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Stephanoscyphistoma corniformis (Komai, 1936) (Cnidaria, Scyphozoa, Coronatae) from the north coast of São Paulo, Brazil.[3]

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SILVEIRA, F.L. da; MORANDINI, A.C. *Stephanoscyphistoma corniformis* (Komai, 1936) (Cnidaria, Scyphozoa, Coronatae) from the north coast of São Paulo, Brazil. **Semina:** Ci. Biol./Saúde, Londrina, v. 17, n. 2, p. 137-145, Jun. 1996.

ABSTRACT: *The Coronatae scyphistomae* ***Stephanoscyphistoma corniformis*** *(Komai, 1936) are recorded for the first time along the Brazilian coast and their supportive periderm cones are re-described. It is also the second record of a scyphistoma in Brazil and of a Coronatae scyphistoma in the western South Atlantic.*

KEY-WORDS: *Cnidaria; Scyphozoa; Coronatae;* ***Stephanoscyphistoma****; taxonomy; South Atlantic.*

Introduction

The polypoid stage in the order Coronatae is a scyphistoma within a supportive periderm cone (WURMBACH & SIEWING, 1985). The periderm sheath all-round the scyphistoma is a distinguishing character of Coronatae, considering the other extant orders of Scyphozoa (CHAPMAN & WERNER, 1972), and resembles the skeleton of extinct order Conulata (WERNER, 1973). The medusoid stage is a medusa with the coronal furrow encircling the umbrella, below which there are pedalia equal in number with the solid marginal tentacles and the rhopalia (RUSSEL, 1970). The Coronatae scyphistomae are frequently found in benthos samples (LELOUP, 1937; KRAMP, 1962; ALLWEIN, 1968), many times from the deep-sea (KRAMP, 1959 AND JARMS, 1990), and are usually processed as other dredged benthic samples without any concern to sort and rear them.

There is an independent systematic classification for the polyp and the medusa of Coronatae likewise other metagenetic Cnidaria (MAYER, 1910). The few works that have changed Coronatae systematics, repporting the entire life cycles, are WERNER (1971a; b; 1983), ORTIZ-CORP'S, CUTRESS & CUTRESS (1987) and JARMS (1990). Nevertheless, there is an old record to suggest the correspondence between a certain scyphistoma and a medusa of Coronatae (METSCHNIKOFF, 1886 *in* KOMAI, 1935).

JARMS (1990: 11) briefly reviewed the genera synonym names of Coronatae scyphistomae - *Stephanoscyphus* Allman, 1874 = *Spongicola* Schulze, 1877 - and updatted the nomenclature to predict the situations in which the life cycle is known and starting from the scyphistomae. If there is any strobilation, the genus name is that of the medusa group, *Nausithoe* Kölliker, 1853 or *Linuche* Eschscoltz, 1829. If the sole

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material were the scyphistoma, he recomended to adopt the genus collective group name *Stephanoscyphistoma* Jarms, 1990, a provision well stablished in The International Code of Zoological Nomenclature (1985).

In this paper a Coronatae scyphistoma from the Brazilian continental shelf and upper slope is described and identified as *Stephanoscyphistoma corniformis* (Komai, 1936). Recently, Silveira & Morandini (1997) described the life cycle of a Nausithoidae from São Paulo, Brazil.

Material and Methods

The examined materials are 82 benthic samples of scyphistomae obtained during the project to study **the structure and function of the continental shelf ecosystem from the southeastern Brazilian bight*** , from 7 stations (see Table 1). All samples were sorted, fixed and preserved in ethanol 70. Part of the studied material is deposited in the collection of Cnidaria Museu Nacional, UFRJ, Rio de Janeiro, Brazil; **A** - small scyphistoma growing on larger one, the latter attached to small calcareous substrate, St. 3, 8.XII.1988, 2422,3' **S** - 4418,0' **W**, 240 m, dredge, N/OC Prof. Besnard - MNRJ 02688; **B** - one scyphistoma without pedal disk, St. 14, 6.XII.1988, 2442,5' **S** - 4430,0' **W**, 320 m, dredge, N/OC Prof. Besnard - MNRJ 02689; C - one scyphistoma in wholemount preparation, St. 3, 8.XII.1988, 2422,3' **S** - 4418,0' **W**, 240 m, dredge, N/OC Prof. Besnard - MNRJ 02690.

