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New Species of *Caecum* (Caenogastropoda: Rissooidea: Caecidae) from the Atlantic Coast of South America (Brazil) with a Description of the Protoconch and Growth Stages

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Two new species of Caecinae are described from the Brazilian coast. Specimens of *Caecum metamorphosicum* sp. nov. were collected from northern to southeastern Brazil. The teleoconch V of this species is characterized by strong, raised, quadrangular, rather closely arranged axial ribs, except the last two to three preceding the aperture, which are slightly larger and more widely separated, and a finger-shaped mucro. Specimens of *Caecum trindadense* sp. nov. were only collected from southeastern Brazil. The teleoconch VI of this species is characterized by conspicuous, sinuous longitudinal striae, finger-shaped mucro, and rather smooth varix. The protoconch and all growth stages of *C. metamorphosicum* sp. nov. and *C. trindadense* sp. nov. are described and figured here based on scanning electron microscopy. A brief discussion on the biodiversity of Caecidae on the Atlantic coast of South America is given. This report provides a basis for the better recognition of growth stages among members of Caecinae.

Key words: biodiversity, south Atlantic, Brazil, continental shelf, shallow waters, archipelago, micromollusk, Gastropoda, Caecinae

INTRODUCTION

The family Caecidae Gray, 1850 comprises minute marine caenogatropods represented by more than 200 recent species with worldwide distribution (Lightfoot, 1993a; Ponder and Keyzer, 1998), occurring predominantly in tropical regions and inhabiting a multitude of marine ecosystems from the intertidal zone to depths of about 300 m (Moore, 1970, 1972; Lightfoot, 1992a; Pizzini et al., 1994; Di Geronimo et al., 1995; Ponder and Keyzer, 1998; Pizzini and Nofroni, 2001a; Tunnell Jr. et al., 2010). These microgastropods are associated to various substrates, such as sediments, rocks, calcareous formations, algae, sea grasses, mangrove roots, sponges and corals (Moore, 1962, 1972; Abbott, 1974; Mello and Maestrati, 1986; Bandel, 1996; Gomes and Absalão, 1996; Nofroni et al., 1997; Pizzini and Nofroni, 2001a).

Caecum Fleming, 1813 and *Meioceras* Carpenter, 1859 are the most studied caecids based on the shell morphology (Carpenter, 1858; Folin, 1867a, b; Klappenbach, 1964; Keeler, 1981; Jong and Coomans, 1988; Lightfoot, 1992a, b; Diaz and Puyana, 1994; Gomes and Absalão, 1996; Absalão and Gomes, 2001; Redfern, 2001; Rios, 2009). These genera have a tubular, slender, slightly arched teleoconch formed through growth stages, which are obliterated until complete morphological development of the gastropods (Day, 1983; Draper, 1985; Bandel, 1996; Pizzini, 1998; Ponder and Keyzer, 1998; Absalão and Gomes, 2001; Absalão and Pizzini, 2002). The various growth stages may exhibit different sculpture patterns, which hampers species identification (Van Aartsen, 1977; Pizzini, 1998; Bandel, 1996; Absalão and Pizzini, 2002).

In recent years, a number of studies have expanded knowledge on the alpha-taxonomy of Caecidae for the Atlantic Ocean (Lightfoot, 1992a, b; Absalão, 1994, 1997; Diaz and Puyana, 1994; Pizzini et al., 1994, 1995; Nofroni et al., 1997; Absalão and Gomes, 2001; Pizzini and Nofroni, 2001a; Redfern, 2001; Lee, 2009; Tunnell Jr. et al., 2010). However, very few data have been published on the group for the Atlantic coast of South America, with the majority of information originating from southeastern Brazil (Absalão, 1994, 1997; Absalão and Gomes, 1995; Gomes and Absalão, 1996; Rios, 2009).

During taxonomic studies on a large number of caecids from the western Atlantic in the framework of a research project carried out between 2008 and 2010 (Lima, 2010), it became evident that specimens of *Caecum* in material deposited in Brazilian malacological collections had been misidentified and were actually undescribed species previously unknown to science.

The present contribution is part of a continuing effort

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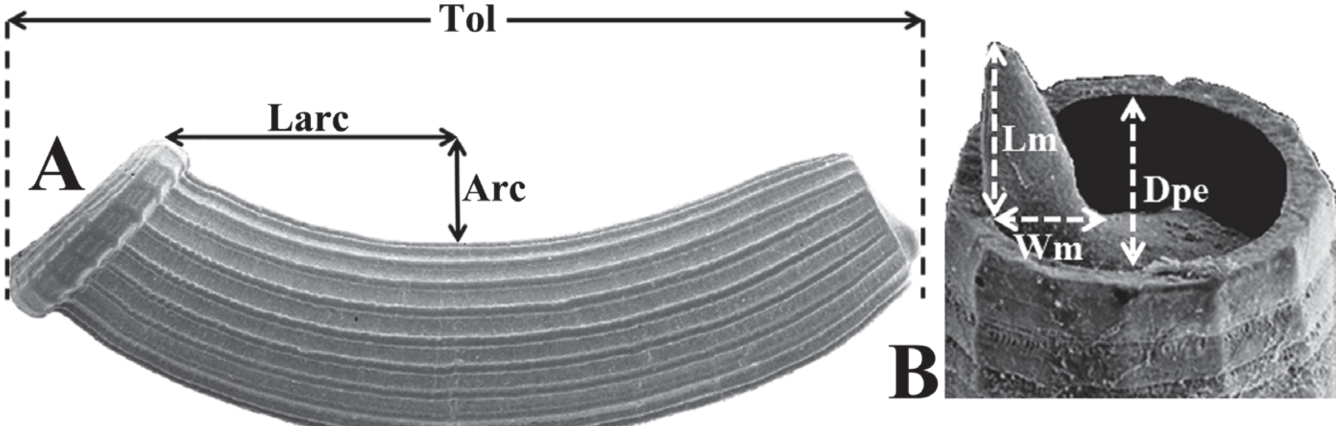

Fig. 1. Schematic *Caecum* shell with morphometric measurements taken: **(A)** entire shell, lateral view - total length (Tol), length from aperture to the point of maximum arc (Larc), maximum arc (Arc); **(B)** posterior extremity - diameter of posterior extremity (Dpe = Da), length of mucro (Lm), width of mucro (Wm).

toward a better taxonomic understanding of Caecidae from the western Atlantic, with an emphasis on taxa from the Atlantic coast of South America. This paper describes two new species of *Caecum* from Brazilian waters.

MATERIALS AND METHODS

Most of the examined material was collected through dredging and box coring activities carried out by an oceanographic research vessel in Brazilian waters during the development of the Environmental Characterization of Campos Basin (ECCB/Brazilian Petroleum Co.: 1998, 2003–2004), Multidisciplinary Study of the Continental Shelf of Amazonia (AMASSEDS/Brazil: 1990), Marine Geology of the Continental Shelf of Brazil (GEOMAR: 1979) and Live Resources of the Economical Exclusive Zone Program (REVIZEE/Brazil: 1996 to 1998 and 2001 to 2002). This collection area comprises a region on the coast of Brazil stretching from the state of Pará to the state of Rio de Janeiro, including oceanic islands (Trindade and Martim Vaz Archipelago).

Identification of the material was performed under a stereomicroscope and based on comparisons with type material, original descriptions/illustrations, and other references. Simultaneously, specimens were studied based on photographs taken with scanning electron microscopy (SEM), at the Electron Microscope Laboratory of the “Museu Nacional do Rio de Janeiro (MNRJ)” and “Departamento de Física da Universidade Federal de Pernambuco (UFPE)”. In the material examined, number inside square brackets indicates number of specimens in each lot.

The following standard measures were taken using a stereomicroscope with an eyepiece micrometer: total length (Tol), length from the aperture to the point of maximum arc (Larc), maximum arc (Arc), diameter of aperture (Da), diameter of posterior extremity (Dpe), length of mucro (Lm) and width of mucro (Wm) (Fig. 1). Only undamaged shells were measured. One other variable and abbreviations used: number of axial sculptures (As), number (N), mean (M), range (R), standard deviation (SD). Simple descriptive statistics were performed to determine the range of meristic and morphometric variables.

Growth stages in shells were recognized based on truncation regions characterized herein as strangulation (Fig. 2A: arrow), suture (Fig. 2B: arrow), pronounced increase in diameter (Fig. 2C: arrow), or with an interface of sculpture patterns (Fig. 2D: arrow). Roman numerals discriminate and arrows delimit each growth stage (Fig. 2A–D). Some growth stages were characterized together (e.g., Fig. 2C: II–III) due to the lack of a distinct transition.

