A new species of Camallanidae (Raillet and Henry, 1917) from a siluroid catfish in Barak River, Jiribam, Manipur (India)

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Abstract Based on the two Camallanid gravid females recovered from the intestine of siluroid catfish *Aorichthys aor* (Hamilton, 1822) in Barak River, Jiribam, Manipur, India, *Procamallanus (Spirocamallanus) jiriensis* n. sp. is described. It is morphologically characterized by 20–24 (9-incomplete) spiral thickenings (ridges), occupying posterior 2/3rd of the buccal capsule. The present species differs from its closely related species *Procamallanus (Spirocamallanus) chauhani* (Sahay in Indian J Helminthol 18(2):114–122, 1966) in many aspects such as two pair of teeth antero laterally present in oral cavity, a pair of finger-shaped thickenings, which is laterally present at the buccal capsule, presence of well-developed globular vulvar lips, vagina directed posteriorly from vulva, a small conical spike-like projection at the rounded tail tip with well-developed caudal muscles and papillae.

Keywords *Aorichthys aor* · Barak River · Camallanid · Jiribam · *Procamallanus (Spirocamallanus) jiriensis* n. sp. · Siluroid

Introduction

Fishes have high nutritional value and serve as a staple food item for human beings. In India, they are traditionally and economically important hence they have high demand in different sections of population. Fishes are subjected to many parasitic infections due to their diverse feeding habits and habitats in both freshwater and marine systems. The parasite fauna of freshwater fishes of Jiribam, Manipur is not yet fully explored. During the course of a study on the parasite fauna of freshwater fishes from Barak River, Jiribam is carried out in different seasons (Pre-monsoon, Monsoon and Post-monsoon) during 2015–2016. During the investigation (2015–2016), 6 hosts (*Aorichthys aor*) were examined. In pre-monsoon (Jan.–April), only one host was examined and found to be infected by multiple parasite with high intensity of infection. Among the forty recovered parasites, only two are taken for detail study in this paper and are found to be closely related with the species *Procamallanus (Spirocamallanus) chauhani* (Sahay 1966) within the sub-genus *Spirocamallanus* Olsen, 1952 of the genus *Procamallanus* Baylis, 1923 (Camallanidae).

Materials and methods

Fish hosts were collected from Barak River in different seasons (Pre-monsoon, Monsoon & Post-monsoon) during 2015–2016. Fishes were anaesthetised, killed and examined for the presence of parasites. The recovered parasites (two gravid females) were washed in normal saline solution (0.7%). The specimens were fixed in A.F.A. (Alcohol Formaline Acetate) and dehydrated in G.A. (Glycerine Alcohol). After preparation of permanent slide specimens

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were examined using Olympus light binocular microscope (CH20i) and photomicrograph were obtained by Nikon Stereozoom-microscope (SMZ1270). Diagrams were drawn with the help of Weiber Camera Lucida and measurements were taken using Ocular micrometer. Measurements are given in millimeter except when indicated.

Results

The morphological analysis of the 2 (two) gravid female allowed the identification of *Procamallanus* (*Spirocamallanus*) *jiriensis* n. sp.

Description

Female (based on 2 gravid specimens): Body 13.33–15.69 in length and 0.16–0.17 in width (Fig. 1a–d), tapering

towards both anterior and posterior extremities, cuticle thin, finely striated in the cephalic and posterior region and coarser in mid-region of the body. Head truncated with rounded mouth, buccal capsule thick-walled, barrel-shaped with spiral thickenings, 0.09 in length and 0.04 in width, basal ring of buccal capsule represented by a knob-like structure, 0.01 in length and 0.03 in width, inner surface of capsule provided with 20–24 (9-incomplete) uninterrupted spiral thickenings (ridges) when counted diagonally, coating posterior 2/3rd of buccal capsule, a pair of lateral finger-shaped thickenings at buccal capsule, two pairs of antero-lateral teeth present in anterior 1/3rd of buccal capsule (Fig. 2b). Club-shaped muscular oesophagus is shorter than glandular oesophagus, 0.52–0.62 in length and 0.06 in width, columnar-shaped glandular oesophagus is 0.78–0.91 in length with 0.06 in width, entire oesophagus (1.3–1.4 in length) covered 9.7% of the body length. Nerve ring at anterior 1/5th of the muscular oesophagus, 0.19–0.20 from the anterior end, with a pair of prominent rounded structure attached above it (Figs. 2a, b, 3a, b). Vulva post-equatorial, with well-developed globular lips,

