, oceanic side; Gulf of California; coast of México, Jalisco.

Slug from Curaçao chocolate brown in life (C), preserved notum blackish grey, darker in the middle, bears black border extending onto whitish grey hyponotum. Sole white with grey spots. Dark rhinophores and 6 tripinnate gills tipped with white. Measurements (in mm): length 12, breadth 6, height 2, width of sole 2.5.

64. **Tritoniopsis frydis,** spec. nov. Figs. 134-137

FLORIDA: Elliott Key, Margot Fish Shoal, 2–3 m, under rock (Gary Hendrix), 5.V.1966 (B), 2 specimens.

Preserved slugs 10 and 17 mm long, 5 and 7 mm broad, 5 and 6 mm high. As gills are folded, breadth can only be given approximately. Gills of smaller specimen preserved up to 3 mm long. Alive bigger animal (Fig. 134) bright orange yellow; smaller one cream with white branchial tufts. Back slightly nodulous, sheaths of rhinophores and stems of gills scaly papillose. Foot notched in front, not distinctly bilobate; pointed behind. Cephalic veil entire, expanded on both sides, forming grooved tentacles. Digitate simple appendages of velar border 9 in bigger and 13 in smaller slug. Longer and shorter appendages alternate irregularly.

Sheath of rhinophores (Fig. 135) wide, thin, somewhat prolonged anterolaterally. Surface bears papillae, border is lobed. Long cylindrical club surrounded by simple, thread-like plumes fastened to its middle. Threads united in indistinct groups which might correspond to pinnate plumes of other tritoniids. Notal rim bears great number of finely ramified gills of alternating size. Bigger slug has more than 20, smaller one 14 gills on either side. Branchial ramifications essentially dichotomous, not all branches continue bifurcating. In both animals genital opening under 4th branchial tuft. Anus in both a little in front of middle of body, under 9th tuft in bigger, under 7th in smaller specimen. Renal pore close behind anus.

Light yellow jaws of larger animal (Fig. 136) short and broad,

2 mm long, 1.5 mm wide. A small area of minute, blunt, granule-like platelets on each jaw. These areae asymmetrical on both mandibles. Radula of larger specimen 1.8 mm long, 0.22 mm broad, has 36 rows and 5–6 smooth lateral teeth per half-row. Rhachidian tooth (Fig. 137) 80 μ long, 50 μ broad, has single strong median cusp and 2 series of up to 12 small lateral denticles on underside. Size of lateral teeth decreases outward, their bases broader than in Fig. 137, drawn from the edge. Stomach without plates; its lining folded.

Viscera covered by lobes of ovotestis. One slug was kept entire. Inner organs of dissected slug brittle and sticking together, therefore reproductive organs not completely analyzed. Two tubes half everted from genital aperture, in front unarmed penis, behind it vagina. Nidamental duct opens independently. Glandular prostatic portion of efferent duct between ampulla (THOMPSON's vesicula seminalis, 1961, fig. 3) and penis; vagina continued into a thin bursa. Female gland mass large as in ODHNER's figure of *T. elegans* (1936, fig. 13).

Since ODHNER's survey of *Tritoniopsis* (1936, p. 1080) 2 species were described, *T. alba* BABA (1949, p. 84, 165) from Sagami Bay and Brisbane (KENNY 1960, p. 223), and *T. aurantia* MATTOX (1955, p. 8) from southern California. The latter belongs to *Toshuina* ODHNER (1963, p. 50) and is very near to, probably identical with, the type-species of this genus (MARCUS 1961a, p. 32). *T. brucei* ELIOT (1905, p. 22) from Gough Island in the southern Atlantic, the type-species of *Tritoniopsis*, differs from *T. frydis* by about 30 teeth per half-row and the dorso-median ridge giving off side ridges to the large branchiae. With less than 10 teeth per half-row and without a ridge *T. elegans* from the Red Sea, that is VAYSSIÈRE's *T. gravieri* (1912, p. 90), and *T. alba* come nearest to the present species. Their rhinophoral clubs, however, have quite short, spine-like plumes (*elegans*), or possibly none at all (*alba*). *T. elegans* has some, *T. alba* all lateral teeth denticulate. The rhachidian tooth of *alba* bears denticles as that of *frydis*, that of *elegans* is smooth (PRUVOT-FOL, 1933, pl. 4 fig. 53) like that of *brucei* (ELIOT 1905, figs. 17, 18).

According to VAYSSIÈRE (1912, p. 90), BALCH has seen a species of *Tritoniopsis* from the Antilles, but it was evidently not described.

65. **Doto chica** Marcus, 1960

MARCUS 1960a, p. 167; 1963, p. 39.

PUERTO RICO: Bahía Fosforescente, outer bay, muddy sand with algae, 4–5 m, 17.IX.1963 (H 1424A), 1 specimen.

Further distribution: Florida, E coast of Virginia Key (original locality); Curaçao, Piscadera Baai.

Preserved slug 2 mm long, has 4 pairs of 1 mm-high cerata with light tips, yellowish gland cells in epidermis, and melanophores in connective tissue, especially numerous in veil.

66. **Doto caramella wildei,** subspec. nov. Figs. 138-141

CURAÇAO: Piscadera Baai, from growth (algae, sponges, Hydrozoa) on the pillars of the sea fence of the Piscadera Baai Club, 21.I.1966 (C), 1 specimen.

Further distribution of *D. c. caramella*: Brazil, São Paulo.

Preserved specimen 5.2 mm long; back 1.4 mm high; cerata 1.4 mm high. Seven cerata on right, 6 on left side (Fig. 139). According to PETER DE WILDE's drawings (Fig. 138) living animal had white-tipped cerata with white tubercles and orange interspaces. Orange colour not preserved. Tubercles low and round, 4–6 of them form 4, exceptionally 5, rings around ceras. In living and preserved slug most tubercles of one and the same ring coalesced, forming slightly subdivided bulge. Two apical rings complete, 2–3 basal ones interrupted on inner side by insertion of ceras and by gill (Fig. 141). Gills on all cerata; they are so long and richly branched that their terminations stand out on inner side of cerata (Fig. 138).

Some melanophores on base of cerata and on sides of body. Tubercles frosted with white (C), probably secretion of so-called defensive glands. Margin of rhinophoral sheath smooth, slightly prolonged in front. Median cusp of radular tooth flanked by 3 denticles.

The subspecies is named for Drs. P.A.W.J. DE WILDE.

SWENNEN (1961, p. 70) restricted the importance of 2 characteristics used in the determination of preserved slugs of *Doto*, the margin of the rhinophoral sheath and the prominence of the gills. The latter is more reliable, because it can be examined in sections in cases of doubt.

In present animal tubercles are lighter than body (ODHNER, 1936, p. 1120, group II), but apical spots are not marked off. White tubercles and tips of the cerata combined with orange ground colour, distinct gills on the inner side of each ceras, and a few melanophores on back and sides as in present specimen occur also in *D. caramella* MARCUS (1957, p. 458). After publication of first description 5 further animals from São Paulo were seen. These have up to 5 pairs of cerata (MARCUS 1967, fig. 136) and pointed tubercles rather distant from one another, not coalesced. The gills are shorter and less branched than in present specimen, but variability of gills is known, e.g., in *D. amyra* MARCUS (1961a, p. 38).

Also *D. albida* BABA (1955, p. 25, 50) from Sagami Bay differs from *D. caramella wildei* by non-coalesced ceratal tubercles and shorter gills. *D. albida* has only 1–2 lateral denticles on radular cusp and irregular margin of rhinophoral sheath.

67. **Janolus comis** Marcus, 1955

MARCUS 1955, p. 170; 1958c, p. 32; 1960a, p. 176.

CURAÇAO: Piscadera Baai, outer bay, from *Halimeda* and other algae, 12.I. & 1.III.1966 (C), 2 specimens.

Further distribution: Florida, Virginia Key; Brazil, São Paulo.

68. **Capellinia conicla** Marcus, 1958

MARCUS 1958c, p. 41; 1960a, p. 176.

FLORIDA: Virginia Key, sand flat with *Cymodocea* and *Thalassia* beds, ½–2 m, 4.IX.1963 (H 1408), 2 specimens.

Further distribution: Florida, Miami area; Brazil, São Paulo.

69. **Catriona tina** Marcus, 1957

MARCUS 1957, p. 459; 1963, p. 43; EDMUNDS 1964, p. 6.

CURAÇAO: Piscadera Baai, central part of inner bay, *Rhizophora*, muddy, 0–1 m, 25.XI.1963 (H 1489), 1 specimen.

Further distribution: North Carolina, Beaufort; Florida, Miami area; Jamaica; St. Kitts; Bonaire.

SCHMEKEL (1968, p. 437–439) discusses and separates *Trinchesia* Ihering, 1879, and *Catriona* Winckworth, 1941.

70. **Catriona maua** Marcus, 1960

MARCUS 1960a, p. 177; 1963, p. 43; EDMUNDS 1964, p. 2.

CURAÇAO: Piscadera Baai, outer bay, sand, 3½ m, 29.XI.1963 (H 1453a), 3 specimens.
FLORIDA: Virginia Key, piling of Marine Laboratory, concrete pools in muddy water, tidal flow, 0–1½ m, 1.IX.1963 (H 1409), 4 specimens.

Further distribution: Curaçao; Bonaire: Jamaica, Port Royal; Florida, Virginia Key.

Preserved specimens from Curaçao up to 5 mm long, 1.5 mm broad, 1.5 mm high. Cerata 1.3 mm high, often dilated at tip; diverticulum of digestive gland in ceras sacculated. Small size of cnidosac compensated by adjacent pouch of hepatic diverticulum which functions as accessory cnidosac (EDMUNDS 1966a, p. 50). Present specimens stored many stenoteles measuring 31–39 × 20 μ.

71. **Learchis poica** Marcus, 1960

MARCUS 1960a, p. 183; 1963, p. 44; EDMUNDS 1964, p. 18.

CURAÇAO: Piscadera Baai, from algae and Hydrozoa at entrance of inner bay, 9.II.1966 (C), 1 specimen, 3.5 mm long preserved.
FLORIDA: Biscayne Bay, Virginia Key, off pilings at Marine Laboratory (E. McSweeny), III.1967 (B), 1 specimen.

Further distribution: Florida: Miami area (original localities); Jamaica; Curaçao; Ghana, West Africa (EDMUNDS, 1968a, p. 208).

New specimen from Florida (photograph) transparent white, frosted with opaque white flecks, has dark brown bases of cerata. Rhinophores have about 12 weak perfoliations. Radula with 20 teeth per half-row.

A valuable synopsis of the genera of the Facelinidae is given by SCHMEKEL (1966b, p. 44).

72. **Moridilla kristenseni** Marcus, 1963 Figs. 142-143

MARCUS 1963, p. 44.

CURAÇAO: Playa Lagoen, among algae, 30.XII.1965 (C), 1 specimen. – Piscadera Baai: Outer bay, from algae, 7. & 11.I.1966 (C), 2 specimens. Outer bay, sand, 4 m, 29.IX.1963 (H 1454), 1 spec. Entrance of inner bay, *Rhizophora*, sandy, 0–½ m, 14.XII.1963 (H 1460), 1 spec. Entrance, *Rhizophora*, sandy, 0–½ m, 14.XII.1963 (H 1463), 1 spec. Near entrance, sandy mud, *Thalassia*, ½–1 m, 11.XII.1963 (H 1465A), 1 spec. Southern part of inner bay, *Rhizophora*, sandy rock, 0–1 m, 19.XII.1963 (H 1469), 1 spec. Central part of inner bay, *Rhizophora*, rocky, 0–½ m, 13.XII.1963 (H 1473), several spec. Central part, *Rhizophora*, muddy sand, 0–1 m, 13.XII.1963 (H 1475), several spec. Central part, *Rhizophora*, 0–½ m (Louise J. van der Steen), 25.VII.1962 (H 1476), 2 spec. Northern part of inner bay, *Rhizophora*, muddy sand, 0–1 m, 11.XII.1963 (H 1485), 2 spec. Northern part, *Rhizophora*, muddy, 25.XI.1963 (H 1489), 1 spec.

Further distribution: Curaçao.

Maximum size of present preserved specimens 7 mm, exceeds that of the 2 original animals, 5–6 mm alive. EDMUNDS (1966a, p. 56) considers *Palisa papillata* EDMUNDS (1964, p. 12) from Jamaica and Florida, Miami, as a possible synonym for *Moridilla kristenseni*; his living animals were up to 16 mm long. Colour similar in both species; dark spots at base of ceras and just below cnidosac of *papillata* generally less obvious in *kristenseni*, due to many spots in between. Cerata differ by degree, as tips are more slender (EDMUNDS 1966a, fig. 14) than in *kristenseni*. Mandibular ratio of length to breadth 1.7 : 1 in *kristenseni*, 1.6 : 1 in *papillata*. In both species central cusp of tooth flanked by 4–6 denticles, contrasting with 2 in *Moridilla brockii* BERGH (1889b, p. 681; 1890, p. 878) from Java. Denticles of *kristenseni* smooth (Fig. 142), those of *papillata* ir-

regularly serrulate. In *kristenseni* denticles taller than in *papillata*. Breadth of tooth in *kristenseni* 55–67% of length, that of *papillata* (EDMUNDS 1964, fig. 9 B, C) 67–83%. Shape of arch formed by 2 limbs of base different in the 2 species. Except for number of denticles, the tooth of *kristenseni* approaches that of *M. brockii* BERGH (1889b, pl. 17 fig. 4) more than that of *papillata*.

Follicles of gonad in *kristenseni* and *papillata* with male cells in centre and female cells in peripheral pouches (Fig. 143, ov). Hermaphrodite duct quite short in *kristenseni*, of regular length in *papillata*. The latter has ovoid ampulla with ectal exit of spermoviduct (EDMUNDS 1964, fig. 10 A). Ampulla of *kristenseni* a tubular sac (au), and spermoviduct (ey) leaves it halfway between ends. In sectioned specimen autosperms in ampulla lie with heads directed to wall.

Seminal receptacle of *papillata*, EDMUNDS' spermatheca, a dilatation of inner oviduct, immediately ectal to its origin from spermoviduct; in *kristenseni* the receptacle (sc), a voluminous, longish sac, connected with inner oviduct (io) by long canal (s), the way of entering vagina and descending allosperms (insemination duct). These lie, as in other spermatocysts (seminal receptacles), with heads directed to wall. In PRABHAKARA RAO's description (1965, fig. 2d) of *Moridilla brockii* communication of seminal receptacle with inner oviduct is short; allosperms enter it by way of vagina emerging from glandular oviduct, without an outer vaginal opening. Further reproductive organs of *M. kristenseni* are a looping inner oviduct (io) which enters female gland mass (mu). This pallial oviduct opens (fa) beside male aperture (ma). Male duct (d) begins without glands, becomes glandular (q) in middle part and ends with muscular, long, thin, unarmed penis (p) located in deep male atrium (a). Penis 530 μ long, about 60 μ in diameter.

Moridilla kristenseni and *Palisa papillata* are different species; serrulate denticles of tooth and not pedunculate seminal receptacle of papillata justify generic separation from *Moridilla*.

73. **Phidiana lynceus** Bergh, 1867

MARCUS 1963, p. 45 (with field notes); 1967, p. 111; EDMUNDS 1964, p. 16.

CURAÇAO: Piscadera Baai, inner and outer bay, under stones and among *Thalassia* and algae, 16.XII.1965–1.III.1966 (C), 20 specimens. Outer bay, sandy pebbles, ½–2 m, 5.I.1964 (H 1458), 1 specimen.
BONAIRE: Kralendijk near Pasanggrahan rocky beach with some sand, low tide and lower zone, 20.IX. 1948 (H 1057 C), 1 specimen.

Further distribution: Pacific side of Panamá; Curaçao; Bonaire; Guadeloupe; Virgin Islands; Florida, Biscayne Bay; Brazil, Bahia, Rio de Janeiro, São Paulo.