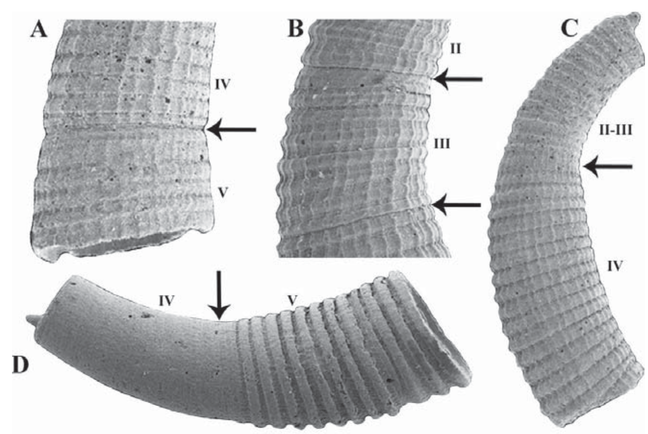

Fig. 2. *Caecum* shells in growth stages—Roman numerals discriminate and arrows delimit each stage: **(A)** arrow pointing to strangulation; **(B)** arrows pointing to sutures; **(C)** arrow pointing to area with pronounced increase in the diameter; **(D)** arrow pointing to sculpture change at interface between stages.

All specimens studied are deposited in the following scientific collections: Academy of Natural Sciences of Philadelphia (ANSP), Philadelphia, USA; Coleção de Invertebrados Paulo Young, Departamento de Sistemática e Ecologia, Universidade Federal da Paraíba (UFPB MOLL), João Pessoa, Paraíba, Brasil; Coleção Malacológica Prof. Henry Ramos Matthews - série A (CMPHRM-A), Fortaleza, Ceará, Brasil; Delaware Museum of Natural History (DMNH), Wilmington, Delaware, USA; Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro (IBUFRJ), Rio de Janeiro, Brasil; Florida Museum of Natural History (FLMNH), University of Florida (UF), Gainesville, Florida, USA; The Bailey-Matthews Shell Museum (BMSM), Sanibel, FL, USA; The Natural History Museum (NHMUK), London, Great Britain; Muséum National d’Histoire Naturelle (MNHN), Paris, France; Museu Nacional, Universidade Federal do Rio de Janeiro (MNRJ), Rio de Janeiro, Brazil; Museu Oceanográfico “Prof. Eliézer de Carvalho Rios”, Universidade Federal do Rio Grande (MORG), Rio Grande, RS, Brasil; Museu de Zoologia, Universidade de São Paulo (MZSP), São Paulo, Brasil; Universidade Estadual de Campinas (UNICAMP/ZUEC GAS), Campinas, São Paulo, Brasil; Zoologische Staatssammlung Muenchen (ZSM), malacological collection, Munich, Germany.

Other abbreviations and information used through the text: coll.—collector; sta—station; oceanographic vessel: 'Almirante Câmara', 'Antares', 'Astro Garoupa', 'Columbus Iselin' and 'Seward Johnson'.

TAXONOMIC DESCRIPTION

Subclass ORTHOGASTROPODA Ponder and Lindberg, 1996
Superorder CAENOGASTROPODA Cox, 1959
Order SORBEOCONCHA Ponder and Lindberg, 1997
Suborder HYPSOGASTROPODA Ponder and Lindberg, 1997
Superfamily RISSOOIDEA Gray, 1847
Family CAECIDAE Gray, 1850
Subfamily CAECINAE Gray, 1850
Genus *Caecum* Fleming, 1813
Caecum metamorphosicum sp. nov.

(Figs. 3–6; Table 1)

Diagnosis. Teleoconch sculpture with raised, strong, thick, wide, quadrangular (flattened at top), regularly spaced axial ribs, except last two to three preceding aperture, which are slightly larger and more widely separated. Interspaces rather deep, narrow. Mucro finger-shaped, blunt. Axial rib around apical region wider than subjacent. Aperture with three to four axial ribs sharply reduced, flattened and fused around.

Type material. Holotype—[1] IBUFRJ 18364, REVIZEE/Score Central VI (Rio de Janeiro: sta R1#1, 21°38′S, 40°10′W, 140 m, 13.vi.2002, coll. 'Astro Garoupa'); Paratypes—[4] IBUFRJ 18372, AMASSEDS (Pará: sta #3209, about 01°20′N, 49°15′W, 40 m, v.1990, coll. 'Columbus Iselin'); [1] IBUFRJ 18371, REVIZEE NORTE (Maranhão: Banco Tarol, about 00°56′36″S, 44°47′04″W, 20.vii.1997, coll. Márcia); [1] IBUFRJ 14347, REVIZEE/Score Central V (Bahia: sta 13D, 16°46′S, 37°40′W, 50 m, 30.vi.2001, coll. 'Antares'); [1] IBUFRJ 7946, REVIZEE/Score Central I (Espírito Santo: sta D13, 21°09′S, 40°34′W, 20 m, 25.iv.1996, coll. 'Antares'); [5] IBUFRJ 12698, REVIZEE/Score Central I (Espírito Santo: sta #vv21, 20°38′S, 40°00′W, 25 m, 26.ii.1996, coll. 'Antares'); [2] MORG 33.439, REVIZEE/Score Central (Espírito Santo, 22.vii.1996, coll. "Antares"); [7] ANSP 450674, ECCB (Rio de Janeiro: sta H16-C05-R2, 22°57′28.41″S, 40°50′30.51″W, 143 m, 03.vii.2009, coll. 'Seward Johnson'); [1] ANSP 450675, [1] CMPHRM-A, [1] MNHN IM-2012-35, [1] MNRJ 31247, [5] MORG 50.129, [1] MZSP 110310, [1] NHMUK 20120341, [1] UF 458837, [1] ZUEC GAS 742, ECCB (Rio de Janeiro: 23°04′S, 40°59′W, about 100 m, 17.xii.2004, coll. 'Seward Johnson'); [5] BMSM 50758, ECCB (Rio de Janeiro: sta H16-C03-R1, 22°46′54.27″S, 41°03′33.08″W, 78 m, 02.vii.2009, coll. 'Seward Johnson'); [10] CMPHRM-A, ECCB (Rio de Janeiro: sta H16-G04-R3, 22°03′38.37″S, 40°06′59.40″W, 90 m, 07.vii.2009, coll. 'Seward Johnson'); [6] CMPHRM-A, ECCB (Rio de Janeiro: sta H16-D05-R1, 22°57′28.05″S, 40°50′30.30″W, 142 m, 03.vii.2009, coll. 'Seward Johnson'); [10] MNHN IM-2012-34, ECCB (Rio de Janeiro: sta H16-D03-R2, 22°19′31.88″S, 40°37′19.23″W, 73 m, 04.vii.2009, coll. 'Seward Johnson'); [4] MNRJ 31248, ECCB (Rio de Janeiro: sta H16-F03-R1, 22°07′43.55″S, 40°18′47.00″W, 72 m, 05.vii.2009, coll. 'Seward Johnson'); [10] MNRJ 31249, ECCB (Rio de Janeiro: sta H16-G04-R2, 22°03′39.04″S, 40°06′59.81″W, 90 m, 06.vii.2009, coll. 'Seward Johnson'); [4] MNRJ 31250, ECCB (Rio de Janeiro: sta H16-E04-R1, 22°17′42.21″S, 40°27′00.05″W, 103 m, 04.vii.2009, coll. 'Seward Johnson'); [7] MNRJ 31251, ECCB (Rio de Janeiro: sta H16-C04-R2, 22°52′02.05″S, 40°57′29.00″W, 91 m, 03.vii.2009, coll. 'Seward Johnson'); [1] MORG 48.367, ECCB (Rio de Janeiro, 2003); [7] MORG 50.927, ECCB (Rio de Janeiro: sta H16-G04-R2, 22°03′39.04″S, 40°06′59.81″W, 90 m, 06.vii.2009, coll. 'Seward Johnson'); [9] MZSP 110294, ECCB (Rio de Janeiro: sta H16-G04-R2, 22°03′39.04″S, 40°06′59.81″W, 90 m, 06.vii.2009, coll. 'Seward Johnson'); [8] MZSP 110308, ECCB (Rio de Janeiro: sta H16-D03-R3, 22°19′31.87″S, 40°37′18.97″W, 73 m, 04.vii.2009, coll. 'Seward Johnson'); [6] MZSP 110299, ECCB (Rio de Janeiro: sta H16-G04-R1, 22°03′38.66″S, 40°06′59.32″W, 89 m, 06.vii.2009, coll. 'Seward Johnson'); [5] UF 458835, ECCB (Rio de Janeiro: sta H16-D05-R3, 22°31′07.51″S, 40°31′32.53″W, 138 m, 03.vii.2009, coll. 'Seward Johnson'); [8] UFPB MOLL 3546, ECCB (Rio de Janeiro: sta H16-B04-R2, 23°10′05.30″S, 41°03′06.62″W, 107 m, 02.vii.2009, coll. 'Seward Johnson'); [8] NHMUK 20120342, ECCB (Rio de Janeiro: sta H16-G03-R1, 22°03′45.38″S, 40°09′59.18″W, 76 m, 06.vii.2009, coll. 'Seward Johnson'); [10] ZUEC GAS 743, ECCB (Rio de Janeiro: sta H16-G04-R3, 22°03′38.37″S, 40°06′59.40°W, 90 m, 07.vii.2009, coll. 'Seward Johnson'); [5] ZSM Mol 20120181, ECCB (Rio de Janeiro: sta H16-C03-R1, 22°46′54.27″S, 41°03′33.08″W, 78 m, 02.vii.2009, coll. 'Seward Johnson').

