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Monogenean Parasites on the Gills of Some Fish Species from Lakes Sapanca and Durusu, Turkey

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Özet: ***Sapanca ve Durusu Göllerindeki bazı balık türlerinin solungaçlarındaki Monogenean parazitler.*** Sapanca ve Durusu göllerindeki 11 balık türü; *Silurus glanis*, *Esox lucius, Rutilus rutilus, Vimba vimba, Scardinius erythrophthalmus, Abramis brama, Tinca tinca, Cyprinus carpio, Rhodeus sericeus amarus, Chalcalburnus chalcoides, Rutilus frisii*'den Monogenean parazitler çalışıldı. *Dactylogyrus*, *Silurodiscoides, Tetraonchus* ve *Paradiplozoon* genuslarına ait 19 monogenoid türü; *Dactylogyrus sphyrna, D. vistulae, D. phoxini, D. difformis, D. difformoides, D. chalcalburni, D. bicornis D. nybelini, D. frisii, D. crucifer, D. cornu, D.cornoides, D. extensus, D. macracanthus, D. izjumovae, Silurodiscoides siluri, S.vistulensis, Tetraonchus monenteron* ve *Paradiplozoon* sp. bulundu. *D.bicornis, D.nybelini* ve *D.izjumovae* Türkiye için yeni kayıtlardır.

Anahtar Kelimeler: Balık Monogenoidea, parazit, Sapanca Gölü, Durusu Gölü.

Abstract: Monogenean parasites from 11 fish species *Silurus glanis*, *Esox lucius, Rutilus rutilus, Vimba vimba, Scardinius erythrophthalmus, Abramis brama, Tinca tinca, Cyprinus carpio, Rhodeus sericeus amarus, Chalcalburnus chalcoides, Rutilus frisii* were examined, from Lakes Sapanca and Durusu, Turkey. Nineteen monogenoid species were found, belonging to four genera; *Dactylogyrus*, *Silurodiscoides, Tetraonchus* and *Paradiplozoon*. These are: *Dactylogyrus sphyrna, D. vistulae, D. phoxini, D. difformis, D. difformoides, D. chalcalburni, D. bicornis D. nybelini, D. frisii, D. crucifer, D. cornu, D.cornoides, D. extensus, D. macracanthus, D. izjumovae, Silurodiscoides siluri, S. vistulensis, Tetraonchus monenteron* and *Paradiplozoon* sp. *D. bicornis, D. nybelini* and *D. izjumovae* are new records for Turkey.

Key Words: Fish, Monogenoidea, parasite, Lake Sapanca, Lake Durusu.

Introduction

Monogenoidea parasitize the gills, skin and fins of marine and freshwater fish may cause economic losses in fish farms when present in overwhelming numbers. Fish harbouring monogenoids may show necrosis on gills, which facilitates secondary infection of bacteria, fungi and protozoa.

There is a published list of over 900 nominal species of *Dactylogyrus* (Gibson *et al*., 1996). The majority of species have been described from Europe, former USSR and USA. A total of 180 monogenoid parasites have been reported from Canadian freshwater fish (McDonald and Margolis, 1995). In the Czech and Slovak Republics 178 species of monogenoid parasites were identified (Moravec, 2001). Furthermore, the total number of representatives of the class Monogenoidea reported for Bulgaria is 107 (Nedeva and Babacheva, 1999). There are 236 fish species and subspecies which belong to 26 families in inland water of Turkey (Kuru, 2004). Despite the wide diversity of fish life in Turkey, about 70 species of monogenoids have been identified up to now, but there has been increased interest in monogenoids of Turkish freshwater fish. In this study, a survey of monogeneans from 11 fish species from Sapanca and Durusu lakes in Turkey was conducted.

