

Dipartiella kazubski sp. nov. (Ciliophora: Peritrichida), a new ectoparasitic trichodinid species from the gills of freshwater fishes in India

Amlan Kumar Mitra and Probir K. Bandyopadhyay

*Parasitology Laboratory, Department of Zoology, University of Kalyani,
Kalyani, West Bengal, India*

Summary

Ichthyoparasitological surveys were carried out in the freshwater fishes of the river Tista, Churni of West Bengal, India for the occurrence of protozoan parasites and two hosts, i.e., *Batasio batasio* (Hamilton-Buchanan) of the river Tista and *Wallago attu* (Schneider) of the river Churni were found to be associated with a remarkable species of ectoparasitic trichodinid of the genus *Dipartiella* (Raabe, 1959) Stein, 1961. Till now, the genus was considered to be a marine one consisting of only one species. The present study confirms the occurrence of a freshwater species under the genus *Dipartiella* Stein, 1961 with extreme morphological variability and deals with taxonomy, systematic, prevalence and host preferences of the species.

Key words: *Dipartiella kazubski* sp. nov., freshwater fish's ectoparasites, trichodinids, India.

Introduction

Trichodinids are a widely distributed group of ciliates-ectoparasites. Their biology, distribution and pathogenesis have been studied worldwide (Lom and Hoffman, 1964; Lom, 1970, 1973; Ahmed, 1977; Calenius, 1980; Das and Pal, 1987; Van As and Basson, 1987; Sanmartin Duran et al., 1991; Özer and Erdem, 1999; Özer, 2000).

The first record of trichodinids from India dated back to the early XX century, but the research gained momentum in the 1980ies. Altogether, twelve new species belonging to the genera *Trichodina* Ehrenberg, 1838 and *Paratrachodina* Lom, 1963 (Asmat and Haldar, 1998; Asmat, 2000, 2001a, 2001b,

2001c, 2002a, 2002b; Mitra and Haldar, 2004, 2005) and four previously described species, *T. pediculus* (Annandale, 1912; Hagargi and Amoji, 1979), *T. nigra* (Mukherjee and Haldar, 1982; Saha et al., 1995; Asmat, 2002a), *T. reticulata* (Mishra and Das, 1993) and *T. acuta* (Asmat, 2000) have been reported from India.

Ichthyoparasitological surveys in the freshwater fishes of the river Tista and Churni revealed the occurrence of a new species of trichodinid ciliates belonging to the genus *Dipartiella* (Raabe, 1959) Stein, 1961. The present paper deals with the taxonomy, systematic and prevalence of the new species based on the wet silver nitrate impregnation technique and comparisons with closely related species.

Material and Methods

Samplings were carried out to collect host fishes from the rivers Tista (Latitude 26° 43' N, Longitude 88° 24' E) and Churni (Latitude 23° 11' N, Longitude 88° 37' E) and adjacent water bodies (Fig. 1). Living host fishes were brought to the laboratory, and gill and skin smears were made on grease-free slides. Slides containing ciliates were impregnated using Klein's wet silver impregnation technique (Klein, 1958). Preparations were examined under an Olympus phase contrast microscope using $\times 100$ oil immersion objective, photographs were taken with an Olympus camera. All measurements are in micrometers and follow the uniform specific characteristics as proposed by Lom (1958), Wellborn (1967) and Arthur and Lom (1984). In each case minimum and maximum values are given, followed in parentheses by arithmetic mean and standard deviation. In the case of denticles and radial pins, the mode is given instead of the arithmetic mean. The span of the denticle is measured from the tip of the blade to the tip of the ray. Body diameter is measured as the adhesive disc plus border membrane. The description of denticle elements follows the guidelines