Biggest preserved specimens 15 mm long. Most of them have an opaque white line which bifurcates in front of rhinophores, running to tentacles, and an opaque white line along each side. Connecting canal over right interhepatic space bears glandular cerata (MARCUS 1957, p. 470, fig. 215).

74. **Godiva rubrolineata** Edmunds, 1964

EDMUNDS 1964, p. 23; MARCUS 1967, p. 112.

BRAZIL: Near Ubatuba (23°27′ S, 45°06′ W), from *Padina*, tidal zone, 6.X. 1967, 1 specimen.
CURAÇAO: Piscadera Baai, northern part of inner bay, *Rhizophora*, muddy sand, 0–1 m, 11.XII.1963 (H 1485), 1 specimen.
FLORIDA: Biscayne Bay, Crandon Park Marina (R. C. Work & W. J. Rees), III.1967 (B), 1 specimen and photograph.

Further distribution: Florida. Virginia Key and Key Biscayne; Jamaica, Port Royal.

First right liver of Brazilian slug has 14 cerata, rough denticles on masticatory border, 27 radular teeth with 4–7 denticles on either side of median cusp, which is higher than in original material (EDMUNDS 1964, fig. 16 C).

75. **Dondice occidentalis** (Engel, 1925)

ENGEL 1925, p. 73; MARCUS 1958c, p. 62; 1963, p. 48; EDMUNDS 1964, p. 27.

CURAÇAO: Piscadera Baai, northern part of inner bay, on buoy, 0–½ m, 31.X. 1963 (H 1482), 1 specimen.

TRINIDAD: Caroni Swamp, among hydroids in the Blue River, about 1 mi. from the mouth, salinity 17.5‰, 25.IV.1967 (Peter R. Bacon), 3 specimens.

Further distribution: North Carolina, Beaufort; Florida, Miami; Jamaica (original locality); St. Martin; Bonaire; mainland of Venezuela; Brazil, Cananéia (25° S, 47°50′ W), from *Eudendrium* in subsaline water of a lagoon. – The record from Curaçao is the first from this island.

76. **Austraeolis catina** Marcus, 1967

MARCUS 1967, p. 112.

PUERTO RICO: Negro Bank, 15–18 m (John Randall), 3.XII.1961 (W), 1 specimen.

Further distribution: Florida, Biscayne Bay.

Present preserved slug 6.5 mm long, 1.5 mm broad, 2 mm high, hence a little bigger than animals of first description. Warts of penial disc, each bearing a tiny spine, are important specific characteristic.

A. fucia BURN (1962, p. 122), compared in our first description "is most likely a preserved, mutilated specimen of *Facelina hartleyi*" (BURN 1966c, p. 30). The 2 further species of *Austraeolis* described in BURN's paper (1966c) have penial tips different from *catina*.

77. **Favorinus branchialis** (O. F. Müller, 1806)

MARCUS 1955, p. 181 (*E. auritulus*); 1963, p. 49, 50 (*F. branchialis carneus* and *F. auritulus*); EDMUNDS 1964, p. 19 (*F. auritulus*).

CURAÇAO: Piscadera Baai, inner bay near entrance, sandy mud, *Thalassia*, ½–1 m, 11.XII.1963 (H 1465A), 1 specimen. Piscadera, northern part of inner bay, muddy debris, *Ulva*, 0–1 m, 25.XI. 1963 (H 1497), 1 specimen.
PUERTO RICO: La Parguera, Májimo sand flat with *Cymodocea* and scattered *Thalassia*, 1½–2½ m, 12.XI.1963 (H 1418), 1 specimen.
FLORIDA: Key Biscayne, NW swamp, drainage with tidal flow, about 10 m wide, with mangrove, 31.VIII.1963 (H 1412), 1 specimen.

Further distribution: Brazil, São Paulo; Curaçao; Antigua; Jamaica; Cape Verde Islands; Mediterranean; Atlantic coasts of Europe, S of Lofoten Islands; western Baltic Sea.

As several other opisthobranchs also *F. branchialis* seems to have a trans-Atlantic distribution. The tentative separations of the East Atlantic populations of this polymorphic species did not result in clear subspecies, and the same happens with the West Atlantic material. Not all amphi-Atlantic occurrences can be explained in the same way. For *F. branchialis*, a resistant species (ALDER & HANCOCK 1845, 2nd p. to Fam. 3, pl. 21), HECHT's description (1895, p. 554) of a regular transport by lobster boats with their underwater holes could be relevant, because the spiny lobster on the north-eastern coast of Brazil is fished by French boats.

Dr. MALCOLM EDMUNDS who had published *F. auritulus* from Jamaica (March 1964, p. 19) and later received our paper of 1963, wrote in a letter (8.IX.1964): "my example of *F. auritulus* is clearly *F. branchialis* on your classification". This statement led us to re-examine the specific value of *F. auritulus*, based principally upon the 3 bulbs of the rhinophores, seen in material from São Paulo and Curaçao. This characteristic can be examined only in living slugs, because the bulbs may disappear in preserved material (ALDER & HANCOCK 1855, p. IX; BERGH 1876, p. 641). EDMUNDS (1964, p. 22) records a specimen with 3 well-marked bulbs from Millport found together with typical animals of *branchialis* with a single bulb. The present preserved Puerto Rican slug has one rhinophore with 2, rather far basal, bulbs, not near the tip as ELIOT's *carneus* from the Cape Verde Islands (1906c, pl. 14 fig. 13), and the other rhinophore without bulbs. So the rhinophoral bulbs prove not to be a good taxonomic character. The same holds for the ratio of length to breadth of the penis (MARCUS 1955, p. 183, 184), because the measurements of the Jamaican *auritulus* (EDMUNDS, p. 21) are intermediate between *auritulus* from São Paulo and *branchialis* from the eastern Atlantic and the Mediterranean.

A smooth spur of the tooth and vestigial or distinct basal denticles on either side of it are no longer used as systematic distinctions for the European species. Therefore it seems advisable not to introduce this characteristic into the discussion of the American populations. We noted a spur with denticles seen with high power (São Paulo), with low power (Curaçao 1963), and without denticles at all (Curaçao, present material; Florida, present material) and Jamaica

(EDMUNDS 1964). The distance between the rows of denticles on the masticatory process of the jaw, wide (BERGH 1879a, pl. 8 fig. 4; LÖYNING 1922, fig. 66) and narrow (MARCUS 1955, fig. 262; EDMUNDS 1964, fig. 13 B) seems to distinguish European and American *branchialis*, respectively. There are, however, also narrow distances in European material (VAYSSIÈRE 1928, fig. 3). The present slug from Florida has small distances near the hinge, which become wider towards the free end of the process.

Living American animals reach a length of 12 mm. PRUVOT-FOL (1954, p. 400) indicated the same for Mediterranean material, but VAYSSIÈRE (1928) gave 15 mm (Marseille), TRINCHESE (1881a, p. 69, 70) 15 and 20 mm (Genova), COSTA (BERGH 1876, p. 641) 20 mm (Naples), and BERGH (1883, p. 41) 20 mm (Trieste). From the British and south Norwegian coasts up to 22 mm are recorded (ALDER & HANCOCK 1845, l.c.; LÖYNING 1922, p. 83), and from the Bay of Kiel 25 mm (MEYER & MÖBIUS 1865, p. 24). As 6 mm long mature specimens were found (LÖYNING, l.c.), and the American records are from few localities, the size cannot be evaluated for systematical purposes yet.

The same holds for the colour, the "curious variations" of which were stressed by ALDER & HANCOCK (1855, p. VIII). Food (HAEFELFINGER 1962, p. 313), age, and un-analyzed physiological factors influence the colour, so that its possible systematic (genetic) significance is very difficult to find out.

Eggs of opisthobranchs as food of European *F. branchialis* were observed by ALDER & HANCOCK (1845), MEYER & MÖBIUS (1865, p. 23) and HAEFELFINGER (1962). The cnidosacs of the present Puerto Rican specimen, devoid of nematocysts, suggest the same for American material. But the slugs from the coast of São Paulo, Curaçao, and Florida have nematocysts in their cnidosacs.

78. **Nanuca sebastiani** Marcus, 1957

MARCUS 1957, p. 474; 1963, p. 49.

CURAÇAO: Piscadera Baai, outer bay, among algae, 22.XII.1965–9.II.1966 (C), 12 specimens.

KLEIN BONAIRE: East coast near landing, rocky shore at sandy beach, tidal zone, 13.IX.1948 (H 1049A), 1 specimen.

BONAIRE: Kralendijk, near Pasanggrahan, rocky beach with some sand, ½–1½ m, 20.IX.1948 (H 1057 C), 1 specimen.

Further distribution: Curaçao; Brazil, Pernambuco.

In well preserved, up to 3.5 mm long slugs from Curaçao the cerata have light longitudinal striation overlying dark digestive gland. Striae produced by gland cells full of secretion.

79. **Aeolidiella lurana** Marcus, 1967 Fig. 144

MARCUS 1967, p. 115.

CURAÇAO: Piscadera Baai, inner bay, from algae, 25.I.1966 (C), 1 specimen. PUERTO RICO: Laurel Reef, under rocks, 23.XI.1964 (W), 1 specimen.

Further distribution: Brazil, Bay of Santos.

Puerto Rico specimen 9 mm long alive. Collector described its colours: "transparent, orange patch on top of head, also behind rhinophores. Two orange lines down back, also outlining pericardial prominence. Cerata with brown livers, white cnidosacs. Rhinophores smooth, orange bases, yellow tips. Tentacles smooth, transparent with yellow tips. Eyes tiny, black, at bases of rhinophores". Short processes of foot angles visible on photos. Slug had been dry, so that only radula could be examined. On photos about 5 anterior rows of cerata, and broad middle of back free.

Following characteristics refer to preserved 3.5 mm long specimen from Curaçao: Tail wanting, so that animal must have been longer. Tentacles 270 μ long, rhinophores 250 μ; both smooth. Cerata fusiform, up to 700 μ with 140 μ long cnidosac. Foot smooth, not notched in front. Cerata form short rows, each containing 4–5 cerata in anterior part of body, 3–4 in posterior part. Broad middle stripe of back free of cerata. Anterior liver comprises 4 rows; genital opening under third row. Anus situated behind first row of posterior liver, renal pore under this row, hence farther in front and to the side than anus.

Radula has 14 teeth (Fig. 144) of typical *Aeolidiella*-shape. Median cusp rather strong. Last tooth 116 μ broad, oldest 80 μ; the 2 largest teeth have 18–21 denticles to the sides of the median cusp, the

smallest has 16. Masticatory border of jaws smooth; penis unarmed.

Radulae of both slugs agree with that of single specimen from Santos, colour marks of which are slightly different from those from Puerto Rico. Preserved specimen from Santos 6.5 mm long. Therefore its arrangement of first 3 branches of posterior liver in arches, not in rows as in small slug from Curaçao, may be due to different age.

80. **Berghia creutzbergi,** spec. nov. Figs. 145-147

CURAÇAO: Piscadera Baai, outer bay, from algae, 26.I.1966 (C), 1 specimen.

Alive 15 mm long, brown with white spots on back and cerata. Tentacles had brown bases and white distal halves. In preserved specimen opaque white spots retained on back, cerata, tentacles, and in broad stripe between tentacles. Length of preserved slug 6 mm, breadth 1.4 mm, height 1 mm without cerata.

Tail quite short. Anterior pedal border transversely grooved; groove continues to protruding foot corners which are shorter than tentacles. Fore end of foot slightly concave. Lateral borders of foot folded, 0.5 mm broad. Tentacles and rhinophores about 1 mm long, the former wrinkled transversely, the latter beset with hemispherical tubercles on all sides and with terminal knob. Length of cerata up to 1.5 mm, cnidosac 0.3 mm. Many cerata tipped with a brush of exploded nematocysts. As in other Aeolidiidae (EDMUNDS 1966a, p. 65) these are mastigophores, but some few undischarged other types were seen in wall of cnidosac. Intestinal diverticula in cerata knobbed.

The 4 right liver groups of cerata (Fig. 146) can be understood to be one arch with double rows. Nine cerata in front of and 7 behind the everted penis. First right group of posterior liver forms arch of 6 cerata in anterior, 5 in posterior limb. Anus in angle of arch; renal pore in front of anterior limb. Also 2 following groups of cerata are arches, 3 hind ones, rows.

Oral tube everted, projects as disc with villosities (Fig. 147). Jaws extremely thin. Radula has 18 arched and pectinate teeth, not emarginated in middle. Central denticle smaller; on its sides

generally a bigger and a smaller denticle alternate. Broadest teeth 177 μ, with a total of 65 denticles; narrowest ones 132 μ and 40 denticles.

Curved unarmed penis protrudes from broad base.

The species is named for Dr. FREDERIK CREUTZBERG, Director of the Caribbean Marine Biological Institute, Curaçao.

The type-species of *Baeolidia* BERGH (1888, p. 777), *B. moebii*, has at least 3 anterior rows of cerata, defined by position of genital aperture. Anus opens between 6th and 7th row, but therewith its relation to first group of posterior liver is not indicated (TARDY 1962, p. 16). A right liver with more than 2 branches and anus lying in first arch of posterior liver occurs in *Berghia modesta* Trinchese, 1882, according to TARDY (1962) the same as *Berghia coerulescens* (Laurillard, 1830). By a diagnosis combining branching of anterior liver and location of anus *Baeolidia* and *Berghia* cannot be separated. However, *Baeolidia* need not be dropped, because flattened, leaf-like cerata, as in *B. moebii*, occur in some other Indo-Westpacific species too: *major* Eliot, 1903 (with colour variety *ornata* Eliot, 1903), *amakusana* Baba, 1937 (should be separated from *major* specifically), and *japonica* Baba, 1933. For bibliography of these species we refer to our earlier discussion (MARCUS 1958c, p. 68).

O'DONOGHUE's *Baeolidia moebii* (1929a, p. 796) from the Suez Canal may be BERGH's species; ENGEL & VAN EEKEN's *Baeolidia moebii* from the Gulf of Aqaba (1962, p. 28) with "digitiform cerata" can hardly be. *B. quoyi* PRUVOT-FOL (1934, p. 56), the cerata of which are unknown, has perfoliated rhinophores and belongs to *Spurilla* (ODHNER 1939, p. 88). PRUVOT-FOL's *Baeolidia moebii* (1953, p. 53) belongs either to *Baeolidia* or to *Berghia*; its cerata (fig. XVII, c) seem to be flattened, hence *Baeolidia*-like.

Aeolidiidae with tuberculate rhinophores and round cerata are now called *Berghia*; according to TARDY (1962) the name of the type-species is *B. verrucicornis* (A. Costa, 1864). This name must replace *B. coerulescens* in all reports of western Atlantic material.

In the following the species of *Berghia* are separated from *creutzbergi* by one or more characteristics:

B. coerulescens (Laurillard, 1830). Right liver richly ramified;

rhinophores with small posterior tubercles uniting into lateral lamellae; radular tooth emarginated (see TARDY 1962).
B. verrucicornis (A. Costa, 1864). Rhinophores with big posterior tubercles and lateral lamellae; radular tooth emarginated (see TARDY 1962).
B. norvegica ODHNER (1939, p. 85). Cerata stand in ziczac, double or more series in each arch or row; tooth emarginated.
B. fusiformis (BABA 1949, p. 113, 184). Cerata of anterior and posterior livers in single rows; rhinophores with posterior tubercles.
B. benteva (MARCUS 1958c, p. 65), described as *Baeolidia*. Right liver with 8 rows of 7 cerata each, first group of posterior liver with 5 rows; tubercles on posterior and outer sides of rhinophores; radular tooth emarginated.
B. dela MARCUS (1960 b, p. 924). Radular tooth emarginated.

