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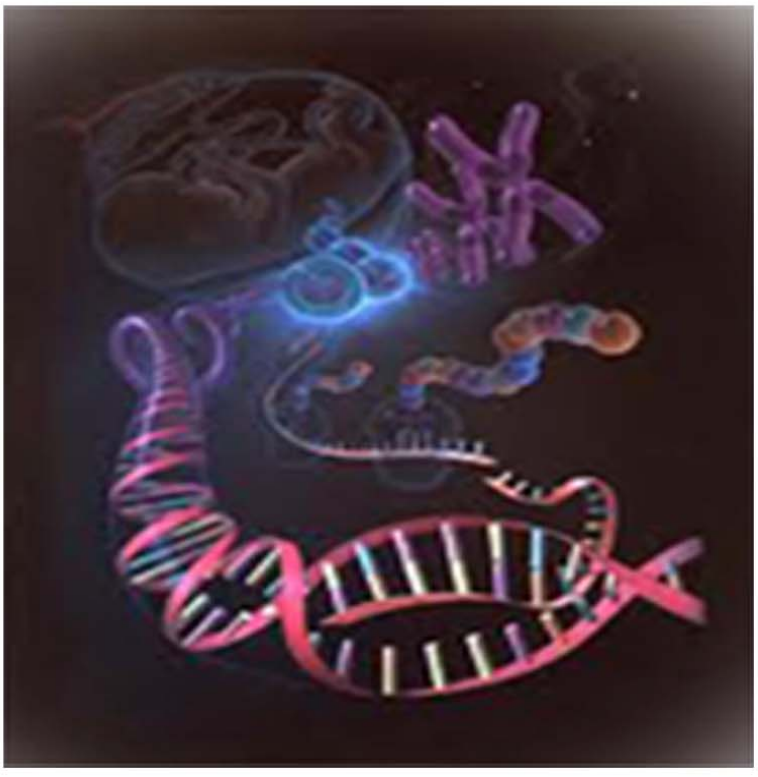

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Research Paper

MONOGENEAN FAUNA OF DISTRICT SAHARANPUR, UP, PART-VI

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Present communication deals with three new species of the genus Thaparocleidus Jain (1952) from freshwater fishes *Eutropiichthys vacha* (Ham.) and *Wallago attu* (Bloch and Schn.). The new species is characterized on the basis of difference in shape of copulatory complex, and haptoral armature, etc.

Keywords: Monogeneans, Thaparocleidus, *Thaparocleidus quadratus*, *T. agrawali, T. yamunaii*

INTRODUCTION

During the course of study of freshwater monogenean fauna of district Saharanpur, I came across two specimen of *Eutropiichthys vacha* (Ham.), three specimens of *Wallago attu* (Bloch and Schn.) and seven specimen of *Wallago attu* (Bloch and Schn.) infected with several specimens of *Thaparocleidus quadratus* n. sp., *Thaparocleidus agrawali* n. sp., and *Thaparocleidus yamunaii* n. sp., respectively. On detailed study, they were found new, therefore, described here as such. The description is based on fresh materials collected by author.

MATERIALS AND METHODS

Fishes, for the present investigation, were collected from river Yamuna and local fish markets of district Saharanpur. They were brought to laboratory and identified. The identification of piscine hosts was made with the help of classical works of Mclnerny and Gerard (1958), Misra (1959), Srivastava (1980), Nelson (2006) and Day (1989). Monogeneans were collected by freezing technique of Mizelle (1936 and 1938).

Worms thus collected, were washed thoroughly, and fixed in hot 70% alcohol or 10% neutral Formaline. Study of chitinoid hard parts was made in temporary Glycerin mounts. Permanent mounts were also made after staining in Aceto alum carmine, dehydrating through ascending grades of Alcohol, clearing in Xylene, and mounting in Canada balsam. Camera lucida sketches were made both from temporary and permanent preparations. Besides this, morphological studies were made using Motic Microscope and Image analyzing system. All measurements were taken with the help of stage micrometer and occulometer by method suggested by Mizelle (1936 and 1938), Gussev

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(1955), Malmberg (1957) and Singh (1959). The measurements were also compared with the measurement taken by Motic image analysis software 2000.

OBSERVATION AND DISCUSSION

Thaparocleidus Quadratus n.sp.

(Plate 1, Figures 1-9 and Plate 2, Microphotograph 1-2)

Plate 1: *Thaparocleidus quadratus* n.sp. 1. Whole Mount; 2. Male Copulatory Complex, 3. Dorsal Transverse Bar, 4. Patches, 5. Dorsal Anchors, 6. Ventral Transverse Bar, 7. Ventral Anchors, 8. Marginal Hooklet, 9. Haptor

