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ARTICLE

Anatomy of two species of *Megalobulimus* (Strophocheilidae, Megalobuliminae) from South-Central Bahia, Brazil

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Abstract. An anatomical and taxonomic study of *Megalobulimus oblongus* (Müller, 1774) and *M. conicus* (Bequaert, 1948) (Strophocheilidae, Megalobuliminae) is carried out, based mainly on samples from the south-central region of Bahia, Brazil. It revealed interesting anatomical differences in several structures, mainly in the pallial cavity, with greater ramification of vessels in the respiratory region of *M. oblongus* when compared to *M. conicus;* and in the genital system of *M. conicus,* which has a more elongated prostate, and the folds of the penis are more spaced. A taxonomical discussion is presented, including several characters confirmed as typical of the genus and subfamily, such as buccal flange, prerectal valve and pulmonary septum.

Keywords. Anatomy; Analysis, Mollusca; Gastropoda.

INTRODUCTION

The subfamily Megalobuliminae includes nearly 60 of the 80 valid species in Strophocheilidae recorded in Brazil to date (Simone, 2006, 2018; Fontenelle *et al.,* 2019). Megalobulimines are herbivores, nocturnal, and go through periods of aestivation; they prefer to remain protected in humid environments, covered by vegetation or humus/loose soil during the day (Bequaert, 1948; Miranda & Fontenelle, 2015).

Megalobuliminae have an unstable taxonomic history (*e.g.,* Pilsbry, 1894; Bequaert, 1948; Morretes, 1952; Leme, 1973), but currently, it is considered a subfamily (Megalobuliminae) of the family Strophocheilidae alongside Strophocheilinae. The family is within the superfamily Rhytidoidea (Bouchet *et al.,* 2017). Megalobuliminae has as its main anatomical characteristics a globose or cordiform kidney, lacking a trace of the primary ureter, the presence of a longitudinal septum in the pulmonary chamber, a mouth with a labial fringe, and a radula with unicuspidated teeth (Leme, 1973; Simone & Leme, 1998; Simone, 2018).

In a recent collection at the South-Central of Bahia, two species of the genus *Megalobulimus* Miller, 1878, were collected: *M. oblongus* (Müller, 1774) and *M. conicus* (Bequaert, 1948) (Silva *et al.,* 2021). Some anatomical data on *M. oblongus* can be found in a few ancient papers (Guppy, 1866; Semper, 1874; Semper & Simroth, 1894; Ihering, 1884, 1891; Baker, 1926), while there are no morphoanatomical studies in the literature for *M. conicus.* The anatomical papers on *M. oblongus* contain simplistic information about the buccal apparatus, pulmonary area and genital system, however, there are no studies that present detailed data on them and from all systems. A detailed anatomical study of these two species is, thus, still needed, a gap that is fulfilled by the present paper.

MATERIAL AND METHODS

The present anatomical study was based on one specimen of *Megalobulimus oblongus* collected in the Mortugaba Municipality, and two specimens of *M. conicus* collected in Mortugaba and Cordeiros municipalities in South-Central Bahia (Fig. 1), deposited in the malacological collection of the Museu de Zoologia da Universidade de São Paulo (MZSP). Specimens were preserved in 70% ethanol and were removed from their shells by rotational movements to prevent any major damage. Dissections were performed under a stereomicroscope, with the aid of a camera lucida, following the procedures described in Simone & Leme (1998). The radulae were examined by scanning electronic microscopy (SEM) in the Electron Microscopy Laboratory, MZSP. Shell measurements were taken with a digital caliper. Anatomical terminology follows Simone & Leme (1998) and Fontenelle *et al.* (2021).

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Figure 1. Map of Bahia state, showing the municipalities where the present specimens were collected. Abbreviations of states: MA = Maranhão; PI = Piauí; PE = Pernambuco; AL = Alagoas; SE = Sergipe; TO = Tocantins; GO = Goiás; MG = Minas Gerais.

Abbreviations: L = shell length; W = shell width; sh = shell; spm = specimen.

Abbreviations in figures: ac, albumen chamber; **ad,** anterior digestive gland; **ae,** esophagus anterior; **ag,** albumen gland; **an,** anus; **bc,** bursa copulatrix; **bm,** buccal mass ceiling; **bt,** hardened region of radular tissue preceding buccal region; **cv,** collar vessel; **da,** duct of the anterior lobe of the digestive gland; **db,** bursa copulatrix duct; **dd,** vas deferens duct; **dg,** duct of albumen gland; **dp,** duct of the posterior lobe of the digestive gland; **eg,** spermatic gutter; **el,** inner fold of epiphallus; **eo,** spermoviduct; **ep,** epiphallus; **es,** esophagus; **et,** esophageal typhlosole; **fo,** free oviduct; **gg,** accessory glandular groove of spermoviduct; **go,** gonad; **hd,** hermaphroditic duct; **if,** inner free oviduct; **in,** middle intestine; **ip,** inner penial folds; **it,** intestinal typhlosole; **jw,** jaw; **ki,** kidney; **m1d,** dorsal longitudinal extrinsic muscles of the buccal mass; **m1l,** lateral longitudinal extrinsic muscles of the buccal mass; **m1v,** ventral longitudinal extrinsic muscles of the buccal mass; **m2,** retractor muscle of the buccal mass; **m3,** transverse extrinsic muscles of the buccal mass; **m3d,** dorsal transverse extrinsic muscles of the buccal mass; **m3p,** posterior transverse extrinsic muscles of the buccal mass; **m4/m5,** retractor muscles of radula; **m7,** muscle of radula; **m7c,** central muscle of radula; **m7l,** lateral muscle of radula; **m11,** ventral tensor muscles of radula; **me,** middle esophagus; **mj,** jaw muscles; **mo,** mouth; **mp,** retractor muscle of penis; **ne,** nerve; **np,** nephrostome; **nv,** ad-renal vessels; **oc,** odontophore cartilage; **ob,** opening of the duct of bursa copulatrix; **og,** oral ganglion; **ot,** oral tube; **pc,** pericardium; **pd,** posterior digestive gland; **pe,** penis; **pi,** proximal intestine; **pl,** pylorus; **pn,** pneumostome; **po,** posterior esophagus; **pr,** ring periesophageal; **pt,** prostate; **pv,** paleo-diaphragmatic muscle; **ra,** radula; **rm,** radular muscle; **rn,** radula nucleus; **rs,** radular sac; **rt,** rectum; **sb,** stomach muscle belt; **sd,** salivary gland duct; **se,** septum; **sg,** salivary digestive gland; **so,** opening salivary gland; **sr,** seminal receptacle; **st,** stomach; **ta,** talon; **tf,** inner transversal fold of penis; **ug,** ureteric groove; **ut,** uterus; **v1-v3,** vessels of pulmonary vein; **vg,** vagina; **vp,** vaginal appendix.

RESULTS

Systematics

Megalobulimus oblongus (Müller, 1774) (Figs. 2-5)

Synonymy, *see* Silva *et al.,* 2021 (complement).
Megalobulimus oblongus: Borda & Ramirez, 2013: 681; Salvador, 2019: 93; Salvador *et al.,* 2021: 68.

Type locality: Not stated.

