A NEW SPECIES OF *RUGOGASTER* (ASPIDOBOTHREA: RUGOGASTRIDAE) PARASITE OF THE ELEPHANT FISH, *CALLORHINCHUS CALLORHYNCHI* (CALLORHINCHIDAE), FROM THE ESTUARY OF THE LA PLATA RIVER, COASTS OF URUGUAY AND ARGENTINA

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SUMMARY: *Rugogaster callorhinchi* n. sp. is the second species described for *Rugogaster* Schell, 1973. Specimens were collected from the rectal glands of the elephant fish, *Callorhinchus callorhynchus* (L.). The fishes were caught from the estuary of the La Plata River, Atlantic Ocean off the coasts of Uruguay and Argentina, South America and unloaded at the port of Rio Grande, State of Rio Grande do Sul, Brazil. *Rugogaster callorhinchi* n. sp. can be separated from the type and only species *Rugogaster hydrolagi* Schell, 1973 by the: 1. much larger size of the body; 2. appearance of the posterior portion of the body where the transverse rugae of the ventral surface which increase instead of diminish in width; 3. posterior extension of the testes which stop at 15.7-39.0% of the body length, from the posterior end; 4. vitellaria stop at 7.5-11.5% of the body length, from the posterior end; 5. ceca reach almost the posterior end of the body, instead of stopping all at almost the same distance from the posterior end of the body; and 6. testes loosely distributed in two rows, without the third row posteriorly.

KEY WORDS: *Rugogaster callorhinchi* n. sp., Aspidobothrea, elephant fish *Callorhinchus callorhynchus*, Uruguay, Argentina, Estuary of the La Plata River.

INTRODUCTION

The Rugogastridae was erected by SCHELL (1973) to accommodate an aspidobothrean so unusual to require him to emend the diagnosis of the infraclass Aspidobothrea Burmeister, 1856. The new aspidobothrean had features of a digenetic trematode, such as: two intestinal ceca, multiple testes, and a ventral sucker. The genus *Rugogaster* Schell, 1973 remained monospecific to the present. Schell's specimens were found in the rectal glands of *Hidrolagus colliei* (Lay & Bennett, 1839), collected from the North Pacific Ocean, off San Juan Island, Washington State, USA and from the Hecate Strait, in Pacific Canada.

GIBSON & CHINABUT (1984), when discussing the reorganization of the "subclass Aspidogastrea", commented upon the systematic position of the Rugogastridae and the affinities of *Rugogaster* with the digeneans and the monocotylid monogeneans. Later, GIBSON (1987) presented cladograms showing the hypothetical relationships between the subgroups of the Aspidogastrea and the Digenea.

SHVETSOVA (1990) collected specimens and described morphological variations of what she called *R. hydrolagi* from a new host: *Hydrolagus ogilbyi*, from the southern part of the Pacific Ocean. This author saw that these specimens had marked differences in the size of the genital atrium in relation to those specimens from *H. colliei*. Her illustrations showed differences in relation to the specimens of SCHELL (1973), which was her only reference. Of course, the mention of the spiral valve as the site of infection must be a mistake.

ROHDE *et alii* (1992) reported *R. hydrolagi* from the southeastern coast of Australia, this time from *Chimaera sp.* II. In their illustrations, these authors showed mature and juvenile specimens with ceca not reaching the posterior extremity of the body. These specimens, as far as size is

concerned, were more like those specimens of SCHELL (1973), and the mature ones must have been completely full of eggs, as not to allow the counting of the number of testes (see Table II on pg. 77). ROHDE *et alii* (1992) affirmed that the differences they saw between the northern hemisphere and the southern hemisphere specimens were due to geographical variation and did not justify the establishment of a new species for the Australian specimens.

MACHIDA & ARAKI (1992) registered *R. hydrolagi* in *Chimaera phantasma* Jordan & Snyder, from the Tora and Suruga Bays, Japan, western North Pacific Ocean.

