

Study on the Trichodinid Ectoparasites (Ciliophora: Trichodinidae) in *Cirrhinus reba* (Hamilton, 1822) Collected from the Kaptai Reservoir, Bangladesh

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Abstract

A study was conducted on *Cirrhinus reba* (Hamilton, 1822), family: Cyprinidae, collected from the Kaptai Reservoir to investigate ectoparasites. During this study, a novel record of an ecto-parasitic trichodinid ciliate (protozoan parasite) of the genus *Trichodina* (Ehrenberg, 1838) has been detected from the gills of *Cirrhinus reba* (Hamilton, 1822). Investigations were carried out between October 2021 and September 2022 at eight designated stations. A total of 108 host fish were examined, of which 17 individuals (15.74%) were found to be infected, indicating a low to moderate prevalence of infestation. Specimens were prepared using dry silver impregnation method, and the morphological and morphometric features of the adhesive disc and denticles were studied in detail. The denticle structure, including blade, ray, and central part, confirmed its identity with *Trichodina heterospina* originally described from *Sardinella fimbriata* in India. This study represents the first record of *T. heterospina* from *C. reba* in Bangladesh, extending the known host and geographical distribution of the species. These findings contribute valuable baseline data on the diversity of trichodinid ciliates in freshwater ecosystems of Bangladesh and highlight their potential significance in fish health and aquaculture management.

Key words: *Trichodina heterospina*, *Cirrhinus reba*, ectoparasite ciliate, Kaptai Reservoir, Bangladesh.

Introduction

The Kaptai reservoir, the largest freshwater impoundment in Bangladesh, was created in 1961 following the construction of a hydroelectric dam across the Karnaphuli River at Kaptai. Recognized as the largest man-made lake in Southeast Asia¹, it represents a major aquatic ecosystem of both ecological and economic importance. The earliest limnological and fisheries investigation in this reservoir documented 27 fish species². Subsequent studies recorded 55 native species, distributed among 7 orders and 23 families³, while later investigation identified a total of 80 fish species belonging to 11 orders and 28 families⁴. Historically, no intensive research has been conducted on trichodinid ciliates in the Kaptai Reservoir of Bangladesh.

Trichodinid ciliates are a group of protists which are renowned for its adaptive variability. They occur in both terrestrial and aquatic habitats, including freshwater, estuarine and marine environments. The current diversity of trichodinid ciliates is over 400 species⁵, most of which are associated with aquatic animals. Under conditions of heavy infection, these ciliates can act as the causative agent of trichodiniasis, a disease of considerable significance in aquaculture. The first report of trichodinid

in Bangladesh was made in 1997, when a new species of *Paratrichodina*⁶ was described from the gills of a bagrid fish, *Mystus vittatus*^{7,8}. Since then 67 species of trichodinids have been recorded from the Indo-Bangla subcontinent, of which 55 were described as new to science and remaining as new records for the region⁹.

Similar studies in the culture pools of Chongqing, China detected *Trichodina cyprinocola* from *Cyprinus carpio*¹⁰.

Trichodina heterospina was first described from the gills of the estuarine fish, *Sardinella fimbriata* collected from the Matla River of South 24 Parganas District of India⁹. During the present investigation, this species was recorded for the first time in Bangladesh from the gills of the host fish *Cirrhinus reba*¹¹ collected from the Kaptai Reservoir, Rangamati, Bangladesh. 17 individuals of *Trichodina heterospina* were identified from the gills of 108 host fish species.

Materials and Methods

Study Area

The study area was Kaptai Reservoir (Latitude: 22°20'–23°18'N, Longitude: 92°00'–92°26'E), Rangamati district of south eastern Bangladesh (Figure 1).