Occurrence: South America (Simone, 2006).

Material examined: BRAZIL: Bahia; Mortugaba, 15°01′42.20″S, 42°22′30.79″W, MZSP 136679, 1 spm (F.S. Silva col. 03/i/2018).

Measurements: L = 118.3 mm, W = 72.0 mm.

Description

Shell (Fig. 2): Size 118 mm (maximum length), outline conic-oval, imperforated, up to 6 whorls, with high spire; color beige, lacking periostracum (Figs. 2A, 2D). Protoconch of 3.5 whorls, maximum diameter ~24 mm, corresponding to 32% of total shell width, and ~18% of total length; first whorl smooth, with regular discreet axial thin ribs with narrow interspaces gradually appearing, color faintly pink (Fig. 2D). Teleoconch of 2.5 whorls, sculptured by strong axial ribs with wide interspaces; suture shallow, but well-marked; penultimate whorl convex, last whorl with surface irregular and malleated, sculpture consisting of axial riblets separated by wide interspaces twice as wide as riblets. Aperture elliptical, ~55% of shell length, ~32% of shell width. Inner lip slightly arched and oblique. Peristome intense rose, deflected and thick.

Head-foot (Fig. 2): Surface reticulated, with irregular grooves defined at edges and weak grooves in dorsal region of tegument, except for smoother sole. Color uniformly greenish dorsally, ventrally beige. Oral flange extending laterally (Fig. 2E).

Pallial cavity (Figs. 3, 4): Pulmonary area at right side from pulmonary vein with many perpendicular vessels, with alternate origin between marginal vein and from left structures. Area at left from pulmonary vein with vessels running from mantle edge towards posterior region. Three vessels of greater caliber (Fig. 4A: v1, v2, v3), branched vessels of medium caliber, in larger amount in lower region of septum, surrounded by vessels of smaller caliber; v1 and v2 ending along septum; v3 moving towards pericardium, ending at base of pericardium re-

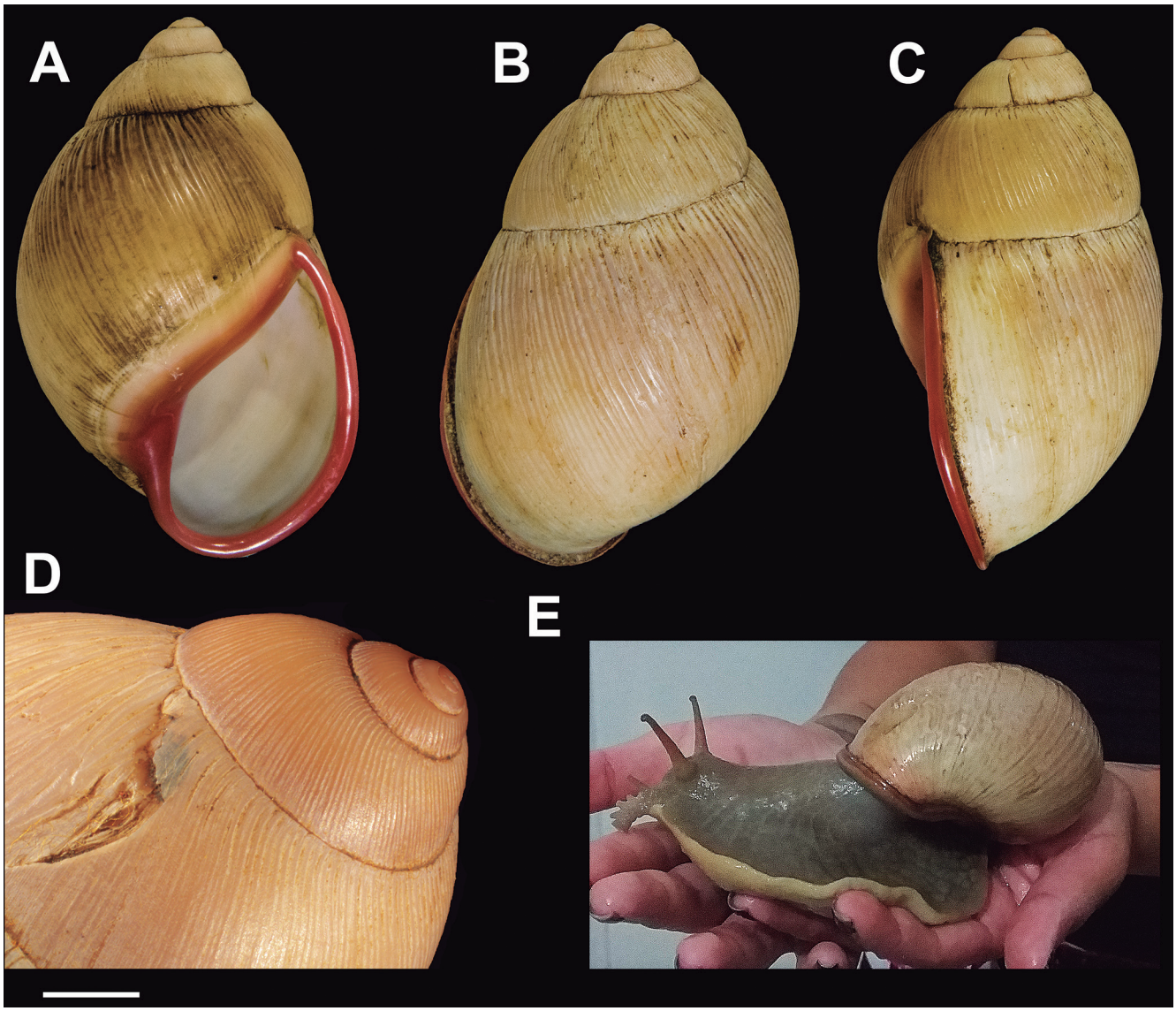

Figure 2. *Megalobulimus oblongus:* (A-D) Shells of specimen from Mortugaba, Bahia state, MZSP 136679 (L = 118,3 mm, W = 72,0 mm), (A) apertural view; (B) abapertural view; (C) lateral view; (D) apex view. Scale = 10 mm; (E) live specimen. Scales = 17 mm (hand).

gion. Region of pulmonary septum (Fig. 4A: se) with high and voluminous fold, covered by tissue with intensely anastomosed vessels, of spongy aspect, surrounding pulmonary vein and left side of pallial cavity. Well-developed network of anastomosed vessels expanding along respiratory region near mantle edge. Urinary gutter composed of small transverse folds, ending near lower side of pneumostome. Reno-pericardial region (Fig. 4A: ki), triangular kidney, left vertex elongated, internally solid, occupying ~25% of the pallial cavity area, pericardium occupying ~5% of the pallial cavity total area. Nephrostome (Fig. 4A: np) partially covered by ad-renal vessels. Pericardium (Fig. 4A: pc) connected to upper region of septum. Plexus of anastomosed vessels covering ~10% of the pericardium.

