ANTHOBOTHRIUM GALEORHINI N. SP. (EUCESTODA: TETRAPHYLLEIDA) A PARASITE OF *GALEORHINUS GALEUS* (TRIAKIDAE) FROM THE ARGENTINE COAST

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Summary :

Anthobothrium galeorhini n. sp. (Eucestoda: Phyllobothriidae) collected from the spiral intestine of *Galeorhinus galeus* (Linnaeus, 1758) at the Puerto Madryn (Atlantic coastal region) is described. The new species differs from *A. cornucopia* as described by Euzet (1959) by the size of body, bothridia, gravid proglottids and eggs ; by the neck length and by the different number of testes and proglottids. The size of bothridia and the gravid proglottids, the cirrus length and the number of testes allow differentiating the species here proposed from *A. laciniatum* Linton, 1890 as described by Euzet (1959). The body and cirrus sac size, the bothridia shape and the number of testes separate the species here described from *A. parvum* Stossich, 1895 as described by Yamaguti (1952). The anatomic differences between the cestode described by Arandas Rego (1977) and located taxonomically under the name *Anthobothrium laciniatum* are listed and the systematic position of the cestode is discussed. Species parasitic of skates listed in scientific literature must be taxonomically reaccommodated, since their characteristics are not consistent with the diagnosis of *Anthobothrium*.

KEY WORDS : parasite, Eucestoda, Tetracophyllidea, Phyllobothriidae, *Anthobothrium*, Triakidae, South Atlantic, Argentine.

Résumé : *ANTHOBOTHRIUM GALEORHINI* N. SP. (EUCESTODA: TETRAPHYLLEIDA) PARASITE DE *GALEORHINUS GALEUS* (TRIAKIDAE) DE LA CÔTE ARGENTINE

Anthobothrium galeorhini n. sp., parasite de *Galeorhinus galeus* (Linnaeus, 1758) de l'Océan Atlantique, région côtière de Puerto Madryn, Argentine, est décrit. Cette espèce est différente d'*Anthobothrium cornucopia* Van Beneden, 1850 redécrite par Euzet (1959) par la taille du corps, des bothridia, des proglottis gravidés et des œufs, et aussi par la longueur du cou, le nombre de testicules et de proglottis. L'espèce proposée se distingue d'*Anthobothrium laciniatum* Linton, 1890, redécrite par Euzet (1959) par la taille des bothridies, des proglottis gravidés, la longueur du cirrus et le nombre de testicules. L'espèce décrite se sépare d'*Anthobothrium parvum* Stossich, 1895, redécrite par Yamaguti (1952) par la taille du corps et de la poche du cirre, la morphologie des bothridia et le nombre de proglottis. Les différences anatomiques du cestode décrit par Arandas Rego (1977) comme *Anthobothrium laciniatum* Linton, 1890 sont notées et la position systématique de ce cestode est discutée. La position taxonomique des espèces parasites de raies, qui, dans la bibliographie sont placées dans le genre *Anthobothrium*, est discutée car leurs caractères anatomiques ne correspondent pas à ceux qui définissent le genre *Anthobothrium*.

MOTS CLÉS : parasite, Eucestoda, Tetracophyllidea, Phyllobothriidae, *Anthobothrium*, Triakidae, Atlantique sud, Argentine.

INTRODUCTION

Galeorhinus galeus (Linnaeus, 1758) is an active coastal-pelagic swimmer inhabiting cold and temperate waters of different seas. It has a world wide distribution and is found on continental slopes in temperate waters: Eastern Atlantic (Iceland, Norway, Faeroe Islands, British Island to Mediterranean), Western Indian Ocean (South Africa), Western South Pacific (Western and South Australia), Central Pacific (Laysand Island), Eastern Pacific (British Columbia to southern Baja California, Gulf of Cali-

fornia, Peru and Chile) (Compagno, 1984). In the Southwestern Atlantic Ocean its geographical distribution ranges from South Brazil to Argentina (Compagno, 1984, 1999), inhabiting the coastal-pelagic region on the continental shelf on the whole Argentine Sea (Lucifora, pers. comm.). A cestode with anatomical features consistent with that of the genus *Anthobothrium* Van Beneden, 1850 was collected from the spiral intestine of *Galeorhinus galeus*. The presence of this genus parasite of elasmobranchs was recorded previously in the Brazilian coast of the southwestern Atlantic Ocean by Arandas Rego (1977) who reported *Anthobothrium laciniatum* from the spiral intestine of *Carchabrinus longimanus* (Poey, 1861). The cestode studied here belongs to a new species of *Anthobothrium*. The aim of this paper is to describe the new species, to compare it with other species belonging to the genus *Anthobothrium* and comment the geographical distribution of the genus in the Southwestern Atlantic Ocean.

