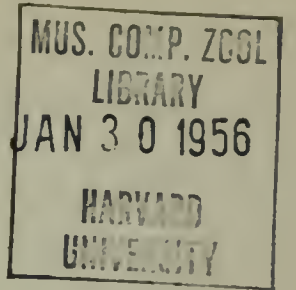


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MELONGENIDAE

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## THE FAMILY MELONGENIDAE IN THE WESTERN ATLANTIC

BY

WILLIAM J. CLENCH AND RUTH D. TURNER

The family Melongenidae possesses only a few species, but these occur in nearly all tropical and temperate seas. All are intertidal or live a little below low water and, so far as is known, are generally predatory in habit though occasionally feeding on dead animal matter. In certain areas, such as western Florida, they may be sufficiently abundant on oyster bars to be a rather serious menace.

*Melongena* has presented many challenging problems. This is particularly true of the polytypic species complex of *Melongena corona* Gmelin. Populations of this species only short distances apart may be strikingly different. Certain populations are very uniform while others show an amazing amount of variation (Plate 100). This type of variation suggests that some factor in their life cycle prevents wide dispersal of the young, and that the progeny of a colony remains within a limited area. Marine species having young which are readily dispersed are usually either quite uniform throughout their range or



Plate 94. Veliger larvae of *Melongena corona* Gmelin, from Punta Rassa, Florida. Fig. 1. Late veliger stage (27 days old) just before emerging from the capsule, showing the four velar lobes, the tentacles, the eyes and the shell. Fig. 2. A specimen at the same stage with the animal partially retracted within the shell. The well-developed foot can be seen in the center with the velar lobes behind. The shell at this stage has one and one half whorls. (about 75x)

else show a gradient of change or a cline from one end of the range to the other. In order to determine the controlling factor, we kept specimens in an aquarium through the breeding season and found that all of the larval stages are passed within the egg capsule, the emerging young crawling snails being capable of only limited dispersal. Such young snails certainly could reach other colonies by mechanical means and this no doubt occasionally happens. However, mechanical transport on floating mangrove leaves or other debris appears to be rather uncommon and as a consequence gene flow between colonies is probably limited.

Early in March 1952, Dr. and Mrs. David Schmidt sent us by air mail six live specimens of *Melongena corona corona* Gmelin from Punta Rassa, Florida. The following notes on the egg laying and development are based on these specimens. The eggs were deposited in light, straw-yellow capsules about 12 mm. in diameter. The capsules were composed of layers of tough, striated, chitinous material and were deposited in strings. Under natural conditions they are attached to rocks, shells or other hard surfaces.

On July 11 the first egg capsules appeared. The temperature of the water at that time was 78° F. Two females observed during oviposition deposited the strings of capsules on the side of the aquarium in the same area. The capsules were attached to a base membrane and the first string was composed of eighteen capsules, the second of fifteen, the third of nine, and the fourth string of only seven capsules. The number of eggs per cap-



Plate 95. Egg capsules of *Melongena corona* Gmelin, from Punta Rassa, Florida. Fig. 1. A single egg capsule showing the larvae within. Fig. 2. Four capsules in normal arrangement viewed from above and somewhat diagonally. The small ellipse at the top of each capsule is the point at which the capsule eventually ruptures to liberate the young crawling snails (about 6x).

sule varied from 50 to 120. The eggs were contained in a jelly-like mass and were a light yellow in color and opaque. The first cleavage occurred two and one half hours after the capsule had been produced; it was equal and complete. It was impossible to follow the cleavages beyond the sixteen-cell stage on living material due to the large amount of yolk and the consequent opacity of the egg. The early trochophore stage had been reached by the third day and the embryo rotated slowly by means of short, minute cilia. By the seventh day the proboscis and foot began to show and the external kidneys were well developed. The next day a well-developed proboscis, foot and velum were evident as well as the beginning of the tentacles with the eyes at their base. The embryonic heart was first seen pulsating at this time. The shell at this stage is small and cap-like. By the sixteenth day the veliger larvae were well developed. They had four large velar lobes with a double row of strong cilia on their outer edges. The foot and operculum were well developed and the shell had one and one half whorls. The animals were actually showing signs of crawling by the seventeenth day. By the twenty-fifth day the young were actively crawling within the capsule. The velar lobes were still very active, however, probably functioning as "respiratory organs" to aid in the circulation of the fluid within the capsule and the consequent diffusion of gas through the capsule wall. The gills and siphon were well developed at this time. Specimens twenty-five days old or older, when removed from the capsule, no longer protruded the velar lobes but crawled actively and could rapidly turn over the shell with the aid of the foot. By this time the escape pore in the egg capsule was very thin. The first capsule ruptured on the twenty-seventh day (August 6). Most of the young snails, now incapable of swimming, immediately crawled to the water's edge and appeared to be feeding on the minute organisms along the sides of the tank. There were no nurse eggs and approximately ninety-five percent of all the eggs developed.

The radulae of *Melongena* and *Pugilina* are surprisingly small, but the individual teeth are strong, with large hooked denticles, making a very effective rasping tool. The radula is rachiglossate, consisting of three longitudinal rows of teeth—a central and two lateral

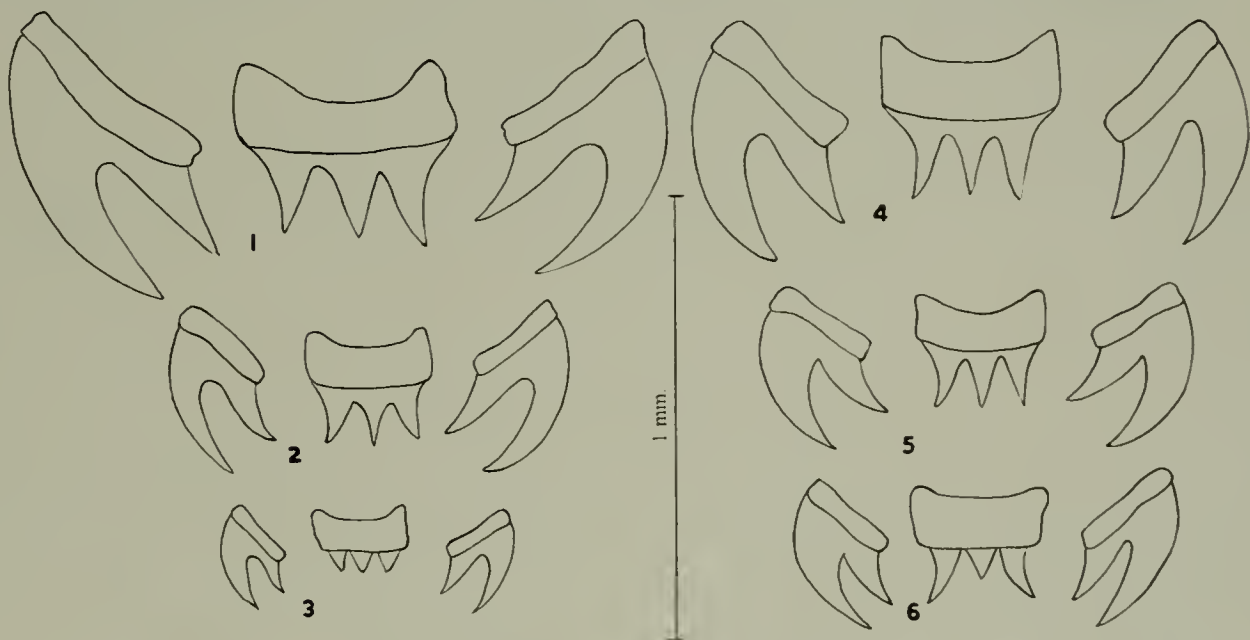
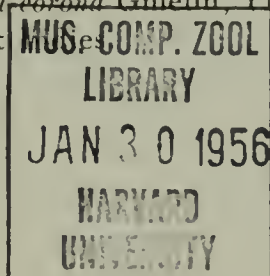


Plate 96. Radulae of *Melongena* and *Pugilina*. Fig. 1. *Melongena melongena* Linné, Cienfuegos, Cuba. Fig. 2. *Melongena melongena* Linné, from a young specimen, Puerto Barrios, Guatemala. Fig. 3. *Melongenu bicolor* Say, Grassy Key, Florida. Fig. 4. *Melongena corona johnstonei* Clench and Turner, Little Lagoon, Gulf Shores, Alabama. Fig. 5. *Melongena corona* Gmelin, Punta Rassa, Florida. Fig. 6. *Pugilina morio* Linné, Ministere Bay, Tobago Island, West Indies.



rows. The differences between the several species and genera are slight but appear to be constant. The various types are figured on Plate 96. The formula is  $\frac{1}{2} : \frac{1}{3} : \frac{1}{2}$ .

The proboscis is long and can be greatly extended when the need occurs, such as when feeding on oysters or other bivalves. In the laboratory, a three-inch specimen was able to reach a small piece of fish placed in the bottom of a six-inch test tube. The proboscis was so greatly extended that it became nearly transparent and it was possible to see the minute bits of fish carried along toward the esophagus. Wilcox (1897, p. 27) describes the feeding of *Melongena corona* under natural conditions.

According to Dall (1890, p. 118) *Melongena* is first recorded from the Eocene in the Vicksburg Limestone. Dall's *Melongena sculpturata*, which he described from the Miocene of Ballast Point, Florida, appears to us to belong to the genus *Pugilina*, as does *M. antillarum* Gabb from Santo Domingo. *Melongena corona* first appeared in the Caloosahatchee marl of the Lower Pliocene. There appears to be little or no difference between these Pliocene specimens and those taken in certain areas of southwest Florida at present.

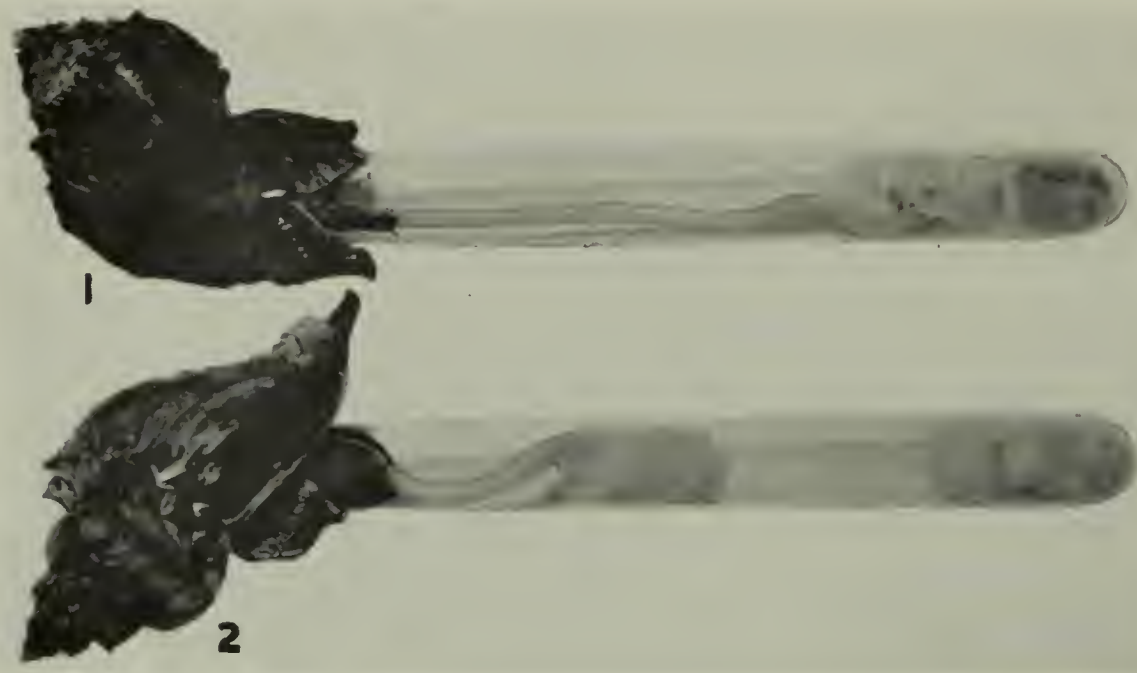


Plate 97. *Melongena corona* Gmelin feeding on a piece of fish placed at the bottom of a six inch test tube. In Fig. 1, the head may be seen inside the test tube with the proboscis fully extended to reach the fish. In Fig. 2, the *Melongena* having grasped the food has pulled a piece part way up the tube for easier feeding. This demonstrates graphically how these animals can so effectively feed on clams (reduced nearly one half).

