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OCCURRENCE OF *TRICHODINA AHMEDI* ASMAT, 2005 AND *TRICHODINA HETERODENTATA* DUNCAN, 1977 IN THE FRESHWATER MAJOR CARP *GIBELION CATLA* (HAMILTON, 1822) FROM HAKALUKI HAOR, BANGLADESH

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ABSTRACT: A systematic assessment of trichodinid ciliates of the genus *Trichodina* Ehrenberg, 1830, was conducted in Hakaluki Haor, Bangladesh. This survey reported two species, *Trichodina ahmedi* Asmat, 2005 (prevalence 7.8%) and *Trichodina heterodentata* Duncan, 1977 (prevalence 5.2%), from the gills of *Gibelion catla* (Hamilton, 1822). This provides the first evidence of these species in Hakaluki Haor, adding important insights into the diversity and geographical range of trichodinid parasites in Bangladesh. Detailed morphological features are provided using Klein's (1958) silver nitrate impregnation method, including photomicrographs. These records also afford new host and locality information for these ciliates.

Key words**:** *Trichodina ahmedi*, *Trichodina heterodentata*, Hakaluki Haor, Sylhet

INTRODUCTION

Trichodinid ciliates are protistan parasites that infect the external surfaces and gills of aquatic animals. Globally, more than 400 species have been identified, yet their study in Bangladesh, particularly in freshwater fishes, remains limited. Research on trichodinid ciliates in Bangladesh took a significant turn in 1997, marking the beginning of systematic investigations in the country (Asmat *et al.* 1997). Since then, researchers have documented 18 species that were new to science alongside 31 species that had been previously identified elsewhere. These ciliates belong to four recognized genera: *Paratrichodina* Lom, 1963; *Trichodina* Ehrenberg, 1830; *Tripartiella* Lom, 1959; and *Trichodinella* Lom, 1963. A wide range of publications has contributed to this growing body of knowledge (Asmat *et al.* 2003a–c, 2005, 2006, 2017; Asmat and Sultana, 2005; Bhouyain *et al.* 1999; Habib and Asmat, 2008; Habib *et al.* 2010a–b; Kibria *et al.* 2009, 2010, 2011a–b; Kibria and Asmat, 2019a–b; Haque *et al.* 2018a–c; Kabita *et al.* 2020). However, data from large freshwater ecosystems such as Hakaluki Haor remain scarce. The current study, conducted

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between April 2018 and March 2022, aimed to identify trichodinid parasites infecting the major carp *Gibelion catla* and to record their occurrence and distribution in Bangladesh.

MATERIAL AND METHODS

Samples of *Gibelion catla* were collected monthly from five sites within Hakaluki Haor: Malam Beel, Chatla Beel, Watch Tower, Dasher Bazar, and Kanungo Bazar. Sampling was carried out from April 2018 to March 2022 on a regular monthly schedule, except between March 2020 and February 2021 when fieldwork was suspended due to COVID-19 restrictions. Among the 77 fish examined, 6 were found infected with trichodinid ciliates. *Trichodina ahmedi* occurred in 6 fishes and *T. heterodentata* in 4 fishes. Four host fishes carried both species.

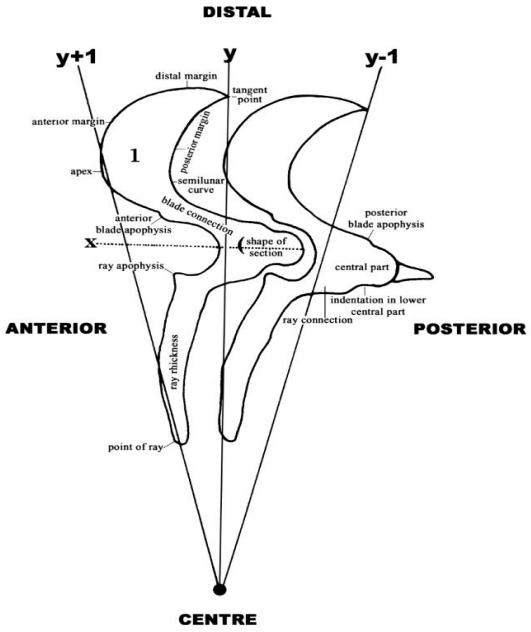


Fig. 1. Diagrammatic representation of trichodinid denticles illustrating the technique used for denticle description (redrawn from Van As and Basson, 1989).

