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**First Record of *Trichodina diaptomi* (Dogiel, 1940) Basson and Van As, 1991,
T. heterodontata Duncan, 1977 and *T. oligocotti* (Lom, 1970)
(Ciliophora: Trichodinidae) from Indian Fishes**

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Abstract: During a study on the species diversity of the trichodinid ciliates from September 1995 to December 1997, *Trichodina diaptomi*, *T. heterodontata* and *T. oligocotti* were recorded from some freshwater fish in the state of West Bengal, India. These three species were found for the first time in the Indian as well as in the south Asian region. Photomicrographs and morphometric data are presented for each species.

Key words: *Trichodina diaptomi*, *Trichodina heterodontata*, *Trichodina oligocotti*, India, Ciliophora, Trichodinidae

INTRODUCTION

In India the first report of any trichodinid ciliate was made by Annandale^[1]. Since then very scanty and infrequent information are available on the taxonomy of this particular group in this region. As a result, 22 species of trichodinid ciliates representing the genera *Trichodina*^[2] *Paratrachodina*^[3] *Tripartiella*^[4] and *Trichodinella*^[5] were identified from different freshwater and estuarine Indian fishes^[6-24]. The primary objectives of the present study were to identify the trichodinid ciliates inhabiting the freshwater and estuarine fishes and to study on the morphology and taxonomic status of these trichodinids. During this period, two widespread and well-known ciliate, *Trichodina heterodontata*^[25] and *Trichodina diaptomi*^[26,27], and a less common species, *Trichodina oligocotti*^[28] were identified from the gills of some freshwater fish.

MATERIALS AND METHODS

The host fishes were collected by fishing nets from different ponds and rivulets of the Ganges River systems in Kalyani of Nadia District and the Hooghly River systems in Triveni of Hooghly District in West Bengal from September 1995 to December 1997. Gill scrapings were made at the collection site. Air-dried gill scrapings were transported to the laboratory. The slides with trichodinid ciliates were impregnated with Klein's dry silver impregnation technique^[29]. Examinations of prepared slides were made under the Olympus Phase-contrast microscope at 10x100 magnification. For having

comprehensive morphological details of the ciliates numerous photomicrographs were made. Measurements were made according to the recommendations of Lom^[30], Wellborn^[31], Arthur and Lom^[32] and Van As and Basson^[33,34]. The level of infection was measured as low (1-5 ciliate/slide), medium (6-10 ciliate/slide) and high (more than 11 ciliates/slide).

RESULTS AND DISCUSSION

***Trichodina diaptomi* (Dogiel, 1940) Basson and Van As, 1991 (Fig. 1A):** Host. *Tetraodon cutcutia* (Hamilton-Buchanan, 1822; Tetraodontidae), *Gagata cenia* (Hamilton-Buchanan, 1822; Sisoridae). Locality. Kalyani of Nadia District, West Bengal, India. Location. Gills. Prevalence. ¹⁰/₅₉ (16.9%) in *T. cutcutia* and ⁰⁸/₁₁₇ (0.8%) in *G. cenia*. Infection. Low. Reference material. Slide TC 1-3 (*Tetraodon cutcutia* prepared on 06-09-1996) in the collection of the Protozoology Laboratory, Department of Zoology, University of Kalyani, Kalyani 741235, West Bengal, India.

Description (n=20)

Body	: Medium-sized trichodinid, cup-shaped, diameter 40.8-55.5 (50.1±3.8).
Border membrane	: 3.6-5.1 (4.3±0.4) wide, finely striated.
Adhesive disc	: Concave, 32.6-46.6 (41.4±4.0) in diameter.
Central area of adhesive disc	: 7.1-9.2 (8.0±0.7) in diameter.
Centre of adhesive disc	: granular with lightly stained central area, 5.1-12.1 (8.5±2.4) in diameter, sometimes with clear central area, 6.1-7.2 (6.4±0.5) in diameter.
Denticulate ring	: 18.3-26.5 (23.4±1.5) in diameter.
Number of denticles	: 18-25 (22.2±1.5).
Number of radial pins per denticle	: 7-10 (8.3±1.0).

