

THE MULTISPIRAL PROTOCONCH OF *STROBILIGERA TORTICULA* (DALL, 1881) COMB. NOV. (GASTROPODA, TRIPHORIDAE)

MAURÍCIO R. FERNANDES & ALEXANDRE D. PIMENTA

Departamento de Invertebrados, Museu Nacional, Universidade Federal do Rio de Janeiro, Quinta da Boa Vista, São Cristóvão, 20940-040, Rio de Janeiro, Brazil

Abstract The present study reveals for the first time the structure of the protoconch of *Strobiligera torticula* (Dall, 1881) comb. nov., being of the multispiral type, with arrowhead-shaped granules on the embryonic shell and incomplete axial sculpture on the larval shell. *Strobiligera torticula* is another example of deep-sea species in Triphoroidea that probably realize ontogenetic migration, by possessing a brown protoconch indicative of an epipelagic larval phase.

Key words Triphoroidea, deep-sea, ontogenetic migration, taxonomy.

INTRODUCTION

Triphora torticula Dall, 1881 is a species restricted to the deep-waters off Florida (southeastern U.S.A.) and Cuba, from 1000m to 1200m (Rolán & Fernández-Garcés, 2008). This species has been recorded in the literature only in its original description (Dall, 1881), in Dall (1889a, 1889b) and, more recently, in Rolán & Fernández-Garcés (2008). Owing to its large size and deep-sea habitat, *T. torticula* was tentatively allocated to the genus *Inella* Bayle, 1879 by Rolán & Fernández-Garcés (2008), although these authors admitted that the lack of protoconch in all available shells of *T. torticula* could obscure its real generic allocation.

The present study reveals for the first time the structure of the protoconch of *T. torticula*, based on shells stored in MORG malacological collection, from the Straits of Florida, and leads to the proposition of a new generic allocation.

For methodology and terminology applied, we followed Fernandes & Pimenta (2014).

Abbreviations used: (MCZ) Museum of Comparative Zoology, Cambridge, U.S.A.; (MORG) Museu Oceanográfico "Prof. Eliézer de Carvalho Rios", Rio Grande, Brazil; (NMNH/USNM) National Museum of Natural History, Washington D.C., U.S.A.

SYSTEMATICS

Family Triphoridae Gray, 1847

Subfamily Triphorinae Gray, 1847

Genus *Strobiligera* Dall, 1924

Type species *Triforis ibex* Dall, 1881

Definition see Fernandes & Pimenta (2014).

Strobiligera torticula (Dall, 1881) comb. nov.
(Fig. 1)

Triforis torticulus Dall, 1881: 82

Triforis (Sychar) torticula Dall, 1889a: 249, pl. 20, fig. 11B; Dall, 1889b: 138, pl. 20, fig. 11b

Inella torticula Rolán & Fernández-Garcés, 2008: 112, figs 15, 36H

Type material Lectotype: MCZ 7390, examined by photograph (Fig. 1A). The paralectotype in NMNH (USNM 87312) is still missing (E. Strong, pers. comm.), as indicated by Rolán & Fernández-Garcés (2008).

Type locality Yucatan Strait, 1170m, off Cuba.

Material examined 4 fg / 1 sh, Straits of Florida, U.S.A., 1000–1200m, MORG 39354.

Measurements See legend for Fig. 1B-F.

Characterization Shell sinistral, nearly rectilinear profile; smaller shells are conical and thin, but with late whorls increasing very much in width

