

JOHNSONIA

Published by
THE DEPARTMENT OF MOLLUSKS
Museum of Comparative Zoölogy, Harvard University
Cambridge, Massachusetts

MUS. COMP. ZOOLOG.
LIBRARY

FEB 7 1969

HARVARD
UNIVERSITY

FEBRUARY 7, 1969

TELLINIDAE

VOL. 4, NO. 47

THE SUBFAMILY TELLININAE IN THE WESTERN ATLANTIC

THE GENUS STRIGILLA

BY

KENNETH J. BOSS

The genus *Strigilla*, a distinctive element of the family Tellinidae, has a discontinuous distribution in the shallow, tropical-subtropical seas of the world and is represented in the fauna of the African Eastern Atlantic, the Indo-Pacific, the Western Atlantic, and the Eastern Pacific regions. The zone of the greatest concentration of species is the Caribbean-Eastern Pacific area. In the West African province, there is a single relict species of the subgenus *Aeretica*, whereas in the Indo-Pacific region, several species of *Aeretica* and a few of the subgenus *Strigilla* are present; however, it must be admitted that information regarding species in the East Indies is, at best, fragmentary. Olsson (1961) has recently treated the Eastern Pacific species and Olsson and McGinty (1958) have discussed the Western Atlantic species. In the present monograph, six species are recognized in the Western Atlantic fauna; of these, four are placed in the nominate subgenus *Strigilla*; the two remaining belong to the subgenus *Pisostrigilla*. One species of *Pisostrigilla*, one species of *Simplistrigilla*, and six species of *Strigilla* s.s. are found in the Eastern Pacific.

The geographic conditions which obtained during the early Tertiary allowed a continuous distribution of species of *Strigilla* from the Western Atlantic to the Eastern Pacific. The formation of the isthmus of Panama during the Pliocene facilitated a divergence of two faunas and today most species of *Strigilla* in the Western Atlantic have analogous species in the Eastern Pacific.

Genus *Strigilla* Turton

Strigilla Turton 1822, Conchylia Insularum Britannicarum, Dithyra, p. 117, pl. 7, fig. 15 (type species, *Tellina carnaria* Linnaeus, subsequent designation Gray 1847, p. 186).

Strigella 'Turton' Gray 1840, Syn. Cont. Brit. Mus., Ed. 42, p. 150 [error for *Strigilla* Turton].

Strigula 'Turton' Menke and Pfeiffer 1861, Malacozoologische Blätter, 7: index, p. 8, non Perry 1811 (Mollusca), [error for *Strigilla* Turton].

Strigillina 'Turton' Stoliczka 1870, Palaeontologia Indica, Cretaceous Fauna of Southern India. Pelecypoda, 3: 120, non Dunker 1862 (Mollusca), [error for *Strigilla* Turton].

Limicola 'Leach' Fischer 1887, Manuel de Conchyliologie, p. 1149, non Koch 1816 (Aves), nec 'Vieillot' Agassiz 1846 (Aves), nec 'Leach MS' Gray 1852 (Mollusca), nec Gray 1857 (Mollusca).

Strigillia 'Turton' Sowerby 1894, Jour. of Conch., 7: 376 [error for *Strigilla* Turton].

Description. Shell small or medium sized, never extending more than 2 inches in length, subcircular to subovate in shape, inequilateral with the umbos usually in front of the middle. Sculpture consisting of incised scissulations which descend across the shell from a high point along the anterior dorsal margin toward the ventral margin; these sulci may be variously flexed or angled along the posterior slope. In the left valve, the hinge dentition consists of two weak lateral teeth and of a cardinal complex including an anterior bifid tooth and a posterior laminate tooth. In the right valve, the hinge dentition consists of two strong lateral teeth with sockets above, and of a cardinal complex including a posterior bifid tooth and an anterior laminate tooth. The color of the shell is predominantly white with some suffusions of red, pink, yellow, green, or brown.

The genus *Strigilla* was originally subdivided into three groups or subgenera by Dall (1900b), who utilized morphological characters which are widely employed in the separation of taxa in the Tellinidae. These include the size and configuration of the pallial sinus as well as the relationship between that sinus and the anterior adductor muscle scar. However, in *Strigilla* the pallial sinus and its position in the valves are characters which exhibit extreme variability and, as Olsson (1961) stated, have little value in the delineation of subgenera. The only character which serves to segregate natural groups in the genus *Strigilla* is the precise nature of the scissulations which are incised obliquely over the external surface of the valves. The presence or absence of posterior flexures of the oblique sulci and the nature or number of these flexures form the most important basis for subgeneric rank. The genus may then be subdivided into at least four subgenera. The subgenus *Strigilla*, with *Tellina carinaria* Linnaeus as type, is highly developed in the Caribbean and Eastern Pacific regions but is also represented in the Australian fauna. The subgenus *Aeretica*, with *Strigilla senegalensis* Hanley as type, is represented in the fauna of the African Eastern Atlantic but is particularly developed in the Philippine region. The subgenus *Simplistrigilla*, with *Strigilla strata* Olsson as type, seems to be restricted to the Eastern Pacific. The subgenus *Pisostrigilla*, with *Tellina pisiformis* Linnaeus as type, is represented in the Caribbean fauna as well as in the Eastern Pacific.

The genus first appears in the late Oligocene of the North American Tertiary, and according to Olsson, there are no substantiated records from the Eocene.

The peculiar acentric sculpture and the suborbicular shape of the shell are diagnostic for the genus. In the Western Atlantic species, the coloration of the shell is pure white, red, or white with suffusions of red or pink. Individuals from this area never attain the size of the largest representative of the genus in the Eastern Pacific, namely *Strigilla disjuncta* Carpenter, which reaches over 40 mm. in length. Generally, the shells are solid with well developed hinge dentition, and for identification of species, details of the sculpture of the posterior slope are most important. In addition, the configuration of the pallial sinus, the disposition of the lateral and cardinal dentitions, and the formation of the ligament are diagnostic. As the acentric sulci descend across the disc, a smooth dorso-ventral band along the anterior quarter of the valve may obliterate the sulci, but this character, employed by earlier workers such as Mörch, Philippi and Carpenter, has been discarded as not being diagnostic. Indeed, the width, extent, disposition and presence or absence of this band are all variable; the full range of variation generally is present in a single population. Plate 164 illustrates the morphological traits used in the definitions and descriptions of the species treated herein.

FEB 7 1969

HARVARD
UNIVERSITY

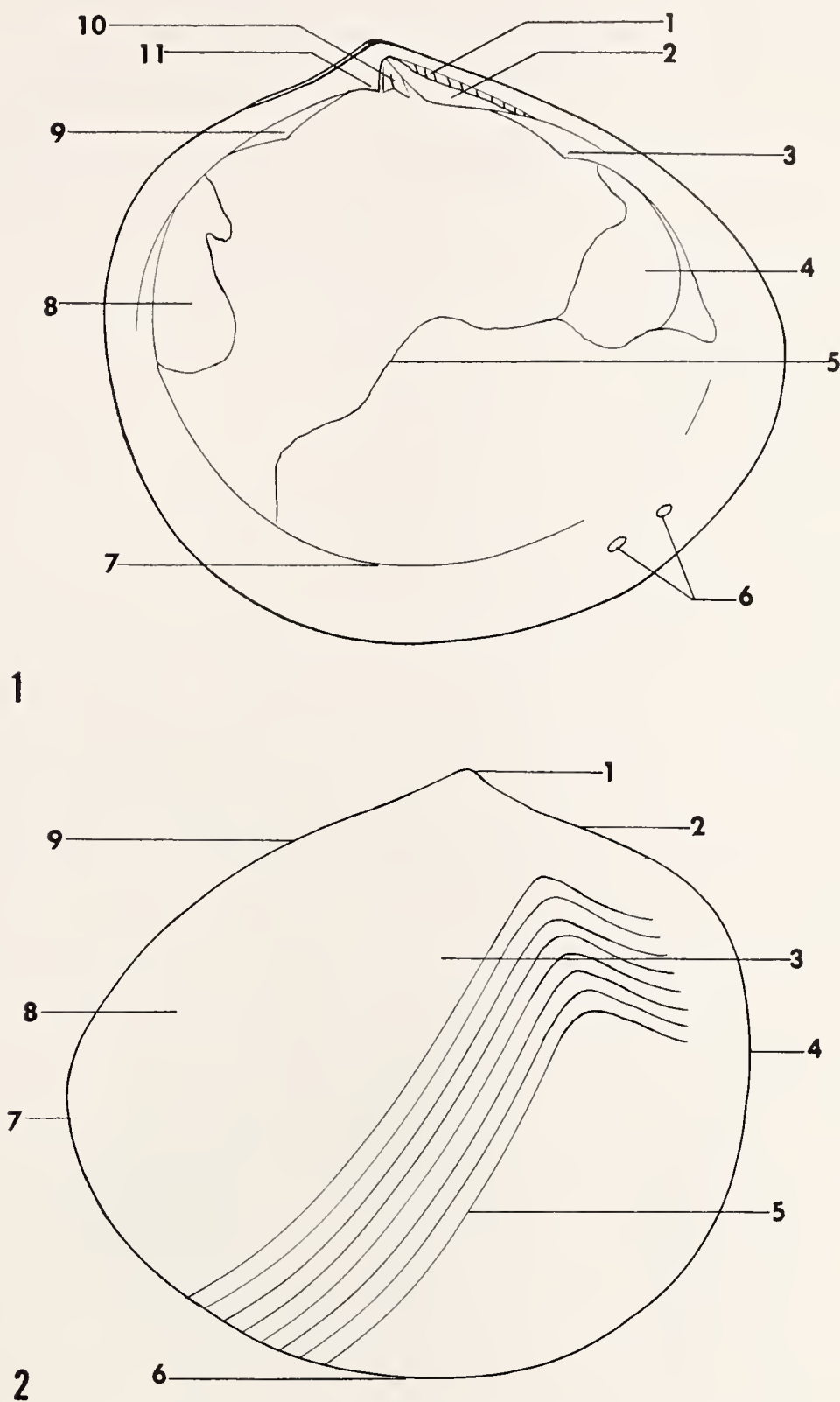


Plate 164. Fig. 1. Diagram of the internal surface of the right valve of *Strigilla*. 1. Ligament. 2. Nymphal callosity. 3. Posterior lateral tooth. 4. Posterior adductor muscle scar. 5. Pallial sinus. 6. Cruciform muscle scars. 7. Pallial line. 8. Anterior adductor muscle scar. 9. Anterior lateral tooth. 10. Bifid tooth of the cardinal complex. 11. Laminate tooth of the cardinal complex. Fig. 2. Diagram of the external surface of the right valve of *Strigilla*. 1. Umbo. 2. Anterior dorsal margin. 3. Disc. 4. Anterior margin. 5. Scissula (or acentric sulcus). 6. Ventral margin. 7. Posterior margin. 8. Posterior slope. 9. Posterior dorsal margin.

Strigilla (Strigilla) carnaria (Linnaeus)

Plate 166, figs. 3-4; Plate 167, figs. 1-2; Plate 168, fig. 1

Tellina carnaria Linnaeus 1758, *Systema Naturae*, ed. 10, p. 676 (in *Oceani brevibus*); Gmelin 1792, *Systema Naturae*, ed. 13, p. 3240 (in *Angliae sinubus et insularum Oceani americani*) [type locality, here restricted, Barbados, West Indies; syntypes, collection of Linnean Society, London].