The wholemount preparations followed mounting and staining techniques with Mayer Paracarmin according to Knudsen (1966).

Specimens fixed and preserved in ethanol 70, re-fixed in formalin 4, were employed for histological preparations. They were dehydrated and imbedded with Paraplast following the method to soften the cuticle with N-butil alcohol (Gatenby, 1937:97). Sections were stained with Mallory Tricromic after counter staining cell nuclei with Weigert's Hematoxylin (Mahoney, 1973:269-270).

All measurements were done with a compound microscope and drawings were made with a camera lucida.

Eighteen specimens, 4 wholemount and 14 ready made preparations, were employed to measure the relationship between base length : height of spines per set (set = a distinct whorl of spines), number of spines in each set and total length of periderm cone. The specimens were chosen among the lighter periderm ones and in which there were few debries within the cone.

Wholemount preparations and sections were employed to study and to draw the spines morphology. Sixteen sections of one scyphistoma were examined to measure the thickness of periderm layers.

Specimens fixed and preserved in ethanol 70 were employed for scanning electron microscopy (SEM) preparations. The periderm cones were sectioned transversely over and below a single whorl of distal internal spines. The periderm ring fragments were dehydrated through ethanol solutions of 80, 85, 90, 95 and 100 (5 min. each). The fragments were then immersed in hexamethyldisilazane (HMDS) for 5 min, air dried at room temperature, and mounted on aluminum stub using double-sided tape with the borders covered by a film of silver paste. The specimens were kept in a desiccator overnight. They were sputter coated with 10 nm of gold in a Balzers S-SCD 050 sputter coater. Specimens were examined at 5 to 20 kV in a Zeiss DSM 940 SEM and photographed on Kodak T-Max 100 film.

Results

The scyphistomae are solitary polyps usually fastened to hard substrate - in the materials examined these were always calcareous substrates, e.g. fragments of mollusk shells. They attach to the substrate by a small and flattened periderm pedal disk (Fig. 1). The periderm cone around the soft tissues can be either slightly curved or almost straight.

The soft tissues of all specimens were observed in the proximal 1/3 of the periderm cone length. It was impossible to remove the soft parts without severely damaging them.

The periderm cones are usually light brown, transparent and with glossy surface, but some of them are dark brown and opaque. In a few instances there were small scyphistomae growing on larger ones, a possible auto-epizoism case (Fig. 1A). Some specimens showed a second periderm cone growing out the aperture of another cone (Fig. 1B), suggesting regenerative growth. A pattern of many variable transverse rings, more or less proeminent and with longitudinal striations can be see on their surface (Fig. 1A and B, 2A and B). The striations are also variable and may form a scale-like pattern. On the inside there are hollow periderm processes (= spines or teeth) directed toward the centre of the cone (Figure 1A and B, 2A and B, 3A and B, and 5).

The spines are arranged in distinct whorls (= sets), more or less in the same plane. Under the

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Table 1. Number of specimens (n), sample date, location and abiotic data from sampling stations in which *Stephanoscyphistoma corniformis* (Komai, 1936) were obtained (according to Sumida, 1994).