#### ACKNOWLEDGEMENTS

As with all previously issued numbers in this series, we are deeply indebted to several persons who have aided in many ways to make this study possible. To Dr. and Mrs. David Schmidt of Saron, Wisconsin, we are grateful for live material from several localities in Florida. Their repeated sendings made possible the study of the gross embryology of *Melongena corona*. To Mr. and Mrs. Harry I. Johnstone of Mobile, Alabama, we are indebted for a long series of *Melongena corona johnstonei* from Little Lagoon, Gulf Shores, Alabama, which has established the westernmost record for this genus in the northern Gulf area. To Mr. John H. Butler of Marathon, Florida, we are grateful for specimens of *Melongena bicolor* Say and the notes on their feeding habits. We are also

indebted to C. G. Aguayo, A. C. Bippus, John Finlay, Ruth Merrill, H. A. Pilsbry, J. J. Parodiz, H. A. Rehder and Jeanne S. Schwengel for the loan of material which has aided greatly in obtaining an understanding of the distribution of the various species.

### Genus *Melongena* Schumacher

*Galeodes* Röding 1798, Museum Boltenianum, p. 53; non *Galeodes* Olivier 1791 [Arachnida].

*Melongena* Schumacher 1817, Essai d'un Nouveau Système des Habitations des Vers Testacés, Copenhagen, p. 64, 212.

Type species, *Melongena fasciata* Schumacher (= *Murex melongena* Linné), monotypic.

Shell imperforate, subglobose to elongate and generally solid to massive in structure. Sculpture variable, ranging from smooth specimens to those having as many as four rows of shoulder spines and one row of basal spines. Periostracum usually persistent, yellowish-brown in color and usually sufficiently transparent to show the coloration beneath. Operculum unguiculate with a basal nucleus.

Iredale<sup>1</sup> pointed out that *Volema* Röding had priority over *Melongena*, but at the same time, he designated *Volema paradisiaca* Röding as the type species. This was a fortunate choice as *Volema paradisiaca* (= *Murex ficus* Gmelin) is certainly not congeneric with *Melongena* of the Western Atlantic and Eastern Pacific.

### Subgenus *Melongena* Schumacher

Shell capacious, generally massive in structure and with the later whorls gradually enveloping the earlier whorls, leaving an irregular and somewhat deeply channeled suture and an apparently greatly reduced spire. Spines generally short, broad and spike-like, and usually developed at right angles to the whorl surface with no tendency to recurve toward the spire.

This subgenus is limited in its distribution to portions of the West Indies, both coasts of Central America and the northern coasts of South America.

### *Melongena melongena* Linné

Plates 96 and 98

*Murex melongena* Linné 1758, Systema Naturae, ed. 10, p. 751 (America).

*Galeodes melongena* Linné, Röding 1798, Museum Boltenianum, p. 53.

*Pyrula melongena* Lamarck 1816, Encyclopédie Méthodique (table of plates, p. 8), pl. 435, figs. 3a-e; Lamarck 1822, Animaux Sans Vertèbres 7, p. 140 (l'Océan des Antilles).

*Melongena fasciata* Schumacher 1817, Essai d'un Nouveau Système des Habitations des Vers Testacés, Copenhagen, p. 212 (no locality given).

*Melongena melongena* Linné, Tryon 1881, Manual of Conchology (1) 3, p. 107, pl. 41, figs. 197-198; Bayer 1952, Zoologische Mededelingen 31, p. 268.

*Melongena melongena denudata* Dollfus 1887, Bull. Société d'Études Scientifiques d'Angers (n.s.) 17, p. 56, pl. 2, fig. 3 (Antilles).

*Melongena melongena multispinosa* Dollfus 1887, Bull. Société d'Études Scientifiques d'Angers (n.s.) 17, p. 56, pl. 2, fig. 4 (Antilles).

*Melongena melongena semispinosa* Dollfus 1887, Bull. Société d'Études Scientifiques d'Angers (n.s.) 17, p. 56, pl. 2, fig. 5 (Antilles).

*Melongena margaritana* Richards 1943, Journal of Paleontology 17, pp. 120-123, figs. 1-2 (Pleistocene fossil, Juan Griego, Margarita Island, Venezuela).

<sup>1</sup> Iredale, T. 1917, Proc. Malacological Society London 12, p. 322.

*Description.* Shell reaching 182 mm. (about  $7\frac{1}{2}$  inches) in length, solid and usually spinose. Color white with dark brown to brownish-purple spiral bands of varying widths. Generally there is a broad band from the whorl shoulder to the periphery which is separated by a white area from a much narrower subperipheral band. Below this subperipheral band there are usually numerous thread-like bands, rarely a broad solid band. Whorls  $7\frac{1}{2}$ , strongly convex, particularly above the periphery. Spire somewhat elevated in young specimens, but in the adult stage the spire is depressed, occasionally hardly extending above the top of the body whorl. Aperture subelliptical with a well-developed anal notch and a broad, flattened and short siphonal canal. Parietal lip usually heavily glazed. Palatal or outer lip moderately thin and usually strongly crenulate, particularly below the peripheral area. Columella nearly perpendicular and twisted. Umbilicus nearly always closed by the extension of the parietal callus. Suture canaliculate, the channel becoming fairly broad in large specimens. Occasionally the later whorls are folded over the earlier whorls. The broadening of the channel is sometimes due to the presence of spines on the previous whorl that were developed ahead of the area of the anal canal. Sculpture consisting of spiral rows of strong spines. Usually there are two or three rows above and one row below the periphery near the base of the shell. Occasional specimens are completely devoid of spines and others may have but few. Young specimens very frequently show a rather well-developed sculpture of small spiral threads. The young specimens and the early whorls of the adult are usually strongly nodulose. As the shell advances in age the nodulose costae disappear or are resolved into spines. Operculum horny, unguiculate, rather solid, with the nucleus at the lower end, and sculptured with rather strong concentric lines of growth. Lower surface of the operculum with a large muscle scar which has a smooth shiny margin and a dull rugose central area. Periostracum quite smooth, dull and having exceedingly fine axial growth lines.

length	width *	
182 mm.	144 mm.	Bay of Cárdenas, Cuba
179	131	Jamaica
97	71	Monte Cristi, Santo Domingo

\* not including the spines

*Types.* It would certainly appear that Linné did not have a specimen of *Melongena melongena* in his collection at the time the original description was written. There is, however, no question as to what species he was dealing with, as his references are mainly to recognizable figures of this common West Indian species. We here select Bonanni 1684, *Recreatio*, fig. 186, to be the type figure, for this was Linné's first reference. As Linné gave only America in his original reference we here limit the type locality to Kingston, Jamaica. Hanley (1855, p. 298, *Ipsa Linnaei Conchyliæ*) states that Linné's reference to Lister "was correctly referred to in the review copy" (i.e., the interleaved copy of the 12th edition that Linné used for his corrections and additions) and that Jamaica had been added to the label of the specimen then in the Linnean Cabinet, a specimen probably received after the tenth edition had been published. The holotype of *M. margaritana* Richards is in the Academy of Natural Sciences, Philadelphia, no. 14931, from Juan Griego, Margarita Island, Venezuela, a Pleistocene fossil.

*Remarks.* *Melongena melongena* Linné and *Melongena patula* Broderip and Sowerby are exceedingly close in their relationship. In general, *M. melongena* never reaches the

size that is exhibited by *M. patula*. Also, *M. patula* is much darker in coloration. *M. melongena* may lack spines or have as many as four rows of spines, while *M. patula*, which also may be without spines, never has more than one row, and this is composed of relatively few spines. There is considerable variation in the number of rows of spines in *M. melongena*, even among specimens obtained from a single locality. We have a large series from Monte Cristi, Santo Domingo, containing specimens which are completely smooth and others which have up to four rows of rather large spines.

The distribution of this species in the West Indies is rather remarkable. It appears to be limited to Cuba, the Isle of Pines, Jamaica and Hispaniola. It does not occur in the Bahamas or in Puerto Rico. In the Lesser Antilles it occurs only in Trinidad and Tobago which are on the continental shelf of South America. This is true in part for the records we have from the Bay Islands and Curaçao. These island groups are beyond the continental shelf but they do lie close in, being only a few miles off the coast. A few of the earlier records are certainly open to question, like those given by Krebs (1864, p. 18) for the Virgin Islands and Lesser Antilles. Records from the Florida Keys and the Texas coast are certainly in error (Dall 1889, p. 112). It must be understood that many of the early published records were based upon guesses as to the locality: once in print, they were continually copied until challenged or completely disproved. This was a fault of the times rather than an intent to mislead. Locality data at that time were only of casual interest, perhaps added as an afterthought to the all important *name* of the specimen. Today the name of a specimen is certainly the least important of all data associated with it. It is the only thing that can be changed without destroying the real factual data associated with a specimen. Accurate locality data are the only basis upon which ranges can be established and the ranges of many species considered together outline patterns of distribution allowing us to define faunal regions.

*Melongena melongena* Linné occurs usually in places where there is a moderate ad-

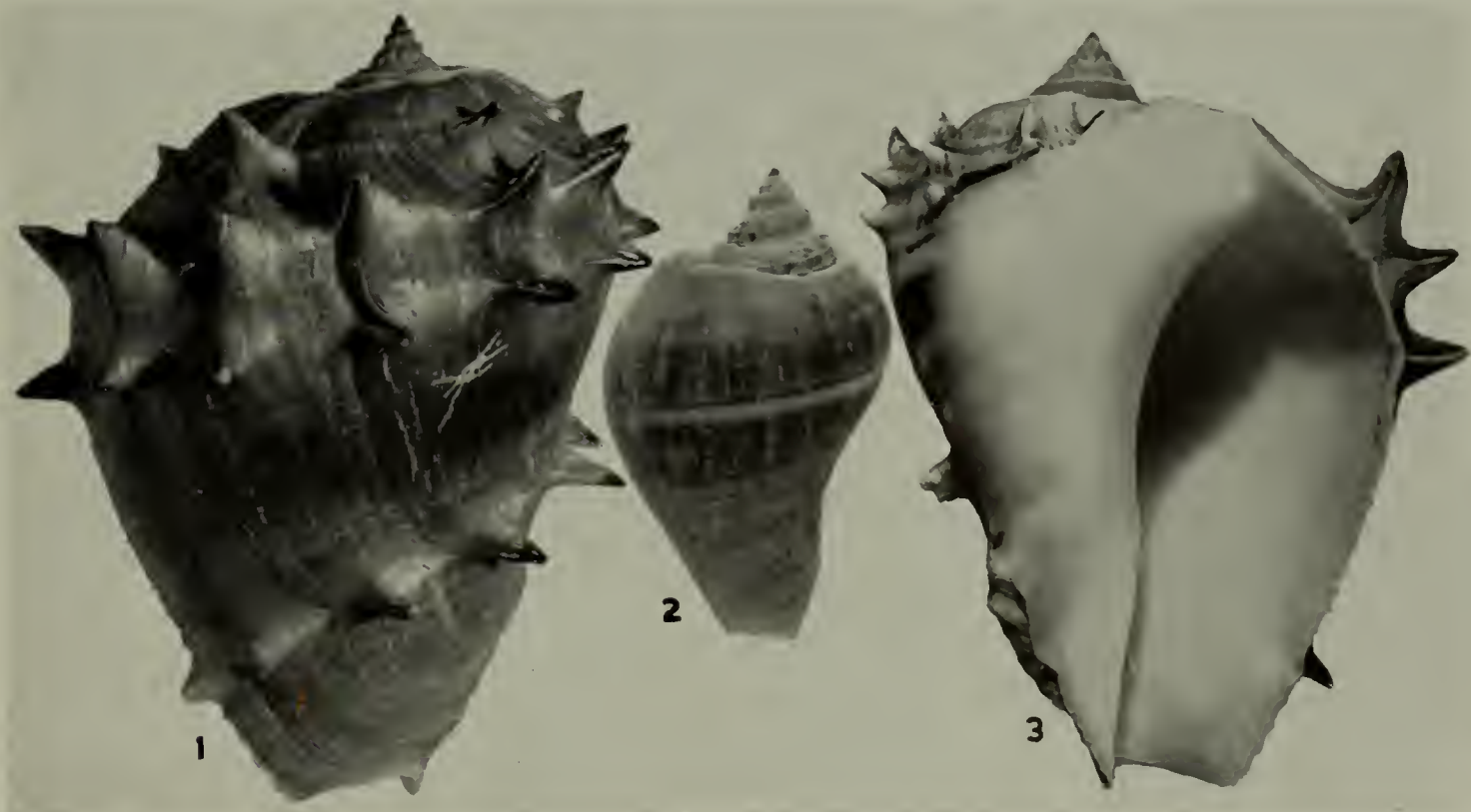


Plate 98. *Melongena melongena* Linné. Figs. 1-3. Hicacos Peninsula, Cárdenas, Cuba. Fig. 1 (3/5x). Fig. 2 Young specimen (natural size). Fig. 3 (2/3x).

mixture of fresh and salt water, such as at the heads of bays where enough freshwater enters to produce a somewhat brackish condition.

This species was probably used for food by the Cuban Indians as specimens now in the Museo Poey, Habana, were found in a kitchen midden at Vertientes, Camagüey, Cuba. The same is true of *Melongena patula*, as many specimens were found in some recent Indian excavations near Balboa, Panama.