Gill scrapings from these fish were air-dried, transported to the laboratory, Department of Zoology, University of Dhaka, and treated following the silver nitrate staining protocol established by Klein (1958) to enhance structural visibility. Observations and morphometric analyses were performed using an XSZ–107BN microscope at 1000× magnification. Measurements of the adhesive discs of the ciliates were taken in micrometres (µm) following the methodological guidelines outlined by Lom (1958) and further refined by Van As and Basson (1989, 1992). Photomicrographs for morphological analysis were taken using an

Omax 18.0 MP USB 3.0 digital microscope camera. Trichodinid ciliates were categorised based on body diameter into three groups: small (<35 µm), medium (35–60 µm), and large (>60 µm). Infestation intensity was determined by counting the number of ciliates present on each slide, classifying them as low (1–5 ciliates), moderate (6–10 ciliates), or high (more than 10 ciliates).

RESULTS AND DISCUSSION

Two ciliate species under the genus *Trichodina* Ehrenberg, 1830 were identified during this study. They were *Trichodina ahmedi* Asmat, 2005 and *Trichodina heterodentata* Duncan, 1977 obtained from the gills of a major carp of Hakaluki Haor, *Gibelion catla* (Hamilton, 1822).

Trichodina ahmedi Asmat, 2005

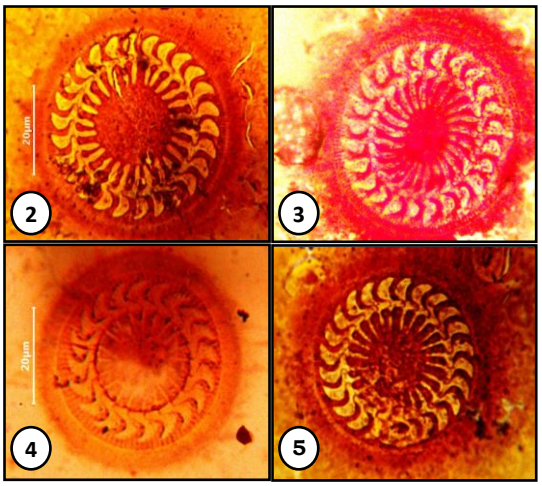
Host: G*ibelion catla* (Hamilton, 1822); Locality: Hakaluki Haor in Sylhet Division; Location: Gills: Prevalence: $^{6}/_{77}$ (7.8%); Infection: Low; Reference Materials: Lectotype Slide CC 2 (prepared on 15/02/2020).

Description (n=15): The observed trichodinid ciliate is medium-sized and cup-shaped, having a concave adhesive disc encircled by a delicately striated border membrane. The adhesive disc comprises 21 to 27 denticles, providing a characteristic feature for species identification. The central region of the adhesive disc looks granular with distinct staining, the central part of the denticle is clearly visible. The dorsal ciliary aperture exhibits about 400° turn, which is the unique morphological attributes of the genus *Trichodina*.

