



Two New Species of the Monogenoid Genus *Cornudiscoides* Kulkarni, 1969 from Naked Catfish *Sperata aor* (Hamilton, 1822): Specialist or Generalist?

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ABSTRACT

The genus *Cornudiscoides* was established by Kulkarni in 1969 with type species *C. heterotylus* along with *C. microtylus* and *C. megalorchis* from *M. tengara*. So far, only one species *C. mystusi* has been reported from *S. aor* (*Mystus aor* synonymise under *Sperata aor*). Two new species of the genus *Cornudiscoides* viz. *C. longicirrus* n.sp., and *C. aori* n.sp., have been described herein from *Sperata aor* were collected from river Gomti. They are characterized by their unique copulatory complex and vaginal armature. A short note on host specificity of the genus *Cornudiscoides* is also being discussed herein along with key to species (Indian).

Article Information

Received 7 May 2015

Revised 17 October 2015

Accepted 5 December 2015

Available online 25 September 2016

Authors' Contribution

SR and JV contributed in wet lab as well as fieldwork. NA, SR and JV wrote the manuscript.

Key words

Cornudiscoides, *Sperata aor*.

INTRODUCTION

Thirty seven species have been assigned under the genus *Mystus* Scopoli, 1971 of the family Bagridae Bleeker, 1858, distributed throughout India, Nepal, Sri Lanka, Bangladesh, Myanmar Thailand, Indochina, Peninsular Malaysia, Syria, Singapore and East Indies to China (Burgess, 1989). Of these, two species viz., *M. aor* (Hamilton, 1822) and *M. seenghala* (Sykes, 1839) are placed under the genus *Sperata* Holly, 1939. *Sperata* is a freshwater demersal, potamodromous catfish, commonly known as naked catfish, long whiskered catfish, Bada tengan or shovelnose (Froese and Pauly, 2014). It is restricted in Southern Asia ranging from Afghanistan to Thailand, along with two more species, *S. acicularis* (Ferraris and Runge, 1999) and *S. aorella* (Blyth, 1858). *Sperata aor* harbours two monogenoidean genera *Thaparocleidus* Jain, 1952 and *Cornudiscoides* Kulkarni, 1969 (Rajvanshi and Agrawal, 2013). The genus *Cornudiscoides* is known from India, Sri Lanka, Malaysia and Pakistan (Pandey and Agrawal, 2008; Gusev, 1976; Lim, 1987; Rizvi, 1971). In the genus *Cornudiscoides* 14 species have been described so far in India (Agrawal and Vishwakarma 1996; Devak and Pandey, 2007). Of which, 13 species infesting 4 species of genus *Mystus* viz. *M. cavasius*, *M. vittatus*, *M. Bleekeri* and *M. tengara* (Table I). So far, in India, only one species i.e. *C. mystusi* (Rizvi, 1971) Dubey *et al.*, 1992 has been described from *S. aor* (earlier known as *Mystus aor*). Lim (1987) described six species from gills of *Mystus nigriceps* (Valenciennes, 1840) and *M. nemurus*

(Valenciennes, 1840) namely *C. anchoratus* Lim, 1987; *C. bagri* Lim, 1987; *C. facicirrus* Lim, 1987; *C. sundanensis* Lim, 1987; *C. malayensis* Lim, 1987 and *C. selangoricus* Lim, 1987. Later on, Lim *et al.* (2001) listed 17 species of *Cornudiscoides* parasitizing on gills of six fish hosts of the family Bagridae. Pandey and Agrawal (2008) listed 12 *Cornudiscoides* sp. from India. Rastogi *et al.* (2012) described *C. Kulkarnii* and *C. susanae* as new species. However, both proved synonyms of *C. proximus* Gusev, 1976. During further studies on the genus *Cornudiscoides*, two new species, infesting *S. aor*, have been collected and studied in detail. This establishes the fact that *Cornudiscoides* parasitizes on one more host *Sperata*, under the same family Bagridae. Since there is no record of the parasite from member of any other host family, So the genus *Cornudiscoides* is considered to be a specialist parasitizing on closely related fish host i.e belonging to metastexenous (sub category of Mesoxenous) while *C. longicirrus* n.sp. and *C. aori* n.sp. are also specialist infesting to single fish host species hence these two new species are oioxenous (Pojmanska and Niewiadomska, 2012).