The three names given by Dollfus, *denudata*, *multispinosa* and *semispinosa*, apply only to individual forms of *Melongena melongena*, all of which are occasionally found in a single colony. They certainly have no taxonomic value.

*Melongena margaritana* Richards appears to be nothing but a young specimen of *M. melongena* Linné. Richards compares his species with *M. corona minor* Sowerby [= *bicolor* Say] from which, of course, it differs. He stresses the lack of spines as perhaps the most outstanding character of his new form, but the young as well as many adults of *M. melongena* often lack spines.

*Range.* From Tampico, Mexico south and east along the coast of Central and northern South America as far as Dutch Guiana. In the West Indies it occurs only in Cuba, Isle of Pines, Hispaniola, Jamaica and some islands off the coast of South America.

*Specimens examined.* CUBA: Puerto Esperanza; Bahía Honda; Mariel (all Museo Poey); Bahía de Cabañas (MCZ; Museo Poey); mouth of Almendares River (M. Jaume); Batabanaó (MCZ; USNM); Matanzas Bay (Museo Poey); Cárdenas (MCZ; Museo Poey; John Finlay); La Isabela (M. Jaume); Cayo Cristo, Sagua la Grande; Cayo Francés, Caibarién; Rio Damuji, Donastia and La Milpa, Cienfuegos (all MCZ); Nuevitas, Camagüey; Punta Carenero, Puerto Padre (both M. Jaume); Gibara (J. Weber; Museo Poey; USNM); El Cañon, Banes Bay (MCZ); Macabi, Banes Bay (A. Quiñones; Museo Poey); Mouth of Yateras River (MCZ); Rente, Santiago de Cuba (M. Jaume); Guantánamo Bay; Manzanillo (both Museo Poey). ISLE OF PINES: (D. and N. E. Schmidt). HISPANIOLA: Port au Prince and Fort Liberté, Haiti (MCZ; USNM); Monte Cristi and Puerto Plata, Santo Domingo (both MCZ). JAMAICA: Kingston; Black River, St. Elizabeth; Port Royal (all USNM); Port Antonio; Bogue, Montego Bay (both A. Bippus). LESSER ANTILLES: Alley Creek; Ortoire River, Mayaro; Carenage; and Matura Bay, all Trinidad (all H. G. Kugler); Tobago (MCZ). CARIBBEAN ISLANDS: Utila Island, Bay Islands (MCZ); Vignon, Curaçao (USNM). MEXICO: Tampico: 15 miles north of Tecolutla, Vera Cruz (both T. Pulley); Tuxpam, Vera Cruz (M. Bourgeois); Campoton, Campeche (MCZ). GUATEMALA: Livingston (MCZ); Puerto Barrios (Univ. of Michigan; USNM); Punta Manabique (USNM). HONDURAS: Trujillo (MCZ); Puerto Cortez; Tela (both USNM). PANAMA: Colón (USNM). COLOMBIA: near Santa Marta; Sabanilla (both USNM); Cartagena (USNM; MCZ); Puerto Colombia (USNM). VENEZUELA: Isla de Margarita (USNM). BRITISH GUIANA: 4 mi. east of Georgetown (H. G. Kugler). DUTCH GUIANA: Corentyn River (H. G. Kugler).

### *Melongena patula* Broderip and Sowerby

Plate 99

*Pyrrula melongena fusco-nigricans* Sowerby 1825, Catalogue of the Shells in the Collection of the Earl of Tankerville, London, p. 62 [*nomen nudum*].

*Pyrrula patula* Broderip and Sowerby 1829, Zoological Journal 4, p. 377 (Mazatlan, Mexico).

*Cyrtulus patula* Broderip and Sowerby, Jay 1850, Catalogue of the Shells contained in the collection of John C. Jay, New York, 4th edition, p. 323.

*Cassidulus patula* Broderip and Sowerby, Mörch 1852, Catalogus Conchyliorum Comes de Yoldi, Denmark, p. 103.

*Melongena patula* Broderip and Sowerby, Petit de la Saussaye 1852, Journal de Conchyliologie 3, p. 146.

*Galeodes patula* Broderip and Sowerby, Zetek 1918, Revista Nueva, Panama 5, p. 526 [p. 21 in reprint].

*Galeodea patula* Broderip and Sowerby, Pilsbry and Lowe 1932, Proceedings Academy Natural Sciences, Philadelphia 84, p. 114.

*Description.* Shell reaching 260 mm. (about 10 inches) in length and 190 mm. (about  $7\frac{1}{2}$  inches) in width, solid and usually smooth or only moderately spinose on the whorl shoulder. Color generally of a dark chestnut-brown with a light cream-colored band just below the widest bulge of the whorl. This band may consist of several very narrow bands grouped together. In addition, there may be other spiral bands of the same color, usually thread-like and varying greatly in number. A single specimen that we have seen also shows axial streaks of this cream color. Whorls  $7\frac{1}{2}$  to 8, strongly convex, particularly above the periphery. Spire somewhat elevated in young specimens, but in the adult stage the spire is depressed, occasionally hardly extending above the top of the body whorl. Aperture subelliptical with a rather deep anal notch and a broad, flattened and short siphonal canal. Parietal wall rather heavily glazed. Palatal or outer lip moderately thin and only moderately crenulated. Columella nearly perpendicular and twisted. Umbilicus closed. Suture deeply channeled; occasionally, the later whorls are folded over the early whorls. Sculpture consisting of a single row of spines at the whorl shoulder or none at

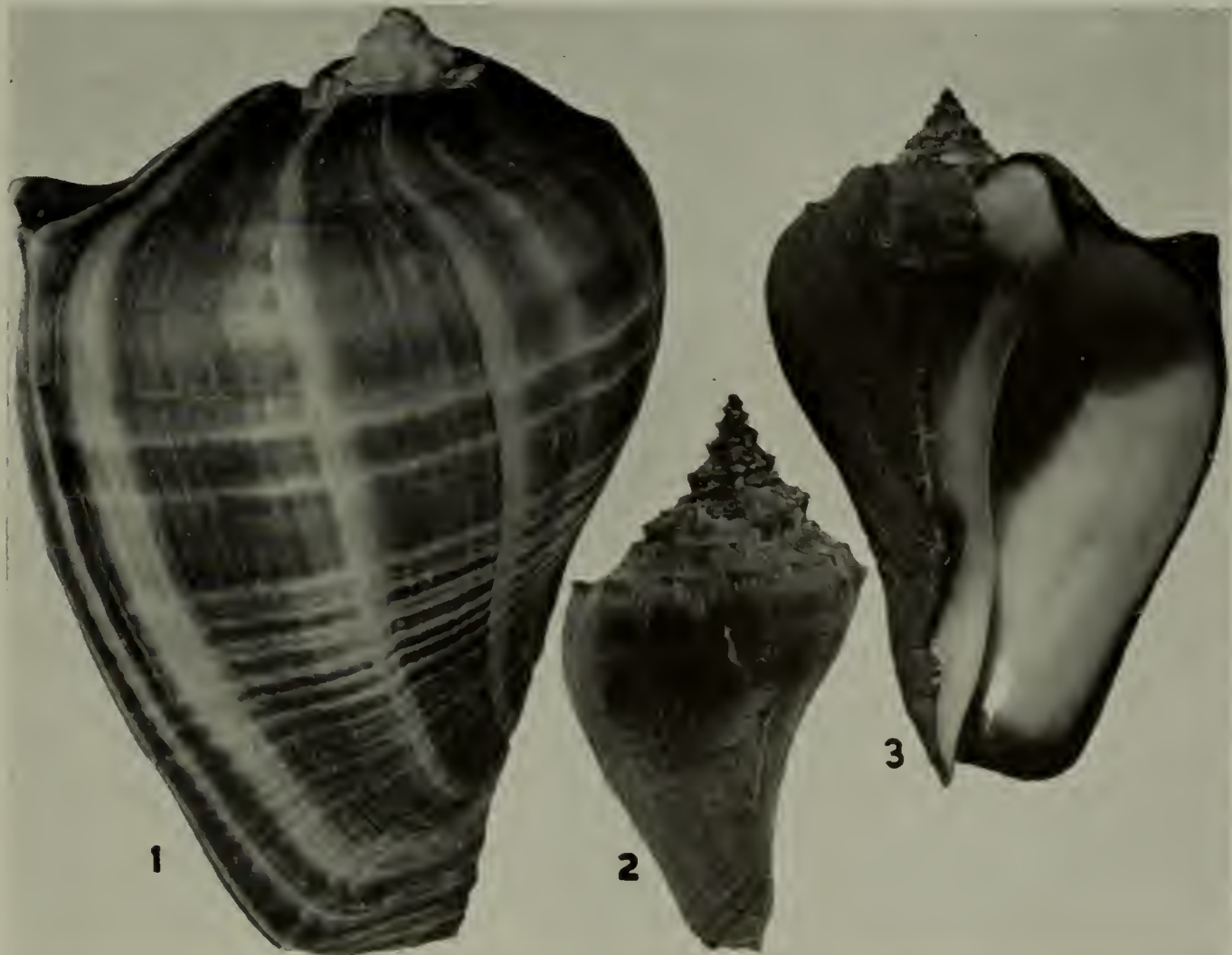


Plate 99. *Melongena patula* Broderip and Sowerby. Figs. 1-3. Guaymas, Sonora, Mexico. Figs. 1 and 3, about  $4/5x$ . Fig. 2. Young specimen (about  $1.3x$ ).

all. Most specimens show numerous and rather fine, spiral, incised grooves developed mainly on the lower half of the shell. Young specimens and the early whorls of adult specimens are usually strongly nodulose. Operculum horny, unguiculate, rather solid with the nucleus at the lower end and sculptured with rather strong concentric lines of growth. The inner surface has a large muscle scar which has a smooth shiny margin and a somewhat roughened and dull central area. Periostracum quite smooth, dull and having exceedingly fine axial growth lines.

length		width	
260 mm.*	*	190 mm.	Panama
195	*	144	Panama
131	*	98	Mazatlan, Mexico

\* early whorls lost

*Types.* Type specimens of this species are probably in the British Museum. The type locality is Mazatlan, Mexico.

*Remarks.* See also Remarks under *Melongena melongena* Linné.

It is possible that this species was derived from the West Indian *Melongena* and entered the Pacific from the Atlantic during the submergence of the Isthmus of Panama in the late Miocene and early Pliocene times. Today the two forms are differentiated sufficiently to be considered separate species. There are many similar cases of such parallel species in the two oceans, such as *Strombus gracilior* Gray, *Purpura patula panza* Gould, *Barnea subtruncata* Sowerby, and *Pholas chiloensis* Molina of the Pacific and *Strombus pugilis* Linné, *Purpura patula* Linné, *Barnea truncata* Say and *Pholas campechiensis* Gmelin of the Atlantic.

*Range.* Gulf of California from Guaymas, Mexico south to Bahía de Caráques, Ecuador. This southern record is given by Bayer (1952, p. 272).

*Specimens examined.* MEXICO: Guaymas, Sonora (H. R. Turver; A. Sorensen); Mazatlan (MCZ). NICARAGUA: Corinto (Charleston Museum). COSTA RICA: Gulf of Nicoya (MCZ). PANAMA: Chame Bay; Canal Zone (both MCZ); Verrado Beach (C. M. Dum-bauld); near Balboa (J. Zetek; MCZ).

#### Subgenus *Rexmela* Olsson and Harbison

*Rexmela* Olsson and Harbison 1953, Academy of Natural Sciences Philadelphia, Monograph 8, p. 213.

Type species, *Melongena subcoronata* Heilprin (= *Melongena corona* Gmelin), original designation.

Shell moderate in size to fairly large, generally solid and strong but not massive. Spire extended, the later whorls not enveloping the earlier whorls. Suture not channeled but coarsely imbricate, the imbrications being previous margins of the anal canal. Spines variable, claw-like to spike-like, generally open on their forward margin. They may be produced at right angles to the shell surface but generally they are somewhat parallel to the long axis of the shell, and frequently curve inwardly.

*Rexmela* was introduced as a subgenus, separating the Pliocene *Melongena subcoronata* Heilprin from the recent *M. corona* Gmelin. In our opinion, these two forms are synonymous: in fact, we can duplicate almost exactly the type of *M. subcoronata* with recent specimens from Lossman's Key.

However, the name *Revmela* is available to use for a subgenus separating *corona*, its subspecies and closely related forms, from *M. melongena* Linné and *M. patula* Broderip and Sowerby, two species quite different from the *corona* complex.

This subgenus is limited in its distribution to Florida, Alabama and the northern tip of Yucatan.

The *Melongena corona* complex

The multiplicity of forms in *Melongena corona* Gmelin is quite probably due to factors of isolation of smaller or larger areas along the central and southwest coast of Florida during its geologic history since the Pliocene. This is a region of very low relief and even minor changes in the oceanic level would affect profoundly much of the coast line. Areas of land were invaded by the sea as the oceanic level was raised, new habitats were created and colonies of this species developed as they moved into these new areas. Possibly chance alone brought in a few individuals with a similar gene complex and thus a population evolved that was remarkably uniform. In others, one or more different assemblages invaded a new area and a mixture took place giving rise to a very varied population. A lowering of the oceanic level would have a similar effect, exposing a new land area that would shortly build up the mangrove association or a similar assemblage of a somewhat brackish water fauna and flora.