Cardium carneosum da Costa 1779, *British Conchology*, p. 181 (change of name for *Tellina carnaria* Linnaeus).

Lucina carnaria Linnaeus. Lamarek 1818, *Animaux s. Vertèbres*, 5: 542.

Strigilla carnaria Linnaeus. Turton 1822, *Conchylia Insularum Britannicarum*, Dithyra, p. 117, pl. 7, fig. 15.

Strigilla areolata Menke 1847, *Zeitschr. f. Malak.*, 4: 188 (ad Antillas insulas) [type locality, here restricted, Barbados, West Indies; type not seen].

Strigilla rombergii Mörch 1853, *Catalogus Conchyliorum Comes di Yoldi*, 2: 15, no. 157 (Brazilia) [type locality, here restricted, Recife, Pernambuco, Brasil; holotype, Zoological Museum, Copenhagen].

Strigilla (Rombergia) rombergi [sic] Mörch. Dall 1900, *Trans. Wagner Free Inst., Sci., Philadelphia*, 3(5): 1038.

Description. Shell extending to 28 mm. (about $1\frac{1}{8}$ inches) in length and to 26 mm. (about 1 inch) in height, transversely subovate, inequilateral, equivalve, subsolid, somewhat inflated, the right valve more convex, and usually without a posterior flexure. Umbos in front of the middle, elevated above the hinge line, rather inflated, rounded and blunt. Anterior margin very broadly rounded; ventral margin convex, smoothly rounded and rising behind; anterior dorsal margin short, concave just in front of the umbos and then rounded; posterior dorsal margin more or less straight, short and steeply inclined; posterior margin poorly defined, obliquely inclined, and nearly straight. Sculpture consisting of rather evenly spaced scissulations which descend across the shell from a high point along the anterior slope toward the ventral margin. This scissulate pattern of sculpture is flexed in the posterior third of the shell where it turns sharply upward, forms an acute angle pointing ventrally and extends upward to the posterior dorsal margin. Another flexure occurs on the anterior slope where the sulci are bowed upward. Ligament brown and slightly protuberant; narrow and slightly depressed escutcheon mostly on the left valve; deeply sunken, broad and short lunule evident in the right valve. Calcareous portion of the ligament moderately developed and subtended by slightly raised nymphal callosities. Hinge line moderately well developed. In the left valve, the cardinal complex consists of an anterior small narrowly elongate bifid tooth with sharp subequal lobes and of a posterior very long and thin laminate tooth closely adpressed to the calcareous element of the ligament and coextensive with the hinge plate; anterior lateral tooth subproximal to the cardinal complex and stronger than the distal posterior lateral tooth. In the right valve, the cardinal complex consists of a posterior thickened, strongly skewed bifid tooth, whose posterior lobe is the larger and of an anterior subdeltoid laminate tooth closely adpressed to the base of the lunule. Anterior lateral tooth stronger and closer to the cardinal complex than the posterior lateral tooth; both with sockets above. The lateral dentition is stronger in the right valve. No true internal ribs present, but some radial vermiculations occur on the internal posterior surface. Adductor muscle scars generally well impressed. Anterior adductor elongate and narrow; posterior adductor rounded. Pallial sinus more or less equal in opposite valves, rising but slightly posteriorly, arcuately descending and uniting with the pallial line. The pallial sinus is well separated from the anterior adductor scar. Cruciform muscle scar round, close to the ventral boundary and the terminus of the pallial line is mid-

way between the anterior and posterior cruciform scars. Shell dull to feebly shining and predominantly white, suffused with pink, sometimes disposed in bands. Internally the surface is dull to shining but not highly polished, white, with central concentrations of pink, or all pink.

length	height	width	
26 mm.	24 mm.	—	Syntype of <i>carnaria</i> Linnaeus
21	19	9 mm.	“ “ “ “
19	17	9	“ “ “ “
19	17	8	“ “ “ “
18	16	8	“ “ “ “
15	14	8	Holotype of <i>rombergii</i> Morch
28	26	—	Charlestown, Nevis, Lesser Antilles
24	21	10	St. Martin's Island, Lesser Antilles
18	16	8	Eight Mile Rock, Grand Bahama Island
15	14	7	St. Thomas, Virgin Islands

Remarks. The specimens of *Tellina carnaria* Linnaeus are in the Linnean Collection in London; they consist of four complete specimens plus one large left valve. In the tenth and twelfth editions of the Systema, Linnaeus gave two references to plates, one in Lister (1678) and the other in Gualtieri (1742): both of these figures are unrecognizable but represent unlike species. Gmelin in the thirteenth edition of the Systema included more references to plates, and one of these (Lister, 1770, pl. 339, fig. 176) is here selected as the type figure; the localities given by Lister include the Barbados and Jamaica, and the type locality is herein restricted to the Barbados.

The present confusion in the taxonomy of this group in the Western Atlantic is due to the misinterpretation of the species 'carnaria' and 'rombergii' by Dall. In his papers (1900 a & b), Dall confused *S. carnaria* (Linnaeus) with a hitherto undescribed species (see *Remarks* under *Strigilla pseudocarnaria*).

This species of the subgenus *Strigilla* is unique and easily identified by its pallial sinus which is widely separated from the anterior adductor scar. The distance is usually from 2 to 5 mm. in adults. The shape of the sinus and the nature of its descent to the pallial line are somewhat diagnostic. The sinus is generally rounded dorsally and arcuate anteriorly with an irregular, more or less short straight drop to the pallial line. Young specimens of *carnaria* have somewhat different proportions than adults. The shells are shorter and the ventral margin is less convex.

From *Strigilla pseudocarnaria*, with which *S. carnaria* is most easily confounded, it may be distinguished by the pallial sinus which is removed from the anterior adductor muscle scar and by its somewhat more closely spaced scissulations. From *Strigilla gabbi*, *carnaria* may be distinguished by its wide nymphal callosity and more external ligament.

Specimens in the southernmost portion of the range, notably southern Brasil and Uruguay, tend to possess thinner shells with weaker hinge lines. The pallial sinus approaches the anterior adductor muscle scar and very rarely a fusion of the sinus and muscle scar actually occurs in some values. The color tends to become paler, with a preponderance of pale red individuals, while northern populations possess larger and heavier shelled ones.

Strigilla carnaria seems to have no counterpart in the Eastern Pacific fauna and it does not seem to be represented in the fossil record.

Range. From Florida and the Bahamas, this species extends south through the Greater and Lesser Antilles, along the coast of South America to a southernmost point at Mar del Plata, Argentina. The species does not occur in the outer Bahama Islands and is absent from the Caribbean coasts of Central and South America where it is replaced by *S. pseudocarnaria* (q.v.). Various other localities have been reported for this species, but they seem to be unfounded. Two lots in MCZ, one from Charleston, South

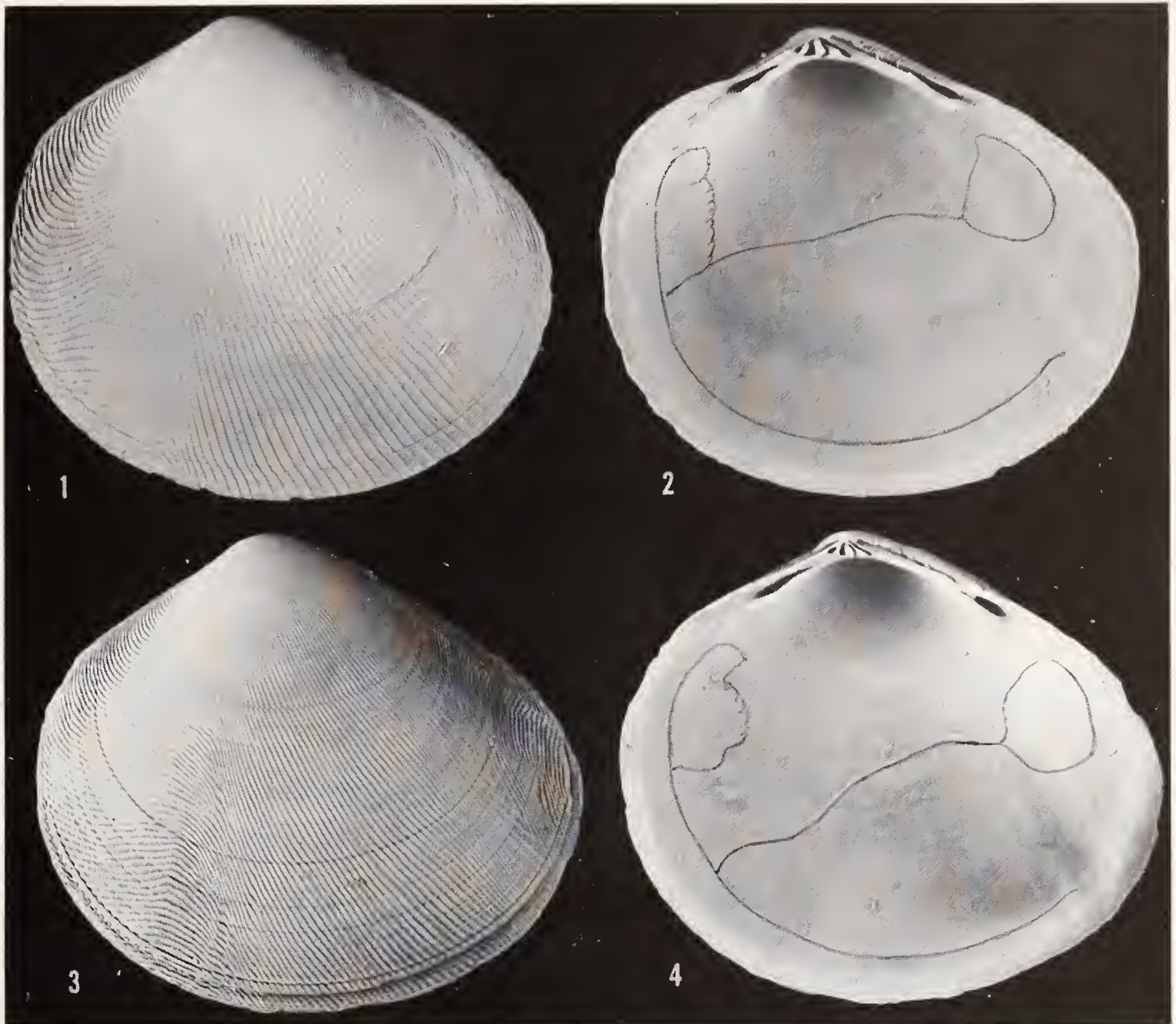


Plate 166. Fig. 1. *Strigilla pseudocarnaria* n.sp., Holotype, MCZ 212736, Bahia de Añasco, Puerto Rico (left valve external; about 4x). Fig. 2. *Strigilla pseudocarnaria* n.sp., Holotype, MCZ 212736, Bahia de Añasco, Puerto Rico (right valve internal; about 4x). Fig. 3. *Strigilla carnaria* (Linnaeus), MCZ 176519, Barbados, West Indies (left valve external; about 3.5x). Fig. 4. *Strigilla carnaria* (Linnaeus), MCZ 176519, Barbados, West Indies (right valve internal; about 3.5x).

