

Trichodina shitalakshyae sp. n. and *Trichodina acuta* Lom, 1961 (Ciliophora: Trichodinidae) from the freshwater fishes in the Shitalakshya River, Bangladesh

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ABSTRACT. Two trichodinid species were identified from freshwater fishes, *Mystus bleekeri* and *Glossogobius giuris*, in the Shitalakshya River of Gazipur district, Bangladesh. *Trichodina acuta* Lom, 1961 is found for the first time in Bangladesh. *Trichodina shitalakshyae* sp. n. is characterized by having an undivided clear central area in the adhesive disc with a rounded or slightly undulated perimeter containing a few dark granules which form patches; elongated and rectangular blade with large interblade space and blunt tangent point; indistinct anterior blade apophysis and a shallow apex at the base of blade that never extends beyond the Y+1 axis; moderately wide and triangular central part with blunt point; and space between tip of ray and central clear area forms a wide impregnated ring. Based on these characters and the unique shape and absence of variability of the denticles among the silver impregnated specimens of the present species, it resembles *Trichodina porocephalusi* Asmat, 2001.

Key words: Ciliophora, Trichodinidae, *Trichodina acuta*, *Trichodina shitalakshyae* sp. n., fish, Bangladesh

Introduction

In Bangladesh, Asmat et al. [1] made the first report of trichodinid ciliates. Since then scanty and infrequent information are available on the taxonomy of this particular group in this region. As a result, 17 species of trichodinid ciliates representing the genera *Trichodina*, *Paratrichodina*, *Tripartiella* and *Trichodinella* were identified from different freshwater and estuarine fishes by Asmat et al. [1–6], Asmat and Sultana [7], Bhouyain et al. [8], Habib and Asmat [9] and Kibria et al. [10]. Two trichodinid ciliates, *Trichodina acuta* and *Trichodina shitalakshyae* sp. n., were identified from the gills of *Mystus bleekeri* (Day, 1877) and *Glossogobius giuris* (Hamilton, 1822), respectively. Material was collected during the period January 2008–December 2009 from the Shitalakshya River at the Kapasia Upazila of Gazipur district, Bangladesh (23°49'20.11"N 90°33'0.47"E) (Fig. 1).

Material and methods

The host fishes, *Mystus bleekeri* (Day, 1877) and *Glossogobius giuris* (Hamilton, 1822), were collected from the Shitalakshya River in the Kapasia Upazila of Gazipur district, by seine nets and gill nets. Gill scrapings were made at the pond side; air-dried and then were transported to the laboratory. The slides with trichodinid ciliates were impregnated with Klein dry silver impregnation technique [11] and examined under a research microscope, OSK 9712 T-2 at 10×100 magnifications. Measurements were made according to the recommendations of Lom [12], Wellborn [13], Arthur and Lom [14], and Van As and Basson [15,16]. All measurements are given in micrometers, range in parentheses by the arithmetic mean and standard deviation. For statistical analysis, morphometric measurements of 20 specimens for both species were considered. Photomicrographs were made in order to have