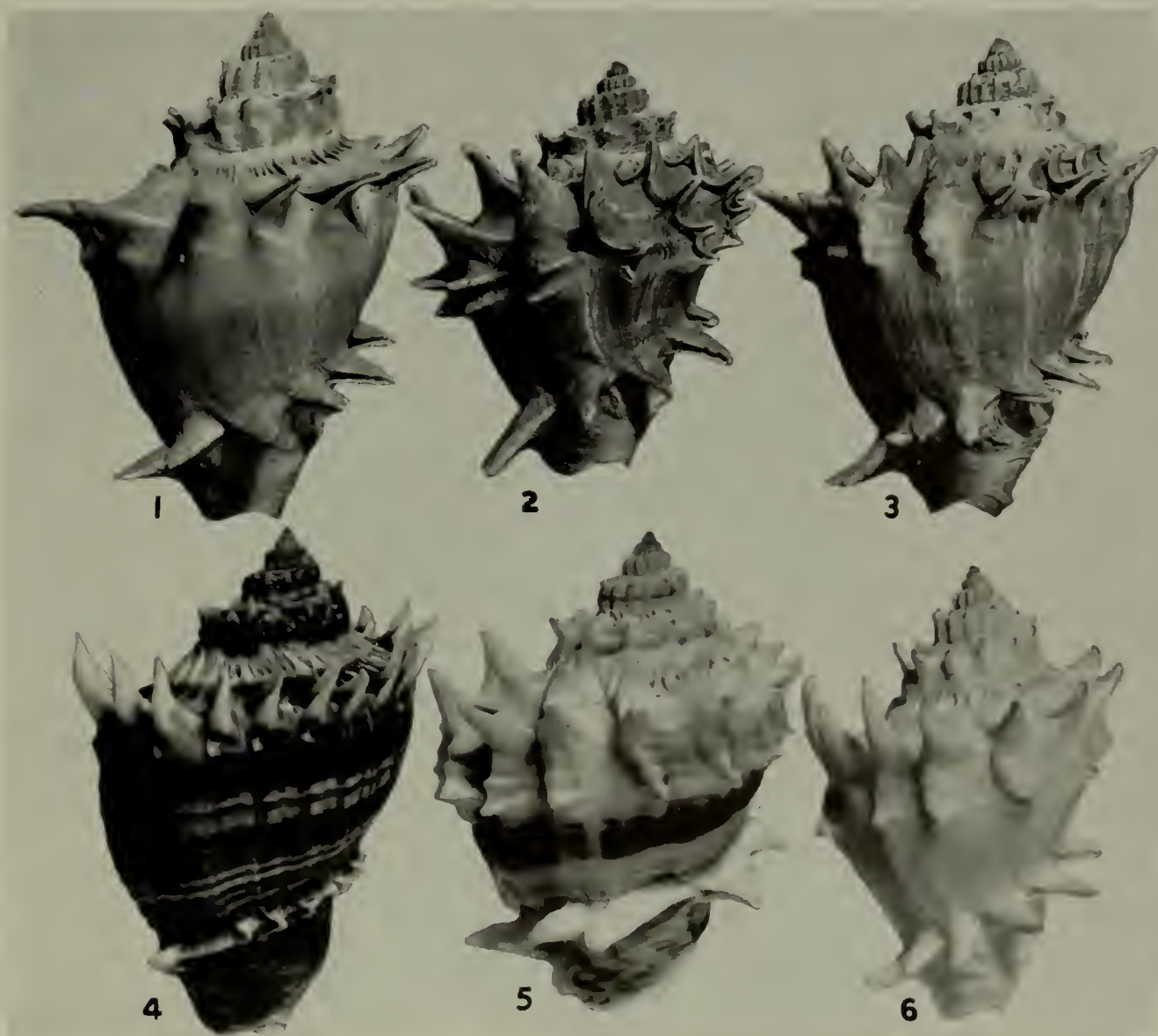


Plate 100. *Melongena corona corona* Gmelin. Figs. 1-3. Barfield Bay, Caxambas, Florida. Figs. 4-5. Pinaire, Pine Island, Lee Co., Florida. Fig. 6. Goodland, Marco, Florida (all 5/6x).

Naturally such changes were slow and as they took place, either as a plus or minus factor of oceanic level, the fauna and flora advanced or retreated. Thus the present situation is perhaps but a picture of much of the past. We are but viewing at this time a medley of colonies or populations that have been forced to move back and forth: some maintaining a certain genetic purity, others becoming thoroughly mixed by the vicissitudes of chance introductions.

The area of greatest disturbance appears to be between Tampa Bay and Cape Sable. North of Cedar Keys *Melongena* exhibits a fine example of a cline, ending at Gulf Shores, Alabama as a subspecies which we have called *johnstonei*. Starting at Cape Sable and going east and then north along the east coast of Florida the populations of *Melongena* are very uniform and are considered here as the subspecies *altispira*. The Keys, from Key Largo to the Tortugas possess another species, *Melongena bicolor* Say, which is remarkably uniform.

### *Melongena corona corona* Gmelin

Plates 94-97: 100-103

*Murex corona* Gmelin 1791, Systema Naturae, ed. 13, p. 3552 (Sinu Mexicano).

*Melongena belknapi* Petit de la Saussaye 1852, Journal de Conchyliologie 3, p. 65, pl. 2, fig. 5 (coast of Florida).

*Melongena subcoronata* Heilprin 1887, Transactions Wagner Free Institute of Science, Philadelphia 1, p. 70, pl. 1, fig. 3 (Pliocene: Banks of the Caloosahatchie River below Fort Thompson, Florida).

*Melongena corona aspinosa* Dall 1890, Transactions Wagner Free Institute of Science, Philadelphia 3, p. 120, pl. 9, fig. 6 (Pliocene: Caloosahatchie Beds, Florida).

*Melongena corona inspinata* Richards 1933, Nautilus 47, p. 57, pl. 6, fig. 1 (near Sarasota, Florida).

*Melongena perspinosa* Pilsbry and Vanatta 1934, Nautilus 47, p. 120, pl. 12, fig. 1 (Lossman's Key, near Shark River, Florida).

*Melongena corona incurvata* Lermond 1936, Check List of Florida Marine Shells, Gulfport, Florida, p. 40 [*nomen nudum*].

*Melongena corona sargenti* Emery and Lermond 1936, Check List of Florida Marine Shells, Gulfport, Florida, p. 42 [*nomen nudum*].



Plate 101. *Melongena corona corona* Gmelin. Fig. 1. Paratype, *Melongena corona inspinata* Richards (= *Melongena corona corona* Gmelin) Palma Sola Key, Florida (natural size). Fig. 2. Boca Ciega Bay, Gulfport, Florida (about 1.3x).

*Melongena corona trinodulosa* Emery and Lermond 1936, Check List of Florida Marine Shells, Gulfport, Florida, p. 40 [*nomen nudum*].

*Melongena corona mulletensis* 'Lermond' VanHyning 1940, A Check list of the Mollusca of Florida, Gainesville, Florida, p. 19 [*nomen nudum*].

*Melongena corona perspectiva* Abbott 1954, American Sea Shells, New York, p. 72. [This was a lapsus for *Melongena corona perspinosa* Pilsbry and Vanatta.]

*Description.* Shell reaching 205 mm. (about 8 inches) in length, fairly thin to relatively thick and solid, and usually sculptured with spines. Color generally ivory with spiral bands of light orange-brown to dark red-brown. These bands are very variable, some specimens having almost a continuous series of bands of varying widths. However, the most widespread pattern consists of three major bands: one at the whorl shoulder, one about at the whorl periphery and a broad band at the base of the whorl. Whorls 7, rather convex and shouldered. The shoulder is usually horizontal and rather narrow: occasionally it may be broad and with a downward slope. Spire subdepressed to extended. Aperture subovate. Outer lip thin and usually crenulated. Inner lip usually consisting of a thin callus, but in old specimens it becomes thick and white in color. Columella rather broad and twisted. Umbilicus glazed over by the parietal shield. Suture relatively inconspicuous, generally a little more pronounced on the earlier whorls. Sculpture exceedingly variable. Usually there is a single row of rather large spines at the whorl shoulder and another at the base of the whorl. However, occasional colonies may have specimens ex-

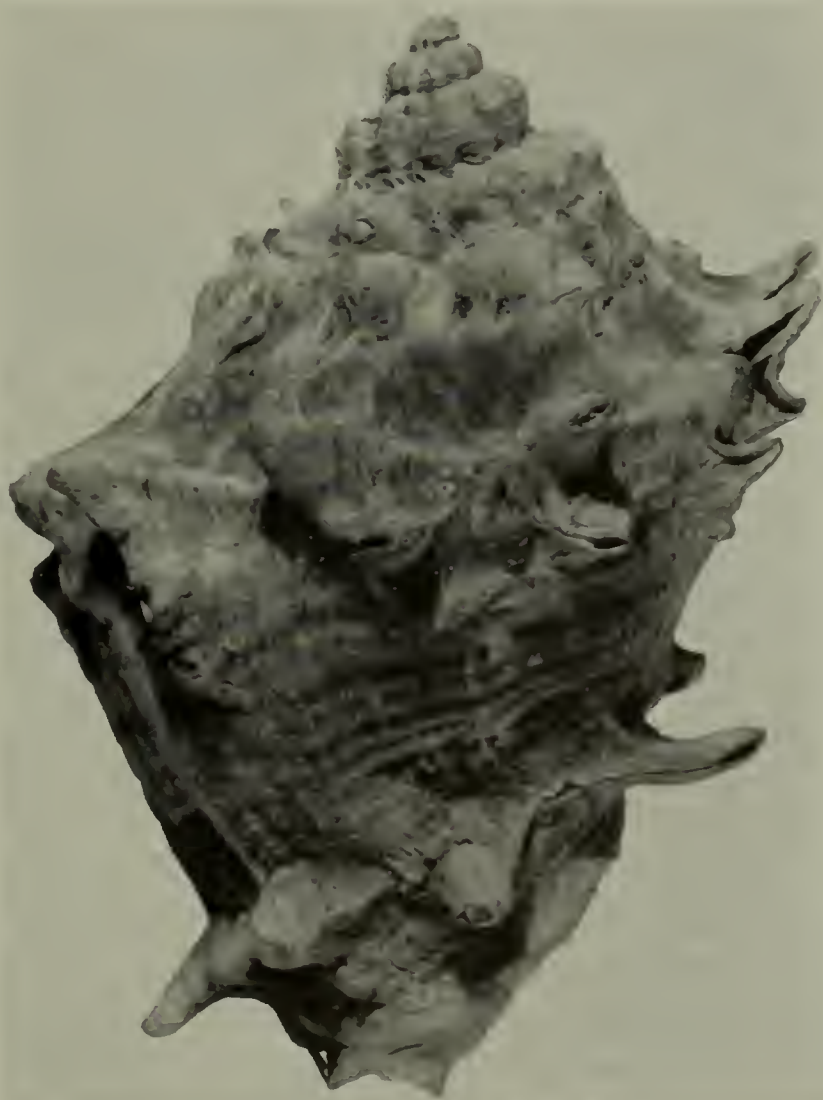


Plate 102. *Melongena corona corona* Gmelin. Holotype, *Melongena perspinosa* Pilsbry and Vanatta (= *M. corona* Gmelin), Lossman's Key, Florida (about 1.1x).

hibiting the large shoulder spines and one to two rows of smaller spines immediately below: in addition, there is sometimes a row of smaller spines between the shoulder series and the suture. In other colonies the spines may be reduced to a single row at the whorl shoulder, the basal row being absent. In various colonies the spines may project at right angles to the shell axis, or more commonly project upwardly and may even be arched toward the spire. There is a great deal of variation in the number of large shoulder spines, these ranging from 10 to 26 on the body whorl. Generally the spines are claw-like in appearance and are open on the forward side. Occasionally these spines are closed, at least near the base, especially in colonies from the region between Cape Romano and Lossman's River. At the suture there is a series of imbrications representing the previous growth stages of the anal canal. These are most conspicuous on the last three whorls. In addition to the spiral rows of spines there are numerous spiral ridges which vary in their intensity between colonies. The early whorls are generally rather strongly axially costate. Operculum unguiculate, the nucleus basal, the outer surface with numerous and exceedingly fine concentric ridges. Inner surface with the palatal margin smooth and glazed, and the inner area with a series of rather widely separated concentric ridges which appear shingled. Periostracum usually colored a dark and dull greenish-brown to a dull red-brown.

length	width*	
205 mm.	127 mm.	Goose Cove, Cedar Keys, Florida
187	123	Big Carlos Pass, Sanibel Island, Florida
138	95	Lossman's Key, Florida
98	70	Holotype of <i>M. perspinosa</i> P. and V.

