

The Family Triphoridae (Mollusca, Gastropoda) in Cuba.

2. The Genus *Iniforis* Jousseume, 1884

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ABSTRACT: The species of the genus *Iniforis* Jousseume, 1884 (family Triphoridae) from Cuba are studied. Three new species are described, being designated a neotype for *I. turriothomae* (Holten, 1802). The protoconch, important element for specific separation, is described and illustrated for each species.

RESUMEN: Se estudia en género *Iniforis* Jousseume, 1884 (familia Triphoridae) en la isla de Cuba. Se describen tres nuevas especies siendo designado un neotipo para *I. turriothomae* (Holten, 1802). Las protoconchas de todas las especies, elemento importante para la separación específica, son descritas y representadas.

INTRODUCTION

JOUSSEAUME (1884: 235-236) created the genus *Iniforis* with the following description: "coquille sénestre, allongée et subulée, à surface granuleuse; spire composée de plus de quinze tours; le dernier à trois ouvertures inégales". LASERON (1958: 579) comments: "Jousseume divided the recent species with the so-called three apertures into two series: *Iniforis*, for those with two rows of gemmules and more than 15 whorls and *Mastoniaeforis* for those with three rows of gemmules and 15 whorls of less".

MARSHALL (1983: 7) considered that the genera *Mastonia* Hinds, 1843, *Iniforis* Jousseume, 1884 and *Mastoniaeforis* Jousseume, 1884 are related because they show a progressive development of the poste-

rior canal from a simple notch. MARSHALL (*op. cit.*: 45), opted for maintaining *Mastonia*, *Mesophora*, *Iniforis*, and *Mastoniaeforis* as separate genera.

Material collected in Cuba through the cooperation of two Spanish Universities (Autónoma of Madrid and Oviedo) with the University of La Habana, and also material collected in other occasions by the junior author yielded a lot of species of the Family Triphoridae. The first work (ROLÁN & FERNÁNDEZ-GARCÉS, 1993) tried on the genus *Metaxia*. Several species which could be included into the genus *Iniforis* due to the existence of three apertures and two cords per whorl, are studied in the present. The number of spire's whorls of these species were up to 15 in some of them, and fewer in some others, especially in those with a paucispiral

protoconch. They are very similar to the shells figured by LASERON (1958: 214 & 217) for the genus *Iniforis*, but also to the species placed in the genus *Epiforis* Laseron, 1958.

RESULTS

Abbreviations used:

MNCN: Museo Nacional de Ciencias Naturales, Madrid

IES: Instituto de Ecología y Sistemática, La Habana

MNH: Museum National d'Histoire Naturelle, Paris

BMNH: The Natural History Museum, London

AMNH: American Museum of Natural History, New York

ZMA: Zoölogisch Museum, Amsterdam

CFG: R. Fernandez-Garcés, Cienfuegos, Cuba

CER: E. Rolán, Vigo, Spain

Genus *Iniforis* Jousseaume, 1884

= *Mastoniaeforis* Jousseaume, 1884

= *Epiforis* Laseron, 1958

= *Contraforis* Laseron, 1958

No important characters separate the genus *Mastoniaeforis* (and its synonyms *Epiforis* and *Contraforis*, in the opinion of MARSHALL, 1983) from *Iniforis*, because the form of the protoconch or the number of whorls are not good specific characters for generic separation.

Iniforis turrithomae (Holten, 1802)

Figs. 1, 2, 3, 4, 20, 21, 31, 32, 33, 34

Turris Thomae Chemnitz, Systematisches Conchylien-Cabinet, vol. 11, p. 310, t. 213, fig. 3022, a to d.

Turbo turris-Thomae Holten, 1802. Enumeratio systematica Conchyliorum beat. Chemnitzii, p. 71 (refers the fig. 3022 of Chemnitz).

Cerithium mirabile C. B. Adams, 1850. Contrib. Conch, 7: 118.

Material examined

More than two hundred specimens and shells collected in the following places:

North of Cuba (CER): at 4 m, in Baracoa; at 3 m, in Marina Hemingway; at 10 m, in La Herradura; at 5 m, in Jibacoa; at 3 m, in the proximity of the Hotel Comodoro, La Habana.

South of Cuba: at 1 m, in Cable Inglés and between 15 to 30 m, in Faro de los Colorados, Cienfuegos (CER y CFG); between 10 m to 17 m, in Cayo Matías, at 6 m, in Cayo Cantiles and at 8 m, in Cayo Avalos, Arquipelago of Los Canarreos (CER); at 50 m, in Punta Pedernales and between 10 to 20 m, in Punta Francés, Isla de la Juventud (CER y MNCN).