MATERIALS AND METHODS

Fishes were collected from river Gomti, Lucknow (26.84°N 80.94°E). Whereas live hosts were purchased from, fish markets and maintained in glass aquaria. Hosts were identified with the help of Fish base (Froese and Pauly, 2014). The fresh and fixed gills of fishes (3% formalin, diluted with lukewarm water) were examined. Parasites were dislodged using micro needles in glass Petri-dishes and studied under a Phase Contrast microscope (Olympus BX 51). The method of Kristsky *et al.* (1986) was used for staining, mounting and illustration of parasites and numbering of hooks were

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0030-9923/2016/0006-1687 \$ 8.00/0

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counted according to Kulwiec (Kulwiec, 1927; Gusev, 1976). Measurements were taken in μm , using a calibrated micrometer, means were followed by the range and number (n) of specimens measured in parentheses. Unstained glycerine mounts were sealed with sealant (nail enamel) and used for measurements. Measurements were done with Image-ProExpress 6.0 software (for Image analysis). Holotype and voucher specimens of *C. longicirrus* n.sp. and *C. aori* n.sp. have been deposited in Helminthological collection of Zoological Survey of India (ZSI), Kolkata.

RESULTS

Two new species of the genus *Cornudiscoides* have been identified and described herein.

Cornudiscoides longicirrus, new species (Fig. 1)

Taxonomic summary

| | |
|----------------------------|----------------------|
| Type host: | <i>Sperata aor</i> |
| Type locality: | River Gomti, Lucknow |
| Site of infection: | Gills |
| No. of fish examined: | 35 |
| No. of fish infected: | 27 |
| No. of parasite collected: | 79 |

Body 602 (329-765, n=10) long, maximum width 136 (112-147, n=10) at mid length (Fig. 1). Cephalic region well developed, cephalic lobe 2 pairs; eye spot 2 pairs, posterior pair larger, accessory granules present or absent; pharynx spherical 36 (30-5, n=10) in diameter; oesophagus short to non-existent.

Testis 79 (79-96, n=10) long, maximum width 55 (52-62, n=10) at mid length; vas deferens loops around left intestinal caecum; seminal vesicle 53 (50-60, n=10) long. Prostatic reservoir single, opening at the base of copulatory complex. Copulatory complex consists of a long, two clock wise coils of sclerotized copulatory tube, 86 (71-96, n=10) long (across coils), proximally articulating with a vase-shaped accessory piece, 36 (32-40, n=10) long (Fig. 1E). Ovary round to oval, inter-caecal, 79 (79-96, n=10) long, maximum width 64 (55-70, n=10) at mid point. Vagina highly sclerotized, 38 (31-42, n=10) long, vaginal tube with a blade like accessory part (Fig. 1D) Vitellaria dense, throughout trunk, except in the region of reproductive organs.

Haptor bilobed, 138 (132-140, n=10) long, 97 (94-99, n=10) wide. Dorsal anchor; outer length 38 (34-40, n=10), inner length 46 (44-48, n=10), recurved point 25 (23-28, n=10) long (Fig. 1B); dorsal patch 21 (20-24, n=10) long (Fig. 1B). Ventral anchor: outer length 23

(22-25, n=10), inner length 28 (27-30, n=10), recurved point 15 (14-16, n=10) long (Fig. 1.2). Dorsal bar 38 (29-42, n=10) long (Fig. 1.5). Ventral bar 85 (68-114, n=10) long (Fig. 1H). Hook seven pairs, similar, except third pair, 13 (12-14, n=10) long, third pair, 27 (24-28, n=10) long (Fig.1G).

Remarks

Cornudiscoides longicirrus n.sp., is characterized by its unique vase-shaped copulatory complex and vaginal armature with blade like accessory structure.

Although *C. longicirrus*, *C. aori* n.sp. and *C. mystusi* are congeneric parasites of *S. aor*. These congeneric parasites express high degree of morphometric variations as in copulatory complex (vase shaped accessory piece in *C. longicirrus*; inverted, hollow, sac like in *C. aori*; n.sp. Urn shaped in *C. mystusi*), vaginal armature (additionally have a blade like structure in *C. longicirrus* n.sp; simple tube like in *C. aori* n.sp. and *C. mystusi*), ventral anchor (longer inner root, blunt in *C. longicirrus* n.sp.; blunt more or less equal in *C. aori* n.sp.; inner root pointed sharp in *mystusi*).

