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A NEW RECORD OF *RHABDOCHONA (RHABDOCHONA) HELLICHI TURKESTANICA* (SKRJABIN, 1917)  
MORAVEC ET AL., 2010 (NEMATODA: RHABDOCHONIDAE) FROM HIMACHAL PRADESH, INDIA.

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Abstract

The nematode *Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917) Moravec et al., 2010, a specific intestinal parasite of the cyprinoid fish, is described and illustrated from specimens parasitizing *Schizothorax plagiostomus* Heckel, 1838 from the river Ravi, at Chamba, Himachal Pradesh, in India. It is characterized by the presence of 14 anterior teeth in prostome (3 dorsal, 3 ventral and 4 on each lateral side); spicules unequal and dissimilar, bifurcated tip of left spicule having a ventral process distinctly longer than the dorsal one and scanning micrograph exhibiting its cuticular sheath as being distinctly blunt claw-hammer shaped; female vulva, in SEM, rectangular and guarded by a penta ribbed cantilever; eggs oval, each bearing distinct protuberance on either pole and provided with broad filament of fibrous structure.

**Keywords:** Nematode, *Rhabdochona*, *Schizothorax*, India.

Introduction

The genus *Rhabdochona* includes a large number of species all over the world (Nimbalkar et al., 2013). Yamaguti (1961) had listed about 36 species under the genus *Rhabdochona* Railliet, 1916. Sahay (1971) while revising the genus *Rhabdochona* provided a key to the Indian species. Moravec (1975) proposed four subgenera *Rhabdochona (Rhabdochona)* Railliet, 1916, *Rhabdochona (Globochona)* Moravec, 1972, *Rhabdochona (Globochonoides)* Moravec, 1975 and *Rhabdochona (Sinonema)* Moravec, 1975 on the basis of a complex of morphological features (mainly number of teeth in prostome and presence and absence of cervical alae) and their geographical distribution, from 25 species considered valid from Europe and Asia. Sood (1989) compiled the information on the nematode parasites including 35 species of *Rhabdochona* Railliet, 1916 reported till that date, from South Asia in the form of a monograph entitled "Fish Nematodes from South Asia".

At present the nematode genus *Rhabdochona* Railliet, 1916 includes about 105\* species parasitizing fresh water fishes in all zoogeographical regions, including recently described eight

new species viz., *Rhabdochona (Rhabdochona) hypsibarbi* Moravec et al., 2013 (from *Hypsibarbus wetmorei* (Smith) in the Mekong River, Nakhon Phanom Province, northeast Thailand); *Rhabdochona putitori* Anjum, 2013 (from *Tor putitora* (Hamilton-Buchanan) from Poonch river of Jammu & Kashmir in India); *Rhabdochona carpiæ* Nimbalkar et al., 2013 (from *Cyprinus carpio* (Linnaeus) at Jaikwadi dam of Aurangabad district, Maharashtra, India); *Rhabdochona haspani* Kakar et al., 2014 (from *Cyprinion watsoni* (Day) in Harnai (Sibi Division) Balochistan); *Rhabdochona (Globochona) puntii* Gonzalez-Solis et al., 2014 (from *Puntius sophore* (Hamilton) and *Neolissochilus hexastichus* (McClelland) from the Gadhena River, the Western Ghats, Maharashtra State, India) and three new species in the Central African Republic by Moravec and Jirku, 2014 namely; *Rhabdochona (Rhabdochona) centroafricana* (from *Barbus miolepis* Boulenger), *Rhabdochona (Rhabdochona) marcusenii* (from *Marcusenius greshoffii* (Schilthuis), *Rhabdochona (Globochona) tricuspidata* (from *Raiamas christyi* (Boulenger).

During recent nematological investigations on some freshwater fishes from the district Chamba in Himachal Pradesh a large number of specimens of *Rhabdochona* were recovered from the intestine of the *Schizothorax plagiostomus* (Cyprinidae, Cypriniformes). Whereas geographically *Schizothorax* spp. are spread in different rivers and tributaries throughout Himalayan extending to confines of China, eastern Afghanistan, Pakistan, Turkistan, Nepal, Ladakah, Tibet, Bhutan. In India *Schizothorax* spp. are the most important food fish of the Himalayan region including Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh foothills and Assam etc. (Bahuguna et al., 2009) and it also plays an important role in commercial fish production (Bahuguna, 2002).

