

Jadwiga WIERZBICKA

Parasitology

DEVELOPMENTAL STAGES OF PROTOZOANS
TRICHODINA KUPERMANI ARTHUR ET LOM, 1984
(CILIOPHORA, PERITRICHIA) PARASITES OF BLUE BREAM,
ABRAMIS BALLERUS (L.)

STADIA ROZWOJOWE PIERWOTNIAKÓW
TRICHODINA KUPERMANI ARTHUR ET LOM, 1984 (CILIOPHORA,
PERITRICHIA) PASOŻYTA ROZPIÓRA *ABRAMIS BALLERUS* (L.)

Department of Fish Diseases, Agricultural University of Szczecin, Poland

Studied specimens of the blue bream, *Abramis ballerus* (L.) originated from Dąbie Lake—a component of the Odra River estuary (northwestern Poland). The gills of the host fish yielded a number of adult specimens and different developmental stages of *Trichodina kupermani* Arthur et Lom, 1984. Among the developmental stages there were post-cleavage and post-conjugation individuals. There were distinct morphological differences observed between these two developmental forms. They both differed also from the adult specimens.

INTRODUCTION

Asexual reproduction of the trichodinid protozoans was studied, among others, in *Trichodina fultoni* Davis, 1947 parasitic on gills and skin of *Lepomis cyanellus*, *Micropterus salmoides*, and *Rhinichthys atratulus* from waters of North America (Lom and Hoffman 1964). An early post-cleavage stage of *T. truttae* Mueller, 1937 was recorded and illustrated by Arthur and Margolis (1984). The above-mentioned authors studied juvenile specimens of *Salmo gairdneri* Richardson, *Oncorhynchus kisutch* (Walbaum), and *O. nerka* (Walbaum)—all taken from a fish farm in British Columbia, Canada. Another contribution to this subject was by Feng Shujuan (1985) who presented observations concerning asexual reproduction of *T. nobilis* Chen, 1963—a parasite of *Ctenopharyngodon idella* (Valenciennes). Basson and Van As (1989) described early and later post-cleavage stages of *Hemitrichodina robusta*. This species was found on the skin and fins of *Mar-*

cusenius macrolepidotus (Peters, 1852) in South Africa. A drawing of the adhesive disc of a post-cleavage specimen of *Paratrichodina incisa* (Lom, 1959) with partially resorbed old denticulate ring was published by Stein (1967). He found these parasites on the gills of *Thymallus arcticus arcticus* (Pall.) from Kamchatka. Studies on the development of the skeletal element of the adhesive disc of *Trichodina pediculus* (O.F. Müller, 1786) Ehrenberg, 1838 were conducted by Kazubski (1967).

A course of reproduction through conjugation was described by Ahmed (1977) in protozoans *Trichodina reticulata* Hirschmann et Partsch, 1955. Micro- and macroconjugants observed in the above-mentioned study did not differ distinctly (cited after Lom and Dyková 1992).

Parasitic ciliates *Trichodina kupermani* were for the first time found on the gills of blue bream, *Abramis ballerus* (L.) from the Rybinsk Reservoir on the Volga River and described by Arthur and Lom (1984) as a new species. Subsequently this parasite was recorded in Philippines on juvenile specimens of *Ctenopharyngodon idella* previously imported from Taiwan (Albaladejo and Arthur 1989). The species was once again found on the gills of blue bream in Dąbie Lake, Poland by Wierzbicka (1997). The latter work, among other things, listed morphometric characters of the adult specimens and provided analysis of seasonal dynamics of infection with this parasite.

The present work describes morphology of various developmental stages of *T. kupermani*.