\* not including spines

*Types.* It is practically certain that Gmelin had no specimens of this species, his description being based on the Latin diagnosis and figures in Chemnitz. We here select Chemnitz's figure in the Conchylien-Cabinet 1788, (1) 10, pl. 161, fig. 1527 as the type figure. The type locality was given originally as the Gulf of Mexico. We here restrict it to Tampa Bay, Florida, as possibly the area from which this material may have come. The type of *Melongena belknapi* Petit de la Saussaye is in the collection of the Journal de Conchyliologie. The holotypes of *M. subcoronata* Heilprin and *M. perspinosa* Pilsbry and Vanatta are in the Academy of Natural Sciences, Philadelphia. The holotype of *M. corona inspinata* Richards is in the collection of Mrs. E. R. Edgerly, Trenton, New Jersey: paratypes are in the Academy of Natural Sciences, Philadelphia. The holotype of *Melongena corona aspinosa* Dall is in the United States National Museum, no. 135319.

*Remarks.* The life history of this species is exceedingly interesting and much of it accounts for the variation exhibited by the typical form. Through the kindness of Dr. and Mrs. David Schmidt we were able to get live material for our studies. *Melongena corona* breeds in the summer months, starting in early July. Live specimens were received in March and placed in an aquarium. They continued to be active throughout the spring and on July 11, laid the first egg capsules. Their gross embryology was followed daily. Each day a capsule was cut open and the young examined. In this way a study was made from the initial egg stage to the young snail that emerged from the capsule, as described in the introduction. All stages in the development are passed within the capsule, from the egg through the trochophore and veliger larvae, and the young finally emerge as very

small but nevertheless fully developed crawling snails. Naturally, egg capsules attached to objects subject to mechanical movement may be dispersed, but in the main, the young are very closely associated with the region where they were produced. From a purely genetic standpoint this would account for the general uniformity of many colonies and also for the variation shown by other colonies. Species which possess free-swimming larvae are generally quite constant in their characters over most of their range, much depending, of course, on the length of larval life and the ability of water currents as a dispersal factor.

According to Dall (1890, p. 118) various members of the Melongenidae appeared in America in the Upper Eocene. So far as we can trace *Melongena* appeared in the Pliocene of central Florida. There seems to be no difference between the recent *Melongena corona corona* Gmelin and the Pliocene *M. subcoronata* Heilprin. Our figure of a specimen from Lossman's Key, Florida (Plate 103, fig. 1) is almost an exact replica of the figure given by Heilprin for his *subcoronata*. We have other specimens from Fort Myers Beach, Florida which are also nearly identical with Heilprin's figure.

*Range.* The subspecies *M. c. corona* extends from Keaton's Beach, Taylor County, Florida south to the north end of Cape Sable, Florida.

*Specimens examined.* FLORIDA: Lossman's Key, Ten Thousand Islands (D. and N. Schmidt; MCZ: USNM); Plover Key, 5 mi. north-northwest of Lossman's River, Monroe Co.; Allen River, Everglades, Collier Co. (both MCZ); Pavilion Key (Carne-

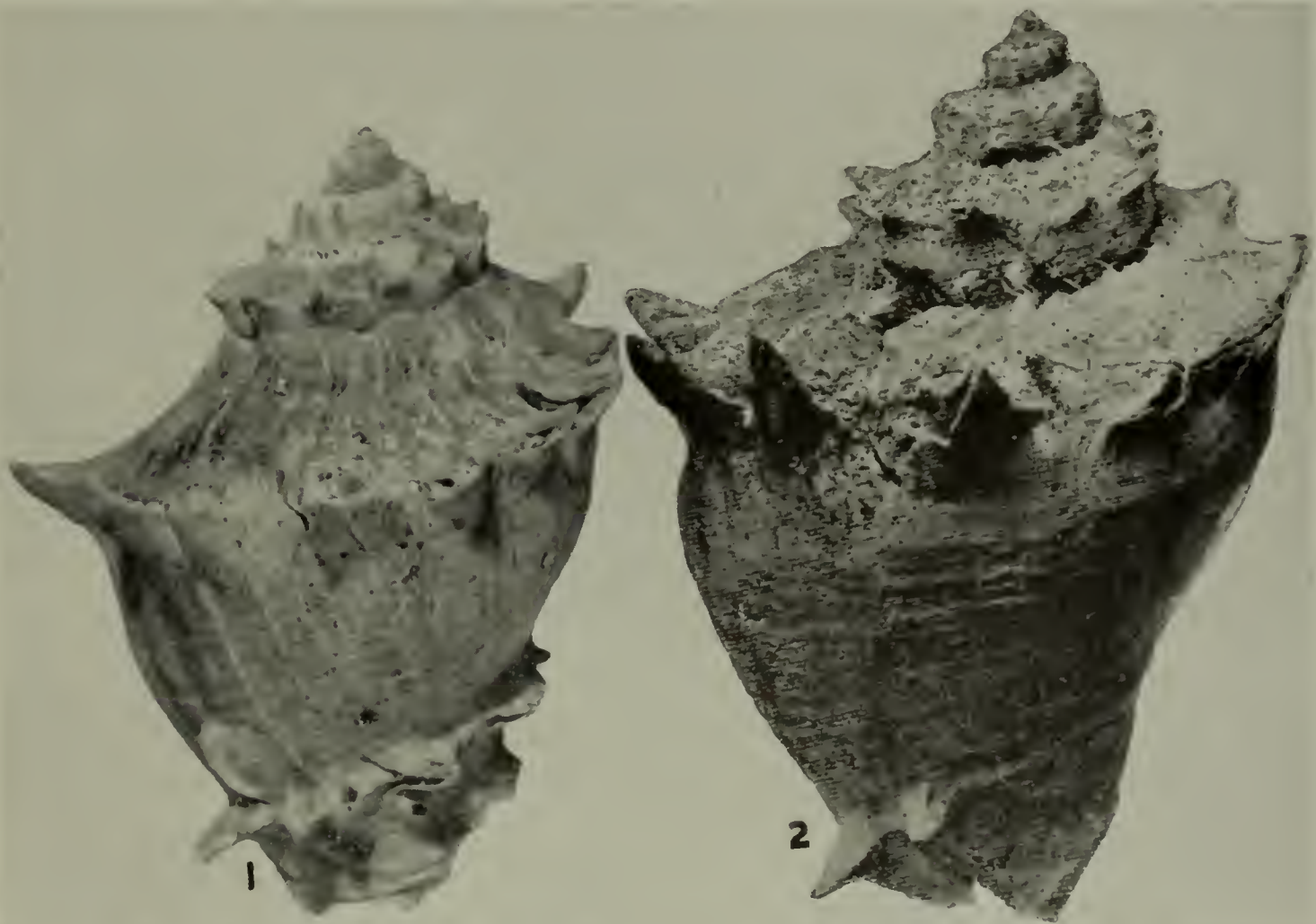


Plate 103. *Melongena corona corona* Gmelin. Fig. 1. Lossman's Key, Ten Thousand Islands, Monroe County, Florida (1.1x). Fig. 2. Holotype, *Melongena subcoronata* Heilprin (= *M. corona* Gmelin) from Heilprin 1887, pl. 1, fig. 3 (about natural size).

gie Museum): Cape Romano (D. and N. Schmidt): Horse Key,  $1\frac{1}{2}$  miles southeast of Marco, Collier Co. (MCZ): Marco Island (D. and N. Schmidt: R. Merrill: J. Schwengel: M. Branham): Gordon River, Naples (D. and N. Schmidt): Barfield Bay, Naples (R. Cahoon: D. and N. Schmidt): Bonita Beach, Bonita Springs (MCZ: D. and N. Schmidt): Estero Island (R. Merrill: D. and N. Schmidt: USNM): Punta Rassa (R. Merrill: D. and N. Schmidt: USNM: MCZ): Caloosahatchee River, Port Comfort (D. and N. Schmidt): Mouth of Alligator Creek, Charlotte Harbor (MCZ): Sanibel Island (J. Schwengel: R. Merrill: USNM: MCZ): Causeway to Mattacha Pass and Pine Island (G. Weber): Bokeelia Beach, Pine Island (D. and N. Schmidt: G. Weber): Pineaire, Pine Island: St. James, Pine Island (both D. and N. Schmidt): Boca Grande (H. Dodge): Gasparilla (Florida State Museum): Johnson Cove and Cedar Point, Lemon Bay (both MCZ): Englewood Beach (R. Merrill): Venice: Casey's Key, Manatee Co. (both Carnegie Museum): Mouth of North Creek, Little Sarasota Bay: Upper end of Little Sarasota Bay,  $5\frac{1}{2}$  miles south of Sarasota (both MCZ): Sarasota (MCZ: R. Cahoon): Manatee River (MCZ): Palma Sola Bay, Manatee Co.: Anna Maria Key, Bradenton (both D. and N. Schmidt): Long Key, near Pass-a-grille: Mullet Key, St. Petersburg: Clam Bayou, Boca Ciega Bay, Gulfport: Big Bayou and Monte Cristo Island, St. Petersburg: Piney Point, Lower Tampa Bay (all MCZ): Rocky Point and Safety Harbor, Tampa Bay (both Florida State Museum): Seminole Pier, Clearwater Bay (G. Weber): Davis Causeway, Clearwater (MCZ): St. Josephs Sound, Dunedin (G. Weber): Tarpon Springs (J. Weber): Bayou between Green Key and Port Richey (G. Weber): Crystal River (H. and K. Johnstone): Sea Horse Key, Cedar Keys (MCZ): Goose Cove, Cedar Keys (S. Whitman): Horseshoe Point, Dixie Co. (T. Pulley): Keatons Beach (D. and N. Schmidt).

***Melongena corona altispira* Pilsbry and Vanatta**  
Plate 104

*Melongena corona altispira* Pilsbry and Vanatta 1934, Nautilus 47, p. 119 (Oceanus, Brevard Co., Florida).

*Description.* Shell reaching 72 mm. (about 3 inches) in length, thin but strong, and generally sculptured with spines. Color generally ivory with chocolate brown bands, one at the whorl shoulder, the second at the whorl periphery, and the third at the base of the whorl. These bands appear to be quite constant. Whorls 7, convex and shouldered. The shoulder is usually horizontal and narrow. Spire somewhat elevated. Aperture subovate. Outer lip thin and finely crenulate. Inner lip consisting of a rather thin callus. Columella broad and twisted. Umbilicus glazed over by the parietal shield. Suture relatively inconspicuous. Sculpture variable. In this form there is usually but a single row of small and rather numerous spines at the whorl shoulder. However, many specimens occur, particularly in the Cape Sable area, that are devoid of spines, though others in the same colony may have a single row at the whorl shoulder. These spines project upward and are seldom arched. An occasional specimen will show a row of weak and small spines at the base of the shell. There are numerous and fine spiral ridges which are a little stronger near the base. The early whorls are strongly and axially costate. Sutural imbrications are only weakly developed. Operculum similar to that of the typical form. Periostracum very thin and a dull brownish in appearance.

length	height	whorls	
71.0 mm.	41.0 mm.	8	Mosquito Lagoon, Oak Hill, Florida
70.5	44.0	7	Matanzas Inlet, St. Augustine, Florida
70.0	40.5	8	Cocoa, Florida
58.0	33.5	7	7 miles W. of Flamingo, Florida

*Types.* The holotype of *Melongena corona altispira* Pilsbry and Vanatta is in the Academy of Natural Sciences, Philadelphia, no. 72490. The type locality is Oceanus, Brevard County, Florida.

*Remarks.* This subspecies does not appear to be abundant anywhere throughout its range to judge from the collections we have seen. It appears to be a direct offshoot of *M. corona corona*. Actually, the type series described by Pilsbry and Vanatta are atypical for the subspecies. They appear to be specimens that may have existed under hypersaline conditions, a habitat which frequently causes distortion in shell structure.

We possess other specimens of this subspecies from Oceanus that are very similar to the normal form which exists along the entire east coast of Florida. They were obviously not from the same ecological spot.

Many specimens of this subspecies are devoid of spines, others are weakly spinose and in still others the shoulder spines are exceedingly irregular in their development. The basal row of spines is weak and generally lacking.

We have seen specimens at two localities on the southwest coast that apparently belong to this subspecies. These reached Marco Island and Cape Romano probably by drifting from the Cape Sable region.

This subspecies differs from typical *corona* by being on the average a little smaller, having but a single row of shoulder spines which are weakly developed and frequently absent. The basal row of spines on *altispira* is usually lacking, but when it is present there are always shoulder spines in addition.