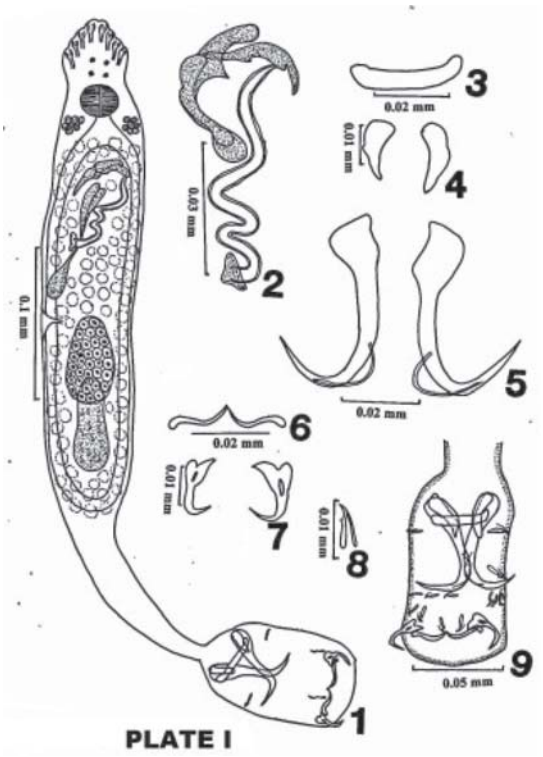
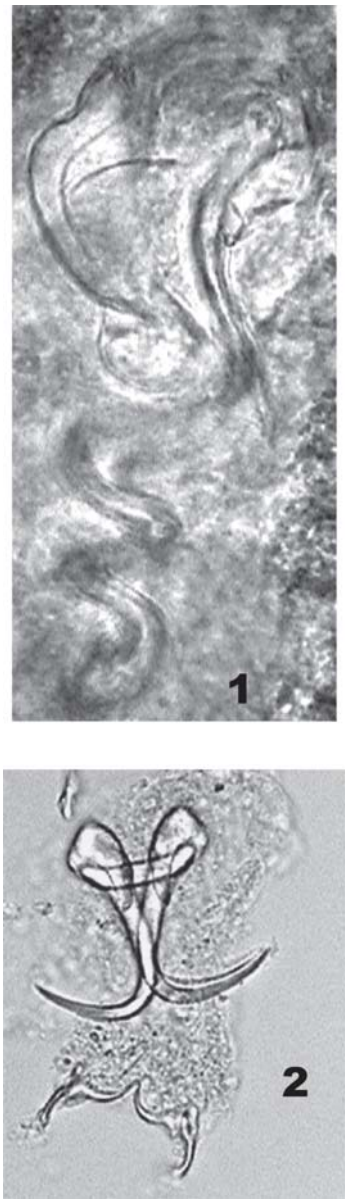


Plate 2: *Thaparocleidus quadratus* n.sp. Microphotograph 1. Male Copulatory Complex, Microphotograph, 2. Haptor



The body of worm is stout, elongated, measuring 0.56-0.57 mm. Maximum width was recorded in cirrus proper region, ranging from 0.061-0.062 mm. Prohaptor is fairly set off from the body proper through a shallow constriction in the anterior region. The opisthaptor is set off with the help of a narrow and elongated peduncle. The head is divisible in two lobes each of which is further divided into four lobes. Head is lodged with four pairs of head organs and two pairs of eyespots. Each head organ is provided with a separate duct extending posteriorly. Eyespots are

very well developed, located slightly anterior to pharynx. Pharynx is oval, measuring 0.025-0.027 x 0.021-0.023 mm. On the postero-lateral sides of the pharynx, seven pairs of darkly stained pharyngeal glands are present. Intestine is simple, bifurcate and crura are united posteriorly.

Male reproductive system consists of a testis, seminal vesicle, vas efference, male copulatory complex, and a pair of prostate gland. Testis is elongated, inter-caecal, equatorial, post-ovarian and measures 0.061-0.062 x 0.024-0.025 mm. Seminal vesicle is oval in shape, located in pre-equatorial region of the body, slightly anterior to vagina, measuring 0.021-0.022 x 0.009-0.010 mm. From the anterior border of seminal vesicle, fine vas efference arises, extends anteriorly and opens at the base of cirrus. A pair of prostate gland is present above the base of cirrus proper. Male copulatory complex consists of curved tubular cirrus and an accessory piece. The cirrus proper is serpentine tube with a triangular chitinoid plate at the base and measures 0.061-0.062 mm. Chitinoid plate measures 0.008-0.009 x 0.003-0.004 mm. The accessory piece of the cirrus is made up of three pieces; one is larger while two are small. First piece is sickle shaped the edges of which are denticulated, second is semicircular in outline, third is bow shaped, and measures 0.021-0.022 mm, 0.023-0.024 mm and 0.041-0.042 mm, respectively. Ejaculatory duct ends at the tip of first accessory piece.

Female reproductive system consists of an ovary, vagina and vitelline glands. Ovary is pre-equatorial, slightly superimposed on the anterior lobe of the testis, oval in shape, and measuring 0.061-0.062 x 0.031-0.032 mm. Vagina is sinistral, muscular, funnel shaped, anterior to ovary, and measuring 0.021-0.022 mm. Vitelline follicles are co-extensive with intestinal caeca.