Dimensions : span, 9.3-12.7 (11.3±1.1); length, 5.6-8.2
of denticle (6.4±0.7).
Dimensions of : Length of ray 3.1-5.2 (4.1±0.7), of blade 3.1-4.6
denticle components (3.9±0.5); width of central part 2.0-3.6 (3.2±0.3).
Adoral ciliary spiral : about 390°.

The variability in body dimension or in other morphometric of this species is not evident. However, variation to some extent could be seen in denticle morphology and the nature of central clear area. In some specimens, the lower part of the apex impregnates heavily, as a result the shape of blade appears as wide sickle (Fig. 1A). The thickness of the central part also varies considerably. In the specimens having more or less distinct clear area at the centre, the denticles possess wide triangular central part with more bluntly rounded point. In these cases, the ray bend towards y+1 axis, ending in fine point, whilst in other specimens having centre with diffused clear area and indistinct perimeter, the denticle consists of almost falciform blade, tubular central part with sharply rounded point and anteriorly slanted straight ray ending in rounded point.

Trichodina diaptomi is a trichodinid species associated with planktonic copepods enjoying a wide geographical distribution. The clear area at the centre of adhesive disc is not clearly defined in all individuals, even on the same microscope slide. Lom^[35] and Basson and Van As^[36] also pointed it out. Although Lom^[35] commented that the degree of clarity of the central clear area depends on the success of impregnation, the actual cause is still unknown. However, based on silver impregnated adhesive disc we have no doubt that the described trichodinid is the same as those presented by other authors occurring on calanoid copepods in various parts of the world. While discussing the fate of a trichodinid from *Metadiaptomus meridianus* in South Africa, Basson and Van As^[36] elaborately described the taxonomic status of trichodinids from planktonic copepods reported earlier by other authors^[35,26,37-40]. Basson and Van As^[36] believed that all the material so far described from calanoid copepods belong to the same species and suggested that this trichodinid should be evaluated to a separate species. They named it as *T. diaptomi*. In comprehensive surveys carried out in South Africa by Basson *et al.*^[41], Basson and Van As^[42,43], they did not yet encountered any specimens of trichodinids resembling *T. diaptomi* on piscine host. They have examined fish in various localities falling within the geographical range of *Metadiaptomus meridianus*. They concluded that piscine hosts do not provide a suitable substrate for *T. diaptomi* to establish a viable population. Lom^[35] also deduced the same after unsuccessfully trying to establish a viable transmission

of *T. domerguei* f. *latispina* from *Diaptomus vulgaris* from *Eudiaptomus gracilis* to crucian carps, *Carassius carassius* and vice versa. Lom^[35] reported the occurrence of *T. domerguei* f. *latispina* on the above mentioned calanoids and also on different species of fish as well as tadpoles. The morphometric data of these two populations presented by Lom^[35] showed considerable differences. Based on these differences Basson and Van As^[36] separated the two populations as two different species of trichodinids, as was the case with the two populations of *T. domerguei* f. *megamicronucleata* described by Dogiel^[26]. They have commented on this situation by saying that it was not unlikely that the trichodinid from calanoids observed by Lom^[35] was in fact a population of *T. diaptomi*, whilst the population from fish and tadpoles might well be *T. domerguei* f. *latispina*, which is a known fish ectoparasite. They have made same remarks in the case of Chen's^[38] *T. domerguei* f. *latispina* on fish, tadpoles and calanoids. By comparing the photomicrographs of the present materials with those of Basson and Van As^[36] it was evident that the described trichodinids collected from the gills of *Tetraodon cutcutia* and *Gagata cenia* from India belong to *T. diaptomi* and are of greater size and other morphometrics. During the present investigation, *T. diaptomi* was found to invade although irregularly and few in numbers, the gills of two freshwater fish, *T. cutcutia* and *G. cenia*. In *T. cutcutia*, the trichodinids were found in three consecutive months including two other months. But in *Gagata cenia*, their occurrence was recorded only from two months, i.e. July and August, 1996. It is not unlikely that this trichodinid infected more piscine host and forms viable population there. Hence, *T. diaptomi* is not host specific, at least in this region. Thus, the present finding records the distribution of *T. diaptomi* in a new part of the world as well as piscine host as suitable substrate.

