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New Taxonomic Contribution *Goezia jamshoransis* n. sp. of genus *Goezia* (Anisakidae: Goeziinae) from Freshwater Fish *Rita rita* of Indus River, Pakistan

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Abstract. The 56 host fish *Rita rita* collected from district Jamshoro, Sindh, Pakistan for study of helminth parasites. 27 (20 ♀ & 7 ♂) specimens of new species belong to genus *Goezia* processes by standard material and method of nematodes. New species *Goezia jamshorensis* differ from its congeners in having different diagnostic characteristics such as, body size, cuticle rings along with spines format, cephalic structures shape and arrangement, ventriculus and ventriculus appendix shape, size and position, cadual papillae number and arrangement, spicules shape and size, vulva position and shape of posterior end of specimens.

Keywords: nematodes, *Rita rita*, new species, Indus river, Jamshoro, Pakistan

Introduction

Genus *Goezia* established by Zeder in 1800. It was reviewed by (Deardoff and Overstreet, 1980; Hartwich, 1975; 1974 and 1957; Sprent, 1978; Rasheed, 1965; Mosgovoi, 1951; Dollfus, 1935) on the basis of the number of ventricular appendices, the genus split into two subgenera such as *Goezia* and *Pseudogoezia.* Though this splitting was accepted by (Zaidi and Khan, 1975; Rasheed, 1965; Yamaguti, 1961) considered this differentiating characteristics as invalid pointing out that double appendix was created by the folding of the single appendix on itself due to a longitudinal groove. Kreis (1937) on the structure of the cuticular rings and the absence of ventricular appendage, established another genus Neogoezia but Yamaguti in (1961) on the basis of unspined cuticular ringsand simple oesophagus without posterior appendage separate it from *Goezia*.

Species of genus *Goezia* recorded from marine and freshwater fishes of world including: *G. pelagia*, *G. minuta*, *G. kliksi*, *G. sinamora* and *G. aspinulosa Arya*, investigated by Deardorff and Overstreet in (1980), while *G. chitali*, *G. heteropneusti* and *G. tanusi*. *G. pakistanica*, *G. tanusi* and *G. pseudascaroides* in (1977) and *G. ascaroides* by Railliet and Henry (1912), *G. leporine* by Martinus and Yoshitoshi (2003), *G. spinulosa* by Santos and Moravec (2009). In Pakistan there is little or no work has been done on taxonomic status of helminth parasites which help to control the infection rate in fish. This work has great contribution to science.

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Materials and Method

Host fishes *Rita rita* collected from water bodies of Jamshoro, Sindh Province, Pakistan were examined for helminth parasites. Hosts were dissected with care of the worms, 27 specimens were collected from stomach of host during examination of entire alimentary canal, viscera under stereo dissecting microscope. Processing of recovered nematodes, live specimens will be killed in hot 70% ethanol and preserved in alcohol glycerol solution in glass vials. Temporary mounts in glycerol and lacto-phenol made for the detailed study. Diagrams were made with the help of camera Lucida. Measurements of the body and other structures will be taken in millimeters (mm).

Results and Discussion

Systematic position. Family: Anisakidae Railliet and Henry (1912); **Genus:** *Goezia* Zeder (1800); **Species:** *Goezia jamshorensis* n. sp.; **Status:** New species; **Number of specimen recovered:** 27 (20 ♀ and 7 ♂); **Number of host infected:** 12; **Host:** *Rita rita*; **Site of infection:** Stomach; **Entamology:** The name of new species *Goezia jamshorensis* denoted to the name of district Jamshoro from where host fishes were collected.

Description. (Fig. 1-3). Body of worm broad, covered with cuticular rings and each ring surrounded by series of unequal spines directed backward with pointed ends, the lateral sides of body carry large spines. Distance of each ring varies, at anterior end rings are close to each other and distance increase at posterior end of body. Female body broad, rounded in shape and male body narrow, elongate and widest at equatorial region of body in male and post-equatorial region in female. Anterior end of body bear 3 lips and inter-labia, dorsal lip bear 1 single one pair of papillae, each ventrolateral lip bear a pair of papillae. Oral aperture triangular in shape. Esophagus muscular broad in male as compare to female, ventriculus straight and short, ventriculus appendix large and curved. Intestinal caecum extending from half length of ventriculus to backward of body. Posterior end of male with rounded tail bear large spine like structure at tip, 16 caudal papillae, two spicules of same shape but different in size, spicules anteriorly rounded and pointed posteriorly. Posterior end of female conical V-shape bear large spine like structure at tip of tail. Anus at near to the tail region of body. Vulva post-equatorial with rounded vulvar lips, vagina muscular curved. Eggs rounded to spherical.