Haptor is like quadrangular plate, measuring 0.11-0.12 x 0.06-0.07 mm. Armature of haptor consists of two pairs of unequal anchors, double transverse bar, a pair of patches and seven pairs of marginal hooklets. Each dorsal anchor is with broad base, strong shaft, and recurved points, measuring 0.061-0.062 mm. In the shaft region, each anchor is equipped with well developed sleeve sclerite. Each anchor is with a patch on its base, measures 0.014-0.018 mm. Dorsal transverse bar is strong, well developed with an anteriorly protruded margins giving appearance of boat, measuring 0.027-0.028 mm. Each ventral anchor consist of well developed inner root, slightly less developed outer root, shaft and recurved points, measures 0.018-0.019 mm. Inner root are avian beak like in shape. Ventral transverse bar is made up of two parts, each part is 's' shaped measures 0.017-0.016 mm. Marginal hooklets are seven pairs, embedded in the margins of haptor. Each marginal hooklet is provided with sickle shaped blade, handle, heel and opposable piece, measuring 0.008-0.009 mm in length.

DISCUSSION

Jain (1952) established the genus *Thaparocleidus* for the worms collected from the gill filaments of *Wallago attu* (Bloch) at Lucknow. The generic diagnosis for the worm is

Tetraonchinae: Gut bifurcate but confluent posteriorly. Several pairs of head organs and two pairs of eyespots. Anchors in two pairs, dissimilar in shape and size. Three haptoral bars dissimilar in shape and size. Five pairs of hooks. Testis anterior to ovary. receptaculum seminis and vesicula seminalis present. Vagina sinistral, highly chitinised and coiled. Cirrus coiled with several complete loops, accessory piece horse-shoe

shaped with a handle; both non-articulate at the base. Vitellaria from pharynx to the posterior end. Single egg, Parasite of freshwater fishes.

Gussev (1973) synonymized the genus *Thaparocleidus* Jain (1952) with *Silurodiscoides* for the worms collected from gill filament of *Silurus glanis.* The generic diagnosis is-

Dactylogyridae, Ancylodiscoidinae, two pairs of glandular head lobes, two pairs of eyespots. Haptor slightly separated from the body, its armament consists of seven pairs of hooks, more often hooks are of larval type, two pairs of anchors of which ventral have re-curved point and are smaller than dorsal ones, of non-paired dorsal bar and non-paired or paired ventral bar, pair of patches (additional supporting bars) of dorsal anchors. Ventral anchors are somehow removed backwards from the dorsal ones and are disposed in two moderate posterior lobes of haptor. The rest as in the diagnosis of the subfamily. Parasites of catfishes.

Gussev (1973) included 48 species to this genus from Europe, Far east, India and Indochina.

Lim (1996) pointed out that *Thaparocleidus* is a senior synonym of *Silurodiscoides*, listed 80 species of *Thaparocleidus*, emphasized the need to ascertain the status of some of species from Indian fishes, and suggested that a detailed redescription of *T. wallagonius*, the type-species was required.

Lim *et al.* (2001) listed dactylogyridean monogeneans of siluriform fishes of the Old World and have tentatively considered 77 species of *Thaparocleidus* valid and further questioned the validity of certain Indian species. Moreover, they also amended the generic diagnosis of genus *Thaparocleidus* -

Body elongate, with four eyespots. Caeca unite posterior to testis. Haptor may or may not be well demarcated from body, sometimes bilobed. Patches on dorsal anchors. Dorsal anchors usually larger than ventral anchors, with roots of variable length; ventral anchors usually smaller, with roots of variable length. Dorsal bar straight to V-shaped; ventral bar usually V-shaped or divided into two parts. Marginal hooks of variable shapes and sizes. Seminal vesicle single, blind, sac-like. Copulatory organ consists of usually coiled copulatory tube and accessory piece. Vaginal opening normally sinistral. On freshwater siluriform fishes, Palaearctic, India, Southeast Asia.

Pandey *et al.* (2003) redescribed some Indian species of genus *Thaparocleidus* along with *T. seenghali* (Jain, 1961) Lim (1996).

To the best of my knowledge following species have been reported from India, appended in tabular form in Table 1.

I disagree synonymy of *Dactylogyrus seenghali* to *T. seenghali* (Jain, 1961) [syns *Dactylogyrus seenghali* Jain (1961); *Jainius seenghali* (Jain, 1961) Achmerow (1964); *Silurodiscoides seenghali* (Jain, 1961) Gussev (1978)], Lim (1996), on account of redescription of *D. seenghali* by Kumar and Singh (2004). Kumar and Singh (2004) also found only one pairs of anchor in the specimens at their disposal. So, species described by Pandey *et al.* (2003) is considered as *T. pandeyii*.

Present form differs to all known Indian species of genus *Thaparocleidus* in having different shape of dorsal anchors, ventral transverse bar and male copulatory complex. Therefore, it is described as *T. quadratus* n.sp., on account of presence of quadrangular haptor.

