

## New species of Architectonicidae (Gastropoda Heterobranchia) from northeastern Brazil

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*Solatisonax rudigerbieleri* n. sp., *Solatisonax cabrali* n. sp., *Psilaxis clertoni* n. sp., *Pseudotorinia jonasi* n. sp. and *Heliacus willianseverii* n. sp. are described for the continental shelf and slope off northeastern Brazil. The genera *Pseudotorinia* and *Solatisonax* are cited for the first time for the South Atlantic. Comparisons are made with other known species of the western Atlantic and the Pacific. *Heliacus* and *Psilaxis* have previously been recorded for northern and northeastern Brazil, including oceanic islands off the northeastern region. The species described here are considered endemic to northeastern Brazil.

KEY WORDS: continental shelf, continental slope, *Solatisonax*, *Heliacus*, *Pseudotorinia*, *Psilaxis*, Architectonicidae, Brazil.

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## INTRODUCTION

Architectonicidae has not been revised along the Brazilian coast and no new species have been described recently. Only nine species were recorded for this region by RIOS (1994, 2009). Lists of recent species from the western Atlantic can be found in DALL (1889), ABBOTT (1974), DIAZ & PUYANA (1994), REDFERN (2001) and RIOS (1994, 2009).

The group encompasses both fossils and recent species. Gastropods commonly known as “sundials” comprise a group with worldwide distribution, mainly in tropical and subtropical waters. This is the only family of gastropods that possesses heterostrophic protoconchs and broadly conical, umbilicate, dextrally coiled teleoconchs (BIELER 1993, ROBERTSON 1993). These gastropods normally have a depressed-conical, turbinate or planorboid, porcellaneous shell, with a broad, deep umbilicus. The aperture is angular. Typical sculpture consists of either smooth or beaded spiral ribs. Descriptions have only been based on conchological characteristics, with a particular emphasis on the “finger-print” pattern described by BIELER (1993), elaborated for the recognition of the spiral ribs of the teleoconch in Architectonicidae.

During the REVIZEE (Live Resources of the Exclusive Economic Zone) program off the Brazilian coast between 1999 and 2003, a large number of small Heterobranchia belonging to Architectonicidae were dredged up from the continental slope and shelf off northeastern Brazil at depths between 30 and 720 m. These dredgings revealed previously undescribed species for the genera *Solatisonax* Iredale 1931, *Psilaxis* Woodring 1928, *Pseudotorinia* Sacco 1892 and *Heliacus* (*Torinista*) d'Orbigny 1842.

The aim of the present paper is to update the systematics of the family Architectonicidae for the coast of northeastern Brazil, especially species from the continental shelf and slope.

## MATERIAL AND METHODS

The examined specimens were obtained during oceanic prospecting work carried out on the continental slope off northeastern Brazil at depths ranging from 100 to 720 m in muddy sediments by the fishing vessel *Natureza* owned and operated by the Research and Management Center for Fishery Resources of the Northeastern Coast (CEPENE/IBAMA), as well as by the research vessel *Sinuêlo* owned and operated by the Fishery and Aquaculture Department of the Universidade Federal Rural de Pernambuco. The latter vessel worked mainly in the area of the continental shelf at depths between 30 and 100 m. The analyzed material was collected off the states of Rio Grande do Norte (04°15' S, 37°12' W), Pernambuco (08°46.5' S, 34°44.5' W), Alagoas (10°06' S, 35°46' W) and Sergipe (11°58.7' S, 36°49.2' W).

Only dead shells were found. Shells were mounted for scanning electron microscopy using the standard method. Genus identification was performed by comparisons with illustrations and descriptions in BIELER (1985a,b; 1993), BIELER et al. (1985) and RIOS (1994, 2009). The characterization of the Architectonicidae fauna is based on the specialized literature. The statistical approach consisted of linear regression analysis (SOKAL & ROHLF 1981).

## ABBREVIATIONS

BF - Basal field; D - Dredging; H - Height; IPR - Infra-peripheral rib; LMR - Lower midrib; LPR - Lower peripheral rib; PD - Protoconch diameter; SD - Shell diameter; SSR - Subsutural rib; UC - Umbilical crenae; UD - Umbilical diameter; UMR - Upper midrib; UPR - Upper peripheral rib; LMUFRPE - Laboratório de Malacologia, Universidade Federal Rural de Pernambuco; MNRJ - Museu Nacional do Rio de Janeiro; MZUSP - Museu de Zoologia da Universidade de São Paulo.

## RESULTS

## SYSTEMATICS

## Family Architectonicidae Gray 1840

Genus *Solatisationax* Iredale 1931

*Type species.* By original designation, *Solatisationax injussa* Iredale 1931; Recent, Indo-Pacific.

*Solatisationax rudigerbieleri* n. sp. (Fig. 1; Table 1; Table 2)

*Type material.* Holotype: MNRJ 13.021 [SD-5.8 mm; PD - 0.74 mm; H-2.7 mm; UD-1 mm], off the state of Pernambuco, Brazil, D-11, 08°46.5' S, 34°44.5' W, 690 m, muddy bottom, 18.XI.2000. Paratype 1, MNRJ 13.022 [SD-3.62 mm; PD-0.72 mm; H-2.1 mm; UD-0.76 mm], off the state of Alagoas, Brazil, D-31,