Digestive system (Figs. 3, 5): Jaw (Fig. 3B), yellowish, with eight equidistant thick axial columns with weak transverse growth lines. Radula (Figs. 3C, 3D) with ~90 rows; marginal/lateral teeth unicuspidated, apex long and rounded, base wide (43-1-43). Rachidian tooth ~25% smaller than marginal/lateral, with rounded base. Buccal mass (Fig. 4B, 4C) elongated, superficial longitudinal extrinsic muscle bundles symmetrical, dorsal branch insertion located above buccal ganglion, length ~63% of the buccal mass length; additional ventral branch insertion close to radular nucleus, length ~73% of buccal mass length (Fig. 4B: m1v); narrow lateral muscles insertion located under ventral muscle bundle (Fig. 4B: m1l); pair of large retractor muscle of buccal mass inserting into buccal mass below radular nucleus (Fig. 4B: m2); **m3,** superficial transverse muscle, occupying ~30% of buccal mass volume, insertion between m1v and radular nucleus. Oral ganglion (Fig. 4B: og) located just above external insertion of salivary duct (Fig. 4B: sd). Oral tube internally marked by dorsal transverse groove corresponding to jaw. Odontophore (Figs. 4E, 4F) rounded to elliptical, **m4,** main pair of dorsal tensor muscles of radula thick, surrounding pair of odontophore cartilages externally; **m5,** relatively thin and narrow, originating at posterior margin of cartilages as a fusion of main and secondary dorsal tensor muscles of radula (Fig. 4E: m5/m4); **m11,** pair of ventral tensor muscle of radula, originating on postero-dorsal surface of cartilages, inserting in subradular membrane at end of radular ribbon; **mj,** jaw muscles thick, inserting latero-dorsally in odontophore. Radular sac (Fig. 4D), covered by hardened tissue (Fig. 4D: bt); **m7l,** longitudinal muscles of radular nucleus inserted laterally; **m7c,** central longitudinal muscle, ~30% of total width of

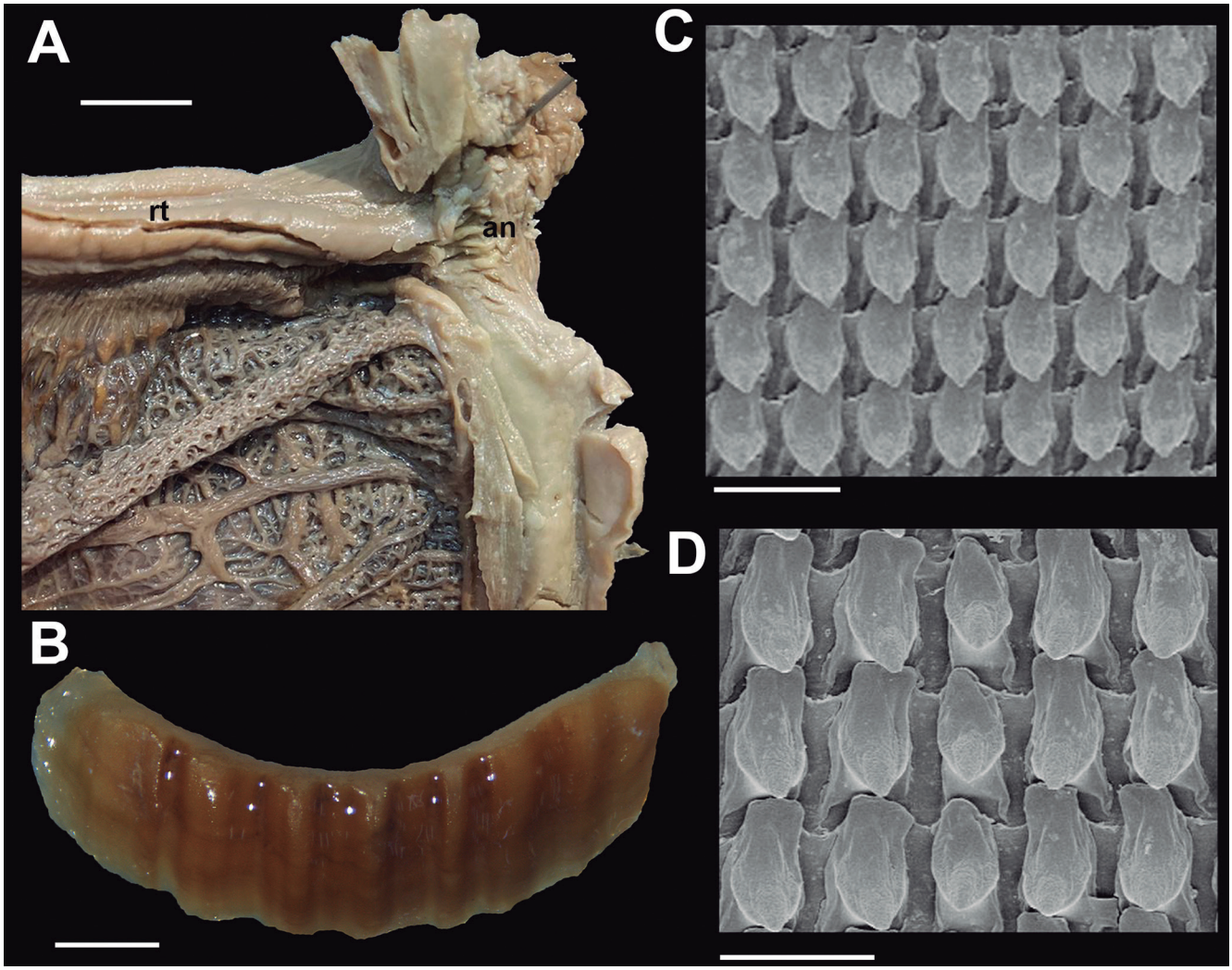

Figure 3. *Megalobulimus oblongus:* (A) pulmonary pallial cavity, an (anus), rt (rectum); (B) jaw, anterior view. Scales = 10 mm; (C-D) radula, in SEM. Scales = 0,1 mm; (C) marginal teeth; (D) central region, rachidian tooth.