Male. Body of the worm measures 3.9-5.14 × 0.5-0.6. Esophagus measures 0.28-0.29 × 0.16-0.17. Ventriculus measures 0.14-0.23. Ventriculus appendix measures

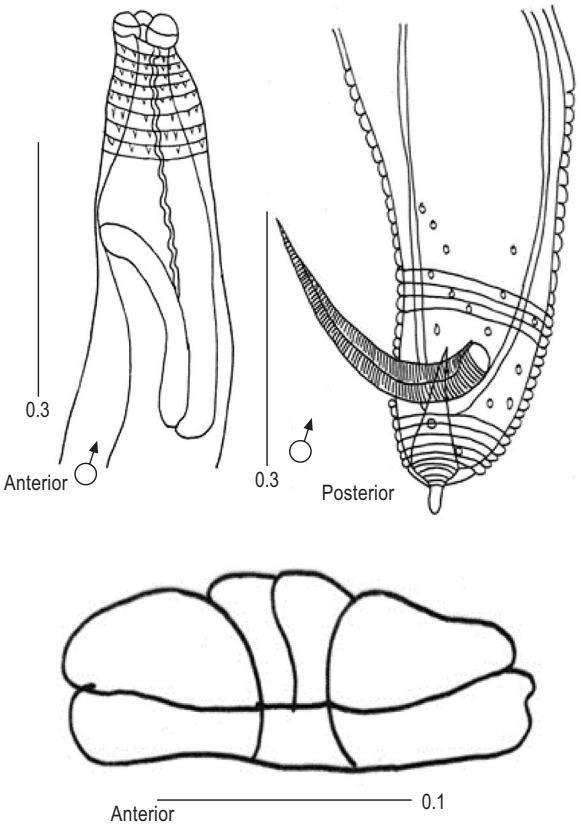

Fig. 1. *Goezia jamshorensis* n. sp. anterior and posterior diagrams of male worm.

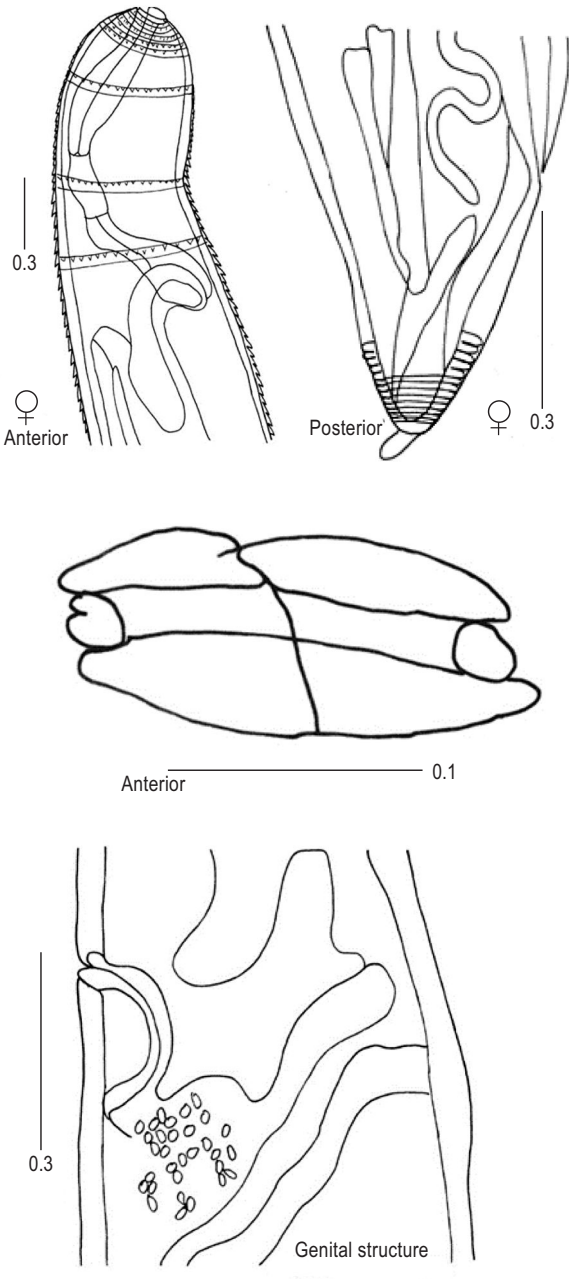

Fig. 2. *Goezia jamshorensis* n. sp. anterior and posterior diagrams of female worm with genital structure.