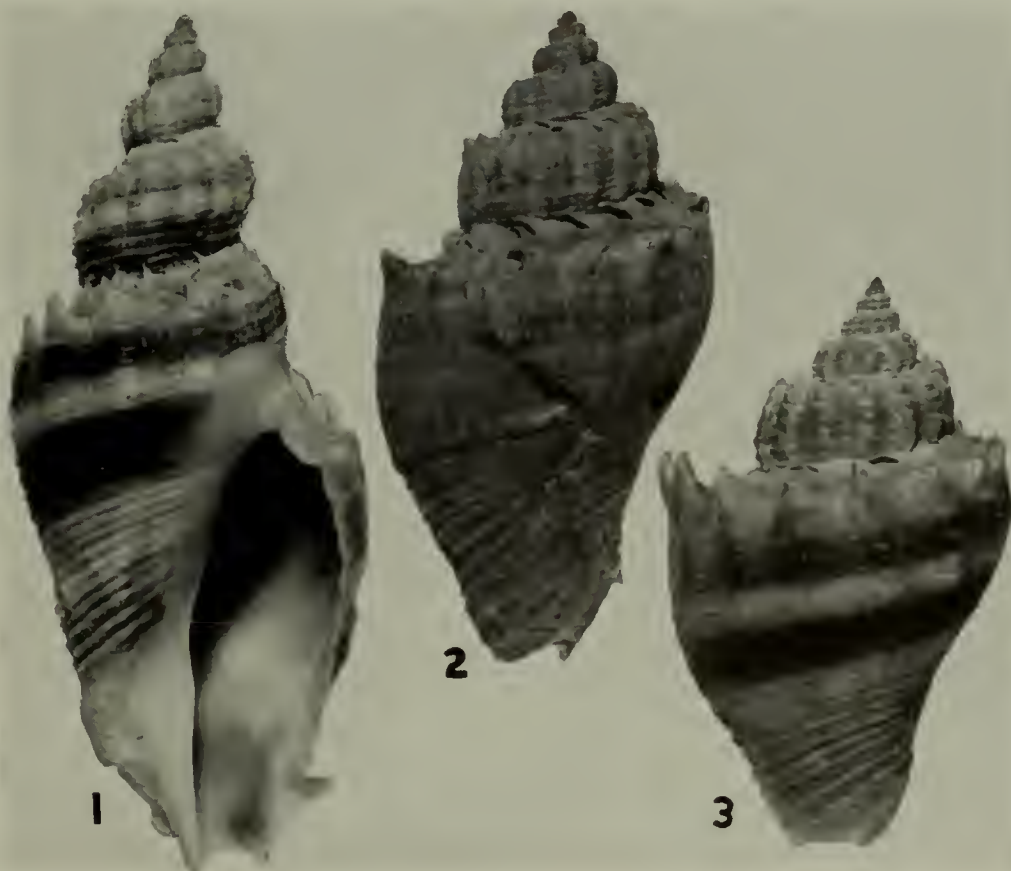


Plate 104. *Melongena corona altispira* Pilsbry and Vanatta. Fig. 1. Holotype, Oceanus, Florida. Fig. 2. Banana River, 2 miles east of Coco Beach, Florida. Fig. 3. New Smyrna, Florida (all about 1.3x).

We have not detected any evidence of a true cline along the east coast of Florida in this subspecies. Perhaps the data at hand are still insufficient. On the other hand, until the inland water way was made continuous, there were many stretches, some long ones, that offered only the open ocean as a highway, areas quite unsuitable for *Melongena* and, in addition, having coastal currents that trend southwards rather than to the north. Our most northern record, Matanzas Inlet, was based upon a single dead shell and this may well be a recent introduction into this area. The Florida portion of the inland waterway needs far more study, both in the dredged cuts as well as along the entire Indian "River" area where only a boat channel was dredged.

See also Remarks under *M. bicolor* Say.

*Range.* This subspecies extends from the region of Cape Sable, Florida in the south, to the east and north as far as Matanzas Inlet near St. Augustine.

*Specimens examined.* FLORIDA: Matanzas Inlet, 15 miles south of St. Augustine: Daytona Beach: New Smyrna (all MCZ): Mosquito Lagoon, near Oak Hill (USNM): Indian River, Cocoa, Brevard Co. (USNM: MCZ: J. Schwengel): Ocean Beach, Brevard Co. (Carnegie Mus.): Oceanus, Brevard Co. (ANSP: MCZ): Eau Gallie (MCZ): Sebastian (R. Merrill): St. Lucy Inlet (J. M. Cannon): Virginia Key, Miami (J. Weber): Matheson Hammock, Biscayne Bay (R. Merrill): Coral Gables (J. Weber; R. Merrill): Coconut Grove: Key Largo Station, Key Largo (both MCZ): Barnes Sound, Key Largo (J. Weber): Madeira Bay (MCZ): 7 miles west of Flamingo, Cape Sable (D. and N. Schmidt): Sandy Key, Cape Sable (MCZ: J. Schwengel): Marco Island: Cape Romano (both D. and N. Schmidt).

### *Melongena corona johnstonei*, new subspecies

Plates 96 and 105

*Description.* Shell reaching 171 mm. ( $6\frac{3}{4}$  inches) in length, rather solid and strongly sculptured. Color generally pale ivory overlaid with two or three bands of dark chocolate-brown which coalesce in the adult forming an almost solid brown shell. In some specimens the brown bands persist in the adult and these are best observed in transmitted light as seen from within the aperture. Whorls  $7\frac{1}{2}$  to 8, rather strongly convex and shouldered. Spire extended. Aperture subovate. Outer lip fairly thin and rather finely crenulate. Inner lip usually consisting of a thin to fairly thick callus. Columella broad and twisted. Umbilicus glazed over by the parietal shield. Suture relatively inconspicuous. Sculpture consisting usually of a single row of strong, erect or recurved spines on the margin of the whorl shoulder. Rarely there exists a rather weak series of spines near the base of the shell. In addition to the spines there are numerous fine spiral ridges which are strongest near the base. At the suture there are numerous imbrications representing previous growth stages of the anal canal. Operculum as in the typical form. Periostracum thin and a dull greenish-gray in color.

length	width	whorls	
171 mm.	94.0 mm.	8.0	Paratype
126	76.0	8.0	Port St. Joe, Florida
102	54.0	7.5	Holotype
94	56.5	7.5	Pensacola, Florida
83	51.0	7.0	Panacea, Wakulla Co., Florida

*Types.* Holotype, Museum of Comparative Zoölogy, no. 189687, from Little Lagoon, Gulf Shores, Alabama. Paratypes from the same locality in the Museum of Comparative Zoölogy, the United States National Museum, the Academy of Natural Sciences, Philadelphia, the Florida State Museum, the Alabama Museum, and the Collections of Harry and Kathleen Johnstone, David and Nevada Schmidt, and D. Thaanum.

*Remarks.* This subspecies has a very limited distribution in northern Florida and extreme eastern Alabama. It appears to merge more or less with the typical form in the region of Apalachee Bay, Florida. It differs in being more elongate, in being in general much darker in color, and in having a brown coloration well diffused over most of the shell leaving a few narrow, spiral bands of white. The shoulder is generally broader than in *M. c. corona*, and the shoulder spines are vertical and more generally pointed inwardly toward the spire.

At Little Lagoon, Gulf Shores, Alabama, *M. c. johnstonei* were feeding on *Ensis minor* Dall and *Tagelus divisus* Spengler. They would locate these bivalves and then extend their proboscises down into the burrow and clean them out. Dead specimens of these two species were the only common bivalves in the beach drift and *Melongena corona johnstonei* was the only large gastropod that we collected along two miles of shore line.

This subspecies exhibits a smooth cline. The gradient of change starts above or along the area of Dead Man's Bay, which is the "bight" area of north central Florida on the west coast. Transitional elements with *M. c. corona* appear in this region. As colonies

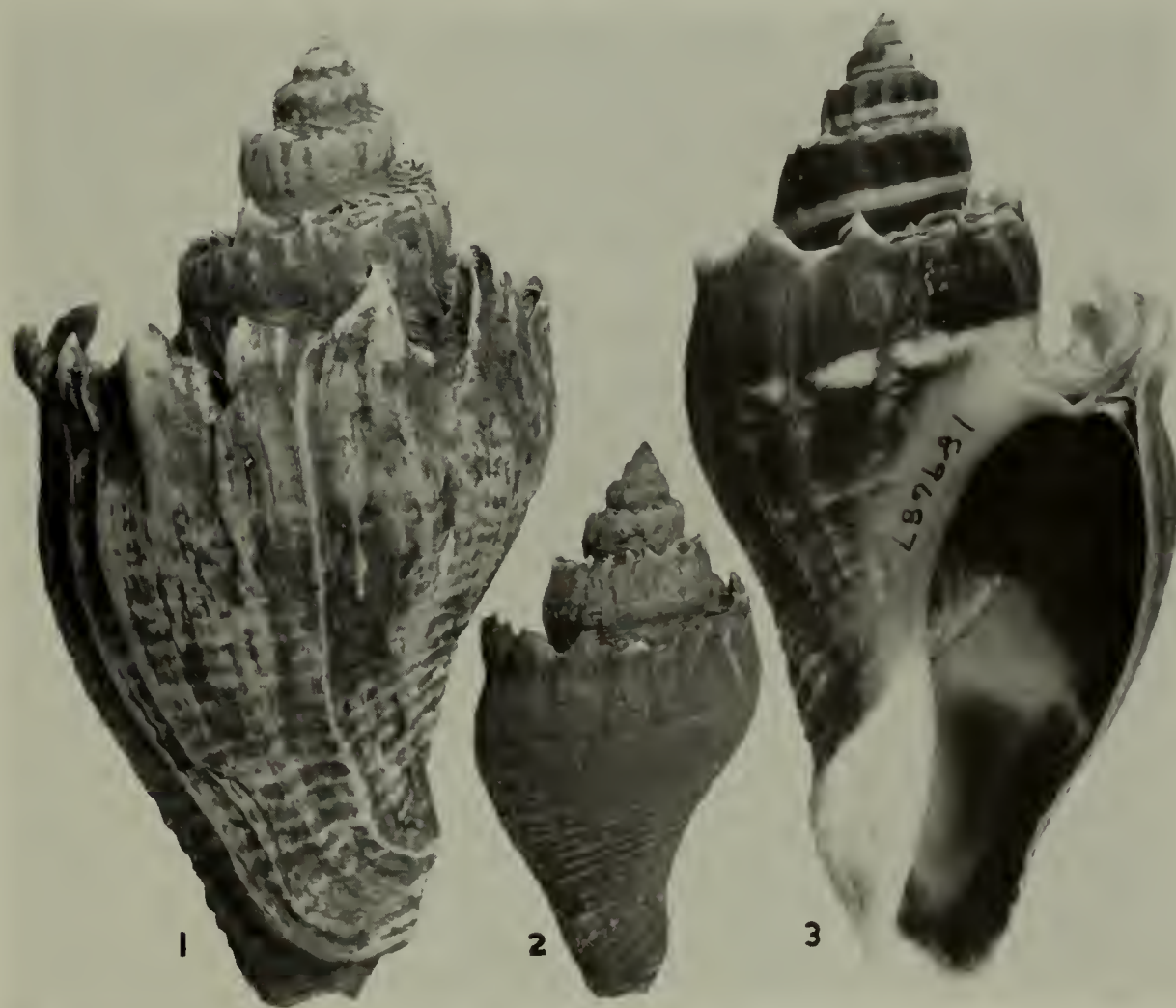


Plate 105. *Melongena corona johnstonei* Clench and Turner. Fig. 1. Holotype. Figs. 2-3. Paratypes, all Little Lagoon, Gulf Shores, Alabama (all natural size).

are obtained at stations both north and west, the specimens become somewhat larger and definitely more attenuate, reaching their ultimate size and attenuation at Gulf Shores, Alabama. The scant data available indicate that if *M. corona* occupied this territory during the warm Pliocene, it was killed out during the cold Pleistocene and invaded this territory anew after the Pleistocene. The subspecies *johnstonei*, having a more uniform gene complex has become somewhat stabilized in the area north of Cedar Keys where it is more or less isolated from the typical *M. c. corona*. This is a result of the small tidal flow in the vicinity of Cedar Keys so that there has been far less opportunity for variable genetic elements of the *corona* complex of the south to reach this area by mechanical means.

See also the remarks under both *M. c. altispira* and *M. bispinosa*.

It is with pleasure that we name this subspecies for Mr. Harry I. Johnstone of Mobile, Alabama.

*Range.* From Gulf Shores, Alabama east to Panacea, Wakulla County, Florida.

*Specimens examined.* ALABAMA: Little Lagoon, Gulf Shores (Mr. and Mrs. H. I. Johnstone: MCZ). FLORIDA: Pensacola (MCZ; T. Pulley); west end of Santa Rosa Island (Univ. of Florida: J. Weber); Fort Walton, Santa Rosa Island (H. I. Johnstone); Port St. Joe (R. Merrill; D. and N. Schmidt; Univ. of Florida); James Island, Franklin Co. (T. Pulley); Panacea (MCZ).