Table 1: Showing Different Species of Genus *Thaparocleidus* Jain, 1961 Reported from India

Species	Author	Host
T. chauhani	(Agrawal and Pandey, 1981) Lim, 1996	*Wallago attu*
T. dayali	(Pandey and Agarwal, 1988) Lim, 1996	*Wallago attu*
T. devaraji	(Gussev, 1973) Lim, 1996	*Ompok malabaricus*
T. gomtius	(Jain, 1952) Lim, 1996	*Wallago attu*
T. guptai	Pandey and Mehta, 1986	*Wallago attu*
T. gussevi	(Singh, Kumari and Agarwal, 1992) Lim, 1996	*Wallago attu*
T. indicus	(Kulkarni, 1969) Lim, 1996	*Wallago attu*
T. isostylus	Kulkarni, 1969	*Wallago attu*
T. jaini	Agrawal, 1981	*Wallago attu*
T. kheri	Pandey and Agarwal, 1990	*Labeo rohita*
T. longicirrus	(Tripathi, 1959) Lim, 1996	*Wallago attu*
T. lucknowensis	(Agrawal and Sharma, 1988) Lim, 1996	*Mystus vittatus*
T. malabaricus	(Gussev, 1976) Lim, 1996	*Ompok malabaricus*
T. multispiralis	(Jain, 1957) Lim, 1996	*Silonia silondia*
T. octotylus	(Kulkarni, 1969) Lim, 1996	*Ompok pabda*
T. pangasi	(Tripathi, 1959) Lim, 1996	*Pangasius pangasius*
T. purvulus	(Gussev, 1976) Lim, 1996	*Mystus vittatus*
T. postorchidis	(Kulkarni, 1969) Lim, 1996	*Sperata aor*
T. raipurensis	(Dubey, Gupta and Agarwal, 1992) Lim, 1996	*Clupisoma garua*
T. ramalingami	(Pandey and Mehta, 1986) Lim, 1996	*Wallago attu*
T. ritius	(Jain, 1961) Lim, 1996	*Rita rita*
T. saharanpurensis	Pandey and Agarwal, 1990	*Wallago attu*
T. sharmae	Lim, 1996	*Wallago attu*
T. sohani	Pandey and Mehta, 1986	*Wallago attu*
T. sudhakari	(Gussev, 1976) Lim, 1996	*Wallago attu*
T. surendrai	Pandey and Agrawal, 1990	*Wallago attu*
T. tengra	(Tripathi, 1959) Lim, 1996	*Mystus tengra, M. gulio*
T. vachi	(Tripathi, 1959) Lim, 1996	*Eutropiichthys vacha*
T. vachius	(Jain, 1961) Lim, 1996	*Eutropiichthys vacha*
T. vaginalis	(Gussev, 1976) Lim, 1996	*Clupisoma garua*
T. yogendrai	Agrawal, 1981	*Wallago attu*
T. pusillus	(Gussev, 1976) Lim, 1996	*Mystus vittatus*

Thaparocleidus agrawali n.sp.

(Plate 3, Figures 1-10 and Plate 4, Microphotograph 1-3)

The body of worm is stout, elongated, measuring 0.34-0.37 mm. Maximum width was recorded in testicular region, ranging from 0.052-0.055 mm. Prohaptor and opisthaptor are fairly set off from the body proper through a shallow constriction in the anterior and deep constriction in posterior regions, respectively. The head is rounded, lodged with four pairs of head organs. Each head organ is provided with a separate duct extending posteriorly. Eyespots are degenerated and scattered melanistic granules are present. Pharynx is oval, muscular, and measures 0.017-0.018 x 0.014-0.016 mm. On the postero-lateral sides of the pharynx, seven pairs of darkly stained pharyngeal glands are present. Intestine is simple, bifurcate and crura unite posteriorly, at the level of haptoral peduncle.

Plate 3: *Thaparocleidus agrawali* n.sp. 1. Whole Mount, 2. Male Copulatory Complex, 3. Male Copulatory Complex (Paratype), 4. Haptor, 5. Dorsal Transverse Bar, 6. Patches, 7. Dorsal Anchors, 8. Ventral Transverse Bar, 9. Ventral Anchors, 10. Marginal Hooklet