1.87-2.91. Larger spicule measures 0.492-0.54 × 0.04-0.05. Smaller spicule measures 0.26-0.29 × 0.02-0.03. Tail measures 0.12.

Female: Body of the worm measures 6.1-8.72 × 0.65-0.74. Esophagus measures 0.65-0.69 × 0.2-0.5. Ventriculus measures 0.25-0.34. Ventriculus appendix measures 2.78-4.85. Genital pore from anterior extremity measures 3.37-4.65. Tail is 0.44-0.54. Eggs measures 0.99 × 0.23-0.27.

The comparison of present species with previously reported species of genus in detail (Table 1).

G. pelagia Deardorff and Overstreet (1980) from *Rachycentron canadum* of Mexico differs from present species in having nerve ring circle around the esophagus at anterior end, deirids present, tail conical with digitiform processes and each with spinous structures, spicules equal in size, 18-25 pairs of caudal papillae, vulva equatorial, eggs spherical.

G. minuta Deardorff and Overstreet (1980) from *Bagre marinus* of Mexico varies from present species in having smaller in length, nerve ring circle around the esophagus at anterior end, tail conical with processes and circlet of spinous structures, spicules equal in size, 22 pairs of caudal papillae, vulva pre-equatorial.

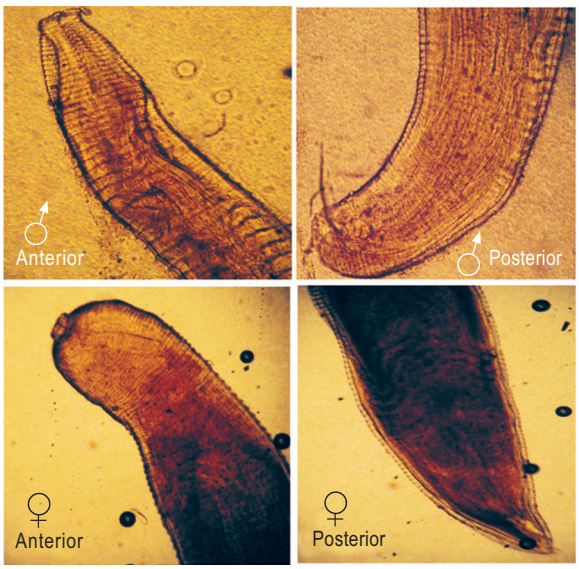

Fig. 3. *Goezia jamshorensis* n. sp. anerior and posterior photographs of male and female worm.

Table 1. Comparison of present species with closely related species of genus *Goezia*

Species	Present species		*G. ascaroides* Railliet and Henry, (1915)		*G. pakistanica* Bilqees *et al.* (1977)		*G. pelagia* Deardorff and Overstreet (1980)		*G. leporine* Martins And Yoshitoshi (2003)	
Host	*Rita rita*		*Thryssa hamiltonii*		*Apolectus niger*		*Rachycentron canadum*		*Leporinus microcephalus*	
Locality	Jamshoro, Pakistan		Bangladesh		Karachi, Pakistan		Mexico		Brazil	
Gender	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Body	3.9-5.14	6.1-8.72	10.53-23.22	27.00-32.37	11.12-21.30	26.25-37.29	3.4-12.0	3.6-14.5	20.31	27.02
Width	0.5-0.6	0.65-0.74	0.15-0.67	0.64-0.73	0.61-0.71	0.60-0.78	0.4-1.0	0.3-1.3	0.70	0.81
Esophagus	0.28-0.29× 0.16-0.17	0.65-0.69× 0.2-0.5	1.78-3.10	3.10-3.37	2.53-2.66	3.18-5.5	0.4-1.0	0.5-1.3	1.23	1.45
Ventriculus	0.14-0.23	0.25-0.34	0.13	0.09-0.10	0.338	0.33	41-105	50-129	0.09	0.11
Ventriculus appendix	1.87-2.91	2.78-4.85	2.56-4.32	5.2-5.5	0.715	2.15	0.8-2.2	0.6-2.3	3.83	4.54
Large spicule	0.492-0.54× 0.04-0.05		1.30-2.02		1.87		800-980		0.48	
Small spicule	0.26-0.29× 0.02-0.03		1.20-1.90		1.78		800-980		0.47	
Vulva from anterior end		3.37-4.65		8.00				1.2-7.0		11.59
Eggs		0.99-0.99× 0.23-0.27		0.03-0.04		0.039-0.065× 0.039-0.042		25-35		
Tail	0.12-0.15	0.44-0.54	0.06-0.09	0.23-0.25	0.19-0.20		84-120	108-284	0.13	0.13

Goezia kliksi Deardorff and Overstreet (1980) from *Pogonias cromis* of Mexico varies from present species in having nerve ring circle anteriorly to esophagus, tail conical with caudal processes and circlet of spinous, spicules equal in size, 17 to 23 pairs of caudal papillae, vulva pre-equatorial.