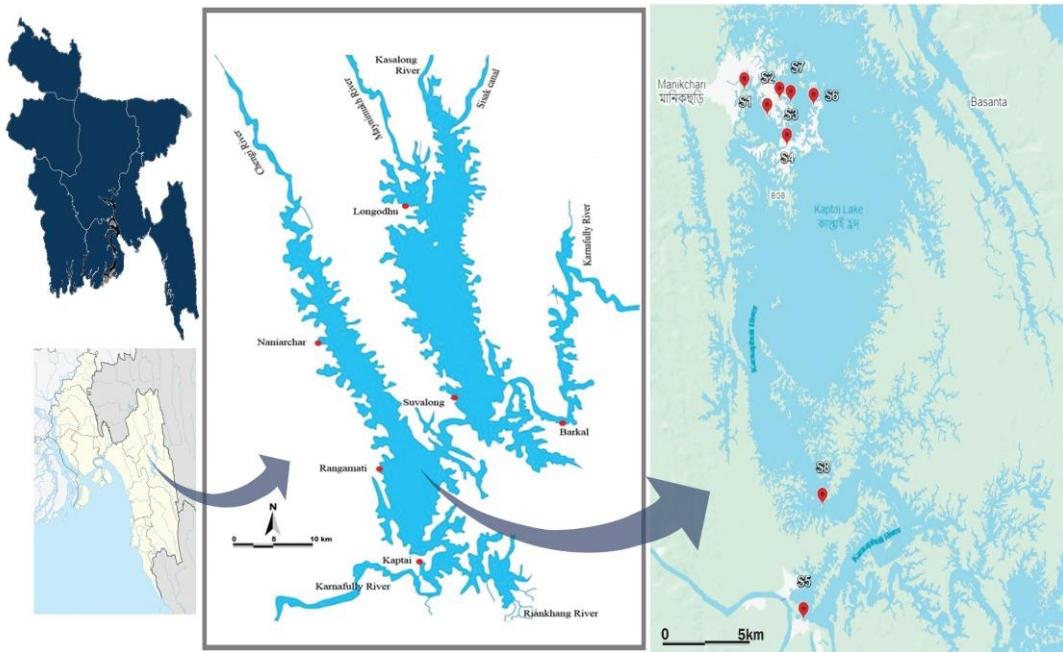


Figure 1. Geographical map of the Kaptai Reservoir, Bangladesh, indicating the locations of eight sampling stations (S₁-S₈) from which host fish specimens were collected.

Study Period

Monthly sampling was conducted from October 2021 to September 2022 at eight stations (S₁-S₈).

Specimen Collection and Identification

Host fish specimens were collected monthly from multiple locations within the Kaptai Reservoir, encompassing eight designated sampling stations (S₁-S₈). Identification of these host fishes were studied systematically¹².

Fresh Preparation

Gill smears were prepared at the sampling site. After exposing the gill chamber, a gill arch was removed and smeared on clean, dry microscope slides. The smears were air-dried for 3-5 minutes and examined under different magnifications to detect trichodinid ciliates. Precautions were taken to minimize water loss from tissues and avoid contamination.

Permanent Preparation

Microscopic preparation containing trichodinid ciliates were treated following the dry silver impregnation technique¹³ to visualize the structural features of the adhesive disc and denticles.

Mucous smears were stained with 2% AgNO₃ for 8-10 minutes, rinsed with distilled water, and irradiated under UV light (or direct sunlight) for 20-24 minutes. Permanent preparations were examined with a Leica ICC50E microscope using LAS X software.

Data analysis

Measurements were conducted following the standardized methodologies and taxonomic guidelines proposed by the authors^{14,15,16,17,18}. All measurements are expressed in micrometers (μm), with ranges provided in parentheses followed by the arithmetic mean and standard deviation. For statistical evaluation, morphometric data were obtained from 17 specimens. Detailed photomicrographs and morphometric assessments of the adhesive disc and denticles (Figure 2) were conducted to facilitate a comprehensive morphological characterization of the ciliates. The intensity of infection was classified into three categories based on parasite load: low (≤ 5 ciliates per slide), moderate (6 to 10 ciliates per slide), and high (> 11 ciliates per slide).

