On a new genus and species of Hemicytheridae (Ostracoda, Crustacea) from the southern Brazilian coast

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ABSTRACT. This study is based on 62 samples of bottom sediments and phytal collected in the upper rocky sublitoral (≤ 3 m water depth) of the central and northern coasts of Santa Catarina State (26°10'/27°50'S – 48°26'/48°40'W), southern Brazil. Living and dead ostracodes distributed among 16 families were recovered. In this paper is emphasized one new hemicytherid genus and species that are described and richly illustrated: *Auricythere sublitoralis* gen. nov., sp. nov. Some ecological and zoogeographical aspects of this new ostracode are briefly discussed.

KEYWORDS. Taxonomy, Tribe Aurilini, Santa Catarina State, Atlantic Ocean.

RESUMO. Foram coletadas 62 amostras de sedimentos de fundo e fital no infralitoral rochoso superior (≤ 3 m de profundidade) das regiões central e norte do Estado de Santa Catarina (26°10'/27°50'S – 48°26'/48°40'W). Os ostracodes vivos e mortos recuperados estão distribuídos em 16 famílias, destacando-se, neste trabalho, um novo gênero e espécie de Hemicytheridae, os quais são descritos e ricamente ilustrados: *Auricythere sublitoralis* gen. nov., sp. nov. Alguns aspectos ecológicos e zoogeográficos deste novo táxon são brevemente discutidos.

PALAVRAS-CHAVE. Taxonomia, Tribo Aurilini, Estado de Santa Catarina, Oceano Atlântico.

The study of benthic marine ostracodes of Brazil had three beginnings. BRADY (1880), in his monumental work on benthic ostracodes from different oceans, identified some species of ostracodes recovered from deep-waters adjacent to the northeastern region of Brazil, all of them collected during the H.M.S. Challenger Expedition. In 1955 and 1956, the German ostracodologist Gerd Hartmann described some new species from samples collected by hand off Santos city and Ilhabela Island, both places localized in the north coast of the State of São Paulo, southeastern Brazil. The third beginning of research on marine benthic ostracodes of Brazil was the paper of PINTO *et al.* (1978), a landmark in the study of these microcrustaceans in this country. They examined hundreds of bottom sediment samples collected along 7,408 km of the continental shelf, identifying, preliminarily, about 50 genera of Ostracoda. RAMOS (1996), COIMBRA *et al.* (1999), MACHADO *et al.* (2005) and BERGUE & COIMBRA (2008) present a more detailed bibliographic review.

Most work on marine benthic ostracodes of Brazil has been devoted to the study of species recovered from the continental shelf, and more recently from the slope. Ostracodes from coastal regions are still poorly understood, highlighting herein the studies of HARTMANN (1955, 1956), already cited above, and ORNELLAS (1974, Tramandaí town, State of Rio Grande do Sul), COIMBRA *et al.* (1992, Tamandaré Bay, State of Pernambuco), DIAS-BRITO *et al.* (1988, Sepetiba Bay, State of Rio de Janeiro), COIMBRA & BERGUE (2003, São Sebastião town, State of São Paulo), COIMBRA *et al.* (2007, Cananéia town, State of São Paulo State, and references therein) and BERGUE & COIMBRA (2011, northern coast of the State of São Paulo).

The main purpose of this study is the description of one new hemicytherid genus and species, *Auricythere sublitoralis* gen. nov., sp. nov., recovered living and dead from the upper rocky sublitoral (≤ 3 m water depth) of the central and northern coasts of Santa Catarina State (26°10’/27°50’S – 48°26’/48°40’W). The other species of ostracodes recorded in the study area, distributed in 16 families, are part of an ongoing project.

MATERIAL AND METHODS

This study was based on samples of phytal and bottom sediments collected along rocky beaches of eight municipalities of the State of Santa Catarina, between the coordinates 26°10'/27°50' S and 48°26'/48°40' W (Fig 1; Tab I).