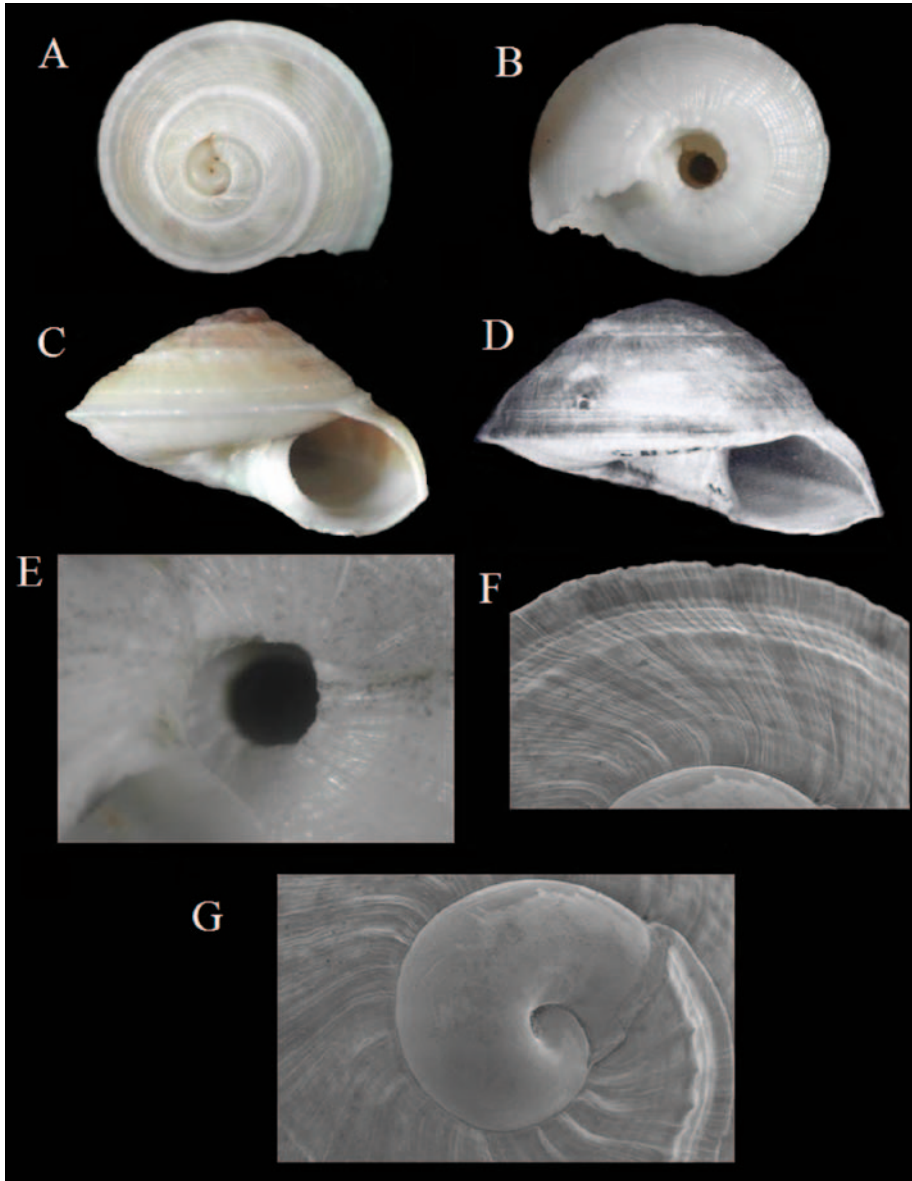


Fig. 1. — *Solatisonax rudigerbieleri* n. sp.: A. Holotype, dorsal view (Height: 2.1 mm; Diameter: 3.62 mm); B. Paratype 5 ventral view (Height: 2.5 mm; Diameter: 5.7 mm; Umbilicus Diameter: 0.9 mm); C. Paratype 4 lateral view (Height: 2.8 mm; Diameter: 6.2 mm); D. *Solatisonax injussa*, lateral view; E. Holotype, Detail of umbilicus (Umbilicus Diameter: 1.0 mm); Detail of Paratype 7 (F-G) F, detail of periphery; G. detail of protoconch (Diameter: 0.7 mm).

10°06' S, 35°46' W, 720 m, muddy bottom, 16.XII.2001; Paratype 2, MZUSP 15.642 [SD-3.3 mm; PD-0.72 mm; H-1.9 mm; UD-0.5 mm], off the state of Pernambuco, Brazil, D-01, 06°25.6' S, 34°43.9' W, 425 m, muddy bottom, 29.VIII.1999; Paratype 3, MNRJ 13.023 [SD-5.5 mm; PD-0.7 mm; H-2.4 mm; UD-0.8 mm], off the state of Pernambuco, Brazil, D-01, 06°25.6' S, 34°43.9' W, 425 m, muddy bottom, 29.VIII.1999; Paratype 4, MNRJ 13.024 [SD-6.2 mm; PD-0.8 mm; H-2.8 mm; UD - 0.9 mm], off the state of Pernambuco, Brazil, D-09, 08°45.1' S, 35°44.9' W, 500 m, muddy bottom, 12.XI.2000; Paratype 5, MNRJ 13.025 [SD-5.7 mm; PD-0.8 mm; H-2.5 mm; UD-0.9 mm], off the state of Pernambuco, Brazil, D-10, 09°04.7' S, 34°51.2' W, 520 m, muddy bottom, 17.XI.2000; Paratype 6, MZUSP 15.643 [SD-3.0 mm; PD-0.7 mm; H-2.0 mm; UD-0.6 mm]; Paratype 7, MNRJ 13.026 [SD-2.2 mm; PD-0.7 mm; H-1.2 mm; UD-0.5 mm], both off the state of Pernambuco, Brazil, D-11, 08°46.5' S, 34°44.5' W, 690 m, muddy bottom, 18.XI.2000.

*Type locality.* Off the state of Pernambuco, Brazil, 08°46.5' S, 34°44.5' W, 690 m.

*Geographic distribution.* Off the states of Pernambuco and Alagoas at depths of 425 to 720 m.

*Description.* Shell small, depressed cone-shaped, relatively thin-walled, diameter 5.8 mm, height 2.7 mm, upper side inflated, 3 inflated whorls, slightly concave areas on both sides for peripheral keel, umbilicus widely open (UD ca. 14.5-22.7% SD). Body whorl on the dorsal face with a nodular subsutural rib, which can be smooth or even absent, followed below by five spiral ribs of the same appearance and a sixth rib of either the same shape or slightly more raised than the previous ribs. Below this rib, forming a small concavity on the peripheral keel, there are three very fine, equal spiral ribs, thinner than the others found on this face. Lower peripheral rib forming a strong, smooth keel of a lighter color than the rest of the shell. Axial ornamentation with strongly prosocline growth threads. Base depressed cone-shaped, with approximately 10-11 spiral cords or threads, initially alternating between weak and strong, then increasing in size toward the umbilicus. Axial growth lines distributed throughout the base. Basal keel with strong axial nodules, at times also with a smoother appearance. Umbilicus with strong intraumbilical axial ribs, intercalated by fine growth threads and spiral threads, forming a fine reticulation. Yellowish-white coloration on the whorls of the upper side and lighter colored base. Protoconch median, smooth, inflated, distinctly heterostrophic, continuing with  $1\frac{1}{8}$  whorl after immersion, then forming a distinct vein of a darker color. Aperture angular, broad, rounded, with a peripheral keel. Parietal region strongly reflected.

*Etymology.* In homage to Dr Rüdiger Bieler of the Malacology sector of the Zoology Department at the Field Museum of Natural History (Chicago, USA).

*Remarks.* The genus *Solatisonax*, here represented by *Solatisonax rudigerbieleri* n. sp. and *Solatisonax cabrali* n. sp., is recorded for the first time for the Brazilian coast. There are no species similar to *S. rudigerbieleri* in the South Atlantic. *Solatisonax sigsbeeii* (DALL 1889) from the North Atlantic (off Bahia Honda, Cuba), is similar

to *S. rudigerbieleri* especially in the contour of anfractos, but this species has higher and granular ornamentation, and the whorls are higher and less discoidal. *S. rudigerbieleri* has lower, non-granular ornamentation. *Solatisonax injussa* Iredale 1931 from the southeastern Pacific shares with *S. rudigerbieleri* the inflated shape of the whorls and the presence of distinctly concave zones developed on both sides of the prominent peripheral keel. The two species are easily distinguished by *S. injussa* having nodular upper peripheral ribs and a convex area between the suture and UPR, with 7-12 weak, smooth spiral ribs. In *S. rudigerbieleri*, the nodular subsutural rib is either smooth or absent, which is followed by five equal weak ribs, a sixth rib that is either a bit stronger or equal to the previous ribs and three finer spiral ribs in the depression on the peripheral keel. *S. injussa* has a base with 15-20 spiral ribs or threads, which increase in size toward the umbilicus, whereas *S. rudigerbieleri* has 10-11 spiral cords on the base, which alternate between weak and strong.