Additional material examined. [1] IBUFRJ 9645, REVIZEE/Score Central I (Espírito Santo: sta vv17, 21°09′S, 40°27′W, 27 m, 26.ii.1996, coll. 'Antares'); [5] IBUFRJ 8439, GEOMAR XII (Rio de Janeiro: sta 112, 20°49′80‴–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, coll. 'Almirante Câmara'); [10] IBUFRJ 8443, GEOMAR XII (Rio de Janeiro: sta 22, about 20°49′80″S, 40°16′20″W, 37 m, 28.viii.1979, coll. 'Almirante Câmara'); [14] IBUFRJ 9632, REVIZEE/Score Central I (Rio de Janeiro: sta C62, 20°30′S, 37°28′W, 96 m, 25.iv.1996, coll. 'Antares'); [12] IBUFRJ 18365, REVIZEE/Score Central VI (Rio de Janeiro: sta R1#1, 21°38′S, 40°10′W, 140 m, 13.vi.2002, coll. 'Astro Garoupa'); [10] IBUFRJ 19598, ECCB (Rio de Janeiro: sta H16-D05-R3, 22°31′07.51″S, 40°31′32.53″W, 138 m, 03.vii.2009, coll. 'Seward Johnson'); [1] IBUFRJ 8437, GEOMAR XII (Rio de Janeiro: sta 61, 20°49′80‴–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, 'Almirante Câmara'); [2] IBUFRJ 8441, GEOMAR XII (Rio de Janeiro: sta 114, 20°49′80″–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, coll. 'Almirante Câmara'); [4] IBUFRJ 8442, GEOMAR XII (Rio de Janeiro: sta 63, 20°49′80″–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, coll. 'Almirante Câmara'); [1] IBUFRJ 8445, GEOMAR XII (Rio de Janeiro: sta 120, 20°49′80″–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, coll. 'Almirante Câmara'); [1] IBUFRJ 8447, GEOMAR XII (Rio de Janeiro: sta 97, 22°07′50″S, 40°20′50″W, 67 m, 29.viii.1979, coll. 'Almirante Câmara'); [1] IBUFRJ 8448, GEOMAR XII (Rio de Janeiro: sta 99, 20°49′80″–22°05′00″S, 40°16′20″–40°53′00″W, 12–100 m, 29.viii.1979, coll. 'Almirante Câmara'); [1] IBUFRJ 8454, GEOMAR XII (Rio de Janeiro: sta 127, 20°49′80″–22°05′00″S, 40°16′20″–

40°53′00″W, 12–100 m, 30.viii.1979, coll. 'Almirante Câmara'); [19] IBUFRJ 18374, REVIZEE/Score Central VI (Rio de Janeiro: sta R1#1, 21°38′S, 40°10′W, 140 m, 13.vi.2002, coll. 'Astro Garoupa'); [13] IBUFRJ 9661, REVIZEE/Score Central I (Rio de Janeiro: sta D1–2, 22°48′S, 41°09′W, 69 m, 23.ii.1996, coll. 'Antares'); [10] IBUFRJ 11553, ECCB (Pampo shelf, sta #2D, 3D, 4A, 106–110 m, 20–27.i.1998, coll. 'Seward Johnson'); [1] MNRJ 31252, ECCB (Rio de Janeiro: sta H16-G03-R2, 22°03′45.78″S, 40°09′58.84″W, 75 m, 06.vii.2009, coll. 'Seward Johnson'); [16] MNRJ 31253, ECCB (Rio de Janeiro: sta H16-D05-R3, 22°31′07.51″S, 40°31′32.53″W, 138 m, 03.vii.2009, coll. 'Seward Johnson'); [3] MNRJ 31254, ECCB (Rio de Janeiro: sta H16-F02-R1, 22°03′41.42″S, 40°24′09.88″W, 56 m, 06.vii.2009, coll. 'Seward Johnson'); [1] MNRJ 31255, ECCB (Rio de Janeiro: sta H16-A05-R1, 23°36′14.97″S, 41°21′30.07″W, 145 m, 01.vii.2009, coll. 'Seward Johnson'); [15] MNRJ 31256, ECCB (Rio de Janeiro: sta H16-C03-R1, 22°46′54.27″S, 41°03′33.08″W, 78m, 02.vii.2009, coll. 'Seward Johnson'); [5] MNRJ 31257, ECCB (Rio de Janeiro: sta H16-B04-R1, 23°10′05.20″S, 41°03′06.45″W, 107 m, 02.vii.2009, coll. 'Seward Johnson'); [9] MNRJ 31258, ECCB (Rio de Janeiro: sta H16-E04-R1, 22°17′42.21″S, 40°27′0.05″W, 103 m, 04.vii.2009, coll. 'Seward Johnson'); [2] MNRJ 31259, ECCB (Rio de Janeiro: sta H17-I04-R3, 21°09′09.81″S, 40°16′07.83″W, 103 m, 21.vii.2009, coll. 'Seward Johnson'); [15] MZSP 110295, ECCB (Rio de Janeiro: sta H16-D05-R2, 22°31′07.11″S, 40°31′32.87″W, 137 m, 03.vii.2009, coll. 'Seward Johnson'); [5] MZSP 110291, ECCB (Rio de Janeiro: sta H16-F03-R1, 22°07′43.55″S, 40°18′47.00″W, 72 m, 05.vii.2009, coll. 'Seward Johnson'); [45] MZSP 110297, ECCB (Rio de Janeiro: sta H16-G04-R3, 22°03′38.37″S, 40°06′59.40″W, 90 m, 07.vii.2009, coll. 'Seward Johnson'); [17] MZSP 110298, ECCB (Rio de Janeiro: sta H16-D03-R1, 22°19′32.01″S, 40°37′18.93″W, 74 m, 04.vii.2009, coll. 'Seward Johnson'); [3] MZSP 110293, ECCB (Rio de Janeiro: sta H16-B05-R1, 23°12′08.68″S, 40°59′35.74″W, 141 m, 02.vii.2009, coll. 'Seward Johnson'); [10] MZSP 110296, ECCB (Rio de Janeiro: sta H16-C03-R2, 22°46′54.72″S, 41°03′33.11″W, 78 m, 02.vii.2009, coll. 'Seward Johnson'); [4] UFPB MOLL 3547, ECCB (Rio de Janeiro: sta H16-D03-R3, 22°19′31.87″S, 40°37′18.97″W, 73 m, 04.vii.2009, coll. 'Seward Johnson'); [6] UFPB MOLL 3548, ECCB (Rio de Janeiro: sta H16-C05-R3, 22°57′28.43″S, 40°50′30.30″W, 143 m, 03.vii.2009, coll. 'Seward Johnson'); [8] ZUEC GAS 747, ECCB (Rio de Janeiro: sta H16-D03-R2, 22°19′31.88″S, 40°37′19.23″W, 73 m, 04.vii.2009, coll. 'Seward Johnson'); [22] ZUEC GAS 748, ECCB (Rio de Janeiro: sta H16-C04-R3, 22°52′02.10″S, 40°57′29.07″W, 92 m, 03.vii.2009, coll. 'Seward Johnson'); [15] ZUEC GAS 750, ECCB (Rio de Janeiro: sta H16-F03-R2, 22°07′43.33″S, 40°18′48.05″W, 71 m, 06.vii.2009, coll. 'Seward Johnson'); [11] ZUEC GAS 749, ECCB (Rio de Janeiro: sta H17-I04-R1, 21°09′09.70″S, 40°16′06.77″W, 103 m, 21.vii.2009, coll. 'Seward Johnson'); [1] ZUEC GAS 751, ECCB (Rio de Janeiro: sta H16-E05-R2, 22°17′25.28″S, 40°06′36.90″W, 142 m, 05.vii.2009, coll. 'Seward Johnson'); [3] ZUEC GAS 745, ECCB (Rio de Janeiro: sta H16-B05-R3, 23°12′08.57″S, 40°59′35.66″W, 142 m, 02.vii.2009, coll. 'Seward Johnson'); [12] ZUEC GAS 746, ECCB (Rio de Janeiro: sta H17-I04-R2, 21°09′09.28″S, 40°16′07.45″W, 103 m, 21.vii.2009, coll. 'Seward Johnson').

Etymology. From *metamorphosis* (Greek noun = change, transformation), referring to the remarkable change in sculpture pattern between growth stages.