Carolina and the other from Colón, Panama are not included in the range for there are sound reasons to doubt the authenticity of the specimens. In the case of the former, neither the check list of the mollusk fauna of South Carolina (Mazzyek, 1913) nor the monograph of the Tellinidae of that state (Ravenel, 1885) mentions the occurrence of this species. In the case of the latter, Olsson and McGinty (1958) have recently treated the marine mollusks of Panama, but have not listed the occurrence of this species there.

Specimens of *S. carnaria* which were supposedly taken alive in the Straits of Bonifacio, off Corsica, and which are preserved in the British Museum (Natural History) and another lot in the same museum taken at Land's End, Cornwall, are presumed to be adventitious.

Specimens examined. FLORIDA: Miami (ANSP; USNM); Key West (MCZ); Bonita Springs (D. & N. Schmidt); Sanibel Id. (MCZ). BAHAMA ISLANDS: West End, Eight Mile Rock, and Freetown, Grand Bahama Id. (all MCZ); North Bimini Id., in 20 fathoms (USNM); Alicetown, North Bimini; Nixon's Harbour, South Bimini (both MCZ); Andros (ANSP). CUBA: Monrillo Beach, Bahia Honda, Pinar del Rio (MCZ); Cardenas Bay (USNM); Veradero Park, Cardenas (ANSP); Caibarien, and off Cayo Fragosa, Las Villas; Punta de los Colorados, Cienfuegos Bay; Rancho Aluna; mouth of Arimao River (all MCZ); Cochinos Bay (USNM); Santiago (ANSP); Fish Point, Guantanamo Bay (MCZ). JAMAICA: Montego (USNM); Dunn's River Falls, St. Anns (MCZ); St. Anns Bay; Port Maria; Harboreale near Annotta Bay; Robins Bay; Buff Bay; Port Antonio; Manchioneal (all USNM). HISPANIOLA: HAITI: Cape Haitien (MCZ); Anse de la Plateforme (USNM); Anse de Leogane (ANSP); Coteaux; Port Salut (both USNM). SANTO DOMINGO: Las Granjas, Monte Cristi; Puerto Plata; Puerto Sosua; Santa Barbara de Samana; Punta Cabereta, Cabo Macoris (all MCZ). PUERTO RICO: San Juan (MCZ); Isla Verde, San Juan (USNM); Arroyo (ANSP). VIRGIN ISLANDS: Bogarts Bay, Tortola (MCZ); St. Thomas (ANSP; USNM; BMNH; MCZ); Port Morant, St. Thomas; St. Croix (both USNM). LESSER ANTILLES: Lowlands, and Phillipsburg, St. Martin Id. (both ANSP); St. Kitts (ANSP; BMNH); Charlestown, Nevis; Guadeloupe (both MCZ); St. Lucia (ANSP); Port Castries, St. Lucia (USNM); St. Vincent (ANSP); Barbados (ANSP; USNM; MCZ); Bathsheba, Barbados (USNM); Fontenary Beach and Grande Anse, Grenada (both MCZ); Tobago (ANSP); Trinidad (MCZ). BRASIL: Recife, Pernambuco; Manguinhos, Ilha de Itaparica, Bahia; Barra Secca, Mucuri, Bahia; Vitoria, Espirito Santo; Rio de Janeiro; São Paulo; Praia Grande, Itanhaem, São Paulo; Ilha do Cardoso, Cananéia, São Paulo (all MCZ). URUGUAY: La Paloma Rocha (ANSP). ARGENTINA: Mar del Plata (USNM).

***Strigilla (Strigilla) pseudocarnaria*, new species**

Plate 166, figs. 1-2

Strigilla carnaria 'Linnaeus' H. & A. Adams 1856, *Genera Recent Mollusca*, 2: 399, pl. 104, figs. 1 & 1a, non Linnaeus 1758.

Tellina rombergi [sic] 'Mörch' Römer 1872, *Conchilien-Cabinet* (2), 10(4): 187, pl. 36, figs. 13-16, non Mörch 1853.

Strigilla (Strigilla) carnaria 'Linnaeus' Dall 1900. *Proc. U.S. Nat. Mus.*, 23: 297; 1900. *Trans. Wagner Free Inst. Sci., Philadelphia*, 3(5): 1038.

Types. The holotype of *Strigilla pseudocarnaria* is in the Museum of Comparative Zoology 212736; the type locality is Bahia de Añasco, Puerto Rico.

Description. Shell extending to 22.5 mm. (about 7/8 inch) in length and to 19.5 mm. (about 4/5 inch) in height, transversely subovate, inequilateral, equivalve, subsolid, moderately inflated with the right valve slightly more convex and without a posterior flexure. Umbos in front of the middle, slightly elevated, somewhat inflated and rather

blunt. Anterior margin very broadly rounded and oblique to the dorso-ventral axis; ventral margin smoothly and gently rounded, rising posteriorly; anterior dorsal margin short, nearly straight and gently sloped; posterior dorsal margin long but slightly convex and rather steeply inclined; posterior margin poorly defined, irregular and generally convex. Sculpture consisting of rather evenly spaced, incised scissulations which descend across the shell from a high point along the anterior dorsal margin toward the ventral margin. This scissulate pattern of sculpture is flexed at the posterior third of the valve where it turns sharply, forms an acute angle which points ventrally and continues upward to the posterior dorsal margin. Another flexure occurs on the anterior slope where the sulci are bowed upward or partly replaced by a smooth tract. In the right valve, a weak posterior ridge extends from the umbonal area and forms an ill-defined flattened posterior dorsal slope. Weak, shallow but rather broad radial sulci occur on the posterior slope of the right valve ventral to the posterior ridge and on the anterior slope of both valves; a weak indentation occurs on the anterior margin at the terminus of the weak sulcus. Ligament dark brown in color, somewhat protuberant; escutcheon mostly on the left valve, shallow and short; lunule profound, long, well developed, larger in the left valve. Calcareous element of the ligament moderately developed, subtended by a weak, slightly raised nymphal callosity in the left valve. Hinge line rather well developed. In the left valve, the cardinal complex consists of an anterior elongate, somewhat thickened bifid tooth with subequal lobes and of a posterior thin, extremely elongate laminate tooth closely adpressed to the calcareous element of the ligament; anterior lateral tooth subproximal and stronger than the distal posterior lateral one. In the right valve, the cardinal complex consists of a posterior, thickened strongly skewed bifid tooth with a large posterior lobe and of an anterior subdeltoid, protuberant laminate tooth closely adpressed to the base of the lunule. Anterior lateral tooth subproximal, strong, and somewhat laminate; posterior lateral tooth distal, strong, and laminate; both laterals with sockets above. The lateral dentition is much stronger in the right valve. No true ribs present, but weak internal vermiculations coincident posteriorly with the cruci-

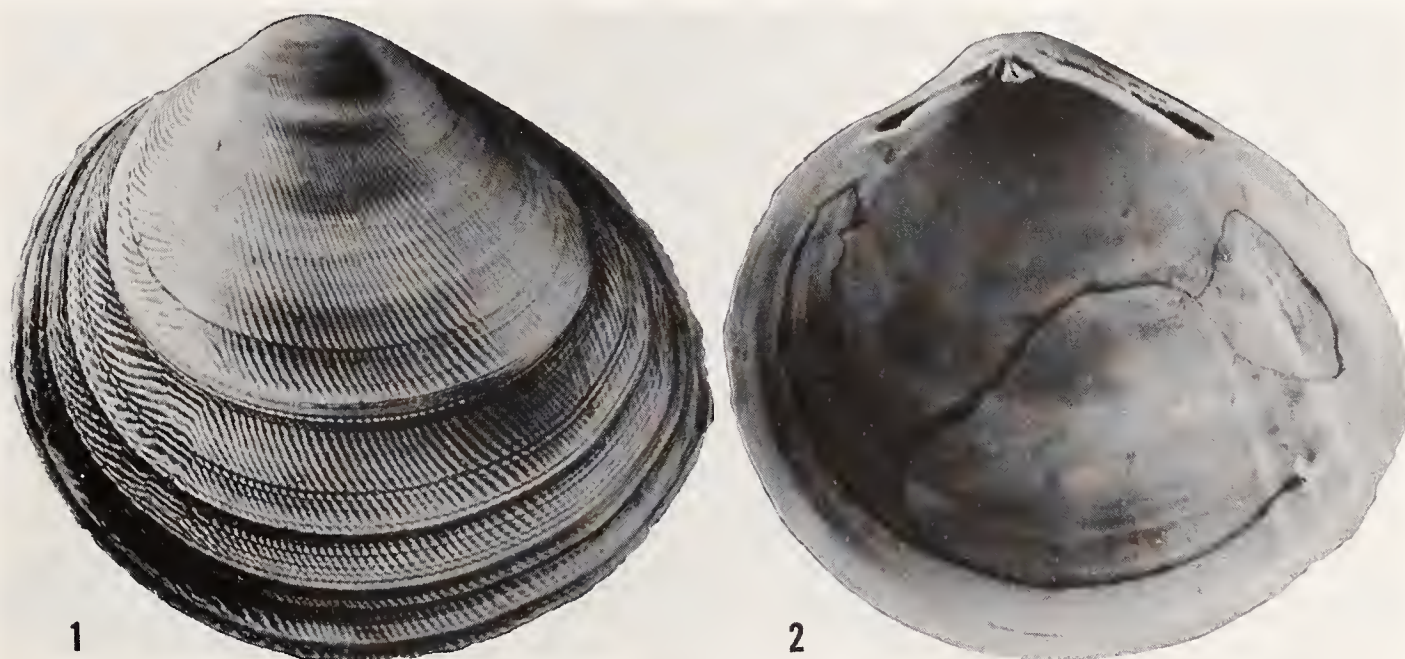


Plate 167. *Strigilla rombergii* Mörch [= *Strigilla carnaria* Linnaeus], Holotype, Zoological Museum, Copenhagen (left valve external; about 5x). Fig. 2. *Strigilla rombergii* Mörch [= *Strigilla carnaria* Linnaeus], Holotype, Zoological Museum, Copenhagen (right valve internal; about 5x).

form muscle scars evident. Adductor muscle scars well impressed. Anterior adductor scar broad and elongate; posterior adductor scar transversely quadrate. Umbonal cavity profound. Pallial sinus more or less equal in opposite valves, hardly rising behind, slightly arcuate above and extending to and uniting with the base of the anterior adductor; confluence with the pallial line entire. Rarely the pallial sinus does not unite with the anterior adductor and a narrow space separates them. Cruciform muscle scars round, though the anterior cruciform scar of the left valve is rectangular; the terminus of the pallial line rises posteriorly and is located midway between the cruciform scars. Externally the shell is dull to shining, predominantly white with concentrations of pink or crimson disposed at times concentrically. Internally the shell is shining but usually not highly polished.

length	height	width	
17.0 mm.	15.5 mm.	7.0 mm.	Holotype of <i>pseudocarnaria</i> n. sp.
22.5	19.5	—	Punta Algarrobo, Puerto Rico
20.0	18.5	9.0	Monte Cristi, Santo Domingo
19.0	17.0	8.0	Bahia de Añasco, Puerto Rico
15.0	13.5	6.5	“ “ “ “ “
10.3	9.1	4.4	Cartagena, Colombia

Remarks. *Strigilla pseudocarnaria* has long been recognized as a relatively common West Indian species, but it has been confused under a number of different names and has never been properly described. Dall (1900a) recognized the presence of two closely related species and referred to one as ‘carnaria’ Linnaeus and the other as ‘rombergii’ Mörch. A study of the type specimens has proved that *carnaria* Linnaeus and *rombergii* Mörch are synonymous and that *carnaria* ‘Linnaeus’ Dall is an undescribed species.

