

## ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

*STOMACHICOLA LYCENGRAULIDIS* N. SP. (DIGENEA, HEMIURIDAE), PARASITE OF THE ATLANTIC SABRETOOTH ANCHOVY *LYCENGRAULIS GROSSIDENS* (CLUPEIFORMES, ENGRAULIDAE)

*STOMACHICOLA LYCENGRAULIDIS* N. SP. (DIGENEA, HEMIURIDAE), PARÁSITA DE LA ANCHOA DE RÍO *LYCENGRAULIS GROSSIDENS* (CLUPEIFORMES, ENGRAULIDAE)

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### Abstract

This paper describes and illustrates a new species of digenetic trematode, parasitic in the stomach of the sabretooth anchovy *Lycengraulis grossidens* (Agassiz, 1829) from the Bahía Blanca estuary and the Paraná River, Argentina, designated as *Stomachicola lycengraulidis* n.sp. The new taxon differs from *S. bayagbonai* and *S. singhi* congeneric species from the Gulf of Guinea and Indian Ocean respectively, mainly in the body size, the structure of the reproductive system, the development of the ecsoma and the sinus sac. It differs from the first one mainly in the presence of two frontal protuberances at the level of the preoral lobe, which are absent in the specimens studied here. Also in general terms, *S. bayagbonai* is comprised of slightly larger individuals, with larger pharynx, testicles and ovary. And it differs from *S. singhi* by their smaller duct and hermaphroditic sac and for having a well developed seminal receptacle, which is absent in the Bay of Bengal specimens. When comparing the relative size of the ecsoma, we found significant differences among both of the populations of digeneans examined, the worms collected in the Paraná River was more developed than those from the Bahia Blanca estuary. The host, *L. grossidens*, migrates to the Paraná river in winter and spring and then, from December to March it makes a trophic migration towards the sea and is found all along the Atlantic coast of Buenos Aires province. For this reason, it is here hypothesized that the relative development of the tail, is affected by environmental conditions, such as pH and osmolarity of the stomach, salinity and/or water temperature.

**Key words:** Anchovy - Digenea - *Lycengraulis* - *Stomachicola*.

## Resumen

En el presente trabajo se describe e ilustra una nueva especie, parásita del estómago de la anchoa de río *Lycengraulis grossidens* (Agassiz, 1829) en el estuario de Bahía Blanca y el río Paraná, Argentina, proponiendo su denominación como *Stomachicola lycengraulidis* n. sp. El nuevo taxón se diferencia de sus congéneres del golfo de Guinea y océano Índico, *S. bayagbonai* y *S. singhi*, respectivamente, principalmente en la estructura del aparato reproductor, el desarrollo del ecsoma y del saco del *sinus*. De la primera de ellas se distingue principalmente por la presencia de dos protuberancias frontales a nivel del lóbulo preoral, ausentes en los especímenes estudiados. Además en términos generales *S. bayagbonai* comprende individuos ligeramente más grandes con faringe, testículos y ovarios de mayor tamaño. Y se distingue de *S. singhi* por el ducto y saco hermafrodita más pequeños y poseer un receptáculo seminal bien desarrollado, ausente en los especímenes de la Bahía de Bengala. Cuando se comparó el tamaño relativo del ecsoma, se encontraron diferencias significativas entre ambas poblaciones de digíneos examinadas, siendo que los especímenes colectados en el Río Paraná tenían un mayor desarrollo que aquellos obtenidos en el estuario de Bahía Blanca. El hospedador, *L. grossidens*, migra hacia el río Paraná en invierno y primavera y luego, desde diciembre a marzo, realiza migraciones tróficas hacia el mar y se lo encuentra a todo lo largo de la costa de la Provincia de Buenos Aires. Por esta razón, aquí se hipotetiza que el desarrollo de la cola es afectado por condiciones ambientales, tales como el pH y la osmolaridad del estómago, así como la salinidad o temperatura del agua.