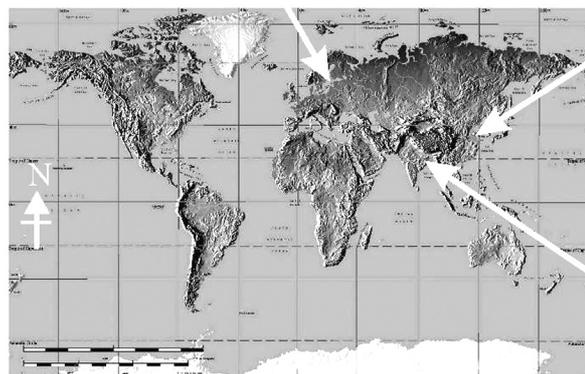
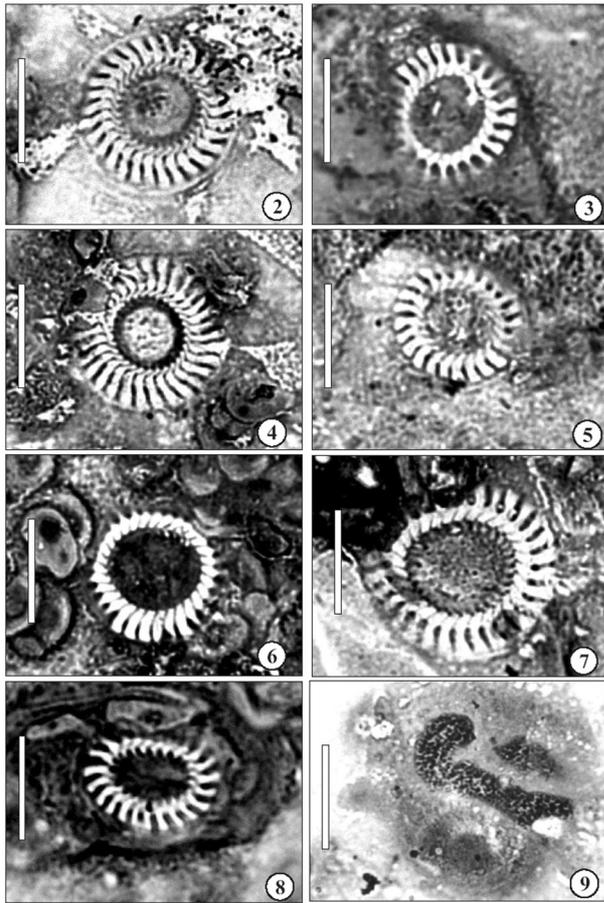


Fig. 1. Distribution of *Dipartiella simplex* (Raabe 1959) Stein, 1961 and *D. kazubski* sp. nov. in the world.

of Van As and Basson (1989). Sequence and method of the description of denticle elements follows the recommendations of Van As and Basson (1992). A dotted line along the central part of each denticle of denticulate ring in camera lucida drawings signifies the shape of the adhesive disc, which could be useful for species diagnosis in some trichodinids.

Table 1. Morphometric comparison of *Dipartiella kazubski* sp. nov. with *D. simplex* (Raabe, 1959) Stein, 1961 reported by Kazubski (1999) and Xu et al. (1999).

| Character | Species | <i>D. kazubski</i> (present study) | <i>D. simplex</i> (Kazubski, 1999) | <i>D. simplex</i> (Xu et al., 1999) |
|------------------------------|---------|----------------------------------------------------------------|-------------------------------------------------|----------------------------------------|
| Host fish | | <i>Wallago attu</i> | <i>Gobius niger</i> | <i>Lateolabrax japonicus</i> |
| Locality | | India | Baltic Sea | China |
| Location | | Gills | Gills | Gills |
| Diameter of body | | 15.5–20.7 (18.2 \pm 1.7) | 15–38 (24.4 \pm 3.47) | 25–34 (30.5 \pm 2.5) |
| adhesive disc | | 14.0–19.2 (15.1 \pm 1.1) | 15.5–22.0 (18.0 \pm 1.51) | 21–30 (26.3 \pm 2.3) |
| Dimension of body | | | | |
| denticulate ring | | 9.0–11.0 (9.8 \pm 0.6) | 4.4–8.8 (6.3 \pm 0.84) | 9–13 (11.0 \pm 1.2) |
| central area | | 5.5–8.0 (7.2 \pm 0.7) | — | — |
| Width of border membrane | | 1.0–1.5 (1.3 \pm 1.1) | — | 1.5–3.0 (2.0 \pm 0.4) |
| Number of denticles | | 23–33 (31) | 17–20 (18) | 23–28 (25.1 \pm 1.3) |
| radial pins/denticle | | 3–5 (4) | — | 4–5 |
| Dimension of denticle | | | | |
| span (large denticles) | | 3.7–4.5 (4.2 \pm 0.8) | — | 4–6 (5.3 \pm 0.6) |
| span (small denticles) | | 1.6–2.4 (1.8 \pm 3.0) | — | — |
| length | | 1.9–2.8 (2.3 \pm 1.1) | 2.2–4.0 (3.2 \pm 0.32) | 1.5–2.5 (2.0 \pm 0.3) |
| Adoral ciliary spiral | | 150–170° | — | 180–220° |
| Macronucleus | | 12.3–18.4 (14.3 \pm 1.1) \times 2.1–3.2 (2.7 \pm 0.3) | 5.5–11 \times 2.3–5.5 (8.06 \times 3.78) | 18–25 (22.1 \pm 5.0) |
| Number of specimens measured | | 40 | 468 | 20 |