Type material

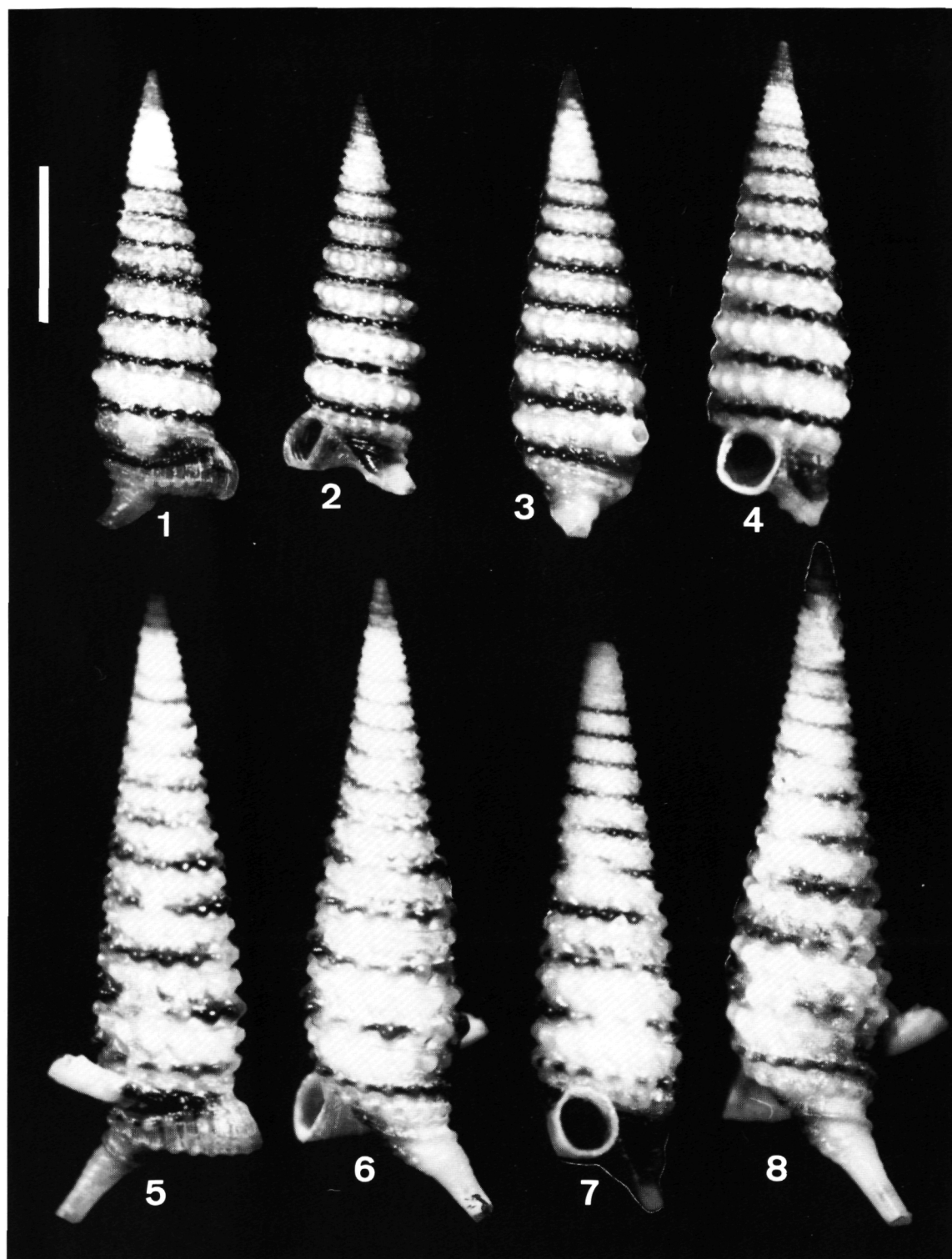
The type material is considered lost (DE JONG & COOMANS, 1988). It is necessary for nomenclatural stability to designate a neotype (Fig. 1), which is 5.5 mm, and is deposited in the MNCN with the number 15.05/6823. Its origin is from Cienfuegos.

Description

The shell (Figs. 1-4) was before figured in WARMKE & ABBOTT (1961: pl. 13, fig. j) and in ABBOTT (1974: fig. 1132). *Cerithium mirabile* C. B. Adams, 1850, which type is represented in CLENCH & TURNER (1950: pl. 38, fig. 1), is a shell without protoconch, but it seems to be the same species.

It is a very well known and repeatedly described species (for example, in ABBOTT, 1974: 111). Dimensions between 4.1 mm to 7.0 mm. To these descriptions it is necessary to add:

The protoconch (Fig. 20) is dark brown with four spiral whorls. It has an average of 0.48 mm of length. The embryonic whorl is 0.13 mm in width and is covered by many small semispheric tubercles which are irregularly



Figs. 1-4. *Iniforis turrithomae*. (Fig. 1: neotype, MNCN).

Figs. 5-8. *Iniforis pseudothomae* n. sp. (Fig. 6: holotype, MNCN; Figs. 5, 7, 8: paratypes, CER).
(scale: 1 mm)

distributed (Fig. 21). Two spiral cords crossed by axial ribs run along the remaining whorls.