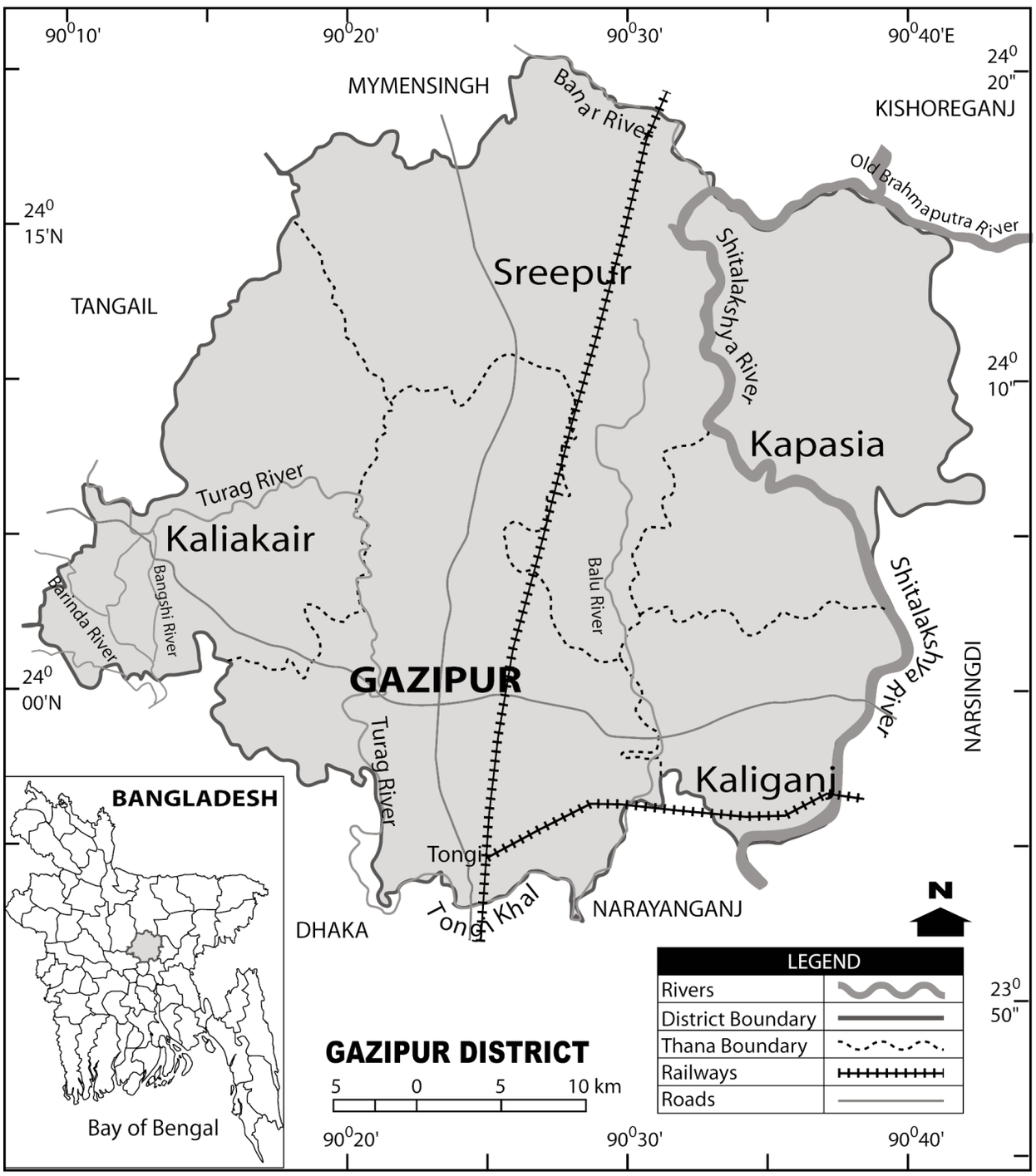


Fig. 1. Map of sampling locality where fishes were collected from the Shitalakshya River

comprehensive morphological analyses of the ciliates. The level of infection was measured as low (1–5 ciliate/slide), medium (6–10 ciliate/slide) and high (more than 11 ciliates/slide). The size of *Trichodina* is classified following Basson and Van As [17]. Detailed descriptions of the denticles are presented in accordance with the method proposed by Van As and Basson [15] (Fig. 2).

Results and discussion

Taxonomic summary

Two ciliates, *Trichodina acuta* Lom, 1961 and *Trichodina shitalakshyae* sp. n. were recorded from the gills of two commercially important finfish species of Bangladesh, *Mystus bleekeri* and *Glossogobius giuris*, respectively.