Facelina agari SMALLWOOD (1910, p. 141) differs from *Berghia creutzbergi* by small tubercles on rhinophores and around their bases, and by an evidently different arrangement of the cerata (fig. 9).

81. **Limenandra nodosa** Haefelfinger & Stamm, 1958 Fig. 158

HAEFELFINGER & STAMM, 1958, p. 418.

BONAIRE: Lac, central part, sandy bottom with *Thalassia*, 3 m, 11.VIII.1967 (H 1570), 1 specimen.

Further distribution: French Riviera, on *Posidonia* and *Dictyota*.

The excellently preserved, well stretched specimen allowed for a comparison of all details with the original description. Except for the colour, necessarily different in living animals and a specimen in alcohol, the conformity is total.

82. **Spurilla neapolitana** (Delle Chiaje, 1823)

EDMUNDS 1964, p. 28; MARCUS 1967, p. 118.

CURAÇAO: Boca Grandi, Savonet, under stone, 26.II.1966 (C), 1 specimen. PUERTO RICO: Enrique Reef, on *Laurencia obtusa*, 30.X.1963 (W), 2 specimens.

FLORIDA: Soldier Key, Biscayne Bay (J. Halpern), 22.VII.1967 (B), 1 specimen.

Further distribution: Mediterranean, eastward to Turkey (SWENNEN 1961, p. 71); Atlantic coast of Europe and Morocco; Canary and Cape Verde Islands; Sargasso Sea; Texas; Florida; West Indies; Brazil, south to São Paulo. – First record from Curaçao.

The strongly contracted slug from Florida is 10 mm long, with tail folded under body. This quite adult animal has very richly ramified digestive gland penetrating into border of foot, spreading over heart and entering tentacles and rhinophores, where alternating big and small liver branches lie in the perfoliations. PRUVOT-FOL (1951, p. 55) and we (MARCUS 1955, p. 184) had observed an intense ramification of liver only in small slugs of *S. neapolitana*.

Coriocella Blainville, 1824

THIELE (1931, p. 265) united the Lamellariinae, i.e., the dioecious Lamellariidae with the radular formula 1.1.1 all in one genus. As in a previous paper (DU BOIS-REYMOND MARCUS 1958, p. 8 ff.) we prefer BERGH's subdivision (1886b, p. 175; 1886c, p. 12) into 3 genera, of which one comprises 3 subgenera. The genera are: *Marseniella* BERGH (1886d, p. 179; 1887, p. 251), the body whorl of which is separated from the minute spire; *Coriocella* with the ectal part of the efferent duct running within the body wall; *Lamellaria* Montagu, 1815, with the efferent duct lying free in the body cavity till it enters the penis. A cylindrical penis in *Coriocella* against a flattened one in *Lamellaria* (BERGH 1853, p. 101) was not confirmed by BERGH's later description (1886d, p. 222) nor by the present *Coriocella*.

According to the teeth 3 subgenera of *Lamellaria* can be distinguished:

1) *Lamellaria*, type-species *Helix perspicua* Linné (see BERGH 1853, p. 90), with lateral denticles on the cutting edge of the median tooth and denticles on both sides of the lateral teeth.

2) *Djiboutia* Vayssière, 1912, with the single species *D. verrucosa* (p. 122), without lateral denticles on the edge of the median tooth,

and only 1 denticle on the inner side of the lateral tooth. The reproductive organs of the single specimen are not known.
3) An Atlantic group of species (ODHNER 1926b, p. 34–35) differs from the others by an entire, not bifurcate, base of the median tooth.

The oldest species of this group, which deserves subgeneric rank, is *Lamellaria pellucida* Verrill, 1880 (BERGH 1886d, p. 168; 1887, p. 239).

83. **Coriocella fella,** spec. nov. Figs. 148-154

FLORIDA: Biscayne Bay, Virginia Key, Norris Cut, under rocks, intertidal (R. C. Work), 16.II.1966 (B), 2 specimens.

Preserved specimens 15.5 mm (♂, holotype), and 12.5 mm (♀) long, 12 and 10 mm broad, 8.5 and 7 mm high. Mantle and mantle border smooth, colourless. Hyponotum, head, dorsal side of foot pigmented. Lining of roof of shell cavity has black blotches.

White, glossy shells (Figs. 148–152) of male (and female) semitransparent, 12 (9) mm long, 10 (7) mm broad, 6 (4.5) mm high. Greatest diameter of aperture 9 (7) mm. There are $3\frac{1}{4}$ ($3\frac{1}{3}$) whorls, and the first is the nuclear whorl. As border of body whorl is incompletely calcified (BERGH 1886d, p. 152, 176), and its conchinous rim dries irregularly, measurements of shell are somewhat arbitrary. Growth lines fine; whorls very convex; suture deeply impressed; second whorl enlarges rapidly.

Tentacles with longitudinal furrow on underside and basal eyes (Fig. 153); tentacles of male broad triangular flaps, those of female a little narrower, but this depends upon contraction. Nor is position of inhalant siphon a specific characteristic; in ♂ it is dorsal to left tentacle, in ♀ median. Foot narrower and shorter than mantle and rather smooth. Osphradium has about 38 (♂) and 30 (♀) leaves on either side, its left part a little narrower. Ctenidium has 38 (40) leaflets, these 5.5 (3) mm long.

Muzzle somewhat evaginated. Strong jaws 1.65 (1.4) mm in dorsoventral, 1.4 (1.0) mm in antero-posterior direction. Radula (Fig. 154) has 74 (62) rows. Median tooth with 2–5 denticles on right side of cusp. Denticles develop late; are absent in 36 last formed, youn-

gest teeth. About 8 of the 62 median teeth of the ♀ have 3–4 extremely small denticulations on left edge of cusp. Denticles of lateral teeth are 3–6 (5–6) big ones on inner and 4–10 (8–11) small ones on outer side.

Hind end of visceral sac of ♂ empty. Then follows, still in spire, the racemose testis. Coils of efferent duct in body cavity are empty too; straight section within body wall rather wide, but narrows in outermost, penial course, also empty in present ♂. Penis (Fig. 153) curved, flattened, thinner in middle than in outer third, slender again towards tip. Whole organ 1.5 mm long, up to 0.6 mm broad.

Big ovary extends to hind end of visceral sac. Transversely in front of it lies gland mass, resembling FRETTER's figure 3 (1946). Its hind end is embedded in digestive gland, bears several end sacs of seminal receptacle; outer end opens near anus.

BERGH (1898c, p. 563–564) mentioned several of the difficulties in the determination of a lamellariid. We could define the present ♀ by the radula which agrees with that of the ♂ from the same locality. Also the rapidly enlarging second whorl and the strongly convex whorls separated by deeply impressed sutures (Fig. 151, 152) guarantee the classification.

The descriptions of the species of *Coriocella* (DU BOIS-REYMOND MARCUS 1958, p. 9–10) were compared with *C. fella* and found morphologically different. Geographical viewpoints are especially inadequate to the taxonomy of the lamellariids, the larvae of which have a long planctonic life and were found in the open ocean (SIMROTH 1895, p. 29 ff.; THORSON 1961, p. 466).

Due to its globose shell with rapidly enlarging whorls *Lamellaria patagonica* E. A. SMITH (1881, p. 32) from the south Atlantic Ocean was allotted to *Coriocella* (BERGH 1887, p. 285); CARCELLES (1950, p. 59; 1951, p. 284) and POWELL (1951, p. 122) call it *Lamellaria*. None of the colour photos which accompany the present lamellariids from Florida shows the dirty yellow ground colour of the mantle with lines and blotches of light vandyke brown as described for *patagonica*, and none of the snails has equal legs of the median tooth. A ♀ from the Fiji Islands classified as *Chelyonotus* (that is *Coriocella*)

patagonicus (BERGH 1905b, p. 112) had unequal legs of the rhachidian tooth, but also this cannot be *C. fella*, because its reddish grey back was traversed by anastomosing black lines.

SCHWENGEL's 2 species from Florida with naticoid shells (PERRY & SCHWENGEL 1955, p. 126–127) can neither be identified with the present species nor safely separated from it, because neither the radulae nor the male organs were described. The cusp of the rhachidian tooth in the species that we classified (MARCUS 1962, p. 480) als *Lamellaria leucosphaera* Schwengel, 1942, does not agree with the present material.

84. **Lamellaria perspicua perspicua** (Linnaeus, 1758)

Figs. 155-157

FLORIDA: Biscayne Bay, Virginia Key, Norris Cut, under rocks, intertidal (R. C. Work), 16.II.1966 (B), 2 specimens. Same locality and same collector, 8.V.1967 (B), 1 specimen.

Further distribution: In all seas with exception of the Arctic and Antarctic ones; recently also from the Pacific American coast (MARCUS 1967, p. 145).

The 2 snails of 1966 are ♂♂, 17 and 18.5 mm long, 12.5 and 18 mm broad, 8 and 9 mm high. Border of mantle and foot undulate; the back, at least of bigger specimen, slightly gibbous.

Obliquely auriform shells (Fig. 155) white, semitransparent, glossy; comprise 3 or a little more than 3 whorls. Measurements (in mm): length 11, 12; breadth 7.8, 8.5; height 4.0, 5.0; greatest diameter of aperture 9.3, 10.0. Suture, though impressed, not as deep as in *C. fella*, and convexity of whorls correspondingly less pronounced.

Radulae have 48 and 45 rows, hence considerably less, than ♀ of *C. fella*, which is of comparable body length (12.5 mm). A neck-like constriction between base and cutting edge of median tooth (Fig. 157) is somewhat atypical, but does not require a special denomination. Denticles occur on right and left side of central cusp.

Penis of bigger ♂ is 9 mm long, 2 of which belong to flagelliform tip.

The only sure difference between *Coriocella* and *Lamellaria* consists of the location of ectal part of efferent duct within body wall (*Coriocella*) and free in body cavity (*Lamellaria*). Female of 1967, from same locality as couple of *Coriocella fella*, could be classified only by the shell, because deep suture in *Coriocella* (Fig. 151, 152) differs by degree from shallower one in *Lamellaria* (Fig. 156). Preserved ♀ of *L. perspicua* from Norris Cut 30 mm long, 24 mm broad, 12 mm high; shell measured 18.5 × 13.5 mm. A little higher snails, 30 × 23 × 21 mm, were recorded from the Gulf of Ancud (41°48′ S, 73°21′ W), the shell of which was 22 × 18 mm (MARCUS 1959a, p. 13). These snails nearly reach maximum of *L. perspicua* from Naples (BERGH 1887, p. 228–229) with 33 × 28 × 17 mm body size and 19 × 14.25 × 8.5 mm shell. Shell of ♀ from Norris Cut has 3 whorls; radula has 60 rows, hence less than animals from Chile with nearly 4 whorls and up to 93 rows. Number of whorls of big specimen from Naples not indicated; its radula has 51 rows, while smaller snails had up to 74 (BERGH 1887, p. 232). Rhachidian tooth of ♀ from 1967 bears 4–8 denticles on either side of cusp; limbs of this tooth unequal; lateral teeth have 6–7 coarse inner and 15–17 fine outer denticles.

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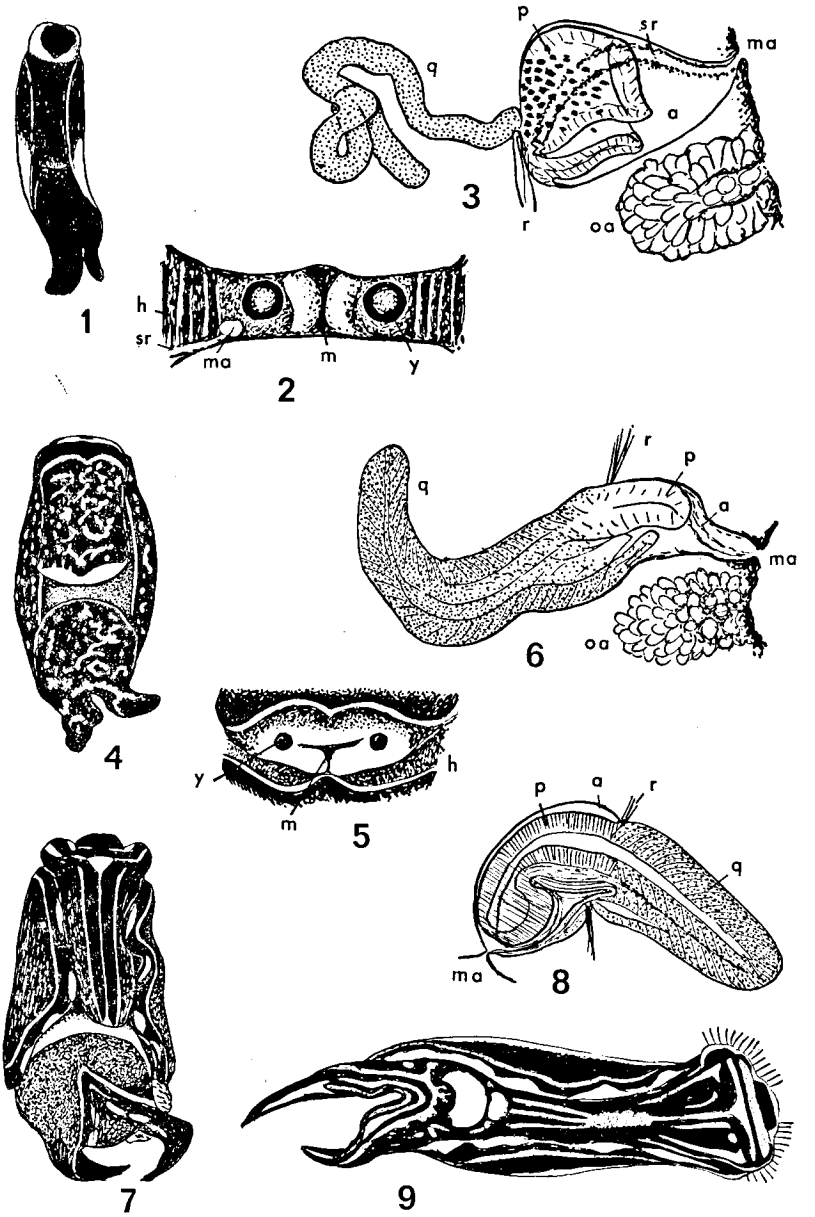


Fig. 1–3. *Aglaja felis*, spec. nov., from Puerto Rico. — 1. Living animal, from photo (W). – 2. Face of preserved specimen. – 3. Male copulatory organ. a – male atrium; h – Hancock's organ; m – mouth; ma – male opening; oa – anterior foot gland; p – penis; q – prostate; r – retractor; sr – seminal groove; y – eye.

Fig. 4–6. *Aglaja hummelincki*, spec. nov., from Puerto Rico. — 4. Preserved animal – 5. Face of same. – 6. Male copulatory organ. a – male atrium; h – Hancock's organ; m – mouth; ma – male opening; oa – anterior foot gland; p – penis; q – prostate; r – retractor; sr – seminal groove; y – eye.

Fig. 7–9. *Chelidonura hirundinina* (Quoy & Gaimard, 1833). — 7. Preserved animal from Curaçao. – 8. Male copulatory organ. – 9. Living snail, from kodachrome (B). a – male atrium; ma – male opening; p – penis; q – prostate; r – retractor.

