

# Record of Three Species of the Genus *Heteronchocleidus* Bychowsky, 1957 (Monogenoidea: Dactylogyridae) from Gills of *Colisa fasciata* Bloch & Schneider, 1801 from India with a Note on its Geographical Distribution

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**Abstract.** Record of *H. buschkieli* Bychowsky, 1957, *H. gracilis* Mizelle and Kritsky, 1969 and *H. colisai* Chandra and Yasmin, 2003, emphasizing morphological details, for first time in India has been made. A note on geographical distribution of the genus *Heteronchocleidus* is also given.

**Keywords:** Monogenoidea, Dactylogyridae, *Heteronchocleidus*.

## INTRODUCTION

Bychowsky (1957) established the genus *Heteronchocleidus* for dactylogyrids having three well developed and one greatly reduced anchors, along with two bars, with *H. buschkieli* as type species. Of the three species under study, one was described earlier from Czechoslovakia, one from Bangladesh and third one from India. The new records lead to their detailed study, as some features were not observed earlier. *Heteronchocleidus* has been described from fishes belonging to order Perciformes, commonly known as Labyrinth fishes (Anabantoidei), including family Osphronemidae and Anabantidae, except *H. athari* Pandey and Mehta 1986 from silurid (needs verification), of which *Ctenopoma kingsleyae* Gunther, 1896 of Anabantidae is distributed across Africa and *Colisa fasciata* (Bloch and Schneider, 1801) of Osphronemidae in Asia. *C. fasciata*, is also known as 'Banded Gourami'. Some members of the family Osphronemidae are ornamental and used in aquarium trade. Peculiar geographical distribution of monogenoidean genus across various continents is also taken into account.

## MATERIALS AND METHODS

Hosts were collected from River Gomti, Lucknow, India. The worms were studied mostly

live under a phase contrast microscope or after being fixed in 3% formalin diluted with lukewarm water. The methods of staining, mounting, and illustrating the dactylogyrids were those described by Kritsky *et al.* (1986); the numbering of hooks is that of Kulwiec (1927). Measurements, all in  $\mu\text{m}$ , were taken using a calibrated micrometer following procedure of Gusev (1976); means were followed by the range and the number (n) of specimens measured in parentheses. Unstained flattened specimens mounted in glycerine were used to obtain the measurements of the internal organs (pharynx and gonads), body and haptoral sclerites. Terminology is that of Gusev (1976), with two modifications; the term "thumb" and "shank" are used instead of "heel" and "handle" of hooks respectively. Illustrations were prepared with the aid of a camera lucida attached to a phase-contrast microscope. Host name follows FishBase (Froese and Pauly, 2004). Museum to which specimens were deposited is referred to in the text as follows: British Natural History Museum (BNHM), London.

### 1. *Heteronchocleidus buschkieli* Bychowsky, 1957 (Fig. 1)

Syn:	<i>H. stunkardi</i> Majumdar, Ramchandrla, Trupati and Agrawal, 1988
Type host	<i>Macropus opercularis</i> (Linnaeus, 1758)
Type locality	Czechoslovakia
Infection site:	Gills
Present record and locality	<i>C. fasciata</i> (Bloch & Schn., 1801), river Gomti, Lucknow, India. (26°45'–27°N; 80°50'–81°05'E).
Specimens studied:	10

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0030-9923/2010/0006-0751 \$ 8.00/0  
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Voucher specimens (2010.6.1.5-7) in the Natural History Museum, London.