The animal is translucent white, with very small milky-white blotches, some on the entire body, but most on the cephalic part. There is yellow pigmentation on the propodium and on the dorsal part of the metapodium. Some small red violet spots are present on the dorsum of the foot, more concentrated in its central part. Tentacles are translucent.

Radula with many teeth, all very similar among them, with three long cusps (Figs. 31-32 & 34). BANDEL (1984: fig. 95, pl. 5, fig. 4) previously illustrated this radula.

Operculum (Fig. 33) almost circular, translucent whitish-yellow, with a central nucleus, and 4-6 spiral whorls. Ovoid insertion surface form placed in a lateral position.

Comments

The description of *I. turrithomae* is based in a figure of Chemnitz lacking the necessary details for defining the species. However, the authors who before represented the shell, agreed about the shells belonged to this species. At present, the existence of other species with similar shell (see below) and with very similar but different protoconch, makes it necessary to designate a neotype in order to preserve the nomenclatural stability.

KOSUGE (1966: figs. 21 & 22 a, b & c) shows the radula of two species of *Iniforis*: *I. albogranosa* and *I. concors*. These radulae have a pentacuspoid rachidian tooth, tricuspid lateral and monocuspoid marginal teeth. The radula represented by MARSHALL (1983: fig. 4, H) for *Iniforis* cf. *violacea* is similar to the one of the present species. So it must be considered that the radula of this genus can have a variable number of cusps on its teeth.

Triphora turrissimilis Nowell-Usticke, 1971 is not a synonym of this species, but a triphorid not included in the genus *Iniforis* because its anal canal is close to the aperture. The same condition occurs in *Triphora bermudensis* Bartsch, 1911, which was sometimes synonymized with the present species (ABBOTT, 1974).

Iniforis casta (Hinds, 1843)

Figs. 9, 10, 11, 24

Triforis (Mastonia) castus Hinds, 1843. Ann. Mag. Nat. Hist., ser. 1, 11: 20.

Material examined

Type material: Lectotype, 4.9 x 1.7 mm from S. Vincent, W. Indies, BMNH number 196536-37, Gray collection, selected by Moolenbeek & Faber (in press). A paralectotype is a fragment without protoconch and with a continuous dark spiral line, and is probably a different species.

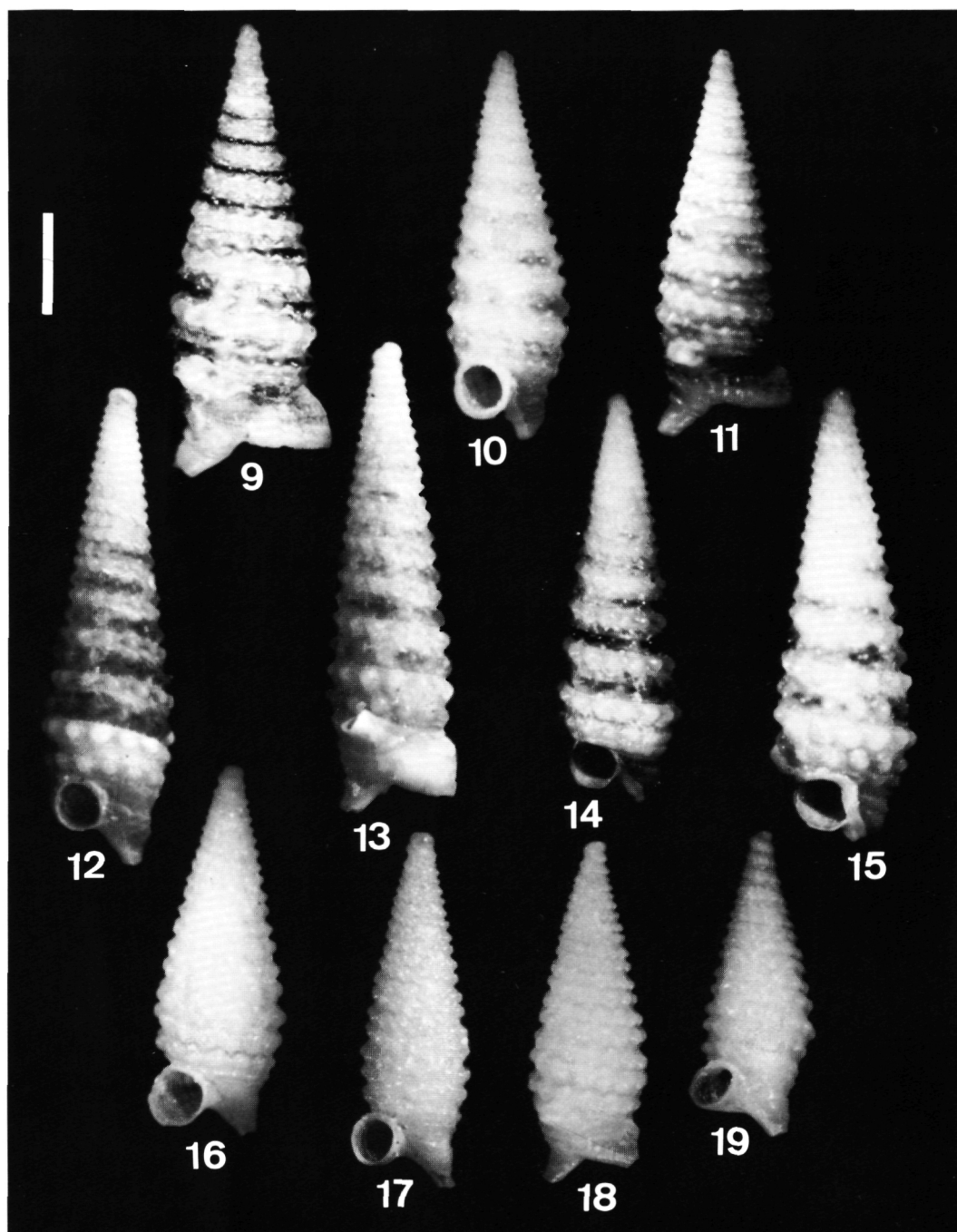
North of Cuba: 8 shells and 24 fragments with protoconch at 5 m in Jibacoa (CER); 1 shell at 6 m in Yacuanabo (CER).