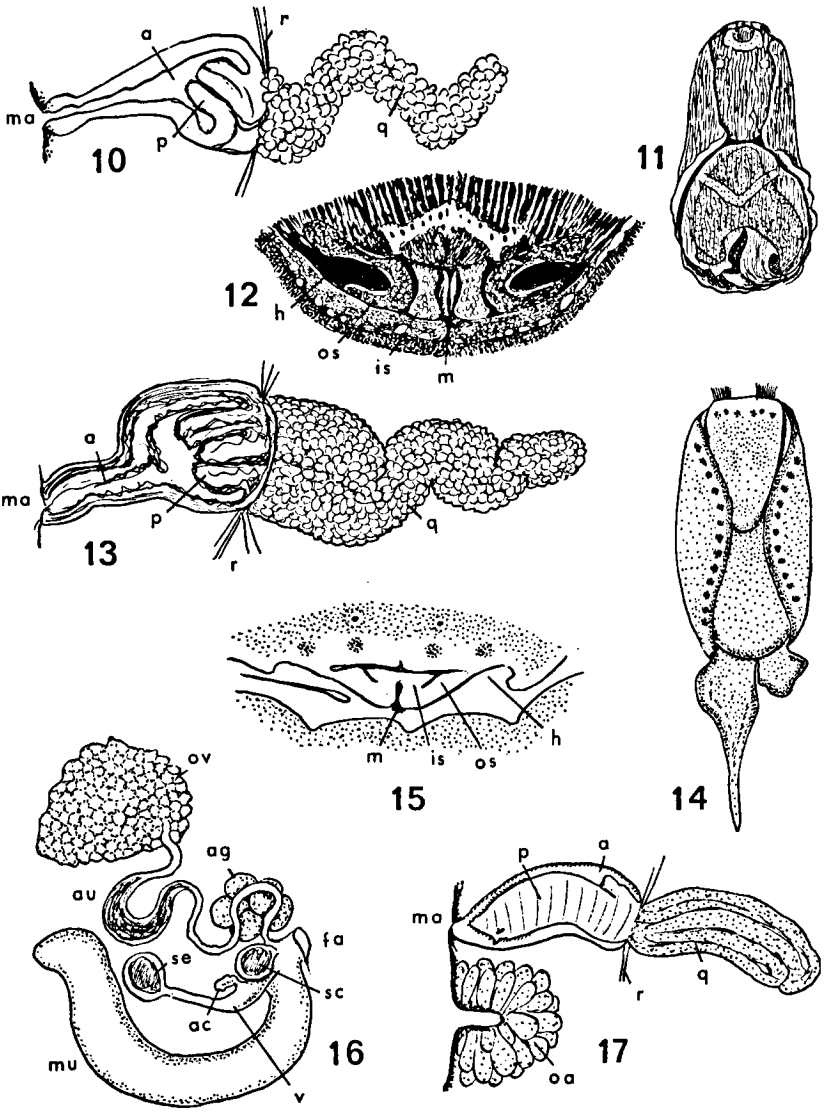
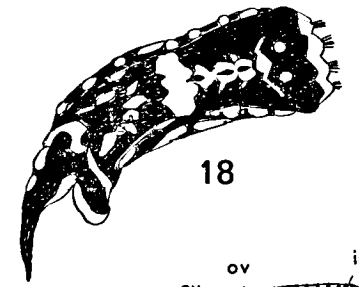


Fig. 10. *Chelidonura evelinae evelinae* Marcus, 1955, from Ubatuba, Brazil. — Male copulatory organ; a – male atrium; ma – male opening; p – penis; q – prostate; r – retractor.

Fig. 11–13. *Chelidonura evelinae dica*, subsp. nov., from Curaçao. — 11. Preserved animal with outline of shell. – 12. Head of preserved animal. – 13. Male copulatory organ. a – male atrium; h – Hancock's organ; m – mouth; ma – male opening; p – penis; q – prostate; r – retractor.

Fig. 14–17. *Chelidonura sabina*, spec. nov., from Sabine Island. — 14. Living animal after sketch by Dr. N. R. Cooley; densely stippled border: orange; hatched spots: blue; sparely stippled: brown. – 15. Head of preserved animal. – 16. Reproductive organs. – 17. Male copulatory organ. a – male atrium; ac – accessory gland; ag – albumen gland; au – ampulla; fa – female aperture; h – Hancock's organ; is – inner sensory knob; m – mouth; ma – male opening; mu – mucus gland; oa – anterior foot gland; os – outer sensory knob; ov – ovotestis; p – penis; q – prostate; r – retractor; sc – spermatocyst; se – spermatheca; v – vagina.



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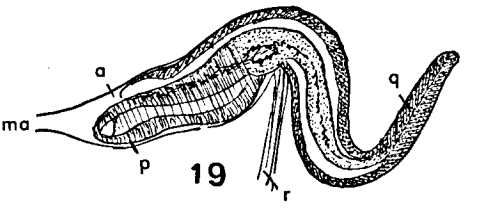

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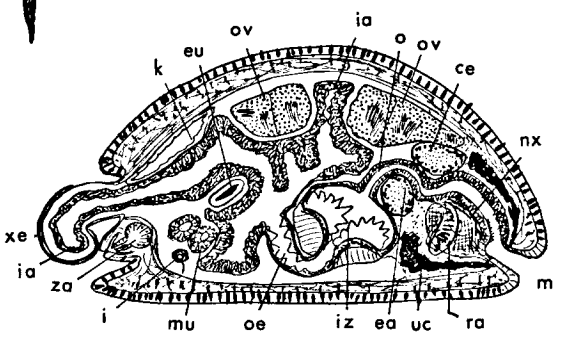

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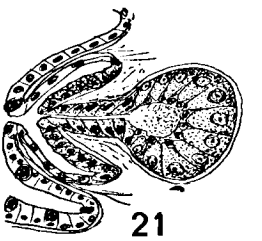

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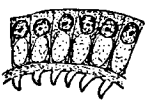

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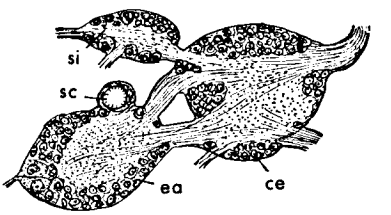

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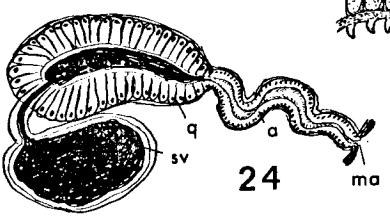

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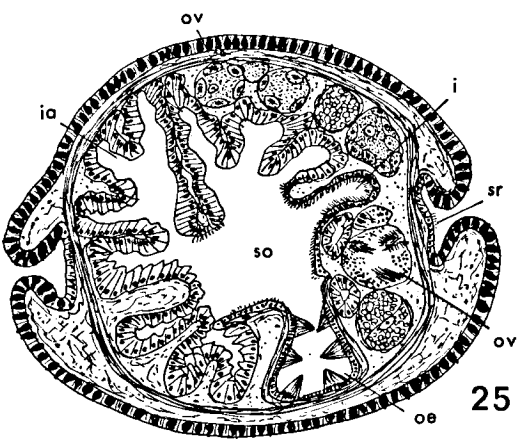

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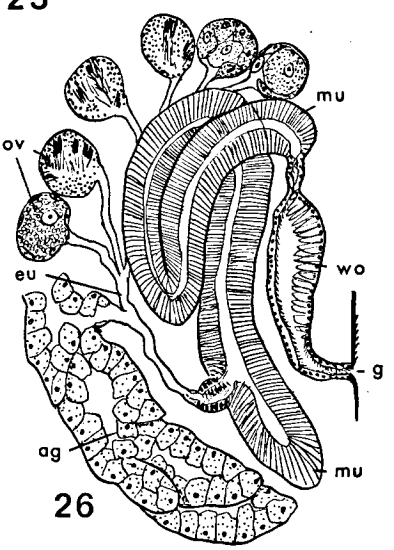

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Fig. 18–19. *Chelidonura berolina*, spec. nov., from Puerto Rico. — 18. Living animal, from photo (W). – 19. Male copulatory organ. a – male atrium; ma – male opening; p – penis; q – prostate; r – retractor.

Fig. 20–26. *Lapinura divae* (Marcus, 1963), from Curaçao. — 20. Combined sagittal section. – 21. Sagittal section of pallial gland. – 22. Section of jaw elements. – 23. Lateral section of nerve ring. – 24. Male copulatory organ. – 25. Transverse section on level of stomach. – 26. Diagram of reproductive organs. a – male atrium; ag – albumen gland; ce – cerebro-pleural ganglion; ea – pedal ganglion; eu – hermaphrodite duct; g – genital opening; i – intestine; ia – digestive gland; iz – gizzard; k – kidney; m – mouth; ma – male opening; mu – mucus gland; nx – pharynx; o – oesophagus; oe – second oesophagus; ov – ovotestis; q – prostate; ra – radula; sc – statocyst; si – supra-intestinal ganglion; so – stomach; sr – seminal groove; sv – sem. vesicle; uc – oral glands; wo – widening oviduct; xe – shell; za – pallial gland.

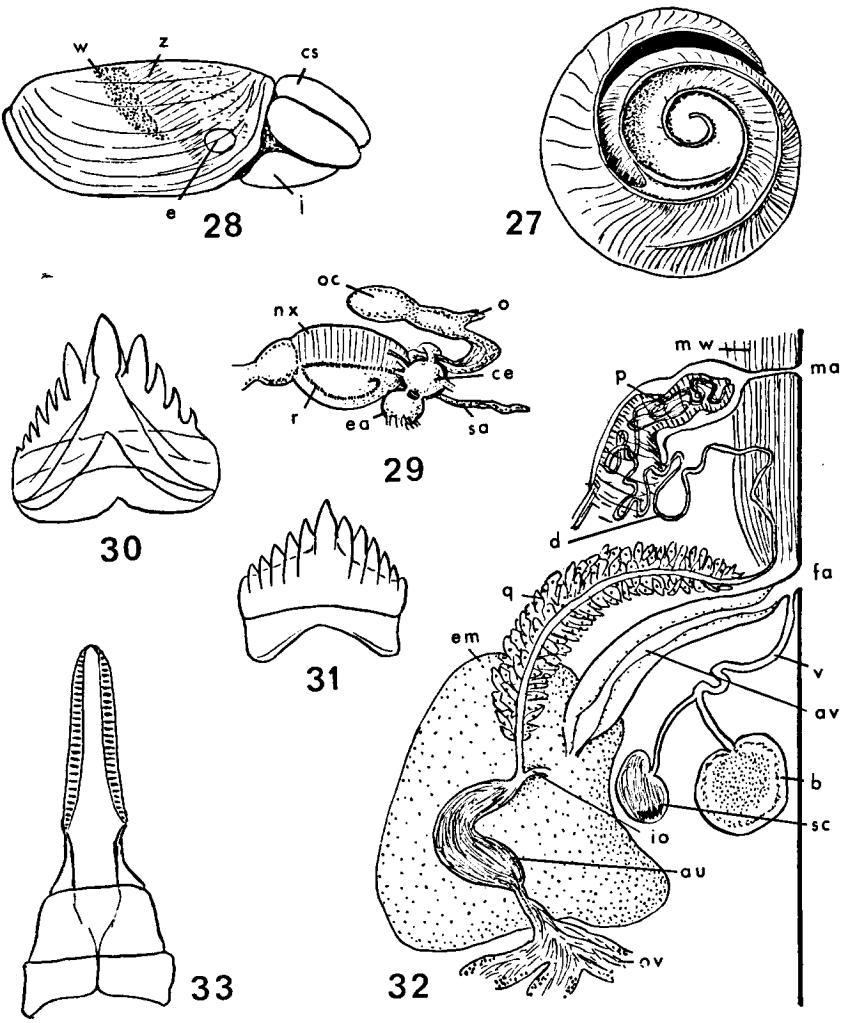


Fig. 27–32. *Cylindrobulla beaui* Fischer, 1856. — 27. Apical view of shell. – 28. Right side view of preserved snail. – 29. Pharynx. – 30. Radular tooth from Florida. – 31. Radular tooth from Curaçao. – 32. Diagram of reproductive organs. au – ampulla; av – pallial oviduct; b – bursa; ce – cerebro-pleural ganglion; cs – cephalic shield; d – efferent duct; e – adductor muscle; ea – pedal ganglion; em – female gland mass; fa – female aperture; io – inner oviduct; j – foot; ma – male opening; mw – muscle layer of body wall; nx – pharynx; o – oesophagus; oc – oesophageal pouch; ov – ovotestis; p – penis; q – prostate; r – retractor; sa – salivary glands; sc – spermatocyst; v – vagina; w – hypobranchial gland; z – gill.

Fig. 33. *Cylindrobulla ulla*, spec. nov., from Brazil. — Radular tooth.

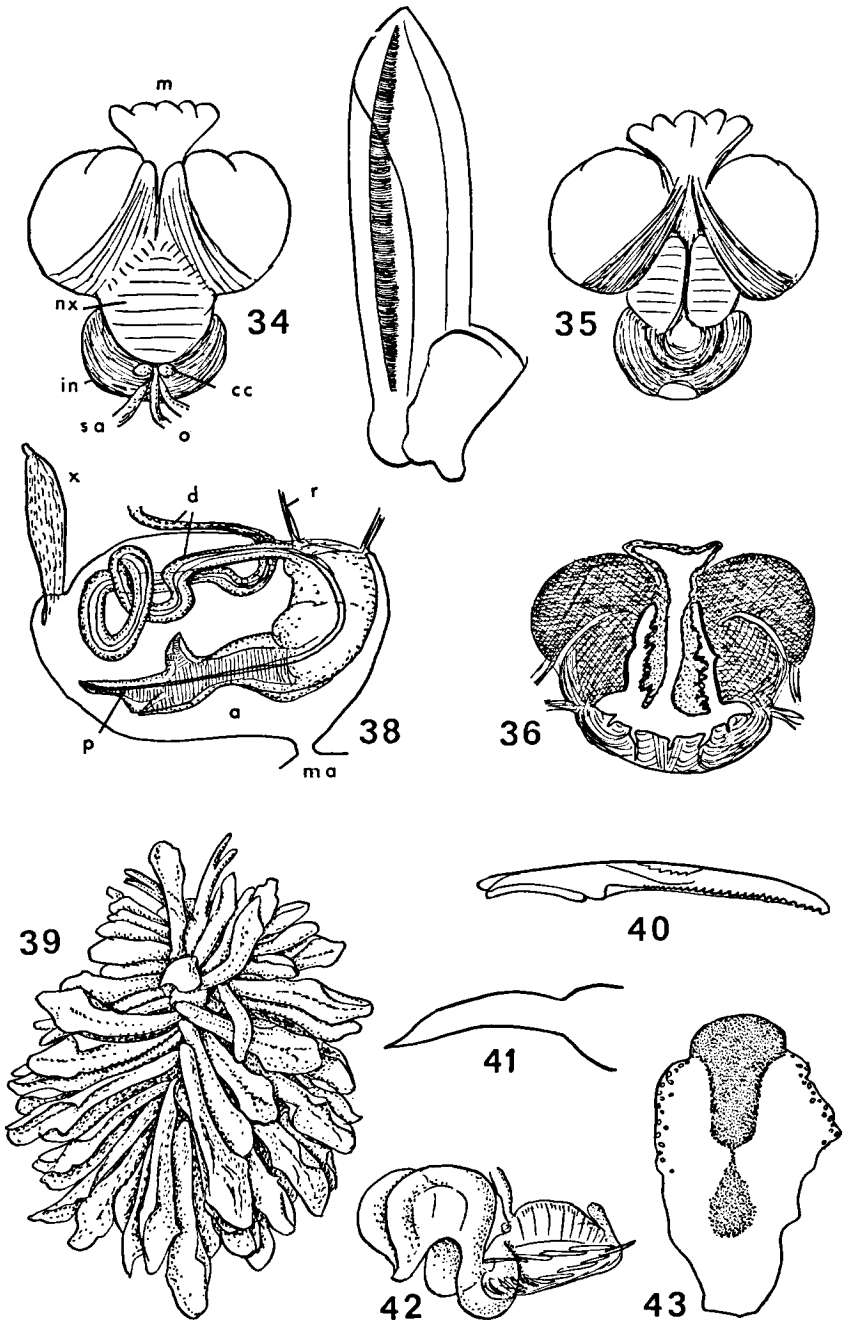


Fig. 34–38. *Oxynoe antillarum* Mörch, 1863. — 34. Anterior part of alimentary tract, dorsal view. – 35. Same, ventral view. – 36. Same, transverse section. – 37. (top centre). Radular tooth. – 38. Male copulatory organ. a – male atrium; cc – buccal ganglia; d – efferent duct; in – crop; m – mouth; ma – male opening; nx – pharynx; o – oesophagus; p – penis; r – retractor; sa – salivary gland; x – atrial diverticulum.