### Description

Body 700 (695-710; n=10) long; maximum width 165 (160-166; n=10) at mid-length. Cephalic region well developed; four cephalic lobes. Two pairs of eye spots, posterior pair larger, accessory granules absent. Pharynx spherical 33 (30-35; n=12) in diameter; oesophagus short to non-existent. Testis 53 (52-55; n=8) long, 23 (21-24; n=8) wide; vas deferens loops left intestinal caecum; seminal vesicle a sigmoid dilation of vas deferens. Two prostatic reservoirs observed. Copulatory complex consists of a copulatory tube, proximally articulating accessory piece. Copulatory tube sclerotised 31(29-33; n=10) long. Accessory piece 14(12-15; n=10) long, Ovary round to oval, 55 (53-57; n= 10) long, intercaecal; oviduct, ootype, uterus not observed. Vaginal armament not observed. Vitellaria dense, throughout trunk, except absent in regions of reproductive organs. Haptor 80 (76-82; n=10) long, 125 (123-127; n=10) wide. Ventral anchor inner length 32 (30-33; n=10) outer length 30 (28-32; n=10), recurved point 15 (14-16; n=10) long. Right dorsal anchor: inner length 34(33-35; n=10), outer length 30 (28-32; n=10), recurved point 10 (8-11; n=10) long. Fourth rudimentary anchor 14 (12-15; n=7). Dorsal connective bar 34 (32-35; n=10) long, ventral bar 36 (34-37; n=10) long. Left dorsal anchor inner length 29 (27-30; n=10), outer length 28 (26-29; n=10), recurved point 7 (6-8; n=10). Seven pairs similar hooks 13 (11-14; n=10) long. Stout egg, with bipolar filaments, base of one of the filament of which is dilated, 32 (30-35; n=2) long.

### Remarks

*H. buschkieli* was described by Bychowsky in 1957 from *Macropus opercularis* in Czechoslovakia. The specimens collected by us agree well with description of *H. buschkieli*. The details of seminal vesicle and prostatic reservoirs, looping of intestinal canal, cephalic glands, lobes and reproductive morphology were not observed by Bychowsky (1957), a redescription was, therefore done. This is the first record of this species and a new host in India.

