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SHORT COMMUNICATION

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A new report on the occurrence of monogenean parasites (Monogenoidea) on gill filaments of freshwater fishes in Meghalaya

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Abstract The edible freshwater fishes of several genera including *Labeo*, *Cyprinus*, *Cirrhinus*, *Danio*, *Puntius*, *Garra* (Cypriniformes), *Channa* (Channiformes), *Clarias*, *Heteropneustes*, *Rita*, *Monopterus*, *Ompak*, *Bagarius* and *Mystus* (Siluriformes) in Meghalaya State were examined for their helminth parasite spectrum. Two monogenean flukes representing the genera *Diplozoon* and *Bifurcohaptor* were recovered from the gills of the host fish, which are redescribed herein and their descriptions supplemented with information on their surface fine topography. *Labeo pangusia* and *L. boga* constitute new host records for the diplozoid monogenean. Both the monogenean species are reported for the first time from the fishes in Meghalaya, a new locality record.

Keywords *Bifurcohaptor* · *Diplozoon* · Freshwater fish · Monogenea

Introduction

The spectrum of helminth parasites of freshwater piscine hosts has been scantily studied and there is limited information available on this aspect pertaining to the north-eastern region of India. In context of Meghalaya there are very few reports available on the parasitic helminth fauna of fishes, wherein the occurrence of some trematode species has been recorded (Srivastava and Ghosh 1967; Soota and Ghosh 1977); however the caryophyllidean cestode fauna of siluriform fishes is relatively well documented (Chakravarty and Tandon 1988; Tandon et al. 2005).

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During an exploratory survey of edible freshwater fishes in Meghalaya, a wide spectrum of Cypriniformes, Channiformes and Siluriformes fish species were examined for the platyhelminth fauna sustained by them. Of the fishes examined, the species of *Labeo* (Cypriniformes) and *Mystus* (Siluriformes) were found to harbor two monogenean fluke species. In the present communication we redescribe these species, the occurrence of which is being reported for the first time from the northeastern region of India.

Materials and methods

A large number of specimens of *Bifurcohaptor indicus* were recovered from the gills of the catfish *Mystus tengara* and *M. vittatus* and 45 specimens of *Diplozoon cauveri* were collected from the gill filaments of 42 *Labeo pangusia* and 8 specimens from 6 *Labeo boga*. The recovered parasites were flattened, fixed in 70% alcohol and processed for wholemount preparations following standard procedure and using Borax carmine and Mayer's carmalum as stains. For scanning electron microscopy (SEM) the specimens fixed in 4% cold neutral buffered formalin were processed and treated with tetramethylsilane (Roy and Tandon, 1991), metal coated and viewed under a LEO 435 VP scanning electron microscope at accelerating electron voltage ranging between 10–20 kV. Measurements of the body and the various structures are given in millimeters.

Results

Monopisthocotylea

Order: Dactylogyridea Bychowsky, 1937
Family: Dactylogyridae Bychowsky, 1933

Genus: *Bifurcohaptor* Jain, 1958
Bifurcohaptor indicus Jain, 1958 (Figs. 1, 2).

Body elongated, blunt anteriorly. Cephalic region broad, head organs paired, with a set of four organs lying on either lateral side of anterior end. Eye spots two pairs, posterior pair larger than anterior. Opisthaptor forceps-like, deeply bifurcated, nearly 1/3rd of total body length; armature of opisthaptor comprising two pairs of anchors, larger dorsal and smaller ventral; each dorsal anchor with three sclerotized plates—one median, two dorsolateral, anchor comprising a stout base, long shaft and strong recurved points;