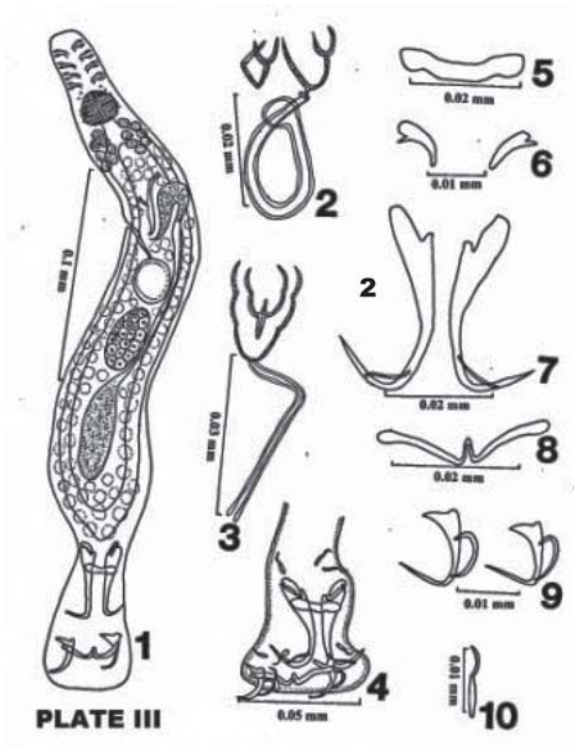
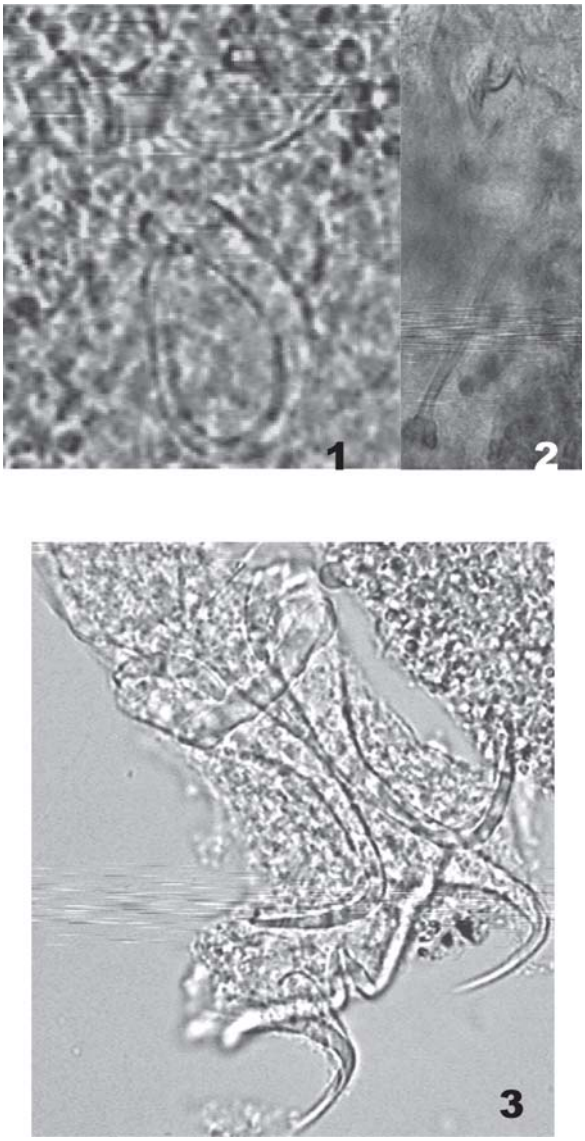


Plate 4: *Thaparocleidus agrawali* n.sp. Microphotograph 1. Male Copulatory Complex, Microphotograph, 2. Male Copulatory Complex (paratype), Microphotograph 3. Haptor



Male reproductive system consists of a testis, seminal vesicle, vas deferens, vasa efference

and male copulatory complex. Testis, elongated, inter-caecal, post-equatorial, post-ovarian and measures 0.051-0.053 x 0.017-0.019 mm. From the anterior border of testis a fine duct, vas deference, arises extend anteriorly and dilates to form seminal vesicle. Seminal vesicle is sigmoid, located in pre-equatorial region of the body, slightly anterior to vagina, forms loop around left intestinal limb, and measures 0.041-0.044 x 0.011-0.012 mm. From the anterior border of seminal vesicle, a fine vasa efferentia arises, extends anteriorly and opens at the base of cirrus. Male copulatory complex consists of curved tubular cirrus and an accessory piece. The cirrus proper is with bubble like base, and measures 0.052-0.054 mm along with its curvature. The accessory piece of the cirrus is made up of two pieces; one is bigger while other is smaller. First piece is with horseshoe shaped anterior part that extends into 'U' shaped tube. The whole structure measures 0.022-0.022 mm. Second piece is also with horseshoe shaped anterior part, extended with curved arm, directing toward its anterior extremities. Whole structure measures 0.018-0.019 mm. Variation is present in the structure of male copulatory complex. Paratype of male copulatory complex is long elongated cirrus and accessory piece. Cirrus proper is elongated '7' shaped, chitinoid double walled structure, measures 0.038-0.039 mm. The accessory piece of cirrus (paratype) is made up two pieces. Both pieces are lobular, measures 0.024-0.025 and 0.037-0.038 mm, respectively.

Female reproductive system consists of an ovary, vagina, receptaculum seminis and vitelline glands. Ovary is equatorial, oval in shape, measuring 0.033-0.036 x 0.019-0.021 mm. Vagina is sinistral, muscular, funnel shaped, anterior to ovary, and communicates with well developed receptaculum seminis. The receptaculum seminis is oval in shape, located anterior to ovary, measures 0.021-0.022 x 0.017-0.018 mm. Vitelline follicles are co-extensive with intestinal caeca.