Figs 2-9. Photomicrographs *Dipartiella kazubski* sp. nov. 2-8 – silver nitrate impregnated adhesive discs of *D. kazubski* obtained from *Batasio batasio* (Hamilton-Buchanan) of the river Tista and *Wallago attu* (Schneider) of the river Churni showing remarkable morphological variability; 9 – macro-nucleus. Scale bars: 10 µm.

Results and Discussion

A new species of trichodinid ciliate belonging to the genus *Dipartiella* (Raabe 1959) Stein 1961 was obtained from the host fishes *Batasio batasio* (Hamilton-Buchanan) and *Wallago attu* (Schneider).

DIPARTIELLA KAZUBSKI SP. NOV. (Table 1).

A small trichodinid. Adhesive disc usually rounded, rarely oblong (Figs 3, 8, 10, 12). Central area granular and slightly whitish (Figs 2, 4, 7). Denticulate ring consisting of denticles of highly irregular shape and size. Three types of denticles observed within the populations, even within a single denticulate ring (Figs 10-13a-c).

In first type of denticulate ring (Fig. 13a), denticles consisting of broad, almost identical, elongated blades occupying most area between y-axes (Figs 2, 4-8, 10). Distal margin of blades truncated, remains at close proximity and parallel to border membrane. Tangent point in most specimens look like short line rather than point and situated enough below distal point of distal margin. Differentiation between distal margin and anterior margin of blade prominent. Anterior margin sloping down backward to form indistinct apex at base of blade. Anterior blade margin straight, never crosses y+1 axis. Posterior margin of blade curved mostly at base, giving it a bulging appearance. Posterior blade apophysis prominent. Semi lunar curve formed by posterior margin shallow, its deepest point remains at a significantly upper level than apex. Anterior and posterior margins of blade almost parallel. Central part reduced and poorly developed.

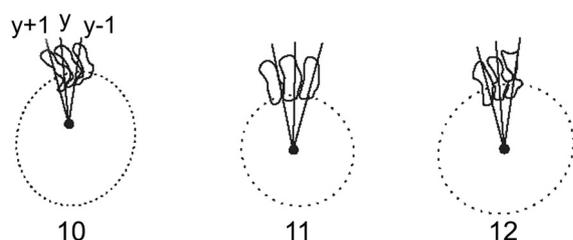
In second type of denticulate ring (Figs 6, 13b), denticles consisting of broad, rectangular blades occupying most area between y-axes, slightly curved towards y+1 axis (Fig. 11). Distal margin of blade truncated, remains in close proximity to border membrane and runs parallel with it. Anterior and posterior blade margins straight and parallel (Figs 11, 13b). Apex absent. Anterior blade apophysis absent. Tangent point like a point in most denticles. Anterior blade margin never touches or extends beyond y+1 axis. Posterior margin of blade almost straight, lacks any apophysis. Central part very underdeveloped. Under this type, in a few denticles, both margins gradually depresses at middle of blade, clearly showing extinction of half portion of blade to form very small third type of denticles (Figs 7, 12, 13c). This variation could be seen even within single denticulate ring.

In third type of denticulate ring (Figs 7, 13c), denticles undeveloped, very small [$1.6-2.4$ (1.8 ± 3.0) µm], mostly rectangular (Figs 12, 13c). Distal margin of blades sharply pointed, due to formation of an angle by joining of anterior and posterior blade margins. Distal margin of blade absent. Tangent point looks like a small point rather than a line. Denticles are slanted towards postero-anterior direction across y-axes (Fig. 13c).