***Trichodina heterodontata* Duncan, 1977:** Host. *Anabas testudineus* (Bloch, 1795; Anabantidae), Triveni of Hooghly District; *Puntius gelius* (Hamilton-Buchanan, 1822; Cyprinidae). Location. gills. Prevalence. $\frac{24}{194}$ (12.4), in *Anabas testudineus* and $\frac{9}{187}$ (4.8%) in *Puntius gelius*. Infection. low. Reference material. Slides AT 6-9 (*Anabas testudineus* prepared on 15/10/1996) in the collection of the Department of Zoology, University of Kalyani, Kalyani 741235, West Bengal, India.

Description (n=40):

Body : Medium-sized trichodinid, cup-shaped, 46.1-61.2 (54.6±3.3) in diameter.
Border membrane : 3.1-5.6 (4.5±0.6) wide, finely striated.
Adhesive disc : Concave, 41.8-52.0 (45.6±2.8) in diameter.

Centre of adhesive disc	: granular with lightly stained central area, 9.2-17.3 (13.5±2.1) in diameter.
Denticulate ring	: 26.0-33.6 (30.4±1.7) in diameter.
Number of denticles	: 21-26 (23.1±1.2):
Number of radial pins per denticle	: 9-13 (10.8±1.2):
Dimensions of denticle	: span, 13.7-17.9 (15.0±1.0); length, 7.6-9.2 (8.3±0.6).
Dimensions of denticle components	: Length of ray 5.9-8.2 (6.9±0.7), of blade 4.1-7.1 (5.3±0.6), width of central part 2.0-3.1 (2.8±0.4)
Adoral ciliary spiral	: about 395-400°

Trichodina heterodentata may be characterized by trichodinids in which the centre impregnates slightly less than the rest of the disc; denticle having strongly falcate blade with fine tangent and anterior blade apophysis, strong triangular central part with bluntly rounded point and thick, straight and pointed ray with distinct central groove (Fig. 1B and C). The intraspecific variability among the present populations of *T. heterodentata* from different hosts and locality are not remarkable.

T. heterodentata was originally described by Duncan^[25] based on materials collected from three separate cultured populations of host fish (*Oreochromis mossambicus*; *O. mossambicus* and *Tilapia zilli* and *Trichogaster trichopterus*) in the Philippines. The species has subsequently been reported from many countries^[5,41-48]. *T. heterodentata*, thus, present itself as a widely distributed and well adapted trichodinid

infesting as many as 37 species of fish hosts including *O. aureus* x *O. niloticus* hybrid. Kruger *et al.*^[49] reported this ciliate from the larvae of the African clawed toad, *Xenopus laevis* in southern Africa. Van As and Basson^[43] also commented on the origin of *T. heterodentata* and its possible transfer to different geographical areas through *O. mossambicus*. This host fish being indigenous to southeast Africa and they collected *T. heterodentata* from this region, Van As and Basson^[43] suggested that this parasite, although originally described from the Philippines by Duncan^[25], originated from southern Africa. They have substantiated their findings by collecting *T. heterodentata* from localities in southern Africa, such as the Limpopo River system, which have not been exposed to introductions of fish from outside Africa. The present finding records the distribution of *T. heterodentata* in a new part of the world as well as *Anabas testudineus* and *Puntius gelius* found to be new hosts.

***Trichodina oligocotti* (Lom, 1970):** Host. *Chanda nama* (Hamilton-Buchanan, 1822; Centropomidae). Locality. Triveni of Hooghly District. Location. Gills. Prevalence. $4/518$ (1.0%). Infection. Low. Reference material. Slide CN 1 (*Chanda nama* prepared on 12/12/1995) in the collection of the Protozoology