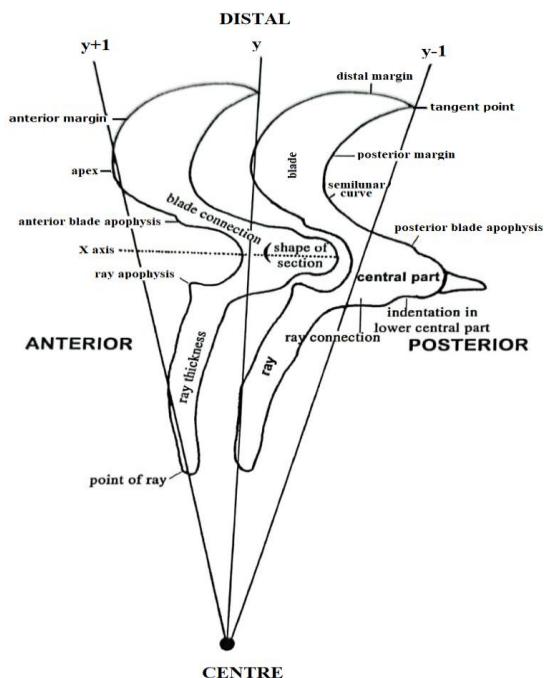


Figure 2. Schematic illustration of trichodinid denticle morphology showing the descriptive terminology (redrawn from¹⁶)

Results and Discussion

*Trichodina heterospina*⁹ (Figures 3-4; Table 1)

Host *Cirrhinus reba*¹¹

Locality Kaptai Reservoir, Rangamati, Bangladesh

Location Gills

Prevalence 15.74% (17/108)

Infection Low to moderate

Reference Material: Lectotypes, Slide CR1 and CR2 prepared on 09.09.2022 are in the collection of Halda River Research laboratory, University of Chittagong, Chattogram 4331, Bangladesh.

Description (n=17)

The size of trichodinids varies, ranging from 29.1-40.7 (31.9±3.4) in diameter. Adhesive disc: Moderately concave, 23.3-34.9 (26.1±3.4) across, bordered by a fine, striated membrane. Denticulate ring: 14.6-18.4 (16.6±1.2) in diameter. Centre of adhesive disc: Argentophobic particles in central area with oval shaped particles, 7.8-9.7 (8.3±0.6) in diameter. Border membrane: 2.6-2.9 (2.9±0.1) wide finely striated. Number of denticles: 18-21 (19.4±1.0). Number of radial pins per denticle: 6-8 (7.5±0.7). Span of denticle (long): 6.8-9.7 (8.2±0.8), Span of denticle (short): 5.8-7.8 (6.9±0.7), Length dimensions of denticle

components: Denticle: 3.8-3.9 (3.9 ± 0.0), Ray (long): 2.9-4.4 (3.3±0.6), Ray (short): 1.5-2.9 (2.1±0.5), Blade 2.8-2.9 (2.9±0.2); width of the central part 1.0-1.9 (1.7±0.3). The adoral ciliary spiral was not observed in the examined specimens (Table 1).

Denticle morphology

The denticle blade is broad, robust, and erect, occupying most of the area between the y-axes, with a slightly angular configuration. Its distal margin nearly reaches the broader membrane, appearing mostly flat and aligned parallel to it. The tangent is flattened, forming a linear edge rather than a sharp point, positioned just below the distal margin. The anterior margin is angular in relation to y+1 axis, creating a distinct apex at the base. The apex extends toward but does not contact the y+1 axis, while the apical depression is prominent and remains unimpregnated. No anterior blade apophysis is present. The blade connection is of similar thickness to the ray connection. The posterior margin exhibits an angular configuration, and forming a subtle crescent that aligns horizontally with the level of the apex, while a posterior blade apophysis is entirely absent. The central part of the denticle is broad and triangular, ending in a sharply rounded point that extends slightly beyond halfway to the

y-1 axis. There is no indentation in the lower central region. Above the x-axis, the central portion slopes gently backward, while the lower portion forms a distinct triangular structure. The ray connection is short and wide, lacking any apophysis. Rays alternate between long and

short forms: the long rays are strong, straight, and narrow at the base, expanding distally into an inflated, rounded tip. Short rays are often inconspicuous or difficult to distinguish. Each ray is slightly inclined anteriorly, with its tip reaching the y+1 axis (Figure 4)