Etymology

This species has a much longer copulatory tube, therefore named as *C. longicirrus*, new species.

Cornudiscoides aori, new species (Fig. 2)

Taxonomic summary

| | |
|----------------------------|----------------------|
| Type host: | <i>Sperata aor</i> |
| Type locality: | River Gomti, Lucknow |
| Site of infection: | Gills |
| No. of fish examined: | 35 |
| No. of fish infected: | 27 |
| No. of parasite collected: | 60 |

Body 488 (387-568, n=10) long, maximum width 99 (82-110, n=10) in middle region (Fig. 2). Cephalic region well developed; cephalic lobe 2 pairs; eye spot 2 pairs, posterior pair larger, accessory granules present or absent; pharynx spherical 27 (23-29, n=10) in diameter; oesophagus short to non-existent.

Testis 56 (51-61, n=10) long, maximum width 40 (34-46, n=10) at mid length; vas deferens looping around left intestinal caecum; seminal vesicle 31 (28-35, n=10) long. Prostatic reservoir single, 29 (24-33, n=10) long, opening at base of copulatory complex. Copulatory complex consisting of a sclerotized copulatory tube, 49 (48-54, n=10) long (across the coil), proximally articulating with an inverted, hollow, sac like accessory

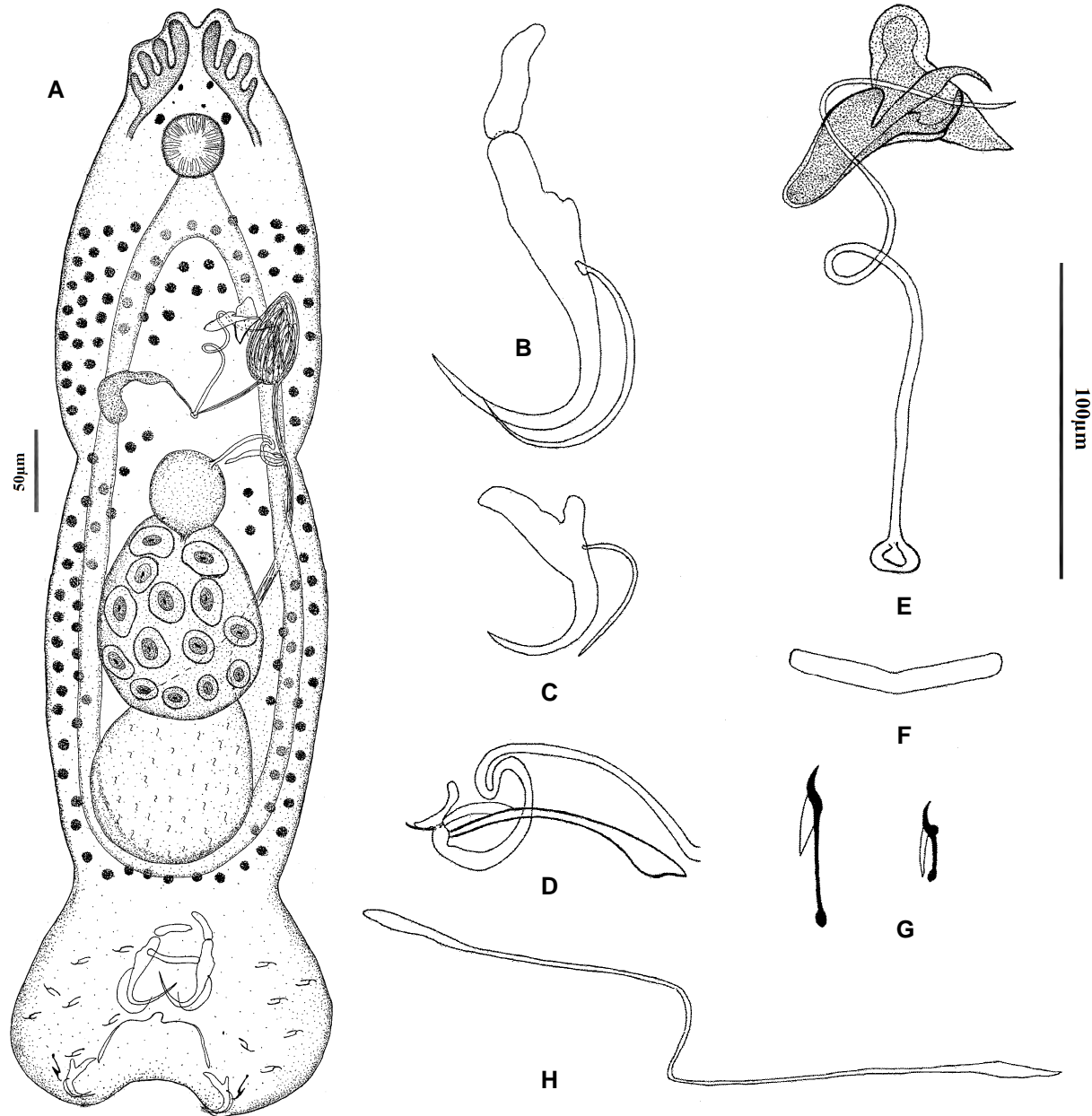


Fig. 1. *Cornudiscoides longicirrus*, new species; A, whole mount (ventral view); B, dorsal anchor; C, ventral anchor; D, vagina; E, copulatory complex; F, dorsal bar; G, hook pairs (1-7); H, ventral bar.

piece, 22 (21-24, n=10) long (Fig. 2F). Ovary round to oval, inter-caecal, 61 (45-72, n=10) long, maximum width 39 (30-46, n=10) at mid length. Vaginal opening funnel shaped, vaginal tube, highly sclerotized, 38 (31-42, n=10) (Fig. 2G). Vitellaria dense, throughout trunk, except in the region of reproductive organs.

Haptor bilobed, 95 (59-112, n=10) long, 95 (89-105, n=10) wide. Dorsal anchor: outer length 30 (28-33,

n=10), inner length 37 (36-38, n=10), recurved point 24 (23-26, n=10) long (Fig. 2B); dorsal patch 14 (12-15, n=10) long (Fig. 2B). Ventral anchor: outer length 18 (17-19, n=10), inner length 22 (21-24, n=10), recurved point 14 (13-15, n=10) long (Fig. 2C). Dorsal bar 31 (28-33, n=10) long (Fig. 2D). Ventral bar delicate in middle region, 93 (76-112, n=10) long (Fig. 2I). Hook seven pairs, similar, 11 (11-12, n=10) long, except third pair,