South of Cuba: 1 shell at 10 m in Cayo Cantiles and 2 fragments with protoconch at 20 m in Cayo Matías, Archipelago of Los Canarreos (CER).

Description

Shell (Figs. 9, 10 & 11) slender and elongated, slightly curved in the last whorls, cream-white, crossed by a spiral brown band (always discontinuous) on the lower row of tubercles. Dimensions: between 4.0 to 5.5 mm in length.

Protoconch (Fig. 24) with between 2 and 3.5 whorls with faint transition protoconch/teleoconch. Its width is 0.30 mm. Spiral striae are present at the beginning but immediately a very tiny axial sculpture is present. Two spiral cords run along the protoconch



Figs. 9-11. *Iniforis casta*, Jibacoa (Cuba).

Figs. 12-15. *Iniforis carmelae* n. sp. (Fig. 12: holotype, MNCN; Fig. 13: paratype, AMNH; Figs. 14-15: paratypes, CER).

Figs. 16-19. *Iniforis immaculata* n. sp. (Figs. 16 & 18: paratypes, CER; Fig. 17: holotype, MNCN; Fig. 19: paratype, AMNH).

(scale: 1 mm)

ending with a single cord, extended in variable distance.

Teleoconch with about 8-10 whorls, each one with two rows of tubercles, separated by a fine undulated spiral rib. The first two whorls are white but in the remaining whorls the lower row is irregular brown. A dark blotch is present on the base of the siphonal tube. There are three tuberculated cords on the body whorl some of which extend onto the base. The aperture is circular. The anal aperture in the suture is slightly separated from the aperture. The siphonal tube is closed, narrow and slightly curved at its end.

The animal is unknown.

Comments

I. casta is easily differentiated from *I. turrithomae* by its white protoconch with less whorls, and also by its discontinuous brown spiral line.

Iniforis pseudothomae n.sp.

Figs. 5, 6, 7, 8, 22, 23

Material examined

North of Cuba: 2 shells at 5 m, in Baracoa (CER).

South of Cuba: 10 shells at 6 m, in Cayo Cantiles and 6 shells at 20 m, in Cayo Matías, Arquipelago of Los Canarreos (CER); 23 shells between 10 to 20 m in the Cienfuegos Bay and 32 shells at 45 m in Rancho Luna, Cienfuegos (type material and CER).

Type material

Holotype (Fig. 6) of 7.4 mm, from Cienfuegos, MNCN 15.05/6820; 5 paratypes in the IES; one paratype in AMNH 226459, MNHN, BMNH 1992133, ZMA 3.93.005 and ten in the CFG and CER (all from the Cienfuegos lot).

Description

Shell (Figs. 5-8) slender and elongated, pointed, with a rectilinear profile except in the

last whorl. Whitish colour with two rows of tubercles: the upper one is white and the lower has an irregular light brown spiral band. Dimensions: between 5.0 to 9.5 mm.

Protoconch (Fig. 23) brown in colour, average 0.67 mm in length. Width of the embryonic whorl is 0.17 mm and it has its surface covered with many small tubercles grouped in bands (Fig. 22). The larval shell has up to five whorls, four of them showing two spiral fine cords crossed by axial ribs; in the last whorl there is a single cord, also crossed by axial ribs.

The teleoconch has between 10 to 15 whorls with a very rectilinear profile. The suture is not evident. Two rows of tubercles are present, all connected by a spiral cord. The upper row is white and bordered by two fine cords, one near the suture and the other close to and below the tubercles. The inferior row is a irregular discontinuous light brown. On the last whorl, there are several spiral cords near the base, most of them without tubercles; the last cord is placed on the siphonal tube. The aperture is circular, clearly separated from the shell. The siphonal tube is elongated, closed and a slightly curved, darker near the aperture. One new tube is placed on the suture a little before the end of the spire, representing the anal canal. The siphonal and the anal tubes are usually elongated.