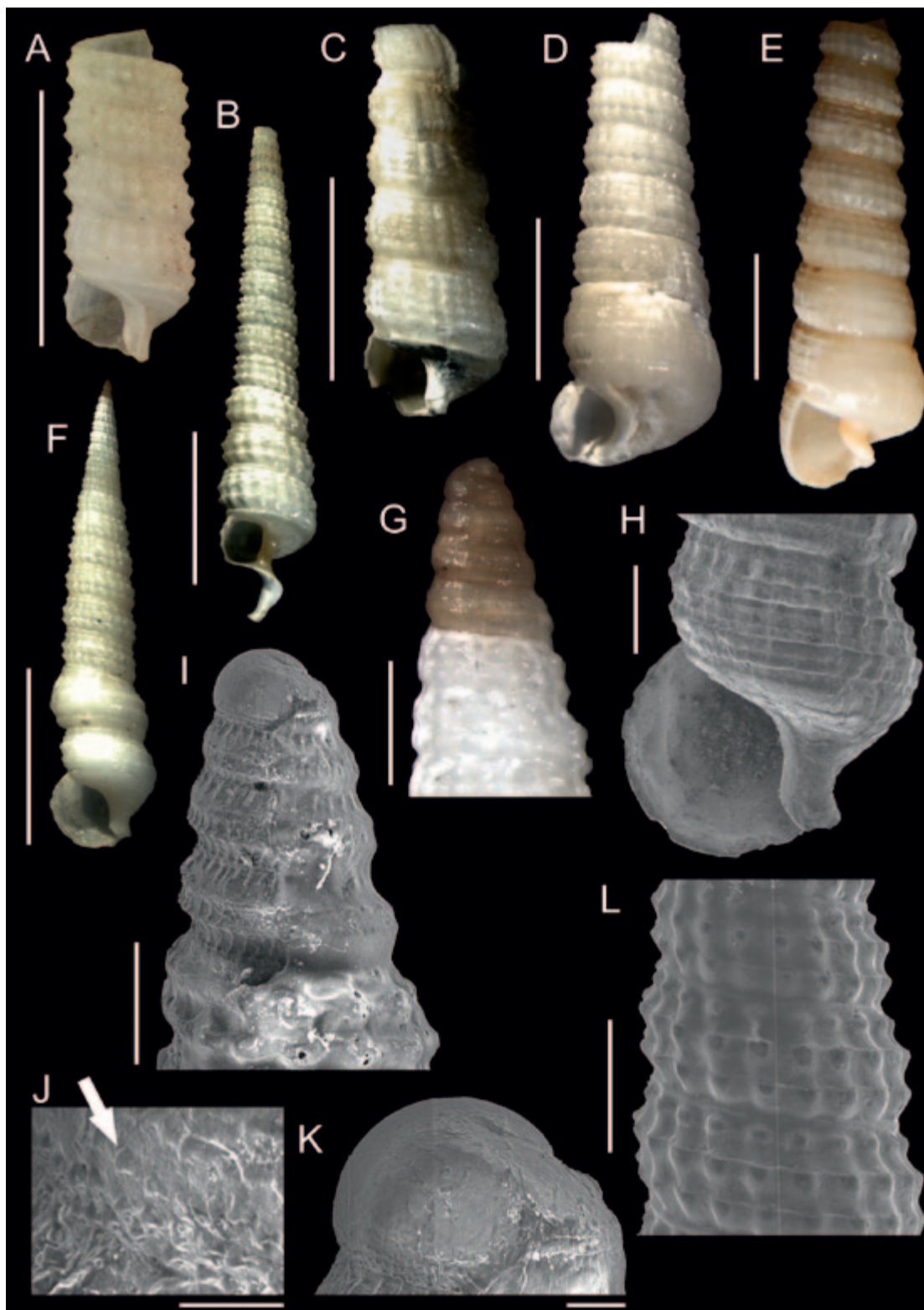


Figure 1 *Strobiligera torticula* (Dall, 1881) *comb. nov.* **A**, lectotype, MCZ 7390, Yucatan Strait, 6.7mm in length. **B–L**, MORG 39354, Straits of Florida. **(B)** 17.04mm in length, 3.23mm in width. **(C)** 9.75mm in length, 3.49mm in width. **(D)** 13.25mm in length, 4.87mm in width. **(E)** 18.76mm in length, 5.66mm in width. **(F)** 13.52mm in length, 2.53mm in width. **(G–L)**: same shell as **F**. **(G, I)** protoconch and beginning of teleoconch. **(H)** abapical portion of shell, frontal view. **(J)** abapical portion of embryonic shell, with arrow evidencing a granule. **(K)** embryonic shell. **(L)** detail of teleoconch whorls, before the emergence of additional spiral cords. Scale bars: **A–F**, 5mm; **G**, 500µm; **H, L**, 1mm; **I**, 250µm; **J**, 25µm; **K**, 50µm.

