

Ecology Studies of Ciliated Protozoa in An Eutrophic Lake Lake Höllerersee, Austria^{*}

I . Species composition

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Abstract As a part of series studies, the planktonic ciliate species composition in Höllerersee, a small eutrophic lake in Austria, was investigated between June 1995 to February 1996. During the investigation, 61 ciliate species, belonging to 2 subphyla, 4 superclasses, 8 classes, 19 orders and 48 genera, were recorded in the paper. The characteristics of ciliate species composition was discussed, preliminarily.

Keywords ciliates, species composition, Lake Höllerersee

Classification number Q 179.1

As an important part of component, ciliated protozoa not only have higher diversities but play a significant role in energy flow and material cycles of water ecosystems. With the last two decades, ciliate protozoan abundance, biomass and species composition in marine and freshwater have been investigated at various locations, as detailed reviewed by Fenchel and Laybourn-Parry^[1]. The species compositions and population dynamics of ciliate communities in inland temperal freshwater lakes and ponds with various trophic status have been reported by some authors^[2]. Although some reports about the time and spatial patterns of zooplanktonic ciliates have been made, we have only a limited knowledge of the spatial distributions patterns of deep lake ciliated zooplankton. The aim of this work was, therefore, to study the ecology included in temporal and vertical distribution of ciliated protozoan community in a small eutrophic lake, Lake Höllerersee, in Austria. We hope, with this series studies, to provide more detailed messages about zooplanktonic especially microzooplanktonic community in this small lake. In this paper, the species composition is reported, firstly.

1 Materials and Methods

Lake Höllerersee, situating in central Austria (Upper Austria) (Fig. 1), is a small

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meromictic lake with insignificant inflow and outflow. It has a surface area of about 0.2 km², a mean depth of 11 m and a maximum depth of 20 m. Its monimolimnion is with high amount of nutrients and below 12 m always no O₂. During the summer stratification, the water from below 8 m depth had high concentration of H₂S. It can be said the epilimnetic is eutrophic. A more detailed description of this lake was given by Nauwerck^[3].

Sampling site was at the centre of the lake, and samples were taken at seven different depths (2, 5, 6, 7, 8, 10 and 12 m). Samplings were carried out from June 1995 to February 1996. At each sampling day, 250 mL water at each depth was taken and fixed with fresh Bouin's fluid, meanwhile, data of water temperature, pH, O₂ and O₂% were analysed. Additionally, the living animals were collected with planktonic net. The identification of ciliated protozoans were processed with living animals and protargol stained specimens were prepared as the method of Foissner^[4]. Taxonomy of ciliates is based on the descriptions of Foissner et al^[5]. The biomass data for each ciliate species was used from Foissner et al as well.

2 Result

Based on the taxonomic system of de Puytorac et al, 61 ciliate species, belonging to 2 subphyla, 4 superclasses, 8 classes, 19 orders and 48 genera, were found during the study. A species list is given as follow:

PHYLUM CILIOPHORA Doflein, 1901

Subphylum **Tubulicorticata** de Puytorac et al, 1993

Superclass Postciliodesmatophora Gerassimova & Seravin, 1976

Class Heterotrichea Stein, 1859

Subclass Heterotrichia Stein, 1859

Order Heterotrichida Stein, 1859

1 *Spirostomum teres* Claparede & Lachmann, 1858

Order Armophorida Jankowski, 1964

2 *Caenomorphra medusula* Perty, 1852

3 *Metopus es* (Müller, 1776) Lauterborn, 1916

4 *Metopus laminarius* Kahl, 1927

Superclass Spirotricha Butschli, 1889

Class Hypotrichea Stein, 1859

Subclass Euplotia Tuffrau & Fleury, 1994

Order Euplotida Small & Lynn, 1985

5 *Aspidisca* sp.

Subclass Oxytrichia Tuffrau & Fleury, 1994

Order Urostylida Jankowski, 1979

6 *Holosticha kessleri* Wrzesniowski, 1877

7 *Holosticha pullaster* (Müller, 1773)

Order Oxytrichida Jankowski, 1979

Suborder Stichotrichina Faué-Fremiet, 1961

8 *Uroleptus* sp.