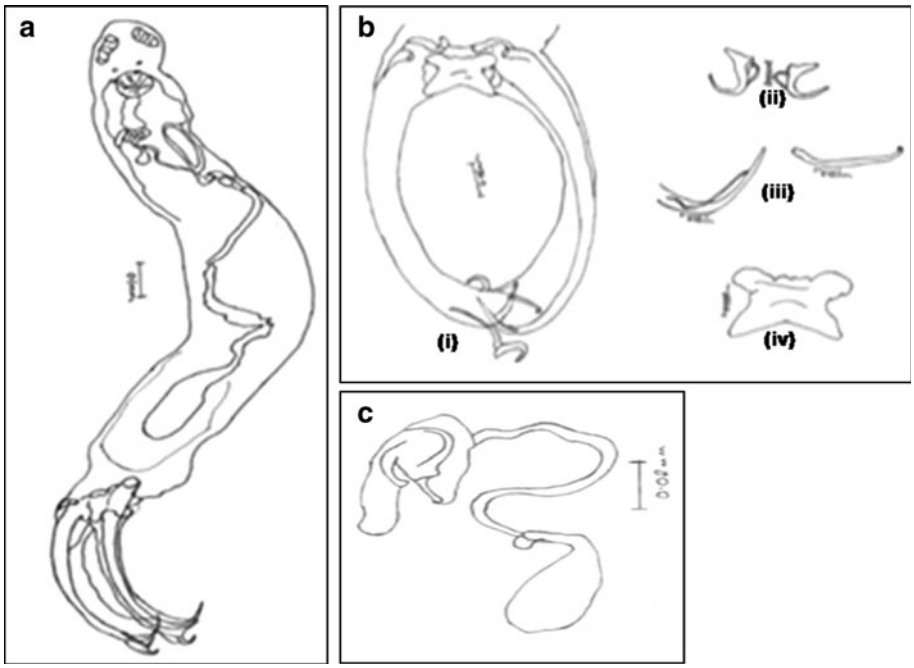

Fig. 1 *Bifurcohaptor indicus*: **a** Whole worm; **b** opisthaptor enlarged showing (*i*) entire haptor with its armature, (*ii*) ventral anchors, (*iii*) ventral bars, (*iv*) dorsal bar; and **c** male copulatory complex showing accessory piece and copulatory tube

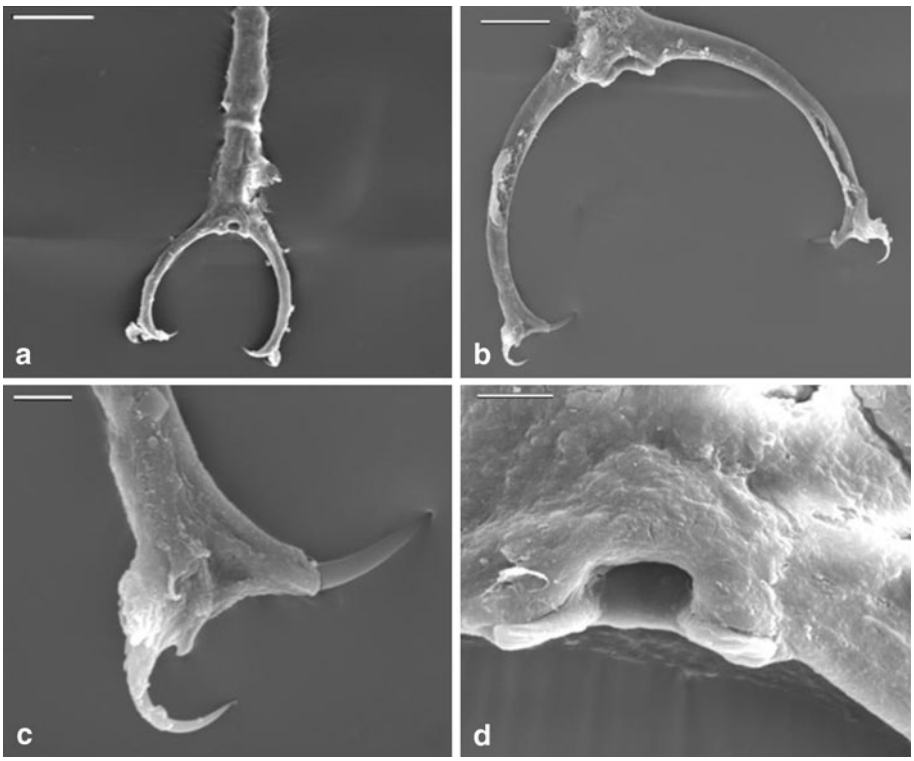

Fig. 2 SEM of *Bifurcohaptor indicus*: **a** Whole worm (*scale bar* 100 μm); **b** posterior end showing the two haptors (*scale bar* 50 μm); **c** magnified dorsal anchor showing recurved hooks (*scale bar* 10 μm); and **d** dorsal bar in higher magnification (*scale bar* 10 μm)