DISCUSSION

in abrupt phases, and assuming an irregular shape in relation to the axis of the shell; larger shells (without apex) are nearly cylindrical and very thick; the largest fragment in size, with 7.5 abapical whorls, measures 18.76mm in length, 5.66mm in width. Protoconch subcylindrical, with 0.64mm in length, 0.45mm in width, almost five convex whorls; embryonic shell dome-shaped and covered with arrowhead-shaped granules in its abapical portion, spirally disposed, remaining portion of embryonic shell is polished by erosion; larval shell with two weak spiral cords, crossed by very weak and orthocline to slightly prosocline axial ribs, except at the smooth spiral zone just above the adapical spiral cord, where axial ribs are not present. Teleoconch with up to 16.5 whorls; two main spiral cords (median and abapical) at the beginning, the abapical one derived from the abapical cord of the protoconch, and a very small cord (adapical) close to the suture; adapical spiral cord gradually strengthens, becoming distinct and nodulose at the sixth whorl, reaching almost the same size as the abapical spiral cord between the seventh and eighth whorl, and becoming more clearly distant from other two cords after the tenth/eleventh whorl; median spiral cord slightly more pronounced than others; distinct but shallow suture, with a smooth sutural cord; near the fifteenth whorl, an additional spiral cord emerges between the adapical and median cords, and some whorls later another spiral cord emerges between the median and abapical cords, numbering five main cords in late whorls (not considering the sutural cord); 23 nearly orthocline axial ribs on the tenth whorl of the teleoconch, axial sculpture disappears on late whorls; nodules of a medium to moderately small size, slightly elliptical, pointed profile; smooth subperipheral cord, with one or two very small, almost indistinct, spiral cordlets appearing in the short base; ovoid, large and very projected aperture; anterior canal extremely short, directed backward, and totally open; posterior canal as a very small sinus, almost indistinct. Light brown protoconch, white teleoconch.

Geographic distribution U.S.A.: Straits of Florida (Rolán & Fernández-Garcés, 2008; this study); off Cuba: Yucatan Strait (type locality).

Bathymetric distribution 1000m to 1200m (Rolán & Fernández-Garcés, 2008; this study).

Dall (1881) described *S. torticula* based on two syntypes, one measuring 6.0mm, the other 10.5mm. Subsequently, Dall (1889a, 1889b) furnished a drawing of the largest shell (10.5mm), containing six teleoconch whorls. Rolán & Fernández-Garcés (2008) accessed only one syntype, with four whorls of teleoconch and measuring 6.7mm, designating this as the lectotype (MCZ 7390). These authors considered that the lectotype seemed to be the same shell illustrated by Dall (1889a), although with fewer whorls “due to the loss of two whorls of the shell”. We disagree with them, because: (1) the drawing shows the development of an additional spiral cord between the adapical and median cords, that is not observed in the earlier whorls of the lectotype (Fig. 1A); (2) the drawing shows that the base of the shell is not yet formed, but it is complete in the lectotype (Fig. 1A); (3) the measurement of 6.7mm by Rolán & Fernández-Garcés (2008) is close to that of 6.0mm of Dall (1881); and (4) this species has a robust shell, which is hardly broken. In this case, we believe that the paralectotype (currently missing from NMNH) is the largest shell studied and illustrated by Dall (1889a, 1889b), and the lectotype is the smaller one.

The lectotype and the material herein studied (MORG 39354) share the white colour, the smooth subperipheral cord and, especially, the adapical spiral cord being slightly more distant from the other spiral cords. However, more complete shells present the most remarkable diagnostic features of this species, i.e., the development of additional spiral cords and the unusual enlargement of late whorls (Fig. 1B, F; Rolán & Fernández-Garcés, 2008: fig. 15C–E). The material herein studied is from the same locality as a shell illustrated by Rolán & Fernández-Garcés (2008: fig. 15C–E).