Most of the southern and southeastern coast of Brazil, including the sampled region, presents micro-tidal regime (amplitude ≤ 2 m), and is inserted in the Southeast Coastal Region (Cabo Frio – Cabo de Santa Marta),

Tab I. Occurrence of *Auricythere sublitoralis* gen. nov., sp. nov. in the study area.

Sample	Municipality	Beach	Coordinates	Substrate	N° carapaces	N° valves
M0901N	Florianópolis	Armação	27°43'S/48°30'W	Algae	0	2
M0904N	Florianópolis	Armação	27°43'S/48°30'W	Algae	0	2
M0905N	Florianópolis	Ponta das Canas	27°23'S/48°26'W	Sediments	0	2
M0910N	Florianópolis	Naufragados	27°50'S/48°33'W	Algae	1	6
M0955N	Barra Velha	Grant	26°41'S/48°40'W	Algae	1	0
M0941N	Porto Belo	Estaleiro	27°07'S/48°31'W	Algae	0	3
M0942N	Porto Belo	Estaleiro	27°07'S/48°31'W	Algae	10	6
M0943N	Porto Belo	Estaleiro	27°07'S/48°31'W	Algae	12	14
M0946N	Bombinhas	Tainha	27°12'S/48°30'W	Algae	0	1
M0947N	Bombinhas	Tainha	27°12'S/48°30'W	Algae	4	0
M0960N	Bombinhas	Sepultura	27°08'S/48°28'W	Algae	6	1
M0961N	Bombinhas	Sepultura	27°08'S/48°28'W	Algae	11	11
M0962N	Bombinhas	Sepultura	27°08'S/48°28'W	Sediments	1	1
M0949N	Bombinhas	Sepultura	27°08'S/48°28'W	Alga	2	0
Total					48	49

formed mainly by sandy beaches with intermittent rocky spits (COUTINHO, 2000; TESSLER & GOYA, 2005). According to PEREIRA *et al.* (2009), the seawater average surface temperature ranges from 21° to 24°C in the months of April and May, during which the fieldwork was conducted (see HESP *et al.*, 2009 for additional information on the study area).

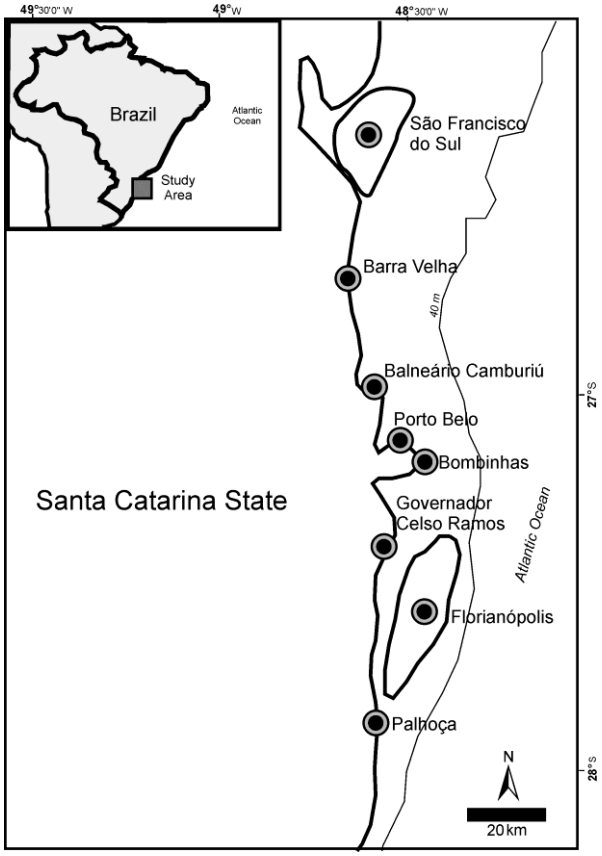


Fig. 1. Location map of the study area.