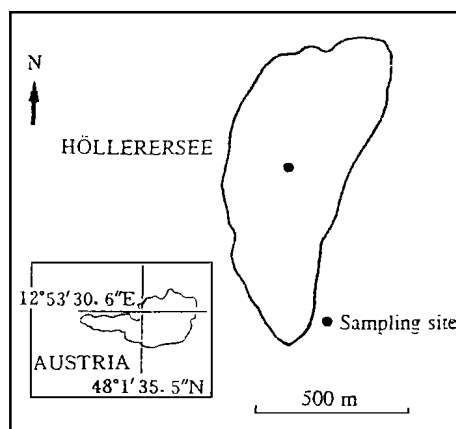


Fig. 1 Map of Lake Höllerersee and sampling site

- 9 *Stichotricha aculeata* Wrzesniowski, 1866
Class Oligotrichea Bütschli, 1887
Subclass Oligotrichia Bütschli, 1887
Order Oligotrichida
Suborder Halteriina Laval-Peuto, Grain & Deroux, 1994
10 *Halteria grandinella* (Müller, 1773) Du-jardin, 1841
Suborder Strombidiina Laval-Peuto, Grain & Deroux, 1994
11 *Strombidium viride* Stein, 1867
12 *Pelagostrombidium fallax* (Zacharias, 1896) Krainer, 1991
Subclass Strobilia Laval-Peuto, Grain & Deroux, 1994
Order Choreotrichida Small & Lynn, 1985
Suborder Strobilidiina Small & Lynn, 1985
13 *Strobilidium caudatum* (Fromentel, 1876) Foissner, 1987
14 *Strobilidium humile* Penard, 1922
15 *Strobilidium lacustris* Foissner, 1989
Order Tintinnida Kofoid & Campbell, 1929
16 *Tintinnidium fluviatile* (Stein, 1863) Kent, 1881
17 *Tintinnidium pusillum* Entz, 1909
18 *Tintinnopsis* sp.
19 *Codonella cratera* (Leidy, 1877) Imhof, 1885
Superclass Transversalia de Puytorac et al, 1993
Class Colpodea Small & Lynn, 1981
Subclass Colpodia Foissner, 1985
Order Cyrtolophosidida Foissner, 1978
20 *Cyrtolophosis mucicola* Stokes, 1888
Class Plagiophlea Small & Lynn, 1985
Order Plagiopylida Small & Lynn, 1985
21 *Plagiopyla nasuta* Stein, 1860
Subphylum **Filicorticata** de Puytorac et al, 1993
Class Litostomatea Small & Lynn, 1981
Order Spathidiida Foissner & Foissner, 1988
Suborder Spathidiina, Jankowski, 1980
22 *Enchelyodon* sp.
23 *Spathidium* sp.
Suborder Didiniina Jankowski, 1980
24 *Didinium nasutum* Müller, 1773) Stein, 1859
25 *Monodinium balbianii* Fabre-Domergue, 1888
Suborder Lacrymariina Lipscomb & Riordan, 1980
26 *Lacrymaria olor* (Müller, 1786) Bory de Saint-Vincent, 1824
27 *Lagynus elegans* (Engelmann, 1862) Quennerstedt, 1867
Suborder Trachelophyllina de Puytorac et al, 1993
28 *Trachelophyllum sigmoides* Kahl, 1926
Suborder Dileptina Jankowski, 1978
29 *Dileptus* sp.
30 *Paradileptus elephantinus* (Svec, 1897) Kahl, 1931
Order Pleurostomatida Schewiakoff, 1896
31 *Litonotus fasciola* Ehrenberg-Wrzesniowski, 1870
32 *Amphileptus clapedii* Stein, 1867
33 *A. pleurosigma* (Stokes, 1884) Foissner, 1984
Order Mesodiniida de Puytorac et al, 1993
34 *Mesodinium pulex* (Claparede & Lachmann, 1858) Stein, 1867
35 *Askenasia acrostomia* Krainer & Foissner, 1990
Superclass Membranellophora Jankowski, 1975
Class Nassophora Small & Lynn, 1981
Subclass Prostomatia Schewiakoff, 1896
Order Prorodontida Corliss, 1974
36 *Balanion planctonicum* (Foissner et al, 1990) Foissner et al, 1994
37 *Coleps setai* Foissner, 1984
38 *Urotricha agilis* (Stokes, 1886) Kahl, 1930
39 *U. apsheronica* Alekperov, 1984
40 *U. armata* Kahl, 1927
41 *U. furcata* Schewiakoff, 1892
42 *U. tricha* Wang, 1933
43 *Prorodon* sp.
Order Protostomatida Schewiakoff, 1896

44 *Holophyra discolor* Ehrenberg, 1833

45 *Holophyra* sp.