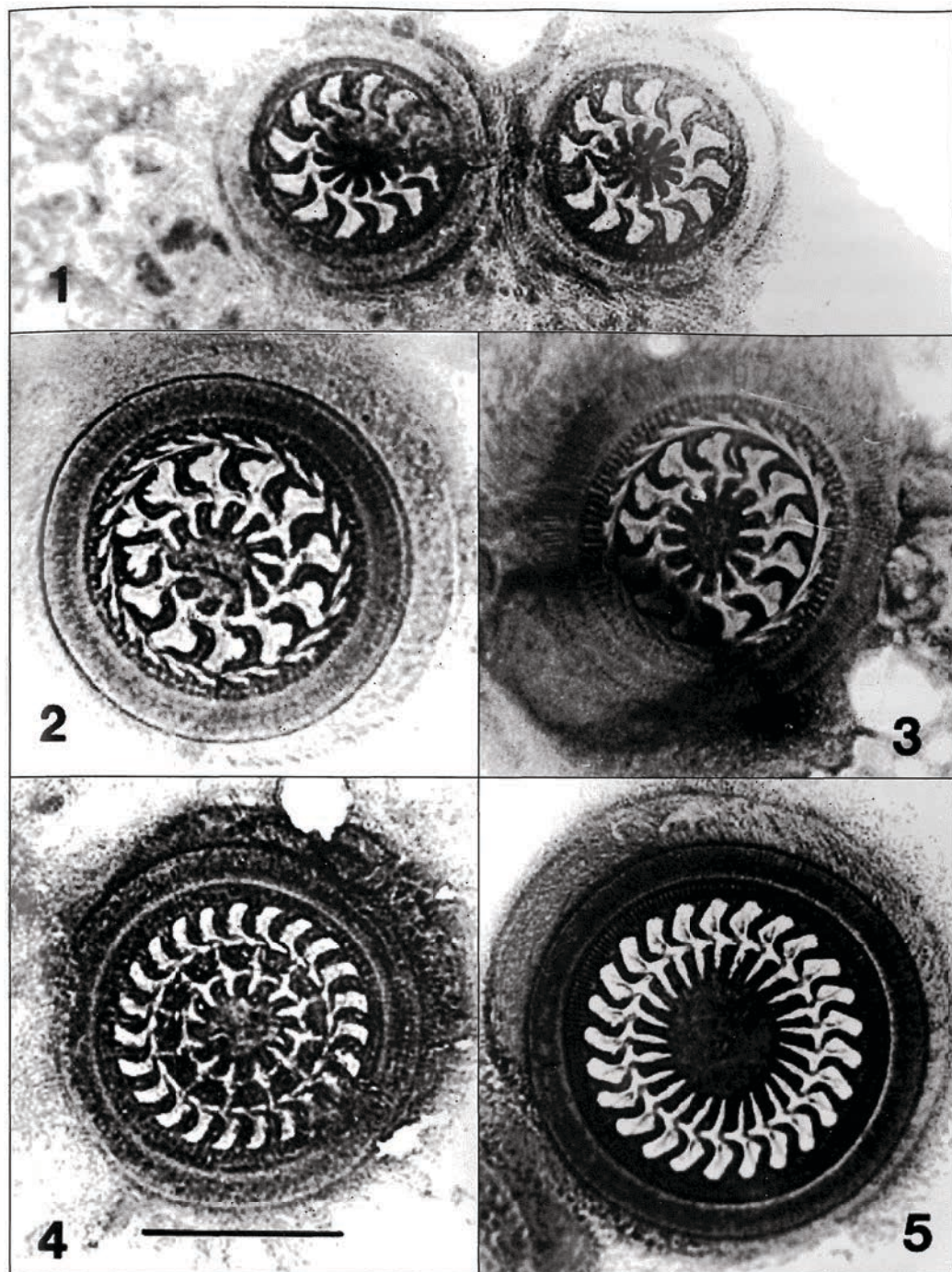
MATERIAL AND METHODS

Studied specimens of the blue bream, *Abramis ballerus* (L.) originated from Dąbie Lake, a component of the Odra River estuary (northwestern Poland). A total of 295 fish was examined. Their age ranged from 1+ to 9 years and their total length—from 8.5 to 44.0 cm. The material was collected during three-year-long period of studies (1969–1971) described by Wierzbicka (1997).

The scraped material from the gills of the freshly acquired blue bream was supravitaly studied under a microscope. Gill imprints on specimen slides were silvered with 1% solution of AgNO₃ (the Klein method) or stained with Delafield hematoxylin and were subsequently mounted in Canada balsam.