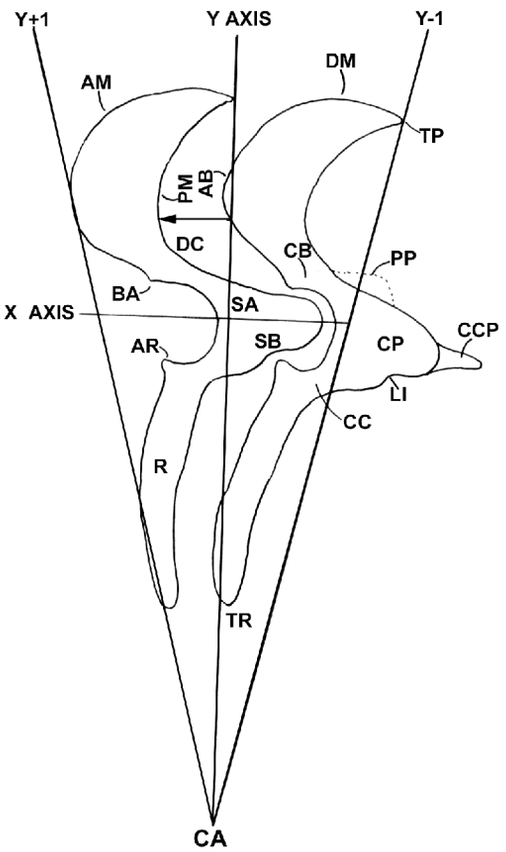


Fig. 2. Denticle structure and construction of X and Y axes as fixed references for description denticles (after Van As and Basson 1989).
Explanations: **AB**, apex of blade; **AM**, anterior margin of blade; **AR**, apophysis of ray; **B**, blade; **BA**, apophysis of blade; **CA**, central area of adhesive disc; **CB**, section connecting blade and central art; **CC**, section connecting central part and ray; **CCP**, central conical part; **CP**, central part of blade; **DC**, deepest point of semilunar curve relative to apex; **DM**, distal margin of blade; **PM**, posterior margin of blade; **PP**, posterior projection; **R**, ray; **SA**, section of central part above X axis; **SB**, section of central part below X axis; **TP**, tangent point; **TR**, tip of ray.

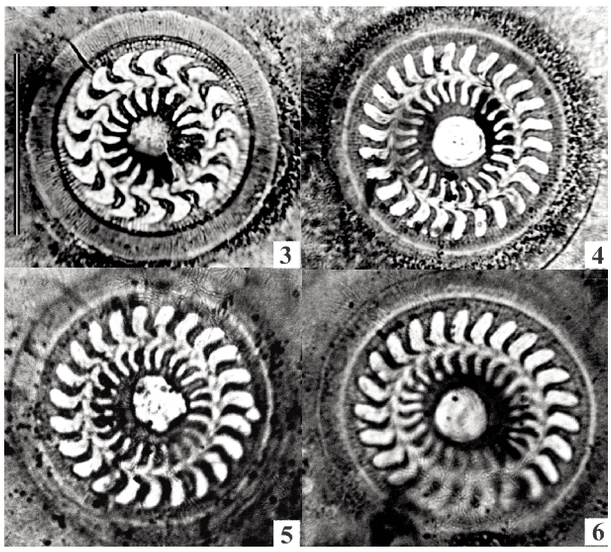
***Trichodina acuta* Lom, 1961** (Figs. 3 and 7–9; Table 1)

Host: *Mystus bleekeri* (Day, 1877); Siluriformes, Bagridae

Location: gills

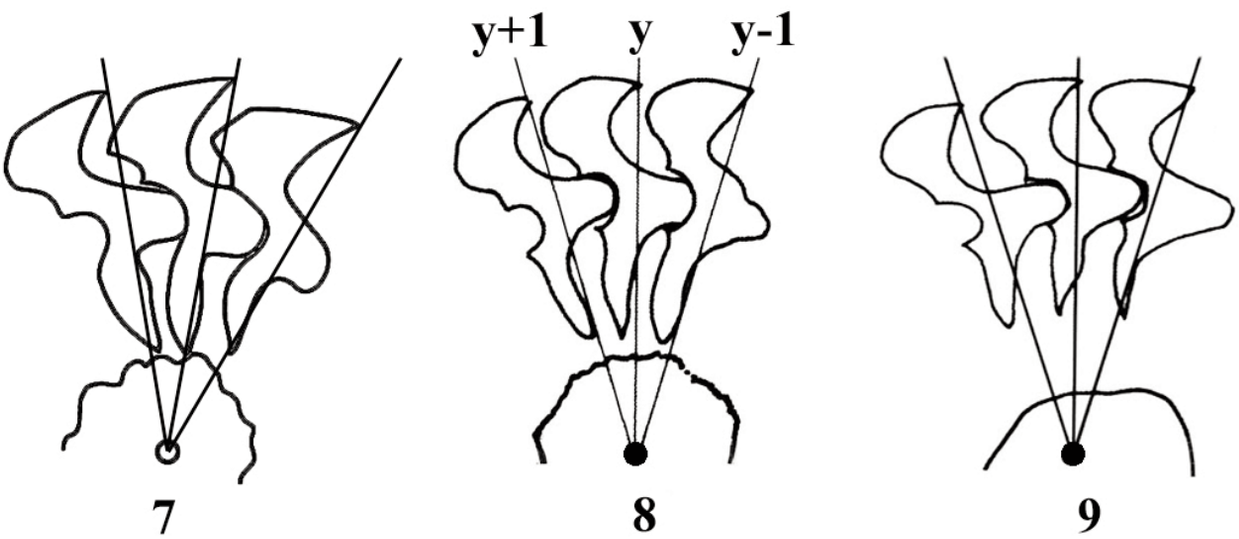
Prevalence: 46.3%. Infection. Low, in mixed infection with *Tripartiella bulbosa* Lom, 1959.