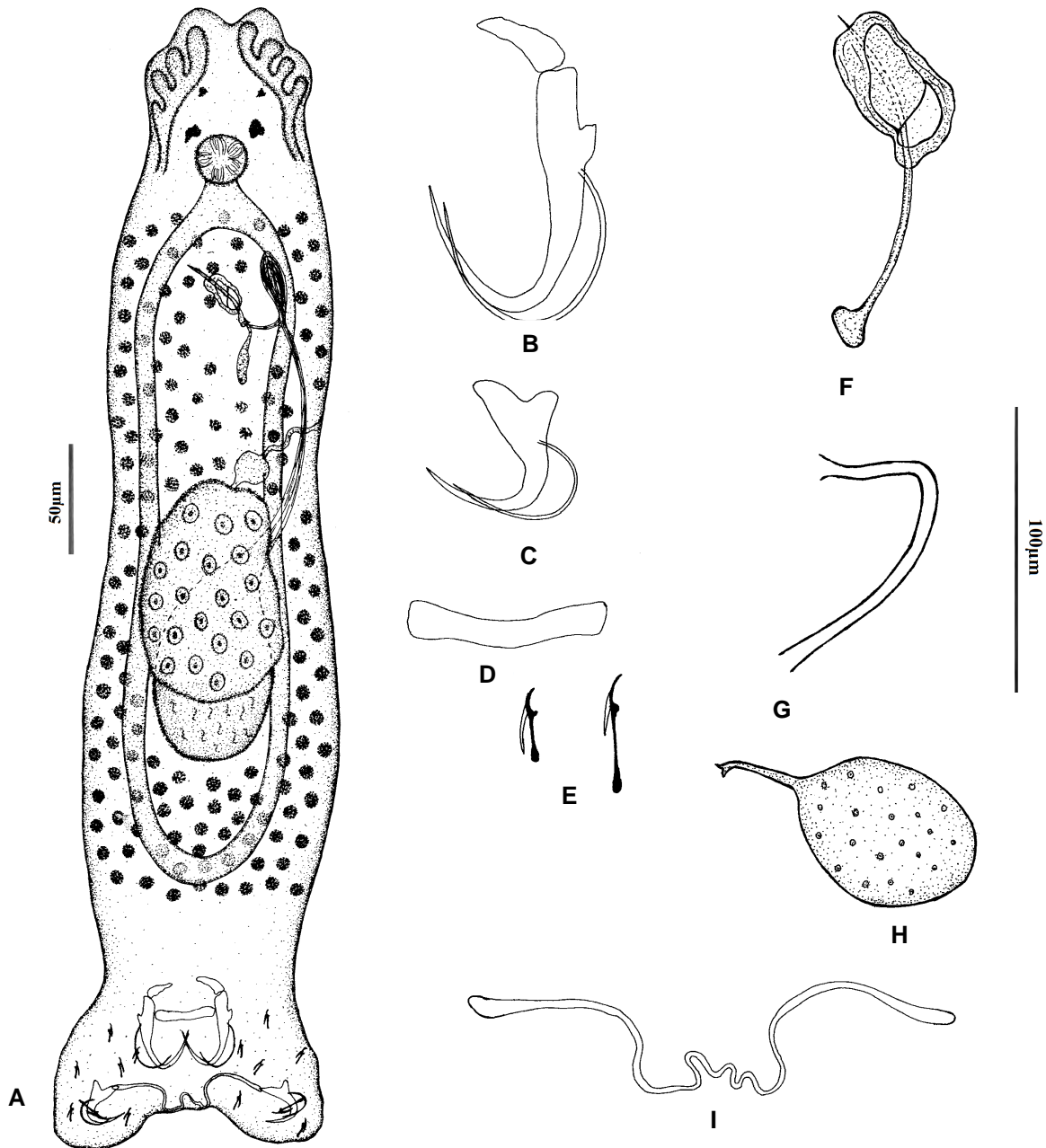


Fig. 2. *Cornudiscoides aori*, new species; A, whole mount (ventral view); B, dorsal anchor; C, ventral anchor; D, orsal bar; E, hook pairs (1-7); F, copulatory complex; G, vagina; H, egg; I, ventral bar.

19 (17-22, n=10) long (Fig. 2E). Egg unipolar, round to oval, 66 (45-93, n=10) long (Fig. 2H).

Remarks

Cornudiscoides aori n.sp. is characterized by unique copulatory complex, having inverted, hollow, sac like accessory piece with a short copulatory tube.

C. aori n.sp., *C. longicirrus* n.sp. and *C. mystusi*, all live harmoniously together on gills of same fish host. *C. aori* n.sp., *C. longicirrus* n.sp. and *C. mystusi* are different in structure of copulatory complex (inverted, hollow, sac like, accessory piece with a short tube in *C. aori* n.sp.; vase shaped accessory piece in *C. longicirrus* n.sp.; Urn shaped, accessory piece with a comparatively

long tube in *C. mystusi*), vaginal armature (simple in *C. aori* n.sp. and *C. mystusi*; blade like structure in *C. longicirrus* n.sp.), ventral anchor (inner root blunt, more/less equal to outer root in *C. aori*; longer inner root, blunt, in *C. longicirrus*; inner root pointed, sharp longer than outer root in *C. mystusi*).

Etymology

The species has been named *Cornudiscoides aori* n.sp. after *Sperata aor* as its type host.

Generic diagnosis (Gusev, 1976; Agrawal and Vishwakarma, 1996)

Body fusiform, haptor bilobed; Cephalic region: lobes well developed, two pair eye spots, posterior pair larger, accessory granule present/absent; Caeca confluent, posterior to testis; Dorsal anchors: large, outer root stumpy, with dorsal patches; Ventral anchors: smaller than dorsal anchors, roots prominent, without patches, well set off on each half of haptor; Dorsal bar: straight; Ventral bar: two pieced/ "V" shaped, median ligament of bar very fine; Hooks: seven pair, larval, similar in shape and size, third pair exceptionally large, needle like, near to ventral anchor; Gonads: intercaecal, overlapped; Testis: posterior-dorsal to ovary; Seminal vesical: blind, sac-like; Vas deference: coils left intestinal caecum; Copulatory complex: simple/coiled tube, accessory piece attached to proximal end of tube; Prostatic reservoir: two; Vagina: sinistral/mid-ventral; Seminal receptacle: large; Parasitize on Bagrids; Southern Asia.