Macronucleus horseshoe-shaped, elongated and with characteristic dilations at both ends (Fig. 9). Micronucleus could not be detected. Adoral ciliary spiral forms a turn of about $250^\circ-260^\circ$.

TAXONOMIC SUMMARY

Type host: *Batasio batasio* (Hamilton-Buchanan), *Wallago attu* (Schneider)



Figs 10-12. Diagrammatic drawings of the denticles of *Dipartiella kazubski* sp. nov. obtained from *Batasio batasio* (Hamilton-Buchanan) of the river Tista and *Wallago attu* (Schneider) of the river Churni showing morphological variability.

Type locality: River Tista (26.4°N and 88.3°E) and river Churni (23°N and 88.5°E).

Location: Gills

Prevalence: 9 out of 26 *Batasio batasio* (Hamilton-Buchanan) host fishes (34%) and 5 out of 11 *Wallago attu* (Schneider) host fishes (45%) were infested with *Dipartiella kazubski* sp. nov.

Etymology: The specific epithet “*kazubski*” is given after Prof. Stanislaw L. Kazubski of Museum and Institute of Zoology, Polish Academy of Sciences, Warszawa, Poland.

Reference Material: Holotype, slide BB2, and paratype slides BB1, BB3, BB5, WA1, WA2, WA7, WA10 in the collection of the Parasitology Laboratory, Department of Zoology, University of Kalyani, Kalyani 741235, West Bengal, India.

Our species has denticles with well-developed blades, no rays and reduced central part; dilated macronucleus arms with a narrowing between them; adoral spiral with an arc of about 260°. These characters justify the inclusion of the species in the genus *Dipartiella* Stein, 1961. The only known species of this genus is *D. simplex*. Our species differs from *D. simplex* in all aspects in relation to body dimension, denticle morphology, denticle number, host and habitat preference. It has a much smaller body than *D. simplex* (Kazubski, 1999; Xu et al., 1999) (Table 1). The denticles of our species show extreme variability of size and shape, observed even within a single denticulate ring. The fully grown denticles of the species are almost rectangular (Type 1, Type 2), whereas the denticles of *D. simplex* are triangular (Xu et al., 1999). Moreover, no variation of the denticles in the single denticulate ring is observed in *D. simplex*. The distal blade margin in *D. simplex* is sharp; in our species it is usually flat and truncated, although a few cases of under-developed

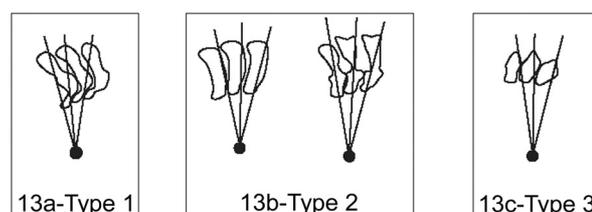


Fig. 13 a-c. Diagrammatic drawings of the three types of denticles of *Dipartiella kazubski* sp. nov. obtained from *Batasio batasio* (Hamilton-Buchanan) of the river Tista and *Wallago attu* (Schneider) of the river Churni showing morphological variability.

blades of the denticulate ring their distal margin is sharp. Number of denticles in our species is (23-33), which is much more than in *D. simplex* reported by Kazubski (1999) (17-20) and slightly more than in *D. simplex* reported by Xu et al. (1999) (23-28). There are also habitat and host differences: *D. simplex* was obtained by Raabe (1959) from a marine host fish *Gobius niger* and by Xu et al. (1999) from a marine host as well; our species has been obtained from freshwater fishes. Considering all these differences, we propose to establish this trichodinid ciliophoran we have obtained from India, a new species and designate it hereby as *D. kazubski* sp. nov.

The new genus *Dogielina* was created by Raabe (1959) to accommodate the type species *D. simplex* obtained from the gills of black goby (*G. niger* L.). Stein (1961) noted that the generic name *Dogielina* was preoccupied by genera of Foraminifera and Nematoda and proposed the new name *Dipartiella*. Raabe's description was short and drawings imprecise; moreover, the species had not been found for a long time, and so Lom and Dykova (1992) regarded the genus *Dipartiella* as “spurious” and the species as a “possible mistaken interpretation of the genus *Trichodinella*”. However, Kazubski (1999) re-examined the original material of *D. simplex* prepared by Raabe, re-described the species properly and declared the genus valid (Fig. 1). The validity of the *Dipartiella simplex* was further supported by the report of this species from China (Xu et al., 1999) from a marine host fish *Lateolabrax japonicus* (Fig 1). The genus has been thought to be marine, consisting with only one species *Dipartiella simplex* (Raabe, 1959) Stein, 1961. The present study confirms the validity of the genus *Dipartiella* and shows that the genus includes freshwater forms as well.