Reference materials: slide MB 1 and MB 2 prepared on 10-10-2009 are in the collection of the Museum of Department of Zoology, University of Chittagong, Chittagong 4331, Bangladesh.



Figs. 3–6. Photomicrographs of silver impregnated adhesive discs of *Trichodina acuta* (3) and *Trichodina shitalakshyae* sp. n. (4–6). Scale bar=30 μm.

Description. Body medium-sized, 40.4–51.5 (47.0±3.3) in diameter, flattened and disc-shaped. Adhesive disc concave, surrounded by finely striated distinct and broad band-like border membrane, 3.0–5.0 (4.4±0.7) wide. Centre of adhesive disc bears a clear area containing some darker spots, especially at periphery, and encircled by a heavily impregnated and wrinkled ring of central area (Fig. 3). Denticulate ring composed of 18–21 (19.5±1.2) denticles. Number of radial pins per denticle 7–9 (8.0±0.8). Blade of denticle relatively short and blunt like a wide sickle, filling most of portion of sector between Y-axes (Fig. 7). Distal margin of blade, lying away from border membrane, has flattened anterior portion which runs parallel to border membrane and then slopes anteriorly to form an angular anterior margin. Apex formed by anterior margin also angularly curved and rarely extends beyond Y+1 axis. Apical depression well developed, but immediate lower portion of apex becomes deeply impregnated giving appearance of blade as hatchet-shape. Tangent point situated slightly lower than distal margin. Anterior apophysis of blade prominent and blade connection well developed. Posterior margin forms small semilunar arch with Y-axes with deepest point almost on same level as apex. Posterior blade apophysis present. Central part robust and widely triangular with bluntly rounded tip which extends halfway past Y-axes and fitted tightly into next denticle. Section of central part above and below X-axis similar. Indentation in lower central part not



Figs. 7–9. Diagrammatic drawings of denticles of *Trichodina acuta*.
Fig. 7. from the gills of *Mystus bleekeri* in Bangladesh; Fig. 8. from the skin and fins of *Cyprinus carpio* in Israel; redrawn from Van As and Basson [15]; Fig. 9. from the skin and gills of *Cyprinus carpio* in Poland; redrawn from Kazubski and Migala [29].

always distinct. Ray connection well developed. Ray slightly curved posteriorly, broad with distinct groove and sharply pointed end. Point of ray lies close to, sometimes almost touches, clear area. Ray apophysis sometimes prominent and situated high, pointing antero-distal direction. Adoral ciliary spiral turns about 390–400°.

T. acuta is one of the most widespread species of its genus [19]. *T. acuta* was originally described by Lom [20] from five species of freshwater fishes, viz., *Cyprinus carpio*, *Perca fluviatllis*, *Lucioperca lucioperca*, *Leucaspis delineatus* and *Rhodeus sericeus*, and from the skin of tadpoles belonging to several species of frogs in Czechoslovakia (Czech Republic). Since then, it was reported to have a wide geographical distribution and occurs on the most diverse hosts from Asia, Africa, Europe and North America. Chen [21–23] and Anon [24] recorded *T. acuta* from China; Kandilov [25] from Azerbaidzhan; Kashkovsky [26], Stein [27] and Kulemina [28] from Russia; Kazubski and Migala [29] from Poland; Lom [30] from the USA; Van As and Basson [15] from Israel; Duncan [31], Natividad et al. [32], Bondad-Reantaso and Arthur [33], Albaladejo and Arthur [34] from the Philippines; Arthur and Lom [35] from Cuba; Navratil [36] from Czech Republic; Halmetojoa et al. [37] from Finland; Burton and Merron [38], Basson and Van As [39] from South Africa; Grupcheva and Sedlaczek [40] from Germany; Özer and Erdem [41,42], Özer [43] from Turkey; Gaze and Wooten [44] from the United Kingdom; Asmat [45] from India; Nikolić et al. [46] from Serbia; Plazza et al. [47] from Brazil reported this species. At least 25 host fish species were infested by this trichodinid. The above results, therefore, confirm the presumption that host specificity in fish trichodinids is absent as expressed by Stein [48], Hoffman and Lom [49] and Van As and Basson [50]. During the present study *T. acuta* was obtained from *Mystus bleekeri*.