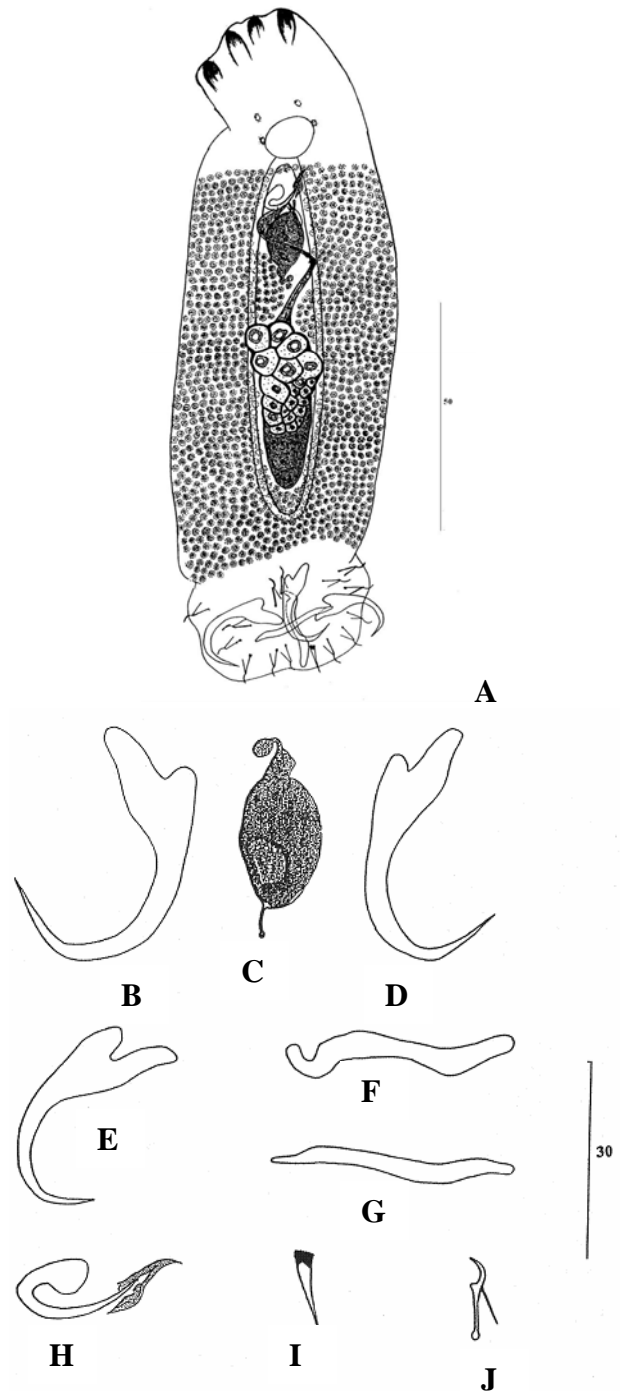


Fig. 1. *Heteronchocleidus buschkieli* Bychowsky, 1957 from *Colisa fasciata* (Bloch and Schn., 1801; A, whole specimen; B, ventral anchor; C, egg; D, right dorsal anchor; E, left dorsal anchor; F, dorsal bar. G, ventral bar; H, copulatory complex; I, fourth anchor. J, hook.

2. *Heteronchocleidus gracilis* Mizelle and Kritsky, 1969  
(Fig. 2)

Type host	<i>Colisa labiosa</i> (Day)
Type locality	India
Infection site:	Gills
Present record and locality:	<i>C. fasciata</i> (Bloch & Schn., 1801) river Gomti, India. Latitude: 26°45'–27°N; 80°50'–81°05'E
Specimens studied:	10
Voucher specimens	(2010.6.1.8-12) in the Natural History Museum, London.

*Description*

Body 720 (715-722; n=10) long; maximum width 115 (112-117; n=10) at mid-length. Cephalic region well developed; four cephalic lobes. Two pairs of eye spots, posterior pair larger, accessory granules absent. Pharynx spherical, 25 (22-28; n=12) in diameter; oesophagus short to non-existent. Testis 70 (68-72; n=8) long, 30 (28-32; n=8) wide; vas deferens loops left intestinal caecum; intestinal caeca bifurcated, united just above the haptor. Seminal vesicle a sigmoid dilation of vas deferens. Two prostatic reservoirs observed. Copulatory complex consists of a 'comma shaped' copulatory tube, proximally articulating accessory piece. Copulatory tube sclerotised, 38 (35-40; n=12) long. Accessory piece 17 (15-18; n=12) long. Ovary round to oval 95 (93-97; n=8) long, intercaecal; oviduct, ootype, uterus not observed. Vaginal armament not observed. Vitellaria dense, throughout trunk, except absent in regions of reproductive organs. Haptor 70 (65-72; n=10) long, 110 (108-112; n=10) wide. Ventral anchor: inner length 35 (33-36; n=10), outer length 32 (30-33; n=10), recurved point 20 (18-22; n=10) long, Right dorsal anchor: inner length 33 (30-34; n=10), outer length 30 (28-32; n=10), recurved point 15 (14-16; n=10) long, Left dorsal anchor, inner length 29 (26-30; n=10), outer length 27 (26-28; n=10), recurved point 7(6-8; n=10). Fourth anchor extremely reduced, 12 (10-13; n=5). Ventral bar 37(35-38; n=8) long, dorsal bar 35 (33-36; n=10) long, Seven pairs similar hooks 15 (13-16; n=12) long. Egg, 45 (42-48; n=7), one of the filaments of egg is very long having a spatulate ending.