Description. Protoconch paucispiral (about 1.375 whorl), planispiral, smooth, transition to teleoconch I marked by very slight axial edge (Fig. 3A, B). Teleoconch I short, sculptured with very weak growth axial marks to threads, transition to teleoconch II marked by very slight axial strangulation (Fig. 3A, B). Teleoconch II about 2.5 times length of teleoconch I, sculptured with very weak growth axial marks to threads, transition to teleoconch III marked by very slight axial strangulation (Fig. 3B). Teleoconch III sculptured with numerous, very weak, thin striae (Fig. 3C–E), transition to teleoconch IV marked by very slight axial strangulation (Fig. 3D; Fig. 4A). Teleoconch IV with identical characters to the teleoconch III, about 2.5 times its length, transition to teleoconch V marked by slight axial strangulation, immediately preceding appearance of axial rib (Figs. 3C–E, 4A–F). Teleoconch V (last growth stage) small [Tol 2.68 to 4.00 mm], tubular, rather thick, robust, moderately and regularly arched [Larc: 0.62 to 1.35 mm; Arc: 0.15 to 0.50 mm], with slight increase in caliber from apical region to aperture, whitish to slight brownish white (Figs. 4G, H, 5A). Surface sculptured with numerous, conspicuous, dense, longitudinal

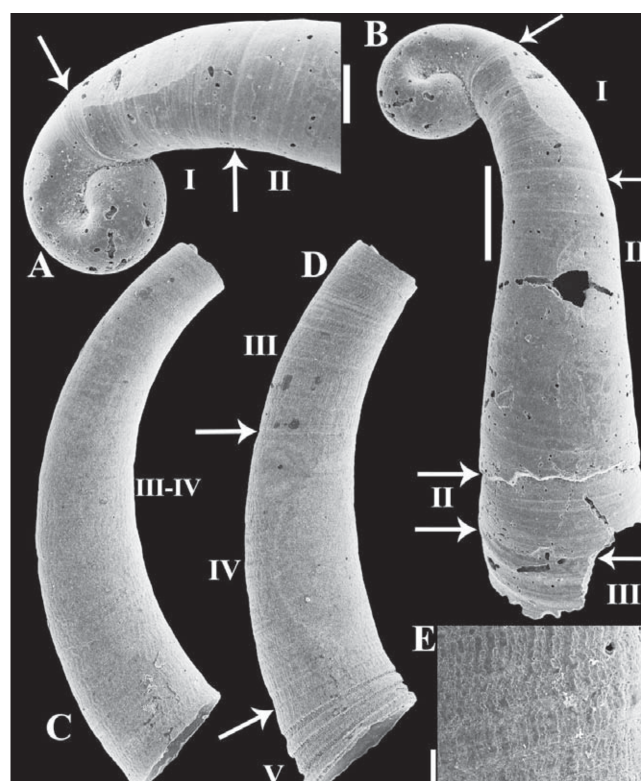

Fig. 3. *Caecum metamorphosicum* sp. nov. shells at different growth stages (paratypes: IBUFRJ 18368): **(A, B)** protoconch to teleoconch II; **(C)** teleoconch III to IV; **(D)** teleoconch III to V; **(E)** sculpture of teleoconch III and IV. Scale bars: **(A)** 100 μm; **(B–D)** 200 μm; **(E)** 50 μm.

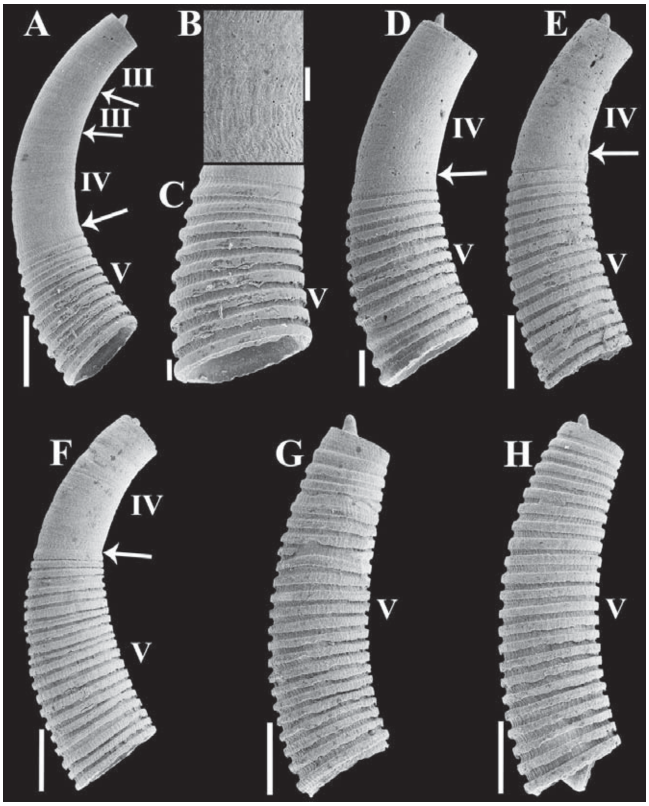

Fig. 4. *Caecum metamorphosicum* sp. nov. shells at different growth stages (paratypes): **(A)** teleoconch III to V (IBUFRJ 18369); **(B)** sculpture of teleoconch III and IV (Fig. A); **(C)** teleoconch V (Fig. A); **(D, F)** teleoconch IV to V (IBUFRJ 18369); **(G, H)**. teleoconch V (IBUFRJ 18370). Scale bars: **(A)** 500 µm; **(B)** 50 µm; **(C)** 100 µm; **(D)** 200 µm; **(E–H)** 500 µm.

striae on axial ribs and interspaces (Fig. 5A–G). Striae more pronounced, alternating between one to three faintly more impressed (Fig. 5F, G). Axial sculpture comprising 21 to 43 raised, strong, thick, wide, quadrangular (flattened at top) ribs rather closely arranged and regularly spaced (Fig. 5A, F, G), except last two to three preceding aperture, which are slightly larger and more widely separated (Fig. 5D). Axial interspaces rather deep, narrow, narrower than or with width of ribs (Fig. 5F, G), except last two to three preceding aperture, which become wider (Fig. 5D). Interspaces on dorsal region slightly wider than on ventral region due to teleoconch curvature (Fig. 5F, G). Apical region circular [Dpe: 0.30 to 0.49 mm], with thick edge (Fig. 5C). Septum rather flattened, slightly recessive (Fig. 5C). Mucro finger-shaped, conical, blunt [Lm: 0.06 to 0.22 mm; Wm: 0.08 to 0.20 mm] positioned on dorsal margin, straight to slightly curved toward dorsal margin (Fig. 5B, C). Axial rib around apical region wider than subjacent (Fig. 5B). Aperture circular [Da: 0.45 to 0.75 mm], thick, with three to four axial ribs sharply reduced, flattened and fused around (Fig. 5E). Lip smooth, with deflected peristome (Fig. 5E). Varix usually absent (Fig. 5A) to slightly developed (Fig. 5D, E). Figure 6 shows the reconstruction of the growth stages.

Taxonomic remarks. *Caecum metamorphosicum* sp. nov. has been studied from a large number of specimens in good condition of teleoconch V and different growth stages still attached. This species seems to be a very abundant and successful caecid living on calcareous and biodendritic substrates over a vast area along the Brazilian coast (states of Pará to Rio de Janeiro) and apparently inhabiting the middle to lower continental shelf. Although reported here only for Atlantic coast of South America, it is likely that *C. metamorphosicum* sp. nov. has tropical western Atlantic distribution, based on extensive material examined throughout much of the region. Thus, the species may be an important component of benthic communities.

Caecum metamorphosicum sp. nov. is similar to *C. floridanum* Stimpson, 1851 in the well-defined, wide, rather closely arranged axial ribs, except the last three, which become larger and more widely separated at the anterior end, but it is distinguished by the raised, quadrangular ribs, deep axial interspaces, finger-shaped mucro, and aperture usually without a varix immediately preceded by axial ribs that are sharply reduced and fused around the aperture. In *Caecum floridanum*, the ribs are rounded and not raised, with shallow axial interspaces, moderately slender, triangular mucro and prominent varix around the aperture (Lightfoot, 1992a: 179, fig. 12; Diaz and Puyana, 1994: 141, fig. 489; Gomes and Absalão, 1996: 521, fig. 10; Redfern, 2001: 41, pl. 20, fig. 174a, b; Lee, 2009: 71, fig. 339; Tunnell Jr. et al., 2010: 144).

Despite the fact that *Caecum metamorphosicum* sp. nov. and *C. brasilicum* Folin, 1874a present axial ribs flattened at top and longitudinal striae on the axial ribs and interspaces, these species are unlikely to be confused. The new species differs basically in having finger-shaped mucro, axial rib around apical region wider than subjacent, axial ribs closely arranged, except the last preceding aperture, deep axial interspaces and aperture with axial ribs sharply reduced and fused around. In contrast, *C. brasilicum* has blunt, triangular mucro, undifferentiated axial rib around apical region compared the subjacent, axial ribs more widely spaced on the teleoconch and shallow axial interspaces (Mello and Maestrati, 1986: 151, fig. 6; Gomes and Absalão, 1996: 515, figs. 1, 2; Rios, 2009: 94–95, fig. 225).