Fig. 39–43. *Cyerce cristallina* (Trinchese, 1881). — 39. Living slug, Florida, from kodachrome (B). – 40. Radular tooth. – 41. Penial stylet. – 42. Pharynx and pharyngeal crop. – 43. Preserved ceras.

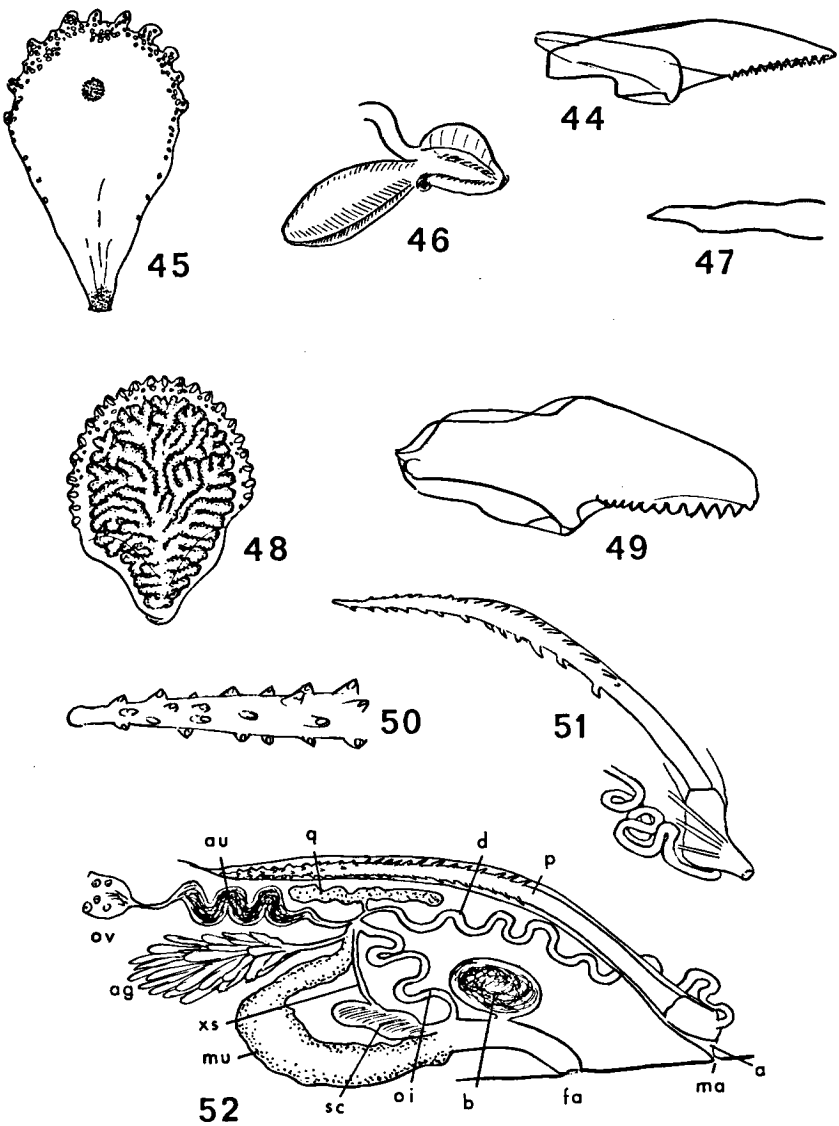


Fig. 44–47. *Cyerce antillensis* Engel, 1927. — 44. Radular tooth. – 45. Ceras. – 46. Pharynx and pharyngeal crop. – 47. Penial stylet.

Fig. 48–52. *Phyllobranchillus viridis* (Deshayes, 1857) from Curaçao. — 48. Ceras. – 49. Radular tooth. – 50. Tip of penis. – 51. Male copulatory organ extracted from sheath. – 52. Diagram of reproductive organs. a – male atrium; ag – albumen gland; au – ampulla; b – bursa; d – efferent duct; fa – female aperture; ma – male opening; mu – mucus gland; oi – vaginal duct; ov – ovotestis; p – penis; sc – spermatocyst; xs – duct of spermatocyst.

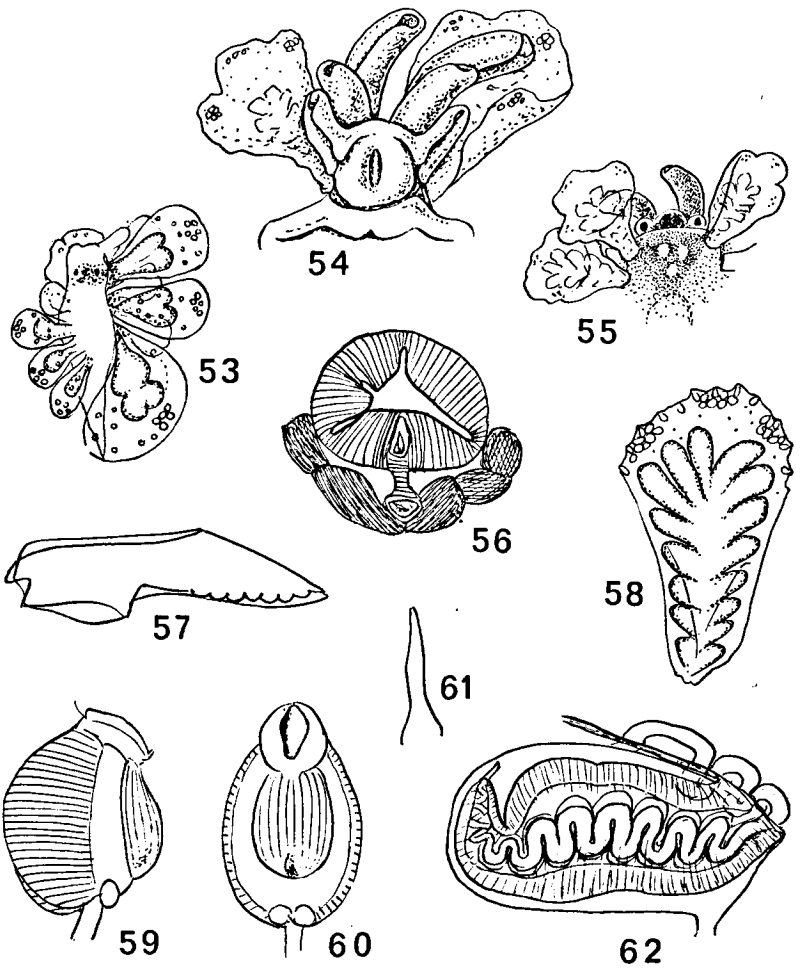


Fig. 53–62. *Mourgona murca*, gen. nov., spec. nov., from Curaçao. — 53. Living specimen, 1.5 mm long, from sketch (C). – 54. Head of preserved specimen, ventral view. – 55. Same, dorsal view. – 56. Transverse section of pharynx. – 57. Radular tooth. – 58. Ceras. – 59. Side view of pharynx. – 60. Ventral view of same. – 61. Penial stylet. – 62. Male copulatory organ.

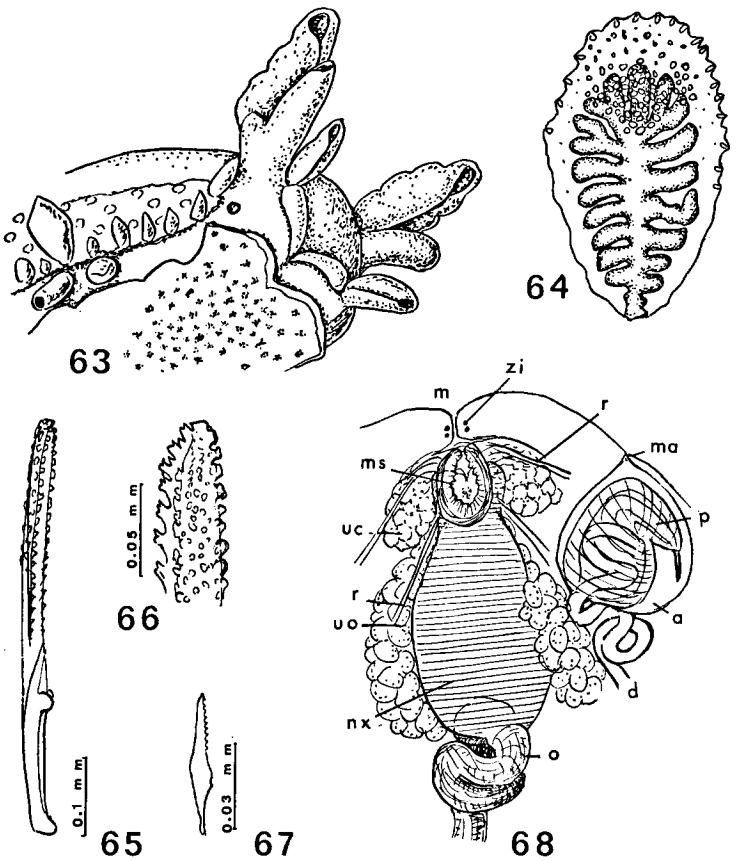


Fig. 63–68. *Mourgona germaineae,* spec. nov., from Puerto Rico. — 63. Fore end of preserved slug. – 64. Ceras. – 65. Radular tooth. – 66. Tip of tooth. – 67. Preradular tooth. – 68. Ventral view of anterior part with pharynx and copulatory organ. a – male atrium; d – efferent duct; m – mouth; ma – male aperture; ms – muscular sac; nx – pharynx; o – oesophagus; p – penis; r – retractor; uc – buccal glands; uo – posterior buccal glands; zi – pigment cells.

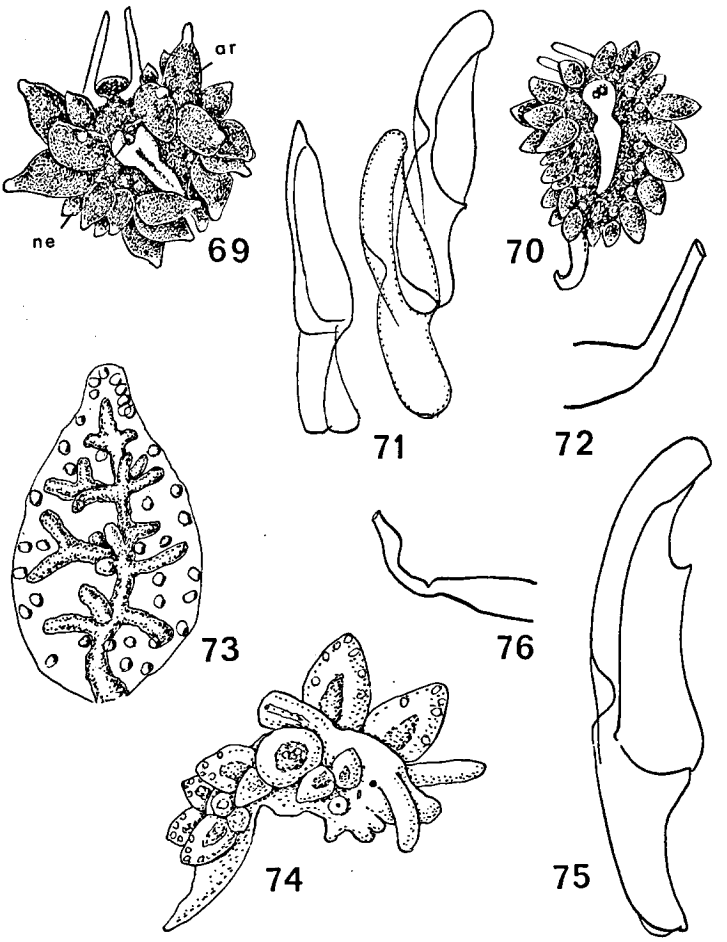


Fig. 69–73. *Stiliger funereus* (A. Costa, 1867). — 69. Antero-dorsal view of preserved slug. – 70. Dorsal view of other specimen. – 71. Three radular teeth. – 72. Penial stylet. – 73. Ceras. ar – anus; ne – nephropore.

Fig. 74–76. *Stiliger cricetus*, spec. nov., from Curaçao. — 74. Right side view of preserved slug. – 75. Radular tooth. – 76. Penial stylet.

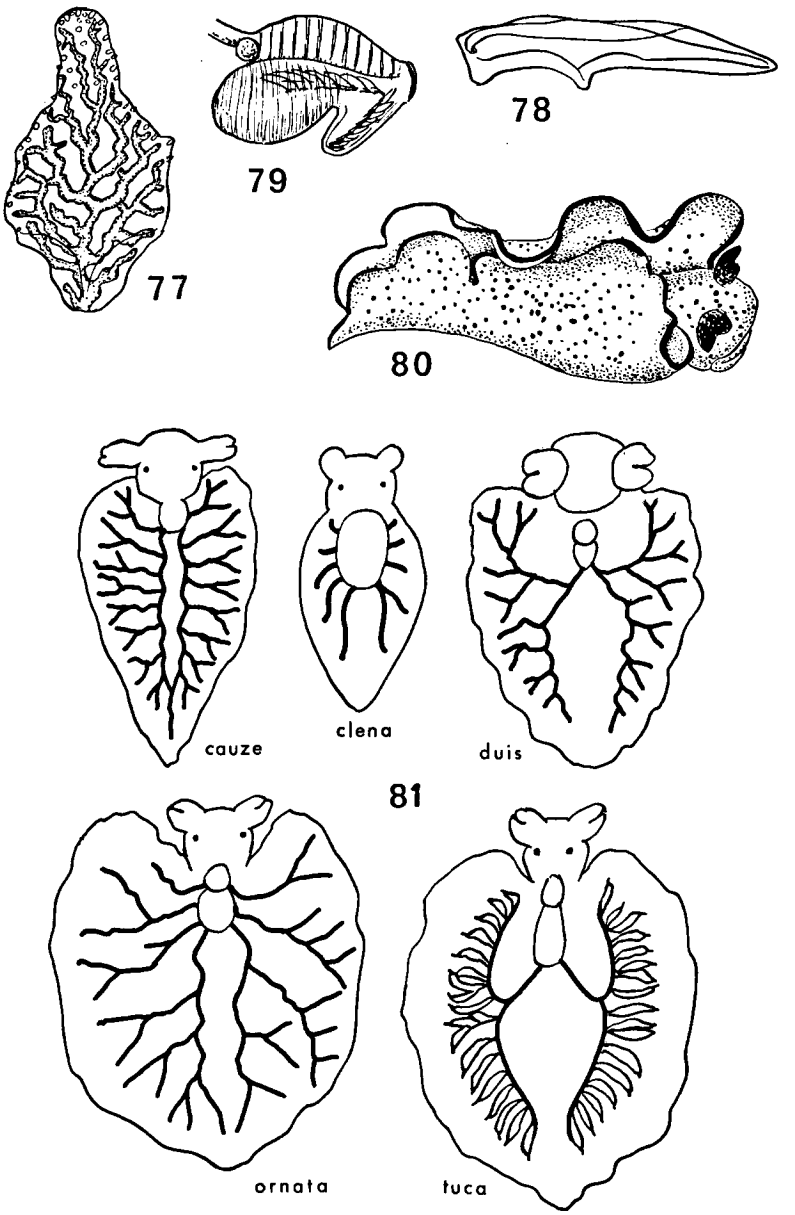


Fig. 77–78. *Caliphylla mediterranea* A. Costa, 1867. — 77. Ceras. – 78. Radular tooth.
Fig. 79. *Placida nonatoi* ((Marcus, 1960). — Pharynx.
Fig. 80. *Elysia ornata* (Swainson, 1840). — Preserved slug.
Fig. 81. Diagrams of dorsal efferent vessels of *Elysia cauze* Marcus, *Elysia clena*, spec. nov., *Elysia duis* Marcus, *Elysia ornata* (Swainson), and *Elysia tuca* Marcus.