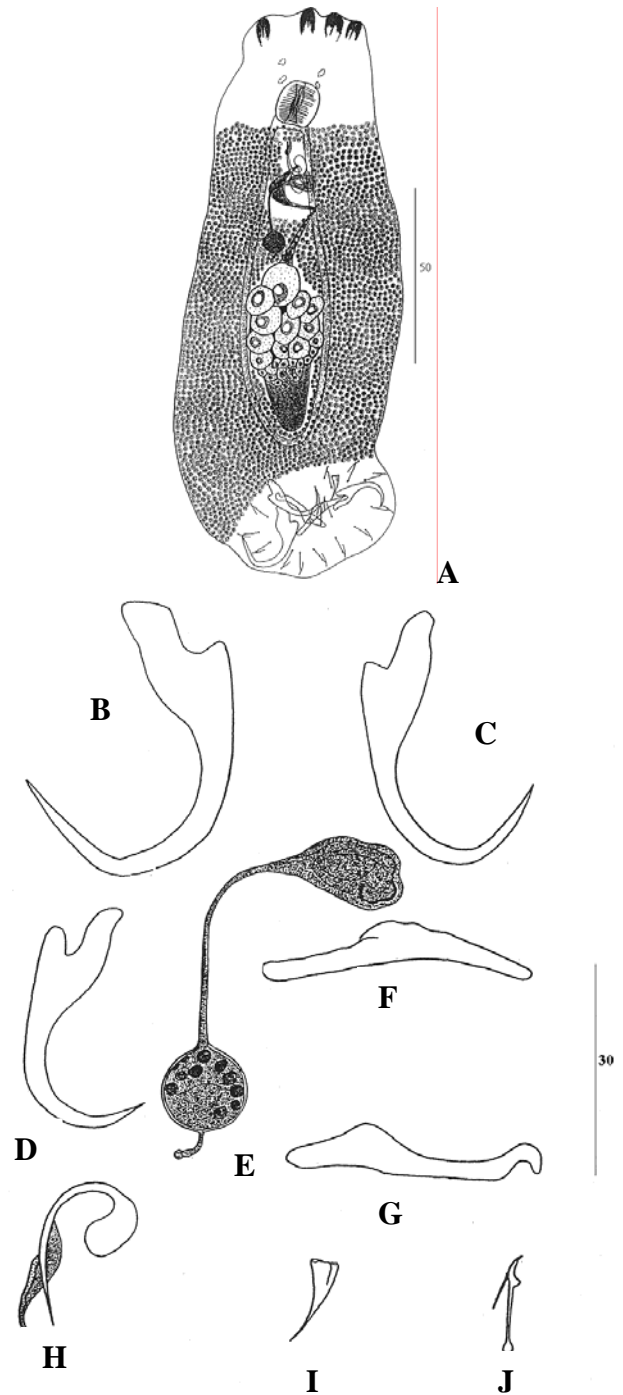


Fig. 2. *Heteronchocleidus gracilis* from *Colisa fasciata* (Bloch and Schn., 1801); A, whole specimen, ventral view drawn from a live specimen; B, ventral anchor; C, right dorsal anchor; D, left dorsal anchor; E, egg; F, ventral bar; G, dorsal bar; H, copulatory complex; I, Fourth anchor, J, hook.

### Remarks

This species was described by Mizelle and Kritsky, 1969 from *Colisa labiosa* (Day) in India. We have observed egg, one of the filaments of which was very long having a spatulate ending in the present study.

### 3. *Heteronchocleidus colisai* Chandra and Yasmin, 2003. (Fig. 3)

Type host	<i>C. fasciata</i> (Bloch & Schn., 1801)
Infection site:	Gills
Present record and locality:	<i>C. fasciata</i> (Bloch & Schn., 1801), river Gomti, Lucknow, India. (26°45'–27°N; 80°50'–81°05'E)
Specimens studied:	10
Voucher specimens	(2010.6.1.1-4) in the Natural History Museum, London.

### Description

Body 500 (490-510; n=10) long; maximum width 125 (120-128; n=10) at mid-length. Cephalic region well developed; four cephalic lobes. Two pair of eyespots, posterior pair larger, accessory granules absent. Pharynx spherical, 132 (130-135; n=12) in diameter; oesophagus short to non-existent. Testis 15 (13-16; n=8) long, 12 (10-14; n=8) wide; vas deferens loops left intestinal caecum; seminal vesicle a sigmoid dilation of vas deferens. Prostatic reservoir (s) not observed.