The samples were hand collected immediately after the low tidal mark, reaching up to 3 m depth. Encrusting algae were scraped off and bagged, while arborescent algae had some branches involved in a plastic bag and then this piece of seaweed was cut off from the plant. The sediment was collected with the aid of a small shovel. All 62 samples (10 from bottom sediments and 52 phytal) were fixed in 8% formaldehyde in the field. In the laboratory, the algal material was washed through a 0.250 mm mesh and all specimens (living and dead) were picked under stereomicroscope. Living specimens were stored in vials containing alcohol 70%, and empty carapaces and isolated valves were glued in micropaleontological slides.

The material of *Auricythere sublitoralis* gen. nov., sp. nov. herein examined is held in the collections of the 'Museu de Paleontologia', Universidade Federal do Rio Grande do Sul (UFRGS), Section of Ostracoda. The figured specimens are identified by the prefix MP-O. All SEM

photographs were taken at the 'Centro de Microscopia Eletrônica' at UFRGS. Morphological abbreviations: LV, left valve; RV, right valve; c, carapace; v, valve; ♀, female; ♂, male. Unfortunately, the paratype MP-O-2469 was lost after SEM procedures.

TAXONOMY

Family Hemicytheridae

Subfamily Hemicytherinae

Tribe Aurilini

Auricythere gen. nov.

Type species: *Auricythere sublitoralis* sp. nov., by monotypy.

Diagnosis. Carapace small, somewhat ear-shaped mainly in LV lateral view. LV conspicuously larger than RV; overlap pronounced in dorsal region and immediately above the caudal process. Surface ornamented by costae and reticulae. Ribs predominantly low, thick and somewhat truncated. Ocular tubercle well developed, crossed by a strong rib. Ventro-lateral rib not superimposed on the corresponding margin. Posterior region with vertical rib bifurcated at the top and the bottom. Accommodation groove well developed. Hinge holamphidont; LV posterior socket with a conspicuous aurila-tooth and an auxiliary anti-slip tooth at its posterior end (*sensu* Jellinek, 1995). Central muscle scars with three frontal and four adductors (1+2+1+1). The frontal ones sometimes not well defined; upper and middle scars frequently somewhat anastomosed. Large duplicature with anterior vestibule. Radial pore-canals numerous, simple and straight. Sexual dimorphism present.

Etimology. From Latin origin, *auris* = outline similar a human ear.

Remarks. According to BENSON (in MOORE & PITRAT, 1961, p. Q300), the hemicytherid ostracodes invariably have one or two of the four adductor scars subdivided. However, HAZEL (1967) claims that Hemicytherinae is the only subfamily of Hemicytheridae with one or more subdivided adductor scars.

Regarding to the frontal muscle scars, Hemicytherinae can be subdivided into two groups with two or three scars (BENSON *in* MOORE & PITRAT, 1961, p. Q300.; MORKHOVEN, 1963; HAZEL, 1967). JELLINEK (1995, tab. 2) presents a comparative table of the genera grouped into the Tribe Aurilini, highlighting that this would be the only tribe to include genera of Hemicytherinae with two frontal scars.

HAZEL (1967) proposes that Hemicytherinae should be subdivided into three major groups: *Orionina*-group, *Aurila*-group and *Muelerina*-group. However, HARTMANN & PURI (1974) erects, among others, the tribes Orioninini, Aurilini and Urocythereidini, and includes, in each of

them, the same genera proposed by HAZEL (1967), respectively, with minor changes. In turn, YAJIMA (1982) follows the proposal of HAZEL (1967) and inserts a fourth group (monogeneric) in Hemicytherinae, *Finmarchinella* Swain, 1963. Diagnostic features compared among the different tribes of Hemicytherinae, confronted to those of the new genus, indicate that *Auricythere* gen. nov. is best allocated in the Tribe Aurilini. For more details of the diagnostic characters of this tribe see JELLINEK (1995).

