International Journal of Research Studies in Zoology
Volume 5, Issue 4, 2019, PP 16-21
ISSN No. 2454-941X
DOI: http://dx.doi.org/10.20431/2454-941X.050403
www.arcjournals.org

Morphological and Morphometric Insights of *Gonocerca phycidis* from the Brushtooth Lizardfish *Saurida undosquamis*

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Abstract: *This parasitological study was conducted between January to December 2019 to investigate the helminth parasites infecting the Brushtooth lizardfish Saurida undosquamis in Hurghada city at the Gulf of Suez, Red Sea, Egypt. The prevalence of Gonocerca phycidis was 9.09% in the fish studied. The extent of G. phycidis infection is determined by the seasonal prevalence. It is shown that the incidence of infection was only 18.18% in the winter season. Morphological characteristics for the present parasite species revealed that it possesses a pre-testicular ovary, a vitellarium consisting of two lateral masses at the same level as the ovary, eggs without filaments, a terminal part of the male duct consisting of a seminal vesicle, a tubular pars prostatica surrounded by a subglobular field of prostatic cells, and a short ejaculatory duct opening into the genital atrium. Moreover, morphometric analysis revealed little differences in measurements with other species of Gonocerca.*

Keywords: *Saurida undosquamis; Derogenidae; Gonocerca spp.; Morphological description*

1. INTRODUCTION

The genus *Gonocerca* Manter [1] is known to be a member of the subfamily Gonocercinae Skrjabin and Guschanskaja [2], within the family Derogenidae Nicoll [3]. The taxonomic status of this genus is controversial, as there are plenty of nominal species [4-7], many of which may be synonymous with *G. phycidis* Manter [1]. *G. phycidis* is a bipolar species found in archybenthal waters in a wide range of hosts. The recorded species are found in Canadian water are *G. phycidis*, *G. crassa* Manter [8], *G. macroformis* Wolfgang and Myers [9], and *G. macrouri* Gaevskaya [10]. Subsequently, the reports of *G. crassa* by Ronald [11] from *Pleuronectes ferrugineus*, by Szuks [12] from *Coryphaenoides rupestris*, and by Zubchenko [13] from *Macrourus berglax* can probably be attributed to *G. phycidis*, as material in the BM (NH) from these or related hosts from both sides of the Atlantic belong to this species. In addition, the distinctive characteristics of *G. crassa* mentioned by Brinkmann [14] require confirmation, since the position of the genital pore relative to the oral sucker appears to be a function of contraction. In addition, *G. macrouri* originally described from *Coryphaenoides rupestris* from the North-East Atlantic, appears to be a synonym for *G. phycidis*, commonly found in this host on both sides of the Atlantic. Zubchenko [13] reported *G. macrouri* in Canadian waters. There is only the original record of *G. macroformis* from the ovary of *Gadus morhua*, *Glyptocephalus cynoglossus*, *Hippoglossoides platessoides* in Newfoundland waters, except for a single specimen that Zubchenko [13] claimed to have found in *Coryphaenoides rupestris* off Labrador. It should also be noted that in the Hudson Canyon off northeast United States, Campbell and Munroe [15] identified three species of *Gonocerca* from macrourids. These were *G. phycidis* from *Coryphaenoides armatus* and two other species, *G. minuta* from *Nezumia bairdii* and *G. haedrichi* from *C. armatus*.

The purpose of this study is to provide a comprehensive data on *G. phycidis* infecting the Brushtooth lizardfish *Saurida undosquamis* from the Gulf of Suez in the Red Sea, as well as to observe how much host- and site-induced variation in size and morphology occurs in this derogenid species.

2. MATERIALS AND METHODS

Forty-four specimens of the Brushtooth lizardfish *Saurida undosquamis* (Family: Synodontidae) were collected between January - December 2019 from the coastal region of the Hurghada city in the Gulf of Suez, Red Sea, Egypt. The collected fish specimens were dissected and internal organs were examined for parasite detection. According to Bush et al. [16], prevalence of the recovered parasites was estimated. Trematode parasites were isolated, fixed in buffered formalin solution (10%), stained with Semichon's aceto-carmine for 3 h, ascending series of alcohol used for dehydration, then cleared in xylene and mounted on Canada balsam. Leica DM 2500 microscopy (NIS ELEMENTS software, ver. 3.8) was used to photograph the recovered parasites. Measurements were represented in millimeters for different body parts as mean ± SD followed by range in parentheses.