St.	(n)	Date	Latitude (ºS)	Longitude (ºW)	Depth (m)	Temp. (ºC)	Sal. ($^{O}/_{OO}$)	O_2 Sat. (%)
3	2	08.12.88	24º22,3'	44º18,0'	240	13.41	35.284	81.7
8	57	08.12.88	24º31,0'	44º28,0'	250	———	35.275	———
9	2	08.12.88	24º34,2'	44º26,0'	350	13.25	35.184	81.2
10	7	07.12.88	24º41,1'	44º18,5'	510	17.88	35.204	89.8
12	2	20.07.87	24º36,4'	44º33,3'	184	16.50	35.411	81.5
13	2	06.12.88	24º35,2'	44º32,8'	248	14.61	35.429	82.2
14	10	06.12.88	24º42,5'	44º30,0'	320	15.14	35.550	82.8

stereomicroscope they are variable in number, at least 1 up to 6 teeth per whorl. The histological sections showed a regular number of 4 larger teeth (perradium), placed cross-wise, and between them there are smaller spines (interradium), no more than one teeth in the middle of each space (Fig. 3B). The outline of the spine base is elliptical, with the main axis parallel to the longitudinal axis of the cone (Fig. 2A and B); in the larger spines, the end of the ellipsis directed toward the base of the scyphistoma is blunt (Fig. 2B). The apex of the spine has a variable shape, sharp to blunt, and its wall shows distinct thickness. The gross morphology of the spines is also variable, except for their base outlines. In the SEM pictures, the apexes of large teeth in the distal set are in the shape of an hatchet blade, with jagged edges (Fig. 5), or in the shape of an arrow point .(Fig. 6). The small teeth are quite variable in shape (Fig. 5 and 6).

Each spine is a hollow invagination of the inner layer of the periderm, which is thicker than the outer layer (Fig. 3A and B). The sections showed that the outer periderm layer stains more than the inner thicker layer. The average thickness values of outer and inner layers of periderm are 12 and 21 m, respectively. The inner periderm layer is usually thinner at the apex of the spine (Fig. 3A and B).

Table 2 presents the data of sequential counts and measurements of spines per set - N is the number of distinct whorls in which spine(s) had been counted and measured - expressed as minimum and maximum numbers and the ratios **base length : height** of spines as means and standard errors. In those specimens in which there were more than 10 sets it was impossible to measure the more distal spines, because they were always damaged.

Notice that: a) considering N per set, there is a decrease of set numbers among the ones closer to the cone aperture, or the last ones; b) considering the mean of the ratio **base length : height** of spines it varies between 1.59 0.2 and 2.31 0.7 (longer bases were observed in the older and newer spines series); c) considering the number of spines in each set they varied between 1 and 6.

Table 2. Spines counts (nº) and measurements (ratio **base length: height** in µm), of up to 15 specimens (see text for other explanations).

Set	nº of spines (min.-max.)	Mean ±(S)
1º (N 15)	2-5	2.06±1.0
2º (N 15)	2-6	1.72±0.5
3º (N 13)	1-6	1.59±0.2
4º (N 14)	2-6	1.74±0.2
5º (N 14)	2-6	1.66±0.2
6º (N 14)	2-6	1.77±0.2
7º (N 11)	3-6	1.91±0.2
8º (N 6)	2-6	2.06±0.2
9º (N 3)	4-6	2.29±0.5
10º (N 2)	5	2.31±0.7

The total length of periderm cone ranked between 7.5 - 20.8 mm; and, the number of sets per cone ranged between 3 and 11, but there is no direct relationship between total length and sets number, as shown in figure 4.

Figure 4 suggests that for a size class between 7.5 and 12 mm one would expect a spines set number variable between 5 and 9, although above this size class there is much variation in set number.