**Palabras clave:** Anchoa - Digenea - *Lycengraulis* - *Stomachicola*.

## INTRODUCTION

Yamaguti (1934) considered that the proposal of a new genus named *Stomachicola* was justified due to the relative size of the ecsoma (approximately 90% of the total length), the extension of the *pars prostatica* and the development of the seminal receptacle of some hemiurids. Later, several Indian workers raised numerous parasites of the stomach of teleostean fishes to species level, mainly from the Pacific and Indian oceans. However, most of these were later considered junior synonyms of the type species *S. muraenesocis* Yamaguti, 1934 (Bilqees, 1971; Hafeezullah, 1980; Gupta & Gupta, 1991). Tanzola & Guagliardo (2000) recorded individuals belonging to *Stomachicola*, as components of low prevalence in the helminth fauna of the Argentine Conger, *Conger orbignianus* Valenciennes, 1847, from the Bahia

Blanca estuary, but the authors did not specify their taxonomical status. This paper describes and illustrates a new species from the stomach of the sabretooth anchovy *Lycengraulis grossidens* (Agassiz, 1829) and its designation as *Stomachicola lycengraulidis* n. sp. is proposed.

## MATERIALS AND METHODS

One hundred and five *L. grossidens* (Teleostei, Engraulidae), were examined. Ninety of them were caught with nets during March 2007 and March 2009 in the Bahía Blanca estuary (38°48' S 62° 16'W) and also 15 fish from the Paraná river (33°20'S 60°12'W) in November 2010. Some fish were dissected fresh and the remainder were kept in a freezer at - 20°C until necropsy. All worms were collected in the lumen of the stomach. They were slightly flattened between microscope slides, fixed and preserved in 5% formalin for

subsequent identification. They were stained with Langeron's hydrochloric carmine, cleared in clove oil and mounted in Canada balsam. Drawings were made to scale with the aid of a drawing tube. The prevalence and intensity of infection (Bush *et al.*, 1997) were calculated for each of the sampling areas. A one-tailed *t* Student test was carried out to compare the lengths of the ecsoma in both populations of hosts. In the present work the specimens come from fish catch. They have not experimented with live animals, not affected population parameters of the host or provoked impacts on the environment and human health or animal.

## RESULTS

*Stomachicola lycengraulidis* n. sp.  
(Figs. 2-4).

**Description** (based on 25 stained and mounted specimens). Very elongated body. Smooth tegument with delicate and little-defined folds. Well developed ecsoma (=tail), half or 2/3 total length. Rounded and subterminal oral sucker.

Spherical or subspherical acetabulum in the first quarter of the body. The forebody is much shorter than the hindbody. Subglobular pharynx. Short oesophagus. Digestive caecae extend to the end of the body, penetrating into the ecsoma.

They are separated and often overlap in the testicular region or in the posterior region of the ecsoma. The preovarian testicles are situated obliquely and immediately after the seminal vesicle. The saccular seminal vesicle has a thin wall, elongated in the longitudinal direction of the body. Very long, tubular and sinuous *pars prostatic*, surrounded throughout by prostatic glandular cells. Short tubular hermaphroditic duct. The sinus sac and body of the sinus organ are pyriform, permanent and muscular. The genital atrium is large and usually contains eggs in small clusters. The genital pore at the level of

the pharynx takes the form of a transversal slit, posterior to the oral sucker. The oval to reniform ovary is located immediately posterior to the testicles. Conspicuous postovarian Mehlis' gland. Seminal receptacle is large and postovarian. Seven sinuous vitellin tubules; three of them on the right side and four on the left side. Vitellaria extend up to the posterior testicle and penetrate backward into the ecsoma. The uterus is mostly postovarian and irregularly coiled. The degree of penetration of the uterus into the ecsoma is variable (in some specimens it is less than the anterior third and in other parts reaches 3/4 of the tail). The eggs are small and oval in shape. The morphometric data of 25 stained and mounted specimens is summarized in Table I.

### Taxonomical summary

Type host: *Lycengraulis grossidens* (Agassiz, 1829) (Teleostei; Engraulidae).

Additional host: *Conger orbignianus* Valenciennes, 1837 (Teleostei; Anguilliformes).  
Site of infection: Stomach.

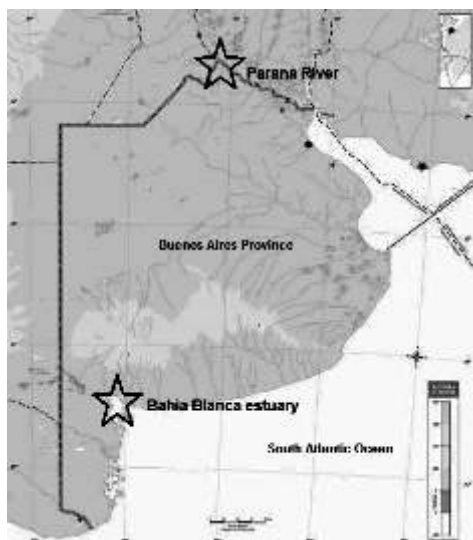
Type locality: Bahía Blanca estuary (38°48'S 62°16'W).