Table 1 Observations on *Bifurcohaptor indicus* Jain, 1958

	Bifurcohaptor indicus Jain, 1958	
	Present observation (mm)	Original observation (mm)
Body		
Length	0.49–1.23	0.55–0.82
Width	0.06–0.19	0.05–0.06
Pharynx diameter	0.045–0.054	0.034
Haptors		
Length	0.38–0.45	0.2–0.27
Width	0.01–0.05	0.15–0.29
Dorsal anchor		
Length	0.19–0.41	0.16–0.2
Width	0.018–0.036	
Dorsal bar		
Length	0.018–0.063	0.041–0.045
Width	0.036–0.072	0.033–0.036
Ventral bar		
Length	0.009–0.009	
Width	0.018–0.027	
Ventral anchor		
Length	0.009–0.009	0.016–0.025
Width	0.015–0.036	0.012
Host	*Mystus tengara*, *M. vittatus*	*M. vittatus*
Locality	Byrnihat, Dawki (Meghalaya)	Lucknow (Uttar Pradesh)

ventral anchors very small, lying at extremities of haptor, each with bifurcate base, shaft and fine recurved point, ventral bars two. Pharynx oval; oesophagus short; intestinal ceaca bifurcated, united just anterior to haptor. Testis and ovary single; male copulatory complex consisting of copulatory tube and single accessory piece. Vitellaria follicular, densely spread throughout body except at region of reproductive organs. Eggs not observed. SEM observations revealed the presence of smooth body surface, devoid of any spines or papillate structures. Measurements of the body are provided in Table 1.

Host—*Mystus tengara*, *M. vittatus*
Location—Gill filaments
Locality—Dawki, Byrnihat (Meghalaya).

Remarks

The genus *Bifurcohaptor* was erected by Jain (1958) with *B. indicus* as its type species, from gill filaments of *Mystus vittatus* at Lucknow. The genus *Bagaritrema*, described by Tripathi (1959) from gill filament of *Bagarius bagarius*, is a synonym of *Bifurcohaptor* (Yamaguti, 1963). Species of *Bifurcohaptor* so far reported from India include: *B. indicus* Jain, 1958 from *Mystus vittatus*; *B. giganticus* Jain, 1958 (= *Bagaritrema son* Tripathi, 1959) from *M. seengala* (= *Sperata seengala*); *B. minutum* Kulkarni, 1969 from *M. tengara*; *B. vishwanathai* Agarwal and Kumar, 1977 from *Bagarius bagarius*; *B. mulleri* Gupta and Sharma, 1981 from *B. bagarius*; *B. tripathii* Gupta and Sharma, 1981 from *Channa striatus*; *B. gorakhnathai* Kumar and Agarwal, 1982 from *B. bagarius*; *B. sohani* Agarwal and Singh, 1982 from *M. vittatus*; *B. hemlatae* Gupta, 1984 from *Rita rita*; *B. ramalingami* Swarup and Jain, 1984 from *M. vittatus* and *B. bagarius*; *B. kulkarnii* Swarup and Jain, 1984 from *B. bagarius*; *B. chauhani* Agarwal and Sharma, 1986 from *B. bagarius*; and *B. pedunculata* Pandey, Agarwal and Tripathi, 2002 from *M. vittatus*.

Pandey and Singh (1989) studied the validity of Indian species of *Bifurcohaptor* and regarded only *B. indicus* as a valid species, with all others being its synonyms. However, Dubey et al. (1990) regarded *B. giganticus*, *B. son*, *B. tripathii* and *B. hemlatae* to be valid species, whereas Lim et al. (2001) retained only *B. indicus*, *B. giganticus* and *B. son* as valid species and considered the rest as species inquirendae. Pandey et al. (2002) concluded that catfishes of the Indian sub-continent harbor only two species viz. *B. indicus* and *B. giganticus.*

The present description of *B. indicus* tallies with the original description of the species, with minor modifications in form and measurements of the body structures. *B. indicus* has been earlier reported from *Mystus tengara*, *M. keletius* and *M. nemurus* (= *Hemibagrus nemurus*) besides its type host. Dawki and Byrnihat, (Meghalaya), as reported herein, are new locality records for this species.

