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DESCRIPTION AND EXCRETORY SYSTEM OF *GYRODACTYLUS NEONEPHROTUS MALMBERGI* N.SP., FROM *HETEROPNEUSTES FOSSILIS* (BLOCH)

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Gyrodactylus neonephrotus malmbergi n.sp., a freshwater monogenean from skin of *Heteropneustes fossilis* (Bloch), at Meerut, is described and its excretory system is also discussed in detail. It differes from other described Indian Gyrodactyloidea in having alae at the base of anchor, wings at the shaft of anchor and shape of marginal hooklets.

INTRODUCTION

Four species of the genus *Gyrodactylus* Nordman, 1832 have been described from the Indian subcontinent *viz. G. elagnus indicus* Tripathi, 1959 from Barrackpore; *G. hyderabadensis* Venkatanarsaiah, 1979 from Hyderabad; *G. eutheraponsis* Venkatanarsaiah & Kulkarni, 1980 and *G. recurvensis* Rukmini & Madhavi, 1989 from Waltair. Besides these, Madhavi (1980) also recorded *Gyrodactylus* sp. from *A. pandrax* and *Oryzias melastigma*. Later, Rukmini & Madhavi (1989) nominated that also as *G. recurvensis*.

Another new form of the genus *Gyrodactylus*, found on the skin of *H. fossilis* at Meerut, is described in the present work. Excretory system of the parasite has also been studied and described in detail.

MATERIAL AND METHODS

Parasites were separated from the skin of fishes and kept in petridishes. They were fixed in hot 70% alcohol. Hard parts of worm were studied in temporary glycerine mounts. Permanent mounts were also made in canada balsam after staining with acetoalum carmine.

Excretory system of the parasite was studied in the live specimens. Rough scheme of the whole specimen was drawn and position of flame bulbs were located. Subsequently, the excretory ducts with all branches were also drawn. Many such schemes were worked out then finally an integrated composition of all the components of excretory system was made. All measurements are given in mm.

OBSERVATIONS

Host	:	*Heteropneustes fossilis* (Bloch)
Location	:	Skin
Geographical distribution	:	Meerut (U.P.), India
Number of specimens studied	:	More than 5,000
Holotypes and Paratypes	:	To be deposited in Z.S.I., Calcutta.

Body (Fig. 1) elongated measuring 0.938 - 1.105 in length and 0.0964 - 0.109 in width. Prosthaptor (Fig. 2), bilobed, provided with a pair of antero-lateral papillae and head organs in either lobe. Globular vesicle present in the head organs, each terminate in an extrusible anterior spine. Head

