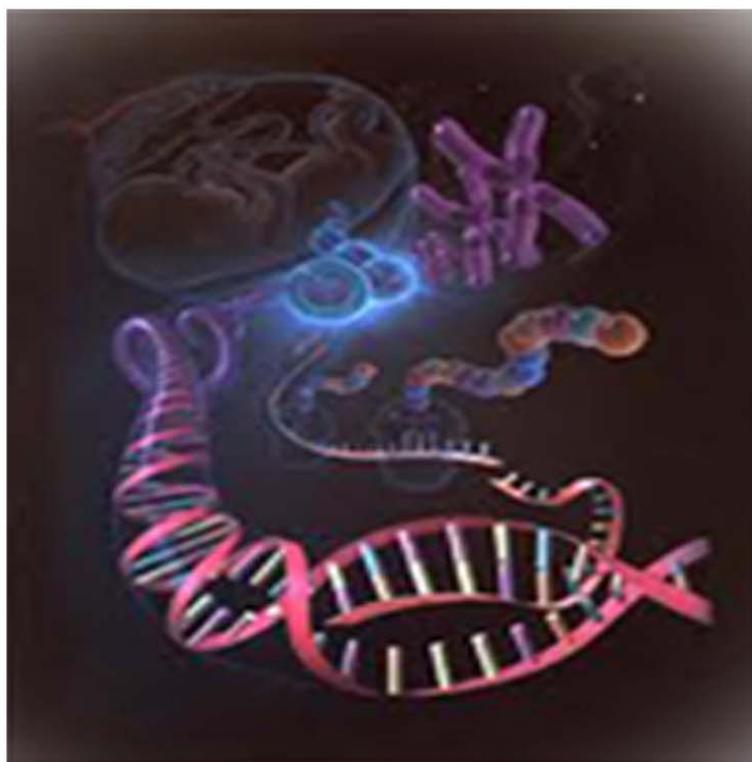




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Research Paper

MONOGENEAN FAUNA OF DISTRICT SAHARANPUR, UP, PART-V

Vivek Kumar^{1*}*Corresponding Author: **Vivek Kumar** ✉ s_vivekkumar1979@rediffmail.com

Present communication deals with one new and one known species of the genus *Paradactylogyrus* Thapar (1948) and *Bifurcohaptor* Jain (1958) from freshwater fishes *Labeo rohita* (Ham.) and *Mystus vittatus* (Bloch). The new species is characterized on the basis of difference in shape of copulatory complex, and haptor armature, etc. Based on the present observation, generic diagnosis of the genus is also amended. Known species exhibit variations besides measurements.

Keywords: Monogeneans, *Paradactylogyrus*, *Bifurcohaptor*, *Paradactylogyrus gussevi*, *Bifurcohaptor indicus*

INTRODUCTION

During the course of study of freshwater monogenean of district Saharanpur, I came across ten specimen of *Labeo rohita* (Ham.) and four specimen of *Mystus vittatus* (Bloch) infected with several specimens of *Paradactylogyrus gussevi* n.sp. and *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh (1989), respectively. On subsequent study, species of genus *Paradactylogyrus* was found new, therefore, described here as such. In light of the present observation, generic diagnosis of the genus *Paradactylogyrus* Thapar (1948) has also been amended.

However on detailed examination of *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh (1989), it was found that the worms at disposal of the author exhibit several variations

besides measurements. Moreover, it also exhibits new type locality for this species. It is, therefore, briefly re-described. The re-description is based on fresh materials collected by author.

MATERIALS AND METHODS

Fishes, for the present investigation, were collected from ponds 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 McInerney and Gerard (1958), Misra (1959), Srivastava (1968), Nelson (1984) 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 chitinous hard parts

¹ Department of Zoology, Vardhaman College, Bijnor, UP, India.

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 oculometer by method suggested by Mizelle (1936 and 1938), Gussev