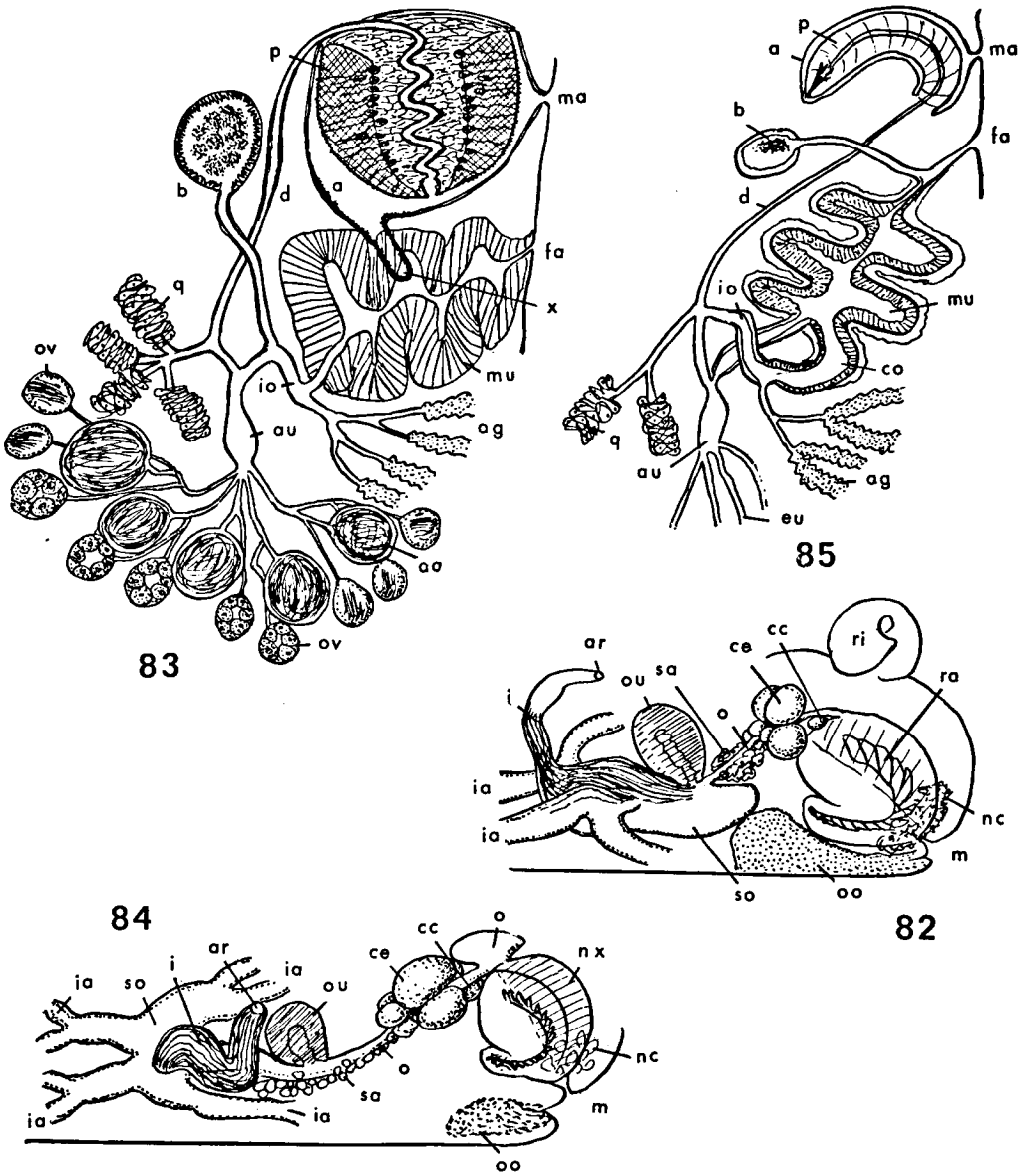


Fig. 82–83. *Elysia ornata* (Swainson, 1840). — 82. Reconstruction of alimentary tract. – 83. Diagram of reproductive organs. a – male atrium; aa – accessory ampulla, ag – albumen gland; ar – anus; au – ampulla; b – bursa; cc – buccal ganglion; ce – cerebropleural ganglion; d – efferent duct; fa – female aperture; i – intestine; ia – ducts of digestive gland; io – inner oviduct; m – mouth; ma – male opening; mu – mucus gland; nc – oral glands; o – oesophagus; oo – foot gland; ou – oesophageal puch; ov – ovotestis; p – penis; q – prostate; ra – radula; ri – rhinophore; sa – salivary gland; so – stomach; x – atrial diverticulum.

Fig. 84–85. *Elysia tuca* Marcus, 1967. — 84. Reconstruction of alimentary tract. – 85. Diagram of reproductive organs. a – male atrium; ag – albumen gland; ar – anus; au – ampulla; b – bursa; cc – buccal ganglion; ce – cerebropleural ganglion; co – focal chamber; d – efferent duct; eu – hermaphrodite duct; fa – female aperture; i – intestine; ia – ducts of digestive gland; io – inner oviduct; m – mouth; ma – male opening; mu – mucus gland; nc – oral glands; nx – pharynx; o – oesophagus; oo – foot gland; ou – oesophageal pouch; p – penis; q – prostate; sa – salivary gland; so – stomach.

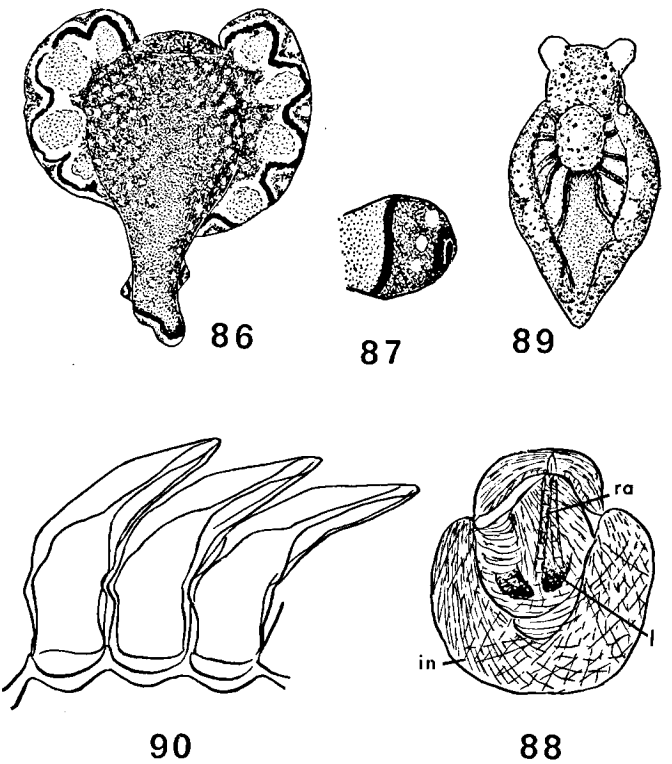
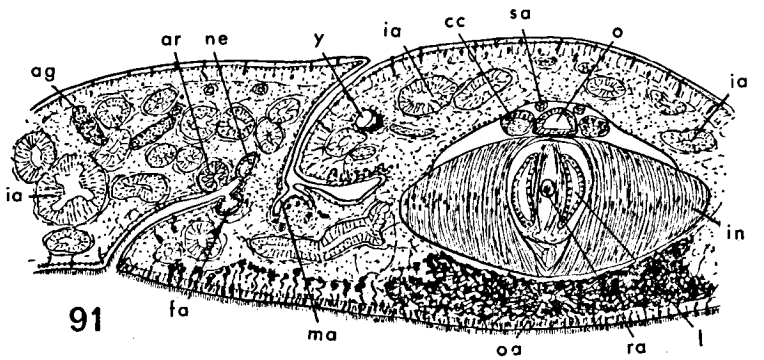
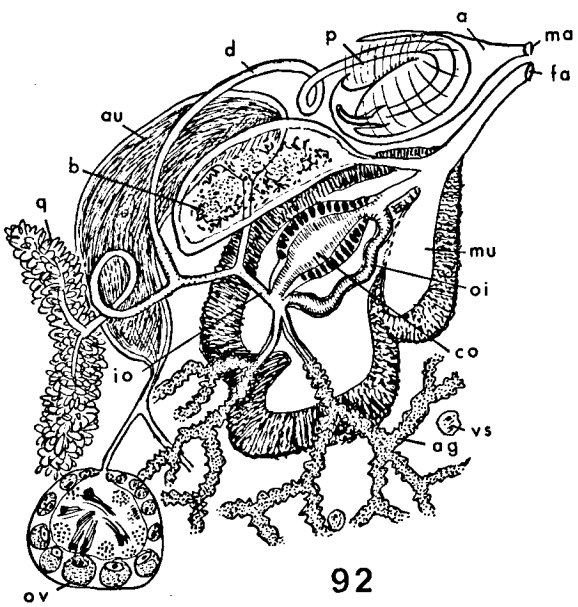


Fig. 86–88. *Elysia duis* Marcus, 1967, from Curaçao. — 86. Ventral aspect of preserved slug. – 87. Left rhinophore of same. – 88. Total mount of buccal mass with crop. in – crop; l – lumina of crop; ra – radula.

Fig. 89–90. *Elysia clena*, spec. nov. — 89. Dorsal view of preserved slug. – 90. Three teeth of radula.





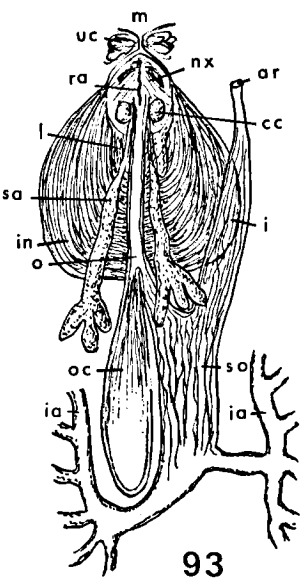


Fig. 91–93. *Bosellia mimetica curasoae,* subspec. nov. — 91. Transverse section on level of apertures. – 92. Diagram of reproductive organs. – 93. Diagram of alimentary tract. a – male atrium; ag – albumen gland; ar – anus; au – ampulla; b – bursa; cc – buccal ganglia; co – focal chamber; d – efferent duct; fa – female aperture; i – intestine; ia – digestive gland; in – crop; io – inner oviduct; l – lumina of crop; m – mouth; ma – male opening; mu – mucus gland; ne – nephropore; nx – pharynx; o – oesophagus; oa – anterior foot gland; oc – oesophageal pouch; oi – vaginal duct; ov – ovotestis; p – penis; q – prostate; ra – radula; sa – salivary glands, so – stomach; uc – buccal glands; vs – vesicles with sperm; y – eye.

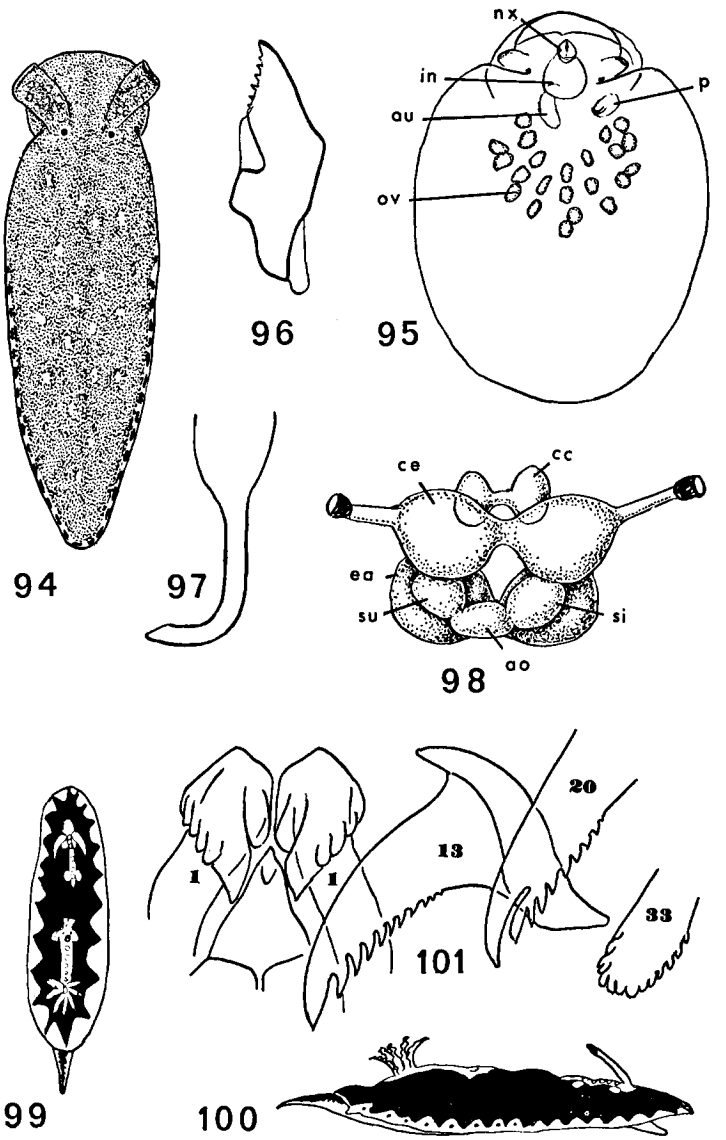


Fig. 94–98. *Bosellia mimetica curasoae*, subspec. nov., from Curaçao. — 94. Living slug from sketch (C). – 95. Stained and clarified slug. – 96. Radular tooth. – 97. Penial stylet. – 98. Central nervous system. ao – abdominal ganglion; au – ampulla; cc – buccal ganglia; ce – cerebropleural ganglion; ea – pedal ganglion; in – crop; nx – pharynx; ov – ovotestis; p – penis; si – supra-intestinal ganglion; su – subintestinal ganglion.

Fig. 99–101. *Chromodoris ponga*, spec. nov. from Curaçao. — 99. Dorsal view of living slug. – 100. Side view of same, from sketches by Drs. P. A. W. J. DE WILDE. – 101. Radular teeth.

