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Preliminary survey of the parasite fauna of some important fish species in the Upper-Reservoir of the Kis-Balaton System

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Abstract: Parasitic infections of a total of 100 specimens of 13 fish species inhabiting the Upper-Reservoir (Hidvégi Lake) of Kis-Balaton were surveyed in the first year of a four-year project. During the survey, which involved five samplings in the season that lasted from spring to autumn, 36 parasites were identified to the species while 14 others to the genus level. The commonest parasite of Kis-Balaton is *Diplostomum spathaceum* s. l. which causes infection of high prevalence but low intensity in many fish species. It is interesting that, despite the abundance of birds acting as definitive hosts, many of the helminth parasites common in Lake Balaton are absent from Kis-Balaton, probably because of the lack of intermediate hosts or due to differences in other ecological factors. Of the parasites found, 45 species are reported for the first time from Kis-Balaton.

Key words: Parasites: Protozoa (Mastigophora, Apicomplexa, Myxozoa, Ciliophora), Platyhelminthes (Monogenea, Cestoda, Trematoda), Nemathelminthes (Nematoda), Annelida (Hirudinea), Mollusca (Bivalvia), Arthropoda (Crustacea), hosts: *Esox lucius, Abramis brama, Alburnus alburnus, Carassius auratus gibelio, Scardinius erythrophthalmus, Blicca bjoerkna, Cyprinus carpio, Rutilus rutilus, Tinca tinca, Silurus glanis, Gymnocephalus cernuus, Perca fluviatilis, Stizostedion lucioperca,* parasite fauna, Kis-Balaton Water Reservoir, Hungary

INTRODUCTION

The Kis-Balaton is a reconstructed wetland and water reservoir whose most important role is to protect and improve, through its filtering and storage functions, the water quality of Lake Balaton, the biggest lake of Central Europe. It is also an important nature conservation and fishing area. Due to its shallow water and partially "cassette-like" structure, this water reservoir is highly sensitive to environmental influences; therefore, factors affecting its biological balance frequently lead to fish mortality. Zoological research of the Kis-Balaton was started several years ago. That research involved a study of fish population structure in the Upper-Reservoir (Hidvégi Lake) which was flooded years ago, and fish-faunistic studies on the Lower-Reservoir (Fenéki Lake) which is still being filled

(Szipola 1987, Csányi 1991, Biró 1994, Keresztessy 1995, Paulovits et al. 1995, Tölg and Biró 1995, Szabó 1996, Csányi et al. 1996, Biró et al. 1996, Tölg et al. 1996, Tátrai et al. 1996). Besides detailed studies on the fish fauna, however, the parasitic infections of fish have not been surveyed systematically. As regards the veterinary examinations of Kis-Balaton fishes, in recent years the specialists of the Central Veterinary Institute have mostly attempted to determine the causes of fish mortality after fish kills (Csaba et al. 1991, Csaba 1996). These studies usually traced back the fish kills, which were mostly limited to the gibel carp population, to oxygen deficiency or bacterial infections. To supply the long felt need for detailed fish-parasitological examinations, in 1996 our team embarked upon a parasitological survey of Kis-Balaton fishes in the framework of a 4-year project supported by the National Research Fund (OTKA) of Hungary. Fish pathology experts of the Central Veterinary Institute also participate in the project primarily by studying bacteriological problems. In the first year of the 4-year project our survey was limited to fish species of the Upper-Reservoir (the so-called Hidvégi Lake), but in subsequent years we plan to extend our studies to the parasites of fishes in the Lower-Reservoir (Fenéki Lake). Although fish-parasitological data are not available for Kis-Balaton, surveys of such type have long been conducted in Lake Balaton whose water system is connected with Kis-Balaton by the Zala River. A detailed list of earlier fish-parasitological research performed by other authors on Lake Balaton fishes can be found in the work published by Molnár and Székely (1995) on the parasite fauna of the major fish species of Lake Balaton in 1994. New studies on the parasite fauna are justified by the massive eel kill that occurred in Lake Balaton in the years 1991–1992 and then in 1995, which Molnár et al. (1991, 1994) attributed to swimbladder damage caused by the introduced nematode parasite *Anguillicola crassus*. Another important disease of hitherto unelucidated aetiology resulted in the pathological emaciation of breams and caused mortality in the bream population of Lake Balaton in 1994.