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MATERIAL AND METHODS

Eighteen specimens of *Galeorhinus galeus* were examined. Specimens were collected at the coastal region of Puerto Madryn (42°43'S-65° W, Province of Chubut) by fishing fleets operating from this city. Twenty-two cestodes were collected from the spiral intestine of the examined fishes. Parasites were placed alive into a Petri dish containing mentholated seawater to relax the specimens, then fixed in AFA. Specimens stained in hydrochloric carmine, dehydrated in an alcohol series, cleared with creosote and mounted in Canada balsam. Histological sections (8 µm thick) were prepared from specimens fixed in Bouin Hollande and embedded in parafin. Sections were stained in hematoxylin-eosine. Drawings were made by means of a drawing tube. Three proglottid types were considered: immature (with external segmentation and without defined organs), mature (showing uterus without eggs) and gravid (uterus with mature eggs). Measurements are given in micrometers, followed by ranges in brackets unless otherwise stated. Cestode taxonomical determination follows Euzet (1994) and host classification follows Compagno (1984-1999).

RESULTS

ANTHOBOTRIUM GALEORHINI N. SP. (Figs 1-6)

Type host: *Galeorhinus galeus* (Triakidae) (Linnaeus, 1758).

Type locality: Puerto Madryn (42°43'S-65° W, Provincia de Chubut) Argentine.

Location in host: Spiral intestine.

Prevalence: 16.6 %

Studied material: 14 specimens with scoleces, 33 strobilar fragments and 25 free segments, three specimens in transversal sections.

Materiel deposited: Holotype in Museo de Ciencias Naturales de La Plata. Helminthological Collection (*Anthobothrium galeorhini* n. sp. Holotype: 4942; paratype: 4943).

Paratype: in the collection of the Muséum National d'Histoire Naturelle (*Anthobothrium galeorhini* n. sp. Paratype MNHN Paris 37 HG).

Etymology: the specific name *galeorhini* refers to specific name of the host.

Description: Phyllobothriidae, Phyllobothriinae, with the characters of the genus *Anthobothrium* as defined by Euzet (1994). Body flattened 25.7 (20.59-30.21) mm long by 0.40 (0.37-0.45) mm wide, with 136 (120-150) proglottids. Each proglottid with rounded proximal end and

distal ending in four lacinia: a dorsal and a ventral pair. Two pair of osmoregulatory ducts (two dorsal and two ventral). Scolex 266 (187-354) long by 428 (350-600) wide formed by four circular bothridia, 200 (140-250) in diameter, each supported by a strong muscular peduncle 110 (70-200) long by 10 (8-12) wide. Accessory suckers absents. Myzorhynchus absent. Neck 2.60 (1.49-2.82) mm long, provided with microtriches 13-17 long. Immature proglottids 40 (35-60) long by 230 (190-250) wide; mature proglottids 1000 (690-1190) long by 580 (250-890) wide and gravid proglottids 2.70 (2.00-3.60) mm long by 0.90 (0.81-1.10) mm. wide.

Testes 179 (160-230) in number, oval, 40 (35-50) long by 30 (20-35) wide; extending from the anterior part of the ovary to the anterior end of the proglottid; arranged in two layers in cross-section. Vas deferens median, coiling at level of cirrus sac. Cirrus sac oval 500 (210-530) long by 200 (140-250) wide with thin wall, located ventrolaterally at the joint between first and second third of the proglottid and containing the ejaculatory duct and cirrus. Cirrus unspined, thick wall, 0.90-1.00 mm long when fully everted, enlarged in its proximal part and thin in its distal part. Genital pore lateral irregularly alternated, 58 % (55 % - 64 %) proglottid length from posterior end.

Ovary median, ventral, located in the posterior part of the proglottid 800 (750-850) long by 650 (580-700) wide bilobed in cross-section, with many secondary lobes. Vagina opens anterior to the cirrus sac. Vaginal canal crosses the vas deferens ventrally and descends median and ventral widening into a seminal receptacle. Vitellarium follicular, in two lateral fields, extending from the posterior to the anterior part of the proglottid; lateral vitelline fields consisting of dorsal and ventral follicles 35 (30-40) long by 20 (15-25) wide. Uterus, ventral median and sac-shaped reaches at level of the cirrus sac Eggs 21-22 in diameter; shell provided with minuscules spines.