3. RESULTS

Of the Forty-four specimens of the Brushtooth lizardfish *Saurida undosquamis*, four (9.09%) were found to be infected with *Gonocerca phycidis*. The infestation was recorded in the stomach. Seasonally, only 18.18% (4 out of 22) of the infestation was recorded in the winter season.

Description (Fig. 1a-e; Table 1)

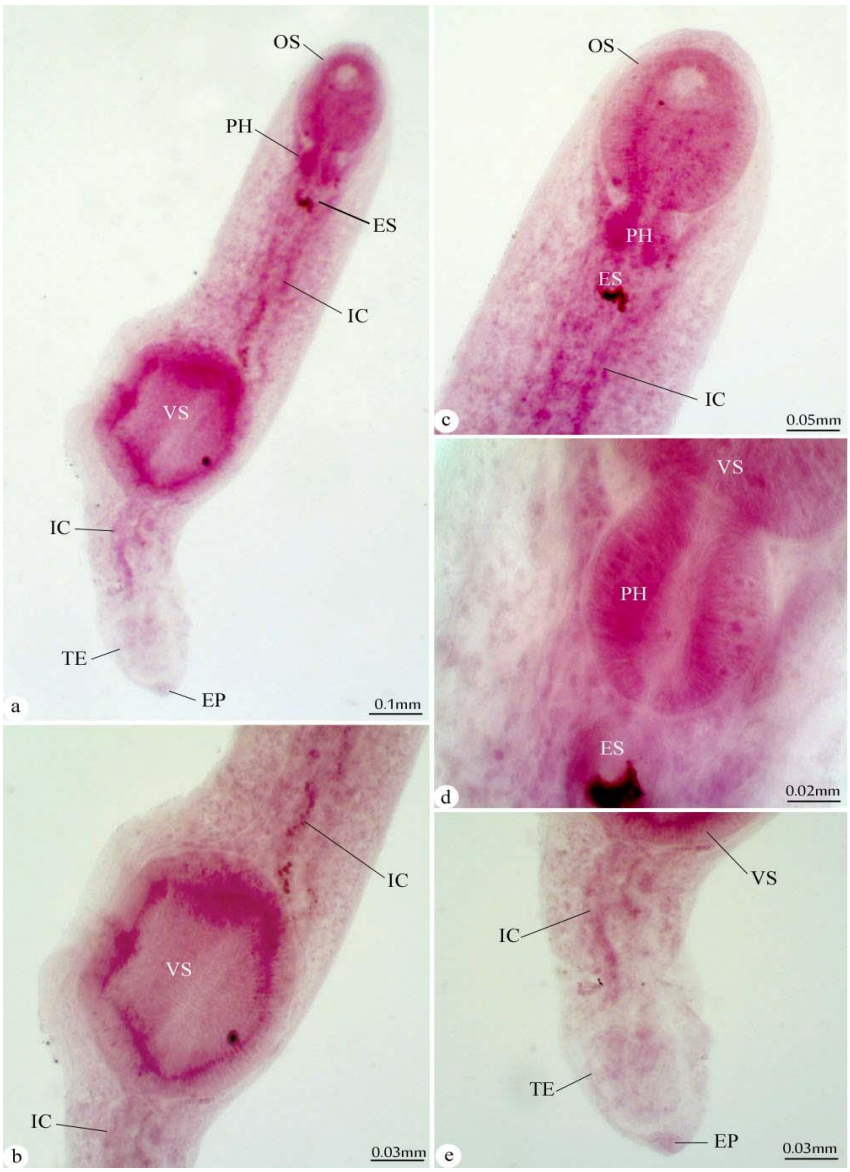

Fig 1. ***a-e*** *Photomicrographs of the adult digenea G. phycidis infecting* S. *undosquamis.* ***a.*** *The adult worm with oral sucker (OS), pharynx (PH), esophagus (ES), ventral sucker (VS), intestinal caeca (IC), testes (TE), and terminal excretory pore (EP).* ***b-e.*** *High magnifications of:* ***b,c.*** *The anterior part of the body showing oral sucker (OS), pharynx (PH), and esophagus (ES).* ***d,e.*** *Ventral sucker (VS), testes (TE), and excretory pore (EP).*