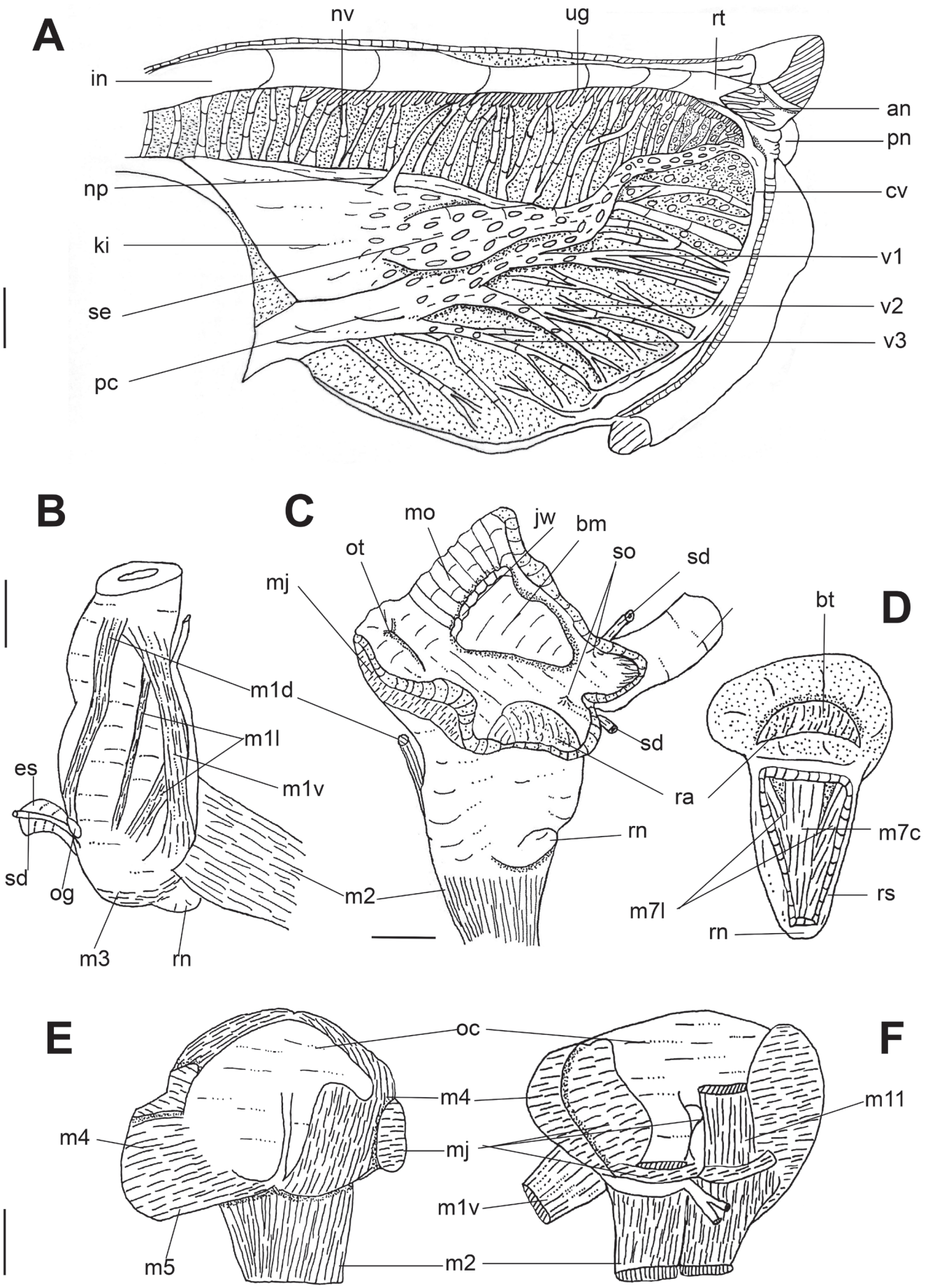

Figure 4. *Megalobulimus oblongus* anatomy: (A) pallial cavity, renopericardial region, ventral view. Scale = 10 mm; (B) buccal mass closed; (C) buccal mass opened ventrally; (D) radular sac; (E) odontophore dorsal view; (F) odontophore ventral view. Scales = 5 mm.

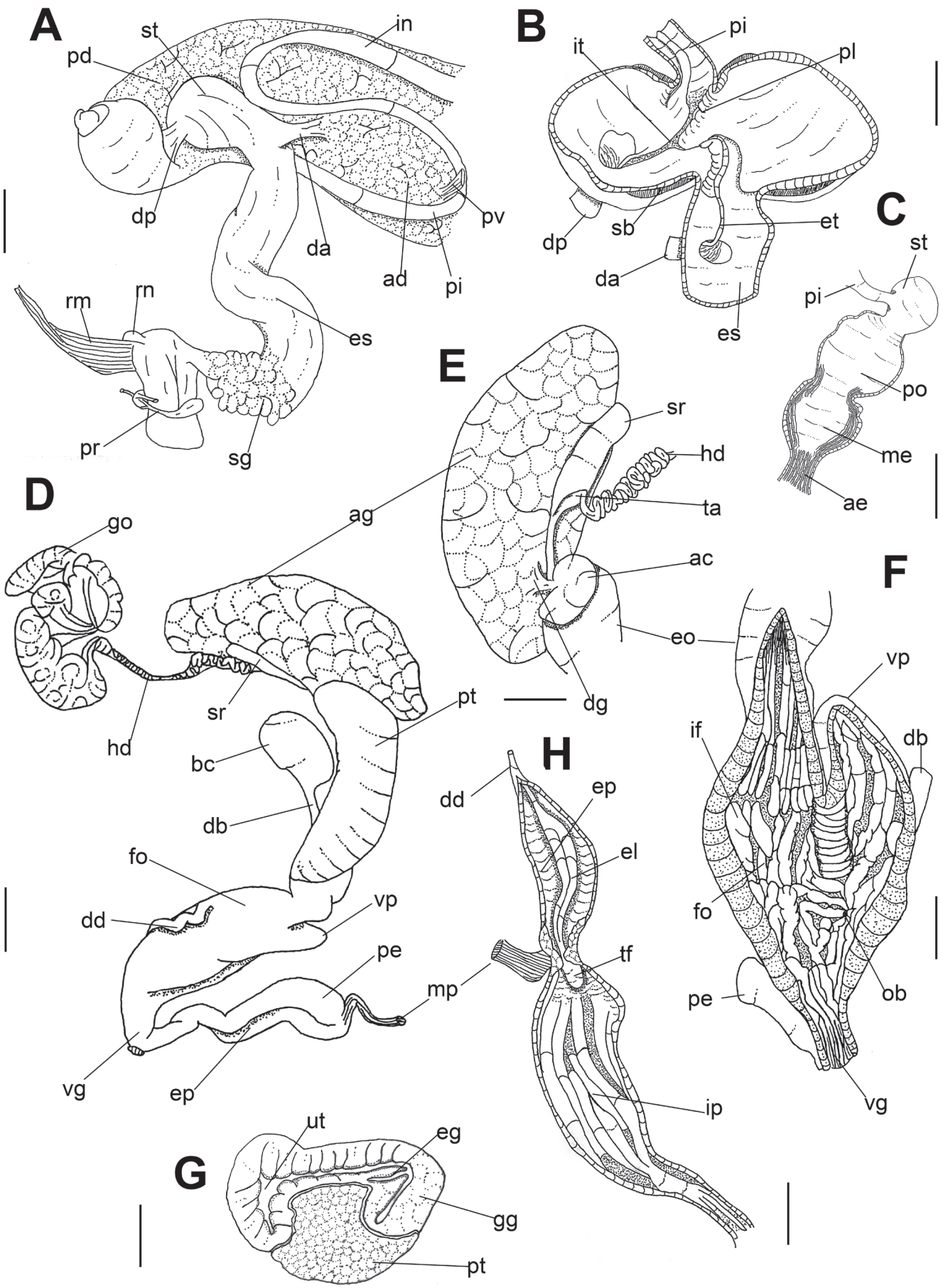

Figure 5. *Megalobulimus oblongus* anatomy: (A) pallial cavity; digestive region; (B) stomach, opened longitudinally; (C) esophagus opened longitudinally; (D) genital system, complete dorsal view; (E) carrefour region, ventral view; (F) spermoviduct and vaginal appendix opened longitudinally; (G) spermoviduct, cross-section at its middle region; (H) penis and epiphallus opened longitudinally. Scales (A, D) = 10 mm; Scales (B-C, E-H) = 5 mm.