Fossil records for *Strigilla pseudocarnaria* are relatively rare. It has been found in the Pleistocene at Fort Morgan, Alabama in wells at depths of 100–122 and 169–175 feet.

In the Western Atlantic, *Strigilla pseudocarnaria* may be most frequently confused with *S. gabbi* and *S. carnaria*. From *gabbi*, *pseudocarnaria* may be distinguished by its greater inflation, its prominent external ligament, its more distally removed right anterior lateral tooth, and its broader sculpture on the posterior slope. From *carnaria*, *pseudocarnaria* is separated by its pallial sinus which unites with the anterior adductor muscle scar in both valves and by its less coarse sculpture. Younger specimens of *S. pseudocarnaria* might be confused with *S. producta*, but the former has its right bifid cardinal tooth strongly skewed posteriorly whereas the latter possesses a perpendicular bifid cardinal tooth in the right valve. In addition, the posterior portion of *producta* is markedly produced or extended.

An isolated population or group of populations of *pseudocarnaria* have been recognized by Olsson in the Eastern Pacific, in an area from Panama to northern Peru. The distribution of this species, if Olsson’s observations are correct, is discontinuous. In the Eastern Pacific, *pseudocarnaria* is also very closely allied to *Strigilla chroma* Salisbury [= *fucata* Gould], but minor differences in the sculpture on the posterior slope as well as differences in shape and size of opposite valves do occur and are species-specific. According to Olsson, *chroma* is smaller and less equivalve. Furthermore, *chroma* has, on its posterior dorsal surface, a small escutcheon-like area which is separated from the remainder of the surface of the shell by a ridge and which is sculptured by irregular and somewhat zig-zagged lines.

Range. In the Western Atlantic, this species is more or less restricted to the Caribbean Sea. From Jamaica, Hispaniola, and Puerto Rico in the north, the range extends to Trinidad. It is found along the Caribbean coast of Central and South America.

Specimens examined. HONDURAS: Puerto Cortes (USNM; MCZ); Tela; Ceiba (both USNM); Utila, Bay Islands; Trujillo (both MCZ); Mosquito Coast (USNM). NICARAGUA: Waunta Haulover (ANSP; USNM; MCZ); America (USNM); San Juan del Sur (MCZ). COSTA RICA: Tortaguero Beach (MCZ); Puerto Limón (USNM). PANAMA: Chagres (MCZ); Colón (USNM). JAMAICA: Black River; Great Pedro Bay; Kingston (all USNM). HISPANIOLA: HAITI: Jeremie; Baie Anglaise; Les Cayes; Ile a Vache; St. Louis; Aquin (all USNM); Jacmal (ANSP); Anse de Cleve (USNM). SANTO DOMINGO: Manzanillo Bay, near mouth of Yaque River (MCZ); Monte Cristi (ANSP; MCZ); Puerto Plata (MCZ); Punta Cabereta; Cabo Macoris (both MCZ). PUERTO RICO: Punta Algarrobo (ANSP; MCZ); Isla Desecheo (USNM); Mayagüez (ANSP; MCZ); Bahía de Añasco (MCZ); Ponce; Arroyo (both ANSP); Punta Lima (ANSP; MCZ). VIRGIN ISLANDS: St. Thomas (ANSP). LESSER ANTILLES: Charlestown, Nevis (MCZ); Marigot, Dominica; Port Castries, St. Lucia (both USNM); Tobago (ANSP); Manzanilla Beach, Ortoire River, and Mayaro Beach, Trinidad (all MCZ). COLOMBIA: mouth of Atrato River; Covenas, Bolivar (both USNM); Cartagena (USNM; MCZ). VENEZUELA: Guanta (ANSP).

***Strigilla (Strigilla) producta* Tryon**

Plate 171, fig. 2

Strigilla producta Tryon 1870, American Jour. Conch., 6: 24, pl. 1, fig. 4 (Jamaica) [syntypes, ANSP, no. 53377].

Description. Shell extending to 10 mm. (about 2/5 inch) in length and to 9.2 mm. (about 3/8 inch) in height, subtrigonal, produced behind, inequilateral, equivalve, sub-solid, moderately inflated with both valves of more or less equal convexity and with little or no flexure to the right posteriorly. Umbos in front of the middle, little elevated above the hinge line, slightly inflated and blunt. Anterior margin very broadly rounded and sometimes almost straight; ventral margin broadly arcuate and rising gently behind; anterior dorsal margin short and rather straight; posterior dorsal margin long, straight and rather steeply inclined; posterior margin poorly defined, short, more or less straight, parallel to the dorso-ventral axis and forming a characteristic blunt truncation. Sculpture consisting of feeble concentric lines of growth transected by strong, regularly spaced sulci or scissulations which descend across the surface of the shell from a high point on the anterior dorsal slope toward the ventral margin; there are 7–9 scissulations per millimeter on the disc. The scissulate sculpture on the posterior quarter of the valve turns and rises sharply, forming an acute angle pointing ventrally, and then it extends upward to the posterior dorsal margin. Ligament light yellowish brown, short, not protuberant, and somewhat sunken in a poorly defined broad escutcheon; lunule broad, short and shallow. Calcareous portion of the ligament moderately developed; no true nymphal callosities present. Hinge line rather well developed with strong lateral dentition. In the left valve, the cardinal complex consists of an anterior, narrow, slightly sulcated bifid tooth with more or less equal lobes and a posterior thin laminate tooth closely

adpressed to the calcareous portion of the ligament and often broken or lost; anterior and posterior lateral teeth subequal in strength, flange-like, thin, and laminate; the anterior lateral tooth is closer to the cardinal complex than the posterior one. In the right valve, the cardinal complex consists of a posterior elongate, thickened and protuberant bifid tooth with more or less equal lobes which are not skewed posteriorly and of an anterior thickened, laminate tooth which is fused to the base of the lunule; anterior and posterior lateral teeth subequal in strength, slightly thickened, elongate and with sockets above; the anterior one is much nearer the cardinal complex than the posterior one. The lateral dentition of the left valve is weaker. Two obscure radial posterior ribs evident. Adductor muscle scars poorly impressed. Anterior adductor scar elongate and narrow; posterior adductor subtrigonal. Pallial sinus more or less equal in opposite valves, rising slightly from the base of the posterior adductor scar, broadly convex above, descending arcuately to unite with the pallial line near to the base of the anterior adductor scar. The pallial sinus may touch the base of the anterior adductor scar or be slightly removed from it. Cruciform muscle scars poorly impressed and located on the ventral terminus of the weak posterior radial ribs. Shell white with red, crimson, or rose concentrated in the umbonal region. External and internal surfaces shining but not polished.

length	height	width	
10.0	9.2 mm.	—	Mayagüez, Puerto Rico
9.5	7.9	4.6 mm.	Bahia de Añasco, Puerto Rico
7.6	6.1	3.7	Jamaica
6.4	5.3	—	Monte Cristi, Santo Domingo

Remarks. This species is characterized by its subtrigonal shape, its produced posterior end and its white color with red, rose, or pink concentrated centrally in the umbonal area. It is most often confused with *S. pisiformis* because of the similar color pattern. However, it may be immediately separated, for in *pisiformis* the scissulate pattern of sculpture is flexed in a single zig zag posteriorly whereas in *producta* there is only a single flexure without any zig zags.

In the Western Atlantic, *S. producta* is most closely related to *S. pseudocarnaria*. It differs from *pseudocarnaria* in its smaller size, its subtrigonal shape, and its extremely long posterior dorsal margin. An important distinguishing character of *producta* is the short, protuberant, and perpendicular bifid cardinal tooth in the right valve. In *pseudocarnaria*, the right bifid cardinal tooth is strongly skewed posteriorly and somewhat thickened. The closest Eastern Pacific relative of *producta* is *S. dichotoma* Philippi. From this species, *S. producta* may be distinguished by its much more trigonal shape, its elongate posterior dorsal slope, and its more closely spaced sulci.

Range. This species is rather rare, but it occurs in the Caribbean from Panama in the west and from Jamaica in the north through the Antilles and south to Barra Secca, Brasil.

Specimens examined. PANAMA: Colón (MCZ). JAMAICA: (ANSP). HISPANIOLA: Monte Cristi and Santa Barbara de Samana, Santo Domingo (both MCZ). PUERTO RICO: Mayagüez, in 12 feet; Bahia de Añasco; Humacao (all MCZ). LESSER ANTILLES: Gulf of Paria, Trinidad (MCZ). BRASIL: Barra Secca (MCZ).

Strigilla (Strigilla) gabbi *Olsson and McGinty*

Plate 168, fig. 2

Strigilla gabbi Olsson and McGinty 1958, Bull. American Paleo., 39(177): 50, pl. 5, figs. 3-3a (Colón, Panama) (holotype, ANSP, no. 218881).

Description. Shell extending to 35 mm. (about 1 2/5 inches) in length and to 30.5 mm. (about 1 1/5 inches) in height, subcircular, inequilateral, equivalve, solid, somewhat compressed with the right valve of a slightly greater convexity and without a posterior flexure. Umbos markedly in front of the middle, little inflated or elevated, blunt and