Fig. 1 *Procamallanus* (*Spirocamallanus*) *jiriensis* n. sp. (Camera Lucida drawing) Female whole mount in four parts: **a** Anterior end, **b** Posterior to oesophagus, **c** Mid-region and **d** Posterior end

Fig. 2 *Procamallanus* (*Spirocamallanus*) *jiriensis* n. sp. (Camera Lucida drawing). **a** Female anterior end, **b** Female anterior end (enlarged view), **c** Vulvar region, **d** Posterior end of female showing spike and papillae and **e** Eggs (enlarged view)

Fig. 3 *Procammallanus (Spirocamallanus) jiriensis* n. sp. by light microscopy. **a** Female anterior region evidencing muscular and glandular oesophagus, **b** Female anterior region showing buccal capsules with spiral ridges and nerve ring (enlarged view), **c** Mid-region of female vulva and vagina, **d** Ventral view of female posterior end showing anus, papillae and spike and **e** Mid-region of female showing eggs (enlarged view)

at 8.27–9.80 (61–72%) from anterior end, vagina muscular, 0.2 long, directed posteriorly. Uterus opposedly branched (amphidelphic), packed with numerous eggs, extending anteriorly little below to junction of intestine and glandular oesophagus, and posteriorly a little above posterior end of intestine (Figs. 2c, 3c). Eggs oval, partially embryonated, inconspicuous-shells, 0.01–0.02 in length, 0.01–0.02 in width (Figs. 2e, 3e). Anus dorsoventrally opens at a short distance above the posterior end, tail 0.19 long and terminally rounded, finely striated, anal body diameter (A.B.D.) 0.05–0.07, with well develop caudal muscles and a pair of caudal papillae, a lateral conical spike-like projection from the rounded tail tip, tail spike 0.02 long (Figs. 2d, 3d).

Discussion

The present finding is the first report of recovery of a nematode parasite from the freshwater fish *Aorichthys aor* (Hamilton 1822) in Barak River, Jiribam, Manipur. Depending on the comparative morphometric analysis using light binocular microscopy, type locality and type host, the present species is identified as new and given the name *Procammallanus (Spirocamallanus) jiriensis* n. sp. The described species comes closer to the specimens described as *Procammallanus (Spirocamallanus) chauhani* (Sahay 1966) in the subgenus *Spirocamallanus* (Olsen 1952) of the genus *Procammallanus* (Baylis 1923).

It also comes closer to the sub-genus *Spirocamallanus* as it possesses spiral thickenings (ridges) in the buccal capsule, which is also supported by Moravec and Thatcher (1997). The latter authors proposed 5 subgenera of *Procammallanus* based on the remarkable features of the buccal capsule viz. *Spirocamallanoides* (Moravec and Sey 1988), *Spirocamallanus* (Olsen 1952), *Denticamallanus* (Moravec and Thatcher 1997), *Procammallanus* (Baylis 1923) and *Punctocammallanus* (Moravec and Scholz 1991). Most species of *Procammallanus* (S.) are parasites of fish in both freshwater and marine habitats and are characterised by the presence of spiral thickenings (ridges) at buccal capsule in both males and females, which is present only in part of the inner surface of buccal capsule with the anterior 1/3rd portion is smooth.