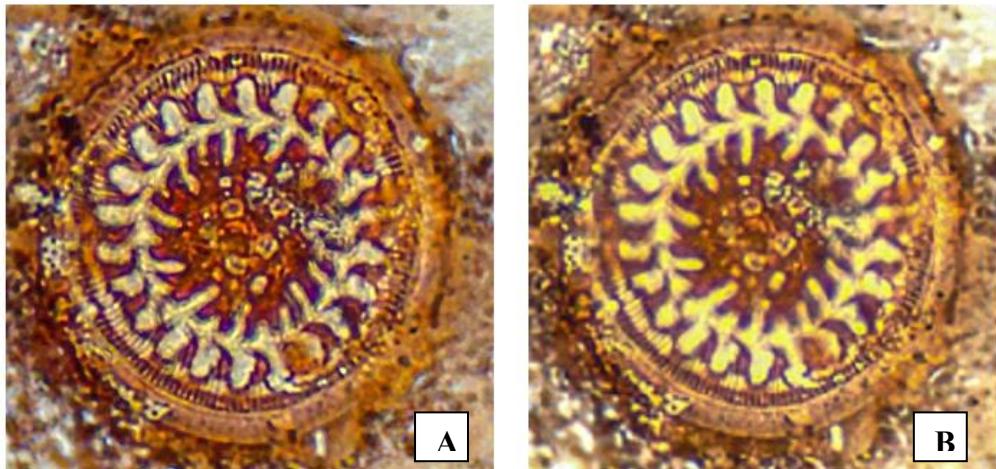


Figure 3A-B. Photomicrograph of silver impregnated adhesive discs of *Trichodina heterospina* from the gills of *Cirrhinus reba*. Scale bar = 31.1 μm (A); 31.7 μm (B).

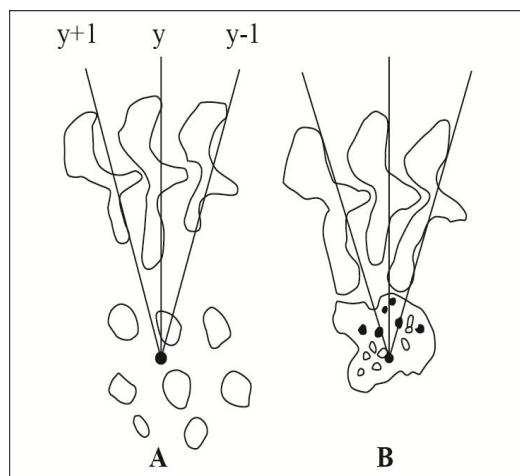


Figure 4 A-B. Structural diagram of the denticular ring of *Trichodina heterospina* from the gills of *Cirrhinus reba*, highlighting diagnostic features of the blade, ray, and central part.

Trichodina heterospina was first described from the gills of the estuarine fish, *Sardinella fimbriata* obtained from the Matla River in the South 24 Parganas District of India⁹. During the present investigation, this species was recorded for the first time in Bangladesh from the host fish species of *Cirrhinus reba* collected from the Kaptai Reservoir in the Rangamati district. The present *Trichodina* species can be distinguished from other congeners by its distinct morphological features, notably a

loosely arranged denticular ring composed of angular, erect blades with truncated or gently curved distal margins and flattened tangent points. The rays are robust and straight, exhibiting narrow proximal bases that expand distally into inflated, rounded termini, alternating with smaller, reduced rays. The central region of the adhesive disc is characterized by the presence of severe bright, marble-like or rod-shaped granules.