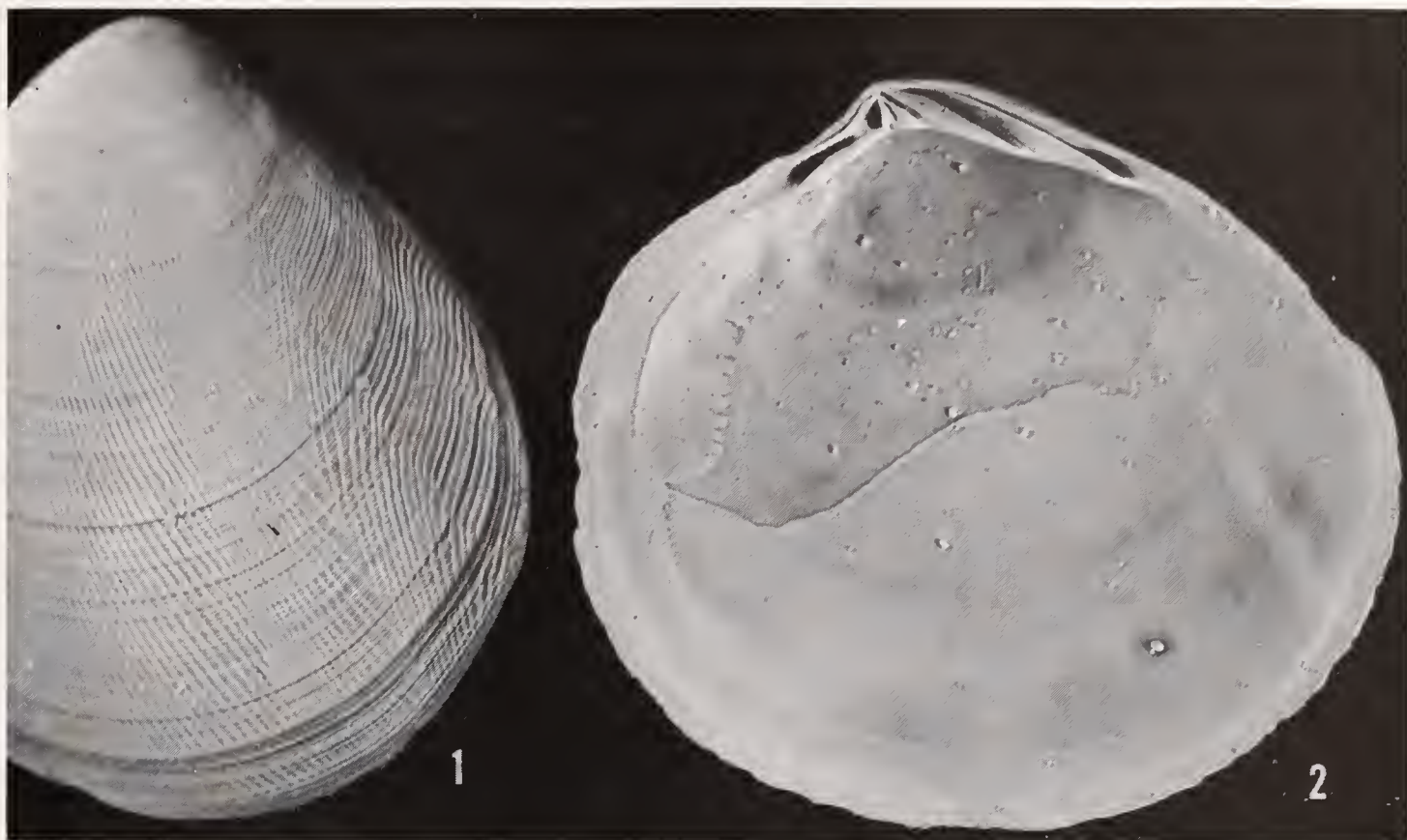


Plate 168. Fig. 1. *Strigilla carnaria* (Linnaeus), MCZ 176519, Barbados, West Indies (posterior dorsal slope of the left valve; about 3x). Fig. 2. *Strigilla gabbi* Olsson and McGinty, Paratype, ANSP 53379, Costa Rica, (right valve internal; about 3.2x).

conspicuously prosogyrous. Anterior margin very broadly rounded and somewhat parallel to the dorso-ventral axis; ventral margin broadly arcuate and convex; anterior dorsal margin short; posterior dorsal margin long and slightly convex; posterior margin poorly defined, short, slightly convex. Sculpture consisting of irregular concentric lines of growth transected by regularly spaced scissulations which descend at angles of 60-90 degrees across the surface of the shell from a high point along the anterior dorsal margin toward the ventral margin. This scissulate pattern of sculpture is flexed at the posterior third of the valve where it turns sharply, forms an acute angle which points ventrally, and extends upward to the posterior ventral margin; the sulci are closely set, crowded, and less well defined on the posterior third of the valve. Another flexure occurs on the anterior slope where the sulci are bowed upward or partly replaced by a smooth tract. In the right valve, a high and dorsal posterior ridge extends from the umbonal area and forms a flattened, narrow posterior dorsal slope; a similar but smaller and less well defined ridge and slope occur in the left valve. Ligament black, deeply sunken or inset;

narrow escutcheon in the left valve; lunule small, narrow, deeply sunken, and larger in the left valve. Calcareous portion of the ligament well developed, deeply inset, and supported on flattened nymphs; no raised nymphal callosities present. Hinge line well developed. In the left valve, the cardinal complex consists of an anterior elongate, narrow, and weakly sulcate bifid tooth and of a posterior thin, elongate laminate tooth which is closely adpressed to the calcareous portion of the ligament and may be lost or destroyed in adults; anterior lateral tooth subproximal to the cardinal complex and stronger than the distal posterior one. In the right valve, the cardinal complex consists of a posterior thickened and skewed bifid tooth whose posterior lobe is the larger and of an anterior strong but small laminate cardinal tooth; anterior lateral tooth very close to the cardinal complex, strong, and with a socket above; posterior lateral tooth distal, pointed, small, much weaker than the anterior lateral tooth and with a socket above. The lateral dentition is weaker in the left valve. Two radial posterior and internal ribs evident and with their distal ends coincident with the cruciform muscle scars. Adductor muscle scars moderately well impressed. Anterior adductor scar somewhat narrow and elongate; posterior adductor scar transversely subquadrate. Pallial sinus more or less equal in both valves, rising slightly behind, convex above, and falling to the pallial line in a sigmoid fashion. The pallial sinus extends toward the anterior adductor and is usually removed from it though rarely it touches and unites with the base of this scar. Cruciform muscle scars well impressed, closely set, and at the distal ends of the internal radial ribs; the pallial line rises sharply posteriorly and ends close to the anterior cruciform scar. Externally, the shell is dull or slightly shining; predominantly white suffused with pink, often disposed in a concentric pattern. Internally, the surface may be dull or slightly shining, but never highly polished. The shell is pink, red, or crimson with the two posterior rays.

length	height	width	
33.3 mm.	30.5 mm.	12.8 mm.	Holotype of <i>gabbi</i> Olsson and McGinty
25.5	24.0	9.5	Key West, Florida
22.5	20.7	9.0	Courland Bay, Tobago
21.5	19.5	8.5	Bimini, Bahama Islands
13.5	11.5	5.5	Courland Bay, Tobago
12.5	11.0	—	Recife, Brasil

Remarks. This species though recently described has previously been confused with *S. disjuncta* Carpenter (= *sincera* Hanley) of the Eastern Pacific, but has most often remained unnoticed in lots of *S. carnaria* and *S. pseudocarnaria*. According to Olsson and McGinty (1958), *S. gabbi* differs from *S. disjuncta* in that the former is more circular in form, pink in color, and with a more angular posterior dorsal area. In addition, the umbos of *gabbi* appear to be more strongly prosogyrous and the compression of the valves is greater than in *disjuncta*. Nevertheless, the two are closely allied species derived from some common ancestor. Young specimens of *gabbi* are distinctly more rounded and the umbos are strongly prosogyrous, pointed, glabrous and pink.

Strigilla gabbi, the largest species of the genus in the Western Atlantic, is similar in some respects to *carnaria* and *pseudocarnaria*. From *carnaria*, it may be immediately distinguished by the pallial sinus which extends directly to the base of the anterior adductor and either unites with it or is separated by a very narrow space. In addition, *gabbi* is characterized by its posterior slope on which the sulci are noticeably more

crowded, by its strong hinge line which lacks an escutcheon and possesses a sunken, almost internal ligament, and by its markedly prosogyrous umbos. On the dorsal posterior slope of the right valve of *gabbi*, a radial umbonal ridge occurs and delineates a dorsal flattened area; neither *carnaria* nor *pseudocarnaria* possess such a structure.

Along the Texas coast, *gabbi* has been found in Pleistocene deposits. A little known fossil, *S. caimitica* Maury from the lower Miocene of Santo Domingo resembles *gabbi* in general shape.

Range. This species ranges from Key West and the Bimini Islands south through the Caribbean and the Antilles to a southernmost point at Recife, Brasil.

Specimens examined. FLORIDA: Key West (MCZ). BAHAMA ISLANDS: Bimini (MCZ). TEXAS: Rockport (Pleistocene fossil, MCZ). NICARAGUA: Waunta Haulover (USNM). COSTA RICA: Puerto Limón (USNM). PANAMA: Bocas del Toro (*teste* Olsson); Rio Salute (USNM); Colón (ANSP). LESSER ANTILLES: Castries, St. Lucia (USNM); Bucco Bay and Courland Bay, Tobago; Trinidad (all MCZ). COLOMBIA: Puerto Colombia (*teste* Olsson); Atrato; Cartagena; Dibulla (Magdalena) (all USNM). DUTCH GUIANA: Nickerie (Leiden Mus.); Coronie (USNM). BRASIL: Recife (MCZ).

Subgenus *Pisostrigilla* Olsson

Pisostrigilla Olsson 1961, Panamic-Pacific Pelecypoda, Paleontological Research Inst., Ithaca, p. 390 [type species, *Tellina pisiformis* Linnaeus, original designation].

Description. Shell with the incised sculpture flexed in a zig zag fashion on the posterior slope so as to form a series of alternating acute angles which point dorsally or ventrally. Shell generally small, convex, solid, and with a coarse hinge.

Strigilla (Pisostrigilla) pisiformis Linnaeus

Plate 165, fig. 2; Plate 169, fig. 2; Plate 170, figs. 1-2

Tellina pisiformis Linnaeus 1758, Systema Naturae, ed. 10, p. 677 (ad O. Europaei ostia fluviorum) (type locality, here restricted, Santa Barbara de Samana, Santo Domingo) [type specimen, collection of Linnean Society, London].

Cardium discors Montagu 1803, Test. Brit., p. 84 (substitute name for *Tellina pisiformis* Linnaeus).

Lucina pisiformis Fleming 1828, British Animals, London, p. 442.

Lucina pulchella Adams 1845, Proc. Boston Soc. Nat. Hist., 2: 10 (Jamaica) [paratypes, BMNH].

Strigilla piciformis Linnaeus. H. & A. Adams 1856, Genera Recent Mollusca, 2: 399 (error for *pisiformis*).

Strigilla pisum Linnaeus. Simpson 1889, Proc. Davenport Acad. Nat. Sci., 5(1): 45-72 (error for *pisiformis*).

Strigilla (Strigilla) pisiformis Linnaeus. Dall 1900, Trans. Wagner Free Inst. Sci., 3(5): 1038.

Strigilla pilsbryi Olsson and McGinty 1958, Bull. American Paleol., 39(177): 50, pl. 5, figs. 2-2a (Bocas del Toro, Panama) [holotype, ANSP, no. 211915].