The proposed new generic allocation to *Strobiliger* is supported by the following features, as established by Bouchet & Warén (1993) and Fernandes & Pimenta (2014): an initially reduced adapical spiral cord of the teleoconch (Fig. 1G, I); a multispiral protoconch with incomplete axial sculpture in the larval shell (Fig. 1I), and arrowhead-shaped granules in the embryonic shell (Fig. 1J). Although the single protoconch is much eroded, the granules are still evident on its abapical portion (white arrow in Fig. 1J).

The most similar species to *S. torticula* is *Strobiligera cristulata* (Sacco, 1895), from the Pliocene of the Mediterranean (Landau *et al.*, 2006), which also presents an additional spiral cord in late whorls of teleoconch. They are mainly differentiated by the protoconch, as *S. cristulata* has a spiral sculpture of cruciform granules on the embryonic shell, instead of sparse arrowhead-shaped granules in *S. torticula*, and the protoconch of *S. cristulata* reaches almost six whorls (but almost five in *S. torticula*).

Strobiligera torticula is another example of deep-sea species in Triphoroidea that may realize ontogenetic migration (Bouchet & Warén, 1994), possessing a brown protoconch (Fig. 1G) indicative of an epipelagic larval phase; other cases can be seen in Bouchet & Warén (1993), Fernandes & Pimenta (2014) and Fernandes *et al.* (2015).

ACKNOWLEDGEMENTS

We are very thankful to Dr. Adam Baldinger (MCZ) and Dr. Ellen Strong (NMNH), for the photographs and search for type material of *S. torticula*, and Dr. Paula Spotorno (MORG), for the loan of the material herein studied; CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico) provided a fellowship to the first author; FAPERJ (Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro) supported this work through projects APQ1-E-26/110.325/2014 and APQ4-E-26/110.068/2014.

REFERENCES

- BOUCHET P & WARÉN A 1993 Revision of the north-east Atlantic bathyal and abyssal Mesogastropoda. *Bolletino Malacologico* 3: 579–840.
- BOUCHET P & WARÉN A 1994 Ontogenetic migration and dispersal of deep-sea gastropod larvae In CM Young & KJ Eckelbarger (eds) *Reproduction, larval biology, and recruitment of the deep-sea benthos*: 98–117.
- DALL WH 1881 Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico, and in the Caribbean Sea, 1877–79, by the United States Coast Survey Steamer 'Blake'. *Bulletin of the Museum of Comparative Zoology* 9: 33–144.
- DALL WH 1889a Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78) and in the Caribbean Sea (1879–80), by the U. S. Coast Survey steamer "Blake", Lieut.-Commander C. D. Sigsbee, U. S. N., and Commander J. R. Bartlett, U. S. N., Commanding. XXIX – Report on the Mollusca. Part II – Gastropoda and Scaphopoda. *Bulletin of the Museum of Comparative Zoology* 18: 1–492, 40pl.
- DALL WH 1889b A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. *United States National Museum Bulletin* 37: 1–232, 95pl.
- FERNANDES MR & PIMENTA AD 2014 Two species of the genus *Strobiligera* (Caenogastropoda: Triphoridae) with a multispiral protoconch in Southeastern Brazil. *American Malacological Bulletin* 32 (2): 165–172.
- FERNANDES MR, GAROFALO R & PIMENTA AD 2015 New species and records of Newtoniellinae (Caenogastropoda, Newtoniellidae) from Brazil. *Journal of the Marine Biological Association of the United Kingdom* 95 (4): 791–804.
- LANDAU B, LA PERNA R & MARQUET R 2006 The early Pliocene Gastropoda (Mollusca) of Estepona, Southern Spain. Part 6: Triphoroidea, Epitonioidea, Eulimoidea. *Palaeontos* 10: 1–96.
- ROLÁN E & FERNÁNDEZ-GARCÉS R 2008 New data on the Caribbean Triphoridae (Caenogastropoda, Triphoroidea) with the description of 26 new species. *Iberus* 26 (1): 81–170.