Auricythere gen. nov. occurs in the study area along with species of two other aurilinid genera: *Auradilus costatus* (Hu, 1979) and *Aurila ornellase* COIMBRA & BERGUE 2003. *Auradilus* JELLINEK, 1995 differs from *Auricythere* gen. nov. by well-defined diagnostic features, such as the pattern of the adductor muscle scars [1(2)+2-2-1] and the characteristic postero-dorsal shoulder. In turn, the highly diverse and cosmopolitan genus *Aurila* Pokorný, 1955 is more ear-shaped in LV lateral view and possesses a quite distinct ornamentation constituted by punctae and/or reticulae, often concentric about mid-point; never with heavy ribs. For more details of morphological features of all Aurilini genera see JELLINEK (1995, tab. 2), and only for a review of the diagnosis of *Aurila* see HARRISON *et al.* (2000).

***Auricythere sublitoralis* sp. nov.**

(Figs 2-21)

Mutilus sp. 1 DIAS-BRITO *et al*., 1988: 480, Pl. 2: 45.

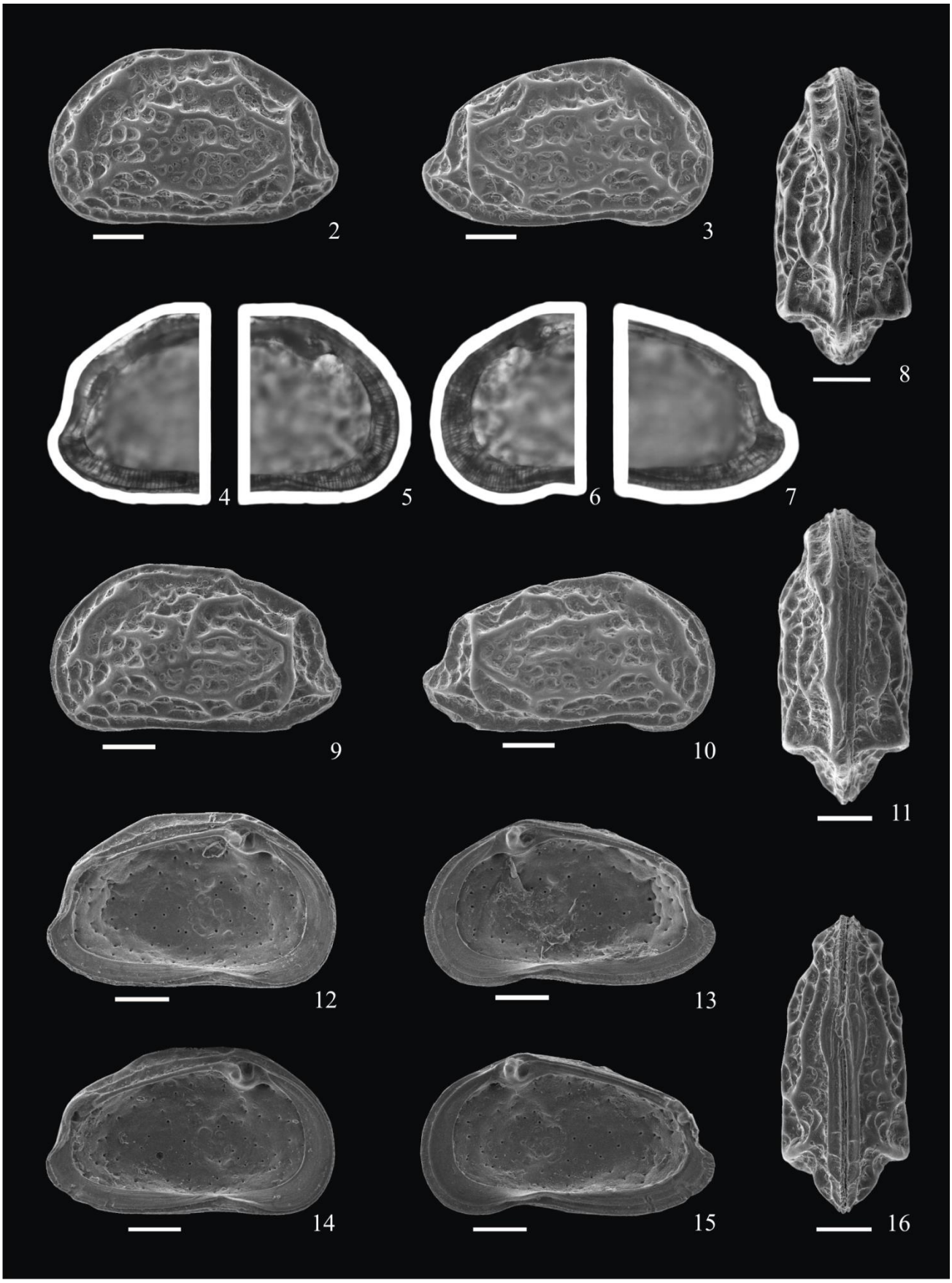
Auradilus sp. MACHADO *et al*., 2005: 240, Pl. 2: 16.