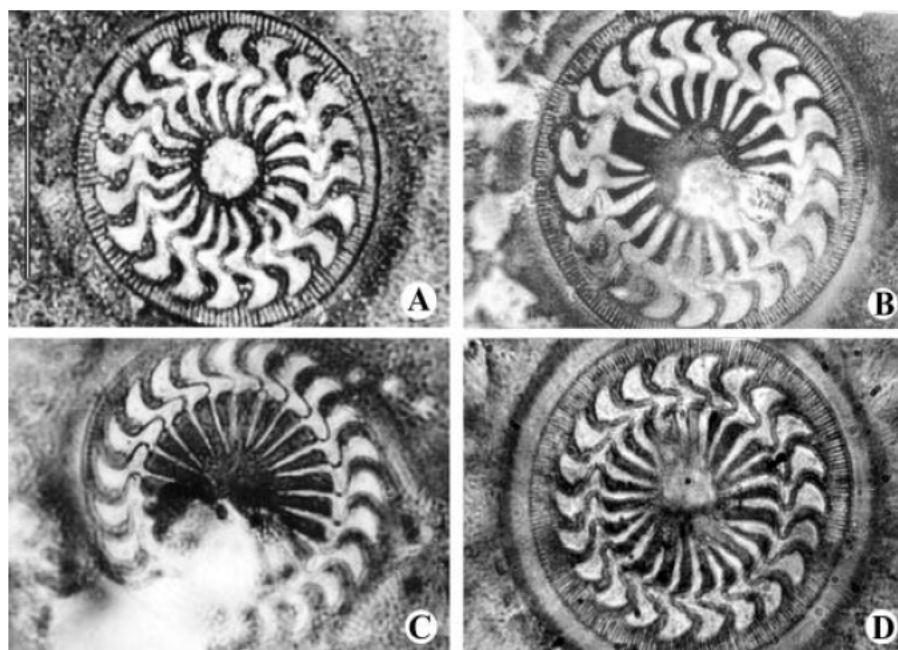


Fig. 1: Silver impregnated adhesive discs of trichodinids: A *Trichodin diaptomi*, B-C *T. heterdentata* and D *T. oligocotti* scale bar-30 μ m

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Description (n=11):

Body	:	Medium-sized trichodinid, cup-shaped, 48.0–58.1 (52.30±3.7) in diameter.
Border membrane	:	4.1–5.6 (4.8±0.5) wide, finely striated.
Adhesive disc	:	Concave, 36.7–46.9 (42.60±3.2) in diameter.
Centre of adhesive disc	:	granular and with uniformly dark stained central area, 7.2–12.2 (9.3±1.5) in diameter.
Denticulate ring	:	25.5–29.6 (27.0±1.6) in diameter.
Number of denticles	:	22–25 (23.1±1.04):
Number of radial pins per denticle	:	9–12 (11.0±1.00):
Dimensions of denticle	:	span, 13.8–17.4 (15.3±1.1); length, 7.2–9.2 (8.2±0.6).
Dimensions of denticle components	:	Length of ray 6.1–8.2 (7.1±0.5), of blade 3.6–6.1 (5.1±0.6), width of central part 2.8–3.6 (3.1±0.2)
Adoral ciliary spiral	:	could not be detected

While studying on the marine fishes of Pacific coast of Washington, USA, Lom^[28] described *Trichodina oligocotti* as a new subspecies of *Trichodina cottidarum*^[26] showing some significant deviation from *T. cottidarum* in the shape of denticles, such as short blade and straight gradually tapering rays. Despite all the differences, Lom^[28] supposed that *T. cottidarum* is a large species comprising many mutually different subunits, one of which is *T. cottidarum oligocotti*^[28]. But the distinct differences between *T. cottidarum* and *T. cottidarum oligocotti* led him to establish it as a new species, *Trichodina oligocotti*. The specimens obtained during the present study were identical with the species originally described from *Oligocottus maculosus* as *T. cottidarum oligocotti*^[28], but the body dimensions and measurements of other parts of the adhesive disc are larger. The only marked difference in the morphology of the adhesive disc of the present *T. oligocotti* was the occurrence of distinct blade apophysis, so the lower portion of the apex becomes notched (Fig. 1D). *T. oligocotti* was also reported by Stein^[50] from the basins of Pacific Ocean from *Veiaspes moseri*. But the morphology of its adhesive disc having broad and more rounded blade, blunt tangent point, narrow central part and blade connection, narrow ray of same width throughout and blunt point as well as the body dimension and measurements of other parts of the adhesive disc are significantly different from the presently described specimens. Based on the above differences, the species which Stein^[50] inserted as *T. oligocotti* would certainly be a separate species.

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