Other localities: Paraná river (33°20'S 60°12'W).  
Prevalence: Bahía Blanca estuary 22.22 %; Paraná river 66.67%.

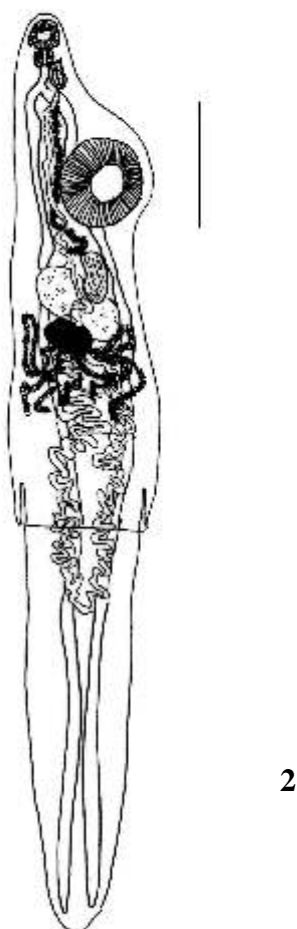
Mean intensity: Bahía Blanca estuary 1.3; Parana river 4.3.

Etymology: The specific names refers to the generic name of its type host.

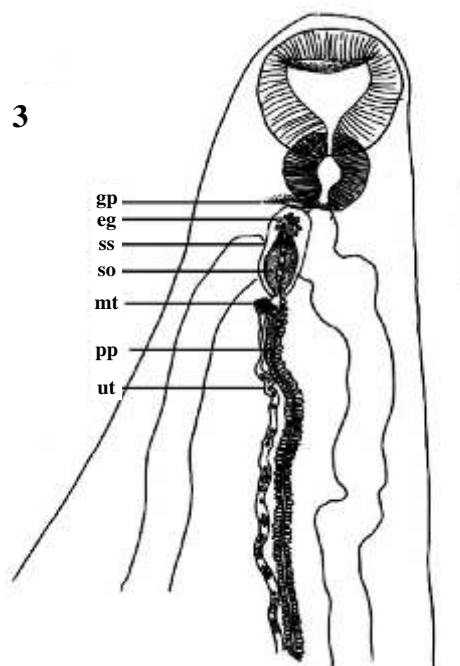
Type material: Holotype accession number= MLP6442; paratype accession number= MLP6443 (Colección de la División Zoología Invertebrados, Museo de La Plata, Argentina).



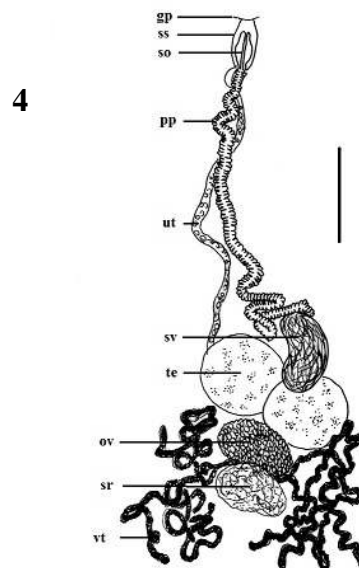
**Figure 1.** Sampling areas of the hosts, *Lycengraulis grossidens*.



**Figure 2.** *Stomachicola lycengraulidis* n.sp. (*in toto*). Scale-bar= 1 mm.



**Figure 3.** *S. lycengraulidis* n.sp. Genital terminalia (detail). Abbreviations: gp= genital pore, eg= eggs in the genital atrium, ss= sinus sac, so= sinus organ, mt= metraterm, pp= pars prostatica, ut= uterus. Scale-bar= 0.250 mm.



**Figure 4.** *S. lycengraulidis* n.sp. Reproductive system (schematic). Abbreviations as in fig. 3. and sv= seminal vesicle, te= testicle, ov= ovary, sr= seminal receptacle, vt= vitellaria. Scale-bar= 0.500 mm.