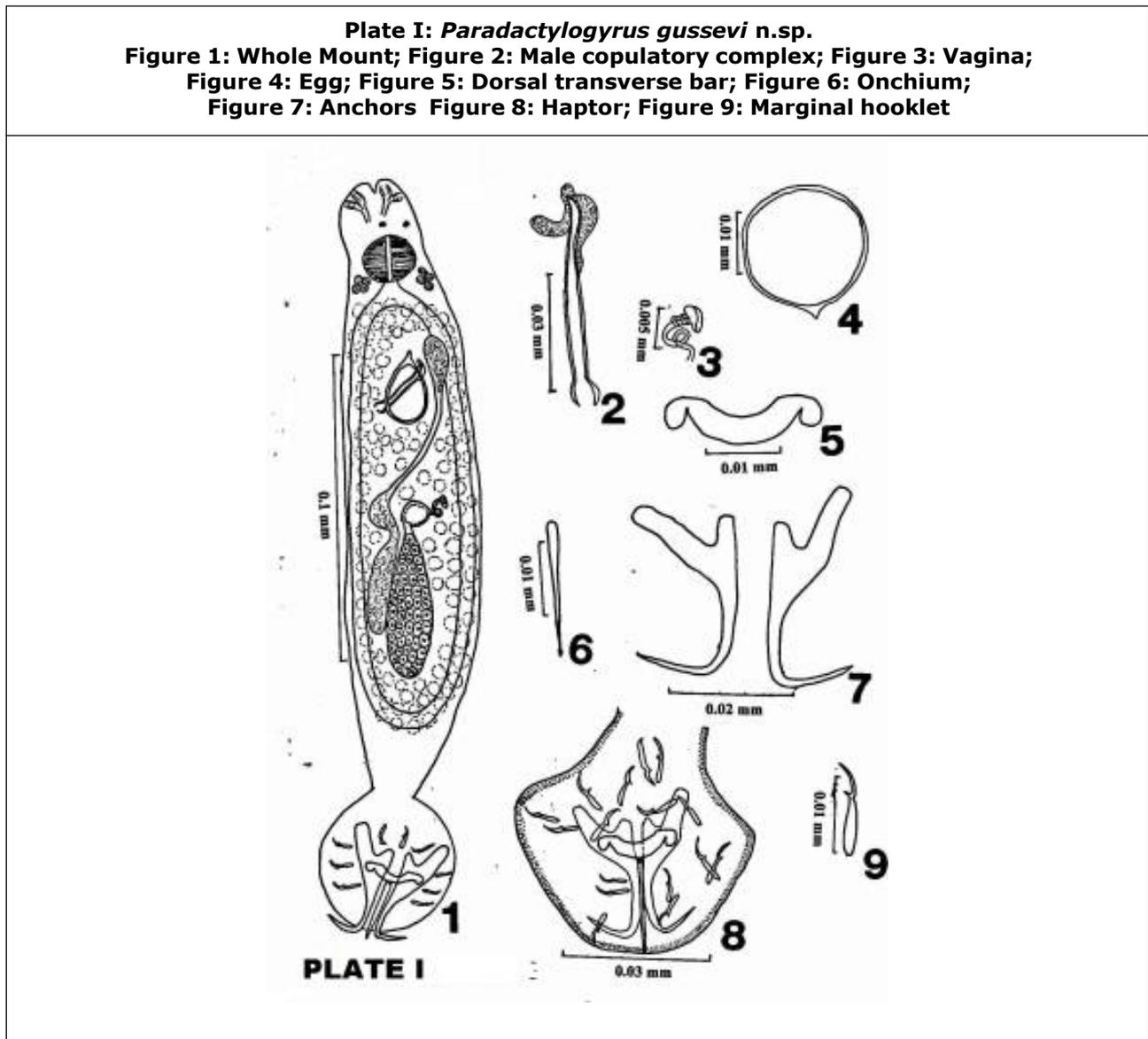
(1955), Malmberg (1957) and Singh (1959). The measurements were also compared with the measurement taken by Motic image analysis software 2000.

OBSERVATION AND DISCUSSION

Paradactylogyrus gussevi n.sp.

(Plate I, Figures 1-9 and Plate II, Microphotograph 1-4)

The body of worm is stout, elongated, measuring



0.27-0.28 mm. Maximum width was recorded in ovarian region, ranging from 0.041-0.042 mm. Prohaptor and opisthaptor are fairly set off from the body proper through a shallow constriction in the anterior and deep constriction in the posterior regions, respectively. The head is divisible in two lobes and is lodged with two pairs of head organs and two pairs of eyespots. Each head organ is provided with separate ducts, these unite to form a common duct, extend posteriorly. Eyespots are very well developed, located slightly anterior to pharynx. Pharynx is muscular, oval in outline, measuring 0.018-0.019 x 0.0171-0.0178 mm. On the postero-lateral sides of the pharynx, four pairs of darkly stained pharyngeal glands are present. Intestine is simple, bifurcated and crura are united posteriorly.