Cirrhinus reba is commercially important fish species in the region. Gill smears were prepared from 108 specimens of *C. reba*. The host fish, caught by using inland gill nets, revealed the presence of trichodinid ciliates. The present study recorded 17 out of 108 individuals (15.74%) of *C. reba* to be infected with *T. heterospina* (Table 1). Based on the available data,

members of the studied populations of *T. heterospina* are interpreted as belonging to the same species, although their host and localities are separated by up to 350 km (land distance from West Bengal to Kaptai Reservoir). *T. heterospina* exhibited low to moderate infection rate (15.74%) in *C. reba* as found in the present investigation.

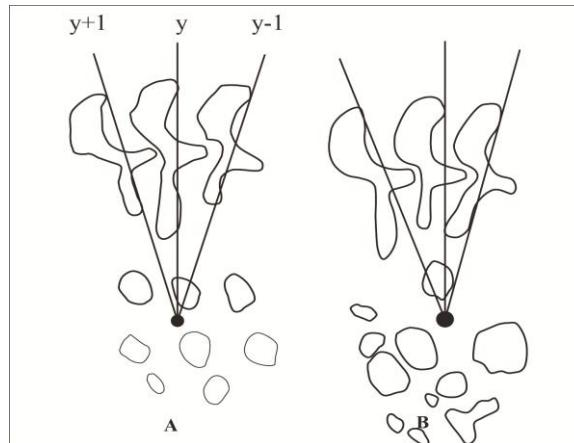


Figure 5A-B. Diagrammatic drawing of the denticles of *Trichodina heterospina* from the gills of (A) *Cirrhinus reba* (present study), (B) *Trichodina heterospina* from the gills of *Sardinella fimbriata*, (redrawn from⁹).

Table 1. Comparative morphometric and meristic analysis of *Trichodina heterospina* from Bangladesh and India.

Species	<i>Trichodina heterospina</i> n=40	<i>Trichodina heterospina</i> n=17
Host	<i>Sardinella fimbriata</i>	<i>Cirrhinus reba</i>
Locality	Matla River, India	Kaptai Reservoir, Bangladesh
Location	Gills	Gills
References	Asmat ⁹	Present study
Diameter of:		
body	31.6-39.9 (36.0 ± 2.1)	29.1-40.7 (31.9 ± 3.4)
adhesive disc	27.6-33.7 (30.7 ± 2.2)	23.3-34.9 (26.1 ± 3.4)
denticulate ring	13.6-22.1 (17.5 ± 2.8)	14.6-18.4 (16.6 ± 1.2)
central area	-	7.8-9.7 (8.3 ± 0.6)
Width of border membrane	3.4-5.1 (3.8 ± 0.6)	2.6-2.9 (2.9 ± 0.1)
Number of:		
denticles	19-24 (21.3 ± 1.6)	18-21 (19.4 ± 1.0)
radial pins/denticle	5-8 (6.3 ± 0.9)	6-8 (7.5 ± 0.7)
Span of denticle (long)	-	6.8-9.7 (8.2 ± 0.8)
Span of denticle (short)	-	5.8-7.8 (6.9 ± 0.7)
Length of dimension of:		
denticle	-	3.8-3.9 (3.9 ± 0.0)
ray (long)	3.1-4.6 (3.7 ± 0.7)	2.9-4.4 (3.3 ± 0.6)
ray (short)	0.5-2.0 (1.3 ± 0.5)	1.5-2.9 (2.1 ± 0.5)
Blade	3.4-5.1 (3.8 ± 0.5)	2.8-2.9 (2.9 ± 0.2)
Width of central part	1.7-2.6 (2.1 ± 0.5)	1.0-1.9 (1.7 ± 0.3)
Adoral ciliature	-	-

Conclusion

This study records *Trichodina heterospina* for the first time on the gills of *Cirrhinus reba* found in the Kaptai Reservoir, Bangladesh, thereby extending the known host and geographic range of the species. Morphological and morphometric analyses confirmed its identity with the original Indian description. The observed infection rate (15.74%) indicates a low to moderate prevalence in the host population. These findings provide important baseline data on trichodinid diversity in Bangladesh and highlight the need for continued parasitological and molecular studies to understand host-parasite interactions in freshwater ecosystems.

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