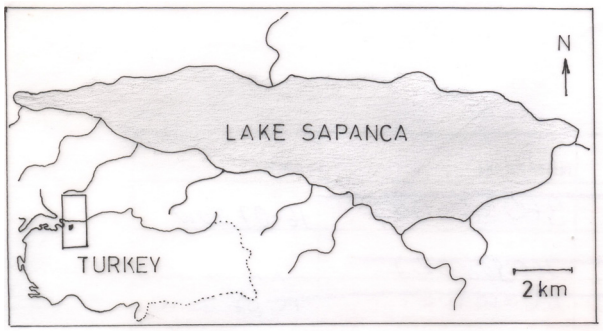

Figure 1. Map of Lake Sapanca

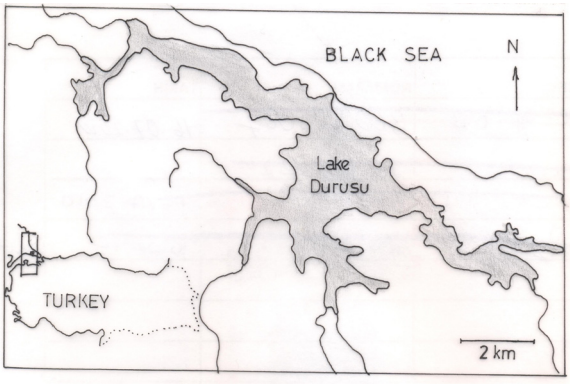

Figure 2. Map of Lake Durusu

Materials and Methods

Lake Sapanca is 16 km in length by 6 km in width and has a surface area of 60 km^2 (Figure 1). The maximum depth is 52 m and average depth 28. 5 m. There are eight small rivers running into the lake and one small river discharging water from the lake. A thermocline is formed between 7 to 20m depth during June to early November (Worthmann *et al*, 1985; Soylu, 1986).

Lake Durusu is 12 km in length by 5 km in width and has a surface area of 25 km^2 (Figure 2). The average depth of the lake is 3.40 m (Soylu *et al*., 1996). Lake Durusu used to be a lagoon until it was disconnected from the Black Sea in order to supply water to İstanbul. Disconnection of the lake was by installing a regulator at the point where the lake meets the Black Sea; after this installation, the water level of the lake rose to +4.5 m above sea level (Gümüş, 1992; Güher, 2001).

Fish were caught by fishermen from both lakes, between May 2003 to June 2005. Thirty four *Silurus glanis*, 45 *Esox lucius*, 123 *Rutilus rutilus*, 28 *Vimba vimba*, 203 *Scardinius erythrophthalmus*, 78 *Abramis brama*, 178 *Tinca tinca*, 51 *Cyprinus carpio*, 155 *Rhodeus sericeus amarus*, 130 *Chalcalburnus chalcoides* and 36 *Rutilus frisii* were examined.

Live fish were brought directly to the laboratory. Each fish was killed by severing the spinal cord just before examination and the gills were excised and observed with a stereomicroscope. Parasites were removed , flattened and mounted in ammonium picrate-glycerin (Bylund *et al*., 1980; Fernando *et al*., 1972). Glycerin-gelatine and lactophenol were also used to prepare slides. Slides were studied with a Nikon Diaphot 300 microscope and the photographs of specimen taken by Sony CCD Iris Color Video Camera line. Drawings of the specimens were made from computer screen. Fish species were identified according to Berg (1949) and Geldiay and Balık (1988).The parasite species were identified on the basis of sclerotised parts according to Bykhovskaya-Pavlovskaya *et al*., (1962); Gussev, (1985); Markevic,(1951) and Khotenovsky,(1985).

Results and Discussion

A total of 19 monogenoid species belonged to Genus *Dactylogyrus*, *Silurodiscoides Tetraonchus* and *Paradiplozoon* were identified on the gills of 11 fish species from Lakes Sapanca and Durusu. These monogeneans are as follows; *Dactylogyrus sphyrna, D. vistulae, D. phoxini, D. difformis, D. difformoides, D. chalcalburni, D. bicornis D. nybelini, D. frisii, D. crucifer, D. cornu, D.cornoides, D. extensus, D. macracanthus, D. izjumovae, Silurodiscoides siluri, S. vistulensis, Tetraonchus monenteron* and *Paradiplozoon* sp. All the monogenoid parasites are given in Table, chitineous parts of the haptors and the copulatory organs of the monogeneans are shown in the figures 3-5.

There are 21 species of fish in Lake Sapanca (Okgerman *et al*., 2006) and 29 fish species in Lake Durusu (Özuluğ, 2003). In the present study the monogenean fauna of eight fish species from Lake Sapanca and nine fish species from Lake Durusu were studied of which *Scardinius erythrophthalmus, Cyprinus carpio, Rhodeus sericeus amarus, Tinca tinca, Silurus glanis* and *Esox lucius* were studied from both lakes. *Vimba vimba* and *Rutilus rutilus* were studied only from Lake Sapanca. *Abramis brama, Chalcalburnus chalcoides* and *Rutilus frisii* were investigated only from Lake Durusu (Table 1).

