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On a new monogenetic trematode *Paramazocraes guptai n*. sp. from gills of fresh-water fish *Eutropichthyes vacha* of district Gonda, Uttar Pradesh, India

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Abstract
The fresh-water fish *Eutropichthyes vacha* (Ham.) was collected from local fish market of district Gonda (U.P.) and examined 16 specimens, of which only 3 specimens were found infected with 17 specimens of said species. The site of infection being the gill filaments of the host. The present form differs from all the known species i.e. *P. thrissocles, P. phasae, P. indica, P. pricei P. gorakhnathai, P. vinodae, P. kasiensis* and *P. nawabgangensis* except *P. kozikodiensis* in shape of oral sucker, presence of pharyngeal glands, arrangements of genital hooks and number of testes. Moreover, it differs from *P. kozikodiensis* in clamp skeleton, shape of ovary, number of testes and shape of anchor in lappet. On subsequent study, the present form appear to be a new species of the genus *Paramazocraes* Tripathi, 1959 and described as a new species and named *Paramazocraes guptai* n. sp. in the honor of Prof. N. K. Gupta, for valuable contribution in this field.

Keywords: fresh-water, monogenean ectoparasites, paramazocraes guptai, eutropichthyes vacha

Introduction

Monogenean occurs commonly as ectoparasites on the gills and skin of fishes and lower aquatic invertebrates. Monogenean undergo asexual mode of reproduction and multiply rapidly to form dense population on the gills of the host. The population structure of this monogenean, however, depends on a wide range of environmental factors; the relative importance of these factors varies from species to species and also within the same species depending on the host taxonomy and the nature of habitat (Chubb, 1977) [6]. Monogenean is a class of parasitic flatworms that are mainly ectoparasites of fishes but occasionally they are found as endoparasites (Gussev and Fernando, 1973) [11].

Monogenean constitutes a group, which play an important role as pathogens of severe diseases (Hoffman, 1979 and Srivastava, 1980) [13, 27]. This is because they affect those organs and tissues which are vital to the normal functioning such as gills and skin, the organs of respiration (Mishra, 2007, 2014a) [16, 18]. In majority of cases, monogenean cause dual type of injury to their hosts. Through their hooks and other organs of attachment, they break the continuity at the site of attachment and result is to localize hemorrhage (Mishra, 2008, 2014b) [17, 19]. Monogenean infestations cause irritation and excessive mucus production and create an opening for bacterial invasion (Dubey, et. al., 1990 and Mishra, 2020a) [7, 22]. A few monogeneans on a healthy mature fish are not usually significant; however, moderate numbers can cause significant mortalities (Pandey and Mehta, 1986) [25]. When fish are exposed to environmental or behavioural stressors, the potential damage from monogenean is greater. Prevention of monogenean infestations by appropriate quarantine is preferable to treatment of the parasites after they have become established in a system (Pandey, 1973 and Mishra, 2020b) [24, 23]. Monogeneans are the most ubiquitous and abundant group of helmith parasites in the aquatic environment. Monogeneans feed upon the blood and cells of ruptured tissues (Bychowsky, 1957; Gussev, 1974 and Mishra, 2015) [4, 12, 21]. Researchers have established that the volume of the blood sucked from the fish is quite appreciable and this leads to certain conditions like anemia and mortality (Lutta, 1941 and Mishra, 2014c) [15, 20].

The genus *Paramazocraes* (Tripathi, 1959) [28] has been recorded and described in detail from the gills of teleost fishes of super family Siluroidae. Several workers like Price (1961); Gupta and Khuller (1967) [8]; Gupta and Krishna (1975) [10]; Kumar and Agarwal (1978, 1981) [14], Agarwal and Kumar (1980, 1990) [1, 2], Agarwal and Singh (1985), Gupta and Masoodi (1985), Singh et. al. (1995); and Mishra (2014a) [18] has reported different species of this genus from different teleost as different name. During the study of fresh-water monogenean of district Gonda, we came across three specimen of *Eutropichthyes vacha*, infected with monogenean belonging to the genus *Paramazocraes* (Tripathi, 1959) [28]. On subsequent study, the present form appears new to us and described here in as such.

Material and Methods

The fishes for the present investigation were collected from fresh-water bodies and local fish market of district Balrampur, Uttar Pradesh, India. The monogenean were collected by Mizelle`s freezing techniques. They were kept in refrigerator for 8 to 48 hours. The low temperature not only relaxes the worm but also help in automatic removal of mucus in which there flukes were entangled. Subsequently, the gills were removed, placed in separate tubes, half filled with water and shake vigorously. This solution now poured in clean petri-dish diluted with water and examined under binocular microscope. The worms thus collected were washed and fixed in hot 70% ethyl alcohol or 10% neutral formalin. Study of chitinoid hard parts were made in either temporary (glycerin) or permanent preparations. Permanent preparations were made after dehydrating through ascending grades of alcohol, clearing in xylene and mounting in Canada balsam. Camera Lucida sketches were made from permanent preparations within a week since the stain fades away in ten days.