Materials and methods

Fish were caught by local fishermen from river Ravi in district Chamba, Himachal Pradesh, India. Almost immediate to its capture, to avoid the deterioration of health of parasitic fauna, the hosts were dissected along the ventral line. The visceral organs were placed in different containers containing saline solution. The mucosal lining of the intestine was scrapped gently with the help of scalpel whereas, the other visceral organs were thoroughly teased into smaller bits to facilitate the release of the embedded

\* According to Moravec and Kamchoo (2012), 97 species of the genus *Rhabdochona* were considered possibly valid.

parasites. The specimens were washed thoroughly in saline to remove the debris, if any. FishBase (Froese and Pauly 2012) was followed for the name/s of fish.

The nematode parasites recovered in saline from the host were killed and fixed by pouring boiling hot 3-4% formalin or 70% alcohol on the bulk of specimens retained in the thin film of saline by draining off excess of the saline. This step also caused the almost straightening of the nematodes. The fixed nematodes were preserved in fresh fixative in glass vials and labelled for date, name and locality of host, location of parasites.

The identification of the nematode parasites was done by following 'CIH Keys to Nematode Parasites of Vertebrates' (Vol. 1-10). The drawings were made with the help of camera lucida. The work has also been supported by seven photomicrographs and four scanning micrographs taken at 'Leica DML S2- Camera DFC 320' and SEM Quanta-250 Model No. D9393 respectively. The measurements for the identification of the specimens were done with the help of ocular and stage micrometers. All measurements have been given in millimeters, unless otherwise indicated.

## Results

Family Rhabdochonidae Travasso *et al.*, 1928

*Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917) Moravec *et al.*, 2010.

Syn.: *Ichthyospirura turkestanica* Skrjabin 1917; *Rhabdochona denudata filamentosa* Bykhovskaya-Pavlovskaya, 1936; *R. kashmirensis* Thapar, 1950; *R. schizothoracis* Siddiqi *et* Khattak, 1984.

**Description :** Body medium sized with transversely striated cuticle; oral aperture hexagonal, with four distinct submedian sublabia, surrounded by four small submedian cephalic papillae and a pair of lateral amphids (Figs. 1C, 2A, 3A); pharynx cylindrical, elongated and dilated anteriorly to form a well defined buccal capsule (Figs. 1A, 2B), buccal capsule armed with longitudinal sclerotized rods projecting anteriorly as 14 small teeth (3 dorsal, 3 ventral and 4 on each lateral side) (Figs. 1C, 2A, 3A); deirids small, deeply bifurcate, situated near middle of vestibule (Figs. 1A, 2B, 3B), oesophagus divisible into two distinct regions, anterior short muscular and posterior long, glandular part; tail of both sexes conical, with sharply pointed tips (Figs. 1G-H, 2E).

**Male:** Body 9.74-10.08 (10.72-10.74)\* long, 0.145-0.165 (0.150-0.163) in maximum width; prostome 0.017-0.025 × 0.015-0.017 (0.024-0.027 × 0.018) and vestibule including prostome 0.125-0.175 (0.147-0.150) long; oesophagus 3.451-4.134 (3.535-4.288) long, muscular oesophagus 0.321-0.364 × 0.028-0.031 (0.345-0.348 × 0.030-0.033), glandular oesophagus 3.13-3.77 × 0.08-0.109 (3.19-3.94 × 0.105-0.114), length ratio of both parts 1:9-10 (1:9-11), length of vestibule with prostome and entire oesophagus forms 36-42% (36-40%) of body length; nerve ring and deirids 0.175-0.22 and 0.05-0.107 (0.189-0.219 and 0.069-0.111) respectively from anterior extremity (Fig. 1A, 2B, 3B); cloacal

papillae 16 pairs, precloacal papillae 10 pairs with nine pairs of subventral papillae and 1 pair of lateral situated between second and third subventral pairs, 6 pairs of postcloacal papillae, second pair lateral whereas remaining subventral (Figs. 1D, 2C ); spicules unequal and dissimilar, left spicule 0.425-0.520 (0.570-0.576) long, its shaft 0.212-0.298 (0.318- 0.339) long, representing 50-57% (56-59%) of entire spicule length, distal tip lanceolate wide, ventrally distended with wide cuticular membrane forming dorsal and ventral processes, the latter being distinctly longer than the former (Figs. 1F, 2D, 3C ), right spicule 0.125-0.14 (0.135-0.138) long, with distinct dorsal barb at distal tip (Figs. 1E, 2C ), length ratio of spicules 1:3.4-3.71 (1:4.17-4.22); tail 0.30-0.392 (0.396-0.441) long (Fig. 1G ).