Finally, ROHDE & WATSON (1992) studied the ultrastructure of the tegument, ventral sucker, and rugae and WATSON & ROHDE (1992) studied the ultrastructure of sperm and spermatogenesis of the Australian specimens of *R. hydrolagi*, collected from the rectal glands of chimaerid hosts from the northeastern coast of Tasmania.

MATERIALS AND METHODS

One hundred and thirty-six elephant fishes, *Callorhinchus callorhynchus* (L.) were collected from the estuary of the La Plata River, off the coasts of Uruguay and Argentina (34-36° S, 54-57° W) by professional fishermen and unloaded at the port of Rio Grande, State of Rio Grande do Sul, Brazil, from 1981 to 1984. The helminths were collected and placed in physiological saline 0.65%; later they were pressed between slide and coverslip, fixed in cold AFA, and stained in Mayer's carmalumen or Delafield's hematoxylin. Specimens for sectioning were fixed in 10% buffered formalin and stained in hematoxylin and eosin. The holotype and some paratypes were deposited in the Helminthological Collection of the Instituto Oswaldo Cruz (CHIOC), Rio de Janeiro, RJ, Brazil.

DESCCRIPTION

Rugogaster callorhinchi n. sp.
(Figs. 1-6)

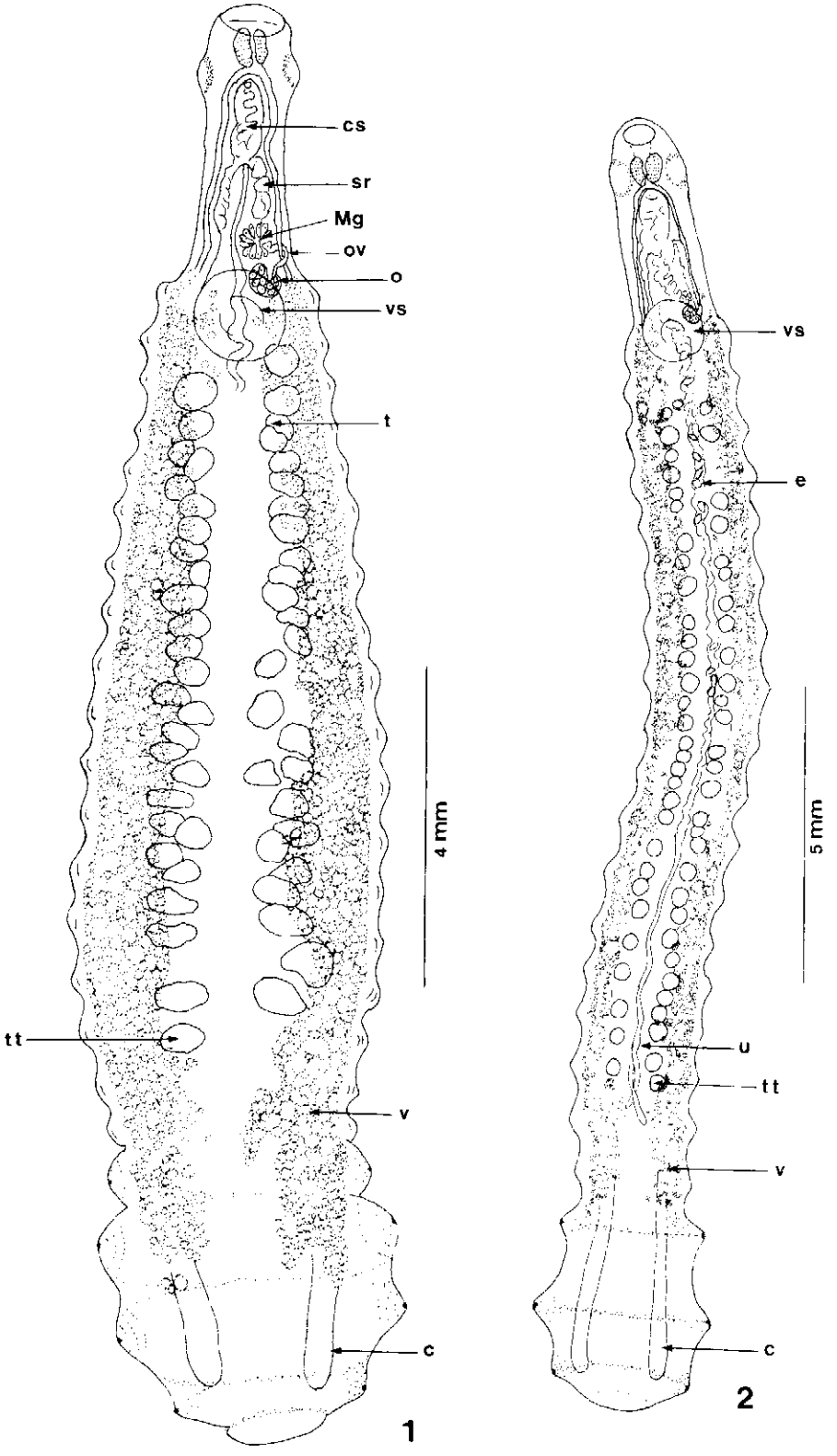
DESCRIPTION (based on 18 adult specimens whole-mounted, four measured): Rugogastridae. Body 14.3-19.7 mm (16.8 mm, n=4) long, 3.5-4.5 mm (4.0, n=4) wide (Fig. 1). Anterior 1/7-1/6 of body narrower, flat, with nearly parallel sides, round shoulders lateral to pharynx. Rest of body wider, 19-22 rugae across ventral surface and posterior 3-4 rugae wider yet. Ventral sucker at level of ovary, 550-770 (638, n=4) long, 770-880 (825, n=4) wide. Buccal funnel with indistinct margins; musculature weakly developed; mouth, including pharynx, 66-154 (110, n=3) long, 396-902 (649, n=4) wide; pharynx 440-506 (484, n=4) in diameter; pre-pharynx and esophagus short; ceca long, reaching posterior end of body. Testes 40-53 in number, in two rows, lacking a third row posteriorly; ventral, and median to ceca, 396-440 (445, n=4) long, 616-726 (671, n=4) wide; last testis at 15.7 to 39.0% (23.7%, n=7) of body length from posterior end; sperm ducts two, parallel to ceca, uniting in short vas deferens, terminal portion dilated, convoluted, filled with sperm; pars prostatica with small cells, in posterior portion of cirrus sac; cirrus sac contiguous to cecal bifurcation, ellipsoid, 484-726 (654, n=4) long, 418-550 (484, n=4) wide; cirrus smooth, 1.03 mm (n=1) long, when everted (Fig. 4), with bulbous extremity. Ovary ellipsoid, amphitypic (right side on eight specimens, left side on 10 specimens), 330-462 (379, n=4) long, 264-484 (357, n=4) wide, with oviduct looping around cecum (Fig. 3); Mehlis' gland preovarian, size similar to ovary; Laurer's canal wide, sinuous; vitellaria abundant, dorsal and ventral to ceca (Fig. 5), stopping at 7.5-13.5% (10.5%, n=6) of body length from posterior extremity; vitelline reservoir at level of Mehlis' gland; metraterm muscular, opening into genital atrium, running ventral to cirrus sac. Eggs ellipsoid, amber, 154 (n=4) long, 110 (n=4) wide (intrauterine) (Fig. 6). Excretory vesicle not observed.

Measurements of two young adults whole-mounted: body 10.2- 21.3 mm (15.7 mm, n=2) long, 1.9-2.9 mm (2.4 mm, n=2) wide (Fig. 2). Twenty to 21 rugae. Ventral sucker 440-594 (517, n=2) long, 484-660 (572, n=2) wide. Pharynx 440-772 (606, n=2) in diameter. Testes 51-59 in number, 132-330 (231, n=2) long, 154-352 (253, n=2) wide; cirrus sac 616-748 (682, n=2) long, 418-660 (539, n=2) wide. Ovary 264-330 (297, n=2) long, 198-286 (242, n=2) wide. Eggs 176-198 (187, n=2) long, 132 wide.