Of the nineteen recorded species of monogeneans; *Dactylogyrus bicornis, D.nybelini* and *D. izjumovae* are new Turkish records. Investigations on the other fish species from both lakes are ongoing.

Table 1. The Monogenean species found in the fish of Lake Sapanca and Lake Durusu.

Parasite species	Specificity	Fish species	Location
Dactylogyrus sphyrna Linstow, 1878	Generalist	*Rutilus rutilus*	Sapanca
		Vimba vimba	Sapanca
		Scardinius erythrophthalmus	Sapanca
		Abramis brama	Durusu
D. vistulae Prost, 1957	Generalist	*Rutilus rutilus*	Sapanca
D. phoxini Malevitskaya, 1949	Specialist	*Cyprinus carpio*	Sapanca
D. difformis Wagener, 1857	Specialist	*Scardinius erythrophthalmus*	Sapanca, Durusu
D.difformoides Glaser and Gussev, 1967	Generalist	*Scardinius erythrophthalmus*	Durusu, Sapanca
D. chalcalburni Dogel and Bychowsky, 1934	Specialist	*Chalcalburnus calcoides*	Durusu
D. bicornis Malevitskaya, 1941	Specialist	*Rhodeus sericeus amarus*	Sapanca, Durusu
D. frisii Bychowsky, 1933	Specialist	*Rutilus frisii*	Durusu
D. crucifer Wagener, 1857	Generalist	*Rutilus rutilus*	Sapanca
D. cornu Linstow, 1878	Generalist	*Vimba vimba*	Sapanca
D.cornoides Glaser and Gussev, 1971	Generalist	*Vimba vimba*	Sapanca
D. extensus Mueller and Van Cleave, 1932	Specialist	*Cyprinus carpio*	Sapanca, Durusu
D. macracanthus Wegener, 1909	Specialist	*Tinca tinca*	Sapanca, Durusu
D. izjumovae Gussev, 1966	Specialist	*Scardinius erythrophthalmus*	Durusu
D. nybelini Markewitsch, 1933	Specialist	*Rutilus frisii*	Durusu
Silurodiscoides siluri (Zandt, 1924)	Specialist	*Silurus glanis*	Sapanca, Durusu
S. vistulensis (Siwak, 1932)	Specialist	*Silurus glanis*	Sapanca, Durusu
Tetraonchus monenteron Diesing, 1858	Specialist	*Esox lucius*	Sapanca, Durusu
Paradiplozoon sp.		*Abramis brama*	Durusu

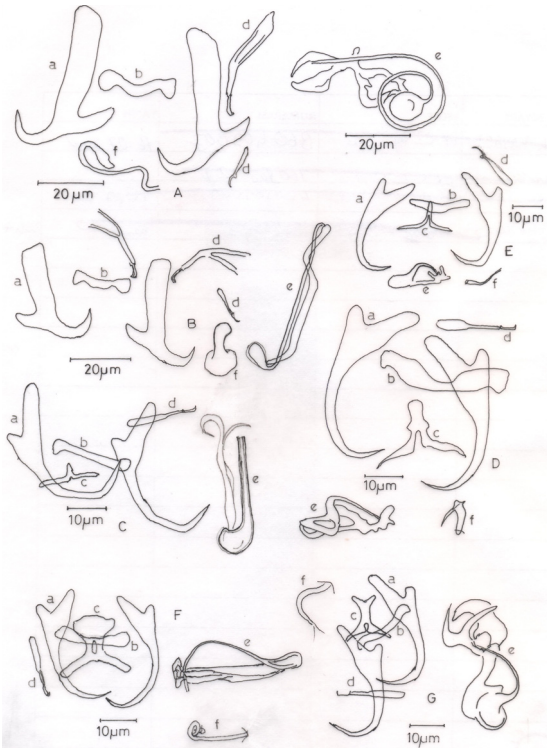

Figure 3. A- *Dactylogyrus sphyrna*, B- *D. vistulae*, C- *D. Phoxini*, D- *D. difformis*,E- *D. difformoides*, F- *D. chalcalburnus*, G- *D. frisii* a- median hook, b- dorsal connecting bar, c- ventral connecting bar, d- marginal hook e- male copulatory organ, f- vaginal armour, g- accessory piece, h- dorsal median hook i- ventral median hook, j- connecting bar of ventral median hook, k- attachment clamp of the diplozoid, l- central hook sticle of the diplozoid, m- egg of the diplozoid.