Caecum metamorphosicum sp. nov. resembles *C. donmoorei* Mitchell-Tapping, 1979 in many aspects, such as the microsculpture pattern on the interspaces and ribs, the axial rib outline and axial ribs that are more widely separated at the anterior end, sharply reduced and fused around the aperture. The most distinguishing features of the new species are the rather closely arranged quadrangular ribs (As 21 to 43), axial rib around apical region that is wider than subjacent, axial interspaces that are usually about half the width of the ribs, flattened septum and finger-shaped mucro, while *C. donmoorei* has well-spaced, noticeably wider, round-topped ribs (up to 27), undifferentiated axial rib around the apical region when compared to subjacent, axial interspaces and ribs with similar width, slightly convex septum and broad mucro (holotype, DMNH 119521, Fig. 5H; Mitchell-Tapping, 1979: 105, figs. 21, 22, 29, 30; Lightfoot, 1992a: 175, 176, fig. 6, *C.* (*C.*) sp. 3 = *C. donmoorei* according to Lee (2009); Redfern, 2001: 40, pl. 19, fig. 168, *C.* sp. A [Fig. 5J] = *C. donmoorei* according to Lee (2009); Lee, 2009: 71, fig. 338 [Fig. 5I]). According to Lightfoot (1992a: 176), the second growth stage in this species has low, abruptly separate axial ribs, very different from those on the

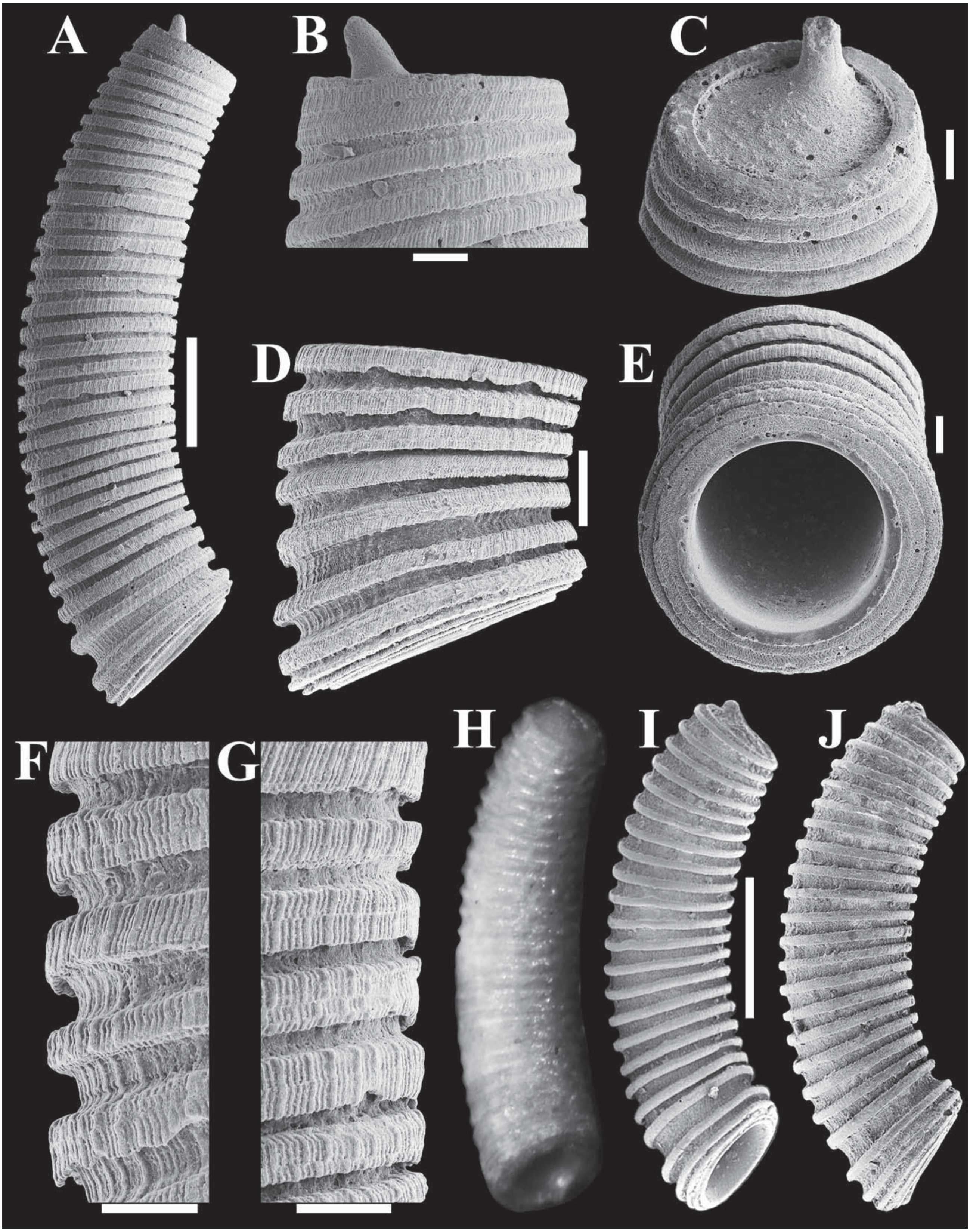

Fig. 5. *Caecum metamorphosicum* sp. nov. **(A, B, F, G)** holotype; **(C–E)** paratypes; teleoconch V fully developed) and *C. donmoorei* (**(H)** holotype: teleoconch fully developed; **(I)** specimen figured by Lee (2009: 71, n° 338, Tol 2 mm), **(J)** specimen figured by Redfern (2001: 40, pl. 19, fig. 168)): **(A)** lateral view (IBUFRJ 18364); **(B)** apical region showing mucro; **(C)** apical region showing septum and mucro (IBUFRJ 18365); **(D)** anterior region view (IBUFRJ 18367); **(E)** aperture view (IBUFRJ 18366); **(F)** view of dorsal margin; **(G)** view of ventral margin; **(H)** lateral view (Mitchell-Tapping, 1979: Tol 1.4 mm); **(I–J)**. lateral view. Scale bars: **(A, J)** 500 μm; **(B, C, E, F, G)**. 100 μm; **(D)** 200 μm.

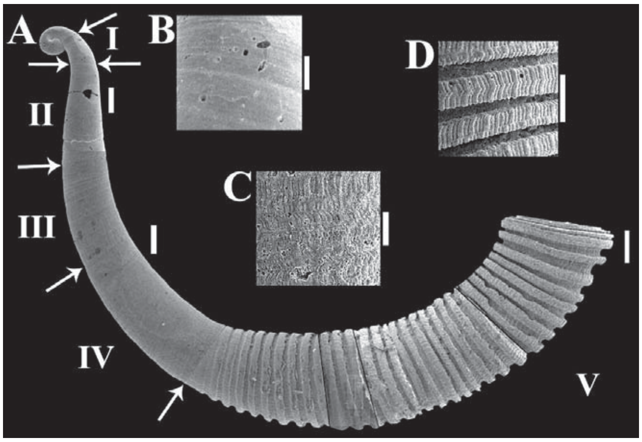

Fig. 6. Reconstruction of growth stages of *Caecum metamorphosicum* sp. nov.: **(A)** protoconch to teleoconch V; **(B)** sculpture of teleoconch I to II; **(C)** sculpture of teleoconch III to IV; **(D)** sculpture of teleoconch V. Scale bars: **(A)** protoconch to teleoconch II (200 μm); teleoconch III and IV (200 μm); teleoconch V (500 μm); **(B, C)**. 50 μm; **(D)** 100 μm.

Table 1. Linear measurements (mm) of *Caecum metamorphosicum* sp. nov. and *C. trindadense* sp. nov. specimens.

	C. metamorphosicum sp. nov.				*C. trindadense* sp. nov.			
	N	R	M	SD	N	R	M	SD
Tol	139	2.68–4.00	3.29	0.34	36	2.37–4.20	3.37	0.45
Larc	139	0.62–1.35	0.92	0.13	36	1.10–2.00	1.51	0.21
Arc	138	0.15–0.50	0.29	0.07	36	0.25–0.56	0.32	0.08
Dpe	137	0.30–0.49	0.4	0.03	35	0.32–0.49	0.39	0.04
Da	138	0.45–0.75	0.56	0.05	35	0.45–0.72	0.56	0.07
Lm	131	0.06–0.22	0.11	0.02	33	0.10–0.25	0.13	0.03
Wm	135	0.08–0.20	0.12	0.02	33	0.07–0.20	0.12	0.02
As	138	21.0–43.0	29.4	3.9				

new species. Specimens of *Caecum metamorphosicum* sp. nov. exhibit axial ribs that are usually corroded on the anterior margin, which may affect the spacing pattern or the width of the axial interspaces between them.

In *Caecum metamorphosicum* sp. nov. and *Caecum eliezeri* Absalão, 1997, the axial ribs are rather flattened at the top and closely arranged. However, the new species has deep axial interspaces, very strong, thick, raised axial ribs (21 to 43) that are slightly larger and more widely separated at the anterior end, while *C. eliezeri* has shallow interspaces and tiny ribs (52 to 90) that are closely arranged throughout the teleoconch (Gomes and Absalão, 1996: fig. 3; Absalão, 1997: 271–272, figs. 1–4; Rios, 2009: 95, fig. 226).

Type locality. Off the coast of the state of Rio de Janeiro (southeastern Brazil), 21°38′S, 40°10′W, 140 m, 13.vi.2002, 'Seward Johnson'.