Type material. Holotype, MP-O-2467, carapace, ♀, length: 0.56 mm; height: 0.33 mm. Paratypes. MP-O-2468, carapace, ♂, length: 0.54 mm; height: 0.30 mm; MP-O-2469, carapace, ♀, length: 0.52 mm; height: 0.30 mm; width: 0,24 mm; MP-O-2470, carapace, ♂, length: 0.53 mm; height: 0.30 mm; width: 0,24 mm; MP-O-02471, carapace, ♀, length: 0.53 mm; height: 0.31 mm; MP-O-2472, carapace, ♂, length: 0.53 mm; height: 0.30 mm; MP-O-2473, carapace, ♂, length: 0.52 mm; length: 0.28 mm.

Etymology. From Latin origin, *sublitoralis* = situated near the seashore, because of its first record being restricted to very shallow coastal waters.

Type locality. Holotype: sample M0943N, Porto Belo town, Estaleiro beach, 27º07'S/48º31'W, on algae. Paratypes: MP-O-2468, sample M0941N; MP-O-2469 and MP-O-2473, sample M0961N; MP-O-2470, sample M0942N; MP-O-2471N, sample M0947N; MP-O-2472, sample M0943N. For more details, see Tab I.

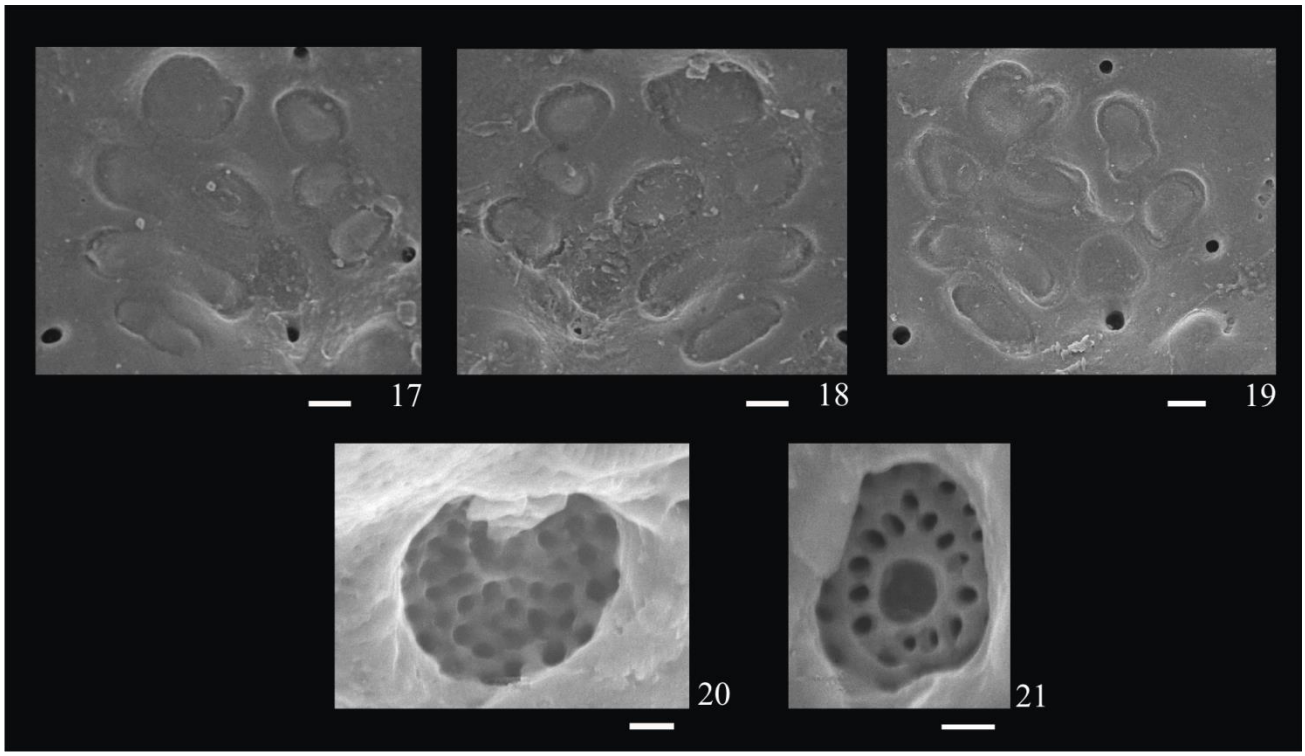
Occurrence. See Tab I.



