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Three New Monogenoids, From the Gills of Glassfishes (Teleostei: Perciformes: Ambassidae) Of Sharda and Ghaghra Rivers Of Tarai Region in India

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Abstract: One new species of the monogenoidea *Spicocleidus* Agrawal *et al.*, 2005 from *Chanda nama* (Hamilton, 1822) viz. *S. brevianchoratus* and two of *Chandacleidus* Agrawal *et al.*, 2006 (Monogenoidea: Dactylogyridae) viz *C. palliaensis* and *C. kheriensis* are described from the gills of *Pseudambassis baculis* (Hamilton, 1822) = *Chanda baculis* collected from Pallia, and Manjhura, district Kheri (new locality record) and are described herein. The new species *S. brevianchoratus* characterized by 'Sickle–shaped' accessory piece, with stumpy dorsal spike and short curved shaft of ventral anchor; *C. palliaensis* is by dorsal bar and pointed copulatory complex; and *C. kheriensis* is characterized by 'V-shaped' dorsal bar and shape of anchors.

Key Words: *Spicocleidus, Chandacleidus,* Monogenoidean, *Chanda nama, Pseudambassis baculis* ,Tarai region.

I. Introduction

Agrawal *et al.* (2005) described a new genus *Spicocleidus* with *S. namae* as its type species from the gills of an ambassid, *Chanda nama* (Hamilton, 1822) in the River Sai near Lucknow, Uttar Pradesh, India. Agrawal *et al.* (2006) further proposed *Chandacleidus* n.g. (Monogenea, Dactylogyridae) to include three species: *C. recurvatus* (Jain, 1961) n.comb. (syn. *Urocleidus recurvatus* Jain, 1961) from the gills of *Chanda nama* and *C. ranga* was redescribed; and *C. saiensis* and *C. lucknowensis* both from *C. nama* and *C. baculis*, now known as *Pseudambassis baculis* (Hamilton, 1822) were added. The glass fishes which are popular aquarium fishes could effectively be used in the control of dreaded Indian disease, the Malaria, were collected from river Sharda at Pallia and river Ghaghra at Manjhura, District Kheri, the Tarai region (meaning "moist land" where Malaria is most prevalent), about 245 (SE) Km from Lucknow, and were found infected with one new species of the genus *Spicocleidus* (on *Chanda nama*) and two new species of *Chandacleidus.*

II. Materials and Methods

Chanda nama (Hamilton, 1822) and *Pseudambassis baculis* (Hamilton, 1822) were collected by drag net during December 2006 to March 2008 from river Sharda at Pallia and river Ghaghra at Manjhura, District Kheri. Gill baskets were removed from the hosts, immediately placed on ice to narcotize the worms and subsequently preserved in hot 4 % formalin. Some of the worms were studied alive. Method of staining, mounting and illustration of dactylogyrids were those described by Kritsky, Thatcher and Boeger (1986). Measurements (in micrometer) were made using a calibrated micrometer; the average measurements are followed by range and number of specimens measured (n) in parantheses. Unstained flattened specimens mounted in glycerine were used to obtain measurements of haptoral sclerites. Numbering of hook pair follows Kulwiec (1927). Vouchers specimens used in the present study were deposited in the museum of Zoological Survey of India (Helminths Section), Kolkatta. Host names follow those in the FAO Fish Base (Froese and Pauley, 2008).

Spicocleidus brevianchoratus n.sp.