Geographic distribution. Northern to northeastern Brazil, Pará, Maranhão, Bahia; southeastern Brazil, Espírito Santo (Trindade and Martim Vaz Archipelago) to Rio de Janeiro, up to 140 m depth. The specimens studied here were collected from calcareous (Trindade Island) and biodendritic (continental shelf of Rio de Janeiro) substrates (Lavrado and Ignacio, 2006).

Caecum trindadense sp. nov.

(Figs. 7–10; Table 1)

Diagnosis. Teleoconch sculptured with conspicuous, prominent, dense, compact, slightly sinuous longitudinal striae and microscopic grooves. Axial sculpture represented by weak ridges not interrupting striae. Mucro finger-shaped, blunt, straight to slightly curved toward dorsal region. Aperture rather thick, swollen due to weak or prominent surrounding varix.

Type material. Holotype—[1] IBUFRJ 18391, REVIZEE/Score Central VI (Rio de Janeiro: sta R1#1, 21°38′S, 40°10′W, 140 m, 13.vi.2002, coll. 'Astro Garoupa'); Paratypes—[1] MNHN IM-2012-37, [1] MNRJ 31260, [3] MORG 33.440, REVIZEE/Score Central (Espírito Santo: Trindade and Martim Vaz Archipelago: Trindade Island: 22.vii.1996, coll. 'Antares'); [4] ANSP 450673, ECCB (Rio de Janeiro: sta H16-G05-R2, 22°06′10.63″S, 40°03′06.30″W, 149 m, 07.vii.2009, coll. 'Seward Johnson'); [1] ANSP 450672, [1] UF 458838, [6] MORG 40.429, [1] MZSP 110290, REVIZEE/Score Central (Rio de Janeiro: sta D1, 22°48′S, 41°09′W, 69 m, 23.ii.1996, coll. 'Antares'); [4] CMPHRM-A, ECCB (Rio de Janeiro: sta H16-C03-R1, 22°46′54.27″S, 41°03′33.08″W, 78 m, 02.vii.2009, coll. 'Seward Johnson'); [2] IBUFRJ 19597, ECCB (Rio de Janeiro: sta H16-D05-R2, 22°31′07.11″S, 40°31′32.87″W, 137 m, 03.vii.2009, coll. 'Seward Johnson'); [4] MNHN IM-2012-36, ECCB (Rio de Janeiro: sta H16-D03-R2, 22°19′31.88″S, 40°37′19.23″W, 73 m, 04.vii.2009, coll. 'Seward Johnson'); [5] MNRJ 31261, ECCB (Rio de Janeiro: sta H17-D4, 22°23′22.23″S, 40°34′59.11″W, 110 m, 25.vii.2009, coll. 'Seward Johnson'); [4] MNRJ 31262, ECCB (Rio de Janeiro: sta H16-E04-R1, 22°17′42.21″S, 40°27′00.05″W, 103 m, 04.vii.2009, coll. 'Seward Johnson'); [1] MNRJ 31263, ECCB (Rio de Janeiro: sta H16-E05-R2, 22°23′39.34″S, 40°20′41.32″W, 149 m, 04.vii.2009, coll. 'Seward Johnson'); [1] MORG 50.929, ECCB (Rio de Janeiro: sta H16-B05-R1, 23°12′08.68″S, 40°59′35.74″W, 141 m, 02.vii.2009, coll. 'Seward Johnson'); [7] MZSP 110292, ECCB (Rio de Janeiro: sta H16-F03-R2, 22°07′43.33″S, 40°18′48.05″W, 71 m, 06.vii.2009, coll. 'Seward Johnson'); [1] MZSP 110306, ECCB (Rio de Janeiro: sta H16-F03-R1, 22°07′43.55″S, 40°18′47.00″W, 72 m, 05.vii.2009, coll. 'Seward Johnson'); [5] NHMUK 20120340, ECCB (Rio de Janeiro: sta H16-D03-R1, 22°19′32.01″S, 40°37′18.93″W, 74 m, 04.vii.2009, coll. 'Seward Johnson'); [4] UF 458836, ECCB (Rio de Janeiro: sta H16-F03-R1, 22°07′43.55″S, 40°18′47.00″W, 72 m, 05.vii.2009, coll. 'Seward Johnson'); [3] UFPB MOLL 3549, ECCB (Rio de Janeiro: sta H16-C05-R2, 22°57′28.41″S, 40°50′30.51″W, 143 m, 03.vii.2009, coll. 'Seward Johnson'); [4] ZUEC GAS 744, ECCB (Rio de Janeiro: sta H16-D03-R2, 22°19′31.88″S, 40°37′19.23″W, 73 m, 04.vii.2009, coll. 'Seward Johnson').

Additional material examined. [1] MNRJ 31264, ECCB (Rio de Janeiro: sta H17-D04-R2, 22°23′20.87″S, 40°34′56.41″W, 110 m, 25.vii.2009, coll. 'Seward Johnson'); [2] MNRJ 31265, ECCB (Rio de Janeiro: sta H16-A05-R1, 23°36′14.97″S, 41°21′30.07″W, 145 m, 01.vii.2009, coll. 'Seward Johnson'); [16] MNRJ 31266, ECCB (Rio de Janeiro: sta H17-D04-R1, 22°23′22.23″S, 40°34′59.11″W, 110 m, 25.vii.2009, coll. 'Seward Johnson'); [1] MNRJ

31267, ECCB (Rio de Janeiro: sta H16-D05-R3, 22°31′07.51″S, 40°31′32.53″W, 138 m, 03.vii.2009, coll. 'Seward Johnson'); [2] MNRJ 31291, ECCB (Rio de Janeiro: sta H16-D03-R1, 22°19′32.01″S, 40°37′18.93″W, 74 m, 04.vii.2009, coll. 'Seward Johnson'); [20] IBUFRJ 19599, ECCB (Rio de Janeiro: sta H17-D04-R1, 22°23′22.23″S, 40°34′59.11″W, 110 m, 25.vii.2009, coll. 'Seward Johnson').

Etymology. The specific name, *trindadense*, is an adjective, referring to one of the islands of the Trindade and Martim Vaz Archipelago, from which the specimens were collected.

Description. Protoconch paucispiral (about 1.5 whorl), planispiral, smooth, transition to teleoconch I marked by very slight axial edge (Fig. 7A, B). Teleoconch I to IV with very slight increase in caliber from apical region to the aperture, sculptured with very weak, slightly sinuous longitudinal striae (Figs. 7B–E, 8A–G, 10B). Teleoconch I and II short, with approximately same length, transition to teleoconch II and III marked by very slight axial edge (Fig. 7B–E). Teleoconch III with about 1.5 × the length teleoconch II (Fig. 7C–E), transition to teleoconch IV marked by very slight axial edge (Fig. 8A–E). Teleoconch IV and V with approximately same length (Fig. 8E–G), transition to teleoconch V marked by very slight axial strangulation and pronounced increase in diameter (Fig. 8A–G). Teleoconch V with identical characters to the teleoconch VI. Teleoconch VI (last growth stage) small [Tol: 2.37 to 4.20 mm], tubular, rather thick, moderately and regularly arched [Larc: 1.10 to 2.00 mm; Arc: 0.25 to 0.56 mm], with inconspicuous to very slight increase in caliber from apical region to the aperture, whitish to slight brownish white (Fig. 9A, H). Surface sculptured with numerous, conspicuous, prominent, dense, rather continuous, slightly sinuous longitudinal striae and deep longitudinal microscopic grooves (Figs. 9D, 10C). Axial sculpture comprising weak microscopic ridges not interrupting striae (Fig. 9D), may still present edges resulting from growth (Fig. 9H) or rarely very faint, narrow, rather closely arranged ribs distributed irregularly on surface. Apical region circular [Dpe: 0.32 to 0.49 mm], with thick edge (Fig. 9C), may present slight constriction (Fig. 9B). Septum slightly convex, slight to deeply recessive (Fig. 9C). Mucro finger-shaped, conical, blunt [Lm: 0.10 to 0.25 mm; Wm: 0.07 to 0.20 mm] positioned on dorsal margin, straight to slightly curved toward dorsal region (Fig. 9B, C, H). Aperture circular [Da: 0.45 to 0.72 mm], rather thick, robust, with weak to prominent surrounding varix (Fig. 9F, G). Lip smooth, weak to well developed, with slightly deflected peristome (Fig. 9E–G). Figure 10 shows the reconstruction of the growth stages.

Taxonomic remarks. *Caecum trindadense* sp. nov. has a very distinctive shell morphology in comparison to the vast majority of congeners from the Atlantic Ocean, which are smooth or develop well-defined longitudinal and/or axial sculptures on the teleoconch (Lightfoot, 1992a, b; Diaz and Puyana, 1994; Absalão and Gomes, 2001; Redfern, 2001; Rios, 2009; Tunnell Jr. et al., 2010).