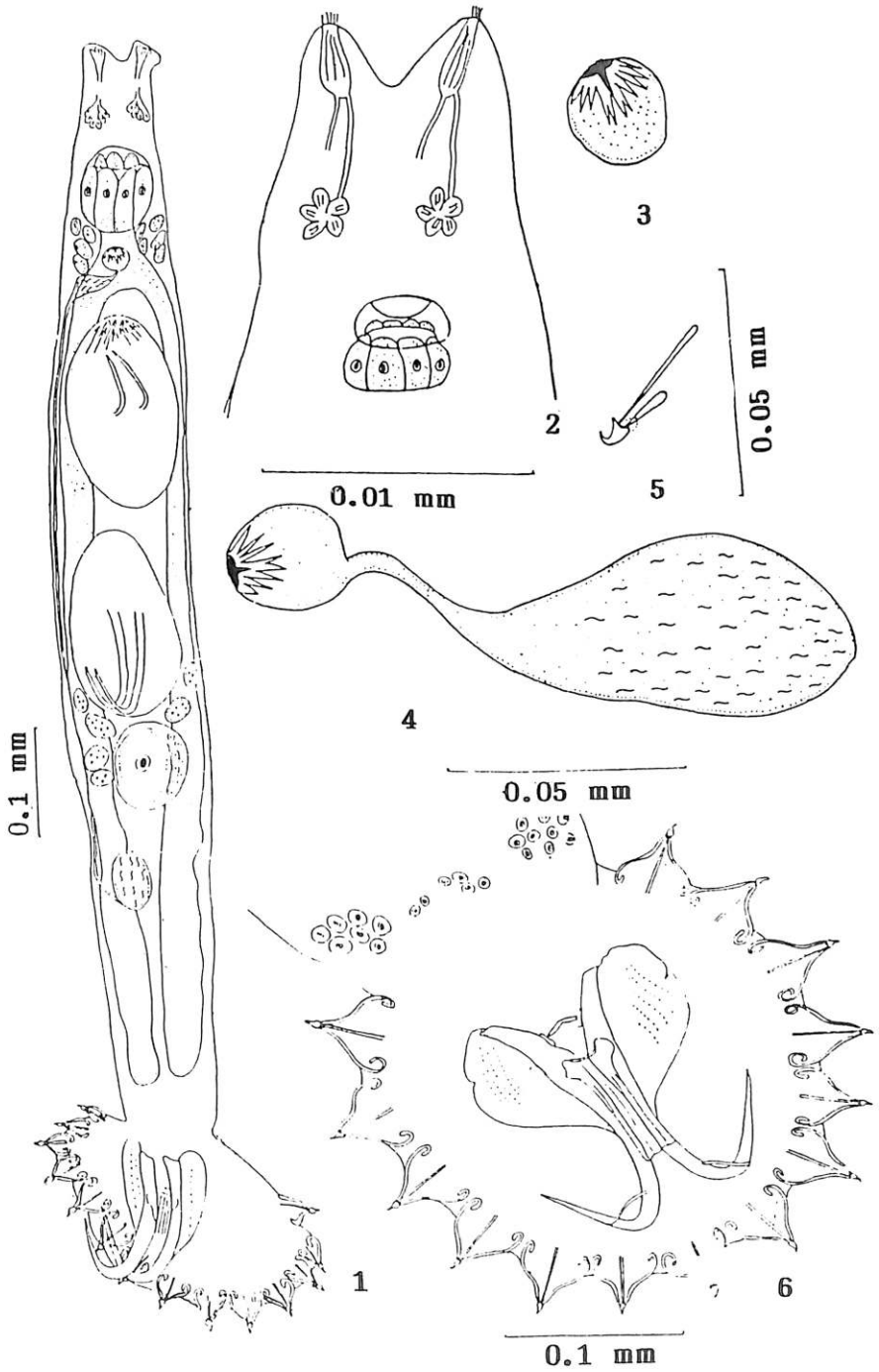
organs are further strengthened with two sets of cephalic glands, one set situated anterior to pharynx and leads at the base of head organ with the help of a fine duct, while the other set situated at the base of pharynx on either side of the oesophagus. Pharynx elongated, bipartite measuring 0.037 - 0.039 × 0.034 - 0.039. Prepharynx measures 0.021 – 0.024 × 0.033 – 0.035, while pharynx proper, broader than the prepharynx and measures 0.024 – 0.026 × 0.036 – 0.039. Pharynx is made up of 8 cells each having small pharyngeal process extending into the lumen of prepharynx. Oesophagus short measuring 0.033 - 0.029 in length. Intestinal crura simple, extending upto opisthaptor and crura terminate blindly.

Male reproductive system comprises testis, vas deferens, seminal vesicle and cirrus. Testis single, post-ovarian, post-equatorial, elongate oval and measures 0.049 - 0.051 × 0.022 - 0.025. From the posterior border of testis, arises a fine vas deferens, extend anteriorly in extracaecal field of the body and finally dialate to form seminal vesicle at the level of intestinal bifurcation. Seminal vesicle (Fig. 4) elongate, spindle shaped and measures 0.038 - 0.039 × 0.117 - 0.119 and open at the base of cirrus with the help of a small ejaculatory duct. Cirrus pouch (Fig. 3) small, round to oval measuring 0.022 - 0.024 in diameter. Armature of cirrus comparises a single row of 8 -10 small spines and a single large spine.