***Solatisonax cabrali* n. sp.** (Fig. 2; Table 1; Table 2)

*Type material.* Holotype: MNRJ 13.027 [SD-2.4 mm; PD-0.5 mm; H-1.3 mm; UD-0.4 mm], off the state of Alagoas, Brazil, D-31, 10°06' S, 35°46' W, 720 m muddy bottom, 16.XII.2001; Paratype 1, MNRJ 13.028 [SD-2.0 mm; PD-0.6 mm; H-0.9 mm; UD-0.5 mm], off the state of Pernambuco, Brazil, D-11, 08°46.5' S, 34°44.5' W, 690 m, muddy bottom, 18.XI.2000; Paratype 2, MNRJ 13.029 [SD-2.5 mm; PD-0.6 mm; H-1.2 mm; UD-0.7 mm], off the state of Pernambuco, Brazil, D-10, 09°04.7' S, 34°51.2' W, 520 m, muddy bottom, 17.XI.2000; Paratype 3, MNRJ 13.030 [SD-2.5 mm; PD-0.6 mm; H-1.4 mm; UD-0.7mm], off the state of Pernambuco, Brazil, D-11, 08°46.5' S, 34°44.5' W, 690 m, muddy bottom, 18.XI.2000.

*Type Locality.* Off the state of Alagoas, Brazil, 10°06' S, 35°46' W, 720 m.

*Geographic distribution.* Off the states of Pernambuco and Alagoas at depths of 520 to 720 m.

*Description.* Shell very small, depressed cone-shaped, strong, diameter 2.4 mm, height 1.3 mm, upper side inflated, with  $2\frac{1}{4}$  strongly ornamented whorls, slightly concave areas on both sides of the strong peripheral keel. Umbilicus widely opened (UD ca. 16.6-28% SD). Body whorl formed on the dorsal face by a strongly nodular subsutural rib, nodules axially developed, corresponding to each of the procline axial ribs, which develop until the lower peripheral rib. Upper midrib and lower midrib smaller than the subsutural cord, upper peripheral rib more strongly nodular than the midribs, of an appearance similar to the subsutural rib; lower peripheral rib strongly nodular. Base depressed, cone-shaped. Infra-peripheral rib raised and finely nodular, separated from the lower peripheral rib by a low thin spiral cord, which borders a small, low furrow. Base ornamented by nodular spiral ribs, with the nodules axially elongated. Axial ribs coincide with the nodules of the basal keel. Umbilicus with strong intra-umbilical axial ribs, yellowish-white coloration on the upper side and base. Protoconch with

one whorl, smooth, inflated, ending in a light-colored varix. First post-embryonic whorl marked by strong prosocline axial ribs crossed by equally strong spiral ribs, forming nodules in the intersections. Aperture rounded near the inner lip, narrowing toward the outer lip, which presents a mid keel corresponding to the lower peripheral rib. Parietal region slightly expanded, columella thinly concave with a small terminal fold, above a small notch formed by the junction of the termination of the basal keel with the outer lip.

*Etymology.* In homage to Mr Enilson Cabral, environmental analyst of CEPENÉ/IBAMA, in charge of the collection of all the material studied here.

*Remarks.* *Solatisonax cabrali* n. sp. is strongly differentiated from *Solatisonax rudigerbieleri* n. sp. by a body whorl with a nodular subsutural cord with axially developed nodules corresponding to each of the prosocline axial ribs and by a very developed lower peripheral rib that is strongly nodular and rounded in its contour. In *S. rudigerbieleri*, the body whorl is ornamented by a more weakly nodular subsutural rib, which, when present, is smooth, followed by 1-5 spiral ribs of the same appearance. The sixth rib is either of the same shape or a bit more raised than the previous ribs. The lower peripheral rib forms a strong, smooth peripheral keel of a lighter color than the rest of the shell. *Solatisonax cabrali* also has affinities with *Solatisonax acutecarinata* (THIELE 1925) from Tanzania with respect to the shape of the LPR. *Solatisonax acutecarinata* differs by being larger, with 2½-4 whorls, and by having concave zones on both sides of the prominent peripheral keel; the UD corresponds to 28% of the SD, the SSR is nodular, the MR has numerous microscopic threads crossed by undulated axial pleats, forming nodules with the SSR and UPR. The UPR is prominent, but weaker than the LPR, which forms the keel. The LPR has very fine, regular nodules and the IPR is narrow and distinctly separate (BIELER 1993). *Solatisonax cabrali* reaches 1.3-2.4 mm, with the lower side inflated and slightly concave areas on both sides of the strong peripheral keel. The umbilicus corresponds to 16.6% of the SD. The body whorl is formed by a strongly nodular subsutural rib. The upper and lower peripheral ribs are more strongly nodular than the midribs and are of a similar appearance to the subsutural rib. The lower peripheral rib is very developed and strongly nodular. The depressed cone-shaped base includes a raised, finely nodular infra-peripheral rib separated from the lower peripheral rib by a thin, low spiral cord that borders a lower furrow. In *Solatisonax acutecarinata*, the base has axial pleats and numerous fine spiral threads that increase in width toward the umbilicus, which is separated from the base by a nodular spiral rib (BIELER 1993). *Solatisonax cabrali* has five nodular spiral ribs that increase progressively in size toward the basal keel, which is more strongly nodular in comparison to *Solatisonax acutecarinata*.