Caecum trindadense sp. nov. is very similar to *C. subvolutum* Folin, 1874b and *C. lineicinctum* Folin, 1880 in its moderately and regularly curved teleoconch with an inconspicuous increase in caliber, recessed septum developing a blunt, finger-shaped mucro curved towards the dorsal margin, but differs in the presence of a slight varix as well as conspicuous, dense, longitudinal striae and grooves on the teleoconch. *Caecum subvolutum* has smooth to faint longitudinal striae on the teleoconch and faint axial rings

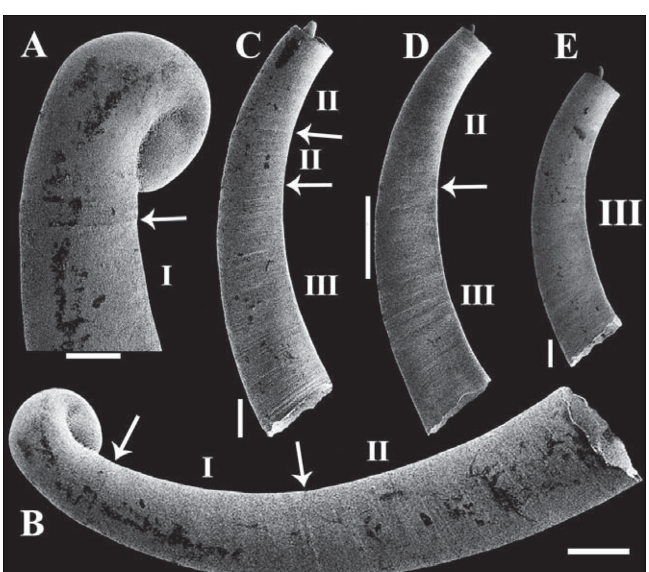

Fig. 7. *Caecum trindadense* sp. nov. shells at different growth stages (paratypes: IBUFRJ 19599): **(A)** protoconch to teleoconch I; **(B)** protoconch to teleoconch II; **(C, D)** teleoconch II to III; **(E)** teleoconch III. Scale bars: **(A)** 100 μm, **(B, C, E)** 200 μm, **(D)** 500 μm.

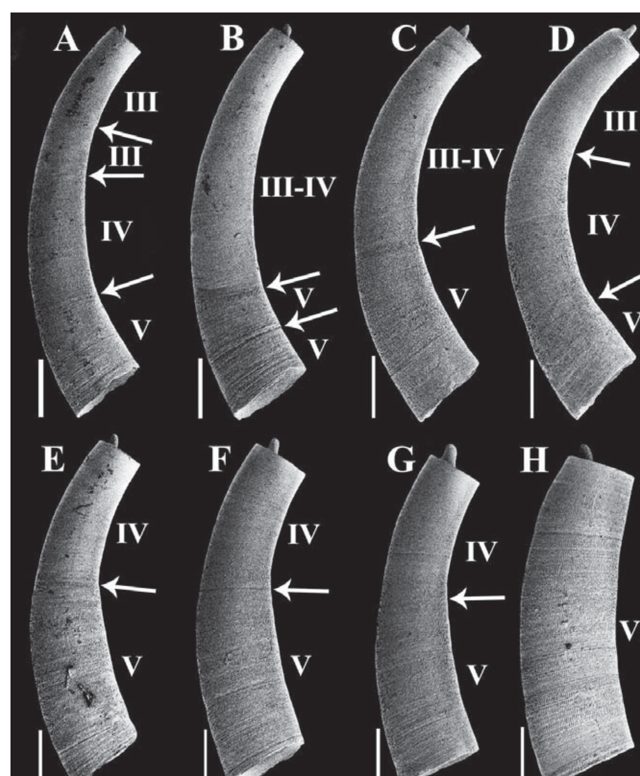

Fig. 8. *Caecum trindadense* sp. nov. shells at different growth stages (paratypes: IBUFRJ 19599): **(A–D)**. teleoconch III to V; **(E–G)**. teleoconch IV to V; **(H)** teleoconch VI. Scale bars: 500 μm.

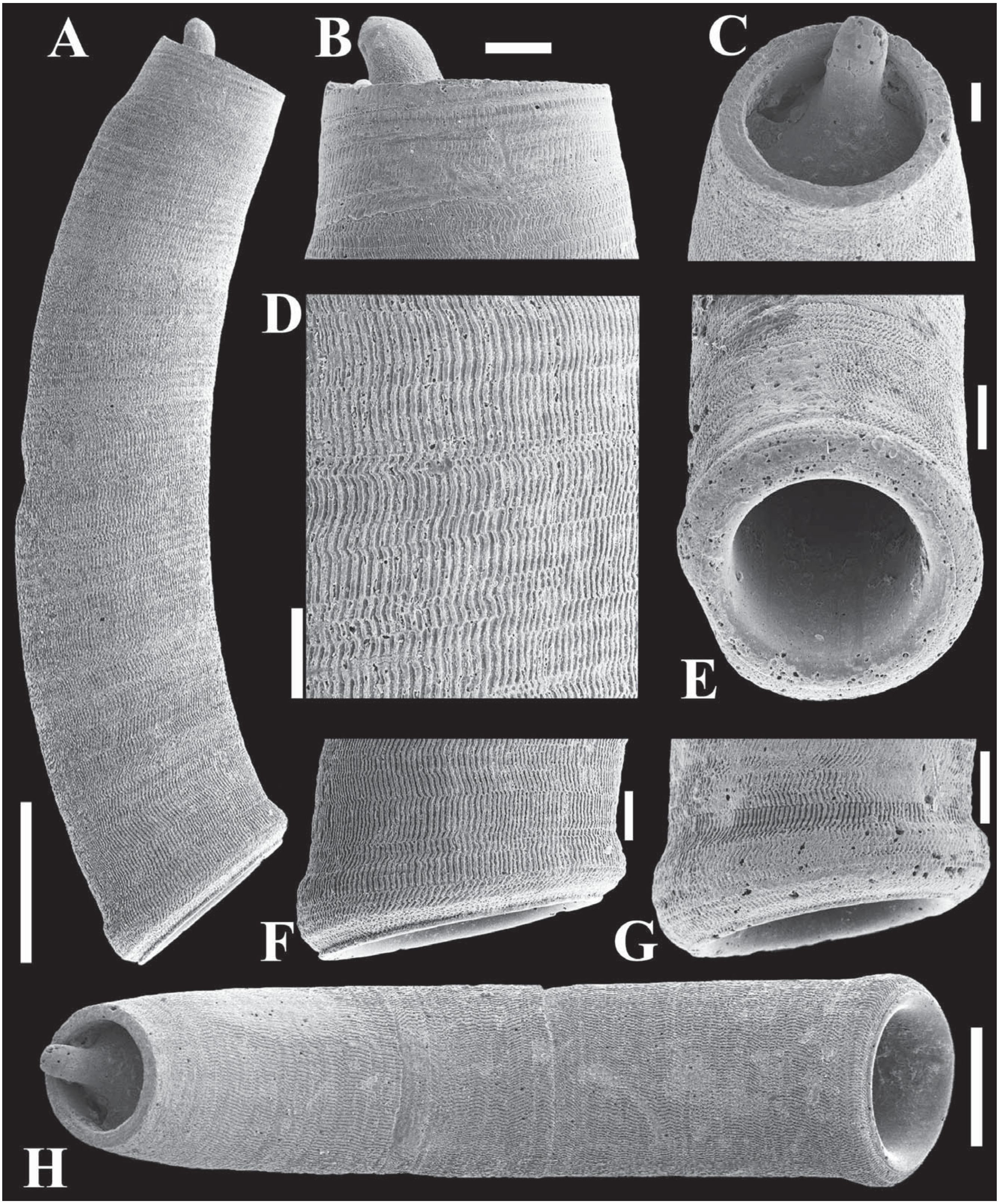

Fig. 9. *Caecum trindadense* sp. nov. **(A, B, D, F)** holotype; **(C, E, G, H)** paratypes; teleoconch VI fully developed): **(A)** lateral view (IBUFRJ 18391); **(B)** apical region showing mucro; **(C)** apical region showing septum and mucro (MORG 40.429); **(D)** sculpture of teleoconch V; **(E)** aperture view (MORG 33.440); **(F)** anterior region view; **(G)** anterior region view (MORG 33.440); **(H)** ventral view (MORG 40.429). Scale bars: **(A, H)** 500 μm; **(B–D, F)** 100 μm; **(E, G)** 200 μm.