Discussion

In general, the solitary scyphistomae described in this paper present similarities with other solitary Coronatae species previously studied. Our observations agree with those whose descriptions were solely based on the periderm theca, e.g. *Stephanoscyphus simplex*

Kirkpatrick, 1890 (= *S. striatus*, *S. sibogae*, *S. bianconis* according to KRAMP, 1959) and *Stephanoscyphus corniformis* Komai, 1936, or on soft tissues/life cycle, e.g. *Stephanoscyphus eumedusoides* (WERNER, 1971a; 1974), *Stephanoscyphus planulophorus* (WERNER, 1971b; 1983), *Nausithoe werneri* Jarms, 1990, *Nausithoe thieli* Jarms, 1990, *Nausithoe maculata* Jarms, 1990, *Nausithoe marginata* (Kölliker, 1853) and *Nausithoe aurea* (Silveira & Morandini, 1997). Up to now, 4 colonial species are known, *Nausithoe punctata* Kölliker, 1853, *Stephanoscyphus allmani* Kirkpatrick, 1890, *Stephanoscyphus racemosus* Komai, 1936, and *Linuche unguiculata* (Swartz, 1788) (= *Stephanoscyphus komaii* Leloup, 1937).

The soft tissues were not taken into account in this study, because they were severely damaged on any attempt to remove them out of the periderm cone. On the other hand, the sections presented poor staining results of the soft tissues. We believe this is due to poor conditions of fixing/preserving in ethanol. KOMAI (1935) was able to remove the periderm theca of much contracted scyphistomae, but fixed either in Flemming or Bouin mixtures. The examination of soft parts on wholemount preparations showed that the polyp mesenteries are inserted between the inner large periderm spines, a general feature well observed for some other species.

The dark color and little transparency of the periderm cone of some scyphistomae studied in this paper resemble some specimens of *S. simplex*, as described by KRAMP (1959). The remaining periderm cone features such as surface ornamentation, spines and regenerative growth or auto-epizoism (sensu MILLARD, 1973) resemble features observed in other species, e.g. *S. planulophorus* (WERNER, 1971b; 1983) and *Nausithoe thieli* (JARMS, 1990).

The spines placed more or less at the same level in each whorl and their number variation (min. 1 - max. 6) are features also observed in some species, e.g. *Nausithoe thieli* (JARMS, 1990). Likewise, large spines alternate with small spines is a feature also observed in *N. werneri* and *N. marginata* (JARMS, 1990).

Spines with base outline in the shape of a long ellipses, the larger ones with a blunt end directed toward the base of the scyphistoma, agree with those of *S. corniformis* according to KOMAI (1936: 179 Fig. 3) and KRAMP (1959:183 Figs 12 and 13). As it is shown in Table 2, the base length is always bigger than spine height. Moreover, the periderm cone sections have always presented in each set four large and four small hollow spines, a feature that agrees with the observations of KOMAI (1936) and KRAMP (1959) to *S. corniformis*. WERNER (1983) concluded that the number (16) and the arrangement of the spines of *S. planulophorus* are diagnostic features for **earlier spines sets**, or proximal sets. JARMS (1990) concluded that the number (16) and the arrangement of the spines of *N. maculata* are diagnostic features for **any spines sets**.

Another aspect in this study is the fact that the periderm cone shows two layers with different thickness and that the spines are invaginations of the inner thicker layer. These characters were fully described for *Stephanoscyphus* sp. indet. and *Nausithoe punctata* (CHAPMAN & WERNER, 1972) and superficially described for *S. simplex* (KRAMP, 1959). In *S. corniformis* it is also possible to recognize both layers, with different thickness, reinterpreting figures 10 and 11 in KRAMP (1959).

The ratio values of **total cone length : number of sets per cone** obtained in this study are scattered among the values observed by KRAMP (1959; 1962) for *S. corniformis*, in three different geographic sample series (Figure 4), although the variation was quite large in all cases.

We identified the species of the present study as *Stephanoscyphistoma corniformis* (Komai, 1936) and therefore agreed and followed the nomenclature recommendation of JARMS (1990). The species shows a circumglobal distribution and most records refer to comparatively shallow depths, 10-94 m, in tropical and subtropical seas (KRAMP, 1959; MOORE, 1961), except for the records along the coast of Chile down to a depth of 390 m (KRAMP, 1962). This study is the second record of a scyphistoma along the Brazilian coast and the first record of *S. corniformis* in the western South Atlantic. KRAMP (1959) mentioned a previous record, Albatross Expedition, of a sample of *Stephanoscyphus simplex* far offshore from N.E. Brazil, in the Ceará Abyssal Plain, 4474-4430 m. VANNUCCI (1963) stated that although unpublished most probably there were medusae of *Nausithoe punctata* along the Brazilian coast. So far, *S. corniformis* has not been related to any medusa and there are no Coronatae medusa species along the Brazilian coast to suggest a probable connection.