Male reproductive system consists of a testis, vas deferens, seminal vesicle and male copulatory complex. Testis simple, bipartite, elongated oval, Inter-caecal, post-equatorial, lies almost parallel to ovary, measuring 0.0491-0.0495 x 0.0081-0.0085 mm. From the anterior border of testis, a fine vas deferens arises, extends anteriorly and dilates to form a balloon shaped seminal vesicle, at the level of cirrus and measures 0.021-0.022 x 0.008-0.009 mm. Male copulatory complex consists of elongated tubular, double walled chitinoid cirrus proper, measuring 0.036-0.037 mm in length, and accessory piece. The accessory piece of the cirrus is made up of two pieces. One accessory piece is comma shaped, measuring 0.015-0.016 mm and second is semicircular in shape, measuring 0.0085-0.0088 mm in length. The anterior ends of both the pieces are found facing each other.

Female reproductive system consists of an ovary, vagina, vitelline glands, and receptaculum

seminis. The ovary is post-equatorial, elongated oval in outline, measuring 0.051-0.052 x 0.0191-0.0193 mm. Vagina is dextral, funnel shaped, extends into long chitinoid tube, measuring 0.0031-0.0034 x 0.0021-0.0022 mm, anterior to ovary and communicates to a well developed receptaculum seminis. Receptaculum seminis is oval in outline, measuring 0.011-0.012 x 0.009-0.010 mm. One egg is observed in few specimens. It is double walled, oval in outline, measuring 0.021-0.022 x 0.0191-0.0194 mm. It is equipped with a well developed spur at its one end, measuring 0.0011-0.0016 mm in length. Vitelline follicles are co-extensive with intestinal caeca.

Haptor is discoidal to pentagonal in shape, measuring 0.048-0.049 x 0.0471-0.0475 mm. Armature of haptor consists of a pair of anchor, transverse bar, an onchium and eight pairs of marginal hooklets. Each anchor is provided with well developed inner root, slightly less developed outer root, strong shaft, re-curved point, measuring 0.033-0.034 mm. Dorsal transverse bar is strong, well developed, with slightly broad margins, and anterior groove in middle, measuring 0.021-0.022 mm in length. Onchium is situated below the transverse bar, slightly broad at anterior end and narrows towards posterior end, oriented along the longitudinal axis of the body. The size of onchium ranges from 0.018-0.019 mm in length. Marginal hooklets are provided with an elongated handle, heel and sickle shaped blade, each measuring 0.0121-0.0123 mm.

DISCUSSION

Thapar (1948) established the genus *Paradactylogyrus* for the worms collected from

the gill filaments of *Catla catla* at Lucknow. The generic diagnosis for the worm was-

Dactylogyridae, Dactylogyrinae, Body elongated, haptor with one pair of anchors supported by a single bar, 14 marginal hooklets and an unpaired central piece ('onchium'). A pair of cephalic lobes bearing ducts of cephalic glands. Pharynx globular and muscular. Esophagus practically absent. Intestine limb simple, united posteriorly. Testis single, elongate, post-ovarian. seminal vesicle present. cirrus tubular with accessory piece. ovary elongated, pre-testicular. Vagina tubular, winding with lateral opening. Receptaculum seminis present, Vitellaria mostly extra caecal. Uterine eggs oval, without filament. Parasite of freshwater teleosts.

Tripathi (1959) synonymised this genus with *Dactylogyrus* though, he has also observed 'onchium' in the specimens recovered from *Labeo bata* at Calcutta. Yamaguti (1963) disagreed with this synonymy and transferred the species described by Tripathi (1959) to the genus *Paradactylogyrus*. Gussev (1973) once again synonymised genus *Paradactylogyrus* with *Dactylogyrus* on the basis of his observation on specimens of this genus recovered from *Labeo gonius*, *L. calbasu* and *Catla catla*. Gussev (1973) was of the opinion that 'onchium' is homologous to ventral transverse bar though, its orientation is different *i.e.* longitudinal axis of the body.

Agrawal (1980) disagreed with the synonymy extended by Tripathi (1959) and retained the genus valid.

Singh and Rastogi (2000) reviewed the status of genus *Paradactylogyrus* Thapar (1948), with a new species *P. indicus* and validate the genus on following features

1. Shape and dimensions of onchium is not uniform (not showing bilateral symmetry), so not be homologous to ventral transverse bar as proposed by Gussev (1973).
2. Presence of wings on anchor.
3. Presence of scattered melanistic granules.

To the best my knowledge, in all following species of the genus *Paradactylogyrus* Thapar, 1948 are known-

1. *P. catalius* Thapar, 1948
2. *P. (D.) bati* Tripathi, 1959
3. *P. thapari* Agrawal, 1980 and
4. *P. indicus* (Singh and Rastogi, 2000) Kumar and Singh, 2004.