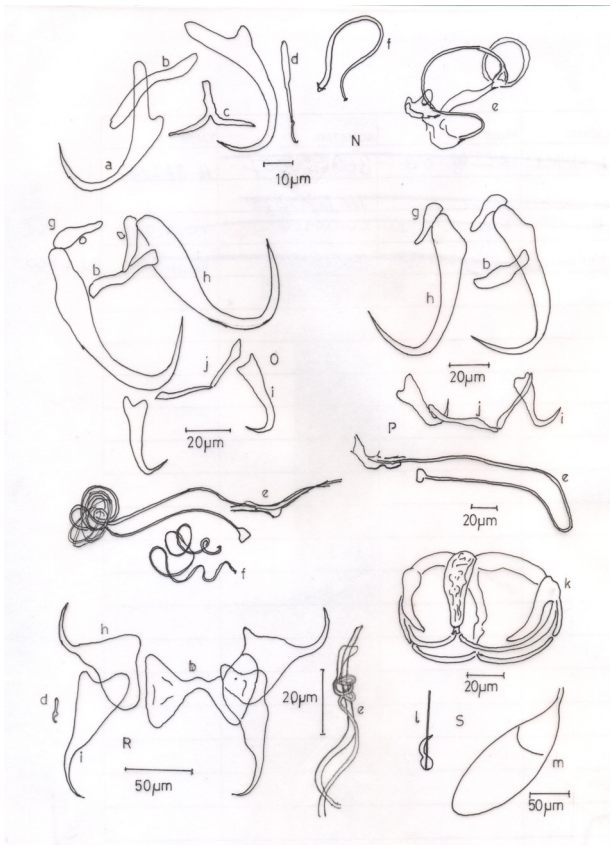

Figure 5. N- *Dactylogyrus izjumovae*, O- *Silurodiscoides vistulensis*, P- *S. siluri*, R- *Tetraonchus monenteron*, S- *Paradiplozoon* sp.

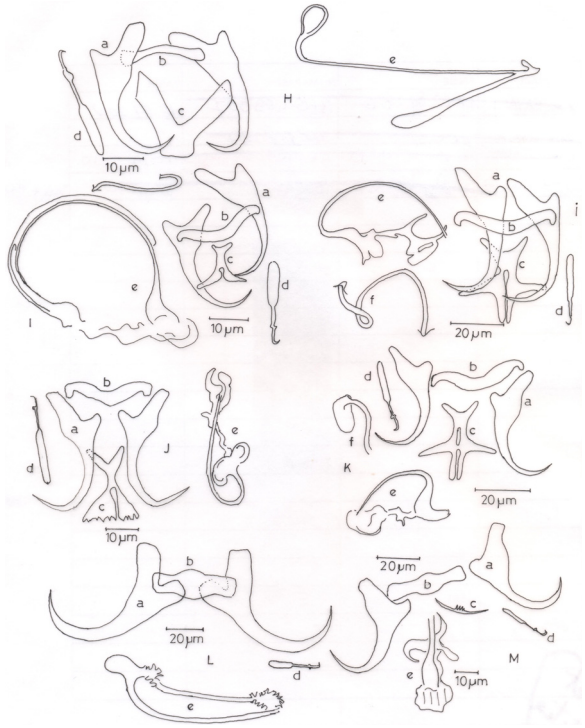

Figure 4. H- *Dactylogyrus bicornis*, I- *D. nybelini*, İ- *D.cornoides*, J- *D. crucifer*, K- *D. cornu*, L- *D. Extensus* , M- *D. macracanthus*.

Monogenoid parasites were considered mainly specialists (Poulin, 1992). In the present study, twelve known specialist monogeneans were recorded. These monogeneans and their hosts are as follows; *Dactylogyrus phoxini* and *D. extensus* from *Cyprinus carpio*; *D. Difformis,D.difformoides* and *D. izjumovae* from *Scardinius erythrophthalmus*; *D. chalcalburni* from *Chalcalburnus chalcoides*; *D. bicornis* from *Rhodeus sericeus amarus*; *D. frisii* and *D. nybelini* from *Rutilus frisii*; *D. macracanthus* from *Tinca tinca*; *Silurodiscoides siluri* and *S. vistulensis* from *Silurus glanis*; *Tetraonchus monenteron* from *Esox lucius*. All these parasites has been recorded previously on the same hosts. (Gusev, 1985; Bychovskaya-Pavlovskaya *et al*, 1962; Markevic, 1951). *C. carpio* were recorded as new host for *D. phoxini* in the present study, this monogenean is known as a specialist for *Phoxinus phoxinus* (Markevic, 1951; Gussev, 1985). Wierzbicka (1974) remarked some *Dactylogyrus* species found on unusual hosts. *P. phoxinus* is present both in the small rivers running into Lake Sapanca and inside the lake (Özuluğ *et al*, 2007). Other recorded monogeneans in the present study are six generalist; *D. sphyrna, D. vistulae, D. difformoides, D. Crucifer, D. Cornu and D.cornoides.* From these parasites*, D. sphyrna* is a generalist (Jarkovsky *et al*, 2003) and found on *Rutilu*s *rutilus, Vimba vimba, S. erythrophthalmus* and *Abramis brama* in the present study. *D.*