radular sac. Esophagus (Fig. 5C) with three parts. Anterior esophagus (Fig. 5C: ae) narrow, ~20% of esophagus volume, with thick walls, with about six irregular longitudinal folds, salivary glands covering it outside (Fig. 5A: sg); middle esophagus (Fig. 5C: me) with thick walls, three thin, smooth longitudinal folds; mid- to posterior esophagus transition marked by a thickened and wrinkled internal surface; posterior esophagus (Fig. 5C: po) cylindric, with thin walls; anterior digestive gland duct located in its posterior part (Figs. 5A-B: da). Stomach oval (Figs. 5A, 5C: st), muscle belt (Fig. 5B: sb) encircling it outside, inner surface velvety, without folds. Esophageal typhlosole (Fig. 5B: et) beginning at duct of anterior lobe of digestive gland, ending abruptly at pylorus muscles (Fig. 5B: pl). Intestinal typhlosole (Fig. 5B: ti) starting at base of orifice of duct of posterior lobe of digestive gland (Figs. 5A, 5B: dp), lying along inner surface of proximal intestine (Fig. 5B: pi). Proximal intestine running from stomach, parallel to posterior esophagus, close to pericardium. Middle intestine (Fig. 5A: in) directed towards pallial cavity, anterior lobe of digestive gland S-shaped (Fig. 5A: ad). Final portion of middle intestine internally smooth, with weak, thin longitudinal folds at transition to rectum. Rectum with about four internal and well-defined longitudinal folds directed towards anus.

Reproductive system (Fig. 5): Gonad with four lobes (Fig. 5D: go). Hermaphroditic duct (Fig. 5D, 5E: hd) intensely coiled, except for both ends, inserting apically in talon (Figs. 5D, 5E: ta). Talon connected to middle third of albumen gland. Albumen gland solid, ~17% length of reproductive system (Figs. 5D, 5E: ag), seminal receptacle elongated, ~30% length of albumen gland (Figs. 5D, 5E: sr). Albumen chamber (Figs. 5E: ac) ~20% length of albumen gland, duct of annex glandular sac inserting in albumen chamber laterally to albumen gland duct. Spermoviduct (Figs. 5E, 5F: eo) occupying ~half of genital length; middle region with prostate occupying ~33% of inner volume; uterus (ut) occupying remaining ~33% of prostate volume (Fig. 5G). Accessory glandular groove in posterior ~50% of spermoviduct (Fig. 5G: gg). Free oviduct length ~30% of spermoviduct length (Fig. 5F: fo), walls thick, internally with 4 irregular longitudinal folds (Fig. 5F: if). Vagina proportionally short (Fig. 5D; F: vg); inner surface simple, with 4-5 longitudinal, low, narrow folds, slightly equidistant from each other (Fig. 5F: vg). Vaginal appendix (Fig. 5F: vp) situated distally to free oviduct, short, apex rounded with folds similar to those of free oviduct, encircling bursa duct ostium (Fig. 5F: ob). Bursa copulatrix oval, ~30% of albumen gland size (Figs. 5D: bc); bursa duct ~30% width of adjacent spermoviduct (Figs. 5D, 5F: db). Penis same length as free oviduct, ~50% of width of spermoviduct, (Figs. 5D, 5F: pe) with six narrow longitudinal, separated and irregular, folds internal (Fig. 5H: ip). Epiphallus ~70% penis length, located as short terminal extension of penis (Figs. 5D, 5H: ep), with dichotomized and voluminous central fold, transverse and short fold near aperture to epiphallus. Vas deferens inserted subterminally in epiphallus (Figs. 5D, 5H: dd).

Megalobulimus conicus (Bequaert, 1948) (Figs. 6-9)

Synonymy, *see* Silva *et al.,* 2021 (complement).
Megalobulimus conicus: Birckolz *et al.,* 2016: 150; Salvador, 2019: 93.

Type locality: Maranhão, Brazil.

Occurrence: Brazil (Amazonas, Maranhão, Bahia, and Tocantins states) (Simone, 2006; Salvador *et al.,* 2015).

Material examined: BRAZIL: Bahia; Mortugaba, 15°01′42.20″S, 42°22′30.79″W, MZSP 143688, 1 spm (F.S. Silva col. 03/i/2018); Cordeiros, 15°02′23.90″S, 41°56′02.07″W MZSP 136647, 4 sh (F.S. Silva col. 17/i/2018).

Measurements: n = 2; shell length = 90,1 ± 0,9; shell width 51,3 ± 1,2.

Differential description

Shell (Fig. 6): Size 90 mm, outline oval-conical, weakly perforated, up to 6 whorls. Spire high ~24% of total length. Color white to yellow, lacking periostracum (Figs. 6A, 6F). Protoconch of 3.5 whorls, ~32% of total shell width and ~15% of total length; first whorl smooth, with regular subsutural weak thin ribs with interspaces with same width of ribs gradually appearing at the start of second whorl. Teleoconch of 2.5 whorls, sculptured by strong axial ribs, more strongly marked near suture, with interspaces as wide as ribs. Aperture elliptical, ~50% of shell length. Inner lip slightly arched and oblique. Peristome bright pink, reflected, and thick.

Head-foot: Head-foot similar to previous species.

Pallial cavity (Figs. 7A, 8A): Lung (Fig. 8A) inner surface ~50% covered by numerous perpendicular vessels. Arrangement of vessels similar to previous species. Septum, covered with ~30% of anastomosed vessels, diffusing with left of pallial cavity covering kidney (Fig. 8A: ki). Net of anastomosed vessels expanding toward lung near edge of mantle; no visible prominent vessels at right of septum. Excretory region with reduced number of adrenal vessels compared to previous species (Fig. 8A: nv). Pericardium (Fig. 8A: pc) surface smooth.

Digestive system (Figs. 7, 8): Jaw (Fig. 7B), yellowish, five salient axial columns with weak transverse growth lines, equidistant from each other. Radula (Figs. 7C, 7D) with ~80 rows; marginal/lateral teeth unicuspidated, apex long and rounded, base wide (formula 40-1-40). Rachidian tooth elliptic, ~30% smaller than neighboring marginal/lateral teeth. Buccal mass short (Fig. 8B), **m3,** (Fig. 8B) occupying ~70% of buccal mass volume, insertion between m1v and radular nucleus. Odontophore (Figs. 8C, 8D) shape similar to previous

species. Arrangement of stomach (Fig. 8E: st), intestine (Fig. 8E: in, pi), and rectum (Fig. 8A: rt) similar to previous species.

Reproductive system (Fig. 9): General characters similar to those of previous species, except for: Albumen gland, less massive, ~24% of total length reproductive system volume. Hermaphrodite duct (Figs. 9A, 9B: hd) uncoiled. Prostate gland occupying ~30% of spermoviduct volume (Fig. 9D: pt). Uterus occupying ~20% of spermoviduct volume (Fig. 9D: ut). Accessory glandular groove situated in posterior half of spermoviduct (Fig. 9D: gg). Free oviduct with eight irregular, narrow, longitudinal folds (Fig. 9C: if).