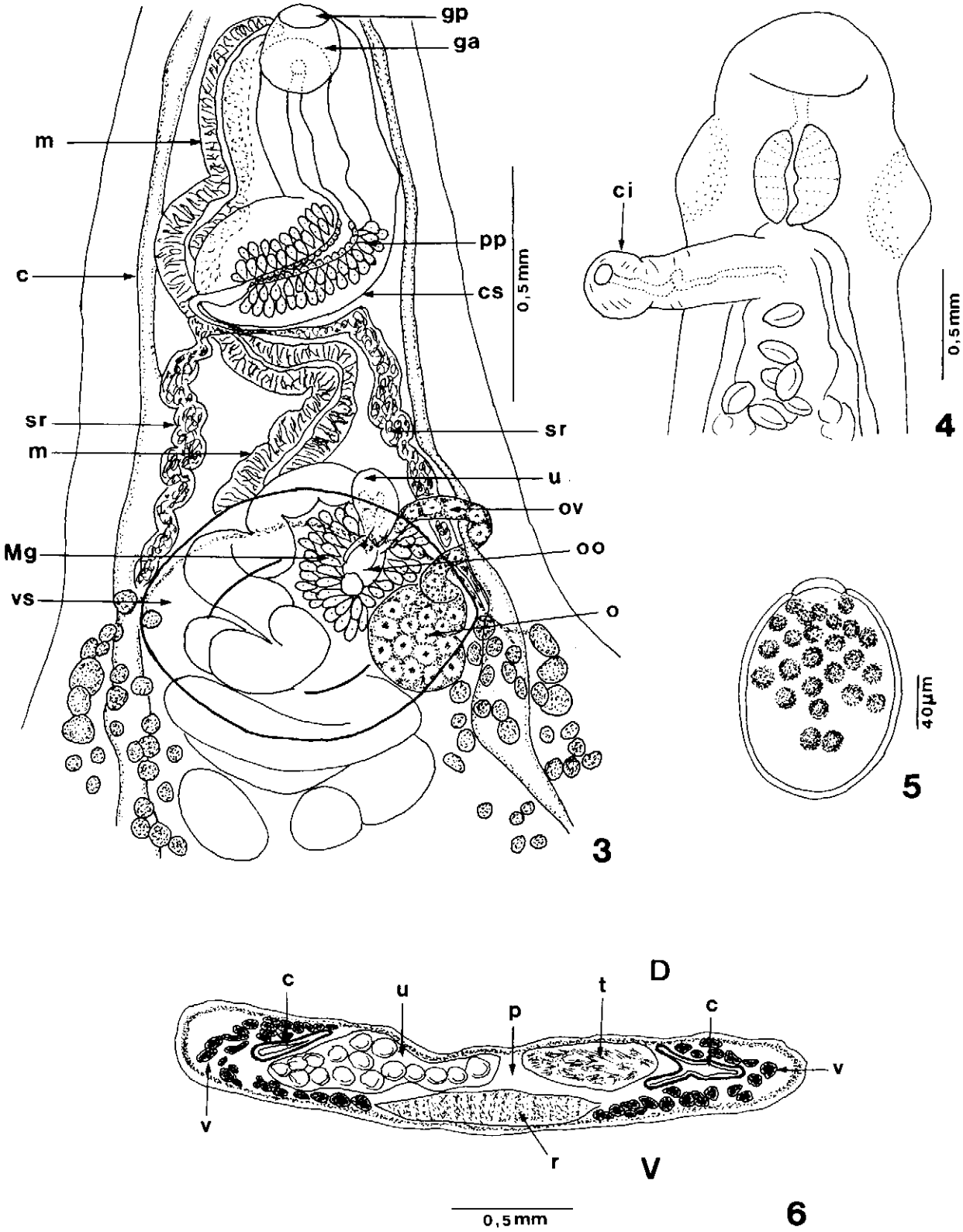
Remarks: one of the young adults measured (Fig. 2) is the longest specimen collected. This might indicate that the length of adults may be longer yet than we have described above. This specimen has only a few eggs, which are larger than those found in the adult specimens measured.