The present form differs from *P. catalius* in number of head organs (three pairs in *P. catalius* and two pairs in present specimens), difference in the shape of onchium, transverse bar and difference in shape of anchors (inner roots are more developed). Gussev (1973) has also reported three pairs of head organs in the specimens of his disposal. It differs from *P. (D.) bati* in having two pairs of head organs, difference in the shape of onchium and male copulatory complex. However, it differs from *P. thapari* in having two pairs of head organs, difference in the shape of onchium, presence of heel on the marginal hooklets. Present form also differs from *P. indicus* (Singh and Rastogi, 2000) Kumar and Singh (2004), in number of head organs (two in present specimens and seven in *P. indicus*), male copulatory complex, shape of vagina, egg, dorsal transverse bar, shape of anchor (inner roots of anchors are more developed than the

anchors of *P. indicus*) and parallel position of testis and ovary. It is therefore, described as a new species, viz., *P. gussevi* n.sp.

In the light of present observations, generic diagnosis of the genus *Paradactylogyrus* Thapar, 1948 is amended- Dactylogyridae, Dactylogyrinae, body elongated haptor with a pair of anchors supported by a single transverse bar, marginal hooklets 7- 8 pairs and an unpaired central onchium oriented along the longitudinal axis of the body. Head organs 2-7 pairs, eyespots two pairs may or may not visible. Pharynx rounded to oval, muscular, intestinal limb simple, crura united posteriorly. Testis single, elongate, post-ovarian or parallel to ovary. Seminal vesicle present. Cirrus tubular with accessory piece. Prostate gland may or may not be present. Ovary elongated or oval, pre-testicular or parallel to testis. Vagina tubular, widening with funnel shaped lateral opening, which may have ridges internally receptaculum seminis present. Vitellaria coextensive with intestinal caeca. Egg oval with or with out spur. Parasitic in freshwater teleosts.

Key to various species of genus *Paradactylogyrus* Thapar, 1948

- | | |
|---|---|
| 1. Head organs 2 pairs | <i>P. gussevi</i> n.sp. |
| Head organs 3 pairs | 2 |
| Head organs 7 pairs | <i>P. indicus</i> Singh and Rastogi, 2000 |
| 2. Dorsal transverse bar with anteriorly directed extremities | <i>P. thapari</i> Agrawal, 1980 |
| Dorsal transverse bar with posteriorly directed extremities | 3 |
| 3. Onchium conical spine | <i>P. bati</i> Tripathi, |

- | | |
|---|--|
| like having anteriorly directed pointed end | 1959 |
| Dorsal anchors with very deeply bifid roots | <i>P. catalius</i> Thapar, 1948 |
| Type Species | <i>P. catalius</i> Thapar, 1948 |
| Additional Species | <i>P. bati</i> Tripathi, 1959
<i>P. thapari</i> Agrawal, 1980
<i>P. indicus</i> (Singh and Rastogi, 2000) Kumar and Singh, 2004
<i>P. gussevi</i> n.sp. |
| Type Host | <i>Catla catla</i> |
| Additional Host | <i>Labeo bata</i> , <i>L. rohita</i>
<i>L. gonius</i> , <i>L. calbasu</i> and <i>Mystus tengara</i> |
| Type Locality | Lucknow |
| Additional Locality | Calcutta, Kalyani, Meerut and Saharanpur |

***Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh, 1989**

Plate III, Figures 1-6 and Plate IV, Microphotograph 1-2

The body of worm is stout, elongated and measuring 0.381-0.389 mm. Maximum width was recorded in ovarian region, ranging from 0.095-0.099 mm. Prohaptor and opisthaptor are fairly set off from the body proper through constrictions in the anterior and posterior regions. Head is divisible in two lobes each of which is further divided into three lobes. Head is lodged with four pairs of head organs and two pairs of eyespots. Each head organ is provided with a separate duct

PLATE II: *Paradactylogyrus gussevi* n.sp. Microphotograph
1. Vagina Microphotograph 2. Male copulatory complex Microphotograph
3. Egg Microphotograph 4. Haptor