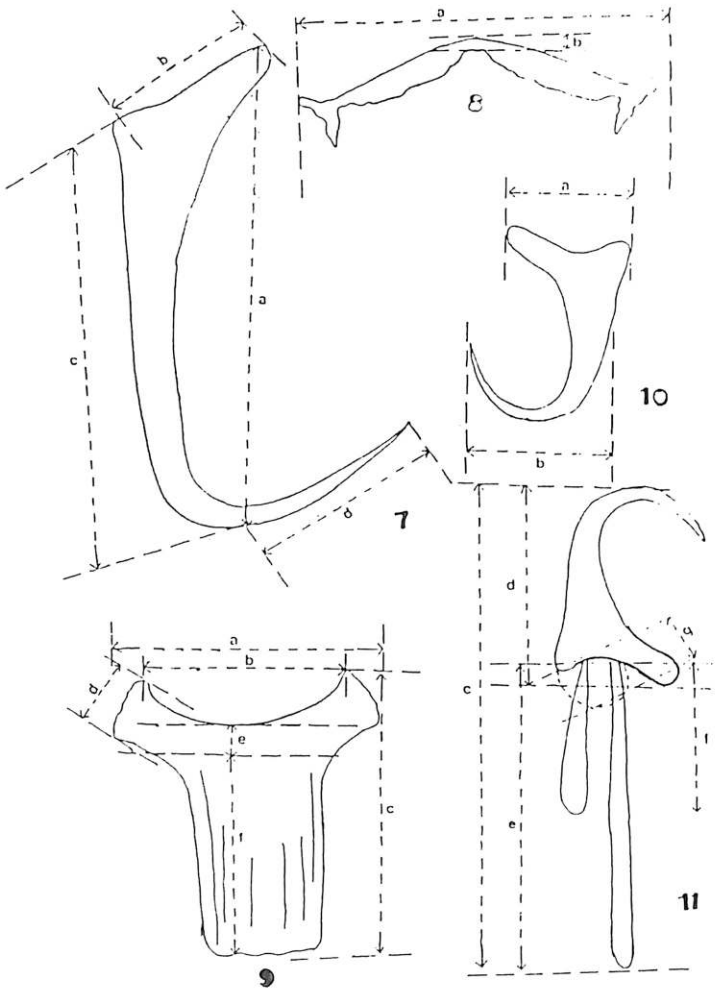
Female reproductive system, consists of an elongate-oval, pretesticular, post-equatorial, intercaecal germarium, having several developing ova and one large developed egg. Germarium measures 0.071 - 0.072 × 0.052 - 0.053, while the developed egg measures 0.065 - 0.066 × 0.042 - 0.043. Uterus, situated in the middle of the body and usually contains 1 - 3 embryo. Vitelline follicles, comprise several elongated follicles distributed irregularly in the region of germarium.

Haptor (Fig. 6) distinctly set off from the body proper and measures 0.275 - 0.279 × 0.302 - 0.305. Armature of haptor comprises a pair of anchor, a pair of transverse bar and seven pairs of marginal hooklets. Each anchor is moderately stout and comparises three main parts, root, shaft and the point. Roots are diverging, shaft, more or lesss straight and the point, deeply recurved and pointed. Anchors, are further strengthened with a small wing starting from inner border of shaft and attached to the anterior margin of anchor point and a broad alae at the base of the root. Details of measurement of anchor : total length 0.161 - 0.164, root length 0.008 - 0.009, shaft length 0.164 - 0.165 and length of anchor point 0.052 - 0.053. Dorsal transverse bar, provided with two attachments or terminal bullae, one on each anchor and with a median connective part, having a central notch measuring : total length 0.021 - 0.024, width 0.001 - 0.003. Ventral transverse bar stout and comprises three parts, a median portion (true bar), a posterior membranous process and two upwardly directed processes which fasten the bar with anchor. Median portion is more or less rectangular, attachment processes are upwardly directed and ventral bar membrane broad extend upto 2/3rd length of shaft and provided with longitudinal or vertical ridges. Details of measurements of ventral transverse bar : total length 0.020 - 0.022, distance between two processes of ventral bar 0.016 - 0.018, total width of ventral bar 0.080 - 0.082, length of processes of ventral bar 0.012 - 0.014, median width of ventral bar 0.007 - 0.009 and length of bar membrane 0.052 - 0.061.