Haptor is discoidal in shape, measuring 0.071-0.074 x 0.051-0.052 mm. Armature of haptor consists of two pairs of unequal anchors, double transverse bar, a pair of patches and marginal hooklets. Each dorsal anchor is with well developed inner root, slightly developed outer root, strong shaft, and recurved points, measuring 0.041-0.045 mm. In the point region, each anchor is equipped with well developed sleeve sclerite. Each dorsal anchor is with a patch (accessory transverse bar) on its base, having bifid base, measures 0.0082-0.0094 mm. Dorsal transverse bar is strong, well developed, with a groove in middle, measuring 0.022-0.023 mm. Each ventral anchor consist of well developed inner root, hardly protruding outer root, shaft and recurved points, and measures 0.0185-0.0192 mm. Inner root are avian beak like in shape. Each ventral anchor is equipped with sleeve sclerite in shaft region. Ventral transverse bar is 'W' shaped, widened arms, measures 0.028-0.029 mm. Marginal hooklets are four pairs, embedded in the margins of haptor, probably other hooks might be shed off during processing of worms. Each marginal hooklet is provided with sickle shaped blade and handle, measuring 0.012-0.014 mm in length.

DISCUSSION

Present form differ from other known form as well as *T. quadratus* in having different shape of dorsal anchors, ventral anchors, transverse bar (dorsal and ventral), patches and male copulatory

complex. Therefore, it is described as a new species, viz., *T. agrawali* n.sp., named in honor of Prof. N. Agrawal, Department of Zoology, Lucknow University, Lucknow.

Thaparocleidus yamunaii n.sp.

(Plate 5, Figures 1-10 and Plate 6, Microphotograph 1-4)

The body of worm is stout, elongated, measuring 0.55-0.59 mm. Maximum width was recorded in testicular region, ranging from 0.094-0.098 mm. Prohaptor and opisthaptor are fairly set off from the body proper through a shallow constriction in the anterior and deep constriction posterior regions, respectively. The head is bi1lobed, lodged with three pairs of head organs and two pairs of eyespots. Each head organ is provided with a separate duct extending posteriorly. Eyespots are well developed, posterior pair of eyespot is considerably larger than anterior pair on account of presence of large number of melanistic granules. Pharynx is oval, muscular, measuring 0.031-0.034 x 0.024-0.026 mm. At the postero-lateral sides of the pharynx, four pairs of darkly stained pharyngeal glands are present. Intestine is simple, bifurcate and crura are united posteriorly, at the level of haptoral peduncle.

Male reproductive system consists of a testis, seminal vesicle and male copulatory complex. Testis is pear shaped, inter-caecal, post-equatorial, post-ovarian and measures 0.086-0.089 x 0.041-0.045 mm. Seminal vesicle is balloon-shaped, located in pre-equatorial region

Plate 5: *Thaparocleidus yamunaii* n.sp. 1. Whole Mount, 2. Male Copulatory Complex, 3. Marginal Hooklet, 4. Haptor, 5. Vagina, 6. Vagina (Paratype), 7. Dorsal Transverse Bar, 8. Dorsal Anchors, 9. Ventral Transverse Bar, 10. Ventral Anchors

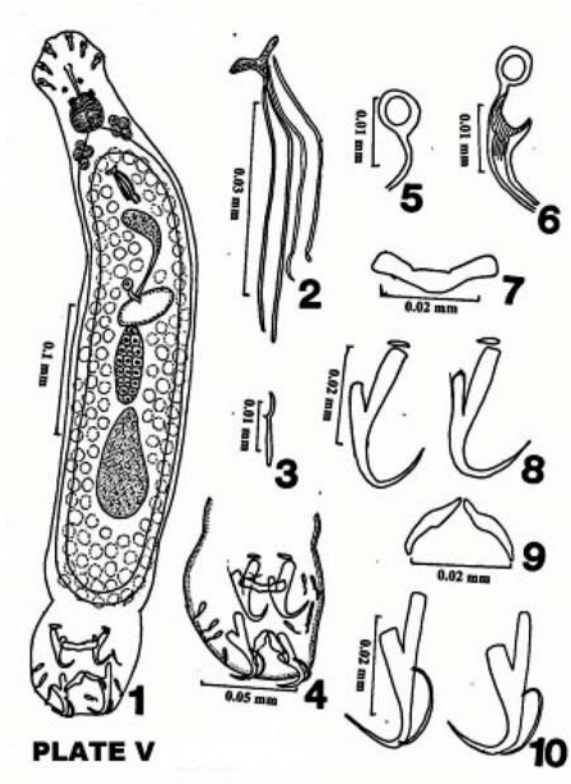
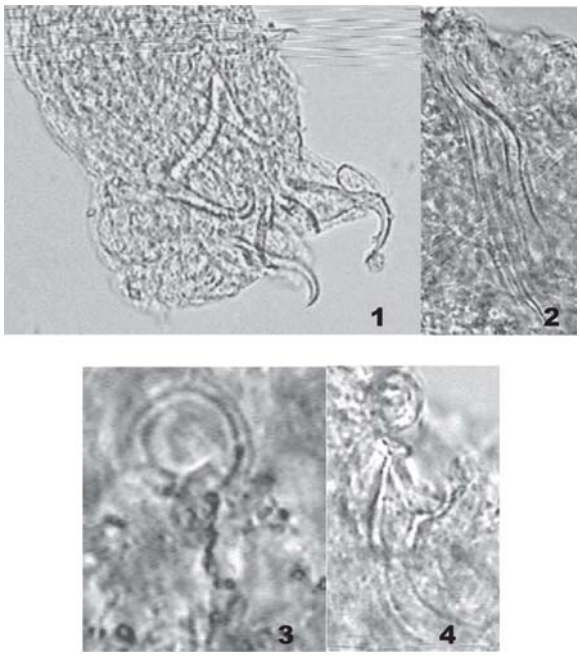