Table 1. *Comparative measurements (in millimeters) of the present Gonocerca phycidis and those described previously*

Species / Parameters		*Gonocerca phycidis*	*G. phycidis*	*G. phycidis*	*G. phycidis*	*G. phycidis*
Host		*Pseudochaenichthys georgianus*	*Macroronusm agellanicus*	*Macrourus berglax*	*Seriolella porosa*	*Saurida undosquamis*
Host locality		South Georgia	San Matías Gulf, Argentina	Admiralty Bay, Indian Ocean	San Matías Gulf, Argentina	Red Sea, Egypt
Reference		Zdzitowiecki [27]	Suriano and Sutton [28]	Kellermanns et al. [29]	Guagliardo et al. [21]	(Present study)
Body	**L**	2.69-6.34	2.600–4.000	2.39-4.18	1.850	2.86-3.92 (3.22±0.1)
	W	0.56-1.10	0.850–1.100	0.78-2.36	0.450	0.58-1.32 (1.10±0.1)
Oral sucker	**L**	0.320-0.600	0.300–0.350	0.27-0.42	0.200	0.29-0.48 (0.35±0.01)
	W	0.340-0.630	0.550–0.600	0.11-0.34	0.232	0.27-0.40 (0.35±0.01)
Ventral sucker	**L**	0.470-0.880	0.700–0.750	0.49-0.76	0.310	0.49-0.68 (0.54±0.01)
	W	0.490-0.900	0.900–0.950	0.49-0.87	0.400	0.50-0.95 (0.83±0.01)
Oral sucker/ acetabulum ratio		1:0.27-1:0.36 (1:0.33)	1:2–3	----	1:1.64	1:0.41 (0.24-0.46)
Pharynx	**L**	0.120-0.210	0.090–0.095	0.10-0.14	0.090	0.11-0.21 (0.18±0.01)
	W	0.120-0.220	0.150–0.160	--	0.080	0.07-0.12 (0.09±0.001)
Anterior testis	**L**	0.280-0.840	----	0.23-0.40	0.150	0.19-0.34 (0.23±0.01)
	W	0.350-0.720	----	0.19-0.31	0.150	0.23-0.43 (0.39±0.01)
Posterior testis	**L**	----	----	0.12-0.66	----	0.15-0.23 (0.20±0.01)
	W	----	----	0.10-0.54	----	0.12-0.27 (0.27±0.01)
Ovary	**L**	0.250-0.510	----	0.04-0.06	0.100	0.13-0.37 (0.25±0.01)
	W	0.240-0.460	----	0.02	0.095	0.12-0.31 (0.26±0.01)
Number of vitellarian lobes		2 compacted lobes	2 compacted lobes	2 compacted lobes	2 compacted lobes	2 compacted lobes
Egg	**L**	----	0.040	----	0.030	0.039-0.057 (0.040±0.01)
	W	----	0.020	----	0.016	0.012-0.032 (0.020±0.01)

Body anterior sub-cylindrical, posterior body fusiform. Length: 3.22±0.1 (2.86-3.92) mm; width 1.10±0.1 (0.58-1.32) mm. Oral sucker sub-terminal; length 0.35±0.01 (0.29-0.48) mm, width 0.35±0.01 (0.27-0.40) mm. Pharynx rounded; length 0.18±0.01 (0.11-0.21) mm, width 0.09±0.001 (0.07-0.12) mm; pre-pharynx absent; esophagus short; ceca mildly inflated, extending to posterior