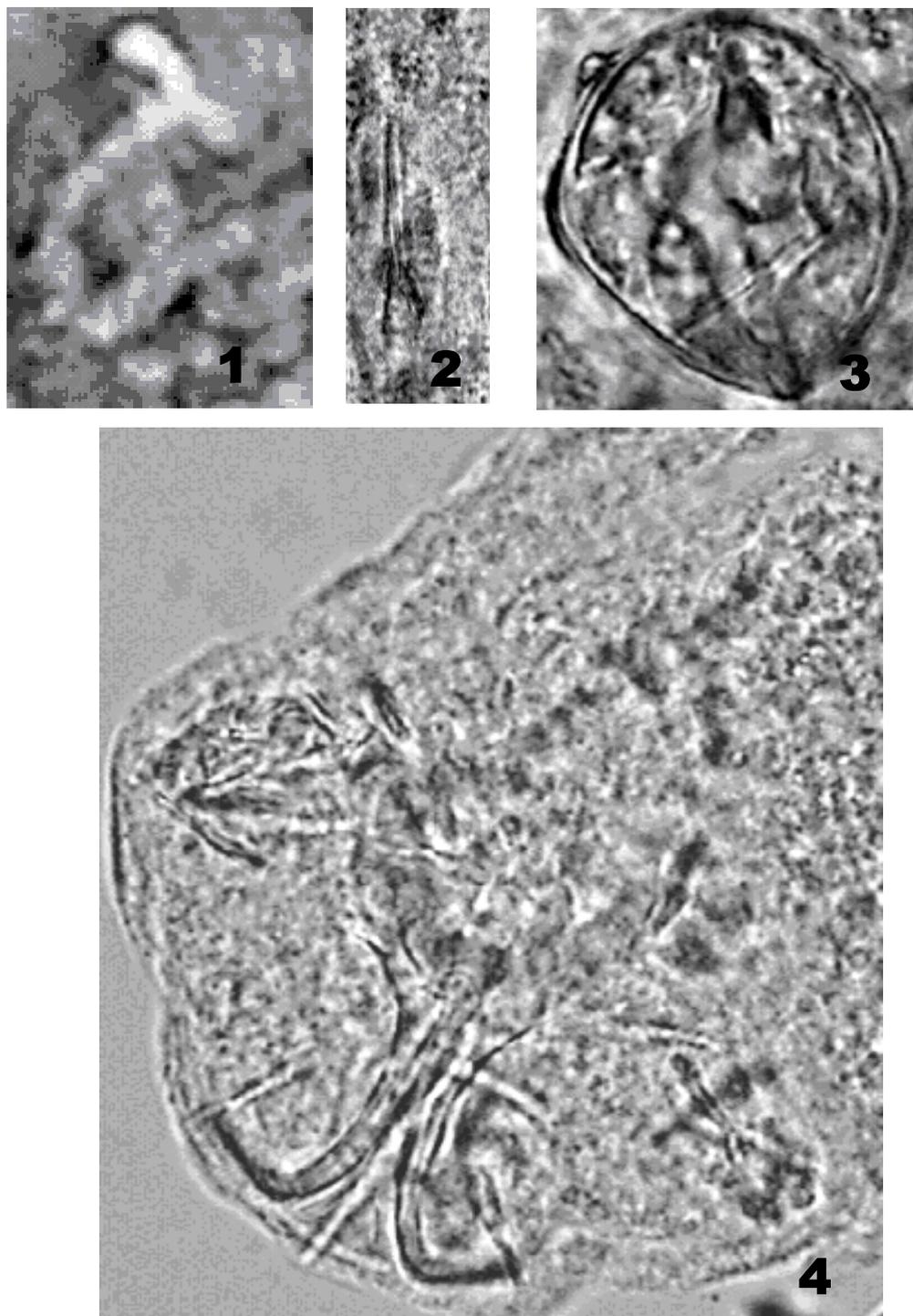
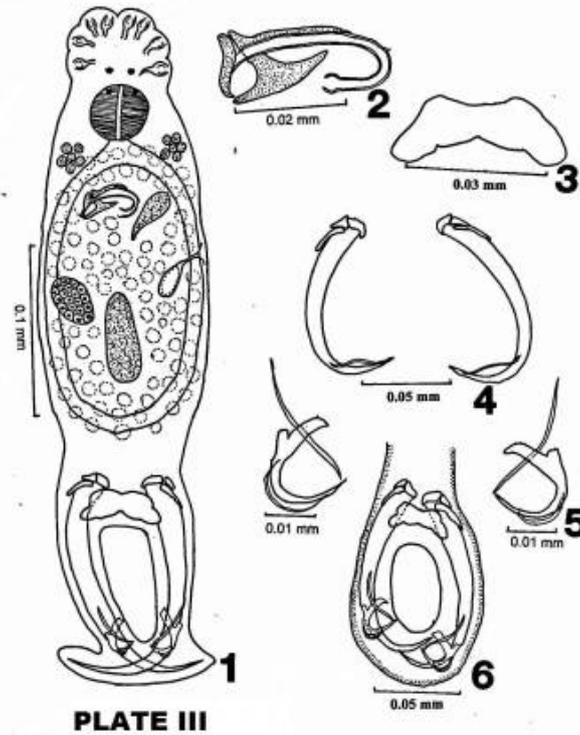