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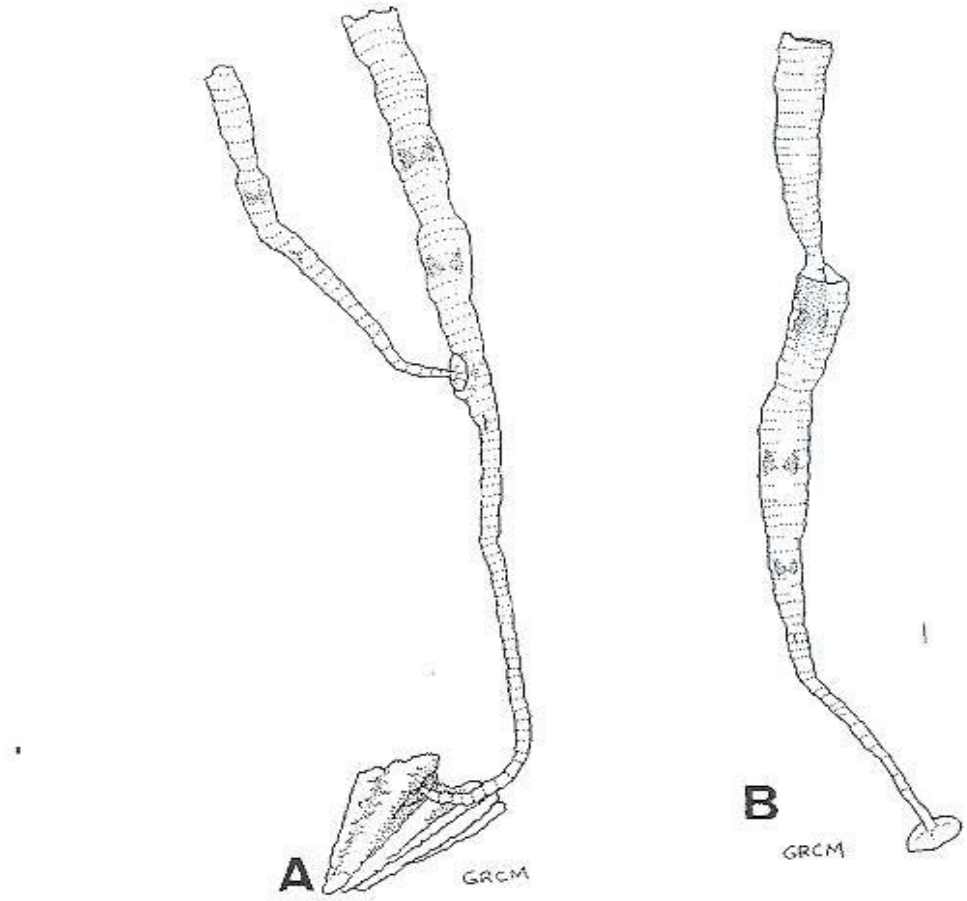

Figure 1. Drawings of preserved specimens of *Stephanoscyphistoma corniformis* (Komai, 1936). A - Small scyphistoma growing on larger one, a possible auto-epizoism case. B - Second periderm cone growing out the aperture of another cone. Scale bar: 2 mm.