Taxonomic summary

Type host: *Callorhinchus callorhynchus* (L.).
Site of infection: rectal glands.
Type locality: estuary of the La Plata River, Atlantic Ocean, coasts of Uruguay and Argentina.
Specimens deposited: CHIOC Nº 33671a (holotype), Nºs 33671b-s, 33672a-c, 33673, 33674, 33675 (paratypes).



Figs.1-2 - *Rugogaster callorhinchi* n. sp. Fig.1. Adult, ventral view, without the representation of the uterus with eggs, showing the posterior distribution of the testes, the vitellaria, and the ceca; cs = cirrus sac, sr = seminal reservoir, Mg = Mehlis' gland, ov = oviduct looping around the cecum, o = ovary, vs = ventral sucker, t = testis, tt = last testis, v = vitellaria, and c = cecum. Fig.2. Young adult, ventral view, showing the posterior distribution of the testes, vitellaria, and ceca; vs = ventral sucker, e = egg, u = young uterus, tt = last testis, v = vitellaria, and c = cecum.



Figs.3-6. *Rugogaster callorhinchi* n. sp. Fig.3. Anterior portion of the body, showing the reproductive organs; gp = genital pore, ga = genital atrium, cs = cirrus sac, sr = seminal reservoir, pp = pars prostatica, m = metraterm, ov = oviduct, o = ovary, oo = ootype, Mg = Mehlis'gland, u = uterus, c = cecum, t = testis, tt = last testis, vs = ventral sucker. Fig.4. Anterior portion of the body, showing the extroverted cirrus. Fig.5. Egg, intrauterine. Fig.6. Transversal section; D = dorsal side, V = ventral side, v = vitellaria, c = cecum, u = uterus, p = parenchima (represented as white space), t = testis, r = rugae.

Specimens examined: *Rugogaster hydrolagi* USNPC Nº 72794 (holotype), Nº 72795 (two paratypes). Specimens lent by Dr. Rohde - 1) with the label: "*Rugogaster hydrolagi*, host: *Hydrolagus colliei*, Hecate Strait, Pacific Canada, 130° 45'6 W - 130° 54'7 W, 53° 17'3 N - 53° 19'3 N, 6092 fms, 12.9.82 - 7⑤"; 2) with the label: "*Rugogaster* juvenile, *Chimera* sp. 2, 891302, m. 52cm, rectal gland, 30.6.89, rec 17.7.89 - ④"; 3) with the label: "*Rugogaster* (best), *Chimera* sp. 2, M. 58cm, rectal gland, 30.6.89, rec. 17.7.89 - ⑤"; Specimen donated by Dr. Schell: *R. hydrolagi*, host - *H. colliei*, without label.

Etymology: the specific name "*callorhinchi*" is given after the generic name of the host *Callorhinchus*, which is masculine in gender and is written with the same spelling of the generic name.

DISCUSSION

Rugogaster callorhinchi n. sp. can be distinguished from *R. hydrolagi* by the: 1) much larger body size; 2) appearance of the posterior region of the body where the transverse rugae of the ventral surface increase in instead of diminishing in width; 3) posterior extension of the testes which stop 15.7-39.0% of the body length, from the posterior end; 4) vitellaria which stop 7.5-11.5% of body length, from the posterior end; 5) ceca which almost reach the posterior end of the body, instead of stopping all (testes, vitellaria, and ceca) at almost the same distance from the posterior end of the body; and 6) testes loosely distributed in two rows, without the third row posteriorly.

ROHDE (1982) referred to *R. hydrolagi*, from *H. colliei* as *R. colliei* (Fig. 3 in his Plate III). Evidently that was an editorial mistake, as on page 175 of his book (Chapter 10, last paragraph of the item Phylogeny), he used the correct name of the species. *Rugogaster hydrolagi* might have been found by WATSON (1911) as she stated on page 365: "and an aspidocotylean, probably belonging to the genus *Macraspis*, was found embedded in the muscles of the rectum". This author, probably, made two incorrect assumptions: first, she thought that the rectal glands of *Hydrolagus* were muscles, and second, she mistook *Rugogaster* for *Macraspis*, an aspidobothrean parasite of the gall bladder.