KEY TO SPECIES OF CORNUDISCOIDES KULKARNI, 1969 (REPORTED SO FAR IN INDIA)

- 1 Ventral bar joined by a very thin median ligament.....
C. proximus, *C. geminus*, *C. vittati*, *C. bleekerei*, *C. gussevi*, *C. susanae*, *C. gontiai*, *C. agrawali*, *C. mystusi*
- (A) Copulatory complex with simple and short tube (more/less equal to accessory piece).....
..... *C. agrawali*, *C. gontiai*, *C. proximus*, *C. vittati*
- Copulatory tube distally attached with cigar-shaped accessory piece..... *C. agrawali*
- Accessory piece Wrench-shaped..... *C. gontiai*
- Accessory piece Claw-shaped (both pieces are of equal length) ...
..... *C. proximus*
- Accessory piece Clipper-shaped, two pieced (three segmented piece attached with basal piece)..... *C. vittati*
- (B) Copulatory complex with simple tube (longer than accessory piece)..... *C. geminus*, *C. susanae*
- Accessory piece Claw-shaped (both pieces unequal, one hangs over another)..... *C. geminus*
- Accessory piece, massive, barrel-shaped..... *C. susanae*
- (C) Copulatory complex with Simple and very long tube.....
..... *C. bleekerei*, *C. gussevi*, *C. mystusi*
- Accessory piece, claw-shaped, two pieced (each one having two segments)..... *C. bleekerei*
- Accessory piece, two pieced, triangular, (one arm, attached with each other)..... *C. gussevi*

- Accessory piece, Urn-shaped..... *C. mystusi*
- 2- Ventral bar not joined by a thin median ligament
C. heterotylus, *C. microtylus*, *C. megalorchis*, *C. sclerovaginalis*, *C. tukarami*,
- (A) Copulatory complex with Simple, short tube (more/less equal to accessory piece)..... *C. microtylus*, *C. megalorchis*
- Accessory piece, short, curved, club shaped..... *C. microtylus*
- Accessory piece, small, bean shaped..... *C. megalorchis*
- (B) Copulatory complex with Simple tube (longer than accessory piece) *C. heterotylus*, *C. sclerovaginalis*, *C. tukarami*
- Accessory piece, complex, seems somewhat clamp like
..... *C. heterotylus*
- Accessory piece, A-shaped..... *C. sclerovaginalis*
- Accessory piece, massive..... *C. tukarami*

DISCUSSION

Cornudiscoides longicirrus n.sp., and *C. aori* n.sp., are characterized by their unique copulatory complex (vase-shaped accessory piece, attached distally to a long copulatory tube in *C. longicirrus* n.sp. and inverted hollow-sac like accessory piece having comparatively short copulatory tube in *C. aori* n.sp.) and vaginal armature (vaginal tube with a blade like accessory piece in *C. longicirrus* n.sp., while funnel shaped opening with highly sclerotized vaginal tube in *C. aori* n.sp.). These two species differ from previously described species of the genus *Cornudiscoides*, mainly in the structure of copulatory complex as shown in Table I. *Cornudiscoides* is a strictly host specific parasite, reported so far from species of the host *Mystus*, except *C. mystusi* (Rizvi, 1971) Dubey *et al.*, 1992, described from *S. aor* (identified as *M. aor* by Rizvi, (1971). Genus *Sperata* includes 4 species viz. *S. aor*, *S. sheengala*, *S. aorella* and *S. aciularis*. Earlier *Sperata* was named as *Macrones* Dumeril, 1856; *Aoria* Jordan, 1919; *Aorichthys* Wu, 1939; *Macronichthys* White and Moy-Thomas, 1940 and *Osteobagrus* Jayaram, 1954. However, Jayaram (1955) proposed a sub genus *Osteobagrus* of *Mystus* and synonymised *Macrones*, *Aoria*, *Sperata*, *Aorichthys*, *Macronichthys* with *Osteobagrus*. Jayaram (1977) again recognised *Aorichthys* as valid, which is a junior synonym of *Sperata*. Ferraris and Runge, (1999) emended the genus *Sperata* for *Macrones*, *Aoria*, *Aorichthys*, *Macronichthys* and *Osteobagrus*. It was supposed that the monogenoid *Cornudiscoides* infests only to *Mystus* sp. (strictly host specific parasite). The genus *Cornudiscoides* is a specialist monogenoid, under the sub-category metastoxenous of mesoxenous, infecting closely related hosts of a family (Pojmanska and Niewiadomska, 2012, Rascalou and Justine, 2007, Pouyaud *et al.*, 2006) as is evident from the present records. It parasitizes *Mystus* and *Sperata* of the same family Bagridae. However, *C. longicirrus* n.sp. and *C. aori* n.sp. are specialist monogenoid (parasitize on gills of *Sperata*). The genus *Cornudiscoides* is also supposed to