Type host:	*Chanda nama* (Hamilton, 1822) (Ambassidae: Perciformes).
Type locality:	River Ghaghra; Manjhura; district Kheri, India. (27^0 5' – 28^0 6'N; 80^0 34' – 81^0 30' E)
Site of infection:	Gills
No. of host collected:	17
No. of host infected:	02
No. of worm burden:	05

Description: Body 685μm (659-718; n=5) long; 140μm (128-156; n=5) wide, fusiform; greatest width at the level of anterior region of trunk. Cephalic lobes developed; cephalic glands four pairs. Two pairs of eye spots, posterior pairs larger, accessory granules in cephalic region and anterior trunk. Pharynx oval, 28 μm (25-34;

n=5) x 32μm (28- 32; n=5). Oesophagus short. Haptor 115 μm (109- 156; n=5) long and 120μm (118- 125; n=5) wide, with ventrolateral alate region (wings). Dorsal anchors modified to form spike, short and stumpy, 88μm(82- 93; n=5) long x 13μm (11- 15; n=5) wide. Ventral anchors 29μm (26- 37; n=5), robust, with poorly developed roots, straightened recurved point 6 μm (5-7; n=5). Ventral bar 27μm (25- 28; n=5), slightly curved in the mid region, dumb-bell shaped with rounded widen lateral terminations. Seven pairs of dissimilar (in size) hooks. Each hook consists of a slender shank of two distinct subunits, proximal subunit marginally inflated, sickle-shaped, with longest pair 40μm. Copulatory tube with broad base 24μm (15- 34; n=5). Accessory piece 'sickle–shaped', grooved at mid-length, partly enfolding and guiding the distal part of tube as platform, 26μm (21- 31; n=5) long. Prostatic reservoirs two, opening at the base of copulatory tube. Testis elongate to oval 80μm (75-89; n=5) long x 27μm (23- 36; n=5) wide. Vas deferens arises from anterior end of testis, runs anteriorly to loop left intestinal caecum from dorsal to ventral side, dilating to form pyriform seminal vesicle, which opens at base of copulatory tube by coiled ductus ejculatorius. Ovary elongate 80μm (76- 87; n=5) x 26μm (19- 33; n=5). Vagina not observed. Vitelline follicles dense, throughout trunk region.

Remarks:

This species is characterised by 'Sickle–shaped' accessory piece, with stumpy dorsal spike and short curved shaft of ventral anchor. *S. namae* is chiefly differ from above species in the shape of 'Sickle–shaped' accessory piece guiding the distal part of tube as platform; stumpy spike (modified dorsal anchor) and a short curved shaft whereas in *S. namae* Agrawal *et al.(*2005) accessory piece is elongate, grooved at mid length, partly enfolding and guiding distal part of tube; spike is robust, slightly curved, without point but with spine-like structure at proximal end; and a long curved shaft of ventral anchor.

Chandacleidus palliaensis n. sp.

Type host:	*Pseudambassis baculis* (Hamilton, 1822) (Ambassidae: Perciformes).
Type locality:	River Sharda; Pallia; district Kheri, India. ($27^0 57^{'}$ N $80^0 47^{'}$)
Site of infection:	Gills
Other record:	Manjura, district Kheri
No. of host collected:	25
No. of host infected:	19
No. of worm burden:	17

Description: Body 385μm (350-449; n=15) fusiform; greatest width 121μm (80-145; n=15) in posterior trunk. Cephalic region broad; two cephalic lobes well developed with 3 pairs of cephalic glands. Two pairs of eye spots, posterior pair larger with eye lens; accessory granules present in cephalic region. Pharynx sub-spherical 22μm (19-26; n=15) in diameter. Peduncle narrow; Haptor sub-hexagonal with two lateral flaps, 65μm (36-75; n=15) long, 89μm (80-120; n=15) wide. Dorsal anchor 31μm (19-36; n=15) long, roots well developed with inner root 16μm (13-17; n=15), and outer root 8μm (6-10; n=15) curved shaft, a sharp point 8μm (7-10; n=15).Ventral anchor 30μm (29-35; n=15) long, well-developed inner root 13μm (12-15; n=15) moderately developed outer root 3μm (2-5; n=15), curved shaft, with point 7μm (5-8; n=15). Dorsal bar 51μm (49-56; n=15) long broad at mid region with small depression downwardly and terminals tapered slightly forming upward projection and 10 μm (9- 13; n=15) wide. Ventral bar 34μm (31-35; n=15) long, 6μm (5-8; n=15) wide curved medially with terminals projecting downwardly. Seven pairs of hooks: pair 1, 25μm (24-29); pair 2, 16μm (14-20); pair 3, 43 μm (38-47); pair 4, 27μm (23- 30), pair 5, 14μm (12-15) pair 6, 18μm (16-21); pair 7, 14μm (12-17) long. The longest pair is 43μm; and the shortest pair is 14μm. Copulatory complex consists of copulatory tube and accessory piece. Copulatory tube 70μm (61-80; n=15) long, inflated broad base, tubular and pointed at the end. Accessory piece 52μm (50-55; n=15) long, comprising variable grooved sheath from mid-length, to the tip of the copulatory tube . Pairs of prostatic reservoirs opening at base of copulatory tube. Testis 45μm (41-49; n=15) long, 26μm (19-30 n=15); wide, dorsal to ovary. Vas deferens arises from anterior end of testis, runs anteriorly to loop left intestinal caecum, dilates to form seminal vesicle, which opens at base of copulatory tube. Ovary elongate to ovate, 92μm (85- 98; n=8), long, 47μm (34-55; n=8) wide; intercaecal. Vagina not observed. Vitelline follicles dense, throughout trunk region.