In spite of many similarities, the new species differs from *P. (S.) chauhani* in many aspects (Table 1) by having a shorter body, slightly shorter glandular oesophagus, number of spiral thickenings (ridges) 20–24 (9-incomplete), was unreported in *P. (S.) chauhani*, though it has two sets of obliquely crossing spiral ridges. Moreover, buccal capsule of present species has a pair of finger-shaped lateral thickenings directed towards the oral aperture whereas *Procammallanus (S.) chauhani* has a pair at the median of buccal capsule. This type of structures are also found to be observed in *P. gubernaculus* (Khera 1955), *P. ditchelli* (Gupta and Garg 1976), *P. meszarosi* (Arya 1984), *P. (S.) belenensis*, *P. (S.) jaliscensis*, *P. (S.) mexicanus*. Furthermore, 2 (two) pair of antero-lateral teeth like structures present in the oral cavity in the present species is absent in *P. (S.) chauhani*, although it is found to be present in other species like *P. (S.) belenensis*, *P. (S.) innopinatus* and *P. (S.) spiralis*.

Uterus of *P. (S.) jiriensis* n. sp. is located less anteriorly and posteriorly than the *P. (S.) chauhani*, uterus packed with embryonated eggs, while eggs are not recorded in *P. (S.) chauhani*. Vulva is found closer towards the posterior extremity (61.50–72.0%) in present species whereas it is located at 57% of the body length in *P. (S.) chauhani*. In

Table 1 Comparison of the present species with its closest relative

Character	<i>Procamallanus</i> (<i>S.</i>) <i>chauhani</i> (Sahay, 1966)	<i>P.</i> (<i>S.</i>) <i>jiriensis</i> n. sp. (present species)
Teeth	Absent	Two pair of teeth anterolaterally present at oral cavity
Finger-like thickenings	A pair of finger-shaped thickenings at the median of buccal capsule	A pair of finger-shaped thickenings laterally present at buccal capsule
Number of spiral thickenings(ridges)	Not reported	20-24 (9-incomplete) ridges
Vulvar lips	Non-globular	Well develop globular vulvar lips
Eggs	Not recorded	Embryonated eggs with inconspicuous shells
Tail spike	Two conical spike at the rounded tail tip	One laterally projected conical spike at the rounded tail tip

addition, vulvar lips of the present species is globular, elevated and directed posteriorly, it was not reported in *P. (S.) chauhani*.

Most female species of *Procamallanus* (*Spirocamallanus*) possess 2-4 terminal spikes on the tip of tail (Moravec et al. 2000). *P. (S.) chauhani* has two spikes whereas a single conical spike is found in present species and *P. (S.) berdii*. Although, the present species differ from *P. (S.) berdii* in many aspects like pre-equatorially located vulval opening, less no. of spiral ridges (15), downwardly projected spike with three papillae in *P. (S.) berdii*.

According to Petter et al. (1977) and Rigby and Adamson (1997), the shape of the female tail appears to be constant within a species in *Procamallanus* (*Spirocamallanus*). Considering the shape of female tail possessing of a single conical spike at the tip of rounded tail, this species is easily distinguishable from all congeneric species.

Considering the above discussed characteristics of the present species, it has become necessary to erect a new species accommodating it and name it as *Procamallanus* (*Spirocamallanus*) *jiriensis* n. sp.

Taxonomic summary

Type host: Aorichthys aor (Hamilton 1822)

Site of infection: Intestine

Type locality: Barak River, Jiribam (24°79' North latitude, 93°94' East longitude), Manipur (23°50' North to 25°41' North latitude, 93°00' East to 94°45' East longitude), India

Prevalence: 16.66%

Intensity: 2 (2/1) parasites per host.

Deposition of Specimens: Holotype female on the slide MU-PJ01/03/15 and

Paratype female on the slide MU-PJ02/03/15

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Etymology: The new species is named after its locality of recovery- Jiribam, Manipur.

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Authors' contributions RKS: Data collection. Analysis and interpretation of data. Drafting the manuscript. RKG: Conception and design of study. Revising the manuscript critically for important intellectual content.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All the procedures performed in research studies using fishes were in accordance with the ethical standards of the Institutional Animal Ethics Committee of Manipur University (M.U/D.Sc./ETHICS-7/09).

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