DISCUSSION

The identification of the *Megalobulimus oblongus* specimen herein studied is based on shell characters described in Bequaert (1948) for its "typical *M. oblongus*", with the following features: oblong-oval outline, large size, complete nepionic ribs, and sculpture well marked along the spirals. Features of the specimen analyzed include: large shell (70-137 millimeters long), broadly oval, protoconch with well-marked ribs, sculpted whorls, expanded outer lip, and a slightly swollen bright pink peristome. *Megalobulimus oblongus* differs from *M. lorentzianus* (Scott, 1939) and *M. musculus* (Bequaert, 1948) by less convex whorls. Additionally, the anatomical charac-

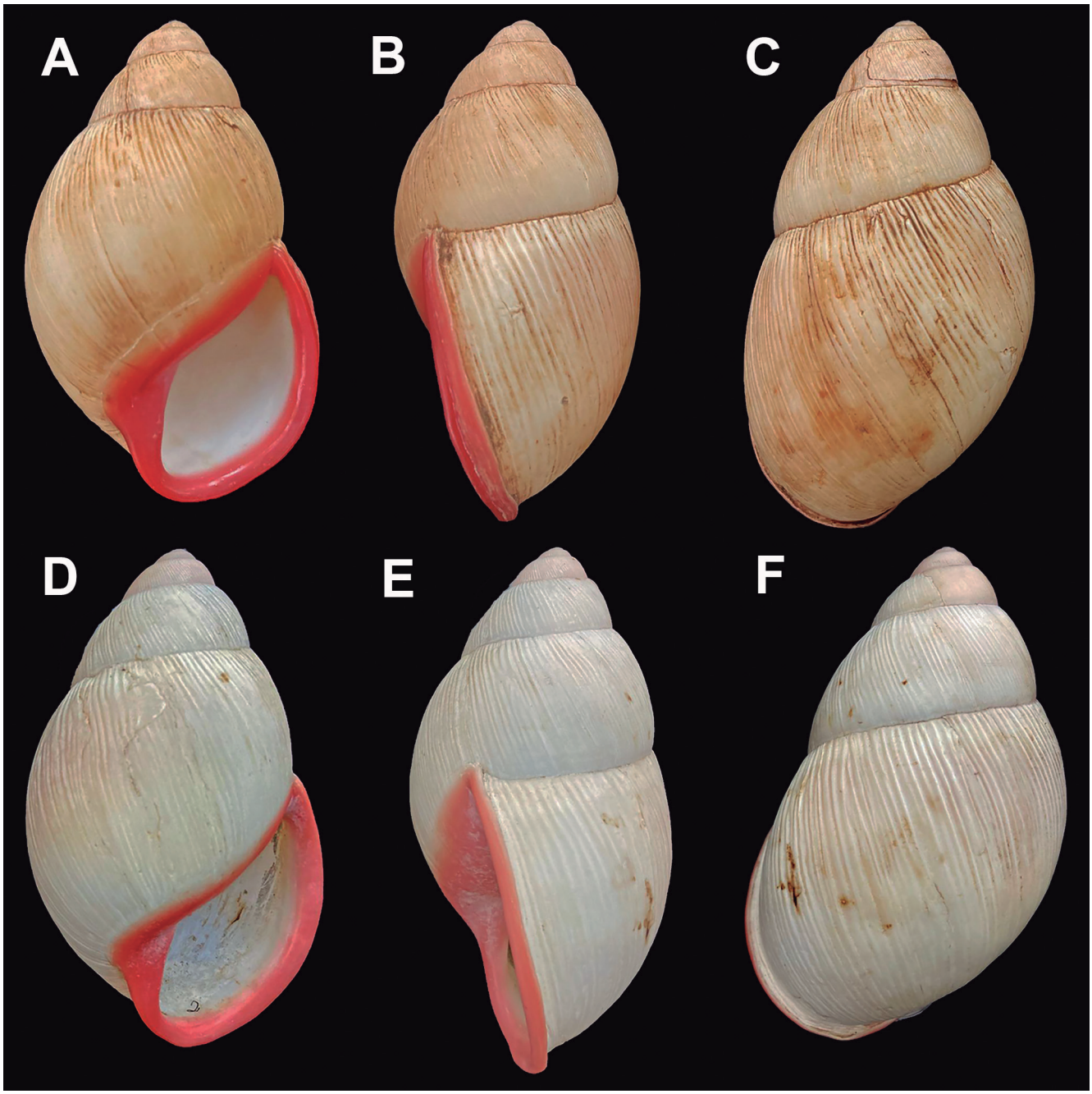

Figure 6. *Megalobulimus conicus:* (A-C) Shells of specimen from Mortugaba, Bahia state, MZSP 143688 (L = 89,5 mm, W = 50,0 mm), (A) apertural view; (B) lateral view; (C) abapertural view; (D-F) Shells of specimen from Cordeiros, Bahia state, MZSP 136647 (L = 90,8 mm, W = 52,2 mm), (D) apertural view; (E) lateral view; (F) abapertural view.

teristics described herein, especially those related to the reproductive system, are congruent with those described by Baker (1926) and Roldán *et al.* (2014) for *M. oblongus*.

The specimen herein studied also confirms previous anatomical studies on *M. oblongus*. The characters of the kidney, the reproductive system, and of the head, respectively, are the same to those found in Ihering (1884, 1891) and Guppy (1866). The reno-pericardial region, reproductive system, jaw, and radula, are similar to those reported by Semper (1874). The pulmonary septum, which contains a usually high fold, the characteristic that separates the subfamily Megalobulimanae, was mentioned by Semper & Simroth (1894) as a high fold that encompasses the pulmonary vein found both in *M. oblongus* and *M. maximus* (Sowerby, 1825). The respiratory region of *M. oblongus* is widely vascularized when compared to *M. lorentzianus*. In this region, the pulmonary network is richly distributed in the anterior and right regions, the remaining surface is more or less smooth (Scott, 1939).

Megalobulimus oblongus was proposed by Müller (1774, as *Helix oblonga*) naming shell illustrations from pre-Linnean works, such as, *e.g.,* Seba (1734-1765) and Lister (1685-1692). Bequaert (1948) analyzed and illustrated material from different parts of South America, including Brazil. One of the shells illustrated in Bequaert's article (pl. 23, fig. 5) is from Colombia, and it is deposited in the Museum of Comparative Zoology, Harvard University (#MCZ 64227), that later was examined and photographed by Simone (2006: fig. 818). The shell of the specimen herein studied is similar to the Colombian MCZ shell, supporting our identification. The difficulty in confirming the occurrence of the typical species can be explained, speculatively, by errors in the information contained in the material analyzed by Bequaert (1948), or even by anthropic introduction, since these animals were used as a source of food and for the manufacture of ornaments by Paleoamericans (Fontenelle *et al.,* 2014). The geographical problem (Colombia and Bahia) can only be resolved when more samples become available.