Denticle morphology: The blade of the denticle of this trichodinid ciliate is broad, moderately spaced, angular, and mostly sickle-shaped, occupying more than fifty percent of the space between the y-axes. In juvenile individuals, the blade exhibits a triangular shape. The blade's distal margin is not clearly identified from the anterior blade margin, which is situated near the border membrane. The anterior outer edge slopes downward, forming a strongly rounded or conical apex that reaches the y+1 axis (Fig. 6). In certain individuals, a well-developed apical depression is observed. The anterior apophysis of the blade is clearly visible and easily identifiable. The posterior border of the blade creates a shallow crescent shape, with the deepest region located at or near the apex. The tangent typically looks blunt, sometimes forming a short, linear shape instead of coming to a distinct point. The blade connection is robust and almost as thick as the ray connection. The central portion of the denticle is robust and broadly triangular, ending in a bluntly rounded tip that reaches approximately halfway towards the y−1 axis and securely interlocks with the preceding denticle. The central portion of the denticle shows a similar shape on both sides of the x-axis, although a noticeable indentation is present in the lower central

area in some specimens. The ray connection appears short yet distinct, and the ray apophysis can be clearly observed in certain individuals. The ray is robust and shaped like a dagger, having a slender base that expands into a broad middle portion featuring a prominent central groove. The tip of the ray is bluntly rounded and sharply defined, occasionally crossing the y+1 axis (Fig. 6). The ray points anteriorly with a gentle bend, highlighting a unique adaptation in its morphology.

Figs. 2–5. Photomicrographs of silver nitrate impregnated adhesive disc of trichodinids: 2–3



Trichodina ahmedi Asmat, 2005; 4–5 *Trichodina heterodentata* Duncan, 1977 from the gills of *Gibelion catla* (Hamilton, 1822) of Hakaluki Haor of Sylhet division. Scale bar: 20 µm. 1000× magnification.

Trichodina ahmedi was first identified by Asmat (2005) from the gills of *Chanda nama* in India. In the current investigation, in Bangladesh, *T. ahmedi* has been reported for the first time from the gills of *Gibelion catla* sampled from Hakaluki Haor. As a result, the known geographical distribution of this parasite now includes both India and Bangladesh, with no other locations reported yet.

This ciliate can be recognized by specific morphological features, such as an adhesive disc with a lightly stained, granular central area, sickle-shaped denticles with rounded, conical apices, a clearly defined central portion, and dagger-shaped rays marked by a prominent central groove running their full length. The tips of the rays are bluntly pointed, closely matching Asmat's original description. However, a notable difference was found during the present study, in Asmat's (2005) specimens, the rays appeared slightly longer than the blades (Fig. 7), while the specimens examined in the current research showed almost equal lengths for both the blade and ray. This difference in denticle size could be influenced by factors such as host species differences, geographic distribution, or natural morphological diversity within the species.

The finding of *T. ahmedi* from *Gibelion catla* represents a new host record. Among the 77 examined specimens of *G. catla*, six (7.8%) were infected with *T. ahmedi*, often in combination with other trichodinid ciliates. These infestations were found mainly during the winter season, reaching the peak prevalence at this time (Fig. 10). Despite the minor morphological variation observed, the present findings agree with Asmat's original description, thereby confirming the accurate identification of *T. ahmedi*.

Trichodina heterodentata Duncan, 1977

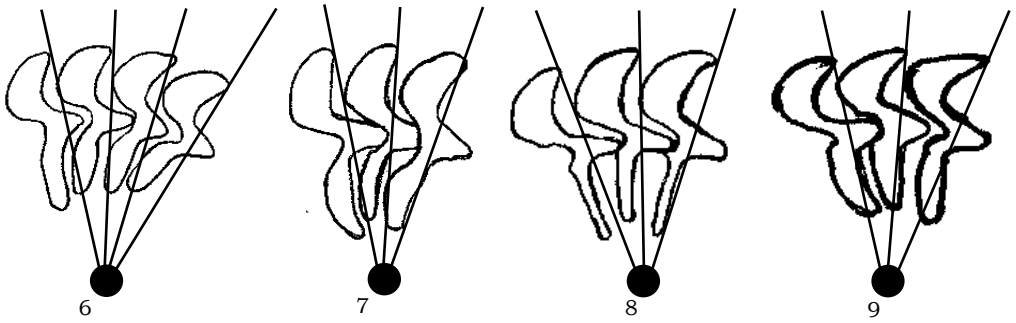
Host: *Gibelion catla* (Hamilton, 1822); Locality: Hakaluki Haor in Sylhet Division; Location: Gills; Prevalence: $^{4}/_{77}$ (5.2%); Parasitic infection: Low; Reference Materials: Lectotype Slide CC 2 (prepared on 15/02/2020).