Etymology

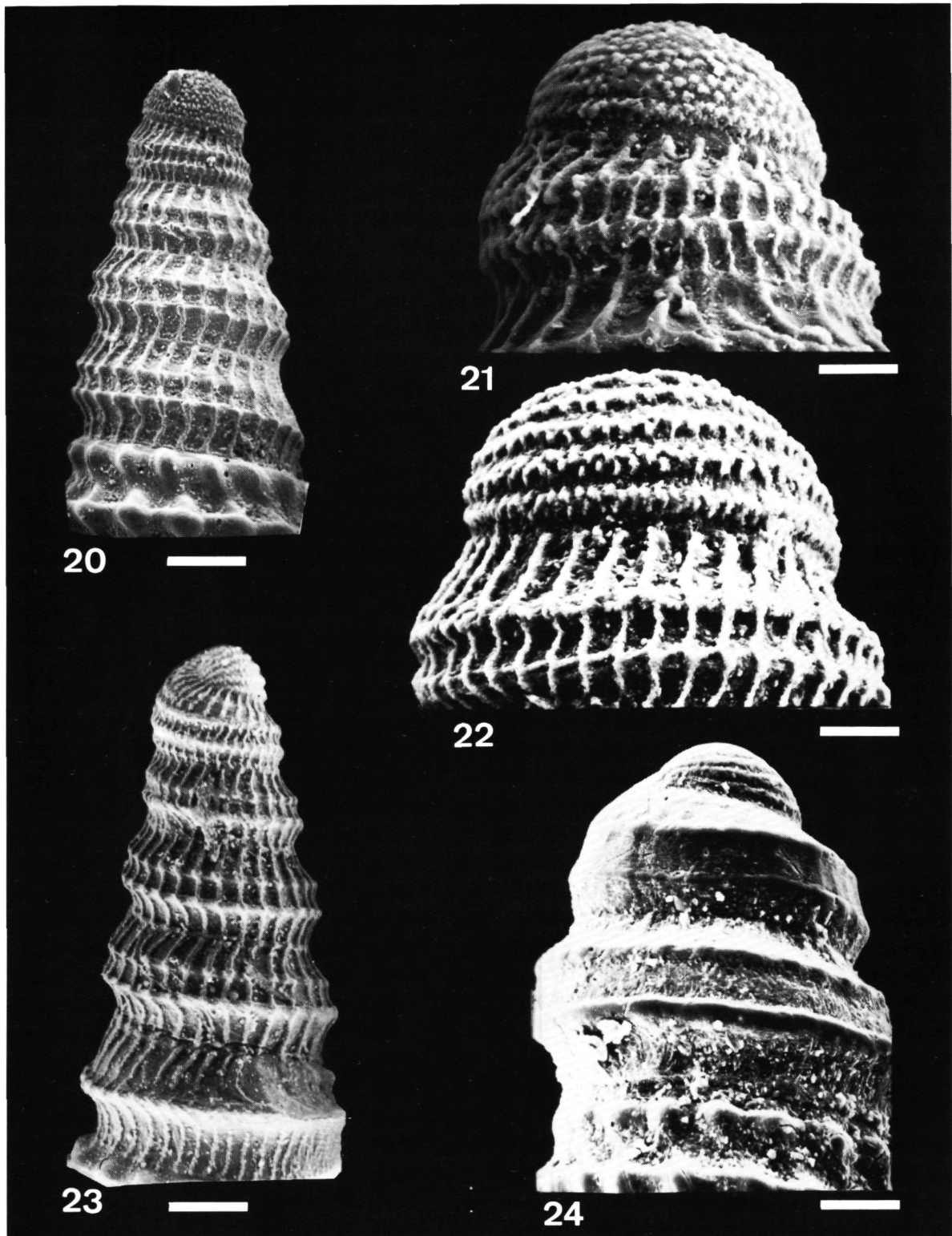
The specific name refers the similarity with the precedent species (*I. turrithomae*).

Type locality

Cienfuegos, in the south of Cuba.

Discussion

I. pseudothomae is very similar to *I. turrithomae* but it has a more rectilinear profile and is usually larger (one specimen had up to 20 whorls of teleoconch). The most distinctive character is the lower row of tubercles of irregular brown colour present in *I. pseudothomae*; the shell is lighter in colour



Figs. 20-21. *Iniforis turrithomae*. (Fig. 20: protoconch; Fig. 21: embryonic shell).
 Figs. 22-23. *Iniforis pseudothomae* n. sp. (Fig. 23: protoconch; Fig. 22: embryonic shell).
 Fig. 24. *Iniforis casta* (protoconch).
 (scale: protoconch: 0.1 mm; embryonic shells: 0.05 mm)

than *I. turrithomae*. The embryonic shell is slightly larger than *I. turrithomae*, and its tubercles are grouped into obvious cords; also the abapical whorl of the protoconch, with one spiral cord, is larger. The siphonal and anal tubes in *I. pseudothomae* are longer than in *I. turrithomae*.