Table I.- Comparative data of *Cornudiscooides* species parasitizing various fish host of family Bagridae.

| Parasite name | Type host | Type locality | |
|---|-----------------------|----------------------------|-----------------|
| 1. <i>C. heterotylus</i> Kulkarni, 1969 | <i>Mystus tengara</i> | Hyderabad , A.P. | (valid species) |
| 2. <i>C. microtylus</i> Kulkarni, 1969 | <i>M. tengara</i> | Hyderabad , A.P. | (valid species) |
| 2. <i>C. megalorchis</i> Kulkarni, 1969 | <i>M. tengara</i> | Hyderabad , A.P. | (valid species) |
| 4. <i>C. proximus</i> Gusev, 1976 | <i>M. vittatus</i> | River Gomti, Lucknow | (valid species) |
| Syn. <i>C. raipurensis</i> Dubey <i>et al.</i> , 1992 | | Add. Locality: Deoria | |
| <i>Neomurraytrema shuklai</i> Agrawal and Singh, 1985 | | Sultanpur, Meerut, Jhansi, | |
| <i>C. kulkarnii</i> Pragati <i>et al.</i> , 2013 | | U.P., India, Sri Lanka | |
| <i>C. susanne</i> Pragati <i>et al.</i> , 2013 | | | |
| <i>C. jaini</i> (Gusev, 1963) Gusev, 1976 | | | |
| 5. <i>C. geminus</i> Gusev, 1976 | <i>M. vittatus</i> | River Gomti, Lucknow | (valid species) |
| Syn. <i>Neomurraytrema lucknowensis</i> | | | |
| Agrawal and Sharma, 1988 | | | |
| 6. <i>C. vittati</i> Dubey <i>et al.</i> , 1992 | <i>M. vittatus</i> | Water bodies near Raipur | (valid species) |
| 7. <i>C. bleekeri</i> | <i>M. bleekeri</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 8. <i>C. gussevi</i> | <i>M. bleekeri</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 9. <i>C. susanae</i> | <i>M. bleekeri</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 10. <i>C. tukarami</i> | <i>M. bleekeri</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 11. <i>C. gomtii</i> | <i>M. vittatus</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 12. <i>C. agrawali</i> | <i>M. vittatus</i> | River Gomti, Lucknow | (valid species) |
| Agrawal and Vishwakarma, 1996 | | | |
| 13. <i>C. sclerovaginalis</i> | <i>M. cavasius</i> | Lucknow | (valid species) |
| Devak and Pandey 2007 | (Ham. 1822) | | |
| 14. <i>C. mystusi</i> (Rizvi, 1971) | <i>Sperata aor</i> | Sindh (now in Pakistan) | (valid species) |
| Dubey <i>et al.</i> , 1992 | (Ham., 1822) | | |
| Syn: <i>Ancylodiscooides mystusi</i> Rizvi, 1971 | | | |

be an excellent bio-marker for error-free host identification (Boje *et al.*, 1997; Oliva *et al.*, 2004; Mackenzie, 2005; Hayward, 2005, Rajvanshi and Agrawal, 2013). This peculiarity is, however, disadvantageous for the parasite as it has high risk of mortality in unsuitable environment due to probable extinction of host (Rajvanshi *et al.*, 2015). Thus, for their survival, parasite should co-evolve with their host (Sasal *et al.*, 1999) or they may widen their niche (be a generalist).

ACKNOWLEDGEMENTS

Facilities developed from UGC-SAP (DRS-I) programme under the thrust area "Helminth Taxonomy" of the Department of Zoology, University of Lucknow, were utilized for the present work. We also acknowledge UGC for financial assistance (28943-SR, F-4-10/2010 BSR-NA and JRF to JV).

Conflict of interest

None.

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