Copulatory complex consists of a 'comma-shaped' copulatory tube, proximally articulating accessory piece. Copulatory tube sclerotised 58 (56-60; n=10) long. Accessory piece 12 (10-14; n=10) long. Ovary round to oval, 110 (108-113; n=10) long, intercaecal; oviduct, ootype, uterus not observed. Seminal receptacle not observed. Vaginal armament 'tube like' with a dilated receptaculum seminis. Vitellaria dense, throughout trunk, except absent in regions of reproductive organs. Haptor 80 (77-83; n=10) long, 120 (118-123; n=10) wide. Left dorsal anchor: inner length 55 (53-56; n=10), outer length, 52 (50-53; n=10), recurved point 10 (8-11; n=10) long. Right dorsal anchor: inner length 50 (47-53; n=10), outer length, 38 (37-40; n=10), recurved point 7 (6-8; n=10) long. Fourth anchor 11 (10-13; n=5) long. Dorsal connective bar 40 (38-42; n=10) long. Ventral bar, 47 (46-48; n=10) long. Ventral anchor, inner length, 99 (97-100; n=10),

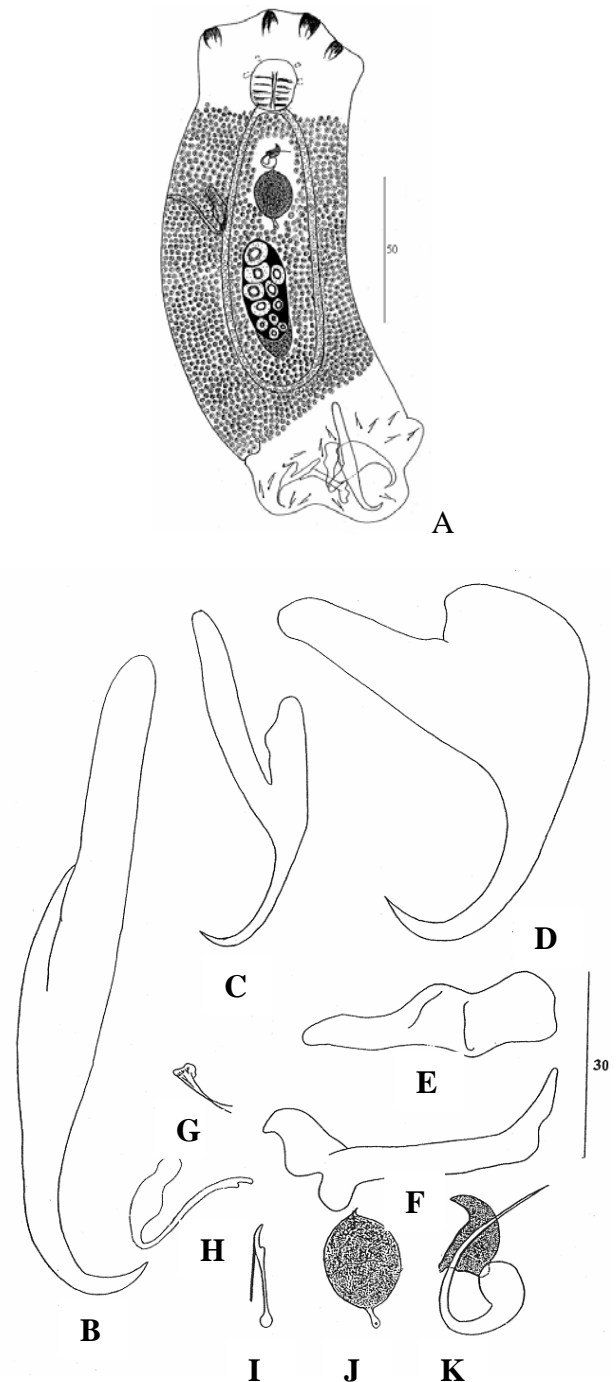


Fig. 3. *Heteronchocleidus colisai* Chandra and Yasmin, 2003 from *Colisa fasciata* (Bloch and Schn., 1801); A, whole specimen, ventral view drawn from a live specimen; B, right dorsal anchor; C, left dorsal anchor; D, ventral anchor; E, dorsal bar; F, ventral bar; G, fourth anchor; H, vagina; I, hook; J, egg; K, copulatory complex.