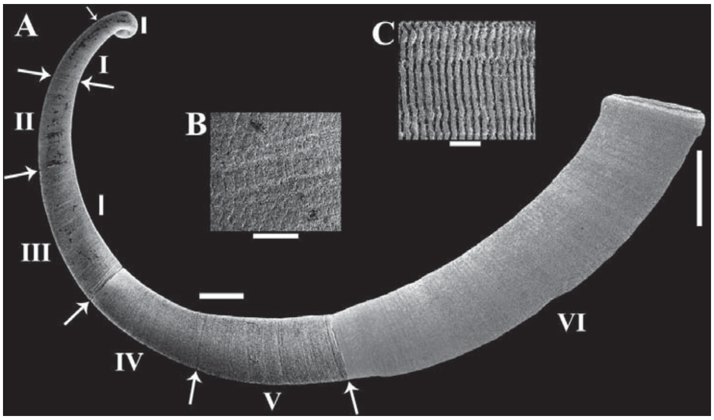

Fig. 10. Reconstruction of growth stages of *Caecum trindadense* sp. nov.: **(A)** protoconch to teleoconch VI; **(B)** sculpture of teleoconch I to IV; **(C)** sculpture of teleoconch V to VI. Scale bars: **(A)** protoconch to teleoconch II (200 μm); teleoconch III (200 μm); teleoconch IV and V (500 μm); teleoconch VI (500 μm); **(B)** 50 μm; **(C)** 100 μm.

limited to the anterior end (see Absalão and Gomes, 2001: figs. 3, 4, type material; Moore, 1972: 885, fig. 4). *Caecum lineicinctum* has an apparently smooth, glossy surface (Folin, 1880: 808; Moore, 1972: 886, fig. 3, 5; Absalão and Gomes, 2001: figs. 1. 2, type material), but with faint axial growth lines (Redfern, 2001), a series of closely set axial rings limited to the anterior end (Folin, 1880; Moore, 1972; Lightfoot, 1992a: 184, fig. 20; Absalão and Gomes, 2001; Redfern, 2001) and may develop a swollen, abrupt, enlarge varix covered with rings (Moore, 1972; Lightfoot, 1992a; Redfern, 2001). *Caecum trindadense* sp. nov. has been mistakenly identified and figured as *C. lineicinctum* by Absalão and Gomes (2001: 11, figs. 5, 6) and Absalão and Pizzini (2002: pl. 2, fig. 12) for the Abrolhos Archipelago, state of Bahia, Brazil. Rios (2009: 98, fig. 235) also reported *C. lineicinctum* for the same archipelago, but reproduced an illustration of the taxon from Redfern (2001: pl. 19, fig. 171A). Based on these previous studies, we can assert that there is no evidence of the occurrence of *C. lineicinctum* in Brazilian waters.

Caecum trindadense sp. nov. and *C. massambabensis* Absalão, 1994 exhibit prominent longitudinal striae on the teleoconch. The new species has a visibly smaller Tol (2.37 to 4.20 mm), a slightly curved, blunt, finger-shaped mucro and slight varix around the aperture, while *C. massambabensis* develops a relatively larger Tol (around 6 mm), conical, pointed mucro, without any terminal varix (Absalão, 1994: 138–139, fig. 1; Gomes and Absalão, 1996: 521, fig. 11), but usually with faint axial rings limited to the anterior end (Lima, 2010).

Caecum trindadense sp. nov., *C. gofasi* Pizzini and Nofroni, 2001a and *C. wayae* Pizzini and Nofroni, 2001a [both from the Eastern Atlantic, Azores Archipelago] share a slight subcylindrical outline from the apical region to the aperture and numerous, conspicuous, longitudinal striae crossed by fine axial growth striae. The new species develops a blunt, finger-shaped mucro, longitudinal striae not interrupted by axial ridges, without any evidence of well-defined longitudinal and axial ornamentation (rarely developing very faint axial ribs irregularly distributed on the teleoconch), while *C. gofasi* has protruding, weakly S-shaped mucro ending in a squashed ball-shaped tip and may have small axial rings on the inflection near the aperture (Pizzini and Nofroni, 2001a: 19–20, figs. 1–7) and *C. wayae* has a spatula-shaped mucro, few axial rings on the teleoconch and longitudinal striae interrupted by growth axial striae (Pizzini and Nofroni, 2001a: 21, figs. 8–15).

Type locality. Off the coast of the state of Rio de Janeiro (southeastern Brazil), 21°38′S, 40°10′W, 140 m, 13.vi.2002, ‘Seward Johnson’.

Geographic distribution. Southeastern Brazil, Espírito Santo (Trindade and Martim Vaz Archipelago) to Rio de Janeiro, up to 140 m depth. The specimens studied here were collected from calcareous (Trindade Island) and biodendritic (continental shelf of Rio de Janeiro) substrates (Lavrado and Ignacio, 2006).

DISCUSSION

Caecidae is one of the least investigated families of marine caenogastropod along many coastlines worldwide, with a lack of adequate knowledge on basic aspects, such as taxonomy and anatomy. Recently, however, a number of studies have improved the alpha taxonomic knowledge of caecids in the north Atlantic (Lightfoot, 1992a, b; Diaz and Puyana, 1994; Pizzini et al., 1994, 1995, 1998; Nofroni et al., 1997; Pizzini and Nofroni, 2001a, b; Redfern, 2001; Lee, 2009; Tunnell Jr. et al., 2010). In contrast, considerable differences are found in research efforts on the group in the south Atlantic, which have apparently been restricted to southeastern and, to a lesser extent, northeastern Brazil (Absalão, 1994, 1997; Absalão and Gomes, 1995, 2001; Gomes and Absalão, 1996; Barros et al., 2003; Rios, 2009). Although representatives of this family typically inhabit shallow waters, species are far from being well known and are currently being recorded and described worldwide, especially in poorly studied regions, such as the Indo-Pacific (Pizzini et al., 2008; Raines and Pizzini, 2009; Pizzini and Raines, 2011) and the Atlantic coast of South America (Absalão, 1994, 1997; Absalão and Gomes, 1995; Gomes and Absalão, 1996; Wiggers and Veitenheimer-Mendes, 2003), at times based on misidentified specimens (Gomes and Absalão, 1996; Absalão, 1997; Absalão and Gomes, 2001; Absalão and Pizzini, 2002; Rios, 2009), as in the case of the species described herein.

Reasonable caecids richness (about 30 taxa) has been reported for the Atlantic coast of South America (Folin, 1867a, b, c; 1868a, b; 1874a, b; Mello and Maestrati, 1986; Diaz and Puyana, 1994; Absalão and Gomes, 1995; Gomes and Absalão, 1996; Absalão and Gomes, 2001; Rios, 2009). However, a number of species are scarcely represented in the literature, and are not yet adequately reviewed, characterized or illustrated (e.g., *Caecum bimamillatum* Folin, 1867b; *C. limpidum* Folin, 1874a; *C. planum* Folin, 1874b; *C. someri* (Folin, 1867a)), while others remain unknown, which hinders an assessment of the biodiversity of this group in the region. The present findings support the hypothesis that the taxonomic understanding of Caecidae on the Atlantic coast of South America remains unsatisfactory and open to further research.

A number of studies have recognized the existence of growth stages in Caecinae (Olsson and Harbison, 1954; Keen, 1971; Abbott, 1974; Draper, 1979, 1985; Mello and Maestrati, 1986; Lightfoot, 1992a, 1993; Diaz and Puyana, 1994; Gomes and Absalão, 1996; Pizzini et al., 1998; Absalão and Gomes, 2001; Redfern, 2001; Absalão and Pizzini, 2002; Rios, 2009; Tunnell Jr. et al., 2010; Albano and Pizzini, 2011), but only a few investigations have attempted to describe and/or figure certain phases for some taxa (Moore, 1970; Van Aartsen, 1977; Draper, 1979, 1985; Keeler, 1981; Mello and Maestrati, 1986; Lightfoot, 1992a, b, c; 1993a, b; Di Geronimo et al., 1995; Bandel, 1996; Nofroni et al., 1997; Redfern, 2001; Absalão and Pizzini, 2002; Tunnell Jr. et al., 2010; Pizzini and Raines, 2011). Only Draper (1985: fig. 6—*Caecum chilense* Stuardo, 1962) and Bandel (1996: fig. 7—*C*. *digitulum* Hedley, 1904; fig. 8—*C*. *antillarum* Carpenter, 1858; fig. 9—*C*. *glabellum* Montagu, 1803; fig. 10—*C*. *nitidum* Stimpson, 1851; fig. 11—*C*. *erroneum*; fig. 12—*C*. *pulchellum* Stimpson, 1851; fig. 13—*C*. *floridanum* not *C*. *imbricatum*; fig. 14—*C*. *troglodyte* Moolenbeek, Faber and Iliffe, 1989; fig. 15—*C*. *plicatum* Carpenter, 1858) fully studied the growth series in *Caecum* species. Most studies addressing growth stages are (apparently) not based on a substantial number of specimens, are not accompanied by descriptions and adequate illustrations of certain phases, and have not analyzed the stages in an integrated, comparative fashion, as performed in the present study. Despite its lack of novelty, the present report presents in detail the basis for the better recognition and general differentiation pattern of growth stages among members of Caecinae. Based on the material examined and previous studies, one may predict that Caecinae species exhibit certain consistency in the number of growth phases (Bandel, 1996; present study), average length and typical sculpture pattern associated to each stage (Draper, 1985; Bandel, 1996; present study), as well as a characteristic transition pattern between stages (e.g., suture, strangulation, pronounced increase in diameter or interface of sculpture patterns) (Draper, 1985; Lightfoot, 1992c; Bandel, 1996; Absalão and Pizzini, 2002; present study). In general, some intraspecific variation may be observed in the conchological ontogeny of species and a reliable study of these stages depends on the perceptions of the researcher analyzing the specimens.

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