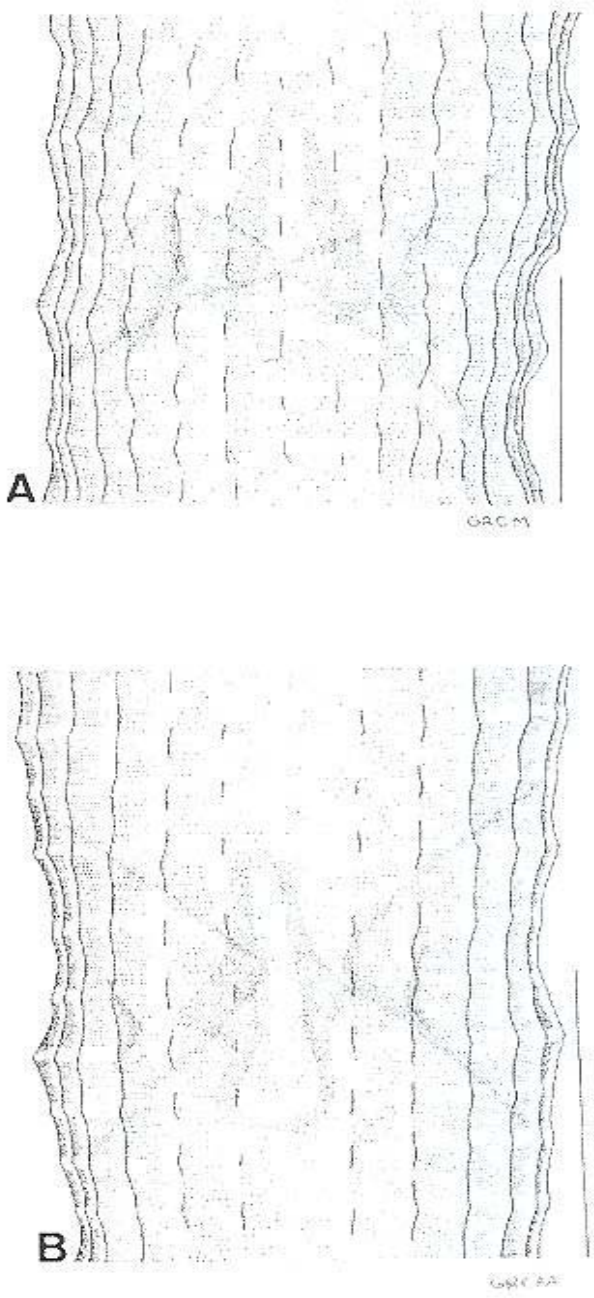

Figure 2. Drawings of segments of specimens of *Stephanoscyphistoma corniformis* (Komai, 1936) in wholemount preparation. A - Proximal part of periderm cone showing large and small spines. Scale bar: 0.3 mm (Notice the outlines of the base of central large spine and of the large lateral spines). B - Distal part of periderm cone showing large and small spines. Scale bar: 0.6 mm (Notice the outline of the base of central large spine with blunt end directed toward the base).

Figure 3. Diagrams of transverse sections of the periderm cone of *Stephanoscyphistoma corniformis* (Komai, 1936) at the level of spines sets. A - Section at the proximal level. Scale bar: 0.5 mm. B - Section at the distal level. Scale bar: 1.5 mm (Notice the presence of large and small spines).

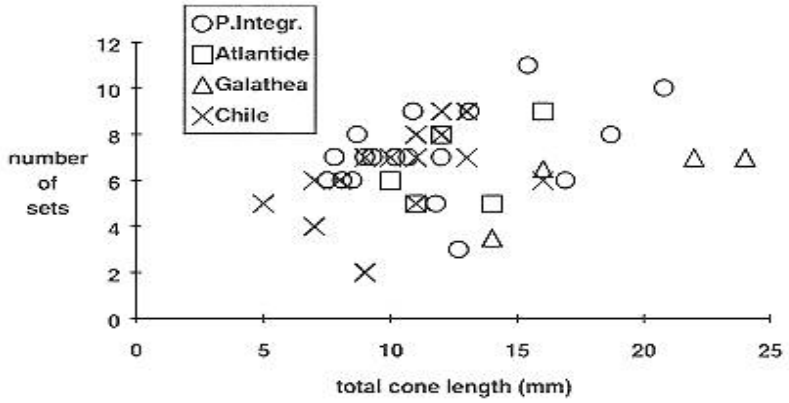

Figure 4. Scatter diagram for the relationship total cone length : number of sets per cone, presented as absolute values in this paper (P.Integr.), in samples from Chile according to Kramp (1962) and in Atlantide Expedition, and as absolute length values and as means of set numbers in Galathea Expedition, according to Kramp (1959).