### *Melongena bispinosa* Philippi

#### Plate 106

*Pyrula bispinosa* Philippi 1844, *Abbildungen und Beschreibungen Conchylien* 1, *Pyrula*, p. 2, pl. 1, figs. 7-8 (locality unknown).

*Pyrula martiniana* 'Pfeiffer' Philippi 1844, *Abbildungen und Beschreibungen Conchylien* 1, *Pyrula*, p. 2, pl. 1, fig. 9 (locality unknown).

*Melongena bispinosa* Philippi, Petit de la Saussaye 1852, *Journal de Conchyliologie* 3, p. 157, pl. 8, fig. 3.

*Melongena corona bispinosa* Philippi, Pilsbry 1934, *Nautilus* 47, p. 120.

*Description.* Shell reaching 75 mm. (about 3 inches) in length, rather light in structure and sculptured. Color light brownish-yellow with one to three spiral bands of dark brown; interior of aperture light yellow. Whorls 6 to 7 and shouldered. Spire somewhat extended; aperture subovate; outer lip rather thin and crenulated. Inner lip usually consisting of a fairly thick callus on the parietal wall. Columella rather broad and flatly sigmoid in profile. Umbilicus usually closed, occasionally with a small perforation. Suture well defined. Sculpture consisting usually of one to three rows of spines at the whorl shoulder: in addition, there is a single row of scale-like spines midway between the periphery and the base of the shell. At the base there are a series of scales which represent former margins of the siphonal canal. A similar series of small scales exists at the suture, which are previous margins of the anal canal. There are numerous thread-like spiral ridges. Axial costae rather strongly developed on the early whorls. These costae are somewhat nodulose.

length	width	
75 mm.	50.0 mm.	from Petit de la Saussaye
43	26.5	Dzilam, Yucatan, Mexico
42	24.5	" " "

*Types.* The whereabouts of the types of both *Melongena bispinosa* and *M. martiniana* Philippi is unknown. They are not in the British Museum (Natural History), where some of Philippi's shells are located, according to Mr. Guy Wilkins who kindly checked this for us.

*Remarks.* This species appears to be nearest in relationship to certain forms of *M. c. altispira* of the Florida east coast. It differs from all other members of the *corona* complex by possessing scale-like spines behind the siphonal canal. These are actually previous margins of this canal. When the animal enlarges the shell it builds a completely new margin to the canal and thus the older ones that are left behind project outwardly, giving the appearance of scales. This same morphological structure is of frequent occurrence in *Murex* and *Rapana*.

The occurrence of this species in Yucatan is one of those anomalous problems in distribution that are exceedingly difficult to explain. This species is completely isolated from other members of the *corona* complex and even in Yucatan occupies only a small area so far as is now known.

It was originally described without any known locality and later Petit de la Saussaye described and figured a specimen which he received from Largilliert, also without locality. Largilliert had collected rather extensively in Central America, including Yucatan, about 1842.

In 1890, Angelo Heilprin, a member of the staff of the Academy of Natural Sciences in Philadelphia, made an expedition to Yucatan mainly in quest of fossil material. Recent marine shells were also collected and these were published by F. C. Baker (1891). Heilprin collected *M. bispinosa* at two stations, Progreso and Silam [Dzilam de Bravo], both on the northern coast of the peninsula. We have seen an additional lot labeled only Yucatan. Undoubtedly more collecting may extend the known range of this species.

Perhaps *M. bispinosa* is only a remnant from the Pliocene of a once far more widely distributed element of the *corona* complex. During this warm period in the geologic past this species complex may have occupied the entire Gulf coast area and later, during the cold Pleistocene these forms may have been driven south or were killed out in the northern portion of the Gulf region. By this means, *M. bispinosa* remains as a relict species, completely isolated from other elements to which it is obviously closely related.

See also remarks under *M. corona johnstonei*.

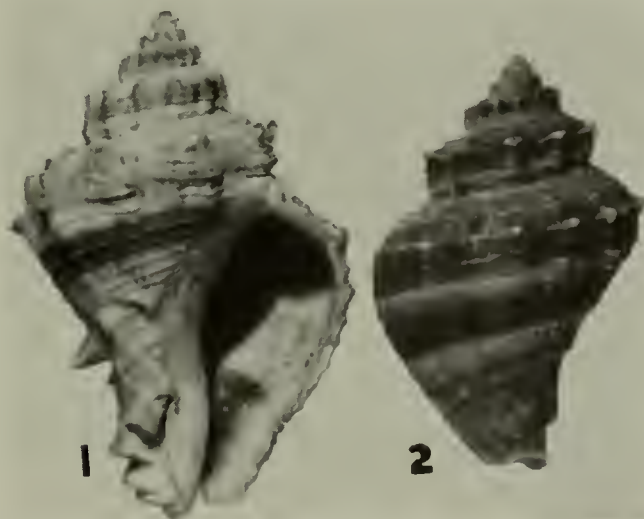


Plate 106. *Melongena bispinosa* Philippi. Figs. 1-2. Yucatan (natural size).

*Range.* Coast of Yucatan from Campeche (N. E. Weisbord, 1926) to Dzilam de Bravo.

*Specimens examined.* MEXICO: Dzilam de Bravo and Progreso, Yucatan (both ANSP).

### *Melongena bicolor* Say

Plates 96: 107-108

*Fusus bicolor* Say 1827, Journal Academy Natural Sciences, Philadelphia 5, p. 215 (southern coast of East Florida).

*Hemifusus corona minor* Sowerby 1878 [1879], Proc. Zoological Society London, pp. 796, 798 (plate caption), plate 48, fig. 13 (Key West, Florida).

*Hemifusus corona estephomenos* Melville 1881, Journal of Conchology 3, p. 157 (Key West, Florida).

*Description.* Shell reaching 50 mm. (about 2 inches) in length, thin but strong and sculptured with spines. Color a light ivory to pinkish-ivory with spiral bands of brown. These bands are variable but generally there are three, one at the whorl shoulder, one at the periphery of the whorl and a third at the base of the whorl. Early whorls often a uniform dark brown. There are occasional specimens without bands. Whorls 8, moderately convex and with a narrow shoulder. Spire elevated. Aperture subovate. Outer lip thin and very finely crenulated. Inner lip consisting of a very thin glaze. Columella broad and twisted. Umbilicus glazed over by the parietal shield. Sculpture somewhat variable. On the whorl shoulder there may be a single row or rarely two rows of rather small and close-set spines which are erect. Very rarely a basal row of spines is present. In addition to the spines, there are numerous very fine spiral ridges which are a little stronger near the base of the whorl. Axial costae strong and well developed on the early whorls, sometimes persisting even on the body whorl. Sutural imbrications very small and only weakly developed. Operculum as in *M. corona*. Periostracum very thin and a dull brownish in color.

length	height	whorls	
49.0 mm.	25.0 mm.	8	Key Vaca, Florida
43.5	23.0	7	“ “ “
43.0	22.5	8	Tortugas, Florida

*Types.* The holotype of *Melongena bicolor* Say is in the Academy of Natural Sciences, Philadelphia, no. 34276, from the southern coast of east Florida, Mr. Elliott collector. The types of *M. c. minor* Sowerby and *M. c. estephomenos* Melvill, both names based upon the same specimens, are probably in the British Museum. The type locality is Key West, Florida. This last can also be accepted as the type locality for *bicolor* Say.

*Remarks.* This is quite a distinct species. In relationship it appears to be nearest to *M. c. altispira* Pilsbry and Vanatta but differs by being smaller, much lighter in color and having more and better developed shoulder spines. We have seen no hybrid specimens even where their ranges overlap or approximate one another in the vicinity of Biscayne Bay. In addition, the ecology of the two forms is quite different, *M. bicolor* living usually on the outer sandy beaches where completely marine conditions exist, while *M. c. altispira* is found in brackish water areas. Young specimens of the two species may be difficult to differentiate.

This species is remarkably uniform in size, specimens from several localities showing but little variation. The number of spines on the body whorl, though variable, appears

to be far more constant than is the case in *M. corona*. There is no question but that Say's name *bicolor* applies to this species. His description was based upon very young and worn specimens, but none the less, it agrees entirely with the young of the form that occurs on the Lower Florida Keys (Plate 108, figs. 1-2). Say's type locality "Southern coast of East Florida" could certainly apply to the Florida Keys, and may possibly have been Key West.

Our northernmost record is Biscayne Bay and from here the records extend down the Keys generally on the outer sandy beaches to as far as the Dry Tortugas.

Mr. John H. Butler has kindly contributed the following data on certain of their habits. "These *Melongena bicolor* are to be found only on the Atlantic side of the Florida Keys. They have developed a method of protection from the elements which shields them from hot sun or wave action during storms. They bury themselves in the marly sand and take their food along with them. As the tide comes in they emerge when covered with a few inches of water, then they hunt their meal. They gather two or three *Cerithium*, carry these around until they decide it's time to dig down again, then they go completely out of sight, sometimes as much as four inches down. There they leisurely devour their lunch and wait for the tide to come back again. They do not seem to like brackish water, for they will not come out on a rainy day. Caught out in a summer shower they at once dig down, and most of them will stay down until the tide turns again.

"I have found no live specimens on the Gulf side of the Keys: a few dead shells occasionally, more often than not inhabited by hermit crabs. Scattered specimens may be found in some of the harbors and back bays of the Atlantic side, such as Boot Key Harbor off Key Vaca. These have most likely been washed in by a storm for they do not thrive in such locations. They seem to prefer the open Atlantic shores where the sand is

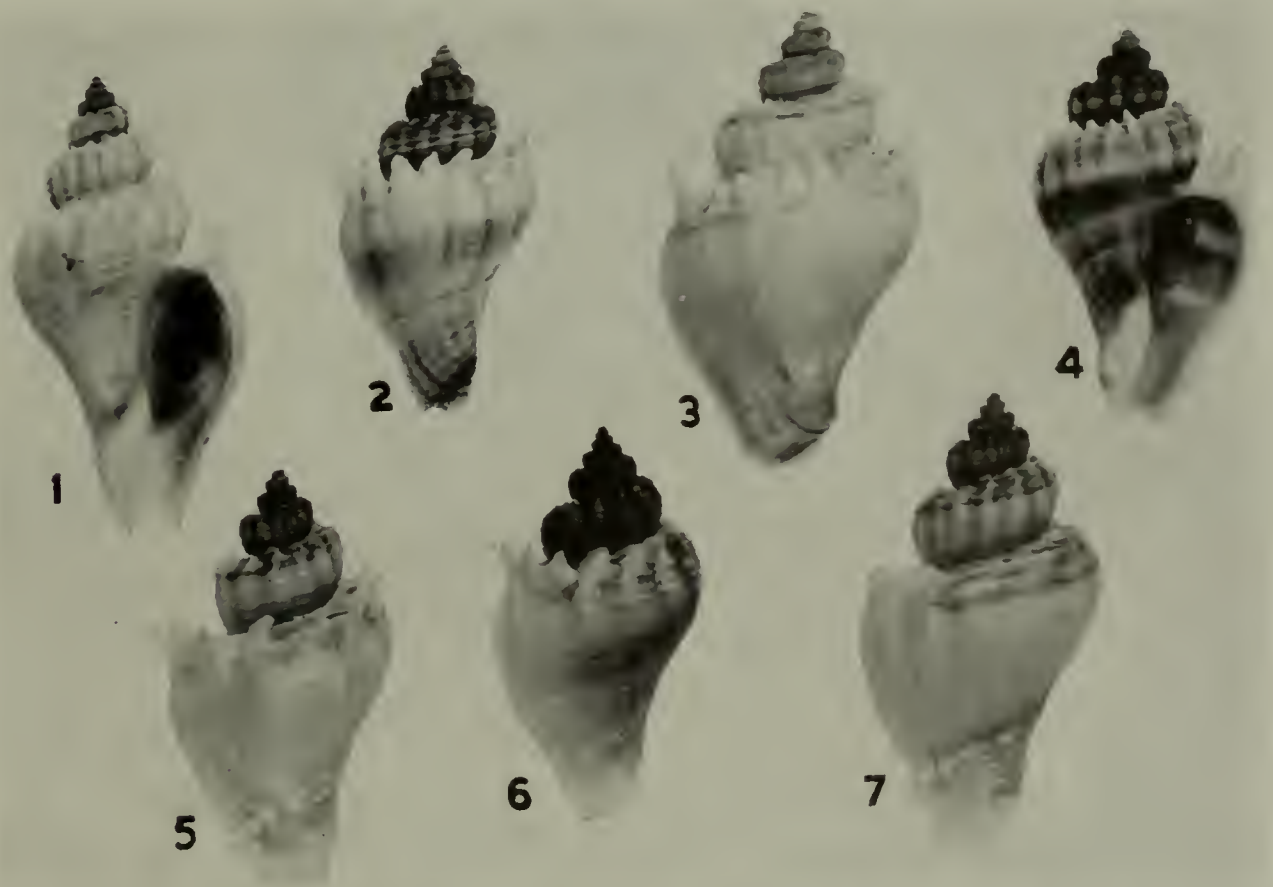


Plate 107. *Melongena bicolor* Say. Figs. 1-4. Outer beach, Grassy Key, Lower Keys, Florida. Figs. 5-7. Lower Matecumbe Key, Lower Keys, Florida (all 1.2x).

heavy with a high marl content. They are entirely absent from such Keys as Bahia Honda having a fine clean sand beach. Such sand moves readily in a storm and they would be washed up on the beach and exterminated. They seem to be strictly carnivorous, preferring their food fresh and alive. I have never found them feeding on dead fish or dead crabs, unlike the large *Melongena corona* of the west Florida Coast. They are absent from large areas where there are no *Cerithium*, other conditions apparently favorable. Where *Cerithium* are scarce you will find adults only, no juveniles."