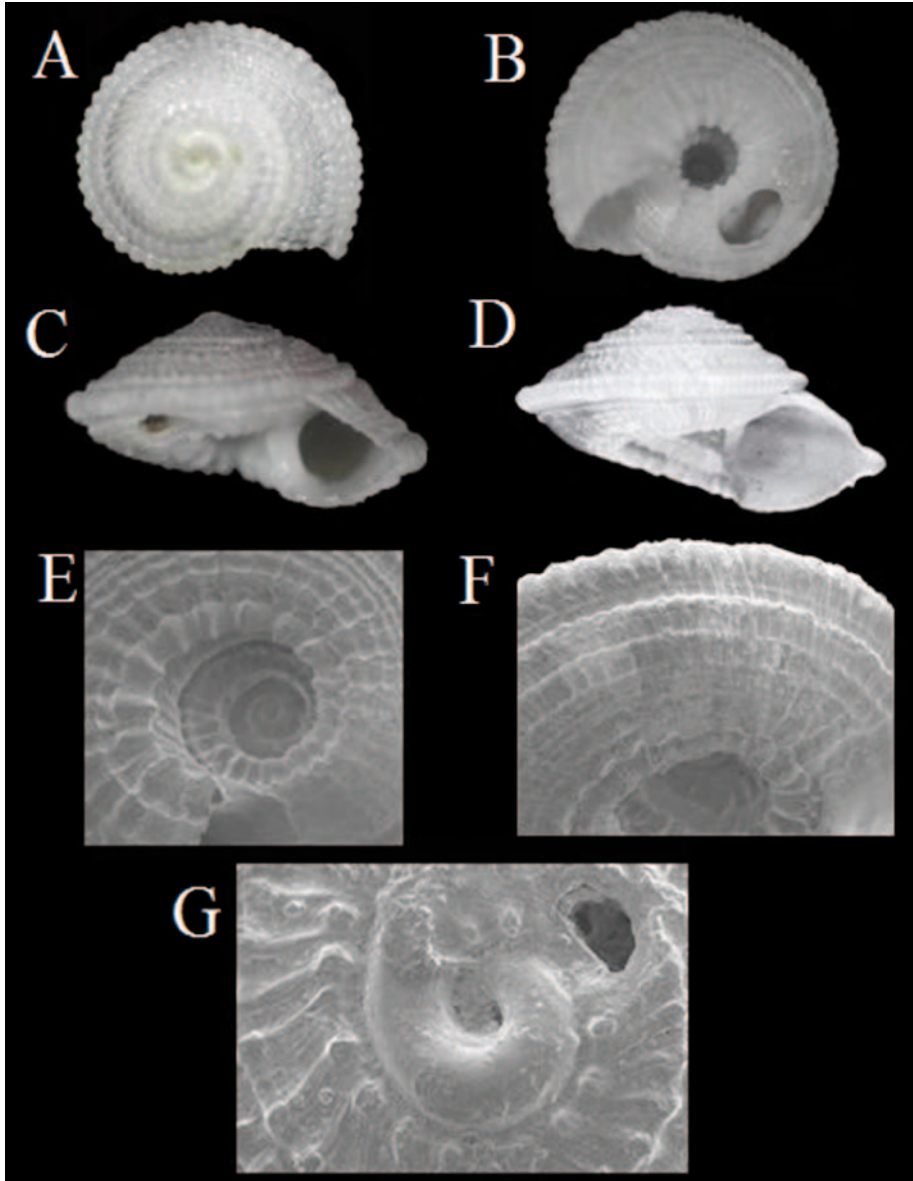


Fig. 2. — *Solatisonax cabrali* n. sp.: Holotype (A-C) A. dorsal view B. ventral view (Diameter: 2.4 mm; Umbilicus Diameter: 0.4 mm); C. lateral view (Height: 1.3 mm); D. *Solatisonax acutecarinata*, lateral view; All details of Paratype 1, E. detail of umbilicus (Umbilicus Diameter: 0.5 mm); F. detail of periphery; G. detail of protoconch (Diameter: 0.5 mm).



Genus *Psilaxis* Woodring 1928

*Type species.* By original designation, *Architectonica (Philippia) krebsii* Mörch 1875; Recent, Atlantic Ocean.

***Psilaxis clertoni*** n. sp. (Fig. 3)

*Type material.* Holotype: MNRJ 13.031 [SD-6.1 mm; PD-0.7 mm; H-2.2 mm; UD-1.1 mm], off the state of Pernambuco, Brazil, D-11, 08°46.5' S, 34°44.5' W, 690 m, muddy bottom, 18. XI. 2000.

*Type locality.* Off the state of Pernambuco, Brazil, 08°46.5' S, 34°44.5' W, 690 m.

*Geographic distribution.* Off the state of Pernambuco, 690 m.

*Description.* Shell small, depressed, cone-shaped, three whorls, diameter 6.1 mm, height 2.2 mm, upper side inflated, with rounded angulated peripheral keel, inflated whorls and moderately wide umbilicus (UD ca. 18% SD). Upper side barely sculptured, marked by weak prosocline axial ribs, stronger on the two initial whorls, as well as microscopic axial and spiral threads. Subsutural rib and midribs undeveloped. Suture well marked. Periphery formed by a prominent keel corresponding to the lower peripheral rib, no upper peripheral rib, weak infra-peripheral rib. Upper point of whorl attachment on lower peripheral rib. Base depressed, cone-shaped, inflated, marked by the presence of a single intra-peripheral rib that crosses axially with irregular thin axial ribs, which become narrower toward the strongly nodular basal keel on which nodules are distributed axially. Thin proxumbilical axial ribs, interspersed by fine axial and spiral threads, form a fine reticulation internally. Dirty-white coloration on the entire shell. Protoconch median, smooth, terminating in a reflected whitish varix, evident in the upper view. Aperture subquadratic, widened medianly due to the dilation of the outer lip, which corresponds to the termination of the peripheral keel. Parietal region very thin, with no evident reflection, columella reinforced and with slight concavity, terminating in a strong rounded thickness.

*Etymology.* In homage to Mr Antonio Clerton de Paula Pontes, Head of the CEPENÉ/IBAMA, who enabled us to carry out the dredging on the continental slope off northeastern Brazil.

*Remarks.* *Psilaxis clertoni* n. sp. is similar to *Psilaxis krebsii* Mörch 1875 of the recent western Atlantic, especially in the polished appearance of the whorls, but the upper side is inflated and the peripheral keel is rounded and angulated; the whorls are more inflated and the umbilicus is wider, corresponding to 18% of the SD. *Psilaxis krebsii* has a more depressed upper side; the whorls are weakly convex, ornamented by microscopic spiral threads, and the umbilicus is bordered by two beaded cords. *Psilaxis clertoni* has a barely sculptured upper side marked by