The examination of the specimen pieces of *R. hydrolagi* from Australia, lent by Dr. Rohde, showed some interesting differences in relation to our specimens: 1) the distance between rugae is larger and they look like the craspedote proglottides of cestodes, while in our specimens the distance between rugae is shorter and their limits over the body cannot be distinguished; 2) the ventral sucker has stronger muscularity and is located in front of the first rugae, while in our specimens it is feeble and located over the first and second rugae.

It was not possible to examine the specimens of SHVETSOVA (1990), but the drawings which this author presented show rugae more like those present in our specimens and more like those depicted by SCHELL (1973). The length of Shvetsova's specimens barely reaches the lower part of the range of our specimens. There is no third column of testes as SCHELL (1973) have shown for *R. hydrolagi*. Shvetsova did not draw the ventral sucker, so it is not possible to determine its position in relation to the rugae.

The examination of the specimen of *R. hydrolagi*, donated by Dr. S. C. Schell (remounted and deposited in the CHIOC), allowed the observation that the testes, the vitellaria, and the ceca, all stop at the same distance from the posterior extremity of the body, exactly as was depicted by SCHELL (1973, Fig. 1). The middle of the body is filled with eggs with air.

The photomicrography of *R. hydrolagi* published by MACHIDA & ARAKI (1992) shows a specimen similar to those of SCHELL (1973). The description presented by these authors includes adults measuring "more than 9 mm in length", much less than the specimens reported in the presented study.

This second species of *Rugogaster* is important to confirm the genus and allows a phylogenetic consideration. BROOKS *et alii* (1985) proposed that the Aspidobothrea and the Digenea be considered sister groups and have indicated the trait "bifurcated gut" to be a synapomorphie. As these authors did not indicate having considered the emendation of the Aspidobothrea made by SCHELL (1973), which includes a bifurcate gut and a "vestigial ventral sucker", the phylogenetic problem of the Aspidobothrea remains unsolved. Actually, the acetabulum of *Rugogaster* is not vestigial, as Schell suggested, but it is an incipient trait. The multiple testes also help to reinforce the closer relationship between the Aspidobothrea and the Digenea, and magnify the importance of *Rugogaster*.

FIGUEIREDO (*in litt.*) commented on the spelling of *Callorhinchus*, the generic name of the elephant fish: "see the commentary no. 121 in the foot of page 560 about the name of the genus. I think that BIGELOW & SCHROEDER also had doubts about what spelling they should use...From now on I will use *Callorhinchus*. As far as the name of the species of Linnaeus, I am sending you the original description: *callorynchus*. But there is one problem. Up to now there is no revision of the nominal

species in the genus *Callorhinchus*. In the manual (FIGUEIREDO, 1977) I followed BIGELOW & SCHROEDER (1953) (see page 562, item species and note 130). Today, however, I have doubt in relation to the specific name, as *C. callorynchus* was described in Africa, and there are not many things in common between the marine fishes of that continent and South America. Anyhow, there are names available for our chimaerid fish, but only a direct comparison of material would allow a final decision. Now, the ball is in your court."