Figs 2-16. *Auricythere sublitoralis* gen. nov., sp. nov.: 2, MP-O-2467, LV, ♀; 3, MP-O-2467, RV, ♀; 4, MP-O-2467, LV, ♀, posterior marginal pore-canals, not in scale; 5, MP-O-2467, LV, ♀, anterior marginal pore-canals, not in scale; 6, MP-O-2467, RV, ♀, anterior marginal pore-canals, not in scale; 7, MP-O-2467, RV, ♀, posterior marginal pore-canals, not in scale; 8, MP-O-2469, c, ♀, dorsal view; 9, MP-O-2468, LV, ♂; 10, MP-O-2468, RV, ♂; 11, MP-O-2470, c, ♂, dorsal view; 12, MP-O-2471, LV, ♀, internal view; 13, MP-O-2471, RV, ♀, internal view; 14, MP-O-2472, LV, ♂, internal view; 15, MP-O-2472, RV, ♂, internal view; 16, MP-O-2473, c, ♂, ventral view. The scale of all specimens = 100 µm, if no other indication.

Description. Carapace small, thick-shelled, somewhat ear-shaped mainly in LV lateral view. Maximum height at anterior cardinal angle. In dorsal view, compressed and with subparallel sides. Maximum width in the posterior region, poorly defined. LV conspicuously larger than RV, the margin of which overlaps it in dorsal region and immediately above the caudal process. In lateral view, anterior margin rounded, gently concave immediately in front of the anterior cardinal angle in RV. Posterior margin with discrete caudal process, more developed in RV. Dorsal margin slightly convex, sloping posteriorly, obscured by the ornamentation in LV. Ventral margin sinuous, with evident oral concavity more developed in RV. Surface ornamented by numerous ribs intercalated by depressed and reticulate areas. Ribs predominantly low, thick and somewhat truncated. Posterior region with a vertical rib subparallel to the correspondent margin, bifurcated at the top and the bottom: at the top, a short branch runs forwards and upwards while the second one reaches the posterior cardinal angle; at the base, a longer and sinuous branch runs forwards and downwards while the shorter and more rectilinear branch runs downward, turning forward before reaching the ventral margin. Eye tubercle conspicuous, crossed by a strong rib, more robust in its anterior branch that ends at about half height. Ventro-lateral rib delicate, not overlapping the corresponding margin. Six to seven well-developed reticulae adjacent to the anterior margin. Normal pore-canals sieve-type, scattered on the costae and muri. Internal view. Accommodation groove well developed in LV. Hinge holamphidont. LV posterior socket with a conspicuous aurila-tooth and an auxiliary small anti-slip tooth at its posterior end (*sensu* Jellinek, 1995). Large duplicature with a conspicuous selvage nearest to the external margin anteriorly. Anterior vestibule narrow and elongated. Radial pore-canals numerous, simple and straight, more abundant anteriorly. Central muscle scars with three frontal and four adductors (1+2+1+1), as follows: dorsal rounded, dorsomedian subdivided, dorsoventral sinuous and elongated, and ventral subelliptical. The frontal ones sometimes not well defined; upper and middle scars frequently somewhat anastomosed. Sexual dimorphism present. Males with a little more developed caudal process and a less arched dorsal margin.