extremity of body. Ventral sucker post-equatorial, sub-spherical; length 0.54±0.01 (0.49-0.68) mm, width: 0.83±0.01 (0.50-0.95) mm. Oral/ventral sucker ratio 1:0.41 (0.24-0.46). Testes diagonal at posterior extremity of body. Anterior testis length: 0.23±0.01 (0.19-0.34) mm, width: 0.39±0.01 (0.23-0.43) mm. Posterior testis length: 0.20±0.01 (0.15-0.23) mm, width: 0.27±0.01 (0.12-0.27) mm. Cirrus pouch elongated with slightly inflated posterior portion with tubular seminal vesicle. Pars prostatica short, surrounded by glandular prostatic cells, close to oral sucker. Genital atrium small with median genital pore, between two oral lobes at the posterior of ventral margin of oral sucker. Ovary between anterior testis and ventral sucker, overlapping former and almost closely to latter; sub-spherical; length: 0.25±0.01 (0.13-0.37) mm, width: 0.26±0.01 (0.12-0.31) mm. Vitellaria divided into two compact masses, bi-lobed, lying dorso-lateral to ovary. Seminal receptacle small, tubular, lying ventral to ovary and ventral sucker. Uterus without descending limb, winding forward between ovary and oral sucker, filling all available space, ending in a weakly developed metraterm entering genital atrium, filled with small numbers of eggs. Egg length: 0.040±0.01 (0.039-0.057) mm, width: 0.020±0.01 (0.012-0.032) mm. Excretory pore terminal, with arms united dorsal of oral sucker.

4. DISCUSSION

Fishing is a very important part of the world's economic activities and it a crucial protein source for the local diet [17]. Fish generally have a wide range of ecto- and endo-parasites [18-20]. In the present study, the prevalence of infestation of the Brushtooth lizardfish *S. undosquamis* with *G. phycidis* was 9.09%. These data agreed with that of Guagliardo et al. [21] who reported that *Seriolella porosa* was infested with *G. phycidis* (9.99%). *Gonocerca* is a widespread genus erected by Manter [1] and characterized by an elongated body without spines, testes tandem to almost symmetrical at the posterior extremity of the body, median genital pore located in the posterior margin of the oral sucker, absent hermaphroditic duct and sinus-sac, small genital atrium, well-developed pars prostatica, small seminal vesicle located just posterior to the genital pore, medium-sized pre-testicular ovary and vitellaria in the form of more or less lobulated pre-testicular masses lateral to the ovary, and a slightly wider range of egg size variability. Based on the characteristics described above, the digenean species isolated in our study resembled the species of *Gonocerca*. There are several species described in the *Gonocerca* genus, namely *G. phycidis* Manter [1]; *G. kobayashi* Layman [22]; *G. crassa* Manter [8]; *G. macroformis* Wolfgang and Myers [9]; *G. oregonensis* McCauley et al. [23]; *G. lobata* Byrd [24]; *G. trematomus* Byrd [24]; *G. japonica* Toman [25]; and *G. caetorinchi* Machida and Kuramochi [26]. Morphological and morphometric comparison revealed that in our study, the *Gonocerca* species is closely related to *G. phycidis* previously described by Zdzitowiecki [27] from *Pseudochaenichthys georgianus* in South Georgia; Suriano and Sutton [28] from *Macroronus magellanicus* in San Matías Gulf, Argentina; Kellermanns et al. [29] from *Macrourus berglax* in Admiralty Bay, Indian Ocean; and Guagliardo et al. [21] from *Seriolella porosa* in San Matías Gulf, Argentina; because of their remarkable similarities in the measurements of the different body parts. *G. phycidis* has a wide host range, infecting members of different fish families. However, it differs from *G. oregonensis*, which has paired fleshy oral lobes, larger sucker size, and four lobed vitellaria; from *G. lobata* Byrd, 1963 which has two masses of lobulated vitellaria; from *G. japonica* Toman [25] from *Caelorinchus* sp. in Suruga Bay, Japan, which has larger body size, higher sucker ratio, irregular testes and vitellaria shapes, and larger egg size; and from *G. caelorinchi* Machida and Kuramochi [26] from *Caelorinchus japonicas* in Suruga Bay, Japan which has smaller body size, remarkably larger pharynx size, ovary with irregular incisions, vitellaria composed of 3-8 lobes, and larger egg size.

5. CONCULSION

In view of all the above, the species found in *S. undosquamis* could be assumed to coincide with *G. phycidis* with a new host record in the Egyptian water.

ACKNOWLEDGMENT

Authors extend their appreciation for providing all facilities to complete this work to Faculty of Science, Cairo University, Cairo, Egypt.

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Citation: *Rewaida Abdel-Gaber., et.al," Morphological and Morphometric Insights of Gonocerca phycidis from the Brushtooth Lizardfish Saurida undosquamis" International Journal of Research Studies in Zoology, vol. 5, no. 4, p. 16-21, 2019. DOI: http://dx.doi.org/10.20431/2454-941X.050403.*