The primary objective of our fish-parasitological studies of Kis-Balaton was to conduct a monitoring-type survey of the fish population which would enable us to call attention to the possible appearance of pathogenic parasites. Other important goals were to get to know the yet unexplored fish parasite fauna of Kis-Balaton and to look for possible fish-parasitological interactions between Lake Balaton and Kis-Balaton.

MATERIALS AND METHODS

The studies were carried out in the fishing season of 1996 (from 3 April to 20 November). At five sampling times, a total of 100 fish specimens belonging to 13 fish species were collected from the area surrounding the fishing establishment of the Upper-Reservoir of Kis-Balaton (Lake Hidvégi; Fig. 1) and were subjected to complete parasitological examination. The following numbers of the fish species included in our research protocol were dissected: gibel carp (*Carassius auratus gibelio*) 27, bream (*Abramis brama*) 14, common carp (*Cyprinus carpio morpha hungaricus*) 12, rudd (*Scardinius erythrophthalmus*) 10, roach (*Rutilus rutilus*) 8, pike (*Esox lucius*) 6, pikeperch (*Stizostedion lucioperca*) 6, bleak (*Alburnus alburnus*) 4, tench (*Tinca tinca*) 4, perch (*Perca fluviatilis*) 3, European catfish (*Silurus glanis*) 3, white bream (*Blicca bjoerkna*) 2, ruffe (*Gymnocephalus cernuus*) 1. The parasitological findings of these dissections have been recorded. The body length of the fishes examined varied between 7 and 77 cm. Unfortunately, the species composition of fish examined at the different sampling times was not uniform as it dependent on the catch.

The fish were mostly caught with the help of fishermen from the Balaton Fisheries Co. Ltd. or with our own electrofishery equipment from the lake-basin and in the littoral zone. The fish were always transported to the laboratory alive, in aerated cans or polyethylene bags inflated with oxygen. If sampling was performed in the summer, the water used for transporting the fish to the laboratory was cooled with ice. Fish transported to our institute were placed in flow-through type concrete basins and aquaria, and dissected as soon as possible, within a few days of catching. During the dissection, all internal organs (liver, kidney, heart, intestines, swimbladder, gallbladder), the gill filaments, the eyes, the fins and the skin were examined. In many cases when fish of large size were dissected, the parasitological findings were based upon the examination of small pieces taken from the individual organs. The examinations included dissection under stereomicroscope and light-microscopic protozoological examination. The parasite species found and the intensity of infection were recorded separately for each fish. Instead of the detailed tables, however, only a host–parasite list is presented in this paper.

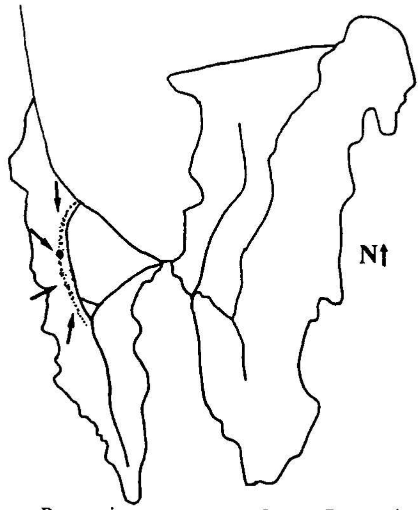

Fig. 1. Sampling sites of the fish-parasitological survey conducted in the Upper-Reservoir of the Kis-Balaton Water Protection System in 1996

RESULTS

The taxonomic classification and hosts of the parasites recorded during the dissections are shown in parasite–host list.

Parasite-host relationships

PROTOZOA

Mastigophora

Kinetoplastidea

TRYPANOSOMATIDAE

Trypanosoma danilewskyi Laveran et Mesnil, 1904 — *Abramis brama, Carassius auratus gibelio, Cyprinus carpio*

Apicomplexa

Coccidia

EIMERIIDAE

Goussia cylindrospora (Stankovitch, 1921) — *Alburnus alburnus*

Goussia carpelli (Leger et Stankovitch, 1921) — *Cyprinus carpio, Carassius auratus gibelio*
Goussia pannonica Molnár, 1989 — *Abramis brama*
Goussia leucisci (Schulman et Zaika, 1964) — *Abramis brama, Carassius auratus gibelio*
Goussia spp. — *Alburnus alburnus, Carassius auratus gibelio, Scardinius erythrophthalmus*

Myxozoa

Myxosporea

SPHAEROSPORIDAE

Sphaerospora spp. — *Alburnus alburnus, Rutilus rutilus*
Hoferellus carassii Achmerov, 1960 — *Carassius auratus gibelio*
Myxidium spp. — *Esox lucius, Scardinius erythrophthalmus*