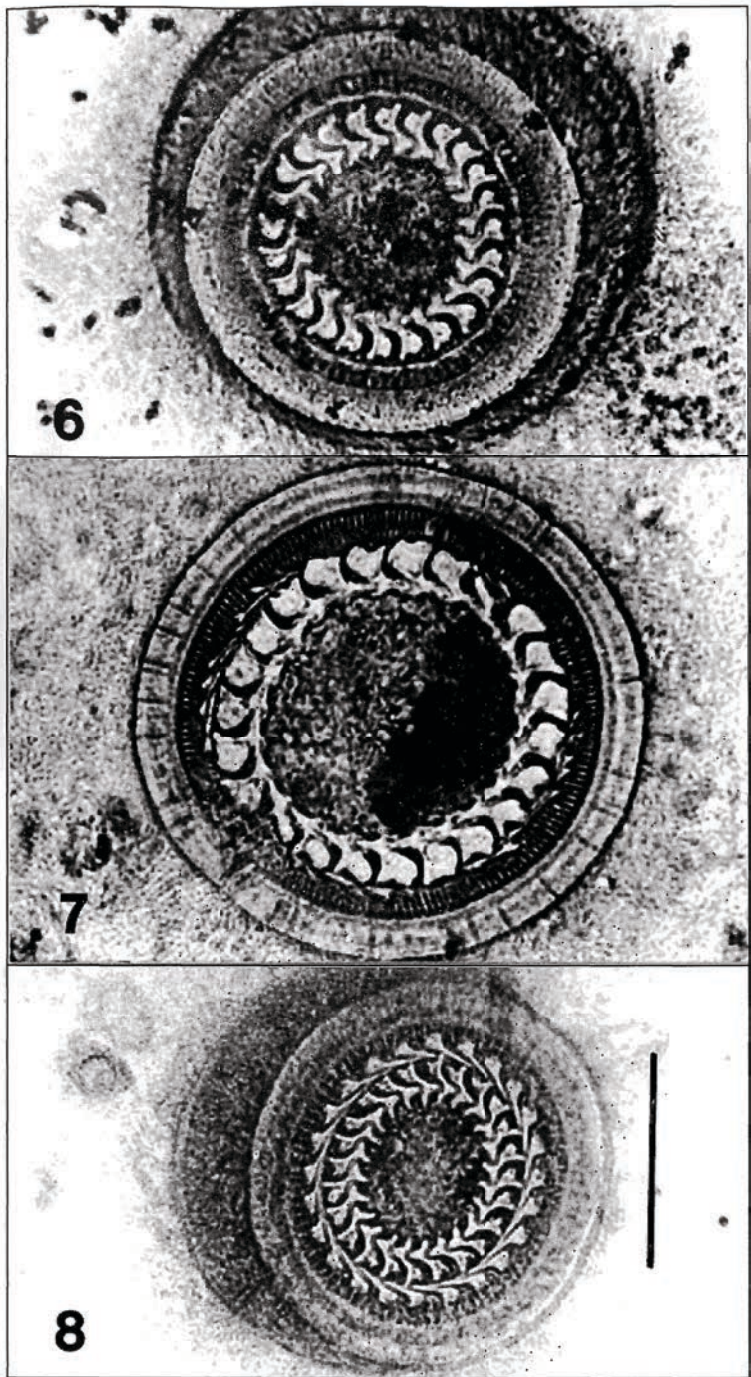
RESULTS

The gills of the studied blue bream yielded abundant adult specimens of *Trichodina kupermani* Arthur et Lom, 1984 and a small number of developmental stages of this species. They were present in the material collected between May and August.