Remarks. DIAS-BRITO *et al*. (1988) and MACHADO *et al*. (2005) identified erroneously specimens of *Auricythere sublitoralis* sp. nov. as *Mutilus* sp. 1 and *Auradilus* sp., respectively. However, the work of BONADUCE *et al.* (1987) considered *Mutilus* Neviani, 1928 as an extinct genus whose occurrences are restricted to the Mediterranean Neogene and Quaternary. In respect to the ornamentation, *Mutilus* bears a typical butterfly-shape in the central area of



Figs 17-21. *Auricythere sublitoralis* gen. nov., sp. nov.: 17, MP-O-2472, LV, ♂, central muscle scars; 18, MP-O-2472, RV, ♂, central muscle scars; 19, MP-O-2471, LV, ♀, central muscle scars; 20, MP-O-2468, RV, ♂, normal pore sieve-type; 21, MP-O-2468, RV, ♂, normal pore sieve-type. Scale bars: 17-19 = 10 µm; 20, 21 = 1 µm.

the valves, present in all its species. Besides, this aurilinid fossil genus possesses a well-defined frame-rib, not developed in *A. sublitoralis* sp. nov. On the other hand, *Auradilus* features outline, ornamentation and central muscle scars very different of the new ostracode herein described, as already discussed above.

DISCUSSION AND CONCLUSIONS

In the Sepetiba Bay, DIAS-BRITO *et al.* (1988) recorded living and dead *Mutilus* sp. 1 (= *Auricythere sublitoralis* sp. nov.) in the biofacies 9 (muddy sand, 4-14 m water depth) and 10 (sand, 5-7 m water depth), regions where the temperature ranges from 23°C to 24°C. These two biofacies occur in stable areas, where salinity variations are practically nonexistent.

Empty shells and isolated valves of *Auricythere sublitoralis* sp. nov., erroneously identified as *Auradilus* sp., were recorded only in three samples (out of 43) by MACHADO *et al.* (2005). The samples consisted of sand and were collected from the inner shelf (43.5 to 57 m water depth) off Cabo Frio town (State of Rio de Janeiro).

According to WEBER (1994) and STEVENSON *et al.* (1998), the most important oceanographic feature of this area is the presence of a strong intermittent upwelling, more common in spring and summer, because coastal waters have an annual average temperature around 18°C.

Auricythere sublitoralis sp. nov. was recorded along rocky beaches of four municipalities (Tab. I). This species occurs in three major algal groups, as follows: (i) green algae, which occurs mostly in clusters of different species, as already verified by PUPO *et al.* (2011); (ii) brown algae of the genus *Sargassum*, also forming groups of different species, which also agrees with the observations of PUPO *et al.* (2011); and (iii) red algae, represented by fewer species.

The second author performed the analysis of 500 samples collected both by Phillips and van Veen grabs during a series of cruises throughout the Brazilian continental shelf between Rio de Janeiro (lat. 21ºS/long.40ºW) and Rio Grande do Sul states (lat. 35ºS/long. 54ºW), and did not record the presence of this new taxon. The study of these samples is part of a long-term project whose goal is to describe the Ostracoda living on the southern Brazilian continental shelf (see RAMOS *et al.* 2009, 2012 for further details).

Therefore, this new taxon is an ostracode typical of euhaline and temperate very shallow waters, probably occurring mainly on phytal substrates. However, the complete geographical distribution of *Auricythere sublitoralis* sp. nov. is still not well defined.

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