Remarks:

This species is distinct from its congeners in having the characteristic dorsal bar. Three species of *Chandacleidus* earlier described by Agrawal *et al*.(2006) are *C. recurvatus* (Jain, 1961) Agrawal *et al.*,2006. *C. saiensis* Agrawal *et al*.(2006), and *C. lucknowensis* Agrawal *et al.(*2006). *C. palliaensis* n. sp. closely resembles with *C. recurvatus*, however, it differs in the shape and size of dorsal bar, size and proportion of marginal hooks also. In *C. palliaensis* dorsal bar is long, broad at mid region with small depression and terminals tapered slightly in upward projection (in *C. recurvatus* it is long, straight with short, blunt medial dilation and pair of short, bilateral silver- like projections frequently present posterior to enlarged endings). The above described species *C. palliaensis* is differs from *C. saiensis* in shape of ventral bar and copulatory complex. The ventral bar in *C. palliaesis* is curved medially and terminals projecting downwardly, copulatory tube with long tubular, pointed at ends whereas, ventral bar is long, broadly 'U'- shaped ends directed laterally and in the shape of copulatory tube having a 'comma- shaped' in *C. saiensis*. Furthermore *C. palliaensis* also differs from *C. lucknowensis* in the shape of ventral bar, curved medially with terminals projecting downwardly, whereas in *C. lucknowensis* ventral bar is long, broadly 'U'- shaped, with slightly tapered ends and dorsal bar is long straight with incipient posteromedial indentation.

Chandacleidus kheriensis n.sp.

Type host: *Pseudambassis baculis* (Hamilton 1822) (Ambassidae: Perciformes).
Type locality: River Ghaghra; Majhura; district (Kheri), India.
(27^0 5' – 28^0 6'N; 80^0 34' – 81^0 30' E)
Site of infection: Gills

No. of host infected: 18
No. of worm burden: 25

Description:

Body 285µm (250-349; n=15) short and stumpy, fusiform; greatest width 84µm (80-115; n=15) in posterior trunk. Cephalic region pointed; cephalic lobes well developed with 3 pairs of cephalic glands. Two pairs of eye spots, posterior pair larger with eye lens; accessory granules absent or present in cephalic region. Pharynx sub-spherical 25µm (22- 27; n= 15) long and 22µm (20-29; n=15) in diameter. Distinct peduncle. Haptor sub-hexagonal with two lateral flaps; 34µm (29-55; n=15) long, 106 µm (100-120; n=15) wide. Dorsal anchor inner length is 24µm (19-29; n=15); outer length 25µm (21-28; n=15), roots well developed, inner root 11µm (9-15; n=15); outer root 5µm (4-8 ; n=15) shaft curved, a sharp point 10 µm (7-10; n=15). Ventral anchor 17µm (15-20; n=15) long, well-developed inner root 8µm (6-13 ; n=15) moderately developed outer root 3µm (2-5; n=15), curved shaft, with point 8µm (5-9; n=15). Dorsal bar 26µm (20-31; n=15) long with 'V'- shaped, terminal projecting upwardly, and 2 µm (1-5; n=15) wide. Ventral bar 26µm (22-34 ; n=15) long, 3µm (2-5; n=15) wide slightly curved with terminals projecting downwardly. Seven pairs of dissimilar size of hooks: the longest pair 44 µm (41-48; n=15), Copulatory complex consists of copulatory tube, distally placed accessory piece. Copulatory tube 35 µm (29-41; n=15) long, inflated broad base with 'comma - shaped'. Accessory piece 29µm (23-35; n=15) long, comprising straight length and tip partly enfolding forming 'hood–shape' to support anterior end of copulatory tube . Pairs of prostatic reservoirs opening at base of copulatory tube. Testis 26µm (20-32; n=15) long, 20µm (18-29; n=15); wide, dorsal to ovary. Vas deferens arises from anterior end of testis, runs anteriorly to loop left intestinal caecum, dilates to form seminal vesicle, which opens at base of copulatory tube. Ovary elongate ovate, 81µm (75- 88; n=8), long, 30µm (28-55; n=8) wide. Vagina not observed. Vitelline follicles dense, throughout trunk region.

Remarks:

C. kheriensis is closely resembles with *C. saiensis* in shape of copulatory complex. However *C. kheriensis* is chiefly differ from *C. saiensis* in the shape of ventral bar having long, straight with slight curved bar. Whereas, in *C. saiensis* long, broadly 'U'- shaped, with slightly tapered ends. *C. kheriensis* is also differs from *C. recurvatus* in the shape of copulatory complex having a coiled tube in *C. recurvatus* and 'comma-shaped' in *C. kheriensis*. Furthermore *C. kheriensis* is closely resembles with *C. lucknowensis* in the shape of bars but dorsal bar is somewhat similar to ventral bar and ventral bar of *C. kheriensis* is 'V'- shaped, but in case of *C. lucknowensis* it is long, broadly 'U'- shaped, with slightly tapered ends. Hence *C. kheriensis* is differs from all the above three species *C. saiensis, C. recurvatus* and *C. lucknowensis*. One species also described in the earlier pages *C. palliaensis*, is differ from *C. kheriensis* in the shape of characteristic dorsal bar whereas in *C. kheriensis* it is 'V'- shaped with small protrudence in upward direction. So it is also differ from its congener *C. palliaensis.*

III. Discussion

Agrawal, Tripathi and Shukla, 2005 established a new dactylogyrid genus *Spicocleidus* with *S. namae* as its type species from the gills of an ambassid, *Chanda nama* (Hamilton, 1822) in the River Sai near Lucknow, Uttar Pradesh, India. Agrawal, Tripathi and Devak, 2006 further proposed *Chandacleidus* n.g. (Monogenea, Dactylogyridae) to include three species: *C. recurvatus* (Jain, 1961) n.comb. (syn. *Urocleidus recurvatus* Jain, 1961) from the gills of *Chanda nama* and *C. ranga* was redescribed; and *C. saiensis* and *C. lucknowensis* both from *C. nama* and *C. baculis*, now known as *Pseudambassis baculis* (Hamilton,1822). With the present new species of *Spicocleidus* and two of *Chandacleidus*, there are now seven monogenoids attributed to glassfishes (Teleostei: Perciformes: Ambassidae) in India; River Sharda and Ghaghra of Tarai region forming new locality record. The presence of dorsal spikes in *Spicocleidus*, which are likely modified dorsal anchors differentiates the genus from *Chandacleidus*, infecting same host. Occurrence of a new species of *Spicocleidus* and several species of *Chandacleidus* further justifies the proposal of new genera, parasitizing only ambassid fishes in India. Further species of these genera still needs to be explored.