Description. Shell extending to 13.3 mm. (about $\frac{1}{2}$ inch) in length and to 12.8 mm. (about $\frac{1}{2}$ inch) in height, transversely subovate, somewhat produced behind, slightly inequilateral, equivalve, solid, inflated with both valves about equally convex and without a posterior flexure. Umbos in front of the middle, somewhat elevated, inflated and blunt. Anterior margin very broadly rounded, sometimes flattened, straight, and nearly parallel to the dorso-ventral axis; ventral margin smoothly rounded, convex and rising gently behind; anterior dorsal margin very short and straight; posterior dorsal margin

rather steeply inclined, straight to slightly convex and longer than the anterior dorsal margin; posterior margin poorly defined, convex and obliquely rounded. Sculpture consisting of incised, rather evenly spaced scissulations which descend across the surface of the shell from a high point on the anterior dorsal margin toward the ventral margin. This scissulate pattern of sculpture flexes in the posterior third of the valve, forms an acute angle pointing ventrally, continues upward, reverses direction once again to form an acute angle pointing dorsally and ends at the posterior dorsal margin. The second flexure occurs high on the posterior slope, and the sulci here are stronger and broader than they are on the disc. A third flexure occurs on the anterior slope, where the sulci

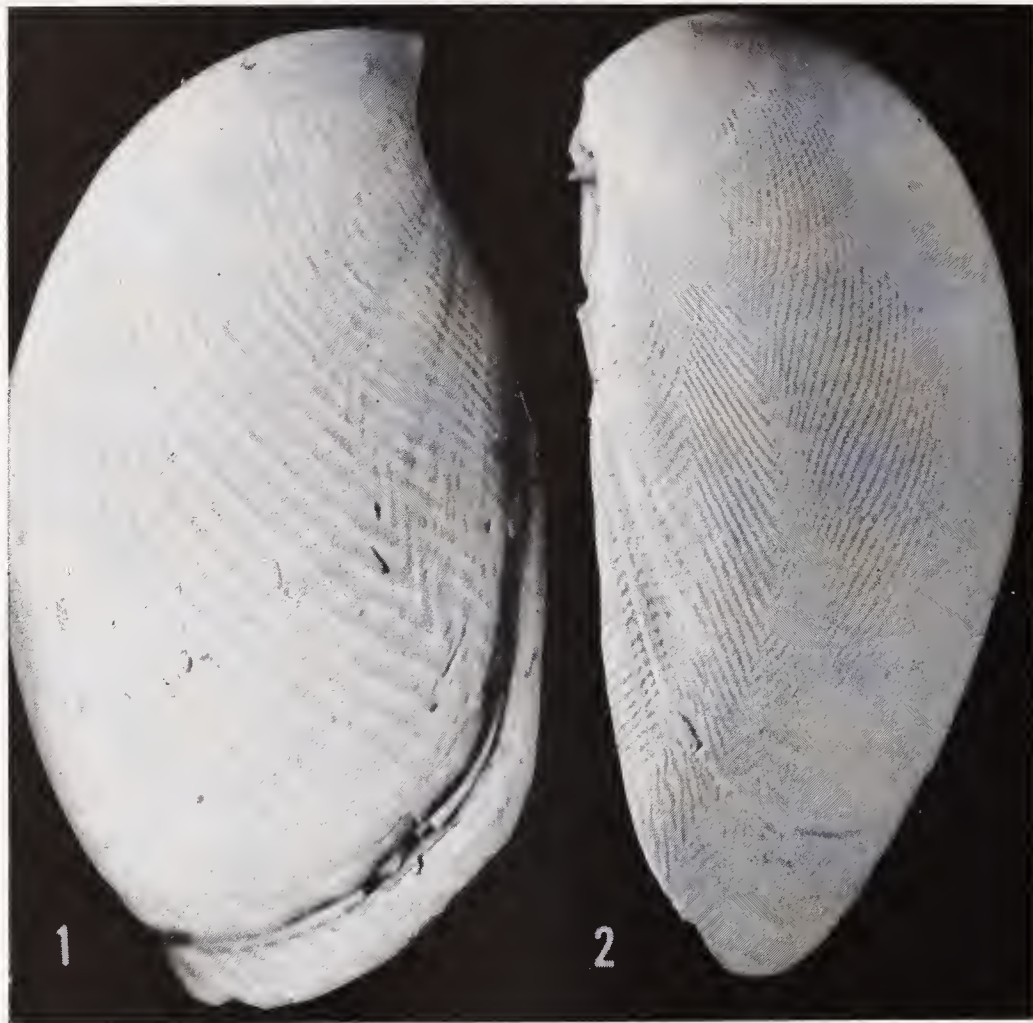


Plate 169. Fig. 1. *Strigilla mirabilis* Philippi, MCZ 195612, Pensacola, Florida (posterior dorsal slope of the left valve; about 11x). Fig. 2. *Strigilla pisiformis* (Linnaeus), ANSP 45887, Livingston, Guatemala (posterior dorsal slope of the right valve; about 10x).

are bowed upward. No well defined ridge present in either valve. Ligament light to dark brown, short, not protuberant and rather deeply set; escutcheon mostly confined to the left valve, rather deep and elongate; lunule broad, profound, and more extensive in the left valve; calcareous portion of the ligament not strongly developed and supported on flattened nymphal plates. Hinge line well developed and thickened. In the left valve, the cardinal complex consists of an anterior small, subdeltoid, poorly sulcated bifid tooth with more or less equal lobes and of a posterior elongate and thin laminate tooth closely adpressed to the calcareous element of the ligament; anterior lateral tooth smaller, thicker and nearer to the cardinal complex than the distal posterior lateral tooth. In the right valve, the cardinal complex consists of a posterior thickened and slightly skewed bifid tooth with variable lobes and of an anterior subdeltoid laminate tooth closely ad-

pressed to the base of the lunule; anterior and posterior lateral teeth thickened, strong and with the sockets above; the anterior lateral tooth is closer to the cardinal complex. The lateral dentition of the right valve is much stronger and heavier than that of the left. No true ribs are developed. Adductor muscle scars poorly impressed. Anterior adductor scar elongate; posterior adductor subquadrate. Pallial sinus more or less equal in opposite valves, rising slightly behind, convex above and falling to the pallial line some distance short of the anterior adductor; the distance that separates the pallial sinus from the anterior adductor is quite variable. The cruciform muscle scars rather poorly impressed, large and round. Externally, the shell is dull or shining, white in color suffused with red, or pink and sometimes pure white. Internally, dull or shining, and generally white suffused with pink concentrated in the umbonal region.

length	height	width	
11.0 mm.	10.5 mm.	—	Holotype of <i>pisiformis</i> Linnaeus
13.3	13.5	—	Holotype of <i>pilsbryi</i> Olsson and McGinty
13.3	12.8	—	Bahia de Añasco, Puerto Rico
10.5	10.0	—	Zapero Island, Maracaibo, Venezuela
10.4	10.0	6.5 mm.	Matanzas Bay, Cuba
7.1	6.5	4.1	Colón, Panama
6.2	5.4	3.6	Santa Barbara de Samana, Santo Domingo

Remarks. Dodge (1952) has remarked that of all the descriptions given by Linnaeus for the bivalve mollusks in his *Systema*, *pisiformis* was the most closely delineated, and that the description alone is sufficient to identify the species. Unfortunately, the type locality, general as it is, is incorrect, and the figure of Gualtieri referred to by Linnaeus is of no value. Furthermore, having copied the wrong letter from the Gualtieri plate, Linnaeus cited the incorrect figure, and, according to Dodge, the original specimens were later replaced. Nevertheless, the concept and definition for *pisiformis* have survived.

Recently, Olsson (1961) has described *panamensis*, an Eastern Pacific species which is a close relative to *pisiformis*, but the former may be distinguished by its 'pure white color and more rounded form.' *Strigilla pilsbryi*, recently described by Olsson and McGinty, proves upon examination of the type to be indistinguishable from *T. pisiformis*. In the Western Atlantic, *pisiformis* has often been confused with *producta*, which is similarly colored, but the former is markedly shorter and has a zig zag sculpture. The nearest living ally to *pisiformis* in the Western Atlantic is *mirabilis*, but these two species are unlike in shell thickness, umbonal inflation, and dental characters. From *mirabilis*, *pisiformis* may always be separated by the single zig zag flexure of the oblique sulci on the posterior slope.

In the fossil record, *Strigilla pisiformis* is well represented. Maury (1917) reported it from Cercado de Mao of the Lower Miocene of Santo Domingo, and Dall (1900b) and Woodring (1925) listed it from the Middle Miocene of the Bowden marl of Jamaica. Woodring has indicated that the Bowden specimens are smaller than those in the Recent fauna. Maury (1925) substantiated its occurrence in the Pliocene of Trinidad and later (1934) she reported it from the Pleistocene of Brasil at Thibau, Rio Grande do Norte. Dall indicated that this species is generally widespread in the Pleistocene of the Antillean region.

Range. From off the southeastern coast of Florida in the vicinity of Cape Florida and from the Bimini Islands in the Bahamas, this species extends southward through the Greater Antilles, around the shores of the Caribbean in Central and South America, through the Lesser Antilles and down the eastern coast of South America to an extreme southern record at São Francisco, Santa Catarina, Brasil.

Specimens examined. FLORIDA: off Fowey Light, in 75–90 fathoms; off Sand Key, in 61–90 fathoms; off Ajax Reef, in 80–100 fathoms (all USNM). BRITISH HONDURAS: Belize; Punta Gorda (both USNM). GUATEMALA: Livingston (ANSP). HONDURAS: Puerto Cortez (MCZ). NICARAGUA: Monkey Point (USNM). PANAMA: Rio Biarra, Chiriqui Lagoon (ANSP); Colón; Chagres (both MCZ). BAHAMA ISLANDS: off North Bimini Island, in 20 fathoms; Nassau, New Providence; Cockburntown, Watling (all USNM). CUBA: Matanzas; Gibara, Oriente (both MCZ). JAMAICA: Montego Bay; Port Maria; Port Antonio; Black River; Great Pedro Bay; Kingston (all USNM). HISPANIOLA: HAITI: Port au Prince; Anse de Clerc; Coteaux; Les Cayes; Baie Anglaise; St. Louis; Anse a Drick; Aquin; Bizoton; Saltrou (all USNM). SANTO DOMINGO: Monte Cristi (ANSP; MCZ); Puerto Plata (MCZ); Matanzas, near Encords Bay (USNM); Santa Barbara de Samana (ANSP; MCZ). PUERTO RICO: Aquadilla (USNM); Bahia de Añasco (MCZ); Mayagüez, in 12 feet (ANSP; MCZ); Isla Desecheo (USNM); Ponce (ANSP); San Juan (USNM); Humacao Playa; Boca de Congrejos (both MCZ). VIRGIN ISLANDS: St. Thomas (ANSP). LESSER ANTILLES: Guadeloupe (ANSP); Dominica; Grenada (both USNM). COLOMBIA: Covenas, Bolivar; Cartagena (both USNM). VENEZUELA: Zapero Island, Lake Maracaibo, Zulia (MCZ); 4.3 km. W of Barcelona (USNM). BRASIL: Recife, Pernambuco; Manguinhos, Ilha de Itaparica, Bahia; Barra Secca, Bahia (all MCZ); Ilha de São Sebasião, São Paulo; Ilha de São Francisco, Santa Catarina (both USNM).

Strigilla (Pisostrigilla) mirabilis Philippi

Plate 165, fig. 3; Plate 169, fig. 1; Plate 171, fig. 1

Tellina flexuosa Say 1822, Jour. Acad. Nat. Sci. Philadelphia, 2: 303 (inhabits the southern coasts), non *flexuosa* Montagu 1803 [types lost].

Tellina mirabilis Philippi 1841, Wieg. Archiv. für Naturgeschichte, 7: 260 (Sinus mexicanus, litus australe statuum unitorum) [types not seen].

Strigilla flexuosa Say. H. & A. Adams 1856, Genera Recent Mollusca, 2: 399.

Strigilla carolinensis Conrad 1862, Proc. Acad. Nat. Sci. Philadelphia, p. 573 (Miocene of Peedee River, South Carolina) [types not seen].

Strigilla fluxuosa 'Say' Conrad 1862, Proc. Acad. Nat. Sci. Philadelphia, (1862), p. 573 (error for *flexuosa* Say).