## DISCUSSION

Yamaguti (1934) raised the genus *Stomachicola* designating *S. muraenesocis* as the type species, a very common parasite of the stomach of *Muraenesox cinereus* in the Inland Sea of Japan and South China Sea. Manter (1947) transferred the species *Dinurus rubeus* Linton (1910) and *D. magnus* Manter (1931) to the genus *Stomachicola*. Yamaguti (1971) in his synopsis of trematode parasites of vertebrates recognized the following species *S. muraenesocis*, *S. rubeus* and *S. magnus*. However, later Sinclair *et al.* (1972) considered *S. rubea* and *S. magnum* as junior synonyms of *S. muraenesocis*. Bilqees (1971) established three genera (with eight species) parasites of marine fish in western Pakistan: *Cameronia* (*C. octovitellarii*, *C. pakistani*); *Segmentatum* (*S. karachiensis*, *S. gadrii*, *S. cinerensis* and *S. magnaesophagustum*) and *Cestodera* (*C. gastrocecus*, *C. unicecus*), but Gibson (2002) considered these three genera together with *Linguastomachicola* Srivastava & Sahai, 1978 as junior synonyms of *Stomachicola*. Hafeezullah (1980) had previously recognized that the eight species described by Bilqees (1971) conformed to the original description of *S. muraenesocis* and that all of them should be considered as junior synonyms. *Stomachicola mastacembeli* Verma, 1973, *S. polynemi* Gupta & Gupta 1974, *S. lepturusi* Gupta & Gupta 1974, *S. rauschi* Gupta & Ahmad 1978 and *S. singhi* Gupta & Ahmad 1978 were raised to designate parasites of marine fish in the Indian Ocean. Siddiqi & Hafeezullah (1975) described *S. bayagbonai*, a parasite in the stomach of the Guinean pike conger *Phyllogramma regani* Pellegrin 1934 (= *Cynoponticus ferox* Costa 1846) in Nigeria. The genera *Pseudostomachicola* Skrjabin & Guschanskaja, 1954; *Acerointestinecola* Jahan, 1970 and *Indostomachicola* Gupta & Sharma, 1973 had been considered as junior synonyms of *Stomachicola* Yamaguti, 1934 by Gibson & Bray (1979). Gupta & Gupta (1991) reviewed the genus *Stomachicola* and transferred *S. lepturusi* and *S. rauschi* to *Allostomachicola* Yamaguti, 1958 and, in the same study, considered that *S.*

*rubea*, *S. mastacembeli*, *S. polynemi*, *S. chauhani* and *S. guptai*, should be conspecific with *S. muraenesocis* on account of the great variability in shape and size of the internal organs.

For all these reasons, the genus *Stomachicola* Yamaguti, 1934 would currently be comprised of the following taxa: *S. muraenesocis* Yamaguti, 1934 (type species), *S. bayagbonai* Siddiqi & Hafeezullah, 1975 and *S. singhi* Gupta & Ahmad 1978, whose comparative morphometric data are shown in Table I.

Yamaguti (1934) gave no measurements in his original description of the genus and made no reference to the extent of the ecsoma. However his iconography shows that the caudal organ occupies approximately 90% of the total length of the body. In the specimens subsequently examined by Gupta & Gupta (1991) this appendix varies over a wide range, comprising between 50% and 82% of the body length. In the remaining species, the caudal appendix represents approximately 75% in *S. bayagbonai* and 80% in *S. singhi*. In our study, specimens have shown less pronounced variation in the development of the tail, constituting only 25% of the total length in some cases while others reached 70%. When comparing the relative size of the tail, we found highly significant differences among both the populations of digenean examined, the worms collected in the Paraná River having a higher development than those from the Bahia Blanca estuary ( $t$  Student = 3.236,  $p = 0.0019$ ). The host, *L. grossidens*, migrates to the Paraná river in winter and spring and then, from December to March, makes a trophic migration towards the sea and is found all along the Atlantic coast of Buenos Aires province (Cervigón *et al.*, 1992). For this reason, here it is hypothesized that the relative development of the tail, which was considered a morphological feature of taxonomic value by some authors, is affected by environmental conditions, such as pH and osmolarity of the stomach, the salinity and/or water temperature. In this regard, Gibson & Bray (1979) suggested that the ecsoma probably functions as a feeding organ that could be