Marginal hooklets (Fig. 5) composed of a sickle, a sickle membrane, a handle and a sickle filament loop. Sickle has proximal and distal parts. Proximal part of sickle has bifid roots. Handle is attached ventrally with the proximal part of sickle, sickle membrane encircles the inner and outer roots of proximal part of sickle. Sickle filament loop is a fine tendon like structure attached with the proximal part of sickle on its inner root. Articulating portion of handle, slender, straight and the other end is slightly swollen for providing site for the attachment of muscles. Details of measurements : total length 0.037 - 0.039; sickle length 0.009 - 0.011, handle length 0.028 - 0.029, length of sickle membrane 0.004 - 0.006, length of sickle filament loop 0.013 - 0.014, width of sickle (distally) 0.002 - 0.004 and width of sickle blade (proximally) 0.0038 - 0.0052.



Figs. 1-6. 1. *Gyrodactylus neonephrotus malmbergi* n.s.; 2. Anterior part enlarged; 3. Cirrus enlarged; 4. Cirrus with seminal vesicle enlarged (drawn from live specimen); 5. Marginal hooklet enlarged; 6. Haptor enlarged.



Figs. 7-11. Methods of measuring hard parts of haptor; **7.** Anchor (a). Total length, (b). Length of anchor root, (c). Length of shaft, (d). Length of point; **8.** Dorsal transverse bar (a). Total length, (b). Total width; **9.** Ventral transverse bar (a). Length of ventral transverse bar, (b). Maximum distance between two processes of the bar, (c). Total width, (d). Length of processes, (e). Median width of bar, (f). Length of ventral bar membrane; **10 & 11.** Marginal hooklet (a). Width of basal part of sickle, (b). Width of distal part of sickle, (c). Length of marginal hooklet, (d). Length of sickle, (e). Length of handle; (f). Length of sickle filament loop, (g). Length of sickle membrane.

Excretory system comprises (Figs. 12 & 13) flame bulbs, excretory bulb, secondary excretory canals, anterior and posterior excretory canal, main excretory canal, excretory bladder and excretory pore. Whole excretory system is divisible into anterior and posterior excretory systems.

Anterior excretory system (Fig. 14) comprises 3 flame bulbs each located at the level of head organ, pharynx and distal most part of uterus. All the three flame bulbs are connected with anterior secondary excretory canal with the help of anterior excretory duct. Anterior secondary excretory canal dialate to form anterior excretory canal which inturn joins the main excretory canal at about the equatorial region of the body.

Posterior excretory system (Fig. 15) is made up of five flame bulbs. Flame bulbs are located at the levels of male genital aperture, in equatorial region, at the level of distal most extremity of

intestinal crura, and two in the haptor on the either side of anchor. Each flame bulb is connected with posterior secondary excretory canal with the help of posterior excretory duct. Posterior secondary excretory canal of either side joins with each other at the level of distal part of intestinal crura, proceed back wardly, reach in the region of haptoral peduncle to form a reverse band and proceed anteriorly in extracaecal field of the body and joins with main excretory canal.

From the junction of excretory canals of anterior and posterior region, main excretory canal proceeds anteriorly on either side of the intestinal crura. After reaching at the level of intestinal bifurcation they dialate to form an elongate oval excretory bladder (Fig. 16) which open out through excretory pore on either lateral sides of the body. Opening of excretory canal is provided with sphinctor like structure which proves its pulsating nature.