Description (n=12): This trichodinid ciliate is characterised by its saucer-shaped, medium-sized body. The adhesive disc of the ciliate is concave in shape and surrounded by a border membrane, with fine striations, which contributes to its structural integrity. The texture of the central area of the adhesive disc closely matches the adjacent regions. The denticulate ring comprises 20–25 denticles (mean ± SD = 23.3 ± 1.8) and exhibits a falciform shape. The dorsal ciliary aperture completes an approximate rotation of 400°.

Denticle morphology: The blade of the denticle is wide and comparatively short, filling the entire region between the y+1 axis and frequently extending just beyond this boundary. The blade is falcate, with a strongly curved distal margin that tapers into a fine, sharp tangent point directed backward and remains below the distal margin. The anterior edge of the blade gently curves downward, creating a rounded apex containing a distinct apical depression, which remains unstained. A notch-like shape is formed at the lower border of the apex. The anterior blade apophysis is clearly visible, while the posterior blade apophysis is not distinctly noticeable. The posterior edge of the blade closely matches the curvature of its anterior edge, creating a deep, crescent-shaped curve whose deepest point aligns exactly with the apex. The blade connection looks strong and broader compared to the ray connection. The central part of the denticle is robust and moderately triangular, ending in a bluntly rounded tip that extends past the midpoint towards the y−1 axis (Fig. 8), firmly interlocking with the previous denticle. Above the x-axis, the central region slopes backward, taking a triangular form. An indentation in the lower central portion is not clearly visible. The ray connection is short, wide, and possesses an indistinct ray apophysis. The ray is longer than the blade, is robust and straight and features a thick base gradually tapering towards a sharp tip. The central groove is not distinctly evident.

Trichodina heterodentata was first identified by Duncan (1977) from three distinct host species: *Oreochromis mossambicus, Tilapia zillii,* and *Trichogaster*

trichopterus. Following its initial discovery, this parasite has been recorded from multiple regions around the globe. Notable locations include South Africa and Israel (Basson *et al.*, 1983; Van As and Basson, 1992; Basson and Van As, 1994), Taiwan (Van As and Basson, 1986), Venezuela (Van As and Basson, 1989), the Philippines (Natividad et al., 1986; Bondad-Reantaso and Arthur, 1989; Albaladejo and Arthur, 1989), Peninsular Malaysia (Shaharom-Harison, 1988), and even from tadpoles of the African clawed toad (*Xenopus laevis laevis*) in South Africa (Kruger *et al.,* 1993). Moreover, recent reports have indicated the presence of *T. heterodentata* on three gobiid species, *Neogobius fluviatilis, Proterorhinus marmoratus,* and *Pomatoschistus marmoratus* in the Lower Kızılırmak Delta of Samsun, Turkey, thereby expanding its known geographic distribution (Öztürk and Çam, 2013).



Figs. 6–9. Illustrative sketches depicting the denticle structures of *Trichodina* species: 6. *Trichodina ahmedi* from the gills of *Gibelion catla in the Hakaluki Haor, Sylhet Division; 7. T. ahmedi from gills of Chanda nama*, West Bengal, India (redrawn from Asmat, 2005); 8. *T. heterodentata* from the gills *Gibelion catla* in the Hakaluki Haor, Sylhet division and 9. *T. heterodentata* from *Tilapia mossambica* in the Philippines (redrawn from Duncan, 1977).

