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INVESTIGATION OF FISH PARASITES AS AN IMPORTANT SOURCE OF INFORMATION ABOUT THE BIOTOP OF THE FISHES*.

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Summary: In summer 1978, a total of 66 fish specimens were examined parasitologically which were rainbow trout, brown trout and chub.

Totally 16 species of parasites were found. The dependence of the different parasite species on the biotop of their hosts were discussed.

Özet: Balıkların yaşadığı alanların (biyotop) özellikleri açısından balık parazitleri üzerinde incelemeler.

1978 yılının yazında Yukarı Avusturya bölgesindeki farklı su ünitelerinde (göl, gölet, kanal, çay) bulunan bazı balık türleri üzerinde parazitolojik incelemeler yapılmıştır. Bu balık türleri: Gökkuşuğu alası (*Salmo gairdneri* Richardson, 1836), dere alası (*Salmo trutta formo fario* LINNE, 1758), göl alası (*Salmo trutta formo lacustris* LINNE, 1758) ve tatlı su kefalı (*Leuciscus cephalus* LINNE, 1758) dir.

Toplam 66 balık açılmış, 16 parazit türü saptanmıştır. Bazı parazit invazyonlarının, bu balık türlerinin, yaşadığı ortama-biyotop alanına-bağlı olduğu görülmü, ve bu parazitlerin konak,ının yaşadığı alanın (biyotop) özelliklerini belirtebileceği üzerined tartışmalar yapılmıştır.

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Introduction

Parasitisation was represented among the three fish species in this survey. These three fish species, chub, rainbow trout and brown trout (lake and river form) have a wide ecological range which reflects on the parasite fauna of fishes.

Brown trout (*Salmo trutta forma fario* LINNE, 1758) occurs in rivers, brooks and streams with steep gradients and rapid-inconstant currents. Stream bed is rocky and sandy. The width and depth are variable, often quite shallow. The waters are cool, oligotrophic and saturated with oxygen (trout zones). Macroinvertebrate fauna of the trout zones are Ephemeroptera, Coleoptera, Trichoptera, Diptera, Mollusca, Hirudinea and Nematoda (21).

Rainbow trout (*Salmo gairdneri* Richardson, 1836) also occurs in clear rivers and stream, particularly near the outlets of lakes and below waterfalls or the rapids (trout zones). Adult rainbow trouts feed mainly on aquatic insects larvae (black flies), Molluscs, Crustaceans and occasionally small fishes (14, 21).

Brown trout can tolerate the water quality II-III and rainbow trout can tolerate the water quality up to III. Generally rainbow trouts are more resistant to a variety of environmental stress and organic pollution than brown trout (20).

Chub (*Leuciscus cephalus* LINNE, 1758) lives in lakes and in low land river systems (barbel zone). The characteristic features of this zone: Volume of the water is high, reduced current, wide temperature range and relatively low oxygen conditions and deposition of silt on the river bed. Mainly macroinvertebrate fauna of this region are Ephemera (Mayfly), Oligochaeta worms, Molluscs, Crustaceans (21).

Chub feeds mainly on invertebrate food which is taken from the substrate. Generally chub is adaptable in its feeding habits. They have a wide range concerning food items but vegetable materials and aquatic insect larvae are predominant. Composition of the food of chub changes with age and season. Young chub prefers plants

and insect larvae (Trichoptera) and aerial insects. Older chub consumes less vegetation and more fish, frogs and crayfish (7, 15). They can tolerate the water quality III (20).

Materials And Methods

Fish specimens were collected from different places in the Upper and Lower Austria by electrofisher. Fish from Almsee and Mondsee were caught by angling.

MONDSEE is an eutrophic lake in the pre-alpine area of the Upper Austria (Altitude: 481 m.; surface area: 14.21 km²; maximum depth: 68 m.). Fish fauna consists mainly of cyprinids and salmonids. The main macroinvertebrate fauna of Mondsee are Amphipods (*Gammarus* sp., *Asellus* sp.) Oligochaeta, Trichoptera, *Psidium* sp., *Planorbis* sp.) (9, 12).

ALMSEE is a small lake in the Upper Austria (Altitude: 589 m.; surface area: 0,7 km²; maximum depth: 5-6 m.). Almsee is not a lake in the limnological meaning of word. There is no stratification and the water body changes about every three days. This lake is oligotrophic with water quality I. The fish fauna of this lake consist mainly salmonids (18).

SCHARFLINGER BACH has a slowly running water. The water discharge is about 3-4 l/sec minimum and 200 l/sec maximum. Water quality is I-II. This brook has a high food capacity such as amphipods and insect larvae (mainly Trichoptera). Salmonids lives in the middle part and cyprinids (mainly chub) especially in the lower part of this brook (18).