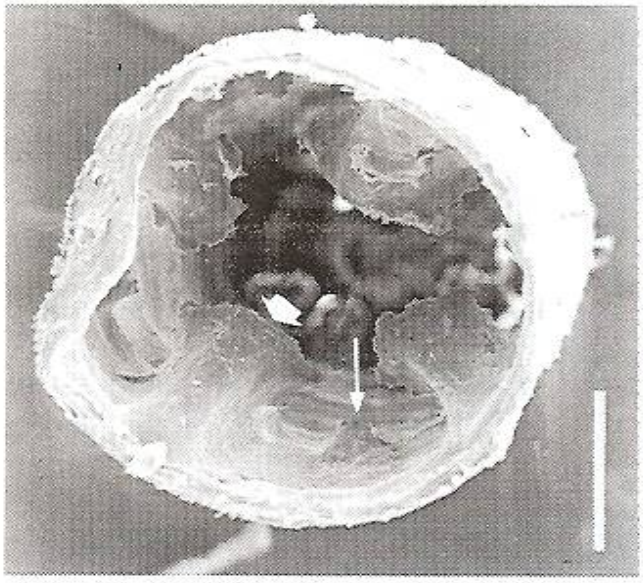

Figure 5. Distal set with 8 teeth in the periderm cone of *Stephanoscyphistoma corniformis* (Komai, 1936). Arrows point to large and small teeth. Scale bar: 200 µm.

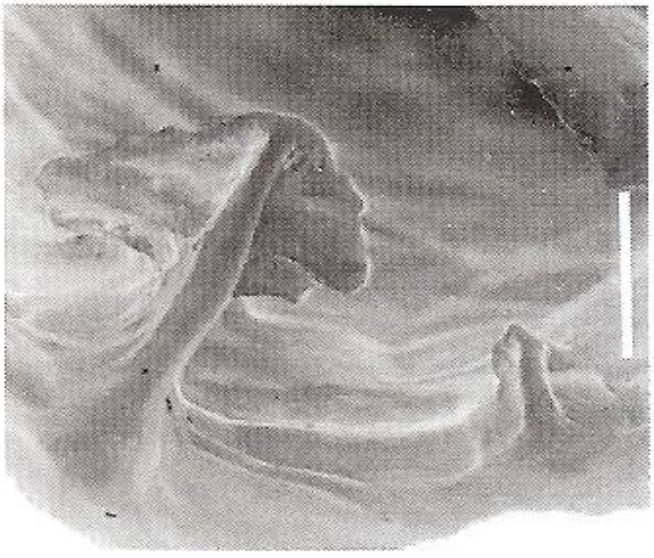

Figure 6. Distal set with only 2 teeth in the periderm cone of *Stephanoscyphistoma corniformis* (Komai, 1936). Note arrow point shape of large tooth on the left. Scale bar: 100 µm.

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RESUMO: *Os cifístomas de* ***Stephanoscyphistoma corniformis*** *(Komai, 1936) (Coronatae) são registrados pela primeira vez na costa brasileira e os seus cones esqueletais peridérmicos são redescritos. Também é o segundo registro de um cifístoma para o Brasil e de um cifístoma de Coronatae para o Atlântico Sul Ocidental.*

PALAVRAS-CHAVE: *Cnidaria; Scyphozoa; Coronatae;* ***Stephanoscyphistoma****; taxonomia; Atlântico Sul.*

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