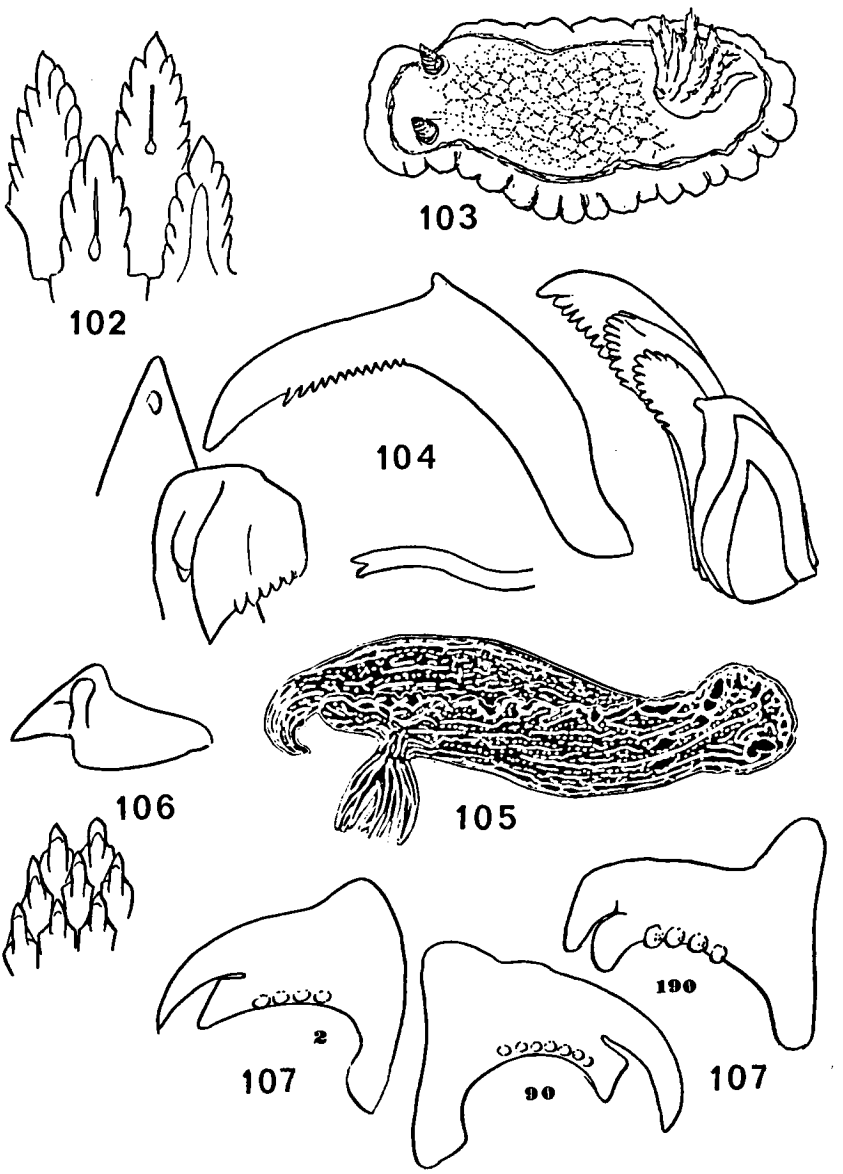


Fig. 102. *Berthella tupala* Marcus, 1957, from Puerto Rico. — Elements of jaw plate.
Fig. 103–104. *Chromodoris dictya*, spec. nov., from Puerto Rico. — 103. Preserved slug. – 104. Radular teeth and labial rodlet.
Fig. 105–107. *Hypselodoris sycilla* (Bergh, 1890). — 105. Living animal, Florida, from kodachrome (B). – 106. Labial elements of animal from Puerto Rico. – 107. Radular teeth of animal from Florida.

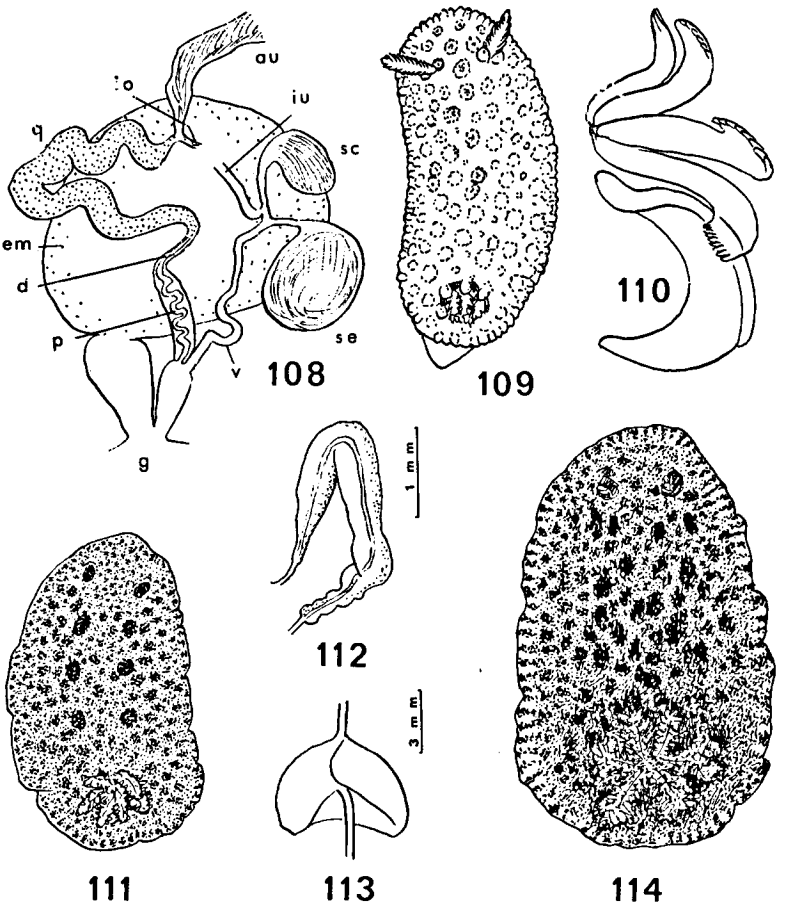


Fig. 108. *Doris bovena* Marcus, 1955. — Diagram of reproductive organs. au – ampulla; d – efferent duct; em – female gland mass; g – genital opening; io – inner oviduct; iu – insemination duct; p – penis; q – prostate; sc – spermatocyst; se – spermatheca; v – vagina.

Fig. 109–110. *Siraius bicolor* (Bergh, 1884) from Florida. — 109. Living animal from kodachrome (B). – 110. Outermost teeth of radula.

Fig. 111–114. *Discodoris hedgpethi* Marcus, 1959, from Puerto Rico. — 111. Living 55 mm-slug from photo (W). – 112. Prostate of same. – 113. Prostate of nr. 114. – 114. Living 108 mm-specimen from photo (W).

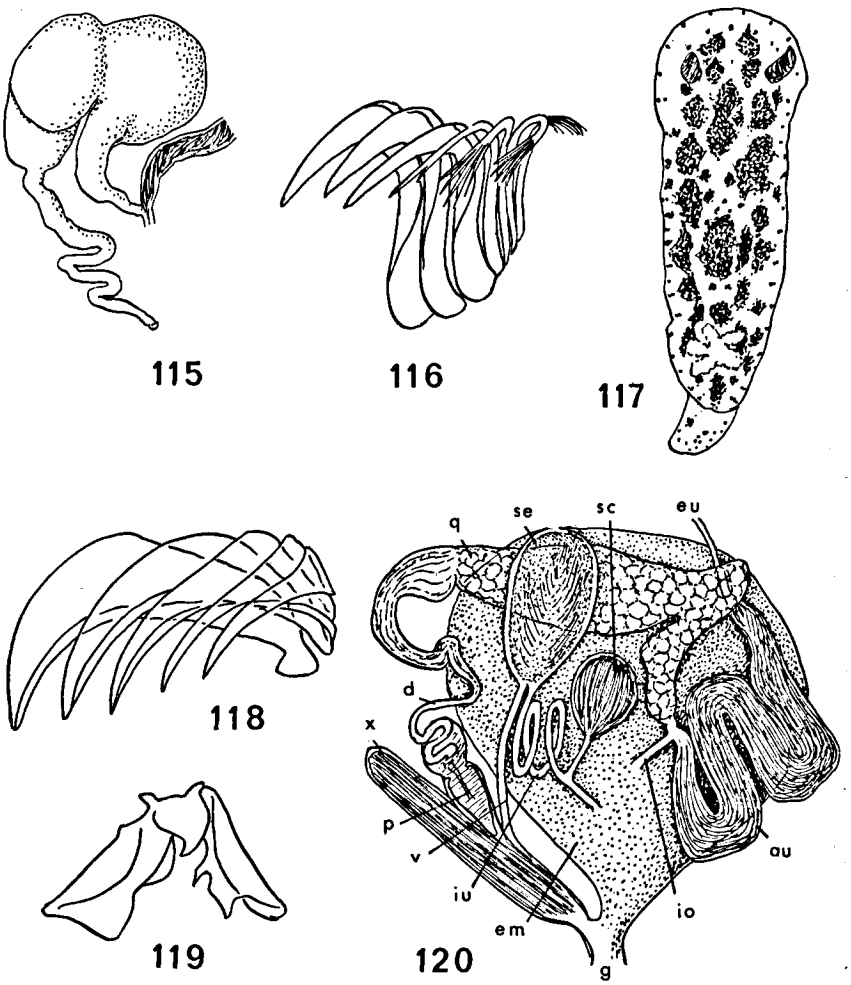


Fig. 115. *Discodoris pusae* Marcus, 1955. — Prostate.

Fig. 116. *Discodoris mortenseni* Marcus, 1963. — Outermost teeth of youngest specimen from Piscadera Baai.

Fig. 117. *Aphelodoris antillensis* Bergh, 1879, from Puerto Rico. — Living animal from kodachrome (W).

Fig. 118–120. *Tayuva ketos gila*, subspec. nov., from Curaçao. — 118. Outermost teeth of radula. – 119. Coalesced innermost teeth. – 120. Diagram of reproductive organs. au – ampulla; d – efferent duct; em – female gland mass; eu – hermaphrodite duct; g – genital opening; io – inner oviduct; iu – insemination duct; p – penis; q – prostate; sc – spermatocyst; se – spermatheca; v – vagina; x – atrial diverticulum.

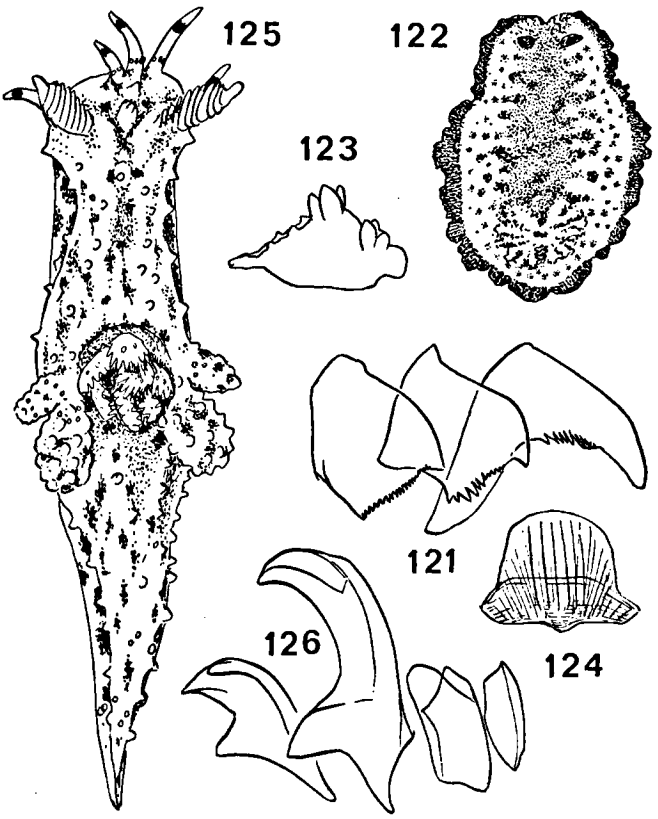


Fig. 121. *Platydoris angustipes* (Mörch, 1863). — Outermost teeth of young row.
Fig. 122. *Hexabranchus morsomus* Marcus, 1962, from Puerto Rico. — Living specimen from kodachrome by JOHN RANDALL.
Fig. 123–124. *Aegires* cf. *sublaevis* Odhner, 1932, from Florida. — 123. Preserved slug. – 124. Jaw plate.
Fig. 125–126. *Polycera rycia*, spec. nov., from Florida. — 125. Living slug from kodachrome (B). – 126. Radular teeth.

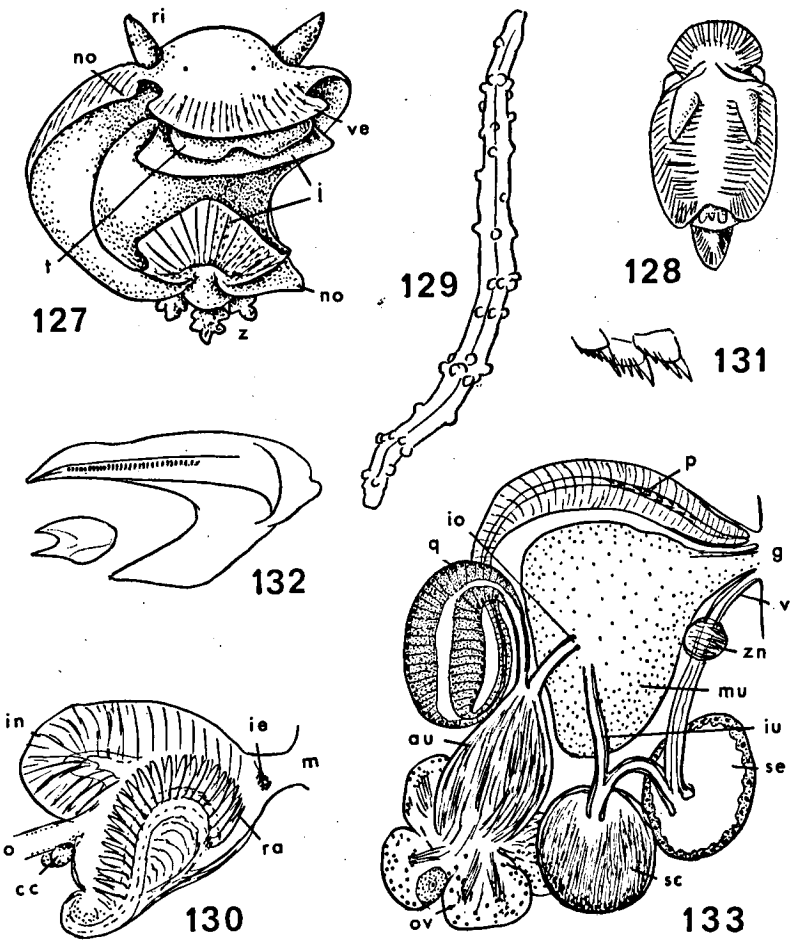


Fig. 127–133. *Lophodoris scala*, spec.nov., from São Paulo. — 127. Living slug. – 128. Dorsal view of clarified slug. – 129. Spicule – 130. Buccal bulb. – 131. Labial elements. – 132. Radular teeth. – 133. Diagram of reproductive organs. au – ampulla; cc – buccal ganglia; g – genital opening; ie – jaw plates; in – crop; io – inner oviduct; iu – insemination duct; j – foot; m – mouth; mu – mucus gland; no – notum; o – oesophagus; ov – ovotestis; p – penis; q – prostate; ra – radula; ri – rhinophore; sc – spermatocyst; se – spermatheca; t – tentacle; v – vagina; ve – velum; z – gill; zn – sphincter.

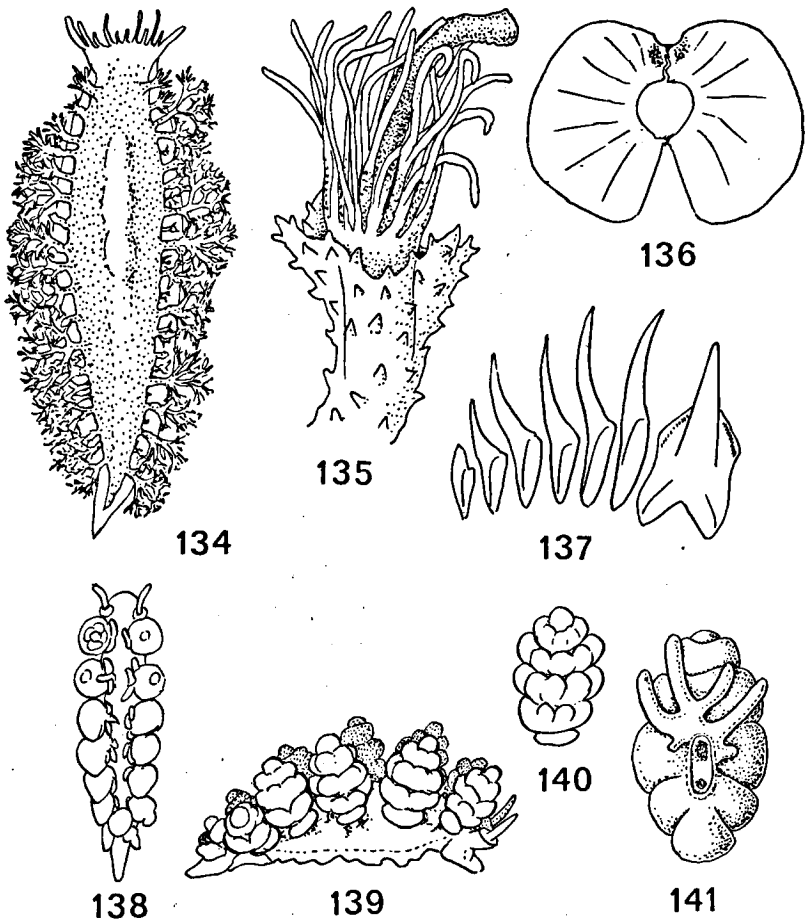


Fig. 134–137. *Tritoniopsis frydis*, spec. nov., from Florida. — 134. Living animal from kodachrome (B). – 135. Rhinophore of preserved slug. – 136. Jaw plates. – 137. Half-row of radula.