The other species of this genus, mentioned in the present work for the Caribbean area, have protoconchs that indicate lecithotrophic development.

ODE (1989: 109), speaking about *Triphora turrithomae*, commented that in some rare cases, the specimens observed have the brown band "...broken into a line of dashes". These specimens are likely to be *I. pseudothomae* n. sp. LEAL (1991: 123, pl. 16, figs. L-M) described and illustrated *Triphora* sp. 2, which could be the present species because "...it differs (from *T. turrithomae*) by having a rather diffuse coloration pattern of brown spots over entire whorls, instead of the single, brown abapical spiral row of nodules". Therefore, we expect *I. pseudothomae* to have a wider range throughout the Caribbean region.

***Iniforis carmelae* n.sp.**

Figs. 12, 13, 14, 15, 28, 29, 30

Material examined

North of Cuba: 4 shells at 15 m, in La Herradura (CER); 3 shells and 4 fragments at 5 m, in Jibacoa (CER); 3 shells at 5 m, in Baracoa (CER).

South of Cuba: 9 shells at 15 m, in Cayo Matías, 1 shell at 5 m, in Cayo Diego Perez (Archipelago of Los Canarreos) (MNCN); 22 shells and 5 fragments at 45 m, in Rancho Luna (Cienfuegos) (type material).

Type material

Holotype (Fig. 12) of 5.2 mm, from Cienfuegos, MNCN 15.05/6822. One paratype in ZMA 3.93.006, AMNH 226457, IES, BMNH 1992134, MNHN, five in the

CFF and fifteen in the CER (all from the Cienfuegos lot).

Description

Shell (Figs. 12-15 & 28) elongated and slender, translucent cream-white, with two rows of tubercles, lower one marked by an irregular brown band. Dimensions between 4.2 mm to 5.9 mm.

Protoconch (Figs. 29-30) blunt, sometimes variable in width (average 0.34 mm), with about 2 1/2 whorls. It begins with a circular smooth nucleus which shows several growth lines. The first whorl is rounded, with a spiral cord that begins at its end. The first whorl shows, in fresh shells, very fine irregular spiral lines devoid of axial sculpture. On the second whorl there are incomplete axial ribs which change into tubercles in some specimens.

The teleoconch shows about 10 whorls, each one with two rows of tubercles. Suture not well marked. A fine spiral rib appears about the 9-10 whorl below the upper row of tubercles and bordering them closely. On the last whorl there are other three non-tuberculated cords below the last two rows. The anal tube is opened in the suture slightly before the end of the spire. The aperture is circular and separated from the shell at its end. The siphonal canal is slightly elongated, closed, and slightly curved. The fragments of the shells show that the interior core is brown.

The animal is unknown.

Etymology

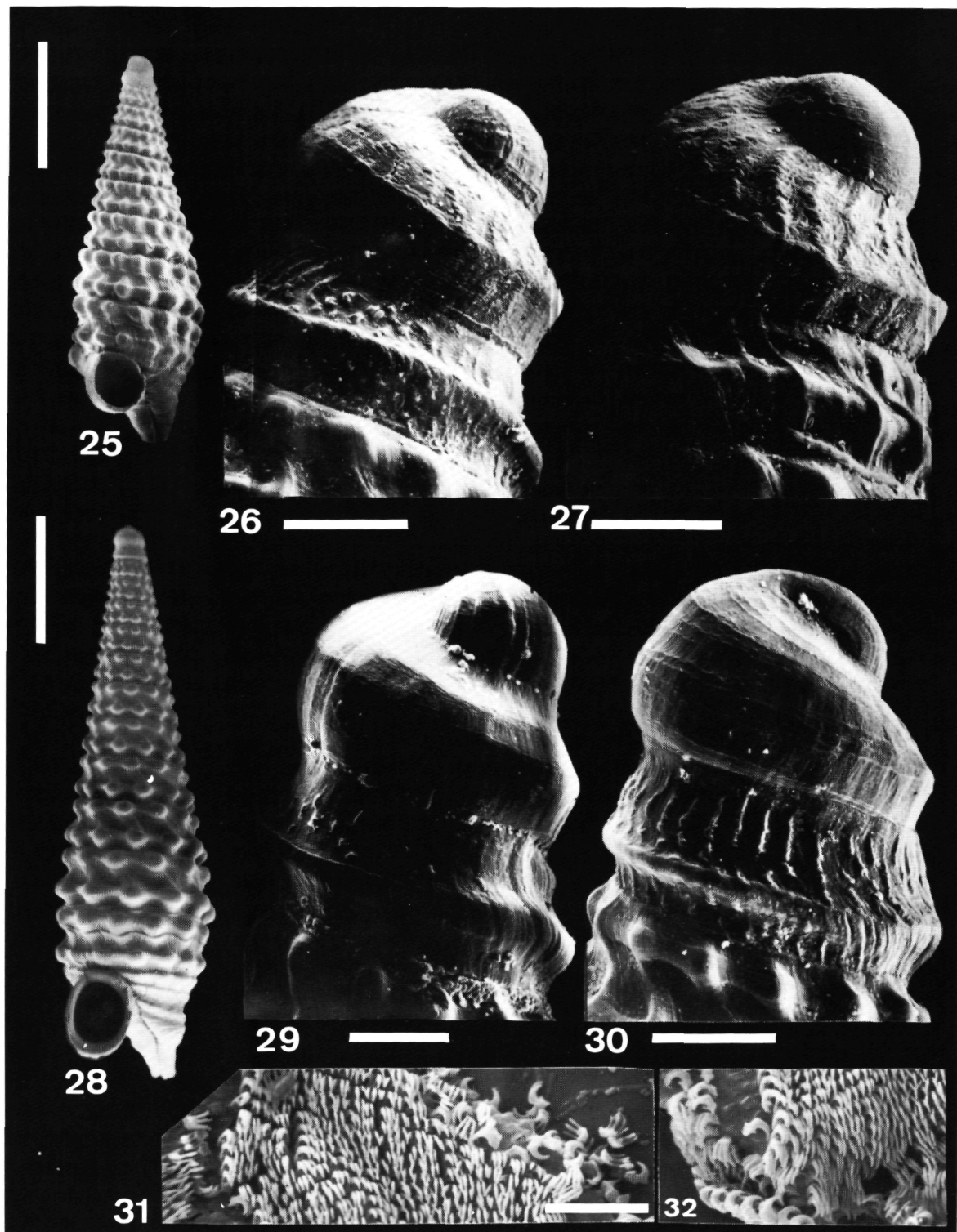
The name is employed in memoriam of a daughter of the senior author.