The dimensions of measurements fall well within the range given for *T. acuta* by Lom [20] and Duncan [32] (Table 1). The denticle measurements are close to specimens presented by Van As and Basson [15] (Fig. 8) from various species of *Oreochromis* from Israel (Table 1) and the morphology of denticles agree in most of the essential aspects with the summer specimens as recorded by Kazubski and Migala [29] from *C. carpio* in Poland (Fig. 9). During the present survey this ciliate was obtained mainly from October 2008 to February 2009, i.e., in pre-colder to post-colder period as was reported by Asmat [45] from India. Basson and Van As [39] stated *T. acuta* as the European species which parasitizes the European and Asian cyprinids and have spread via the translocation of their hosts. They also concluded the presence of this species in South Africa as a recent introduction which will also become part of the fish parasite fauna of that region in the future. In Bangladesh, due to lack of comprehensive survey of

Table 1. Morphometric comparison of *Trichodina acuta* Lom, 1961 obtained in the present study (after dry silver-impregnation) with those of other authors (after dry silver impregnation)

Species	***Trichodina acuta***	***Trichodina acuta* n=40**	***Trichodina acuta* n=19**
Host	*Cyprinus carpio, Perca fluviatilis, Lucioperca lucioperca, Leucaspis delineatus, Rhodeus sereceus*	*C. carpio*	*Mystus bleekeri*
Locality	Czechoslovakia	Israel	Bangladesh
Location	Skin, fins, occasionally gills	Skin and fins	Gills
Reference	Lom (1961)	Van As and Basson (1989)	Present paper
Diameter of			
body		46.3–58.1 (51.7±4.0)	36.4–47.5 (43.3±3.5)
adhesive disc	42–53 (30–66)*	36.5–49.0 (43±3.8)	30.3–37.4 (34.5±2.4)
denticulate ring	23–32 (18–40)	20.5–30.5 (26.1±2.8)	16.2–22.7 (20.0±1.9)
central area	—	—	7.1–9.6 (8.7±0.9)
Width of border membrane	3.5–5.0	3.6–4.9 (4.3±0.3)	3.0–5.0 (4.4±0.7)
Number of			
denticles	18–21 (15–23)	20–23 (21)	18–21 (19.5±1.2)
radial pins/denticle	8 (9,10,11)	8–9 (9)	7–9 (8.0±0.8)
Span of denticle	—	—	10.1–12.1 (10.9±0.7)
Length of			
denticle	10–11	6.1–7.9 (7.0±0.5)	4.5–7.1 (5.7±0.7)
ray	4–7	3.1–5.6 (4.2±0.06)	4.0–5.0 (4.6±0.3)
blade	4.5–6.0	2.8–4.4 (3.5±0.5)	4.0–5.0 (4.7±0.4)
Width of central part	3–7	1.9–3.2 (2.7±0.4)	1.5–2.0 (1.8±0.2)
°Adoral ciliature	380–390	400	390–400

* Two values before parentheses indicate variation range in different populations and on different species of hosts, numbers within parentheses represent absolute minimum and maximum values observed (20)

trichodinid ciliates from indigenous as well as exotic species, it is not possible to comment whether this ciliate is an introduced species or indigenous one. However, the present study reports an extension of the geographic range of *T. acuta* and *Mystus bleekeri* to be a new host.