**Table I.- Following species of genus *Heteronchocleidus* Bychowsky, 1957 are reported across the world.**

1. <i>H. athari</i> Pandey and Mehta, 1986	Silurid	India ( <i>Sp.inq.</i> )
2. <i>H. buschkieli</i> Bychowsky, 1957	<i>Macropus opercularis</i>	Czechoslovakia
Syn : <i>H. stunkardii</i> Majumdar <i>et al.</i> 1988	<i>Colisa lalius</i>	India.
3. <i>H. gracilis</i> Mizelle & Kritsky, 1969	<i>Colisa labiosa</i>	India.
4. <i>H. magnihamatus</i> Tchand and Ji, 1981	<i>Macropus chinensis</i>	Pearl River valley
5. <i>H. asymmetricus</i> Majumdar <i>et al.</i> 1988	<i>Colisa lalius</i>	India.
6. <i>H. lucknowensis</i> Agrawal and Bhatnagar, 1977	<i>Colisa fasciata</i>	India
Syn: <i>H. bangladeshi</i> Chandra and Yasmin, 2003.	<i>Colisa fasciata</i>	Bangladesh
7. <i>H. ctenopomae</i> Paperna, 1969; redescribed by Euzet and Dossou	<i>Ctenopoma kingsleyae</i>	Africa
	<i>Ctenopoma petherici</i>	South-east Ghana
8. <i>H. adjanohouni</i> Euzet and Dossou, 1975	<i>Ctenopoma kingsleyae</i>	Africa
	<i>Ctenopoma petherici</i> Gunther, 1864	Africa
9. <i>H. tuzetae</i> Euzet & Dossou, 1975	<i>Ctenopoma kingsleyae</i>	Africa
	<i>Ctenopoma petherici</i> Gunther, 1864	Africa
10. <i>H. ouemensis</i> Euzet & Dossou, 1975	<i>Ctenopoma kingsleyae</i>	Africa
	<i>Ctenopoma petherici</i> Gunther, 1864	Africa
11. <i>H. colisai</i> Chandra and Yasmin, 2003	<i>Colisa fasciata</i>	Bangladesh

outer length, 65 (63-66; n=10), recurved point 8 (6-9; n=10). Seven pairs similar hooks, 16 (14-17; n=10) long. Egg oval with bipolar filaments 28 (24-30; n=6).

#### Remarks

This species was described by Chandra and Yasmin (2003) from *C. fasciata* at Mymensingh, Bangladesh. Six pairs of two types of hooks have been described by Chandra and Yasmin (2003). However, we observed seven pairs of similar hooks. Cephalic glands, lobes, vagina, egg and reproductive morphology were not depicted in the previous record. We have added information regarding the above details.

#### DISCUSSION

Paperna (1969) suggested that there is an evolutionary trend beginning from two pairs of anchors to three anchors, by loss of one anchor. *Heteronchocleidus* possess a rudimentary fourth anchor, thus paving its way towards evolution, suggesting it to be the ancestral type. According to Gusev (1978) the ventral anchor developed first before the dorsal anchor in 'four-anchor' monogenoideans. Structural differences in anchors and bars are used to differentiate species, while the copulatory organ remains homologous in all the above-described species. Shapes of egg in above

species are quite characteristic. In *H. gracilis*, one of the eggs' filaments is very long having a spatulate ending, in *H. colisai*, egg is oval with bipolar filaments. Chandra and Yasmin (2003) described *H. colisai*, *H. bangladeshi* and *H. anabusi* from the gills of *C. fasciata*. They, however, misinterpreted a species of *Trianchoratus kearni* Agrawal and Bhatnagar, 1994 for *H. anabusi* as the species described by them lack two bars. We, therefore, consider *H. anabusi* a synonym of *Trianchoratus kearni*. We also propose *H. bangladeshi* Chandra and Yasmin, 2003 from *Colisa fasciata* to be a synonym of *H. lucknowensis* Agrawal and Bhatnagar, 1977 from *Colisa fasciata* (no distinctive character noticed in the published account and types could not be obtained). We are also of the opinion that *H. stunkardii* Majumdar *et al.*, 1988 from *Colisa lalius* in India is *H. buschkieli* Bychowsky, 1957 from *Macropus opercularis* in Czechoslovakia, because of lacking distinctive characters (as noted from published data).