Megalobulimus conicus has distinct conchological features compared to *M. oblongus,* mainly regarding the

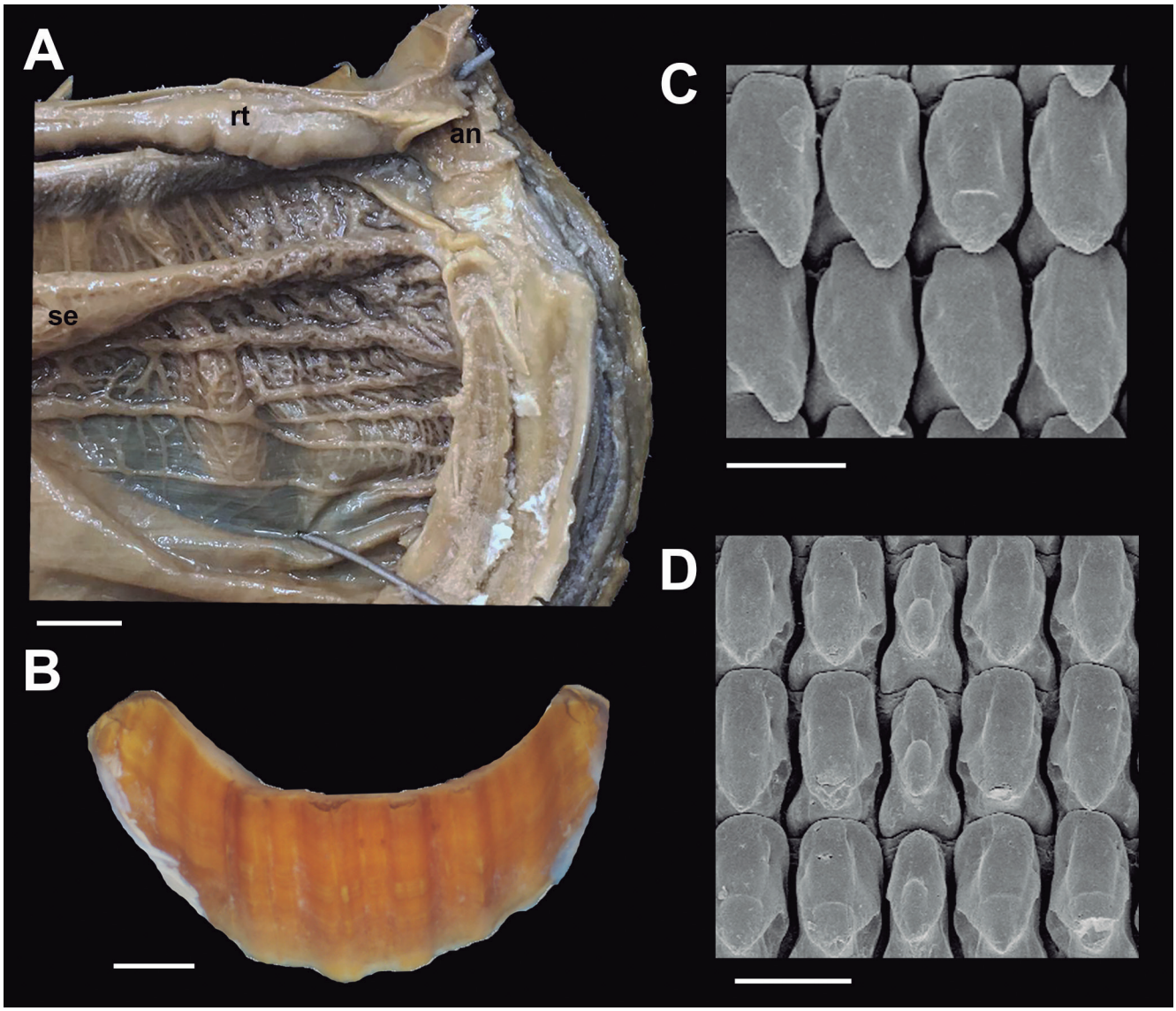

Figure 7. *Megalobulimus conicus,* MZSP 143688: (A) pulmonary pallial cavity, an (anus), rt (rectum), se (septum); (B) jaw, anterior view. Scale = 10 mm; (C-D) radula, in SEM. Scales = 0,1 mm; (C) marginal teeth; (D) central region, rachidian tooth.

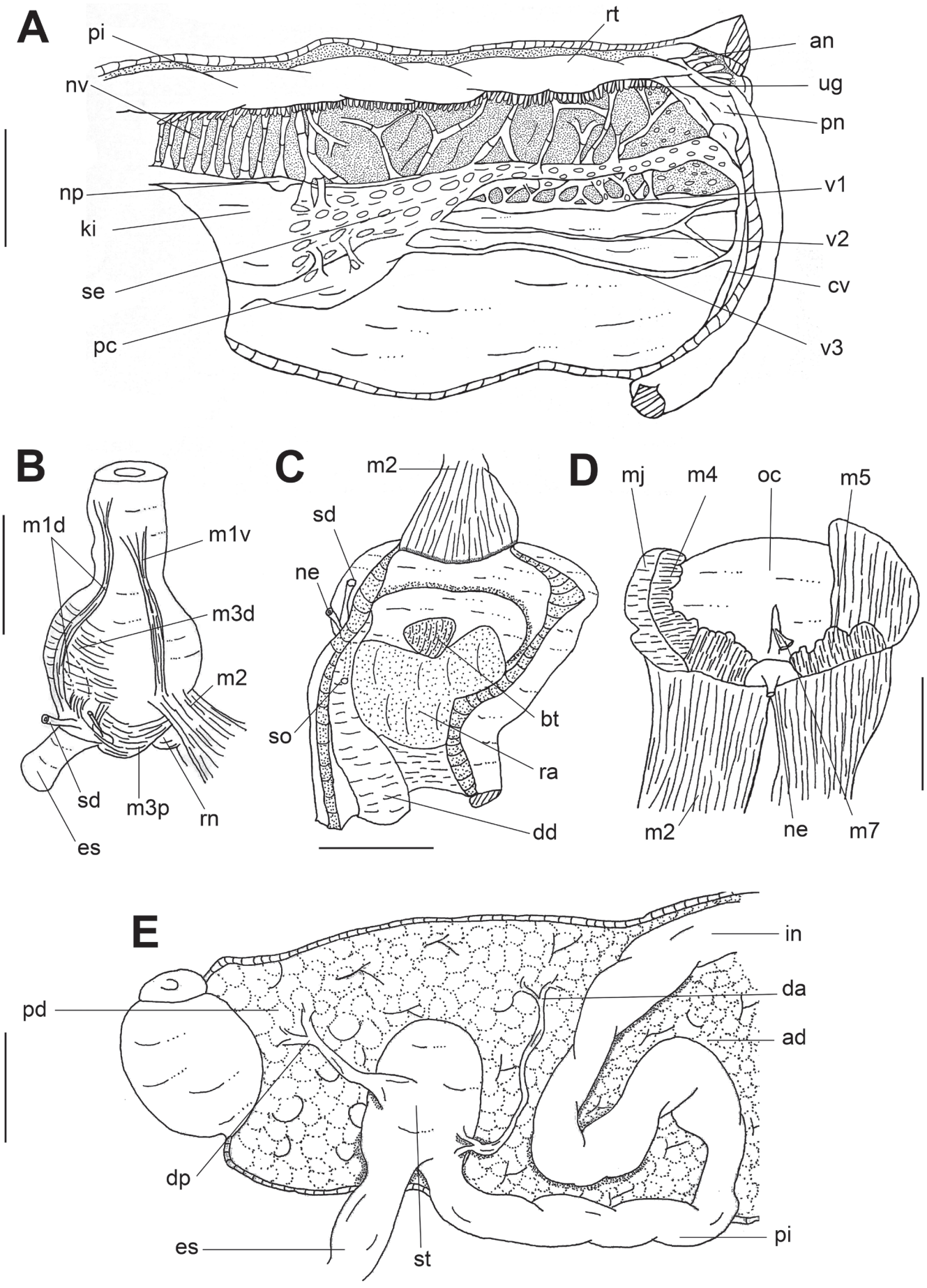

Figure 8. *Megalobulimus conicus,* MZSP 143688 anatomy: (A) pallial cavity, renopericardial region, ventral view; (B) buccal mass closed; (C) odontophore dorsal view; (D) odontophore ventral view; (E) visceral mass; digestive region. Scales (A, E) = 10 mm; Scales (B-D) = 5 mm.