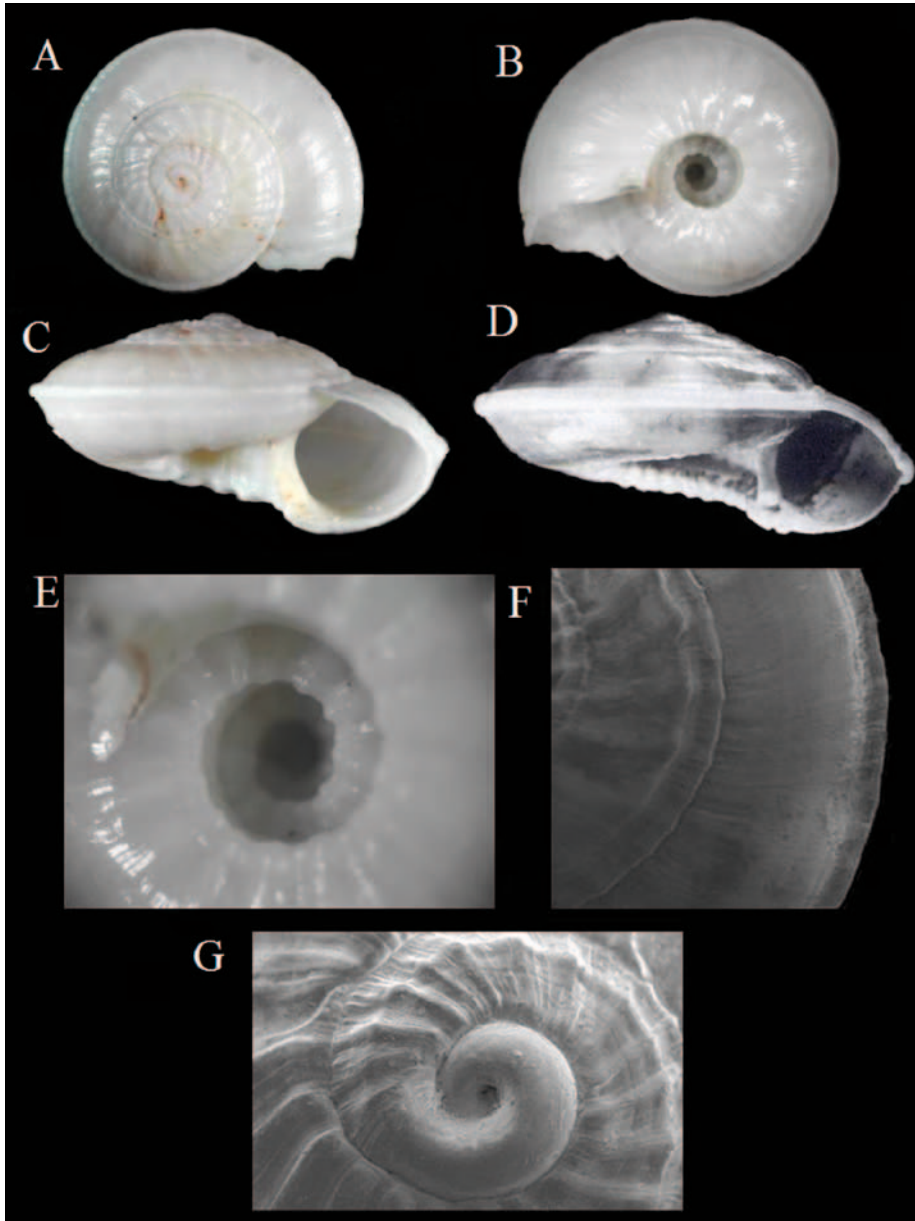


Fig. 3. — Holotype *Psilaxis clertoni* n. sp. (A-C): A. dorsal view (Diameter: 6.1 mm); B. ventral view (Umbilicus Diameter: 1.1 mm); C. lateral view (Height: 2.2 mm); D. *Psilaxis oxytropis*, lateral view; Holotype *Psilaxis clertoni* n. sp. (E-G), E. detail of umbilicus; F. upper detail whorls; G. protoconch (Diameter: 0.7 mm).

weak prosocline axial ribs, stronger on the two initial whorls, and by microscopic axial and spiral threads; the base is ornamented by thin proxumbilical axial ribs, intercalated by fine axial and spiral threads, forming a fine reticulation. *Psilaxis clertoni* may also be compared to *Psilaxis oxytropis* (ADAMS 1855) from the Indian Ocean and western to central Pacific, which is medium-sized (SD 7-19 mm), moderately flat, with a prominent angulated peripheral keel, inflated whorls and wide umbilicus, corresponding to 30% of the SD (BIELER 1993). The whorls on *Psilaxis clertoni* are more inflated, the peripheral keel is less angulated and the umbilicus moderately wide, corresponding to about 18% of the SD. *Psilaxis oxytropis* has an upper side of smooth appearance, ornamented only by weak, dark spiral threads. *Psilaxis clertoni* has thin axial ribs restricted to the initial whorls of the teleoconch.

#### Genus *Pseudotorinia* Sacco 1892

*Type species.* By original designation, *Solarium obtusum* Bronn 1831, Upper Pliocene, Italy.

#### *Pseudotorinia jonasi* n. sp. (Fig. 4)

*Type material.* Holotype: MNRJ 13.032 [SD-0.6 mm; PD-0.1 mm; H-0.3 mm; UD-0.2 mm], off the state of Pernambuco, Brazil, D-09, 08°45.1' S, 35°44.9' W, 500 m, muddy bottom, 12.XI.2000.

*Type locality.* Off the state of Pernambuco, Brazil, 08°45.1' S, 35°44.9' W, 500 m.

*Geographic distribution.* Off the states of Pernambuco and Alagoas at depths of 500 m.

*Description.* Shell very small, fragile, 1¾ whorls, diameter 0.6 mm and height 0.3 mm, outer surface depressed, weak conical suture; base weakly convex and oblique until the umbilicus. White coloration. Umbilicus widely open (UD ca. 33.3% SD). Body whorl ornamented in the dorsal view by a strongly nodular subsutural rib, followed by a thinner upper midrib, forming beads. A lower ribbed furrow is located between the upper midrib and upper peripheral rib, which is equally ornamented by strong nodules similar to those of the subsutural rib. Below this rib, there is a second ribbed furrow bordered by the nodular lower peripheral rib, which corresponds to the peripheral keel. Below this area, there is a deep furrow separated from the infra-peripheral rib, which is beaded and weaker. The basal field is conical, flat, ornamented by three similar nodular ribs. The basal keel has strong axial nodules, bordering a single proxumbilical rib, which is strongly postulate. Umbilical carina strongly nodular, delimiting the umbilical space, axially ornamented by strong ribs, interspaces ornamented by four to five fine spiral threads. Protoconch small, with little more than one whorl, smooth, inflated, with the central portion more depressed than the rest of the whorl. Transition marked by the expansion of the protoconch, forming a narrow, clear varix. Teleoconch

marked by two strong spiral ribs crossed by nodular axial ribs of the same height. Aperture angular, with the most depressed portion between the lower peripheral rib and basal keel. Parietal region reflected, upwardly reinforced in the junction with the body whorl. Columella concave, with a furrow in the termination of the umbilical carina.

*Etymology.* In homage to Dr Rainer Jonas of the Gesellschaft für Biotechnologische Forschung, who sent us the literature on the Architectonicidae of Europe and the Indo-Pacific.

*Remarks.* We consider *Pseudotorinia jonasi* n. sp. to have affinity with *Pseudotorinia architae* (COSTA 1841) and *Pseudotorinia bullisi* (BIELER et al. 1985), although other described species exhibit aspects that may also be compared to the species described here. *Pseudotorinia architae* is from the Pliocene from western Atlantic waters. It has granular spiral ribs, the SSR and 2-3 MR are distinctly developed, the UPR is stronger than the SSR and MR and the LPR forms the strong keel. In *Ps. jonasi*, the SSR is strongly nodular, followed by a thinner upper midrib, forming beads; a lower ribbed furrow is located between the upper midrib and upper peripheral rib, which is ornamented by strong nodules similar to those of the SSR. In *Pseudotorinia architae*, the base is ornamented by 1-2 narrow, distinctly separate spiral ribs; the umbilicus is bordered by a strong granular rib. *Pseudotorinia jonasi* has a basal field with three nodular spiral ribs of similar appearance and the proxumbilical rib is strongly nodular. *Pseudotorinia bullisi* exhibits very strong SSR and UPR and basal spiral sculpture formed by the infra-peripheral cord with a deep narrow excavation between it and the peripheral cord, a very strong basal keel, a strong umbilical cord and two weaker cords between the central cord and the umbilical cord. In *Pseudotorinia jonasi*, the base only has three similar nodular spiral ribs and the basal keel has strong axial nodules bordering a single proxumbilical rib. *Pseudotorinia bullisi* has approximately eight weak threads formed on the base between the infra-peripheral cord and the basal keel. In *Pseudotorinia jonasi*, the umbilical space delimited by the umbilical crenae is ornamented axially by strong, well-defined ribs, the interspaces of which exhibit four to five fine spiral threads.