G. sinamora Deardorff and Overstreet (1980) gathered from stomach of *Tilapia aurea* of Florida varies from present species in having nerve ring circle anterior end of esophagus, tail conical with caudal processes, 18-21 pairs of caudal papillae, vulva pre-equatorial.

G. ascaroides Railliet and Henry (1912) gathered from stomach of *Thryssa hamiltoni* of Bangladesh varies from present species in having larger in length, mouth bear 3 lips with dentigerous ridges and interlabia, 14 pairs of caudal papillae, vulva pre-equatorial.

G. aspinulosa Arya (1980) gathered from intestine of *Scomberomorus guttatus* of India varies from present species in having cuticular rings of body without spines, amphids present on sub ventral lips, nerve ring circle at center of esophagus, tail conical with brushes at tip, spicules expanded proximally and blunt distal end, 19-20 pairs of caudal papillae.

G. chitali Zaidi and khan (1975) gathered from stomach of *Catla catla* and *Notopterus chitala* of India and Pakistan varies from present species in having smaller in length, cuticle rings without spines, esophagus with 2 appendices, vulva pre-equatorial.

Goezia heteropneusti Zaidi and khan (1975) gathered from intestine of *Heteropneustes fossilis* of (Sindh) Pakistan varies from present species in having cuticle rings without spines, lips without papillae, esophagus with 2 appendices, vulva pre-equatorial.

G. pakistanica Bilqees *et al. (*1977) gathered from intestine of *Apolectus niger* of (Karachi) Pakistan varies from present species in having larger in length, anterior end with cephalic alae, cuticle of lips produce 3 teeth like structures and interlabia, nerve ring circle the anterior end of esophagus, tail conical with appendages and spinous circlets, gubernaculum present, 37 pairs of caudal papillae.

G. tanusi Zaidi and khan (1975) gathered from intestine of *Notopterus chitala* of (Sindh) Pakistan varies from present species in having smaller in length, cuticle rings without spines, nerve ring circle at middle of esophagus, vulva pre-equatorial, eggs rounded.

G. pseudascaroides Bilqees *et al. (*1977) collected from stomach of *Mastacembalus puntatus* of (Sindh) Pakistan differs from present species in having lips expanded laterally, tail conical, spicules not overlapped each other, 31 pairs of caudal papillae, vulva pre-equatorial.

G. leporine by Martinus and Yoshitoshi (2003) from *Leporinus microcephalus* of Brazil varies from present species in having larger in length, anterior end cover with smooth cuticle, 3 lips, amphids, internal edges of lips with two projections, mouth parted from body by constriction, a pair of papillae, ventriculus in form of bulb, nerve ring circle around the esophagus at first third half, vulva pre-equatorial, tail conical with caudal processes, thin membrane surrounded both spicules at proximal end, 24-29 pairs of caudal papillae, eggs spherical.

G. spinulosa by Santos and Moravec (2009) from *Arapaima giagas* of Brazil differs from present species in having larger in length, 3 lips with deep grooves, margins alate, inner surface of each lips with two lobes, two lateral amphids, nerve ring circle around the esophagus at fourth half, derides present, tail conical with phasmids and caudal processes, spicules equal in size with cup like proximal end and narrow distal end, 21 pairs of caudal papillae, vulva pre-equatorial, vagina elongate backward, eggs spherical.

The present species varies from all its congenrs species of genus Goezia in having different diagnostic characteristics such as, body size, cuticle rings along with spines format, cephalic structures shape and arrangement, ventriculus and ventriculus appendix shape, size and position, caudal papillae number and arrangement, spicules shape and size, vulva position and shape of posterior end of male and female and perposed as new species. The name of new species *Goezia jamshorensis* denoted to the name of district Jamshoro from where host fishes were collected.

Conflict of Interest. The authors declare no conflict of interest.

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