MYXOBOLIDAE

Myxobolus anurum (Cohn, 1895) — *Esox lucius*
Myxobolus bramae Reuss, 1906 — *Abramis brama*
Myxobolus cyprini Doflein, 1898 — *Cyprinus carpio*
Myxobolus dispar Thélohan, 1895 — *Cyprinus carpio*
Myxobolus pseudodispar Gorbunova, 1936 — *Rutilus rutilus, Scardinius erythrophthalmus*
Myxobolus spp. — *Alburnus alburnus, Rutilus rutilus, Scardinius erythrophthalmus*
Henneguya oviperda (Cohn, 1895) — *Esox lucius*

Ciliophora

Kinetophragminophorea

TRICHOPHRYIDAE

Trichophrya sp. — *Scardinius erythrophthalmus*

Oligohymenophorea

ICHTHYOPHTHIRIIDAE

Ichthyophthirius multifiliis Fouquet, 1876 — *Alburnus alburnus, Blicca bjoerkna, Rutilus rutilus, Scardinius erythrophthalmus*

TRICHODINIDAE

Trichodina sp. — *Stizostedion lucioperca*

Miscellaneous organisms

Mucophilus sp. — Scardinius erythrophthalmus

METAZOA

Platyhelminthes

Monogenea

DACTYLOGYRIDAE

Dactylogyrus auriculatus (Nordmann, 1832) — *Abramis brama*
Dactylogyrus crucifer Wagener, 1857 — *Rutilus rutilus*
Dactylogyrus vistulae Prost, 1957 — *Rutilus rutilus*
Dactylogyrus extensus Mueller et van Cleave, 1932 — *Cyprinus carpio*
Dactylogyrus spp. — *Abramis brama, Carassius auratus gibelio*
Tetraonchus monenteron (Wagener, 1857) — *Esox lucius*

GYRODACTYLIDAE

Gyrodactylus spp. — *Cyprinus carpio, Tinca tinca*

DIPLOZOIDAE

Diplozoon paradoxum Nordmann, 1932 — *Abramis brama*
Diplozoon scardinii Komarova, 1966 — *Scardinius erythrophthalmus*
Paradiplozoon homoion (Bychowsky et Nagibina, 1959) — *Blicca bjoerkna, Rutilus rutilus*
Eudiplozoon nipponicum (Goto, 1891) — *Cyprinus carpio*

Cestoda

LITOCESTIDAE

Khawia sp. — *Rutilus rutilus*

PROTEOCEPHALIDAE

Proteocephalus cernuae (Gmelin, 1790) — *Gymnocephalus cernuus*
Proteocephalus percae (Müller, 1780) — *Stizostedion lucioperca*
Proteocephalus torulosus (Batsch, 1786) — *Alburnus alburnus*

Trematoda

ECHINOSTOMATIDAE

Echinostomum sp. — *Scardinius erythrophthalmus*

DIPLOSTOMIDAE

Diplostomum spathaceum s.l. (Rudolphi, 1819) (l.) — *Alburnus alburnus, Abramis brama, Blicca bjoerkna, Carassius auratus gibelio, Cyprinus carpio, Gymnocephalus cernuus, Rutilus rutilus, Scardinius erythrophthalmus*
Posthodiplostomum cuticola (Nordmann, 1832) — *Scardinius erythrophthalmus*
Tylodelphis clavata (Nordmann, 1832) — *Rutilus rutilus, Gymnocephalus cernuus, Perca fluviatilis*

STRIGEIDAE

Ichthyocotylurus spp. — *Scardinius erythrophthalmus, Stizostedion lucioperca*

Nemathelminthes

Nematoda

SKRJABILLANIDAE

Skrjabillanus scardinii Molnár, 1966 — *Scardinius erythrophthalmus*
Skrjabillanus tincae Shigin et Shigina, 1958 — *Tinca tinca*
Skrjabillanus cyprini Molnár et Moravec, 1997 — *Cyprinus carpio*
Molnaria intestinalis (Dogiel et Bychowsky, 1934) — *Scardinius erythrophthalmus*
Skrjabillanida sp. — Stizostedion lucioperca