*Range.* From Biscayne Bay southwest along the Keys to Dry Tortugas.

*Specimens examined.* FLORIDA: near Coral Gables Canal, Biscayne Bay (D. Moore); Plantation Key (D. and N. Schmidt; H. Moore); Windleys Key (D. and N. Schmidt); Upper Matecumbe Key (MCZ); Lower Matecumbe Key (Carnegie Mus.; MCZ; J. Weber); Upper Grassy Key (D. and N. Schmidt); Grassy Key (J. Butler; R. Cahoon; D. and N. Schmidt); Crawl Key (D. and N. Schmidt); Key Vaca (J. Butler; D. and N. Schmidt); Bahia Honda Key (R. Merrill); Torch Key (MCZ); Sugar Loaf Key (MCZ; Carnegie Mus.; D. and N. Schmidt); Boca Chica Key (Charleston Mus.); Stock Island (Carnegie Mus.); Key West; Dry Tortugas (both MCZ).



Plate 108. *Melongena bicolor* Say. Fig. 1. Lectotype, *Fusus bicolor* Say (= *Melongena bicolor* Say), southern Florida. Fig. 2. Key Vaca, Florida (young) (both about 5.2x).

### Genus *Pugilina* Schumacher

*Pugilina* Schumacher 1817, Essai d'un Nouveau Système des Habitations des Vers Testacés, p. 216.

Type species, *Pugilina fasciata* Schumacher (= *Murex morio* Linné), monotypic.

Shell subdepressed to attenuate, generally rather heavy in structure and relatively smooth to strongly nodulose. Periostracum dark brown and relatively thick. Spiral sculpture variable, consisting of numerous threads or incised lines.

Subgenus **Pugilina** *Schumacher*

Shell subdepressed to extended, rather solidly constructed, smooth to strongly nodulose and having relatively weak spiral threads.

**Pugilina morio** *Linné*

Plates 96 and 109

*Murex morio* Linné 1758, *Systema Naturae*, ed. 10, p. 753 (locality unknown); *ibid.* ed. 12, 1767, p. 1221 (M. Africano); Hanley 1855, *Ipsa Linnaei Conchylia*, p. 300.

*Fusus morio* Linné, Röding 1798, *Museum Boltenianum*, p. 120.

*Fusus corouatus* Lamarck 1803, *Annales du Muséum d'Histoire Naturelle*, Paris 2, pt. 2, p. 321 (no locality given); Lamarck 1816, *Encyclopédie Méthodique*, *Tableau Mollusques et Polypes Divers*, p. 7. Explanation of pl. 430, fig. 5 [error for fig. 4]; Deshayes 1832, *ibid.*, Vers 2, pt. 2, p. 156 (Sénégal and the Antilles).

*Pugilina fuscata* Schumacher 1817, *Essai d'un Nouveau Système des Habitations des Vers Testacés*, p. 216.

*Pyrula morio* Linné, Reeve 1847, *Conchologia Iconica* 4, *Pyrula*, plate 1, fig. 3.

*Melougea morio* Linné, Tryon 1881, *Manual of Conchology* (1) 3, p. 111, pl. 43, figs. 228-229.

*Semifusus morio* Linné, Dautzenberg 1910, *Actes Société Linnéenne de Bordeaux* 64, p. 204 (p. 48 of the reprint).

*Melougea (Pugilina) morio* Linné, Dautzenberg 1921, *Revue Zoologique Africaine* 9, p. 112.

*Description.* Shell reaching 166 mm. (about 6½ inches) in length, solid and usually bluntly spinose. Color a dark chocolate brown, with usually one or more narrow bands of light yellowish-brown at the periphery. Whorls 9 to 10 and moderately convex. Spire extended and cast at an angle of about 55°. Aperture narrow, subquadrate and lengthened below into a somewhat broadened siphonal canal. Anal notch small but well developed. Parietal wall heavily glazed, usually chocolate brown in color; occasionally it becomes somewhat lighter in color on the lower columellar area. Outer lip thin but strong and usually finely crenulated. Columella heavy, fairly broad and twisted. Umbilicus completely closed. Suture slightly impressed. Sculpture consisting of several blunt spines which margin the outer edge of the shoulder. Young specimens and the early whorls of old specimens are axially costate. Occasionally the blunt spines are absent or greatly reduced on adult specimens. Spiral sculpture consisting of numerous and fine ridges which are quite apparent on the early whorls but later become somewhat flattened and inconspicuous on the body whorl. In addition, there are several well-marked spiral ridges on the inner wall of the outer lip. Operculum unguiculate with an apical nucleus and with fine concentric ridges. Periostracum dull, dark brown in color, thick, somewhat deciduous and marked with fine axial growth lines. It is thick enough to hide all color of the shell.

length	width	
166 mm.	80 mm.	Banana, Belgian Congo
158 *	94	Carenage, Trinidad, Lesser Antilles
113	59	Trinidad

\* Spire broken

*Types.* According to Hanley 1855, p. 300, the type specimen is in the Linnean Collection. Linné referred to Bonanni 1684, *Recreatio*, Rome, plate 357. In the twelfth edition of the *Systema Naturae*, Linné referred to Adanson 1757, *Histoire Naturelle du Sénégal*, pl. 9, fig. 31. Adanson recorded his species as coming from Gorée Island, Sénégal which is here selected as the type locality.

*Remarks.* This species has been placed in many different genera since it was originally described by Linné. We give in our synonymy most of the important name combinations that have appeared.

The typical form of this species as originally described by Linné was without spines. Later, Lamarek introduced the name *coronatus* for the spinose form. However, there is a complete intergradation between these two forms, with specimens of both occurring in the same locality. Both the spinose and the smooth forms are found in the Western as well as the Eastern Atlantic. This is another of several species that occur on both sides of the Atlantic in the tropics.

*Range.* EASTERN ATLANTIC: According to Nicklès 1950, p. 101, this species ranges from Cap Blanc, French West Africa, south to Angola, Africa.

WESTERN ATLANTIC: Trinidad and south to Ilha do Mel, Est. do Paraná, Brasil (Lange de Morretes 1949, p. 98).

*Specimens examined.* EASTERN ATLANTIC: SIERRA LEONE: Turtle Island, off Sherbo Island; Tasso Island, Rokelle Estuary (both T. S. Jones). LIBERIA: Marshall (MCZ). GOLD COAST: Accra (MCZ). CAMEROONS: Longji (MCZ); Batanga (Carnegie Mus.). RIO MUNI: Benito; Coriseo Island (both MCZ; Carnegie Mus.). BELGIAN CONGO: Banana (MCZ).

WESTERN ATLANTIC: LESSER ANTILLES: Tobago (R. W. Cabot); Balandra, Carenage and Salena Bay, Trinidad (all H. G. Kugler). DUTCH GUIANA: Niekerie (D. C. Geijskes). BRASIL: Salinas, Pará (MCZ); Bragança, Pará (Carnegie Mus.); Recife, Pernambuco (MCZ; Carnegie Mus.); Bahia, Bahia (Carnegie Mus.); Ilha de Itaparica, Bahia (M. J. Oliveira); Vitória, Espírito Santo (MCZ).

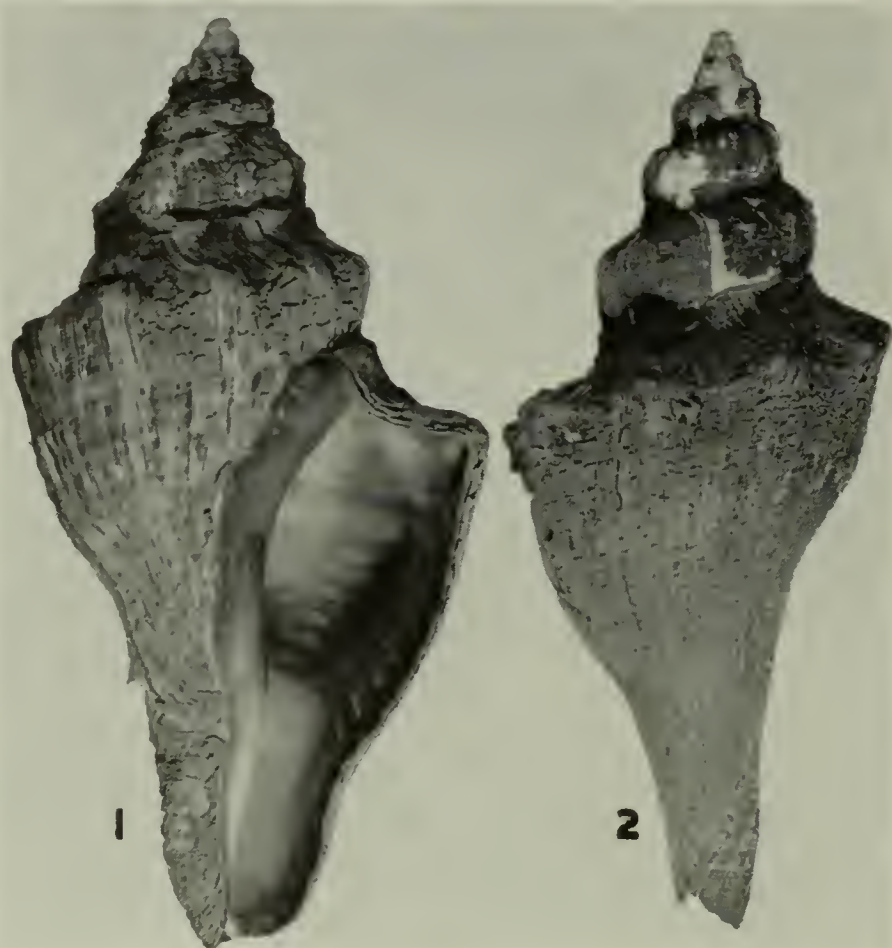


Plate 109. *Pugilia morio* Linné. Figs. 1-2. Vitória, Brasil (about 3/4 natural size).

The following subgenus, *Hemifusus* Swainson, is included only to complete the genus. No species in this subgenus occurs in the Western Atlantic.

### Subgenus *Hemifusus* Swainson

*Hemifusus* Swainson 1840, A Treatise on Malacology, London, p. 308 (and 91).

*Semifusus* Agassiz 1846, Nomenclator Zoologicus, Index, p. 338 [emendation for *Hemifusus* Swainson].

Type species, *Fusus colossens* Lamarck, subsequent designation, Gray 1847.

Shell attenuate, relatively thin, having generally strong shoulder nodules and possessing a relatively strong sculpture of spiral ridges or threads.

\* \* \* \*

### Notes

*Pyrula melongena mutica* Sowerby 1825, Catalogue of the Shells in the collection of the Earl of Tankerville, London, p. 62 [*nomen nudum*].

*Fusus pyruloides* DeKay 1843, Natural History of New York, Mollusca, Albany, New York, p. 147, pl. 9, fig. 191 (Ship's bottom, New York Harbor, believed to have come from a southern port).

We believe this to be a young *Thais*, perhaps *T. haemastoma* Linné and not a *Melongena* as stated by Tryon (1881, Manual of Conchology (1), 3, p. 229).

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## ADDITIONS TO THE PHOLADIDAE — PART II

BY  
RUTH D. TURNER

The following additions and corrections to the monograph of the Pholadidae seemed of sufficient importance to publish at this time rather than wait until the Review Number which will come at the close of Volume 3.

### Genus *Lignopholas* Turner

Johnsonia 3, no. 34, p. 98.

Through an unfortunate omission the citation of a type species for this genus was not included in the original description. It is *Lignopholas clappi* Turner.

### *Jouannetia* (Pholadopsis) *quillingi* Turner

Johnsonia 3, no. 34, pp. 139-140.

Since the publication of Johnsonia, no. 34, two additional records for this species have been received. These extend the range of the species from off Naples, Florida to off Port Isabel, Texas. Both lots were obtained by shrimp boats. One dead specimen was found in the mud, while the others were taken from soft rock brought up by the dredge.

*Specimens examined:* TEXAS: 40 miles north of Port Isabel in 11-14 fathoms (T. Pulley); East-southeast of Port Isabel in 19-20 fathoms (H. Lee).