Genus *Heliacus* d'Orbigny 1842

Subgenus *Torinista* Iredale 1936

*Type species.* By original designation, *Torinista popula* Iredale 1936 [= *Solarium implexum*, Mighels 1845]; Recent, Indo-Pacific.

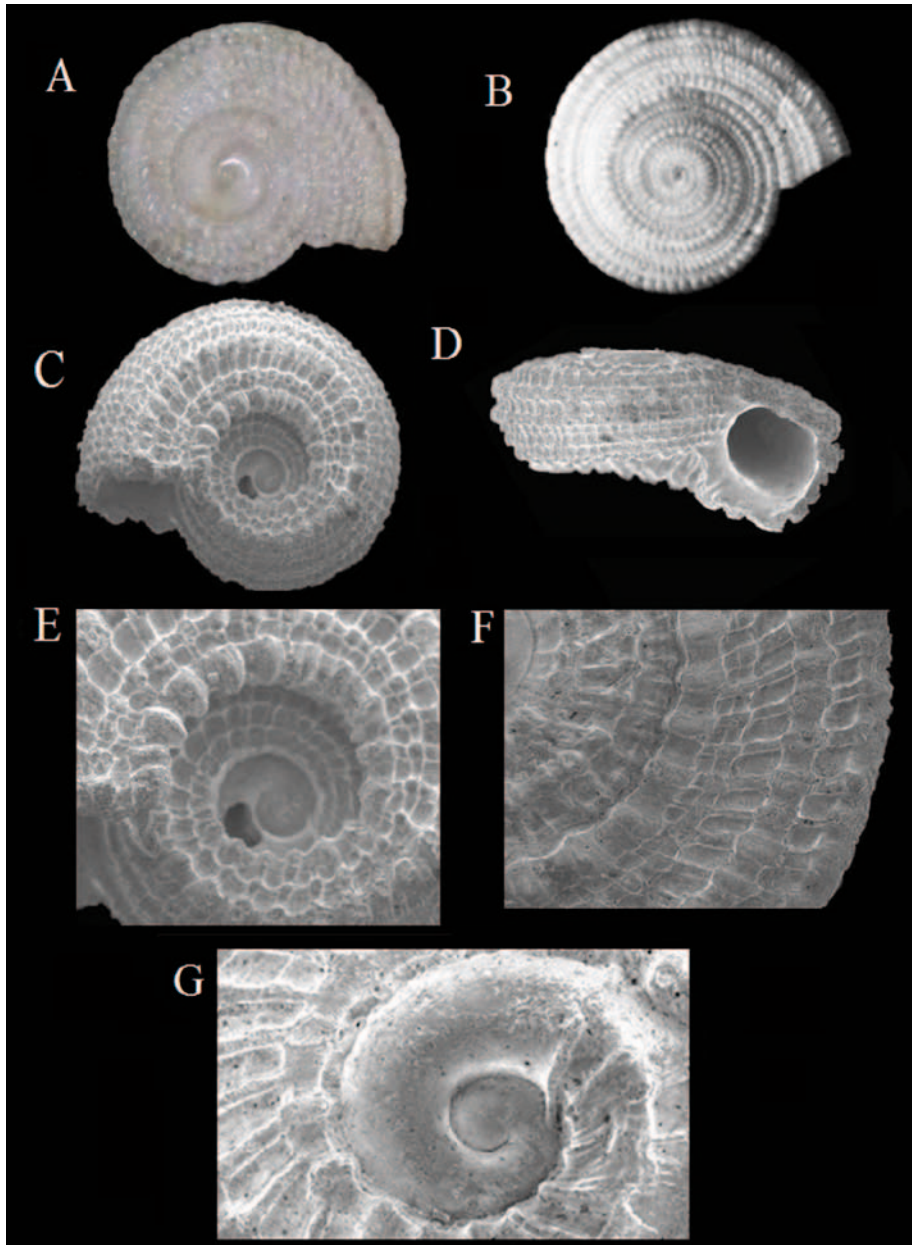


Fig. 4. — A. Holotype *Pseudotorinia jonasi* n. sp. dorsal view (Diameter: 0.6 mm); B. *Pseudotorinia bullisi*, dorsal view; Holotype *Pseudotorinia jonasi* n. sp.: (C- G): C. ventral view (Umbilicus Diameter: 0.2 mm); D. lateral view (Height: 0.3 mm); E. detail of umbilicus; F. upper detail whorls; G. protoconch (Diameter: 0.1 mm).

*Heliacus willianseverii* n. sp. (Fig. 5; Table 1; Table 2)

*Type material.* Holotype: MNRJ 13.033 [SD-3.4 mm; PD-0.5 mm; H-1.7 mm; UD-0.7 mm], off the state of Pernambuco, Brazil, D-Sinuêlo, 09°07' S, 34°53' W, 104 m, bottom with calcareous melobesia algae, 17.IX. 1999; Paratype 1, MNRJ 13.034 [SD-2.4 mm; PD-0.4 mm; H-1.1 mm; UD-0.6 mm]; Paratype 2, MNRJ 13.035 [SD-2.3 mm; PD-0.4 mm; H-1.1 mm; UD-0.5 mm]; Paratype 3, MNRJ 13.036 [SD-2 mm; PD-0.4 mm; H-0.9 mm; UD-0.5 mm]; Paratype 4, 13.037 [SD-3 mm; PD-0.4 mm; H-1.4 mm; UD-0.8 mm]; Paratype 5, MNRJ 13.038 [SD-1.5 mm, PD-0.5 mm, H-0.7 mm; UD-0.4 mm]; all off the state of Alagoas, Brazil, D-Sinuêlo 09°28' S, 35°04'W, 175 m, melobesia bottom, 25.09.1999; Paratype 6, MNRJ 13.039 [SD-1.6 mm; PD-0.4 mm; H-0.7 mm; UD-0.4 mm]; Paratype 7, MNRJ 13.040 [SD-1.9 mm; PD-0.4 mm; H-0.9 mm; UD-0.5 mm]; Paratype 8, MZUSP 15.043 [SD-1.2 mm; PD-0.3 mm; H-0.6 mm; UD-0.3 mm]; Paratype 9, MZUSP 15.044 [SD-1.8 mm; PD-0.4 mm; H-0.8 mm; UD-0.4 mm]; Paratype 10, MZUSP 15.045 [SD-1.8 mm; PD-0.3 mm; H-0.9 mm; UD-0.4 mm]; Paratype 11, MZUSP 15.046 [SD-2 mm; PD-0.4 mm; H-1 mm; UD-0.4 mm]; Paratype 12, MZUSP 15.047 [SD-2 mm; PD-0.4 mm; H-0.9 mm; UD-0.5 mm]; all off the state of Pernambuco, Brazil, D-Sinuêlo, 09°07' S, 34°53' W, 104 m, bottom with calcareous melobesia algae, 17.IX. 1999; Paratype 13, MZUSP 15.048 [SD-2.4 mm; PD-0.5 mm; H-1.1 mm; UD-0.7 mm]; Paratype 14, 15.049 [SD-2.5 mm; PD-0.5 mm; H-1.4 mm; UD-0.4 mm]; Paratype 15, MZUSP 15.050 [SD-1.9 mm; PD-0.5 mm; H-0.9 mm; UD-0.7 mm]; Paratype 16, MZUSP 15.051 [SD-2.7 mm; PD-0.5 mm; H-1.3 mm; UD-0.7 mm]; Paratype 17, MZUSP 15.052 [SD-2.1 mm;