SUMÁRIO

Rugogaster callorhinchi n. sp. é a segunda espécie descrita de *Rugogaster* Schell, 1973. Os espécimes foram coletados das glândulas retais do peixe-elefante, *Callorhinchus callorhynchus* (L.). Os peixes foram capturados por pescadores profissionais no Estuário do Rio de La Plata, litoral do Uruguai e da Argentina, Oceano Atlântico, América do Sul e foram descarregados no porto de Rio Grande, Estado do Rio Grande do Sul, Brasil. *Rugogaster callorhinchi* n. sp. pode ser separada da espécie-tipo e única do gênero *Rugogaster hydrolagi* Schell, 1973 pelo: 1) tamanho do corpo que é muito maior; 2) aparência da porção posterior do corpo onde as rugas transversais da superfície ventral do corpo aumentam, em vez de diminuir, de largura e de comprimento; 3) extensão posterior dos testículos, a qual para a 15.7-39.0% do comprimento do corpo, a partir da extremidade posterior do corpo; 4) vitelários param a 7.5-11.5% do comprimento do corpo, a partir da extremidade posterior corpo; 5) cecos alcançam quase a extremidade posterior do corpo (em vez de todos pararem na mesma distância da extremidade posterior do corpo); e 6) testículos distribuídos em duas fileiras irregulares sem uma terceira fileira na porção posterior da distribuição testicular.

KEY WORDS: *Rugogaster callorhinchi* n. sp., Aspidobothrea, peixe-elefante, *Callorhinchus callorhynchus*, Uruguai, Argentina, Estuário do Rio de La Plata.

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REFERENCES

BROOKS, D. R.; O'GRADY, R. T. & GLEN, D. R. (1985). The phylogeny of the Cercomeria (Platyhelminthes). *Proc. Helminthol. Soc. Wash., 52*: 1-20.

FIGUEIREDO, J. L. (1977). *Manual de Peixes Marinhos do Sudeste do Brasil. I. Introdução. Cações, raias e quimeras*. Museu de Zoologia da Universidade de São Paulo, São Paulo, Brasil, 104 p.

GIBSON, D. I. (1987). Questions in digenean systematics and evolution. *Parasitology, 95*: 429-60.

GIBSON, D. I. & CHINABUT, S. (1984). *Rohdella siamensis* gen. et sp. nov. (Aspidogastridae: Rohdellinae subfam. nov.) from freshwater fishes in Thailand, with a reorganization of the classsification of the subclass Aspidogastrea. *Parasitology, 88*: 383-93.

MACHIDA, M. & ARAKI, J. (1992). Three aspidogastrean trematodes from marine fishes of Japan. *Bull. Natn. Sci. Mus.*, Tokyo, Ser. A, *18*: 51-55.

ROHDE, K. (1982). *Ecology of Marine Parasites*. University of Queensland Press. Queensland, Australia, 245 p.

ROHDE, K. & WATSON, N. A. (1992). Ultrastructure of the tegument, ventral sucker and rugae of *Rugogaster hydrolagi* (Trematoda: Aspidogastrea). *Inter. J. Parasitol., 22*: 967-74.

ROHDE, K.; HEAP, M.; HAYWARD, C. J. & GRAHAM, K. J. (1992). *Calicotyle australiensis* n. sp. and *Calicotyle* sp. (Monogenea, Monopisthocotylea) from the rectum and rectal glands, and *Rugogaster hydrolagi* Schell, 1973 (Trematoda, Aspidogastrea) from the rectal glands of holocephalans off the coast of southeastern Australia. *Syst. Parasitol., 21*: 69-79.

SCHELL, S. C. (1973). *Rugogaster hydrolagi* gen. n. et sp. n. (Trematoda: Aspidobothrea: Rugogastridae fam. n.) from the ratfish, *Hydrolagus colliei* (Lay & Bennett, 1839). *J. Parasitol., 59*: 803-5.

SHVETSOVA, L. S. 1990. A new find of an aspidogasterid with numerous testes, *Rugogaster hydrolagi* from ratfish in the southern part of the Pacific Ocean. *Parazitologiya, 24*: 82-4. (In Russian.)

WATSON, E. E. 1911. The genus *Gyrocotyle*, and its significance for problems of cestode structure and phylogeny. *Univ. California Publ. Zool., 6*: 353-468.

WATSON, N. A. & ROHDE, K. (1992). Ultrastructure of sperm and spermatogenesis of *Rugogaster hydrolagi* Schell, 1973 (Platyhelminthes, Trematoda, Aspidogastrea, Rugogastridae). *Parasitol. Res., 78*: 516-24.

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