**Table 1.** Measurements of *Stomachicola* spp. from different sources (in mm).

Host	<i>S. muraenesocis</i> Yamaguti (1934)		<i>S. muraenesocis</i> Gupta & Gupta (1991)		<i>S. bayagbonai</i> Siddiqi & Hafeezullah (1975)		<i>S. singhi</i> Gupta & Ahmad (1978)		<i>S. lycengraulidis</i> n.sp. Present study	
	min	max	min	max	min	max	min	max	min	max
Number of specimens	(not stated)		35		5		8		25	
Body length	---	55	6.84	15.10	9.44	21.15	5.04	15.81	4.61	19.57
Body width	---	2.5	0.62	0.93	2.13	3.99	0.75	0.82	0.94	2.35
Ecsoma length	---	---	3.39	12.44	---	---	---	---	1.22	12.56
Oral sucker length	0.23	0.42	0.14	0.19	0.28	0.52	0.16	0.22	0.17	0.56
Oral sucker width	0.32	0.58	0.14	0.21	0.36	0.61	0.20	0.24	0.22	0.46
Ventral sucker length	0.70	1.36	0.44	0.59	0.85	1.14	0.56	0.60	0.49	1.19
Ventral sucker width	0.70	1.36	0.47	0.55	0.85	1.28	0.56	0.60	0.47	1.29
Sucker width ratio	---	---	1:2.5	1:3.36	1:2.4	---	---	---	1:1.71	1:2.89
Pharynx length	0.17	0.28	0.08	0.12	0.20	0.33	0.12	0.14	0.10	0.25
Pharynx width	0.17	0.28	0.08	0.13	0.20	0.33	0.11	0.13	0.10	0.25
Oesophagus	---	---	0.05	0.08	---	---	0.12	0.30	0.09	0.19
Anterior testis length	0.45	0.84	0.32	0.54	0.42	1.02	0.48	0.55	0.26	0.63
Anterior testis width	0.53	0.64	0.15	0.49	0.38	0.76	0.34	0.47	0.15	0.46
Posterior testis length	0.28	0.46	0.30	0.45	0.42	1.02	0.45	0.58	0.24	0.45
Posterior testis width	0.52	0.74	0.19	0.32	0.38	0.76	0.34	0.42	0.14	0.43
<i>Pars prostatica</i> length	---	---	1.15	2.21	---	---	0.82	1.63	1.95	3.60
Hermaphroditic duct	---	---	0.08	0.12	---	---	0.27	0.31	0.13	0.23
Seminal vesicle length	---	---	0.34	0.67	---	---	0.47	0.65	0.22	1.16
Seminal vesicle width	---	---	0.10	0.49	---	---	0.29	0.44	0.10	0.35
Ovary length	0.31	0.46	0.17	0.49	0.33	0.52	0.11	0.25	0.10	0.46
Ovary width	0.53	0.85	0.14	0.31	0.54	0.67	0.17	0.39	0.10	0.47
Egg length	0.017	0.022	0.007	0.021	0.017	0.019	0.015	0.020	0.013	0.018
Egg width	0.014	0.014	0.005	0.011	0.011	0.013	0.010	0.012	0.008	0.013

References: \* No stated in original publication.

extruded under conditions of adequate pH and osmolarity.

Specimens examined in this study differ from the type material of *S. muraenesocis* Yamaguti 1934 mainly in the length of the ecsoma. However this difference is not seen in the specimens described by Gupta & Gupta (1991) as *S. muraenesocis* from *Congromuraena anago* Temminck & Schlegel, 1846, *Symbranchus bengalensis* (McClelland 1844) (= *Ophisternon bengalense*) and *Amphipnous cuchia* (Hamilton 1822)(= *Monopterus cuchia*) from the Bay of Bengal, Orissa, India. However, the *pars prostatica*, seminal vesicle and hermaphroditic duct in the parasite of *L. grossidens* are considerably more developed than in *S. muraenesocis*. Unfortunately these latter features of the reproductive system were not taken into account in the original description of *S. bayagbonai* in order for comparisons to be made. However, a notable feature in the last species is the presence of two frontal protuberances at the level of the preoral lobe, which are absent in the specimens studied here. Also in general terms, *S. bayagbonai* is comprised of slightly larger individuals, with larger pharynx, testicles and ovary. Finally, the hemiurids of the present study are distinguished from *S. singhi* by their smaller duct and hermaphroditic sac and for showing a well developed seminal receptacle, which is absent in the Bay of Bengal specimens.

For all these reasons, the parasitic helminths of the stomach of *Lycengraulis grossidens* are considered as representatives of a new species, designated as *Stomachicola lycengraulidis* n. sp.

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