Table 1.

Descriptive statistics of the analyzed material and morphometric relations of new species. Abbreviation: M, mean; R, range; Sd, standard deviation.

Species names		SD	PD	H	UD	SD/H	H/PD	H/UD
<i>Solatisonax rudigerbieleri</i>	R	2.2-6.2	0.7-0.8	1.2-2.8	0.5-1.0	1.5-2.2	1.7-3.6	2.4-3.8
n=8	M	4.4	0.7	2.2	0.7	1.9	2.9	2.9
	Sd	1.4	0.04	0.4	0.1	0.3	0.62	0.43
<i>Solatisonax cabrali</i>	R	2.0-2.5	0.5-0.6	0.9-1.4	0.4-0.7	1.7-2.2	1.5-2.6	1.7-3.2
n=4	M	2.3	0.5	1.2	0.5	1.7	2.0	2.0
	Sd	0.2	0.04	0.1	0.1	0.7	0.9	1.0
<i>Heliacus willianseverii</i>	R	1.2-3.4	0.3-0.7	0.6-1.7	0.3-0.8	1.4-2.5	1.4-3.4	1.5-3.5
n=20	M	2.1	0.4	1	0.5	2.1	2.3	2.1
	Sd	0.5	0.08	0.2	0.1	0.3	0.4	0.6



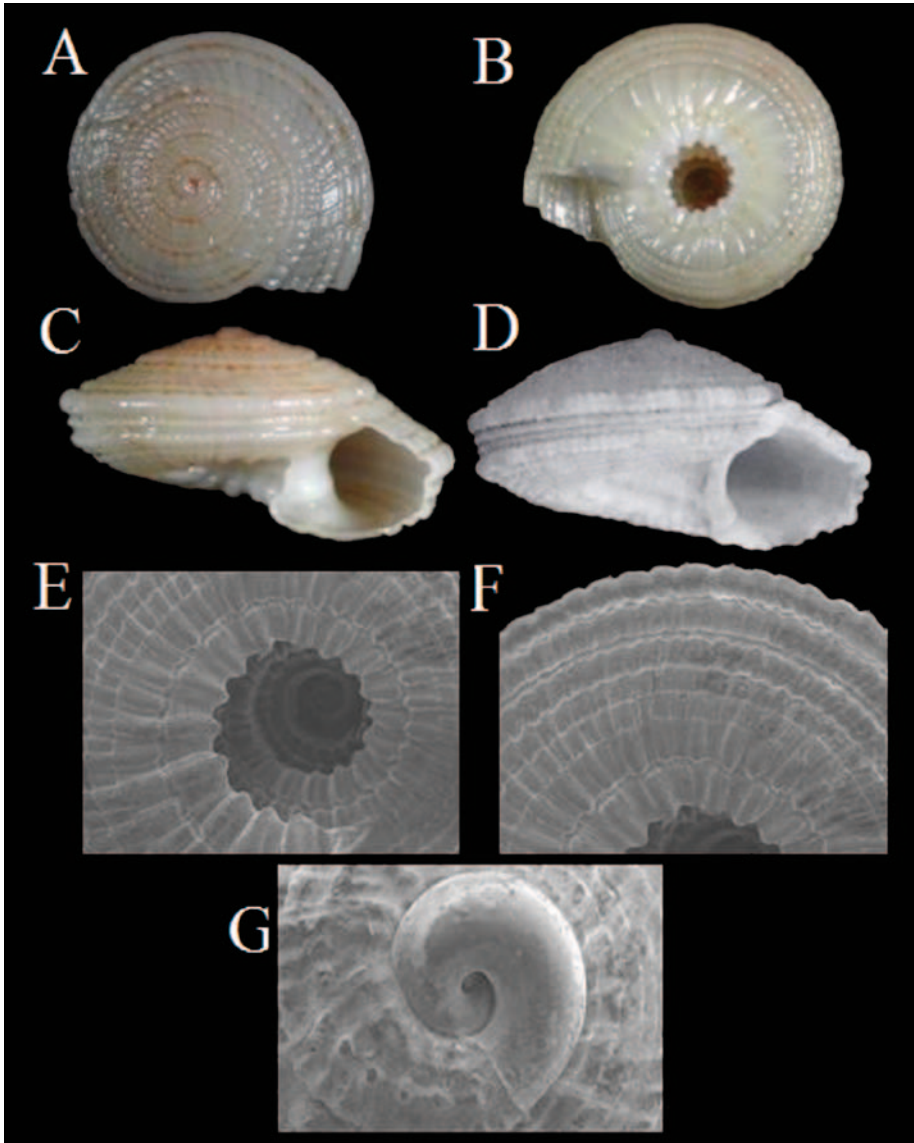


Fig. 5. — *Heliacus willianseverii* n. sp.: Holotype (A-C): A. dorsal view (Diameter: 3.4 mm); B. ventral view (Umbilicus Diameter: 0.7 mm); C. lateral view (Height: 1.7 mm); D. *Heliacus hyperionis*, lateral view; Detail of Paratype 12 (E-G), E. view of umbilicus and circumbilical cord; F. view of basal field; G. protoconch (Diameter: 0.5 mm).

Table 2.

Results of statistical analyses. Abbreviations: r, coefficient; p, probability.