Plate 6: *Thaparocleidus yamunaii* n.sp. Microphotograph 1. Haptor, Microphotograph 2. Male Copulatory Complex, Microphotograph 3. Vagina, Microphotograph 3. Vagina (Paratype)



of the body, anterior to vagina, measuring 0.041-0.045 x 0.014-0.018 mm. Male copulatory complex consists of tubular cirrus and an accessory piece. The cirrus proper is double walled chitinoid elongated structure with bubble like base, measures 0.034-0.035 mm. The accessory piece of the cirrus is made up of single piece. Accessory piece is bow shaped, measures 0.0085-0.0088 mm. From the base of accessory pieces a double walled duct arises which runs parallel to cirrus proper, measures 0.038-0.039 mm.

Female reproductive system consists of an ovary, vagina, receptaculum seminis and vitelline glands. Ovary is equatorial, elongated-oval in shape, measuring 0.061-0.065 x 0.022-0.025 mm. Vagina is chitinoid, funnel shaped, anterior to ovary, measures 0.0072-0.0073 mm, communicate with well developed receptaculum seminis with a narrow tube. Variation is observed in shape of vagina. Paratype of vagina is funnel shaped structure that opens into horseshoe shaped structure, having ridges internally. The receptaculum seminis is oval in shape, located anterior to ovary, measures 0.048-0.051 x 0.023-0.025 mm. Vitelline follicles are co-extensive with intestinal caeca.

Haptor is discoidal in shape, measuring 0.075-0.078 x 0.065-0.068 mm. Armature of haptor consists of two pairs of anchors, double transverse bar, a pair of patches and marginal hooklets. Each dorsal anchor is with well developed inner root, slightly less developed outer root, strong shaft, and recurved points, measuring 0.034-0.035 mm. Each dorsal anchor is with a patch (accessory transverse bar) on its base, measures 0.0034-0.0035 mm. Dorsal transverse bar is strong, well developed, having notches, measuring 0.024-0.027 mm. Each ventral anchor consist of well developed outer root, slightly less developed inner root, shaft and recurved points, measures 0.036-0.038 mm. In the shaft region, each anchor is equipped with well developed sleeve sclerite. Ventral transverse bar is made of two pieces, each piece measures 0.015-0.018 mm. Marginal hooklets are four pairs, embedded in the margins of haptor, probably other hooks might be shed off during processing of worms. Each marginal hooklet is provided with sickle shaped blade and handle, measuring 0.014-0.016 mm in length.

Present form differ from other known form as well as *T. quadratus* and *T. agrawali* in having different shape of dorsal anchors, ventral anchors, transverse bar (dorsal and ventral), patches and male copulatory complex. Therefore, it is described as a new species, viz. *T. yamunaii* n.sp., named on the river from it collected.

CONCLUSION

In the present investigation fish fauna of district Saharanpur were explored. It is a new type locality for monogeneans. Only few references are available from this region.

During the course of study three more species is added to the genus *Thaparocleidus* Jain, 1952 by author-

1. *T. quadratus* n.sp.
2. *T. agrawali* n.sp.; and
3. *T. yamunaii* n.sp.