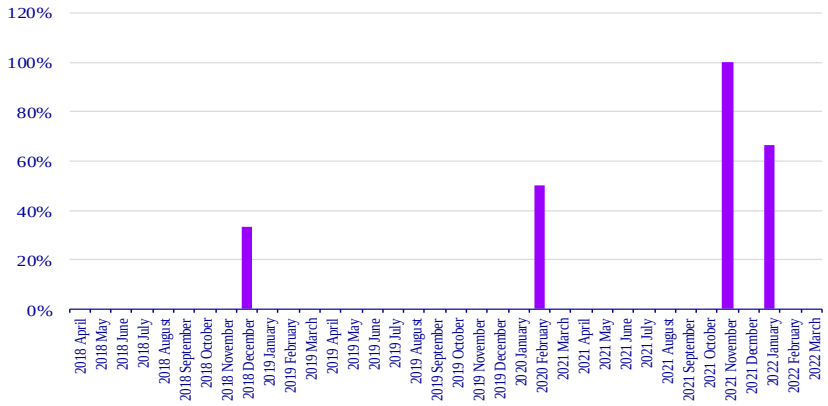


Fig. 10. Monthly prevalence of *Trichodina ahmedi* Asmat, 2005

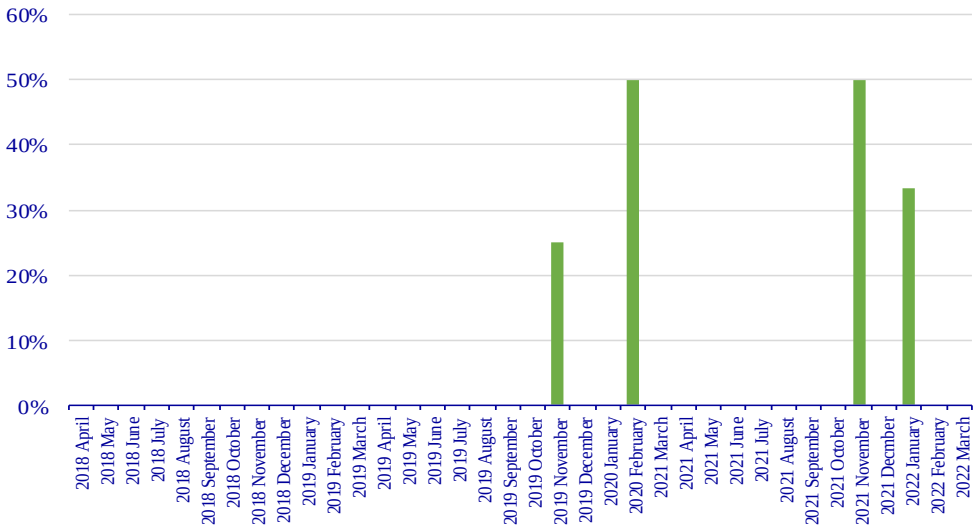


Fig. 11. Monthly prevalence of *Trichodina heterodentata* Duncan, 1977

Table 1: Morphometric comparison of *Trichodina ahmedi* Asmat, 2005 obtained in the present study with that of Asmat, 2005

Species		***Trichodina ahmedi* (n=20)**	***Trichodina ahmedi* (n=15)**
Host		*Chanda nama*	*Gibelion catla*
Locality		Kalyani, West Bengal, India	Hakaluki Haor, Sylhet, Bangladesh
Location		Gills	Gills
Reference(s)		Asmat (2005)	Present study
Diameter of	body	35.7–49.0 (42.8±3.3)	46.0–58.8 (52.0±3.1)
	adhesive disc	28.6–39.8 (33.4±3.5)	38.2–48.9 (43.5±2.8)
	denticulate ring	16.3–30.6 (21.8±3.5)	26.1–34.9 (30.4±2.2)
	central area	5.1–12.2 (8.8±2.2)	15.6–21.5 (18.3±1.5)
Width of border membrane		3.6–5.1 (4.1±0.4)	3.5–4.8 (4.3±0.4)
Number of	denticles	22–30 (25.2±1.6)	23–27 (25.1±1.2)
	radial pins/denticle	6–8 (7.1±0.7)	7–9 (8.0±0.6)
Span of denticle		-	11.3–14.2 (12.5±0.8)
Length of	denticle	4.1–7.2 (5.2±0.7)	5.7–7.0 (6.2±0.4)
	ray	4.1–5.6 (4.7±0.5)	4.2–5.5 (4.8±0.4)
	blade	3.1–5.1 (4.3±0.4)	4.8–6.1 (5.4±0.4)
Width of central part		2.0–3.1 (2.2±0.3)	1.4–3.0 (2.4±0.4)
Degree of adoral ciliature		400–405°	400°