Fig. 138–141. *Doto caramella wildei*, subsp. nov., from Curaçao. — 138. Living animal from sketch by Drs. P. A. W. J. DE WILDE. – 139. Right side view of preserved slug. – 140. Outer side of second left ceras. – 141. Inner side of same.

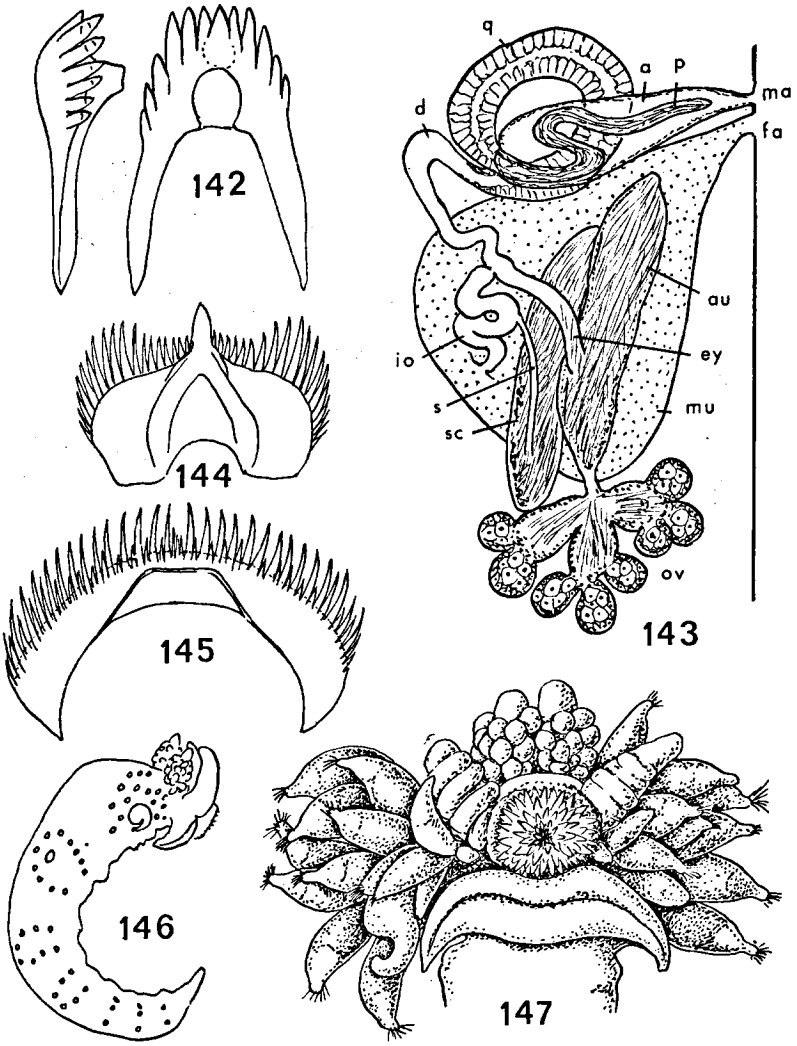


Fig. 142–143. *Moridilla kristenseni* Marcus, 1963, from Curaçao. — 142. Radular teeth. – 143. Diagram of reproductive organs. a – male atrium. au – ampulla; d – efferent duct; ey – spermoviduct; fa – female aperture; io – inner oviduct; ma – male opening; mu – mucus gland; ov – ovotestis; p– penis; q – prostate; s – canal of receptaculum; sc – spermatocyst.

Fig. 144. *Aeolidiella lurana* Marcus, 1967, from Curaçao. — Radular tooth.

Fig. 145–147. *Berghia creutzbergi*, spec. nov., from Curaçao. — 145. Radular tooth. – 146. Distribution of cerata. – 147. Fore end of preserved slug.

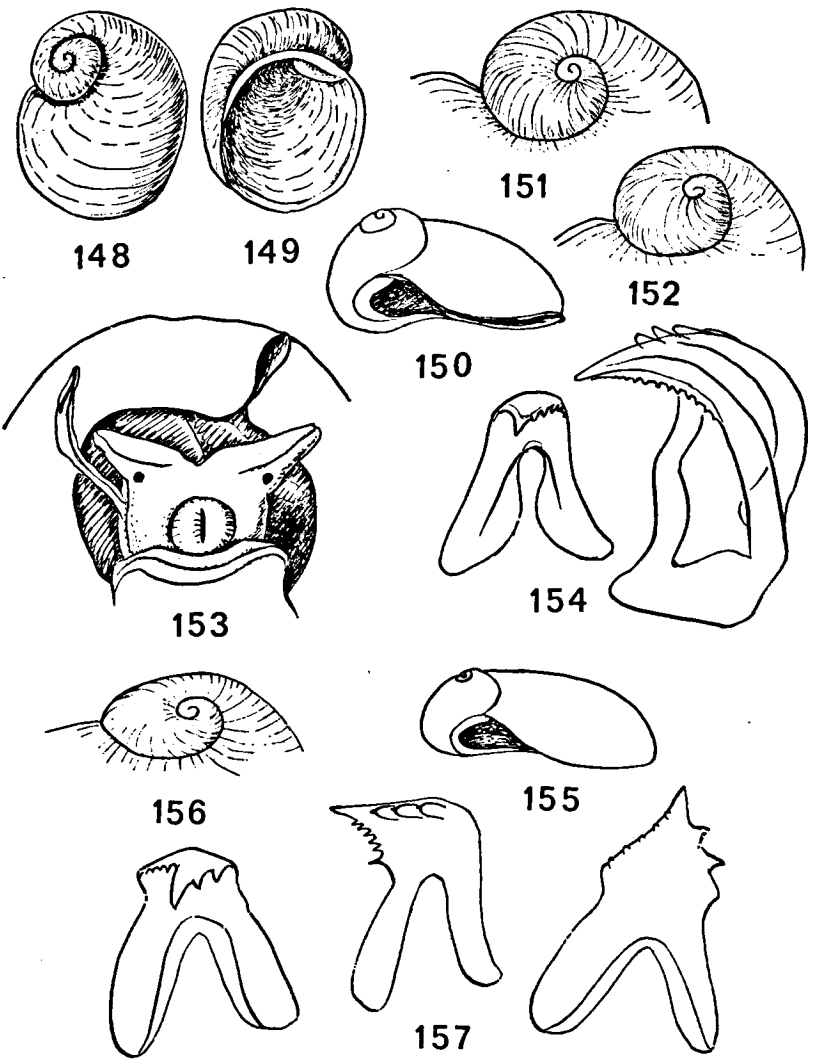


Fig. 148–154. *Coriocella fella*, spec. nov., from Florida. — 148. Dorsal view of shell. – 149. Ventral view of shell. – 150. Right side view of shell. – 151. Apex of male shell. – 152. Apex of female shell. – 153. Fore end of male. – 154. Half-row of radula. Fig. 155–157. *Lamellaria perspicua perspicua* (Linnaeus, 1758). — 155. Right side view of shell. – 156. Apex of female shell. – 157. Different views of rhachidian tooth.

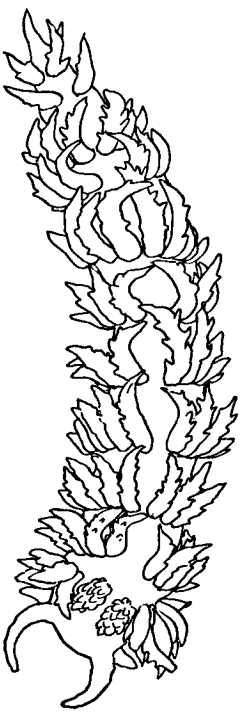


Fig. 158. *Limenandra nodosa* Haefelfinger & Stamm, 1959, from Lac, Bonaire. Preserved, 11 mm in length.

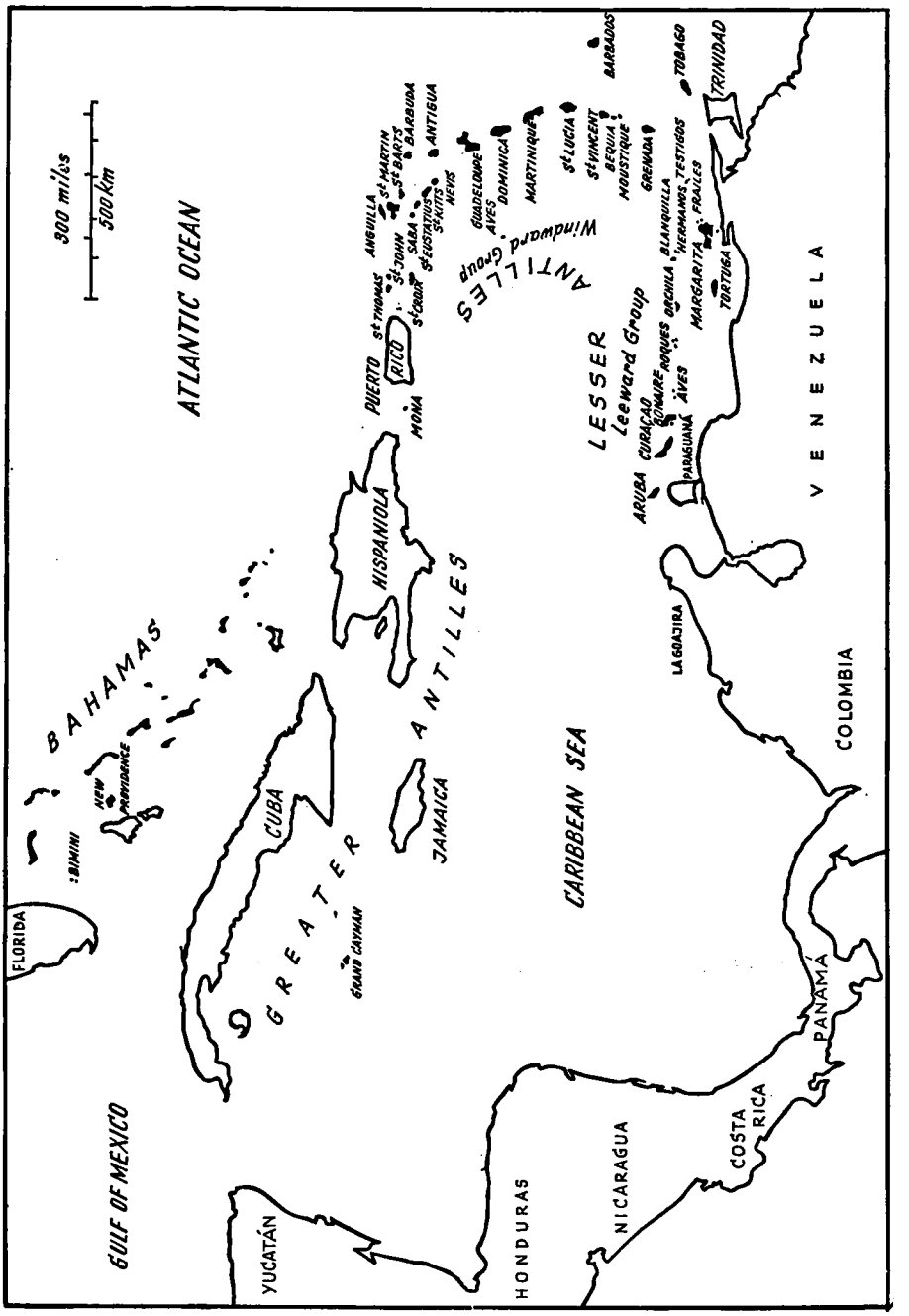


Fig. 159. Sketch of the CARIBBEAN, showing several island-localities of Opisthobranchia treated in this paper.

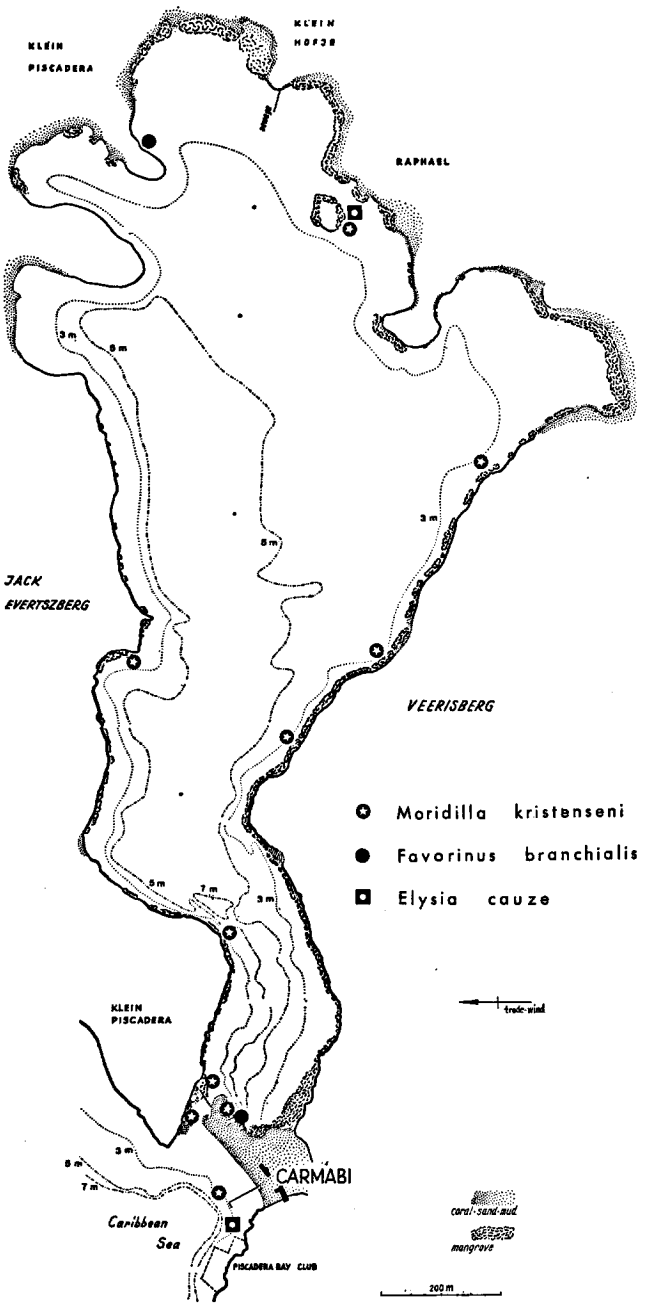


Fig. 160. Distribution of *Moridilla kristenseni*, *Favorinus branchialis* and *Elysia cauze* in Piscadera Baai, CURAÇAO, according to HUMMELINCK's sampling in 1963.