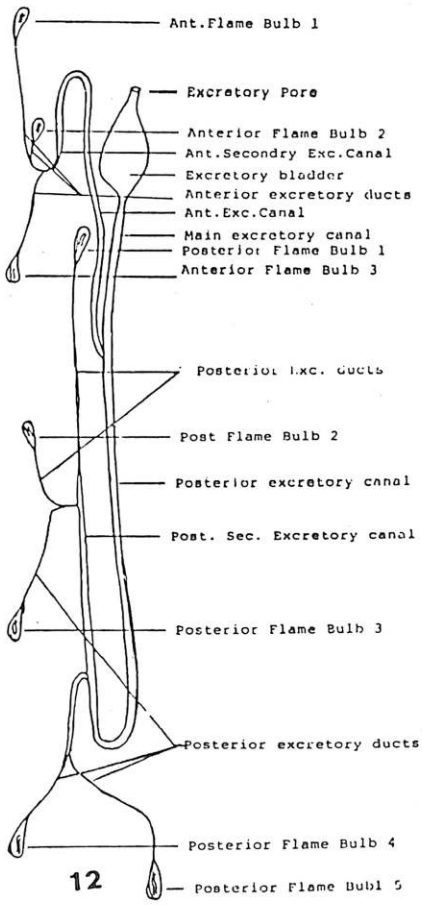


Fig. 12. Schematic representation of excretory system of *G. neonephrotus malmbergi* n.sp.

DISCUSSION

The chief taxonomic characters of *Gyrodactylus* Nordman, 1832 are morphological, with special reference to hard parts and excretory system (Sproston, 1946; Yin & Sproston, 1948; Hargis, 1955; Tripathi, 1959; Putz & Hoffman, 1963; Malmberg, 1957, 1964 & 1970). On the basis of morphological features like : the anchor roots points outwards (divergent), relatively short being only about a quarter of the whole length of anchor and the dorsal bar articulate near the tip, the present form belongs to *G. rarus* subspecies group of Wegner.

However, Malmberg (1957 & 1970) gave a detailed account of excretory system of the genus *Gyrodactylus*. He studied six different types of excretory system in this genus and further pointed out that the excretory system provides a good basis for the classification of genus *Gyrodactylus* to which we also agree.

Malmberg (1957) divided the genus *Gyrodactylus* into six subgenera *viz. Gyrodactylus* (*Gyrodactylus*), *Gyrodactylus* (*Mesonephrotus*); *Gyrodactylus* (*Metanephrotus*); *Gyrodactylus* (*Paranephrotus*); *Gyrodactylus* (*Neonephrotus*) and *Gyrodactylus* (*Limnonephrotus*).

Details of the various characters employed by him in this classification are as follows :

1. Number of flame bulbs

In *Gyrodactylus* (*Gyrodactylus*) 3 + 8 (Three in anterior region and 8 in posterior region).

In the remaining 5 subgenera it is 3 + 5 (Three in anterior and 5 in posterior region).

2. Presence or absence of lateral flame cells

In *Gyrodactylus* (*Gyrodactylus*) 3 + 5 (Three in anterior main canal and 5 in posterior main canal).