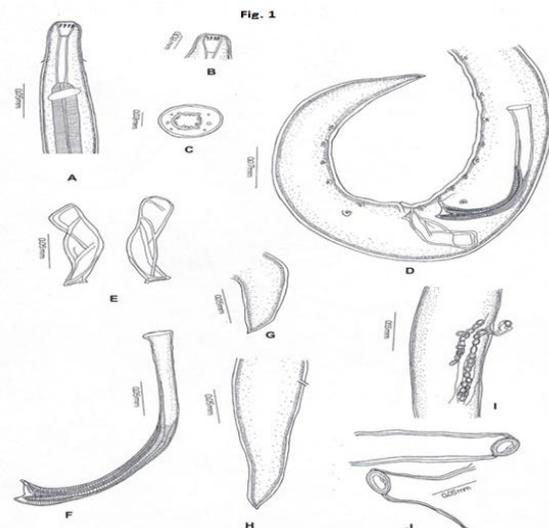
**Female:** Body 12.78-15.49 (12.25-16.09) long, 0.20-0.25 (0.218-0.286) in maximum width; prostome 0.022-0.0275 × 0.015-0.020 (0.027-0.038 × 0.018-0.024) (Fig. 1B ) and vestibule including prostome 0.122-0.175 (0.114-0.165); oesophagus 3.57-4.09 (2.821-4.285), muscular oesophagus 0.32-0.39 × 0.027-0.032 (0.291-0.405 × 0.024-0.036), glandular oesophagus 2.66-3.75 × 0.132-0.139 (2.53 × 3.88 × 0.126-0.144), length ratio of both parts 1 : 8-9 (1 : 8-9); nerve ring and deirids 0.187-0.237 and 0.05-0.105 (0.195-0.225, and 0.078-0.081) respectively from anterior extremity (Fig. 2B); vulva rectangular provided with five longitudinally ribbed cantilever and 'c' shaped window-sill and postequatorial 7.03-8.921 (6.58-8.21) from anterior end, vagina directed posteriorly from vulva (Figs. 1I, 2F, 3D ); eggs oval, 0.025-0.036 × 0.018-0.022 (0.039-0.045 × 0.021-0.027), with distinct protuberances on either pole provided with broad filament of fibrous structure 0.150-0.270 (0.200-0.250) long (Figs. 1J, 2G); tail 0.30-0.38 (0.264-0.360) long (Figs. 1H, 2E ).

**Type host:** *Schizothorax plagiostomus* Heckel, 1838 (Cyprinidae, Cypriniformes)

**Location:** Intestine

**Locality:** Ravi river, Chamba District, Himachal Pradesh, India (collected in April, May and August, 2011)

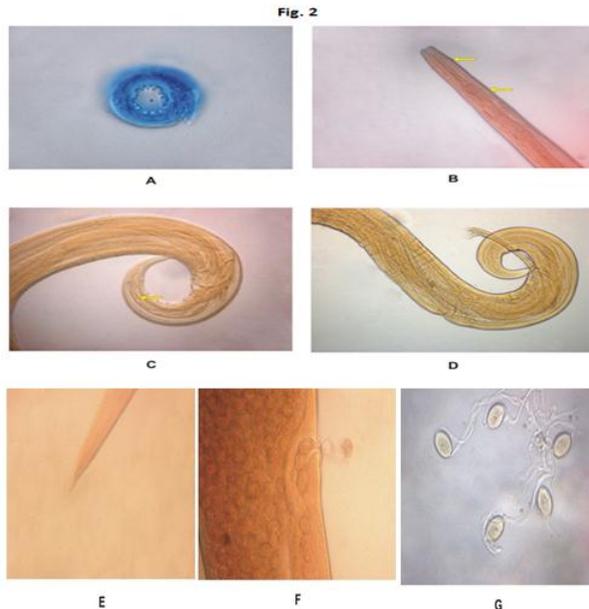
**Prevalence and Intensity of Infection:** 45.71% (48 fish infected/ 105 fish examined); Mean Intensity-5.77 (277/48)



**Fig.1** *Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917) Moravec *et al.*, 2010.

\* Measurements given in the parentheses are those from Moravec *et al.* (2010)