Tarai is the northern extension of the Gangetic Plain in India, commencing at about 300 meters above sea level and rising to about 1,000 meters at the foot of the Siwalik Range. It stretches from the Yamuna River (west) to the Brahmaputra River (east). At its northern edge are numerous springs forming several streams, including the important Sharda and Ghaghara River, that intersect the Tarai (meaning "moist land"). In complete topographic contrast to the mountain and hill regions, the Tarai region is a lowland tropical and subtropical belt of flat, alluvial land stretching along the Nepal-India border, and paralleling the hill region. Both the rivers have a very rich fish fauna including hill stream fishes. Although several species were encountered, the survey of this region is yet to be done to make accurate determination of Monogenoidean fauna, considered harmful for the economically important glass fishes.

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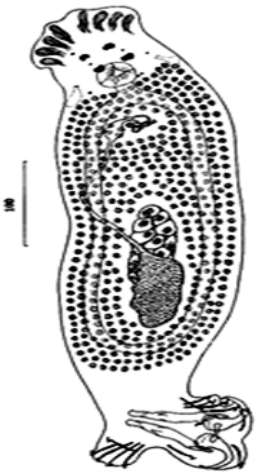


Fig.1. *Spicocleidus brevianchoratus* n.sp. whole mount (dorsal view) Plate- 1A

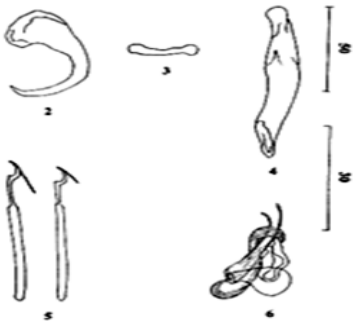


Figure 2-6: 2. Ventral anchor; 3. Ventral bar; 4. Dorsal anchor; 5. Hooks; 6. Copulatory complex.

Plate- 1B

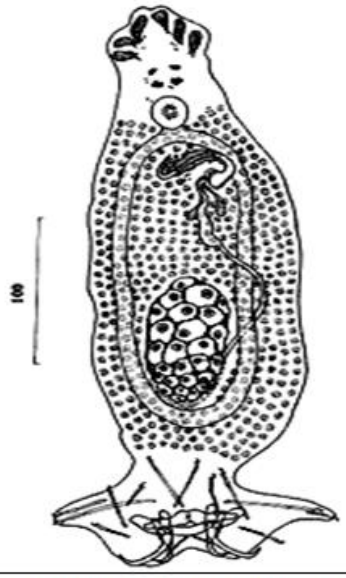
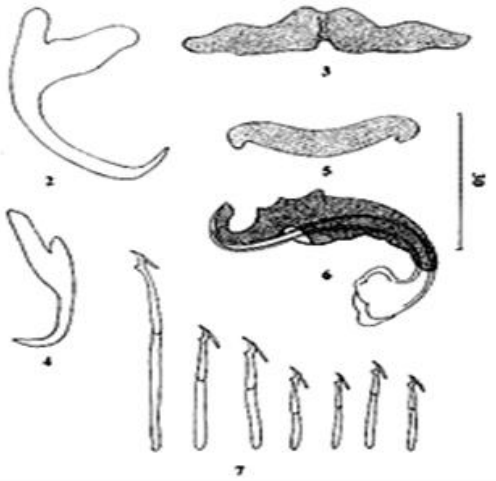


Fig.1 *Chandacleidus palliaensis* n. sp. Whole mount (Ventral view) Plate-2A



Figures 2-7: 2. Dorsal anchor; 3. Dorsal bar; 4. Ventral anchor; 5.Ventral bar; 6. Copulatory complex; 7. Hooks. Plate- 2B

Fig. 1. *Chandacleidus kheriensis* n.sp. whole mount (Ventral view) Plate- 3A

Figure 2-8: 2. Dorsal anchor; 3. Dorsal bar; 4. Ventral anchor; 5. Ventral bar; 6&7. Views of copulatory complex; 8. Hooks Plate- 3B