The morphology of *T. heterodentata* exhibits several distinctive features. These include a center of adhesive disc that stains comparatively less intensely than its surroundings area. The blade is strong, sickle-shaped and ending in sharp tips with clearly visible anterior blade apophyses. The central part of the denticle is robust with a triangular shape and bluntly rounded ends and thick, straight rays characterized by prominent central grooves. Notably, despite being reported from diverse geographic regions and various host species, the morphological

characteristics of *T. heterodentata* remain highly consistent, reflecting its stable taxonomic identity across different ecological conditions. In the present study

Table 2: Morphometric comparison of *Trichodina heterodentata* Duncan, 1977 obtained in the present study with that of Duncan 1977

Species	***Trichodina heterodentata* (n=52)**	***Trichodina heterodentata* (n=25)**	***Trichodina heterodentata* (n=59)**	***Trichodina heterodentata* (n=12)**
Host	*Tilapia mossambica* (Population A)	*Tilapia zillii Tilapia mossambica* (Population B)	*Trichogaster trichopterus* (Population C)	*Gibelion catla*
Locality	Freshwater Aquaculture Center, Philippines	Freshwater Aquaculture Center, Philippines	Freshwater Aquaculture Center, Philippines	Hakaluki Haor, Sylhet, Bangladesh
Location	Body, fins	Gills, fins, and body	Body	Gills
Reference(s)	Duncan (1977)	Duncan (1977)	Duncan (1977)	Present study
Diameter of body	85 (71–106)	80 (58–108)	93 (70–122)	42.3–65.5 (49.9±6.3)
adhesive disc	56 (47–63)	57 (45–74)	67 (54–81)	34.1–54.0 (42.0±5.7)
denticulate ring	32 (26–37)	36 (29–45)	41 (30–52)	23.0–32.0 (26.3±2.8)
central area	-	-	-	9.0–15.0 (13.0±1.9)
Width of border membrane	2.7	4.7 (3.4–5.5)	4.1	3.0–5.5 (4.0±0.8)
Number of denticles	23 (20–27)	26 (20–31)	27 (18–31)	20–25 (23.3±1.8)
radial pins/denticle	11	10 (6–14)	11	5–9 (7.2±1.1)
Span of denticle	-	-	-	11.3–16.0 (13.3 ±1.4)
Length of denticle	8.0	9.2 (7.5–11)	6.3	5.5–7.5 (6.5±0.8)
ray	6.9	8.1 (6.9–10.3)	8.2	4.4–7.5 (6.2±1.0)
blade	4.1	5.7 (4.7–7.1)	5.5	4.5–6.0 (5.1±0.5)
Width of central part	3.4	2.6 (1.4–3.4)	4.1	1.5–3.0 (2.0±0.4)
Degree of adoral ciliature	400°	400°	400°	400°

at Hakaluki Haor, Sylhet Division, Bangladesh. 77 specimens of *Gibelion catla* were examined, with only four (5.2%) infested with *T. heterodentata*, alongside other trichodinids. Infestation occurred predominantly in winter, as depicted in Fig. 11. Thus, this study records *G. catla* as a new host for *T. heterodentata*, contributing insights into its host specificity and distribution.

CONCLUSION

This study represents new locality records for *Trichodina ahmedi* and *Trichodina heterodentata*. As well as understanding the trichodinid biodiversity and their host specificity in freshwater fishes of Bangladesh. Such research is essential for effective management and conservation of aquatic resources in Bangladesh.

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