Philometriadae

Philometroides sanguinea (Rudolphi, 1819) — *Carassius auratus gibelio*

Annelida

Hirudinea

PISCICOLIDAE

Piscicola geometra (Linnaeus, 1761) — *Esox lucius*

Mollusca

Bivalvia

UNIONIDAE

Anodonta sp. *(l.)* — *Scardinius erythrophthalmus, Perca fluviatilis*

Arthropoda

Crustacea

ERGASILIDAE

Ergasilus sieboldi Nordmann, 1832 — *Esox lucius*

ARGULIDAE

Argulus foliaceus (Linnaeus, 1758) — *Abramis brama, Alburnus alburnus, Cyprinus carpio, Scardinius erythrophthalmus, Stizostedion lucioperca, Tinca tinca*

Only large, several years old specimens of the gibel carp (*Carassius auratus gibelio*) could be examined and were found to have low-level parasitic infection. A total of 3 metazoan and 5 protozoan species were recorded. Of the metazoan parasites, the monogenean *Dactylogyrus* species were detected only in samples taken in the spring, while *Philometroides sanguinea,* a nematode whose adult forms parasitise the fin rays, occurred only in samples taken in the autumn. The metacercariae of *Diplostomum spathaceum* could be found in the eye lens throughout the year and caused an infection of low prevalence and intensity. The protozoan parasites *Hoferellus carassii* and *Goussia carpelli* proved to be very common at all sampling times, but caused more intensive infection in fish examined in the autumn than in those dissected in the spring.

In the bream (*Abramis brama*) 4 protozoan and 5 metazoan parasite species were detected. Protozoans, which caused infections of low prevalence and intensity, were represented by *Ichthyophthirius multifiliis, Trypanosoma danilewskyi, Goussia pannonica,* and *Myxobolus bramae.* Monogeneans (*Dactylogyrus* spp. and *Diplozoon paradoxum*) proved to be the commonest metazoan parasites, while carp lice (*Argulus foliaceus*) and glochidia (*Anodonta* sp.) were found on a few fish only. All breams in the catch were of large size and extremely good body condition. We could not catch small-sized breams at the samplings performed.

All specimens of common carp (*Cyprinus carpio morpha hungaricus*) in the catch were wild carp of large body size, having a body length of 42 to 70 cm. As with the bream, no small-sized wild carp could be caught. The common carp was also characterised by a parasite fauna consisting of a few species only: a total of 5 protozoan and 7 metazoan species were recorded. The protozoans *Trypanosoma danilewsky, Ichthyophthirius multifiliis, Goussia carpelli, Myxobolus cyprini,* and *Myxobolus dispar* caused infections of low prevalence and intensity. The most prevalent metazoan was the eye lens parasite *Diplostomum spathaceum,* while the most intensive infection was caused by the nematode *Skrjabillanus* sp. which, however, was detected from the skin of a few common carp only. In addition to the above species, the monogeneans *Dactylogyrus extensus* and *Eudiplozoon nipponicum,* a *Gyrodactylus* species parasitising the epithelium, and carp lice (*Argulus foliaceus*) were recorded on the fish examined.

Of the other cyprinid fishes, the rudd (*Scardinius erythrophthalmus*) was examined in the highest numbers and was found to have 7 protozoan and 9 metazoan parasites. In the roach (*Rutilus rutilus*) population of Kis-Balaton 4 protozoan and 6 metazoan species were detected. Six protozoan and 3 metazoan parasite species were recorded from the bleak (*Alburnus alburnus*), 2 protozoan and 2 metazoan species from the white bream (*Blicca bjoerkna*), and only 3 metazoan species from the tench (*Tinca tinca*).

With the exception of a single specimen, the pikeperch (*Stizostedion lucioperca*) specimens included in the sample represented the first-summer age group. Of the two protozoan parasites found in pikeperch, the gill-parasitic *Trichodina* sp. not identified to the species level may be much more common than it appears from the data, as these ectoparasites disappeared from the fish already after a short time spent in aquarium. Five metazoan parasite species were detected in Kis-Balaton pikeperch: the most prevalent of these were *Thylodelphys clavata* and *Diplostomum spathaceum* detected from the eye.

In the perch (*Perca fluviatilis*) we found 1 protozoan and 2 metazoan parasites, while in the single specimen of ruffe (*Gymnocephalus cernuus*) that we examined 3 metazoan parasites were found.

The parasitological dissection of pikes (*Esox lucius*) revealed the presence of 5 protozoan and 3 metazoan parasite species which caused an infection of low prevalence and intensity in the fish examined.

One out of the three European catfish (*Silurus glanis*) specimens examined was negative for parasites while the other two were found to have only a single parasite species, *Diplostomum spathaceum*.