Discovery of allied types of dactylogyrids on perciformes of both South-east Asia and West Africa, remaining aloof from each other over a considerable geological period of time, suggests zoogeographical and evolutionary interest that this subfamily of dactylogyridae was separated from the main stock and underwent its own process of speciation (Paperna, 1969). Continental drift theory suggests that Indian sub-continent would have been

enamored with unique dactylogyrid fauna with affinities to that occurring on the African and Asian countries Kritsky *et al.* (2004). Regarding Eocene fishes from India, the remains of two families of freshwater fishes discovered in Lower Eocene deposits are important. Anabantidae (climbing perch) and Cyprinidae (minnows) probably evolved in S.E. Asia and although they are in Africa today, they were apparently unable to enter that continent until the early Miocene (Briggs, 1987). Their presence in India may be attributed to an invasion via fresh-water stream capture, after India became part of Asia. Fishes harboring *Heteronchocleidus* belong to the order Perciformes; out of which *C. kingsleyae* Gunther, 1896 of the family Anabantidae is distributed across Africa and *C. fasciata* of the family Osphronemidae is distributed in Asia. *Colisa fasciata* is endemic in Oriental region and has been introduced in Nearctic and Neotropic ecosystems. *C. kingsleyae* is however endemic to the Ethiopian ecosystem. Oriental region comprises Indian subcontinent and Sundaland and Ethiopian region consists of African mainland. About 200 million years ago, Pangaea (super continent) broke into two new continents, Laurasia existing as a part of the split, in the late Mesozoic era and Gondwanaland.

Fishes inherit their parasites and proliferates their population, thus, conjecturing in the co-evolution of host and its parasite. It is not feasible that similar host species in distantly separated and apparently geologically different areas would embrace similar generalized monogenoideans. It would be more likely that parasites co-evolved with their hosts and this in turn would imply that fish with similar parasites had common ancestry (Lim, 1997). Discovery of allied types of dactylogyrids on perciformes of both South-east Asia and West Africa, remaining aloof from each other over a considerable geological period, suggests zoogeographical and evolutionary interest (Paperna, 1969). It is assumed that the two families of Perciformes *viz.*, Anabantidae and Osphronemidae evolved from a common ancestor, the descendants of which separated into two groups, one moving away to Africa and other to South East Asia., Cretaceous (Froese and Pauly, 2004), when continents were separating into current land masses. The Osphronemidae is distributed from Pakistan,

Bangladesh and India to Malaya Archipelago and Korea and represented by 15 genera and 49 species; while Anabantidae is found in Africa, India, Philippines and represented by 4 genera and 36 species.

*Heteronchocleidus* infects Perciformes fishes, of anabantid and osphronemid fishes of India, Bangladesh, Peninsular Malaysia, Africa and south east Ghana. The fresh-water fauna of each continent are speculated to be more implicit to each other than to species of another continent irrespective of host occurrence. However, cases of dispersal between contiguous continents and multiple fresh-water influx of individual landmasses may obscure this predicted pattern (Boeger *et al.*, 2003). Nevertheless, reverting the above fact, ichthyofaunal similarity in such widely separated and apparently unrelated regions embodies that these landmasses were once connected. Highlighting the fact, that Indian sub-continent and African continent probably had a Gondwanaic origin and so is their ichthyofauna. In any case, spatial and ecological barriers are connoisseuring to be more important than phylogenetic distance of host species in explaining extant host-parasite associations (Boeger *et al.*, 2003). Thus, paving way for extant parasite species to accumulate genetic differences transcending them to be treated as distinguished species.

## ACKNOWLEDGMENT

The work was supported by grant (No.C.S.T./AAS/D-03) from the State Council of Science and Technology, U.P.

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(Received 15 April 2010, revised 5 May 2010)