46 *Vasicola* sp.

Class Oligohymenophora de Puytorac et al, 1974

Subclass Peniculia Fau  -Fremiet, 1956

Order Peniculida Fau  -Fremiet, 1956

47 *Frontonia acuminata* (Ehrenberg, 1833) B  tschli, 1889

48 *Paramecium caudatum* Ehrenberg, 1838

49 *Lembadion bullinum* (M  ller, 1786) Per-
ty, 1849

Subclass Scuticociliatia Small, 1967

Order Philasterida Small, 1967

Suborder Loxocephalina Jankowski, 1964

50 *Cinetochilum margaritaceum* Perty, 1849

51 *Dextiotricha granulosa* (Kent, 1881)
Suborder Philasterina Small, 1967

52 *Uronema nigricans* (M  ller, 1786) Flo-

rentin, 1901

Order Pleuronematida Fau  -Fremiet, 1956

Suborder Pleuronematina Fau  -Fremiet, 1956

53 *Ctedoctema acanthocrypta* Stokes, 1884

54 *Cydidium elongatum* Schewiakoff, 1896

55 *C. glaucoma* M  ller, 1786

56 *Histobalantium bodamicum* Krainer &
M  ller, 1995

57 *Calyptotricha lanuginosa* Wilbert & Foiss-
ner, 1980

58 *Pleuronema coronatum* Kent, 1881

Subclass Peritrichia Stein, 1859

Order Sessilida Kahl, 1933

59 *Vorticella infusionum*-complex

60 *Vorticella octava*-complex

61 *Epistylis* sp.

3 Discussions

The species composition is the foundation of ecology study, and there are some closed relationships between species composition and environmental. Concerning the ciliated protozoa in freshwater lakes, especially in shallow lakes, some reports have been made by some authors^[1], but reports of ciliate distributions, in deep lakes with thermal stratification are limited. Within the literatures of deep freshwater lakes, Madoni recorded 36 ciliate species from Lake Kinneret (Israel)^[6]; 40 different ciliates were discerned from Piburger Sees (Austria)^[7]; 14 and 10 ciliate species were discovered in two southern hemisphere temperal Lakes Okaro and Taupo, respectively, (New Zealand)^[8]. Comparatively speaking, the number of ciliate species showed more in Lake H  llerersee. Two causes should be considered, one is the environmental characteristics of the lake, other one is the investigation method. It should be admitted that because of the small size, with an ecological view to study ciliates there were a few difficulties. Some authors did the work using a method which suited for zooplanktons (copepoda, cladocera and rotifer) researches and divided ciliates into different groups based on the ciliate sizes but not on taxonomy. It can not be avoid errorous in identification and counting of ciliates. From the list, we can get that not only some ciliates which need better conditions, but also some ciliates living in odious habitat present in the lake. The knowledge of protozoan ecology showed that all of the ecological factors influencing planktonic ciliate distributions, water temperature and concentration of O₂ play the important roles^[1]. From a point of the view, here, the relationships between ciliate distributions and water temperatures and O₂ contents in

Höllerersee will be approached emphatically, and the diversities of environmental in Lake Höllerersee make it possible that the ciliates, with different living styles and patiences to limnological factors, can live in the lake.

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奥地利 Höllerersee湖的纤毛虫生态学研究

I. 种类组成

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摘 要 作为奥地利一小型富营养化的深水湖泊 Höllerersee湖的纤毛虫生态学研究的一部分内容, 本文报道了生存在该湖泊中的浮游纤毛虫种类组成. 共发现隶属于 2个亚门、4个总纲、8纲、19目、48属的 61种纤毛虫. 文中就纤毛虫种类组成的特点与水环境的关系进行了初步探讨.

关键词 纤毛虫, 种类组成, Höllerersee 湖

分类号 Q 179.1

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