Generic Diagnosis

Body elongate, tapering towards both ends. Haptor with four pairs of unequal, pedunculate clamps and a long digitiform terminal lappet bearing three pairs of anchors. Clamps mazocraeid in structure with perforated middle piece. Oesophagus long bifurcating posterior to vagina, caeca terminating separately in haptor. Testes not numerous, post-ovarian, inter-caecal. Vas deferens long and straight, wider distally. Genital atrium muscular with 5 pairs of hooks of three different types, a lateral pair consisting of long, sickle shaped hooks, each borne on muscular pad, other two pairs inner hooks in two separate groups, of which the anterior two set on a separate pad lie between two lateral hooks, and the remaining two palmate at distal end are set on a semicircular pad, two on each side behind the anterior inner ones in the type species. Vitellaria extending from behind vagina to caecal ends.

Description

The body is elongated, tapering both anteriorly and posteriorly, measuring 1.51 - 1.56 * 0.12 - 0.13 mm. Head is equipped with a pair of muscular, buccal suckers, semicircular in shape, fused at the center, each measuring 0.026 - 0.027 * 0.023 - 0.024 mm. Anteriorly and laterally it is surrounded by a large number of darkly stained cephalic glands. The pharynx is oval, muscular and measures 0.045 - 0.050 * 0.035 - 0.040 mm. The oesophagus and intestine is not visible in the specimens as this region is occupied by vitelline follicles. The testes are equatorial, post-ovarian and 28-36 in number. They are round to oval and their diameter ranges from 0.012 - 0.030 mm. The genital atrium is rounded, muscular and localized pre-equatorial, slightly behind the pharynx. The size of atrium ranges from 0.050 - 0.051 mm. in diameter. In the genital atrium, there exist five pairs of hooks, upwardly directed with broad roots. The size of genital hooks ranges from 0.035 - 0.045 mm. On the either anterior side of the genital atrium darkly stained reproductive glands are present. The ovary is pre-equatorial, pre-testicular, elongated and measures 0.15 - 0.16 * 0.040 - 0.051 mm. The vitelline follicles are well developed scattered from behind the genital atrium up to haptor. The haptor is distinctly set off from the body. It measures 0.54 - 0.55 mm including lappet. It comprises four pairs of unequal pedunculate clamps. The proximal clamps are larger as compared to the distal. The clamps are typical mazocraes type. The clamps skeleton consists of six sclerites. The lappet is armed with two pairs of circular anchor and a pair of hook. The outer pair of anchor is stout, robustus type with powerful roots and smooth transition of shaft in to point. The inner anchors are small juvenile type with slightly recurved point and with root. The hooks are straight, dactylogyrus type. The details of measurements are: Clamps: Diameter of proximal clamp is 0.11 - 0.12 mm. and the diameter of distal clamp is 0.061 - 0.062 mm. Lappet: Length of Lappet is 0.11 - 0.12 mm. Outer Anchor: Total length of anchor is 0.034 - 0.035 mm, Length of anchor root is 0.007 - 0.008 mm, Length of anchor shaft is 0.026 - 0.027 mm and Length of anchor point is 0.006 - 0.007 mm. Inner Anchor: Total length of anchor is 0.009 - 0.011 mm, Length of anchor shaft is 0.12 - 0.13 mm and Length of anchor point is 0.002 - 0.003 mm. Hook: Length of hook is 0.005 - 0.006 mm.

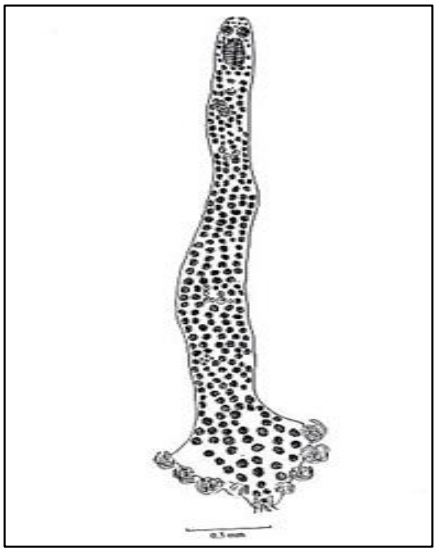

Fig 1

Discussion

The present form belongs to genus *Paramazocraes* Tripathi, 1959 [28]**.** To the best of my knowledge the known species of the genus are *Paramazocraes thrissocles* Tripathi, 1959 [28]; *Paramazocraes phasae* Tripathi, 1959 [28]; *Paramazocraes kozikodiensis* Gupta and Khuller, 1967 [8]; *Paramazocraes indica* Gupta and Krishna, 1975 [10]; *Paramazocraes pricei* Gupta and Krishna, 1979; *Paramazocraes gorakhnathai* Agarwal and Singh, 1985 [3]; *Paramazocraes vinodae* Gupta and Masoodi, 1985 [9] and *Paramazocraes kasiensis* Agarwal and Kumar, 1990 [2].

The present form differs from all the known species except *Paramazocraes kozikodiensis* in shape of oral sucker, presence of pharyngeal glands, arrangements of genital hooks and number of testes. Moreover it differs from *Paramazocraes kozikodiensis* in clamp skeleton, shape of ovary, number of testes and shape of anchor in lappet. The present form is therefore regarded as a new species and named *Paramazocraes guptai* in the honor of Prof. N. K. Gupta for valuable contribution in this field.

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