***Trichodina shitalakshyae* sp. n. (**Figs. 2–4 and 10–11; Table 2)

Type host: *Glossogobius giuris* (Hamilton, 1822); Perciformes, Gobiidae

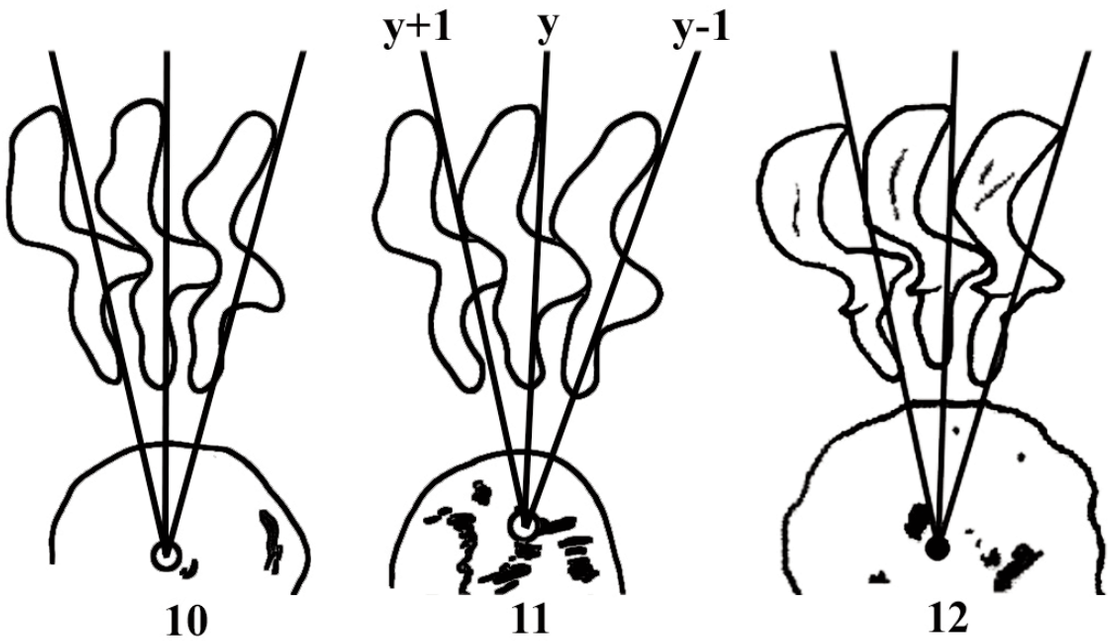
Location: gills

Prevalance: 60%. Infection: low.

Etymology: Specific name derived from the Shitalakshya River, from where the host fish was collected.

Type specimens: one holotype (GG-1 prepared on 11-02-2009) of dry silver stained slide; and two paratype (GG-2 and GG-3 prepared on 10-10-2009) of silver stained slides are deposited in the Museum of the Department of Zoology, University of Chittagong, Chittagong 4331, Bangladesh.

Description. Medium-sized and bell-shaped trichodinid, 40.4-51.5 (47.0±3.3) in diameter, having unique adhesive disc surrounded by finely striated border membrane. Centre of disc argentophobic (Figs. 2–4), contains a few argentophilic dots or patches and surrounded by almost rounded, sometimes undulated border. Denticulate ring consists of 23–26 (24.6±1.0) denticles. Interblade space large. Number of radial pins per denticle 6–9 (7.8±0.8). Blade elongated and rectangular. Distal margin truncated, runs angularly to border membrane, sometimes difficult to separate from anterior blade margin, which distinctly slope downwards. Gap between distal margin of blade and border membrane always large. Tangent point blunt, forms a line with Y-axes, situated lower than distal margin. Anterior margin angularly curves down and in many cases form dimple before creating shallow apex at base of blade that never extends beyond Y+1 axis (Figs. 10–11). Sometimes a notch present just below apical cone in anterior margin. Anterior blade apophysis indistinct. Curve of posterior margin forms a shallow crescent with deepest point at same level as apex (Figs. 10–11). Posterior blade apophysis absent. Blade connection thin. Central part of denticle slightly wide and triangular. Tip of



Figs. 10–12. Diagrammatic drawings of denticles of trichodinid ciliates.
Figs. 10–11. *Trichodina shitalakshyae* sp. n. from the gills of *Mystus bleekeri* in Bangladesh; Fig. 12. *Trichodina porocephalusi* from the gills of *Ophiocara porocephalus* in India; redrawn from Asmat [52].

central part rarely extends halfway past Y–1 axis and interposed firmly into next denticle. Shapes of central part above and below X-axis similar. Indentation on lower central part not visible. Ray connection short and broad bearing no ray apophysis. Ray shorter than blade, stumpy, crooked at base, broad with indistinct central groove and slightly bent in backward direction. Lateral margins of ray parallel, ending in a round or truncated point that always touches or crosses Y–1 axis (Figs. 10–11). Space between tip of ray and central clear area forms a wide impregnated ring. Adoral zone of cilia spirals about 390–400°.