The cestode described above is characterised for having a scolex with four pedunculate bothridia disc shaped; without accessory sucker; myzorhynchus absent; neck provided with microtriches; strobila craspedota, laciniated; euapolytic; genital pore irregularly alternated located at the join of the first and second third of the proglottid; cirrus unspined, bilobed ovary with secondary lobes, shell of the eggs provided with little spines.

DISCUSSION

Van Beneden (1850) created the genus *Anthobothrium* and described its type species for Belgian coasts named it *A. cornucopia*. Euzet (1994) defined *Anthobothrium*. Nowadays the genus

Figs 1-6. - *Anthobothrium galeorhini* n. sp.

1. Scolex of the holotype.
2. Gravid proglottid (ventral view), holotype.
3. Cirrus sac, cirrus everted and vagina.
4. Cross section through gravid proglottid at level of testes.
5. Cross section through gravid proglottid at level of ovary.
6. Egg.

D: dorsal; V: ventral; dod: dorsal osmorregulatory duct; o: ovary; ov: oviduct; sr: seminal receptacle; t: testes; u: uterus; va: vagina; vit: vitellaria; vod: ventral osmorregulatory duct.

Scale bars: 1 and 3: 0.2 mm; 2: 0.5 mm; 4 and 5: 0.1 mm; 6: 0.02 mm.

is a taxonomic wastebasket made up of a number of non-relatives. Under this genus many species parasitic of skates (*A. rajae* Yamaguti, 1952; *A. pteroplateae* Yamaguti, 1952; *A. bifidum* Yamaguti, 1952; *A. oligorchidum* Young, 1954; *A. amuletum* Butler, 1987; *Anthobothrium* sp. Wojciechowska, 1991) and sharks (*A. cornucopia* Van Beneden, 1850; *A. laciniatum* Linton, 1890; *A. parvum* Stossich, 1895) are listed (Schmidt, 1986). According to the bibliographic analysis, species parasitizing skates have a scolex with festooned edges, unlacinate proglottids, genital atrium located at the posterior part of the second third or at the posterior third of the proglottid and testes numbering less than 100 with the exception of *A. pteroplateae* and *A. bifidum*, which possess 70 and 100-130, respectively. Species belonging to the genus in question, in turn parasites of sharks, show their genital atrium in the anterior third or at the joint between the first and second proglottid thirds, and also possess many testes (over 100). These characters allow differentiating between species parasites of skates and shark listed in the bibliography. *Anthobothrium cornucopia*, *A. parvum* (parasitizing Triakidae) and *A. laciniatum* (parasitizing Carcharhinidae) are differentiated by scolex morphology. *A. cornucopia* shows smooth edge pedunculate bothridia; *A. laciniatum* shows pedunculate bothridia with a hemispheric muscular shape in its anterior third which sometimes simulate a sucker; *A. parvum* shows pedunculate bothridia in the shape of a lady's straw hat and the fan-shaped peduncle shows coarse muscle fibers. Euzet (1959) redescribed the type species of the genus: *A. cornucopia*, collected from the spiral intestine of *Eugaleus galeus* (Linnaeus, 1758) (= *Galeorhinus galeus*) (Compagno, 1984, 1999) from the coast of Sète (Mediterranean Sea) and Concarneau (Northeastern Atlantic Ocean). Despite the fact that the cestode from the Argentine coast was collected from the same host species as that of Euzet (1959), it is still possible to differentiate them. For example total length, size of bothridia, proglottids and eggs, length of neck and number of proglottids and testes are different. (Table D). Stossich (1895) described *A. parvum* from *Zygaena malleus* Risso, 1816 considered as a synonym of *A. cornucopia* by Southwell (1930). Yamaguti (1952) described a cestode collected from the spiral intestine of *Mustelus manazzo* Bleeker, 1854 at the Obama coast (Pacific Ocean). Yamaguti compared the morphology of the cestode with Stossich's description as quoted in Southwell (1930) and then revalidated *A. parvum* Stossich, 1895. As was already mentioned, scolex morphology allows, among other characters, to differentiate between *Anthobothrium cornucopia* and *A. parvum* and therefore *A. parvum* is considered as valid species, in agreement with Yamaguti. Caracteres including body size, bothridia