Strigilla mirabilis Philippi. Olsson and McGinty 1958, Bull. American Paleo., 39(177): 48.

Description. Shell extending to 14 mm. (about 9/16 inch) in length and to 13 mm. (about 1/2 inch) in height, transversely subovate, a little produced behind, inequilateral, equivalve; rather solid, inflated with both valves of more or less equal convexity and without a posterior flexure. Umbos located anterior to the middle, slightly elevated above the hinge line, somewhat flattened and blunt. Anterior margin very broadly rounded, sometimes more or less straight and parallel to the dorso-ventral axis; ventral margin broadly arcuate and rising only a little behind; anterior dorsal margin short,

straight to concave; posterior dorsal margin slightly convex and very long; posterior margin smoothly rounded, poorly defined, and convex. Sculpture consisting of strongly incised, more or less evenly spaced scissulations which descend across the surface of the shell from a high point on the anterior dorsal margin toward the ventral margin. The scissulate pattern of sculpture possesses a series of flexures on the posterior slope; the

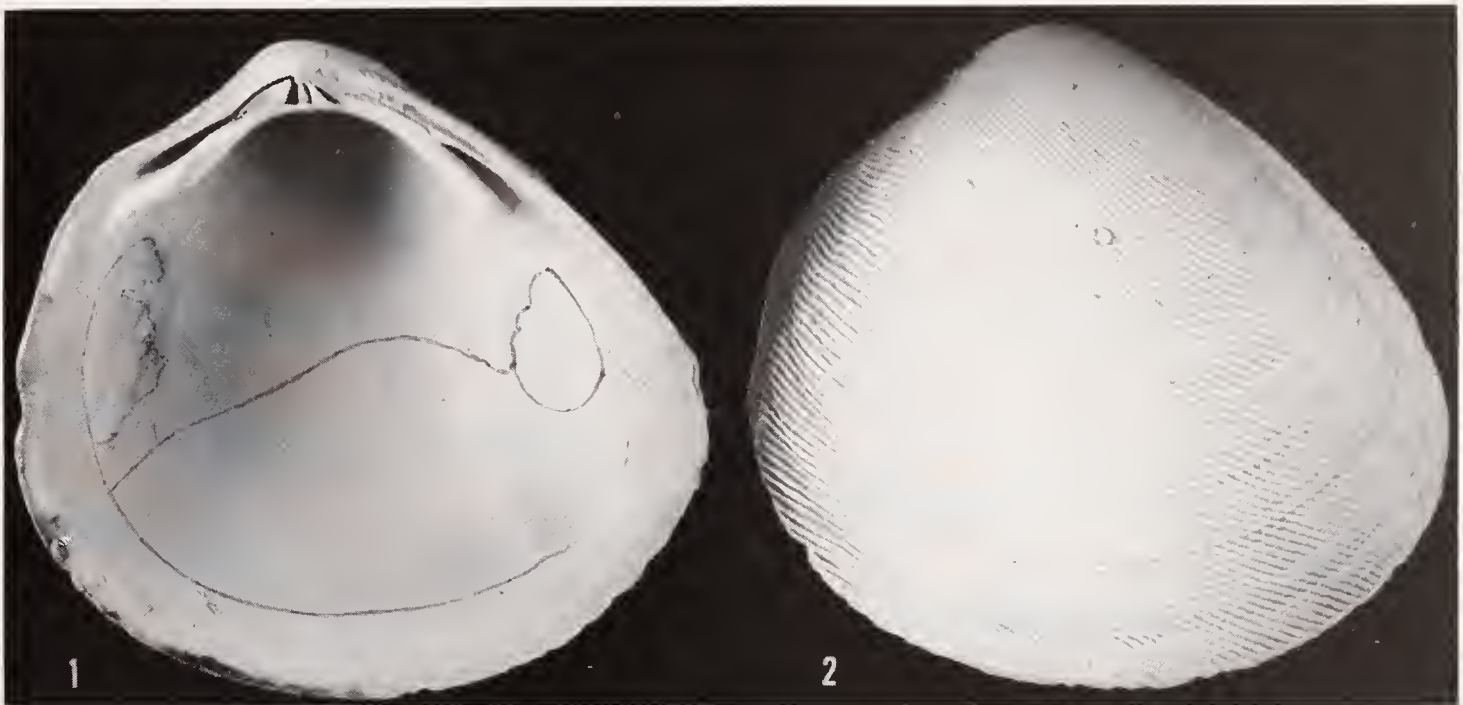


Plate 170. Fig. 1. *Strigilla pisiformis* (Linnaeus), ANSP 45887, Livingston, Guatemala (right valve internal; about 5x). Fig. 2. *Strigilla pisiformis* (Linnaeus), ANSP 45887, Livingston, Guatemala (left valve external; about 5x).

pattern appears as a sequence of zig zags where the flexures form acute angles which point dorsally or ventrally. There may be from four to six flexures on the posterior slope. Posterior ridge lacking in either valve though an irregular shallow radial sulcus sometimes occurs in the left valve. Ligament light to dark brown, rather short, and somewhat sunken; escutcheon weak, shallow, and lanceolate; lunule short, broad and rather profound. Calcareous element of the ligament poorly developed; nymphal plates flattened. Hinge line well developed and thickened. In the left valve, the cardinal complex consists of an anterior small, short, elongate and thin bifid tooth with more or less equal lobes and a posterior elongate and thin laminate tooth which is connected to the base of the nymphal plate; anterior lateral tooth subproximal, weak and a little pointed; posterior lateral distal and weak. In the right valve, the cardinal complex consists of a posterior slightly skewed, subdeltoid, bifid tooth, whose posterior lobe is the larger and of an anterior deltoid laminate tooth which is adpressed to the base of the lunule; anterior lateral tooth subproximal, strong, pointed, triangular and with a socket above; posterior lateral tooth distal, pointed, weaker than the anterior tooth and with a socket above. The lateral dentition of the right valve is much stronger than that of the left. Sometimes weak radial ribs or vermiculations occur internally, especially in the right valve. Adductor muscle scars not well impressed. Anterior adductor broad and elongate; posterior adductor irregularly subquadrate. Pallial sinus more or less equal in opposite valves, rising only a little behind, generally flattened above, and falling in an arcuation to the pallial line. The sinus does not touch the anterior adductor scar and is generally

well separated from it. Cruciform muscle scars poorly impressed, round and near to the ventral border. Internally and externally, the shell is shining and white, rarely vitreous and suffused with yellow.

length	height	width	
14.0 mm.	13.0 mm.	—	Bermuda
8.5	7.3	4.8 mm.	Bahia Honda Key, Florida
8.3	7.2	4.6	Swan Island, Caribbean Sea
6.2	5.3	2.4	North Rock, Bermuda, in 4 fathoms

Remarks. This species is most closely related to *Strigilla pisiformis* and is included with it in the subgenus *Pisostrigilla*. Both are easily distinguished from all other Western Atlantic *Strigilla* by the nature of the flexures of the oblique sulci along the posterior dorsal slope. Normally, *S. mirabilis* has four or more flexures on the posterior slope, whereas *pisiformis* has only a single zig zag flexure. Furthermore, in *mirabilis*, the pallial sinus is most often separated from the anterior adductor muscle scar, the surface of the valves has more widely spaced sulci, the hinge has more protuberant cardinal teeth, and the shell is thinner. The umbos of *mirabilis* are more pointed than the inflated, rounded and blunt umbos of *pisiformis*. The color of *mirabilis* is almost always white while *pisiformis* is generally maculated with red.

Certain characters of *mirabilis* are variable. The strength of the sculpture varies as well as the extent of the dorsally bowed flexure on the anterior slope and the smooth tract which often replaces it. The posterior dorsal sculpture, which is of prime importance in the identification of this species, is often dissimilarly expressed in opposite valves, and may be stronger and more easily discerned in the right valve.

Strigilla mirabilis is closely related to *S. lenticula* 'Philippi' Hertlein and Strong of the Eastern Pacific. Olsson (1961) has recently shown that the posterior sculpture of true *lenticula* Philippi (= *ervilia* Philippi) is unlike that of *mirabilis* and that it is indeed similar to the type found in the nominate subgenus.

This species is one of the two Western Atlantic *Strigilla* which have been well preserved in the fossil record. So-called Oligocene and Miocene precursors include *S.*

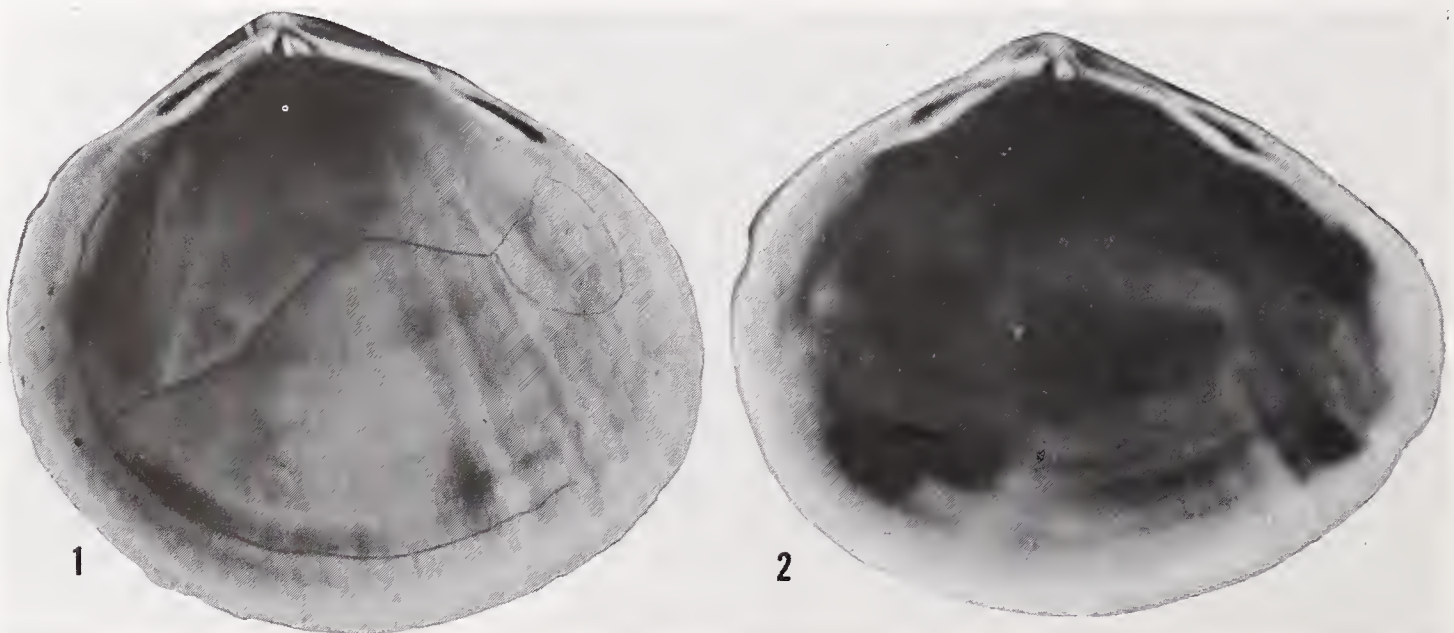


Plate 171. Fig. 1. *Strigilla mirabilis* Philippi, MCZ 223466, Bermuda (right valve internal; about 6.5x).
Fig. 2. *Strigilla producta* Tryon, Syntype, ANSP 53377, Jamaica (right valve internal; about 10x).

entykta Gardner and Aldrich from the Miocene of Williamston, North Carolina, and *S. georgiana* Gardner and *S. paraflexuosa* Gardner from the Alum Bluff of Florida. *Strigilla sphaerion*, although somewhat atypical and thought by Gardner to be completely unlike any other modern Western Atlantic *Strigilla*, also seems to be related to *mirabilis*. Dall considered his Tertiary specimens as *S. flexuosa* (= *mirabilis*), listed the fossil localities, and further indicated that post-Pliocene or Pleistocene specimens could be found in North and South Carolina. Pleistocene and Pliocene records have been cited by Holmes (1860) and Richards (1962) for South Carolina and by Olsson and Harbison (1953) for Florida. Parker (1956) has indicated its occurrence in the Mississippi Delta Region since the Miocene.