INNACH is a tributary of the Danube in the Upper Austria. The water is rather polluted with domestic sewage. Water quality ranges between II-III. The fish fauna of this river are mainly cyprinids, although we found two brown trouts (*Salmo trutta* forma *lacustris*) in our catching period. These two fish came obviously from the backwater of the power plant OTTENSHEIM on the Danube which is stocked with this species. All examined fish were caught in the lower part of Innach (within 500 m. from the mouth

of the Danube). The macroinvertebrate fauna of this river consists mainly of *Gammarus* sp., Ephemeroptera and Trichoptera (18).

TRAISENWERKSKANAL is an old mill stream in the lower Austria. It is polluted with domestic sewage and industrial waste water. Water quality is II-III. It has a high food capacity for trout. The macroinvertebrate fauna of this river is composed mainly of *Gammarus* sp. and Trichoptera larvae (18).

WANGAUAR ACHE is a small river in the Upper Austria, quite shallow and runs into the Mondsee. Water quality is I-II. The fish production is rather high. The macroinvertebrate fauna is composed mainly of *Gammarus* sp., Ephemeroptera, Trichoptera, *Bithynia* and *Leptocerus* sp. (3). The fish fauna of this brook consists mainly of trout and *Cottus gobio*. Chub is found in the lower part of this brook (18). They were caught about 50-100 meters far from the Mondsee.

First, all fishes were controlled for external parasites. At the same time skin-scraping was examined microscopically. Internal organs and gills were removed and put in 0.75 % NaCl solution separately. They were examined under the binocular microscope as a fresh material.

The stomach contents were analysed at several levels magnification and food items present were identified.

For identification of parasites species the following techniques were used:

Octomitus, *Ichthyophthirius*, *Gyrodactylus* sp., *Dactylogyrus* sp. were identified in native preparation. *Acanthocephala*, *Nematoda* and *Argulus* were transferred to glycerine-alcohol.

Myxobolus spores were stained in Lugol solution.

Representative specimens of the Digenea, Cestoda and *Acanthocephala* were stained (Digenea and *Acanthocephala* in GRENACHER'S borax carmine, Cestodes in alanin carmine) and mounted in Canada balsam.

Result An Discussion

The results have been summarized in following table. Totally 16 parasite species were identified* and recorded.

Table 1. List of the parasites and their location

Parasites Name	Host	Location
PROTOZOA		
<i>Myxobolus mulleri</i>	Chub	Wanguar Ache, Scharflinger, Bach, Mondsee
<i>Ichthyophthirius multifiliis</i>	Chub	Mondsee
<i>Octomitus truttae</i>	Chub	Almsee
MONOGENEA		
<i>Dactylogyrus</i> sp.	Chub	Innbach, Mondsee, Wanguar Ache
<i>Gyrodactylus</i> sp.	Brown trout	Almsee
DIGENEA		
<i>Crepidostomum farionis</i>	Brown trout Rainbow trout	Almsee, Scharflinger Bach
<i>Allocreadium isoporum</i>	Chub	Wanguar Ache, Mondsee
CESTODA		
<i>Proteocephalus neglectus</i>	Brown trout	Almsee
<i>Proteocephalus torulosus</i>	Chub	Wanguar Ache
<i>Caryophyllaeus brachycollis</i>	Chub	Innbach, Wanguar Ache
NEMATODA		
<i>Cystidicola farionis</i>	Chub, Brown trout Rainbow trout	Mondsee, Almsee Traisenwerkskanal
ACANTHOCEPHALA		
<i>Neoechinorhynchus rutili</i>	Chub, Brown trout	Wanguar Ache, Almsee
<i>Metechinorhynchus truttae</i>	Rainbow trout Brown trout	Traisenwerkskanal, Scharflinger Bach, Mondsee
<i>Pomphorhynchus laevis</i>	Chub, Rainbow trout, Brown trout	Innbach, Traisenwerkskanal, Wanguar Ache
<i>Acanthocephalus anguillae</i>	Chub	Innbach
CRUSTACEA		
<i>Argulus coregoni</i>	<i>Idus melanotus</i>	Innbach

* Identification of parasite species were carried out by Dr. Manfred Rydlo. Federal Institute of water Research Program and Fisheries, Austria.

Some classes of parasites such as Flagellata, Ciliate, most Sporozoa, Monogenea and Crustacea have a direct development without intermediate host (14). They show no dependence on the food composition of their host.