Species names	SD-H	PD-H	UD-H
<i>Solatisonax rudigerbieleri</i>			
Y = a *X <sup>b</sup>	H' = 0.829 *SD <sup>0.6647</sup>	PD = 0.6659 *H <sup>0.1281</sup>	UD = 0.3737 *H <sup>0.8675</sup>
Growth	- allometric	- allometric	- allometric
r	0.93	0.61	0.86
p	<0.0005	<0.1	<0.0056
<i>Solatisonax cabrali</i>			
Y = a *X <sup>b</sup>	H' = 0.2823 *SD <sup>1.6862</sup>	PD = 0.5882 *H <sup>0.1518</sup>	UD = 0.5268 *H <sup>0.3566</sup>
Growth	+ allometric	- allometric	- allometric
r	0.92	0.32	0.25
p	<0.0713	<0.678	<0.7485
<i>Heliacus willianseverii</i>			
Y = a *X <sup>b</sup>	H' = 0.4744 *SD <sup>1.0037</sup>	PD = 0.4291 *H <sup>0.3958</sup>	UD = 0.5065 *H <sup>0.7547</sup>
Growth	+ allometric	- allometric	- allometric
r	0.9	0.55	0.76
p	<00001	<0.0103	<0.0001

PD-0.4 mm; H-0.9 mm; UD-0.4 mm]; all off the state of Sergipe, Brazil, D-Sinuelo 11°58.7' S, 36°49.2' W, 100 m, muddy bottom, 01.XI.2000; Paratype 18, MNRJ 13.041 [SD-2.5 mm; PD-0.7 mm; H-1.2 mm; UD-0.6 mm]; Paratype 19, MNRJ 13.042 [SD-1.8 mm; PD-0.4 mm; H - 0.8 mm; UD-0.5 mm]; both off the state of Rio Grande do Norte, Brazil, D-21 04°15' S, 37°21' W, 177 m, muddy bottom, 09.XI.2001.

*Type locality.* Off the state of Pernambuco, Brazil, 09°07' S, 34°53' W, 104 m.

*Geographic distribution.* Off the states of Pernambuco, Alagoas, Sergipe and Rio Grande do Norte at depths of 104 to 177 m.

*Description.* Shell small, reinforced, disk-shaped, diameter 3.4 mm, height 1.7 mm, upper side inflated, depressed, cone-shaped, 3/8 angular whorls, umbilicus wide. Umbilicus wide (UD ca. 16-36.8% SD) with axial ribs crossed by fine

spiral threads, forming a very fine reticulum. Body whorl with 3-4 strong spiral ribs bordered by the peripheral keel, which corresponds to the lower peripheral rib. The first spiral rib is the strongly nodular subsutural rib, which ornaments the well-marked suture, followed by two spiral ribs, the upper midrib and lower midrib, which are thinner and of the same appearance or may be substituted by a broader midrib. The upper peripheral rib below becomes somewhat more reinforced than the midribs, bordered by the strong peripheral keel representing the lower peripheral rib. Axial ornamentation of the nodules of the spiral ribs. Prosocline sculpture. Base depressed cone-shaped with 5-6 spiral ribs alternating between very fine and strong, with nodules on the basal keel. Light, yellowish-white coloration on the entire surface of the shell. Protoconch very small, smooth, 1 whorl, inflated, terminating in a small varix. First post-embryonic whorl with four spiral ribs crossed by strong axial ribs.

*Etymology.* In homage to Dr Willian Severi, Fishery and Aquaculture Department of the Universidade Federal Rural de Pernambuco, who assisted with the optical equipment.

*Remarks.* *Heliacus willianseverii* n. sp. resembles *Heliacus bisulcatus* (D'ORBIGNY 1845) from shallow waters along the Brazilian coast. *Heliacus willianseverii* resembles this species in the equally depressed conical shape. But *Heliacus willianseverii* differs in the body whorl with 3-4 strong spiral ribs of variable size bordered by a peripheral keel corresponding to the lower peripheral rib, which is more projected than the rib below; the base has 5-6 spiral ribs alternating between fine and strong, the innermost is strongest. *Heliacus bisulcatus* has a depressed shell, with four whorls on the teleoconch, with 4-5 nodular spiral cords and a periphery with two keels; the base is ornamented by seven beaded spiral cords. *Heliacus willianseverii* also has affinities with *Heliacus hyperionis* Bieler 1993 from Australia and New Zealand, the holotype of which is illustrated here. The two species resemble one another in the depressed conical shape, but *Heliacus hyperionis* exhibits a distinct axial ornamentation pattern, weaker than the spiral ribs; the upper side has four ribs, a weaker LPR, an IPR and two additional narrow ribs between them. *Heliacus willianseverii* has a strongly nodular subsutural rib, followed by two thinner spiral ribs; the upper peripheral rib becomes stronger than the midribs and the lower peripheral rib becomes the peripheral keel. In *Heliacus hyperionis*, the base has seven ribs that increase in width toward the umbilicus, corresponding to about 27% of the SD (BIELER 1993). *Heliacus willianseverii* has 5-6 spiral ribs alternating between very fine and strong, with an umbilical diameter between 16-36.8% of the SD.

#### DISCUSSION

The Brazilian fauna consists of seven genera and 14 species: *Architectonica nobilis* Röding 1798, *Architectonica peracuta* (DALL 1889), *Heliacus bisulcatus* d'Orbigny 1842, *Heliacus cylindricus* (Gmelin 1791), *Heliacus perrieri*

(Rochebrunne 1881), *Adelphotectonica uruguayana* (Carcelles 1953), *Psilaxis krebsi* (Mörch 1875), *Pseudomalaxis nobilis* Verrill 1885, *Pseudomalaxis centrifuga* Monterosato 1890 and the new species *Solatisonax rudigerbieleri* n. sp., *Solatisonax cabrali* n. sp., *Psilaxis clertoni* n. sp., *Pseudotorinia jonasi* n. sp. and *Heliacus willianseverii* n. sp.

The genera *Architectonica*, *Heliacus*, *Pseudomalaxis* and *Psilaxis* are distributed in the coastal region and along the continental shelf throughout Brazil. *Pseudomalaxis* and *Psilaxis* are also reported for the continental shelf (RIOS 1994, 2009). The genera *Pseudotorinia* and *Solatisonax* are recorded here for the first time for the deep southwestern Atlantic. Species from the genus *Pseudotorinia* recorded for the Indo-Pacific have a bathymetric distribution ranging from shallow depths to 900 m (BIELER 1993). The genus *Solatisonax* is recorded from deep waters and is rarely found in collections (BIELER 1993, BIELER & PETIT 2005).

*Heliacus cylindricus*, *Heliacus perrieri* and *Psilaxis krebsi* are reported for the continental shelf as well as the Rocas Atoll and the Fernando de Noronha and Abrolhos archipelagos. *Adelphotectonica uruguayana* occurs at subtropical latitudes, with records for Argentina (RIOS 1994, 2009).

The genera found in the western Atlantic are common to the Indo-Pacific. The Caribbean/Central American fauna reflects this relationship. The same is true for the Brazilian Architectonicidae fauna. The distribution of the genera on the coast of Brazil may be uniform but the bathymetric distribution follows the pattern found in other regions, with some genera found in shallow waters, such as *Architectonica*, *Heliacus*, *Pseudomalaxis* and *Psilaxis*, and others in deep waters, such as *Pseudotorinia* and *Solatisonax*.

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