Acknowledgements

We are very grateful to Prof. Stanislaw L. Kazubski (Museum and Institute of Zoology, Polish Academy of Sciences, Warszawa, Poland) for sending us his and Prof. Z. Raabe's publications on *Dipartiella* species.

References

- Ahmed A.T.A. 1977. Morphology and life history of *Trichodina reticulata* from goldfish and other carps. *Fish Pathol.* 12, 21-31.
- Annandale N. 1912. Preliminary description of a freshwater medusa from the Bombay Presidency. *Rec. Ind. Mus.* 7, 235-256.
- Arthur J.R. and Lom J. 1984. Trichodinid Protozoa (Ciliophora: Peritrichida) from freshwater fishes of Rybinsk Reservoir, USSR. *J. Protozool.* 31, 82-91.
- Asmat G.S.M. 2000. *Trichodina cuchiae* sp. n. (Ciliophora: Trichodinidae) from Gangetic mudeel, *Monopterus cuchia* (Hamilton-Buchanan, 1822) (Synbranchiformes: Synbranchidae) in India. *The Chittagong Univ. J. Sc.* 24, 55-61.
- Asmat G.S.M. 2001a. *Trichodina cancelae* sp. n. (Mobilina: Trichodinidae) from the Gills of a Freshwater Gar, *Xenentodon cancela* (Hamilton) (Belontiidae). *Acta Protozool.* 40, 141-146.
- Asmat G.S.M. 2001b. *Trichodina canningensis* sp. n. (Ciliophora: Trichodinidae) from an Indian estuarine fish, *Mystus gulio* (Hamilton) (Bagridae). *Acta Protozool.* 40, 147-151.
- Asmat G.S.M. 2001c. *Trichodina porocephalus* sp. n. (Ciliophora: Trichodinidae) from an Indian flathead sleeper, *Ophiocara porocephalus* (Valenciennes) (Eleotrididae). *Acta Protozool.* 40, 297-301.
- Asmat G.S.M. 2002a. Trichodinid ciliates (Ciliophora: Trichodinidae) from Indian fishes with description of two new species. *Bangladesh J. Zool.* 30, 87-100.
- Asmat G.S.M. 2002b. Two new species of trichodinid ciliates (Ciliophora: Trichodinidae) from Indian fishes. *J. Zool. Rajshahi Univ.* 21, 31-34.
- Asmat G.S.M. and Haldar D.P. 1998. *Trichodina mystusi*- a new species of trichodinid ciliophoran from Indian estuarine fish, *Mystus gulio* (Hamilton). *Acta Protozool.* 37, 173-177.
- Calenius G. 1980. Parasites of fish in Finland. III. Ciliates of the family Urceolariidae Dujardin, 1851). *Acta Acad. Zboensis. Ser. B.* 40, 1-15.
- Das M.K. and Pal R.N. 1987. Histopathology of gill infestation by Monogenea and Urceolariid ciliates in carps cultured in India. *Indian J. Parasitol.* 11, 127-130.
- Hagargi S.S. and Amoji S.D. 1979. Occurrence of *Trichodina pediculus* Ehrenberg, 1838 on fresh water carps, *Barbus* spp. *Curr. Sci.* 48, 789-790.
- Kazubski S.L. 1999. Redescription of Trichodinid *Dipartiella simplex* (Raabe, 1959) (Ciliophora: Peritrichida) and remarks on the Genus *Dipartiella* Stein, 1961. *Acta Protozool.* 38, 305-311.
- Klein B.M. 1958. The dry silver method and its proper use. *J. Protozool.* 5, 99-103.
- Lom J. 1958. A contribution to the systematics and morphology of endoparasitic trichodinids from amphibians with proposal of uniform specific characteristics. *J. Protozool.* 5, 251-263.
- Lom J. 1970. Observations on trichodinid ciliates from freshwater fishes. *Arch. Protistenkd.* 112, 153-177.
- Lom J. 1973. Adhesive disc of *Trichodinella epizootica*-ultrastructure and injury to the host tissue. *Folia Parasitol.* 20, 193-202.
- Lom J. and Dykova I. 1992. Protozoan Parasites of Fish. Elsevier Publishers, Amsterdam.
- Lom J. and Hoffman G.-L. 1964. Geographic distribution of some species of trichodinids (Ciliata: Peritricha) parasitic on fishes. *J. Parasitol.* 50, 30-35.
- Mishra R.K. and Das M.K. 1993. Urceolariid ciliate, *Trichodina reticulata* infesting gills of *Catla catla* in India. *J. Inland Fish Soc.* 25, 54-56.
- Mitra A.K. and Haldar D.P. 2004. First record of *Trichodinella epizootica* (Raabe, 1950) Ъramek-Hуљек, 1953, with Description of *Trichodina notopteridae* sp. n. (Ciliophora: Peritrichida) from Freshwater Fishes of India. *Acta Protozool.* 43, 269-274.
- Mitra A.K. and Haldar D.P. 2005. Descriptions of two new species of the genus *Trichodina* Ehrenberg, 1838 (Protozoa: Ciliophora: Peritrichida) from Indian fresh water fishes. *Acta Protozool.* 44, 159-165.
- Mukherjee M. and Haldar D.P. 1982. Observations on the urceolariid ciliates of the genera *Trichodina* and *Tripartiella* in freshwater teleosts. *Arch. Protistenk.* 126, 419-426.
- Özer A. 2000. The occurrence of three species of *Trichodina* (Ciliophora: Peritrichia) on *Cyprinus carpio* in relation to culture conditions, seasonality and host characteristics. *Acta Prorozool.* 39, 61-66.
- Özer A. and Erdem O. 1999. The relationship between occurrence of ectoparasites, temperature and culture conditions: a comparison of farmed and wild common carp (*Cyprinus carpio* L., 1758) in the