Trichodina shitalakshyae sp. n is characterized by having an undivided clear central area in the adhesive disc with a rounded or slightly undulated perimeter containing a few dark granules which form patches; elongated and rectangular blade with large interblade space and blunt tangent point.; indistinct anterior blade apophysis and a shallow apex at the base of blade that never extends beyond the Y+1 axis; moderately wide and triangular

Table 2. Morphometric comparison (in micrometres) of *Trichodina shitalakshyae* sp. n. (after dry silver-impregnation) with *Trichodina porocephalusi* Asmat, 2001(after dry silver-impregnation)

Species	***Trichodina porocephalusi* (n=20)**	***Trichodina shitalakshyae* (n=20)**
Host	*Ophiocara porocephalus*	*Glossogobius giuris*
Locality	India	
Location	Gills	Gills
References	Asmat (2001)	Present paper
Diameter of body	32.5–50.5 (42.3±5.2)	36.4–47.5 (43.3±3.5)
of adhesive disc	27.0–42.3 (35.2±4.8)	30.3–37.4 (34.5±2.4)
of denticulate ring	16.3–26.0 (20.9±2.8)	16.2–22.7 (20.0±1.9)
of central area	7.1–17.4 (12.4±2.6)	7.1–9.6 (8.7±0.9)
Width of border membrane	2.0–4.8 (3.5±0.7)	3.0–5.0 (4.4±0.7)
Number of denticles	20–27 (24.3±1.5)	18–21 (19.5±1.2)
of radial pins/denticle	6–9 (7.4±1.0)	7–9 (8.0±0.8)
Span of denticle	8.2–10.7 (9.7±0.7)	10.1–12.1 (10.9±0.7)
Length of denticle	2.5–5.6 (4.7±0.8)	4.5–7.1 (5.7±0.7)
of ray	2.5–4.1 (3.0±0.5)	4.0–5.0 (4.6±0.3)
of blade	3.1–5.1 (4.2±0.6)	4.0–5.0 (4.7±0.4)
Width of central part	1.5–3.1 (2.5±0.6)	1.5–2.0 (1.8±0.2)
°Adoral ciliature	380–390	390–400

central part with blunt point; and space between tip of ray and central clear area forms a wide impregnated ring (Figs. 10–11). Based on these characters and the unique shape and absence of variability of the denticles among the silver impregnated specimens of the present species, it may be said that to a lesser extent, it resembles *Trichodina porocephalusi* Asmat, 2001 (Fig. 12).

Asmat [52] described *T. porocephalusi* from the gills of an estuarine fish, *Ophiocara porocephalus* in Hooghly River of West Bengal, India. Asmat [52] recorded remarkable variation in the denticle morphology of *T. porocephalusi.* Based on the denticle shape he identified three types of specimens and designated as Type I, Type II and Type III. Out of these types, Type III (Fig. 12) looks to some extent closer to *T. shitalakshyae*. In Type III of *T. porocephalusi*, the denticle consists of more slender and shorter blades with parallel margins and truncated distal margin and more arched and slender rays. At a glance the appearance of silver stained adhesive discs of *T. porocephalusi* Type III and *T. shitalakshyae* sp. n. seems identical but the central clear area and the denticle morphology distinctly differs in two species. For example, in *T. porocephalusi*: blade broad and rectangular (*vs* slim and rectangular); interblade space narrow (*vs* wide); distal margin of blade is truncated and runs parallel to the border membrane (*vs* angularly truncated and forms angle to the border mebrane, sometimes difficult to separate from the distal margin); gap between the distal margin and border membrane is moderate (*vs* large); tangent point is blunt, rarley forms a line (*vs* always forms a line); anterior apophysis prominent (*vs* indistinct); apex of blade rarely extends beyond the Y+1 axis (*vs* never touches the Y+1 axis); central part of denticle is robust and sharply pointed (*vs* moderate and bluntly pointed); indentation on the lower central part sometimes prominent (*vs* not visible); ray apophysis and central groove distinct (*vs* absent); central clear area surrounded by undulated or notched border (*vs* mostly rounded, sometimes with notched border); space between the tip of ray and the central clear area forms a very narrow impregnated ring (*vs* wide impregnated ring). The two species also differ in morphometrical data except the diameter of body, adhesive disc and denticulate ring (Table 2).

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