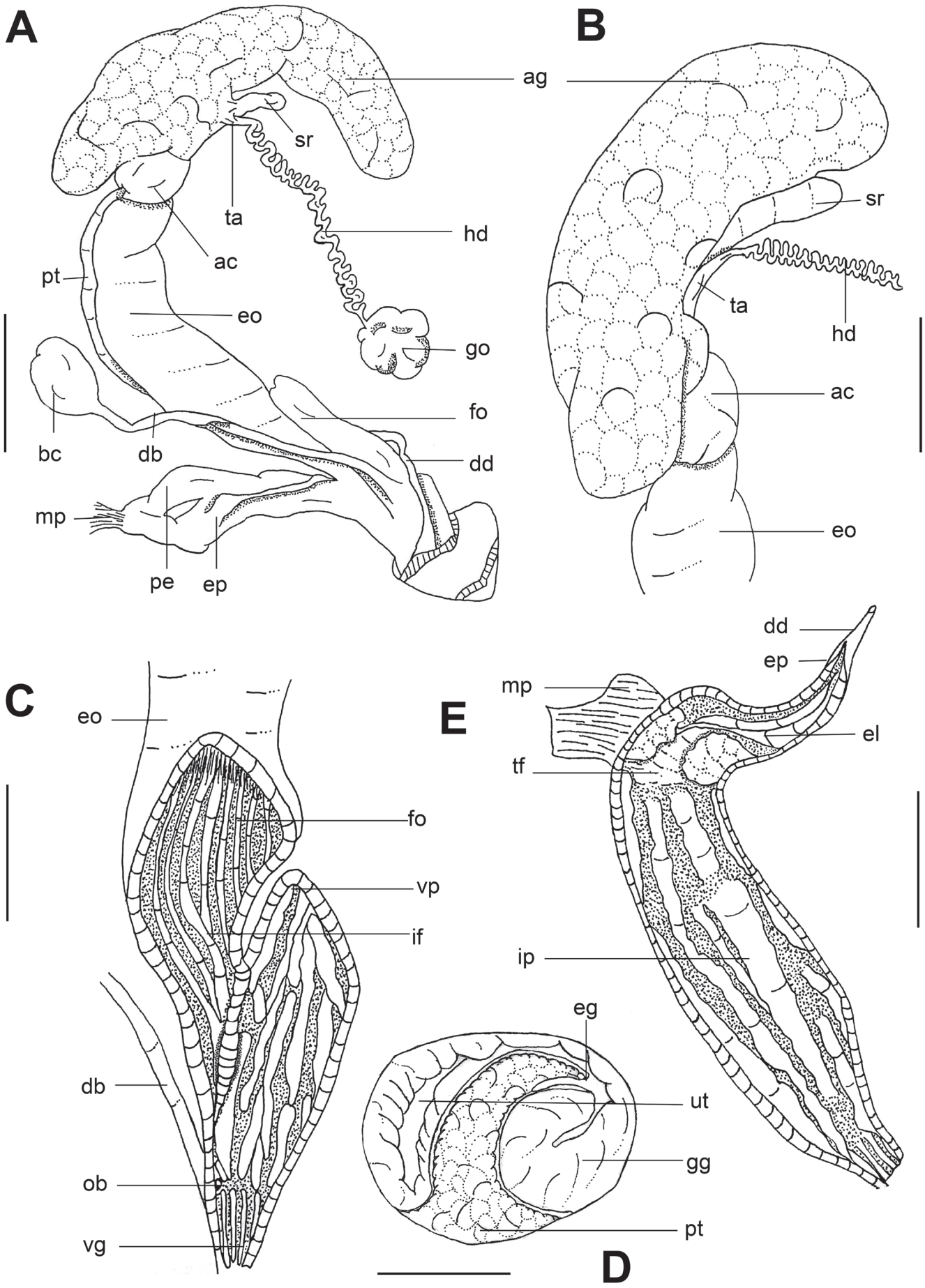

Figure 9. *Megalobulimus conicus,* MZSP 143688 anatomy: (A) genital system, complete dorsal view; (B) carrefour region, ventral view. Scale = 10 mm; (C) spermoviduct and vaginal appendix opened longitudinally; (D) spermoviduct, cross-section at its middle region; (E) penis and epiphallus opened longitudinally. Scales = 5 mm.

size, with length ranging from 84-90 mm, an oval-conic outline, and a relatively smaller opening. It differs from *M. riopretensis* Simone & Leme, 1998 by being laterally flattened, and from *M. mogianensis* Simone & Leme, 1998 in presenting an oval-inflated shell (Simone & Leme, 1998). It further differs from *M. musculus* and *M. lorentzianus* in lacking an obtuse ridge, and from the latter by having a more oval outline (rather than conical) and a wider aperture. *Megalobulimus conicus* shares some anatomical similarities with *M. oblongus* as the digestive system, but differs mainly in the pallial cavity, which is smoother in the lower part of the respiratory region, the diaphragmatic septum has a less developed network of anastomosing vessels; in the reproductive system, the prostate is more elongated and the folds of the penis are more spaced between them. When compared to other species of the genus, *M. conicus* has a greater vascularization than *M. lorentzianus* and differs from *M. riopretensis* and *M. mogianensis* by not having a penile flagellum.

Going further beyond megalobulimines, the species of *Megalobulimus* analyzed, when compared to *Anctus angiostomus* (Wagner, 1827) (family Bulimulidae), the main differences in the reproductive system are found in the albumen gland, which is distinguished by its long and conical and small fusiform seminal receptacle (Simone, 1998). In respect to *Leiostracus carnavalescus* Simone & Salvador, 2016 (family Bulimulidae), the epiphallus is absent and the seminal receptacle is elongated and curved, in both bulimulids, the excretory system has a closed (tubular) primary and secondary ureter, which are opened (groove) in species of the genus *Megalobulimus* (Simone, 1998; Simone & Salvador, 2016). Compared to species of the genus *Anthinus* Albers, 1850 (subfamily Strophocheilinae), the muscle set of the odontophore and excretory system are similar to the *Megalobulimus* species analyzed here, in the reproductive system the seminal receptacle is broadly coarse and the epiphallus is relatively short with approximately 20% length of the penis (Simone, 2022).

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