Polyopisthocotylea

Order: Mazocraeidea Bychowsky, 1957
Family: Diplozoidae Tripathi, 1957
Genus: *Diplozoon* Nordmann, 1832
Diplozoon cauveri Tripathi, 1959 (Figs. 3, 4).

Flukes always occurring in permanent pairing, two flukes joined in posterior half of body, in shape of 'X'; body pale white in colour, forebody longer than hindbody. Prohaptor comprising two cup-shaped suckers. Opisthaptor with four pairs of lateral clamps, rectangular in shape and concave ventrally. Mouth situated on ventral side of anterior extremity; pharynx just behind prohaptoral region. Gut single, intestine not bifurcate but with numerous lateral diverticula. Reproductive organs located in anterior part of hindbody. Testis single, spherical, slightly lobed. Ovary

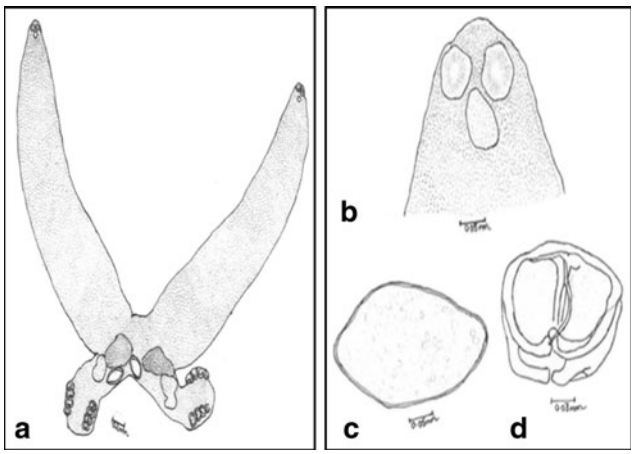

Fig. 3 *Diplozoon cauveri*: **a** A pair of whole worm in union; **b** anterior part of the forebody magnified; **c** single egg magnified; and **d** single clamp magnified

pretesticular. Vitelline follicles extensive, scattered in whole forebody. In utero eggs one, occasionally two in number, oval, without polar filaments. SEM observation showed the presence of rough body surface with absence of spines or papillae. Measurements of the fluke are provided in Table 2.

Host—*Labeo pangusia*, *L. boga*
Location—Gill filaments
Locality—Dawki, Shella, Sonapur (Meghalaya).

Remarks

The genus *Diplozoon*, with type species *D. paradoxum* Nordmann, 1832, was first described from the gills of *Abramis bramis brama*. The species of *Diplozoon* reported from India so far are: *D. indicum* Dayal, 1941 from *Barbus sarana*; *D. kashmirensis* Kaw, 1950 from *Schizothorax niger* and *S. esocinus*; *D. soni* Tripathi, 1957 from *Oxygaster bacaila*; *D. cauveri* Tripathi, 1959 from *Cirrhina cirrhosa*; *D. microclampi* Kulkarni, 1971 from *Barbus sarana*; *D. thapari* Gupta and Krishna, 1979 from *Tor tor* and *D. dasashwamedhai* Agarwal and Kumar, 1989 from *Barilius bola.*

Fotedar and Parveen (1987) also recorded *D. nipponicum* Goto, 1891 from *Cyprinus carpio specularis* from Kashmir. However, Pandey et al. (2002) regarded *D. nipponicum* Goto, 1891 as a synonym of *D. kashmirensis*. Further, Pandey and Agarwal (2008) considered *D. indicum* and *D. nipponicum* as the only valid species.