PLATE III: *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh, 1989
Figure 1: Whole Mount; Figure 2: Male Copulatory Complex;
Figure 3: Dorsal Transverse bar; Figure 4: Dorsal Anchors Enlarged;
Figure 5: Ventral Transverse Bar and Ventral Anchors; Figure 6: Haptor



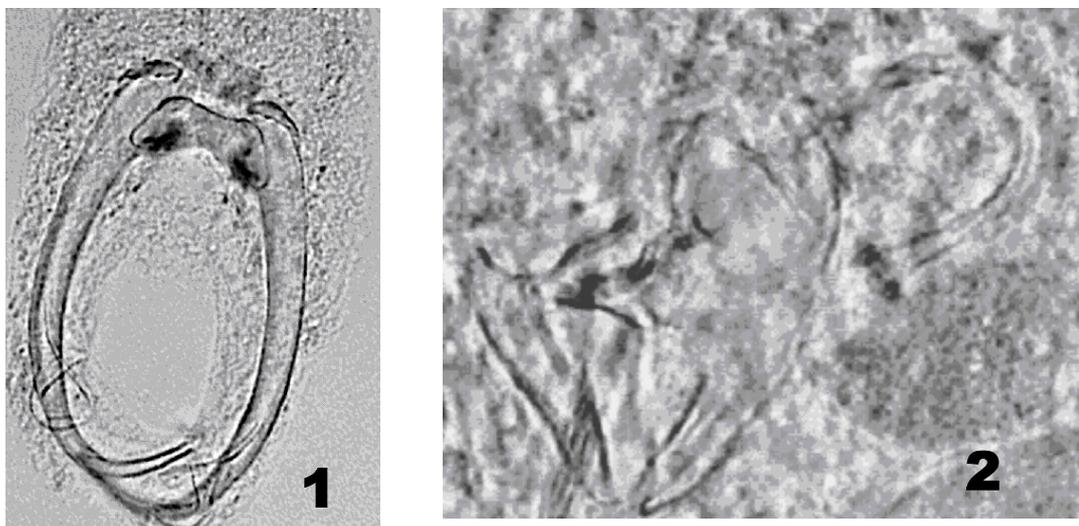
extending posteriorly. Eyespots are very well developed, located slightly anterior to pharynx. Pharynx is spherical, muscular, measuring 0.030-0.031 mm in diameter. On the postero-lateral sides of the pharynx, six pairs of darkly stained pharyngeal glands are present. Intestine simple, bifurcate and crura unite posteriorly.

Male reproductive system consists of a testis, seminal vesicle, and male copulatory complex. Testis simple, elongated oval, inter-caecal, equatorial, measuring 0.054-0.055 x 0.021-0.022 mm. Vas deferens is not visible due to great number of vitelline glands in this region. Seminal vesicle is balloon shaped, anterior to vagina, measuring 0.031-0.034 x 0.012-0.014 mm. Male

copulatory complex consists of tubular, double walled, chitinous, 'J' shaped cirrus proper, measuring 0.045-0.046 mm in length, and accessory piece. The accessory piece of the cirrus is made up of two pieces. Small piece is 'S' shaped, anterior end is pointed, posterior end is broad, measuring 0.010-0.012 mm in length. Second large piece is 'X' shaped, measuring 0.021-0.022 x 0.015-0.016 mm upper two ends face first piece.

Female reproductive system consists of an ovary, vagina, vitelline glands, and receptaculum seminis. The ovary is pre-equatorial, pre-testicular, oval in outline, measuring 0.031-0.032 x 0.019-0.020 mm. Vagina is dextral, funnel

**PLATE IV: *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh, 1989 Microphotograph
1. Haptor Microphotograph; 2. Male Copulatory Complex**



shaped, extends into tube, measuring 0.0093-0.0094 mm, anterior to ovary and communicates to a well developed receptaculum seminis. Receptaculum seminis is oval in outline, measuring 0.024-0.025 x 0.009-0.010 mm. Vitelline follicles are co-extensive with intestinal caeca.