Type locality

Cienfuegos in the South of Cuba.

Discussion

The paucispiral protoconch differs from those species with planktotrophic development (*I. turrithomae* and *I. pseudothomae*). Other



Figs. 25-27. *Iniforis immaculata* n. sp. (Fig. 25: paratype, CER; Figs. 26-27: protoconchs).
 Figs. 28-30. *Iniforis carmelae* n. sp. (Fig. 28: paratype, CER; Figs. 29-30: protoconchs).
 Figs. 31-32. *Iniforis turrithomae* (radula).
 (scale: shells: 1 mm; protoconch: 0.1 mm; radula: 0.01 mm)

species with similar coloration pattern such as *Triphora bermudensis* Bartsch, 1911, *T. elvirae* De Jong & Coomans, 1988 and *T. ellyae* De Jong & Coomans, 1988, have multispiral protoconchs.

I. casta has a more inflated shell, its protoconch is smaller, and presents differently sculpture. The differences with the species to be shown below will be made after its description.

***Iniforis immaculata* n.sp.**

Figs. 16, 17, 18, 19, 25, 26, 27

Material examined

North of Cuba: 3 shells and 2 fragment at 5 m, in Jibacoa; 2 shells and 1 fragment at 4 m, in Baracoa.

South of Cuba: 5 shells and 7 fragments at 15 m, in Cayo Matías; 4 shell and 3 fragments at 15 m, in Rancho Luna and 3 shells and 4

fragments between 10 to 45 m, in Cienfuegos Bay. Most of the shells are type material; rest in CER.

Type material

Holotype (Fig. 17) of 4.00 mm, from Cienfuegos, MNCN 15.05/6821. One paratype in the collections of IES (from Cienfuegos), AMNH 226458 (from Rancho Luna, Cienfuegos), BMNH 1992135 (from Cayo Matías), MNHN (from Cayo Matías) and ZMA 3.93.007 (from Jibacoa); four in the CFG (from Rancho Luna) and seven in the CER (from Rancho Luna and Cienfuegos Bay).

Description

Shell (Figs. 16-19 & 25) slender and elongated, glossy, slightly curved in last whorls, with a slightly translucent white colour. Dimensions: between 3.5 mm to 4.9 mm.

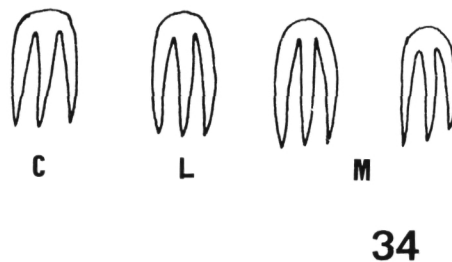
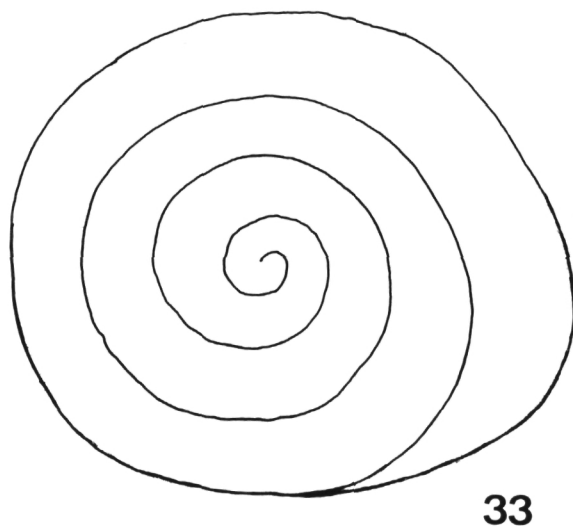


Fig. 33.- Operculum of *Iniforis turrithomae* (scale: 0.5 mm).