The presence of eggs with a long coiled filament is a diagonistic characteristic of the genus *Diplozoon*. However, *D. cauveri* was described as having eggs without polar filament (Tripathi, 1959). The present observations of the diplozoid fluke under study tally with the original description of *D. cauveri* in having non filamented eggs. In view of this character, i.e., eggs without polar filaments, *D. cauveri* should be recognized as a valid species of the genus. As reported herein, *Labeo pangusia* and *L. boga* are new host records and Meghalaya, a new locality record for *D. cauveri*.

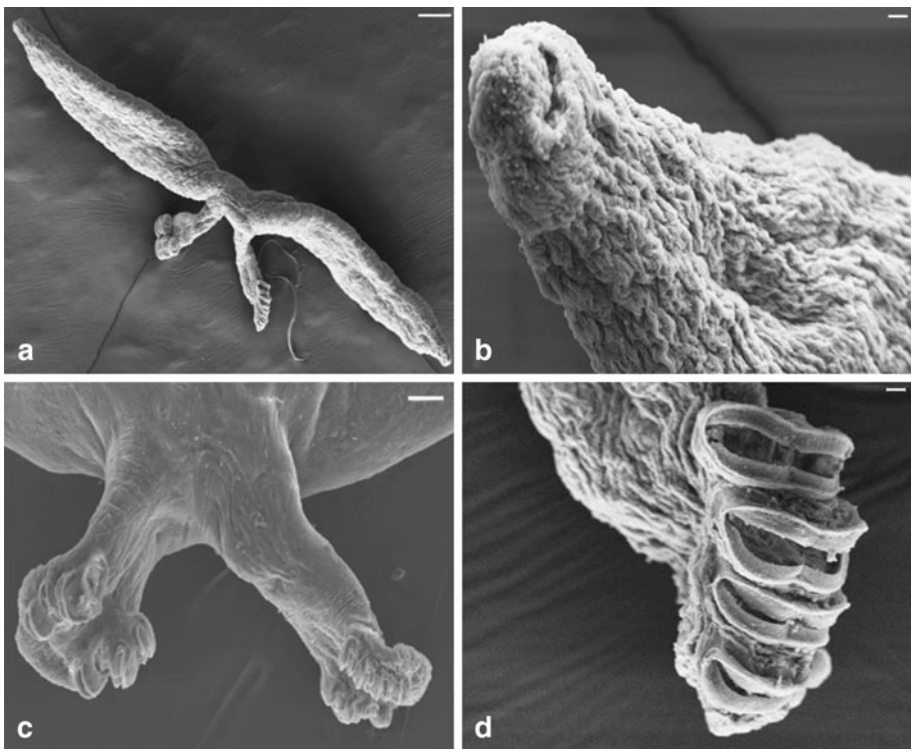

Fig. 4 SEM of *Diplozoon cauveri* **a** A pair of whole worm in union (*scale bar* 200 μm); **b** view of sub terminal oral sucker showing rough texture with lack of papillae (*scale bar* 10 μm); **c** paired opisthaptor in the posterior end showing clamps (*scale bar* 10 μm); and **d** magnified single row of clamps (*scale bar* 10 μm)

Table 2 Observations on *Diplozoon cauveri* Tripathi, 1959

	Diplozoon cauveri Tripathi, 1959	
	Present observation (mm)	Original observation (mm)
Body length	2.82–5.10	4.78–5.14
Forebody		
Length	1.79–4.14	3.11–3.37
Width	0.52–1.31	1.08–1.35
Hindbody		
Length	0.69–1.26	1.5–1.76
Width	0.25–0.66	0.58–0.65
Prohaptor diameter	0.046–0.069	0.09–0.114
Opisthaptor: Clamp (1–4)		
Length	0.046–0.115	0.068–0.106
Width	0.046–0.115	0.125–0.19
Testis		
Length	0.16–0.29	0.24
Width	0.09–0.25	0.17
Ovary		
Length	0.23–0.506	
Width	0.18–0.34	
Egg		
Length	0.18–0.25	0.26–0.27
Width	0.092–0.138	0.1–0.116
Host	*Labeo pangusia*, *L. boga*	*Cirrhina cirrhosa*
Locality	Dawki, Shella, Muktapur (Meghalaya)	Mettur dam (Tamil Nadu)

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