DISCUSSION

As a previously drained wetland which has recently been reconstructed, in the biological sense Kis-Balaton rates as a rather variable habitat having an unsettled limnofauna and, therefore, experiencing continuous changes in the structure, feeding conditions and health status of its animal species including fish. These changes often manifest themselves in the massive growth and subsequent reduction of the population of a given fish species. Therefore, systematic animal health monitoring of the area is essential. Survey of the parasite fauna constitutes an important component of that monitoring. Earlier, studies of this type were conducted by Soviet authors (Akhmerov and Bogdanova 1957, Kamenski and Ponomareva 1964, Bogdanova and Nikolskaya 1965, Iskov and Koval 1965, Komarova 1972, Iskov 1975, Iziumova et al. 1982) who surveyed the parasite fauna of fish in different reaches of rivers before the establishment of water reservoirs and then continuously monitored changes of the parasite fauna in those reservoirs. Similar surveys have also been performed by Hanek and Molnár (1974) on fishes of a new water reservoir naturally created on the Matamek River by a landslide. Our present survey also deals with such a situation, as in the case of Kis-Balaton one part of the water reservoir has already been populated with fish while the other part is currently being filled. A sound parasitological survey would require the processing of large numbers of fish species and specimens, and should include all species of fish parasites. In the course of this study, however, the processing of a sufficiently large sample size was not possible; nor was there an opportunity for the in-depth study of some parasite species difficult to identify. Therefore, many parasites have been identified to the genus level only. This especially applies to the mostly specific representatives of myxosporeans and monogeneans. It is obvious that besides *Dactylogyrus auriculatus*, the species found to be the most prevalent in the samples, at least four other

Dactylogyrus species may have occurred on the gills of bream; however, within the scope of this work it was simply impossible for us to collect and identify these parasites one by one from the gills which were sometimes infested by as many as several hundred monogeneans. Similarly, as *Diplostomum spathaceum* is known to be a collective species, parasites assigned to that species can be accepted as representatives of *D. spathaceum* only in the broad sense of the word. As we are aware of the shortcomings arising from the nature of the work performed, we have drawn moderate conclusions despite the large quantity of data obtained.

Comparing the results of this study with those of a previous survey conducted by us on the parasite fauna of Lake Balaton fishes (Molnár and Székely 1995), it can be established that Kis-Balaton has a much less abundant fish parasite fauna than Lake Balaton, which can obviously be explained by the unsettled host–parasite and parasite–intermediate host relations. Kis-Balaton lacks some helminth species commonly occurring in Lake Balaton (e.g. *Paradilepis scolecina*), whose definitive hosts, cormorant, can be found in large numbers on the Kis-Balaton. The excellent general condition of the fish, probably resulting from the outstanding natural fish-food producing capacity of the new water space, may also contribute to the low level of the parasite fauna. At the same time, the frequent occurrence and high intensity of some parasites such as *Goussia carpelli, G. leucisci* and *Hoferellus carassii* raises the question whether these species play a role in the gibel carp losses recurring every year.

A noteworthy point of interest is the detection of a hitherto undescribed Skrjabillanid-type nematode larva in carp lice parasitic on pikeperch, whose adults have so far been found in the swimbladder of Lake Balaton pikeperch only. Mention should also be made of the new *Skrjabillanus* species detected from the scales of wild carp, whose description is currently in progress.

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Székely, Cs., és Molnár, K.: Előzetes tanulmányok néhány fontos halfaj parazita faunáján a Kis-Balaton I. Ütem Víztározójában

A halak monitoring rendszerű parazitológiai vizsgálata 1996-ban kezdődött a Kis-Balaton felső víztározójánál (Hídvégi-tó). A szerzők 13 halfaj 100 példányából 50 parazita fajt mutattak ki. Ebből 20 Protozoa (1 Mastigophora, 5 Apicomplexa, 10 Myxosporea, 4 Ciliophora) és 30 pedig Metazoa (11 Monogenea, 4 Cestoda, 5 Trematoda, 6 Nematoda, 1 Annelida, 1 Mollusca, 2 Arthropoda) volt. A közölt parazita fajok közül 45 a Kis-Balaton parazita faunájára nézve újnak bizonyult. A leggyakoribb élősködő a *Diplostomum spathaceum* volt, amely alacsony intenzitás mellett sok halfajból előkerült. A madár-paraziták lárvái – annak ellenére, hogy végleges gazdáik nagy számban voltak jelen a vízrendszerben – a halakból még hiányoznak.

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