Haptor is discoidal to rectangular in shape, measuring 0.121-0.123 x 0.071-0.075 mm. Armature of haptor consists of a pair of dorsal anchor, a pair of ventral anchor, a dorsal transverse bar and two ventral transverse bar. Each dorsal anchor is provided with rounded base, strong shaft, and re-curved points, measuring 0.091-0.093 mm. Base has base caps made of three pieces. Sleeve sclerite are present in point region. Each ventral anchor is provided with bifid base, strong shaft, and re-curved points, measuring 0.018-0.019 mm. Inner roots are more developed than outer roots, sleeve sclerite are present in shaft region. Dorsal transverse bar is strong, well developed, with one groove in anterior

part and one middle and two side notches in posterior part, measuring 0.035-0.037 x 0.015-0.016 mm. Ventral transverse bar is feebly developed, present with each ventral anchor. Each transverse bar is slightly curved, measuring 0.028-0.029 mm in length. Marginal hooklets are not visible; probably they are shed off during processing.

Jain (1958) established the genus *Bifurcohaptor* with *B. indicus* as type species for the worms collected from *Mystus vittatus* at Lucknow. Subsequently, Pandey and Singh (1989) made a review of the genus and found that 14 different body characters have been used by workers for the taxonomic purposes:

1. Body Size
2. Ratio of body and haptor
3. Number and pattern of head organs
4. Presence or absence of cephalic glands
5. Shape of testis

- | | |
|--|---|
| 6. Shape of seminal vesicle
7. shape of male copulatory complex
8. Shape of ovary
9. Shape of receptaculum seminis
10. shape of vagina
11. Shape of egg (presence or absence of polar filament) | 12. Ratio of dorsal and ventral anchors
13. Presence or absence of wings on anchors and
14. Presence or absence of marginal hooklets. |
|--|---|

Pandey and Singh (1989) further pointed out that the above-mentioned so called characteristic features are variable which is also reflected during the present observation. The important variations noted during the present study are

Table 1: Showing Difference in Measurement Between Various Body Parts of *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh, 1989 and Present Worm (All Measurements are in mm)

	<i>B. indicus</i> (Jain, 1958) Pandey and Singh, 1989	Present Worm
Host	<i>Mystus vittatus</i> , <i>M. seenghala</i> , <i>M. tengra</i> , <i>M. keletius</i> , <i>Bagarius bagarius</i> , <i>Rita rita</i> and <i>Channa striatus</i>	<i>Mystus vittatus</i> (Bloch)
Locality	Gorakhpur, Varanasi, Dehri-on-son, Kanpur, Mathura, Hyderabad, Colombo	Saharanpur
Body length	0.4-2.5	0.381-0.389
Body width	0.15-0.51	0.095-0.099
Pharynx	0.03-0.04 x 0.023-0.033	0.030-0.031 (diameter)
Testis	0.05-0.08 x 0.022-0.043	0.054-0.055 x 0.021-0.022
Seminal vesicle	0.021-0.033 x 0.011-0.021	0.031-0.034 x 0.012-0.014
Cirrus	0.09-0.18	0.045-0.046
A. C. piece of cirrus	Large- 0.03-0.07 x 0.01-0.03 Second- 0.015-0.032 x 0.005-0.011 Third-0.011-0.021 x 0.003-0.005	Large- 0.021-0.022 x 0.015-0.016 Second- 0.010-0.012
Ovary	0.018-0.022 x 0.021-0.032	0.031-0.032x 0.019-0.020
Receptaculum seminis	0.015-0.031 x 0.015-0.021	0.024-0.025 x 0.009-0.010
Haptor length	0.21-0.92	0.121-0.123
Haptor width	0.15-0.72	0.071-0.075
Dorsal anchor length	0.24-0.31	0.091-0.093
Dorsal transverse bar	0.025-0.061 x 0.018-0.041	0.035-0.037 x 0.015-0.016
Ventral transverse bar	0.06-0.43	0.028-0.029
Marginal hooklet	0.055-0.061	–

Pandey and Singh (1989) reported two to seven pairs of head organs but in present specimens four pairs of head organs are present. Pandey and Singh (1989) also reported similar organization of digestive system. Pandey and Singh (1989) reported similar organization of testis except post equatorial position, which might be due to difference in degree of maturity. Pandey and Singh (1989) reported similar shape of cirrus proper. The shape of accessory piece of cirrus is different and it is irregular plate like structure in the specimens at the disposal of Pandey and Singh (1989). Pandey and Singh (1989) reported more or less similar organization of female reproductive system; ovary and receptaculum seminis are located altogether. Pandey and Singh (1989) observed similar anchors. Pandey and Singh (1989) reported similar transverse bar.