of smaller diameter and differently shaped, number and size of proglottids allow differentiation between the cestode described here and *A. parvum* (Table D). Euzet (1959) redescribed *A. laciniatum* collected from the spiral intestine of the blue shark, *Galeus galeus* (Linnaeus, 1758) (= *Prionace glauca*, Compagno, 1984, 1999) from the Sète coast (Mediterranean Sea) and Concarneau coast (Northeastern Atlantic Ocean). The minor diameter of bothridia, gravid proglottid size, length of the cirrus, number of testes and shape and structure of cirrus (lack of microtriches) distinguish *A. galeorhini* n.sp. from the *A. laciniatum* of Euzet (1959) (Table D). Arandas Rego (1977) redescribed *A. laciniatum* collected from the spiral intestine of *Carcharbinus longimanus* (Poey, 1861) from the coast of Pernambuco, Brazil (Southwestern Atlantic Ocean). Total length, major number of proglottids, proglottids size, cirrus sac size, cirrus structure (lack of microtriches), and major number of testes allow differentiate the cestode here described from the *A. laciniatum* of Rego (1977) (Table D). *A. laciniatum* is most likely a species complex. The analysis of descriptions by Euzet (1959) and Arandas Rego (1977) suggests that *Anthobothrium* specimens from *Prionace glauca* and *Carcharbinus longimanus* are likely separate species.

Nowadays, *Anthobothrium* is represented by *A. cornucopia*, *A. laciniatum*, *A. parvum* and *A. galeorhini* n. sp. Species parasitizing skates listed in the scientific literature as belonging to the genus *Anthobothrium* must be rearranged taxonomically since their characters are not consistent with the original diagnose of the genus. *Anthobothrium* is represented in the Southwestern Atlantic Ocean by *A. laciniatum* of Rego (1977) and *A. galeorhini* n. sp.

Tetraphyllidean cestodes show a strict specificity with their hosts. This leads to doubt about the specific identity of the *Anthobothrium galeorhini* n. sp. host. In fact, *Galeorhinus galeus* seems to have a disjunctive geographic distribution, since there are not records of its presence in the intertropical region. At the Argentine Atlantic coast this shark used to be known as *Galeorhinus vitaminicus* De Buen, 1950. Compagno (1984-1999) indicated that *G. vitaminicus* was a synonym of *Galeus galeus* (Linnaeus, 1758). The discovery of *Anthobothrium galeorhini* n. sp. different from *A. cornucopia*, which is the species specific for *Galeorhinus galeus* raises the possibility that *G. vitaminicus* may not be similar to *G. galeus*, thus casting doubts on the validity of the synonymy of both species. This problem on the identity of the hosts of *Anthobothrium galeorhini* could be solved using molecular biology techniques. This would reveal the specific taxonomy location of the host fish, and also confirm the strict specificity of cestodes with their hosts.

Species Author	<i>A. cornucopia</i> Van Beneden, 1850	<i>A. laciniatum</i> Linton, 1890	<i>A. laciniatum</i> Linton, 1890	<i>A. parvum</i> Stossich, 1895	<i>A. galeorhinii</i> present study
Redescription	Euzet, 1959	Euzet, 1959	Rego, 1977	Yamaguti, 1952	
Locality	Mediterranean Sea North Atlantic Ocean	Mediterranean Sea North Atlantic Ocean	South Atlantic Ocean	Pacific Ocean	South Atlantic Ocean
Length	80.000-100.00*	25.00-30.00*	15.00*	11.00*	25.70 (20.59-30.21)*
Wide	1.50-2.00*	1.00-1.50*	0.76*	0.33*	0.40 (0.37-0.45)*
Scolex	500	-----	640-760	400	266 (187-354) × 428 (350-600)
Bothridia	300-500	600-700 × 300	570 × 420	-----	200 (140-250)
Peduncle	100-400	-----	180 × 270	-----	110 (70-200)
Neck	10-15*	-----	-----	1.10-2.30*	2.60 (1.49-2.82)*
Proglottids number	160-220		45	70-90	136 (120-150)
Gravid proglottids	8.00 × 4.00*	4.50 × 1.50*	3.57-4.06* × 1.06-1.22*	300-340 × 320-340	2.70 (2.00-3.60)* × 0.90 (0.80-1.10)*
Cirrus sac	300-500 × 150-350	500 × 200	130 × 90	90 × 80	500 (210-530) × 200 (140-250)
Cirrus length	1.00*	2.00*	-----	-----	0.90-1.00*
Testes number	275-350	110-140	120	-----	179 (160-230)
Eggs	15-18	20-22	-----	-----	21-22

* Measurements in millimeters.

Table I. – Comparative measurements of *Anthobothrium* spp. parasites of sharks redescribed by different authors.

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