Sinop region of northern Turkey. *J. Nat. Hist.* 33, 483-491.

Raabe Z. 1959. Urceolariidae of gills of Gobiidae and Cottidae from Baltic Sea. *Acta Parasitol. Pol.* 7, 441-452.

Saha B.S., Bandyopadhyay P. K. and Haldar D.P. 1995. Biodiversity of trichodinid ciliates in freshwater fishes of West Bengal. *Environ. Ecol.* 13, 814-823.

Sanmartin Duran M.L., Fernandez Casal J., Tojo J.L., Santomarina M.T., Esrevez J. and Ubeira F. 1991. *Trichodina* sp.: effects on the growth of farmed turbot (*Scophthalmus maximus*). *Bull. Eur. Ass. Fish. Pathol.* 11, 89-91.

Stein G.A. 1961. On the systematics of Urceolariidae (Infusoria, Peritricha). *Zool. Zh.* 60, 1137-1142 (in Russian, with English summary)

Van As J.G. and Basson L. 1987. Host specificity of trichodinid ectoparasites of freshwater fish. *Parasitol. Today.* 3, 88-90.

Van As J.G. and Basson L. 1989. A further contribution to the taxonomy of Trichodinidae (Ciliophora: Peritrichida) and a review of the taxonomic status of some ectoparasitic trichodinids. *Syst. Parasitol.* 14, 157-179.

Van As J.G. and Basson L. 1992. Trichodinid ectoparasites (Ciliophora: Peritrichida) of freshwater fishes of the Zambesi River System, with a reappraisal of host specificity. *Syst. Parasitol.* 22, 81-109.

Wellborn T.L. Jr. 1967. *Trichodina* (Ciliata: Urceolariidae) of freshwater fishes of the southeastern United States. *J. Protozool.* 14, 399-412.

Xu K., Song W. and Warren A. 1999. Trichodinid ectoparasites (Ciliophora: Peritrichida) from the gills of cultured marine fishes in China, with the description of *Trichodinella lomi* n. sp. *Syst. Parasitol.* 2, 219-227.

Address for correspondence: Amlan Kumar Mitra, Parasitology Laboratory, Department of Zoology, University of Kalyani, Kalyani 741235, West Bengal, India, e-mail: amlan_mitra@hotmail.com