Besides this, variations were also recorded in measurements of various body parts, which are given in the form of Table 1.

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 study I found few specimens of *Labeo rohita* (Ham.) infected with several specimens of genus *Paradactylogyrus* Thapar (1948) and four specimens of *Mystus vittatus* (Bloch) infected with several specimens of genus *Bifurcohaptor* Jain (1958). On detailed examination it was found that the specimens of genus *Paradactylogyrus* Thapar (1948), are new from the previously described species. They were characterized as *Paradactylogyrus gussevi* n.sp., on basis of number of head organs, difference in the shape

of onchium, transverse bar and difference in shape of anchors (inner roots are more developed).

Specimens of genus *Bifurcohaptor* Jain (1958), were close to *Bifurcohaptor indicus* (Jain, 1958) Pandey and Singh (1989). But specimens at the disposal of author exhibit several variations like Pandey and Singh (1989) reported two to seven pairs of head organs but in present specimens four pairs of head organs are present. The shape of accessory piece of cirrus is different. Besides this, other variations are in measurements. Therefore, it is re-described.

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REFERENCES

1. Agrawal N (1980), "On two dactylogyrid worms from major carps of district Lucknow", *Proc. Indian Acad. Parasitol.*, Vol. 1, pp 87-90.
2. Day F (1989), *The fauna of British India including Ceylon and Burma Fishes*, Vol. I & II, Today & Tomorrow's Printers and Publishers, New Delhi.
3. Gussev A V (1955), "Monogenetic trematodes of fishes of Amur River system", *Trudy Zool. Inst. A. N. USSR*, Vol. 19, pp. 171-398.
4. Gussev A V (1973), "Freshwater Indian Monogenoidea. Principles of systematics, analysis of world faunas and their evolution",

- Indian Journal of Helmin.*, Vol. 25 and 26, pp. 1-241.
5. Jain S L (1958), "Monogenea of Indian freshwater fishes VII. *Bifurcohaptor*, a new genus of freshwater Tetraonchinae from the gill filaments of two fishes from Lucknow", *J. Parasit*, Vol. 44, pp. 388-394.
 6. 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.
 7. Malmberg G (1957), "On the occurrence of Gyrodactylus on Swedish fishes", *Skec. Sod. Sevr. fish for Arsskr*, pp. 19-76.
 8. McInerney D and Gerard G (1958), *All about tropical fish*, George G. Harrap & Co. Ltd. London, Toronto, Wellington, Sydney, pp. 480.
 9. Misra K S (1959), "Fishes of Eastern Uttar Pradesh", *Rec. Indian Mus.*, Vol. 57, pp. 1-320.
 10. Mizelle J D (1936), "New species of trematodes from gills of Illinois fishes", *Amer. Midl. Nat.*, Vol. 17, pp. 785-806.
 11. Mizelle J D (1938), "Comparative studies on trematodes (Gyrodactyloidea) from gills of North American freshwater fishes", *Ill Biol. Mongr.*, Vol. 17, pp. 1-81.
 12. Nelson J S (1984), *Fishes of the World*, 2nd Edition, John Wiley and Sons, New York.
 13. Pandey KC and Singh H S (1989), "A review of the genus *Bifurcohaptor* Jain, 1958", *Indian J. Helminth.* (n.s.), Vol. 6, pp. 39-56
 14. Singh H S and Rastogi P (2000), "Status of *Paradactylogyrus* Thapar, 1948 (Dactylogyridae) with description of a new species from freshwater fish of Meerut", *Journal of Parasitic Diseases*, Vol. 24, No. 2, pp.151-154.
 15. Singh S N (1959), "On the direct application of the camera lucida in measuring worms", *Jour. Inst. Sci. &Tech. (Lond.) Proc.*, pp. 23-24.
 16. Srivastava G J (1968), *Fishes of Eastern Uttar Pradesh*, Vishwavidyala Prakashan, Varanashi
 17. Thapar G S (1948), "A new monogenetic trematode from the gills of an Indian fish, *Catla catla* from Lucknow", *Ind. Jour. Helminth.*, Vol. 1, pp. 1-10.
 18. Tripathi Y R (1959), " Monogenetic trematode from fishes of India", *Indian J. Helminth.*, Vol. 9, pp. 1-149.
 19. Yamaguti S (1963), *Systema helminthum IV*, Interscience Publication.



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Hyderabad, INDIA. Ph: +91-09441351700, 09059645577

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