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REFERENCES

1. Achmerow A X (1964), "On the evolution of median attachment apparatus of monogenetic suboder Dactylogyrinea", *Trudy Gemint'ologicheskoi Laboratorii,* Vol. 14, pp. 69-79.
2. Agrawal N (1981), "On two known and one unknown monogenetic trematodes from the gills of *Wallago attu* (Bloch and Schn.)", *Proc. Indian Acad. Sci.,* Vol. 40, pp. 561-565.
3. Agrawal N and Pandey KC (1981), "On a new monogenean, *Wallagotrema chauhani* n. sp., from *Wallago attu* (Schneider)", *Ind. J. Parasit.,* Vol. 5, pp. 75-76.
4. Agrawal N and Sharma R (1988), "On a new monogenean, *Neomurraytrema lucknowensis* n. sp., from *Mystus vittatus* (Bloch)", *Ind. J. Parasit.,* Vol. 12, pp. 61-63.
5. Day F (1989), "*The fauna of British India including Ceylon and Burma Fishes,* Vol. I & II. Today & Tom orrow's Printers and Publishers, New Delhi.
6. Dubey A Gupta AK and Agarwal SM (1992), "Studies on monogenean parasites in freshwater fishes at Raipur. VIII. Validity of *Parancylodiscoides* Achmerow, 1964 (*Silurodiscoides*, Gussev, 1974) and two new species from Raipur", *Indian Journal of Helminthology*, Vol. 44, pp. 9–16
7. Gussev A V (1955), "Monogenetic trematodes of fishes of Amur River system", *Trudy Zool. Inst. A. N. USSR.* Vol. 19, pp. 171-398.
8. Gussev AV (1973-74), "Freshwater Indian Monogenoidea. Principles of systematics, analysis of world faunas and their evolution", *Indian Journal of Helmin.,* Vol. 25 and 26, pp. 1-241.
9. Gussev AV (1976), "The Systematic composition of the Indian fauna, Zoogeography and evolution of freshwater monogeneans", *Novana Seriava,* Vol. 35, pp. 5-32.
10. Gussev AV (1978), "Monogenoidea of freshwater fishes. Principles of systematics, analysis of world fauna and its evolution", *Parazitologia Sbornik,* Vol. 38, pp. 96-198.
11. Jain S L (1952), "Monogenea of Indian freshwater fishes II. *Thaparocleidus wallagonius* n.g. n. sp. (subfamily Tetraonchinae) from the gills of *Wallagonia attu* (Bloch), from Lucknow. *Indian J. Helminth.,* Vol. 4, pp. 43-48.
12. Jain S L (1957), "Monogenea of Indian freshwater fishes. IV. *Dactylogyrus multispiralis* n. sp. (subfamily Dactylogyrinae) from the gill filaments of *Silondia silondia* (Ham.), from Lucknow. *Indian Proceedings of the National Academy of Science, Allahabad, Section*, Vol. 27, pp. 26–30.
13. Jain S L (1961), "Three new species of *Urocleidus* Mueller, 1934, with the proposal of its synonymy with *Haplocleidus* Muellers 1937", *Annals of Zoology*, Vol. 3, pp. 135–148.
14. Kulkarni T (1969), "Studies on the trematodes of fishes found in Hyderabad, Andhra Pradesh (India), Part II. *Riv. Parasitol*, Vol. 30, No. 2, pp. 263–282.

15. Kumar V and Singh H S (2004), "Monogenean fauna of district Saharanpur", U.P., Part I. *J. Exp. Zool. India*., Vol. 7, pp. 261-268.

16. Lim L H S (1996), "*Thaparocleidus* Jain, 1952, the senior synonym of *Silurodiscoides* Gussev, 1976 (Monogenea: Ancylodiscoidinae), *Systematic Parasitology*, Vol. 35, pp. 207-215.

17. Lim L H S Timofeeva T A and Gibson D I (2001), "Dactylogyridean monogeneans of the siluriform fishes of the Old World. *Systematic Parasitology*, Vol. 50, pp. 159-197.

18. Malmberg G (1957), "On the occurrence of *Gyrodactylus* on Swedish fishes. *Skec. Sod. Sevr. fish for Arsskr* 19-76.

19. Mclnerny D and Gerard G (1958), *All about tropical fish* ,George G. Harrap & Co. Ltd. London, Toronto, Wellington, Sydney. pp. 480.

20. Misra K S (1959), "Fishes of Eastern Uttar Pradesh", *Rec. Indian Mus.,* Vol. 57, pp. 1-320.

21. Mizelle J D (1936), "New species of trematodes from gills of lllinois fishes", *Amer. Midl. Nat.,* Vol. 17, pp. 785-806.

22. Mizelle J D (1938), "Comparative studies on trematodes (Gyrodactyloidea) from gills of North American freshwater fishes. III", *Biol. Mongr.,* Vol. 17, pp.1-81.

23. Nelson J S (2006), *Fishes of the World,* 4th Edition, John Wiley and Sons, New York, pp. 624.

24. Pandey K C and Agarwal A (1988), "On a new monogenetic trematode from *Wallago attu* (Bloch)", *Indian J. Helminth.* (n.s.), Vol. 5, pp. 47-49.

25. Pandey K C and Agarwal A (1990), "Studies on some new monogenetic parasites of freshwater fishes", *Folia Morphologica,* Vol. 38, pp. 19-23.

26. Pandey K C And Mehta T (1986), "Studies on some new monogenetic trematodes of *Wallagonia attu* (Bloch.) at Meerut, Uttar Pradesh", India. *Proc. of 2nd National Conven. Of youth sci.* Meerut uni. Meerut, pp. 114-132.

27. Pandey K C Agrawal N Vishwakarma P and Sharma J (2003), "Redescription of some Indian species of *Thaparocleidus* Jain, 1952 (Monogenea), with aspects of the developmental biology and mode of attachment of *T. pusillus* (Gussev, 1976)", *Syst. Parasitol*., Vol. 54, pp. 207-221.

28. Singh H S Kumari M and Agarwal S (1992), "On some known and unknown monogeneans from *Wallago attu* (Bloch and Schn.). at Meerut (UP)",*Uttar Pradesh J. Zool.,* Vol. 16, pp. 48-56.

29. Singh S N (1959), "On the direct application of the camera lucida in measuring worms. *Jour. Inst. Sci. &Tech. (Lond.) Proc.,* pp. 23-24.

30. Srivastava G J (1980), *Fishes of Eastern Uttar Pradesh,* Vishwavidyala Prakashan, Varanashi.

31. Tripathi Y R (1959), "Monogenetic trematode from fishes of India", *Indian J. Helminth.,* Vol. 9, pp. 1-149.

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