Range. From off Cape Hatteras, North Carolina, this species extends southward through the Greater and Lesser Antilles to Grenada. It is also found in the Gulf of Mexico as far south as Isla Mujeres, Yucatan, Mexico.

Specimens examined. NORTH CAROLINA: *Albatross* Stations 2277, 2112, 2276, 2273, 2272, 2597, 2598, off Cape Hatteras, in 15–22 fathoms (all USNM); *Albatross* Stations 2607, 2608, 2611, off Cape Lookout, in 18–31 fathoms (all USNM); off Beaufort, in 6–9 fathoms; Wrightsville Beach, New Hanover County (both MCZ). SOUTH CAROLINA: Sullivan's Id.; Seabrook Beach; Morris Id. (all CM). FLORIDA: off Palm Beach, in 10–130 fathoms; off Ocean Ridge, Palm Beach, in 7–10 fathoms (both ANSP); S. Inlet of Lake Worth (MCZ); Boynton Beach; Miami (both ANSP); *Albatross* Station 2646, in 85 fathoms, off Cape Florida; 12 miles E of Frying Pan Shoals, in 12 fathoms; Conch Key, in 1–5 feet (all USNM); Grassy Key (ANSP); Bahia Honda Key (ANSP; MCZ); Snipe Key; Boca Chica Key (both ANSP); Newfound Harbor Key (USNM); Key West (USNM; ANSP); Charlotte Harbor; Boca Grande Key (both USNM); Long Key (MCZ); Cedar Keys (USNM); St. Joseph Bay (ANSP); Pensacola (USNM; MCZ). ALABAMA: Fort Morgan (MCZ). MISSISSIPPI: Horn Island (ANSP). TEXAS: Port Aransas; Padre Island, 30 miles SW of Port Aransas (both MCZ). MEXICO: Veracruz; Isla Mujeres (both MCZ). BERMUDA: Bermuda (subfossil, BMNH); Castle Road, Castle Harbour, in 4–5 fathoms; North Rock, 11 miles N of Hamilton (both MCZ). BAHAMA ISLANDS: Moraine Cay, Little Abaco; Dick's Point, Nassau, New Providence; Leafy Cay Beach, Eleuthera (all MCZ); Little San Salvador (ANSP; MCZ); Orange Creek, and Arthurstown, Cat Island (both MCZ); Rum Cay (USNM); Matthews Town, Great Inagua (MCZ; ANSP). CUBA: *Barrera* Station 211, Cape Cajon (USNM); Arenas de la Chorrera, Habana; Pueblo Nuevo, Matanzas Bay (both MCZ); Cayo Blanco, Cardenas Bay (ANSP); Caibarien, Las Villas; Guarda la Vaca, Banes; mouth of Rio Arimao, 12 miles E of Cienfuegos (all MCZ). HISPANIOLA: SANTO DOMINGO: Bahia de Samana (USNM). PUERTO RICO: Bahia de Añasco (MCZ); San Juan Harbour (ANSP; USNM). VIRGIN ISLANDS: Devil's Bay and The Baths, Virgin Gorda; Monkey Point, Guana Island (all MCZ); St. Croix (ANSP). LESSER ANTILLES: Anguilla; Barbuda (both BMNH); English Harbour and Falmouth Harbour, Antigua (both USNM); Guadeloupe; Union, Admiralty Bay, Bequia Island, The Grenadines; Granada (all MCZ). CARIBBEAN ISLANDS: Swan Island (MCZ).

BIBLIOGRAPHY

- Dall, W.H. 1900a. Synopsis of the family Tellinidae and of the North American species. Proc. U.S. Nat. Mus., **23**: 285-326, pls. 2-4.
- Dall, W.H. 1900b. Tertiary fauna of Florida. Transactions of the Wagner Free Institute of Science of Philadelphia, **3**(5): 1002-1039.
- Dodge, H. 1952. A historical review of the mollusks of Linnaeus. Part 1. The Classes Loricata and Pelecypoda. Bull. Amer. Nat. Hist., New York, **100**(1): 1-264.
- Gualtieri, N. 1742. Index testarum conchyliorum quae adservantur in Museo Gualtieri. Florence, Italy, 23 pp., 110 pls.
- Holmes, F.S. 1860. Post-Pleiocene fossils of South Carolina. Charleston, S.C., 128 pp., 28 pls.
- Lister, M. 1678. Historiae Animalium Angliae. London, 250 pp., 9 pls.
- Lister, M. 1770. Edition Altera. Historiae sive synopsis methodicae conchyliorum. Oxoniæ.
- Maury, C.J. 1917. Santo Domingo type sections and fossils. Bull. Amer. Paleontology, **5**(29): 419-459.
- Maury, C.J. 1925. A further contribution to the paleontology of Trinidad. Bull. Amer. Paleontology, **10**(42): 152-402.
- Maury, C.J. 1934. Fossil invertebrata from NE Brasil. Bull. Amer. Mus. Nat. Hist., **67**(4): 123-179.
- Mazyck, W.G. 1913. Catalogue of Mollusca of South Carolina. Contrib. no. 2, Charleston Museum, 39 pp.
- Olsson, A.A. 1961. Mollusks of the Tropical Eastern Pacific. Panamic-Pacific Pelecypoda. Paleontological Research Inst., Ithaca, N.Y., 574 pp., 86 pls.
- Olsson, A.A., and A. Harbison. 1953. Pliocene Mollusca of southern Florida. Acad. Nat. Sci. Philadelphia, Monograph 8, pt. 1, 361 pp.
- Olsson, A.A., and T. McGinty. 1958. Recent marine mollusks from the Caribbean coast of Panama. Bull. Amer. Paleontology, **39**(177): 1-58, 5 pls.
- Parker, R.H. 1956. Macro-invertebrate assemblages as indicators of sedimentary environments in east Mississippi delta region. Bull. Amer. Assoc. Pet. Geol., **40**(2): 295-376.
- Ravenel, E. 1885. Tellinidae of South Carolina. Proc. Elliot Society, **2**(5): 33-40.
- Richards, H.G.. 1962. Studies on the marine Pleistocene, pts. 1 & 2, Trans. Amer. Phil. Soc. Philadelphia, New Ser., **52**(3): 5-141, 21 pls.
- Woodring, W.P. 1925. Miocene mollusks from Bowden, Jamaica. Pelecypods and Scaphopods. Carnegie Inst. Washington, Publ. no. 366, 222 pp., 28 pls.

BOOK REVIEW

Traité de Zoologie. Anatomie—Systematique Biologie. Tome V. Fascicule III, Mollusques Gastéropodes et Scaphopodes. par E. Fischer, A. Franc, M. Marjota, et G. et H. Termier. 1968. Masson et Cie. Libraires de l'Académie de Médecine. 120 Boulevard Saint-Germain, Paris (VI^e). 286 francs, and 1083 pages and 517 figs.

This work constitutes the second volume on mollusks to appear in the *Traité*. The major portion of the text is by Professor André Franc and considers the Class Gastropoda. After a general introduction to the features of the class, including a discussion of coiling, torsion and asymmetry, which incorporates the latest theories, each of the three subclasses, the Prosobranchia, Pulmonata and Opisthobranchia, are considered in detail. The treatment accorded each group begins with a discussion of external morphology; the shell, if present, the head, and the foot. An elaboration of the anatomical organization follows (very often discussed at the familial or ordinal levels) and includes descriptions of the integument and musculature and the respiratory, digestive, circulatory, excretory, reproductive, and nervous systems. Functional aspects are treated in a section on physiology. Where particular morphological features are of importance in classification, special stress and greater detail are offered. Thus, the nervous systems of the Pulmonata and Opisthobranchia, and the reproductive and digestive systems in the Prosobranchia receive extended discussion.

The systematic section for each group is generally preceded by brief remarks on distribution and ecology; there are no maps or analyses of zoogeographical data. The higher taxa—orders, superfamilies, families and, occasionally, subfamilies—are characterized, while genera and representative species with their geographic range are listed. Phylogenetic and evolutionary relationships, are not elaborated and mechanisms of speciation receive scant attention, although some work on genetics is mentioned. The line-cut illustrations, both in the anatomical as well as the systematic sections, are good and the color plate which illustrates some sacoglossans and nudibranchs is outstanding. However, additional, and more varied, drawings of pulmonates might have been included; those used were largely taken from the works of von Benthem Jutting and Burch and Patterson.

In his treatment of the opisthobranchs, the author relied heavily on a manuscript of Odhner. Thus, there are numerous new families described here as well as at least one new genus. It is annoying (particularly to a taxonomist) to see new familial names replace old ones without explanation. Unfortunately the citation of the author and date with each family is not consistently included.

The bibliographies cite most of the more recent works and are really supplements to the compilations of Simroth and Hoffmann in the respective volumes of Bronn's *Tierreich*.

An outstanding section is the discussion of parasitic and commensal gastropods. The reader will become acquainted with the little known works of two Russian specialists, Ivanov and Grusov, and will be surprised to discover that the largest (longest) gastropod known is *Parenteroxenos doglieli*, an entoconchid which lives in the body cavity of a holothurian and measures some 130 cm. in length and only 5 mm. in diameter.

The chapter on the Class Scaphopoda by Professors E. Fischer-Piette and A. Franc

presents a résumé of information of external morphology and internal anatomy of the tusk shells.

The two remaining sections differ in character, subject and authors. Martoja has written an extensive review article on neurosecretory cells and endocrine glands in mollusks (excepting the cephalopods). The bibliography of this article and its addendum should be helpful to the serious student of molluscan neurophysiology. The brief discussion of the evolution and paleontology of the gastropods by Termier and Termier adds little to the extensive, more thorough treatment in Moore's *Treatise on Invertebrate Paleontology*.

—KENNETH J. BOSS

* * * *

Abbott, R.T. 1968. *Seashells of North America: A Guide to Field Identification. A Golden Field Guide*, New York, 280 pages and numerous colored illustrations. This guide considers the marine mollusks of both coasts of North America with brief descriptions and colored figures of some 850 species. The introduction covers descriptive details on the major groups of mollusks, their evolutionary history and much about their development. Other subjects covered are the environmental niches, dispersal factors, and consideration of the marine faunal provinces in which they occur.

The excellent illustrations are by George F. Sandström, several of which show the animal as it appears alive. —W. J. CLENCH