Figs. 1-5. *Trichodina kupermani*; 1-4—post-cleavage developmental stages; 5—adult specimen (scale bar—20 μm)*

* micrograph by Mr. P. Šmietana



Figs. 6-8. Post-conjugation developmental stages of *T. kupermani* (scale bar - 20 μm)*

* micrograph by Mr. P. Šmietana

The youngest stages—observed immediately after the cleavage were smaller compared to the adult specimens and they had half the number of denticles in their adhesive disc (Fig. 1). There were 12–13 denticles, while the adult protozoans had 21–28 (in average 24.77) denticles (Wierzbicka 1997). In the subsequent developmental stages, such ring, possessing only half of the usual number of denticles underwent gradual resorption. Around it, on the perimeter of the disc a new ring was formed with usual number of denticles. Newly formed denticulate ring was visible on the silvered preparations. It initially looked like a ring made out of pins (Figs 1, 2). Subsequently it assumed shape of a thin, distinctly denticulated ring (Fig. 3). These denticles were located on the outer perimeter of the ring. They gradually enlarged and become blades of the denticles. The next stage had the blades of the denticles in a new ring completely developed while its old ring still had the thorns and central parts of the denticles still visible (Fig. 4) which eventually disappeared completely (Fig. 5).

A number of post-conjugation forms (Figs 6–8) was also found on the gills. They were large and did not differ in this respect from the adult ciliates. Their characteristic feature was the presence of double denticulate rings of equal number of parts. In the material studied there were 23 and 24 denticles in the rings. In these specimens, similarly as in the post-cleavage specimens the inner ring underwent resorption, while on its perimeter a new ring was formed. The reconstruction of such denticulate ring underwent identically as in the post-cleavage developmental stages. In the course of the resorption, however, the thorns of the inner ring shortened (Figs 6–8). The central field of these forms, unlike the field of the adult forms (Fig. 5) exhibited uneven, structure consisting of fine granules.

DISCUSSION

Trichodinid protozoans reproduce most often through cleavage, while the conjugation process occurs rarely (Lom 1995).

Post-cleavage specimens of *Trichodina kupermani* described in the present study are similar to some of the developmental stages of *T. fultoni* studied by Lom and Hoffman (1964), *T. truttae* observed by Arthur and Margolis (1984), and to the stages of *T. nobilis* described by Feng Shujuan (1985). Also the post-cleavage stages of *T. kupermani* are similar to the descendant forms of *Hemitrichodina robusta* described by Basson and Van As (1989).

Presently described developmental stages of *T. kupermani* with double denticulate rings, possessing the same number of denticles, match description of macroconjugants of *T. reticulata*, observed by Ahmed (1977) (cited after Lom and Dyková (1992)). It is evident

from the present data, that ciliates *T. kupermani* can reproduce not only through cleavage but also through conjugation.

CONCLUSIONS

1. The gills of the studied blue bream were parasitized by adult specimens as well as by different developmental stages of *Trichodina kupermani*. The latter forms were post-cleavage specimens as well as post-conjugation ones.
2. The post-cleavage forms distinctly differed morphologically from the post-conjugation forms. They also differed from the adult forms.
3. The presence of macroconjugants in the studied material evidences the occurrence sexual reproduction in *T. kupermani*—rarely recorded in representatives of the family Trichodinidae.

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Jadwiga WIERZBICKA

STADIA ROZWOJOWE PIERWOTNIAKÓW
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STRESZCZENIE

Badane rozpióry pochodziły z jeziora Dąbie położonego w pobliżu Szczecina i mającego połączenie z ujściowym odcinkiem rzeki Odry. Na skrzelach tego żywiciela znaleziono osobniki dorosłe i różne stadia rozwojowe *Trichodina kupermani*. Były to formy potomne po podziale i po procesie koniugacji. Stadia po podziale wykazywały wyraźne różnice morfologiczne w porównaniu do form po koniugacji. Różniły się one także od osobników całkowicie dorosłych.

Występowanie makrokoniugantów w analizowanym materiale świadczy o rozmnażaniu płciowym *T. kupermani*, rzadko notowanym u przedstawicieli rodziny Trichodinidae.

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Author's address:

Jadwiga Wierzbicka PhD DSc
Department of Fish Diseases
Agricultural University of Szczecin
Kazimierza Królewicza 4, 71-550 Szczecin, Poland