vistulae is another generalist, and has been found on *Leuciscus cephalus* and *Chondrostoma nasus* (Gussev, 1985; Galli *et al*, 2002; Stojanovsky et al, 2004). *D. Vistulae* has been recorded from *L. Cephalus*, *C. nasus, Alburnus alburnus, Rutilus piegus, R. rutilus* and *Vimba vimba* (Jarkovsky *et al*, 2003). In the present study *D. vistulae* was found on *R. rutilus*. Both *L. cephalus* and *L. borysthenicus* are present in Lake Sapanca (Geldiay and Balık,1988, Rahe and Worthmann,1986, Worthmann *et al*., 1985). *D. difformoides* is generalist monogenoid and has been recorded on *Abramis bjoerkna* and *S. erythrophthalmus* (Jarkovsky *et al*, 2003). In the present study *D. difformoides* was found on *S. erythrophthalmus* both in Lake Durusu and Sapanca. *D. crucifer* in central Europe is a generalist monogenean, it is found on the gills of *Leuciscus idus, Rutilus rutilus, S. erythrophthalmus* (Simkova *et al*, 2004). *A. alburnus*, *Abramis bjoerkna, Carassius auratus, Leuciscus cephalus, L. idus, R. rutilus, R. pigeus* and *S. erythrophthalmus* has been given fish hosts for *D. crucifer* (Jarkovsky *et al*, 2003). In the present study *D. crucifer* was recorded only on the gills of *R. rutilus*. Another generalist is *D. cornu* and has been found on the gills of *A. ballerus, A. brama, A. bjoerkna, Aspius aspius, L. cephalus, R. rutilus, Vimba vimba* (Markevic,1951., Jarkovsky *et al*, 2003). In the present study *D. cornu* was recorded on *V. vimba* in Lake Sapanca, *D. cornu* has been recorded on *B. bjoerkna* in the same lake (Soylu, 1991). During the present study only one diplozoid was recorded on the gills of *A. brama* and identified as *Paradiplozoon* sp. Lake Sapanca is still in an oligotrophic state, but is slightly evolving towards oligo-mesotrophy (Aykulu *et al*., 2006). Lake Durusu has an eutrophic character according to certain physical parameters and the presence of some important planktonic indicator species (Güher, 2001). Although Lakes Sapanca and Durusu have different characteristics, their monogeneans show similar diversities. In Lake Sapanca 16 monogeneans from eight fish species (2.0 monogenoids for each fish species) and in Lake Durusu, 13 monogeneans from nine fish species (1.4 monogenoids for each fish species) were found. Species richness of monogeneans in the two lakes is similar. Rich parasite communities are formed by specialists and generalists whereas poor communities are composed mainly of generalist parasites (Simkova *et al*, 2001). Results of the present study are in agreement with this study for Lake Sapanca with eight specialists and six generalist monogeneans. But in Lake Durusu, eleven specialists and two generalists were found. The studies in Lake Durusu were performed mainly with large fish species except *Rhodeus sericeus amarus* and *Chalcalburnus chalcoides*. Specialist monogenoids are found preferentially on larger fish (Sasal *et al*., 1999; Simkova *et al*., 2001; Desdevises *et al*., 2002). The high number of specialist monogeneans in Lake Durusu is related to the larger fish studied. In many parasites it is not too easy to determine the specificity. One parasite species could be specific at local level or regional level. For this reason it is very hard exactly classify the specificity of a monogenoid without knowledge's of the diversity of all possible host species. Investigation of other fish species in Lakes Sapanca and Durusu will clarify the exact specificities of their monogeneans.

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