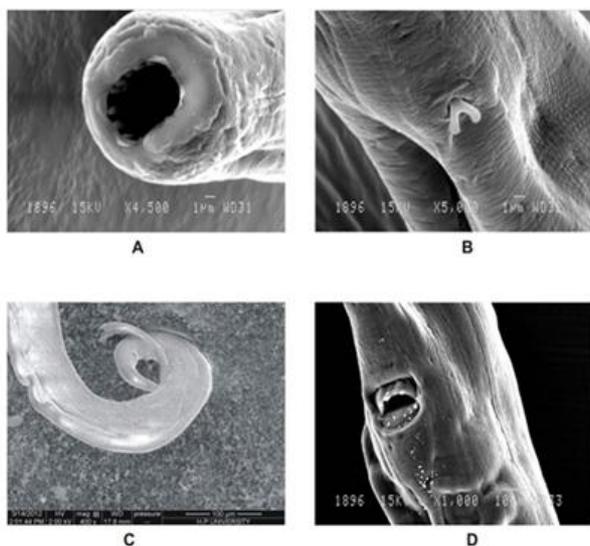
- A:** Anterior end of male, dorsoventral view.  
**B:** Prostome of female  
**C:** Enface view  
**D:** Caudal end of male, lateral view  
**E:** Right spicule, in different, lateral views  
**F:** Distal end of left spicule, lateral view  
**G:** Male tail, lateral view  
**H:** Female tail, lateral view  
**I:** Region of vulva, lateral view  
**J:** Eggs



**Fig. 2** *Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917) Moravec *et al.*, 2010.

- A:** Enface view  
**B:** Anterior end of female, dorsoventral view  
**C:** Caudal end of male, lateral view  
**D:** Distal end of left spicule, lateral view  
**E:** Female tail, lateral view  
**F:** Region of vulva, lateral view  
**G:** Eggs

**Fig. 3**



**Fig 3.** *Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917) Moravec *et al.*, 2010.

- A:** Cephalic End  
**B:** Deirid  
**C:** Posterior end of male, lateral view  
**D:** Region of vulva, ventrolateral view

**Remarks:** The present observations are in agreement with Moravec *et al.* (2010) for *Rhabdochona (Rhabdochona) hellichi turkestanica* (Skrjabin, 1917), being a distinct subspecies excepting some intraspecific variations in the measurements of the body organs representing the Asian distribution from *Schizothorax* and some related genera.

Some small morphological differences observable between European and Asian specimens of *Rhabdochona hellichi* especially in the shape of distal end of the left spicule, were considered to be within the intraspecific variability of the species (Moravec & Amin 1978), whereas Moravec *et al.* (2010) following molecular studies of *Rhabdochona hellichi* from *Barbus barbus* (Linnaeus) in the Czech Republic and those of *Schizothorax* sp. from West Bengal and Sikkim, India by Cernotikova (2010) in considering these being genetically distant, had characterized the nematodes so far reported as *R. hellichi* or under synonyms from Central and South Asia, as two distinct new subspecies on the basis of distal bifurcations of left spicule, *viz.*: *R. (R.) hellichi turkestanica* (Skrjabin, 1917) characterized by having the ventral process of the distal tip of left spicule longer than the dorsal process (from Asian representatives of *Schizothorax* sp. and some related genera), differing morphologically from nominotypical subspecies *R. (R.) hellichi hellichi* (Sramek, 1901) characterized by having approximately equal long processes (from European species of *Barbus*); though Cernotikova *et al.* (2011) had, however, postulated that these two subspecies, *vide supra*, may actually represent separate species; though Rasheed (1965) had observed that, probably no other character is so complex and species specific within *Rhabdochona* as the distal end of left spicule, while Mejia-Madrid *et al.* (2007) working on the phylogeny of *Rhabdochona* opined that phylogenetic patterns reveal an ancient origin for the group that probably predates current continental configurations and the species could be better grouped by spicule form than by any other character, mainly because all other characters exhibit such a low variability so as to render them of very limited use in phylogenetic analyses, since *Rhabdochona* species can be divided into various groups on the basis of distal end of left spicule *viz.*: pointed, lanceolate pronged, lanceolate thin, lanceolate wide, lanceolate bifurcate and lanceolate blunt, since such a complex structure especially in some species can most likely not be acquired more than once.

In *R. (R.) hellichi turkestanica* the distal end of the lanceolate left spicule being, wide to different degrees, is ventrally distended and covered with a cuticular membrane terminating in dorsal and ventral processes. The SEM observations revealed the presence of distinctly bifurcated blunt claw-hammer shaped distal tip of left spicule and females with a rectangular vulva guarded by a penta ribbed cantilever and 'c' shaped window-sill.

The nematode subspecies represents a new geographic distribution in Himachal Pradesh in addition to previously

recorded in Lodhomakhola and Rangit Rivers, West Bengal and Sikkim.

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