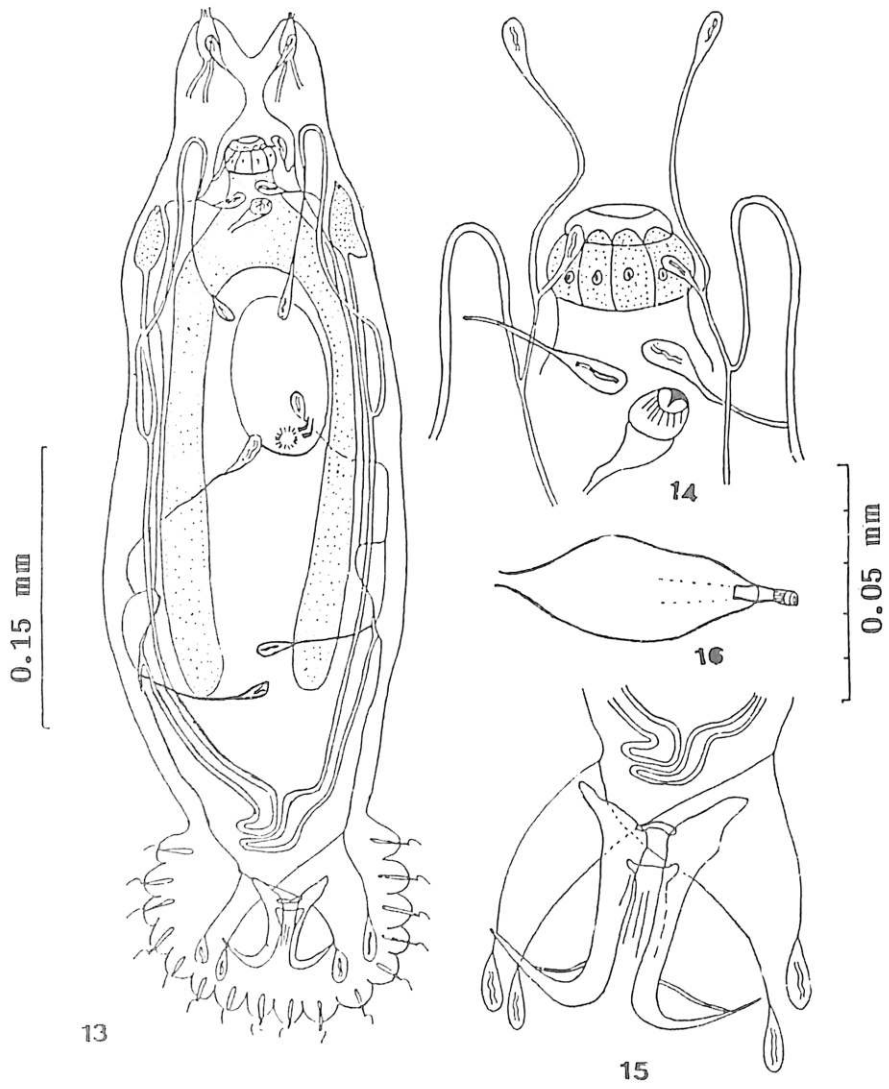


Fig. 13-16. Excretory system of *G. neonephrotus malmbergi* n. sp. (All drawn from live specimens). 13. Excretory system complete; 14. Enlarged anterior excretory system; 15. Enlarged posterior excretory system; 16. Enlarged excretory bladder.

In *G.* (*Mesonephrotus*) 3 + 4 (Three lateral flame bulbs present in anterior main canal and 5 in posterior main canal).

In *G.* (*Metanephrotus*) : Lateral flame bulbs are absent.

In *G.* (*Paranephrotus*) : Lateral flame bulbs are absent, if present. They are of rudimentary type.

In *G.* (*Neonephrotus*) : Lateral flame bulbs are absent and in *G.* (*Limnonephrotus*) : Lateral flame bulbs are also absent.

3. Presence or absence of excretory bladder

In *G.* (*Gyrodactylus*) and *G.* (*Limnonephrotus*) : Excretory bladder is absent. In remaining four subgenera excretory bladder is present.

4. Type of bladder

In *G.* (*Mesonephrotus*) and *G.* (*Metanephrotus*) : Bladder is small.

In *G.* (*Paranephrotus*) : Bladder is large.

In *G.* (*Neonephrotus*) : Bladder is elongated and of permanently pumping type.

Present form, on the basis of the above key, belongs to *Gyrodactylus neonephrotus*. Moreover, it differs from earlier known form of this subgenus, in having alae at the base of anchor root, wings at the shaft of anchor and shape of marginal hooklets. It is therefore, described as a new species *viz. G. neonephrotus malmberai* n.sp. named in honour of Prof. G. Malmberg, Zoological Institute, University of Sweden, for the valuable contribution made hy him in the study of this genus.

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