The parasite species of the class Digenea, Cestoda Nematoda and Acanthocephala have one or two intermediate hosts within their life cycle (1, 4). Therefore the occurrence of these parasites shows dependence on the invertebrate fauna within the host biotop.

Thus the occurrence and degree of the infestation with these parasite species can serve as an auxiliary indicator of the host's biology.

The incidence of *Crepidostomum farionis* in brown trout and rainbow trout shows some indications of the host biotop.

In our study this parasite was found only in clear and oligotrophic water bodies such as Almsee and Scharflinger Bach. The intermediate hosts of this parasite are molluscs (*Pisidium amnium*, *Sphaerium corneum*) and amphipods (*Gammarus pulex*). First intermediate hosts, molluscs occurs in the trout and grayling reagon (4, 21). They can tolerate water quality II and III (20). The second intermediate host, *G. pulex* is the common species in streams, lakes occasionally in subterranean habitats. Its distribution extends to mountain streams. It can tolerate water quality I to III (20).

Thus the great intensity of infestation with *Crepidostomum farionis* in brown trout and rainbown trout showed the importance of *G. pulex* as a food item in Almsee and Scharflinger Bach.

On the other hand the stomach content of fishes from Scharflinger Bach consisted mainly of *Gammarus* sp., Insects, Oligochaetes, *Gordius* and snails. The examined fish from Almsee had empty stomach. Because they had to be kept in the channel after catching in two days.

Margolis (16) also informed that the incidence of *Crepidostomum farionis* in young sockeye salmon indicates uptake of benthic organisms by young sockeye salmon.

According to Scott (19) the incidence of trematode (*Derogones varicus*) parasites of American plaice (flat fish) has increased due to change of diet within the host's lifetime.

In our study, *Pomphorhynchus laevis* and *Metechinorhynchus truttae* were found in chub, brown trout and rainbow trout from different localities. The intermediate host of these parasites is *G. pulex* (4). Therefore, the occurence of these parasites showed dependence on the *G. pulex* within the host biotop.

Hine and Kennedy (8) informed that dispersion of *P. laevis* within the fish population was related to host feeding behaviour (higher rate of infestation in older fish).

Allocreadium isoporum was found in the chub which lives in lakes and slowly running water (outlet to the Mondsee). The intermediate host of this parasite is mollusc (*Sphaerium* sp.) and mayfly larvae (*Ephemera*) (17). Mayfly larvae, living along the shores of

lakes and in stream (sandy and silted bottom) are the food items of the chub (11). More like that *A. isoporum* may show also seasonality incidence depending on mayfly larvae.

The infestation of *Proteocephalus torulosus* in chub from Wangauar Ache (running water) indicated that the host had spent at least a part of its life in Mondsec since the intermediate host, copepod (*Diaptomus castor*, *Cyclops strenuus*, *Cyclops serrulatus*) is restricted to a lake biotop (10, 17).

Margolis, (16) informs that *Proteocephalus* sp. occurs commonly in sockeye salmon. These parasitological characteristics reflect the importance of planktonic copepods in the diet of young sockeye salmon during their lake residence since these parasites utilize cyclopoid and diaptomid copepods as intermediate host.

In our study, *Caryophyllaeus brachycollis* was found only in chub from Innbach and Wangauar Ache. The intermediate host, oligochaeta (*Limnodrilus hoffmeisteri*) is the common species and abundant in freshwater, but often in polluted water together with *Tubifex tubifex* (2). It can tolerate water quality III to IV (20).

Thus this parasite was found Innbach which is rather polluted by domestic sewage. Water quality ranges between II to III. Stomach content of fishes from Wangauar Ache and Innbach consisted mainly rest of the aquatic earthworms, insect larvae (Ephemera, Trichoptera) and water plants.

Cystidicola farionis is rather ubiquitous due to a great ecological range of its intermediate host which is *G. pulex*.

N. rutili was found in brown trout from Almsee and in chub from Wangauar Ache. The intermediate host of this parasite is the larvae of *Sialis* sp. (17). The *Sialis* sp. larvae lives in littoral, sublittoral and sometimes in the profundal zones of lakes, ponds, sluggish streams and rivers where silt is abundant (5). It can tolerate water quality II to III (20). Therefore this parasite mainly were found in fishes from slowly running water bodies with muddy bottom such as Wangauar Ache and Almsee.

Acanthocephalus anguillae was found in chub from Innbach. The intermediate host, *Asellus aquaticus* lives in clear running water and also stagnant polluted water (6, 17), but especially lives abundantly in water quality III such as Innbach.

As a result the occurrence of the most parasites in different fish species showed dependence on the food composition and ecological factors of host biotop.

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