Fig. 34.- Radular teeth of *Iniforis turrithomae*: C- central tooth; L- lateral tooth; M- one of the marginal teeth.(scale 0.005 mm)

Protoconch (Figs. 26-27) blunt, sometimes variable in width (average 0.33 mm), with between 2 and 2 1/2 whorls. It begins with a circular nucleus (Figs. 26-27) which is crossed by several lines. The first whorl is rounded and it has a peripheral spiral cord. Above this cord small sigmoidal axial ribs appear. These ribs are present in the second whorl, where they are narrower and more frequent, and where they become tubercles.

The teleoconch has about 8 whorls, each one with two rows of tubercles and slightly marked suture. A fine spiral rib begins below the upper row of tubercles between the fifth and the sixth whorls. In the last whorl, two other non-tuberculated cords appear near the base, abapically to the other ones. The anal tube is open in the suture, just before the aperture. Aperture is circular and very regular. The siphonal canal is short, closed, slightly curved towards the dorsum. The interior of the shell is totally white.

The animal is unknown.

Etymology

The specific name refers at the totally white colour of the shell.

Type locality

Cienfuegos, in south Cuba.

Discussion

The paucispiral protoconch distinguishes this species from those also white with planctotrophic development, like *Cosmotriphora melanura* (C. B. Adams, 1850). Other Caribbean species with paucispiral protoconch (*T. peetersae* Moolenbeek & Faber, 1989 and *T. calva* Faber & Moolenbeek, 1991) have a different dark colour.

A similar species having a paucispiral protoconch is *I. carmelae* n. sp., but this species has brown colour in the lower row of tubercles in last whorls. The profiles of both species are also different, *I. carmelae* being more rectilinear. Their protoconchs have consistent small

differences only detectable using SEM: tiny spiral lines in *I. carmelae* and axial sculpture in *I. immaculata*. The fragments of both species show that the color of their interior is also different: white in *I. immaculata* and brown in *I. carmelae*.

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REFERENCES

- ABBOTT, R. T. 1974. *American seashells*. (2nd. Ed.). Van Nostrand Reinhold Co. New York. 663 pp., 24 pls.
- BANDEL, K. 1984. The radulae of Caribbean and other Mesogastropoda and Neogastropoda. *Zoologische Verhandlungen*, 214: 188 pp, 22 pls.
- CLENCH, W. J. & R.D. Turner, 1950. The Western Atlantic marine mollusks described by C. B. Adams. *Ocasional Papers on Mollusks*, 1 (15): 233-403.
- DE JONG & COOMANS, 1988. *Marine gastropods from Curaçao, Aruba and Bonaire*. E. J. Brill. Leiden. 261 pp, 47 pls.
- HINDS, R. B. 1843. Description of new shells from the collection of Captain Becher. *Ann. Mag. nat. Hist.*, 1 (11): 16-21
- HOLTEN, H. S. 1802. *Enumeratio Systematica Conchiliorum beat. J. H. Chemnitzii*. London. Linnean Society. 88 pp.
- JOUSSEAUME, F. 1884. Monographie des Triforidae. *Bulletin de la Société Malacologique de France*, 1 (3): 218-270.

KOSUGE, S. 1966. The family Triphoridae and its systematic position. *Malacologia*, 4 (2): 297-324.

LASERON, C. F. 1958. The family Triphoridae (Mollusca) from Northern Australia; also Triphoridae from Christmas Island (Indian Ocean). *Australian Journal of Marine and Freshwater Research*, 9 (4): 569-658.

LEAL, J. H. 1991. *Marine prosobranch gastropods from oceanic islands off Brazil*. Universal Book Services. Oegstgeest. 419 pp.

MARSHALL, B. A. 1983. A revision of the recent Triphoridae of Southern Australia. *Re-*

cords of the Australian Museum, supp. 2: 1-119.

ODE, H. 1989. Distribution and records of the marine Mollusca in the Northwest Gulf of Mexico. *Texas Conchologist*, 25 (3-4): 104-120.

ROLÁN, E. & R. FERNÁNDEZ-GARCÉS, (in press). La familia Triphoridae en Cuba 1. El género *Metaxia* Monterosato, 1884. *Boll. Malacologico*.

WARMKE, G. L. & R. T. ABBOTT, 1961. *Caribbean seashells*. Livingston Publishing Co. Wynnewood, Pennsylvania. 348 pp., 43 pls.