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Distribution of *Ligula intestinalis* (L.) in Turkey

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Abstract

In the present study, besides identifying host fish species and water resources in which it is reported that an important cestode species, *Ligula intestinalis,* exists as endoparasite in fish, inhabiting Turkish waters; our findings are given as new records.

Key words: *Ligula intestinalis*, distribution, host records, Turkey.

Introduction

In Turkey, the biological productivity of lakes and rivers, mostly, is up to the conditions of nature and controlled production of aquaculture products for economic targets has not been realized yet. As well as fishery studies carried out in natural inland water resources, recently artificial water resources, which have provided many benefits, have been installed. Generally, as these systems have fish fauna in their natural structure, new fishery fields for different aims are created thanks to these studies (Innal, 2004). A number of pathogen organisms threatening fish health were discovered in scientific researches that have been started in recent years for the protection of water resources and with the aim of making use of what it presents in the future (Ozturk, 2000; Tekin-Ozan, 2005).

In terms of cestode infections reported in Turkish inland waters, the most common infection is the one that is caused by Ligula. Besides giving a serious harm to fish stocks and reducing the economic value of the fish in aquatic system, it makes a significant reduction in market demand. Ligulids have a complex life cycle involving copepods as the first intermediate host, fish as the second intermediate host and piscivorous birds as the final host. Parasite eggs are deposited via bird faeces into water where hatching eggs release free swimming coracidium larvae. The ciliated coracidium larva will survive 1-2 days in the water and its movement attracts predation by copepods. Development in the copepod produces a procercoid larva, which is infectious to fish, the second intermediate host, after eating the copepod. Within the fish, a large plerocercoid larva develops, which usually remains free within the body cavity of the fish host and grows, swelling the belly of its host and increasing its vulnerability to bird predation (Dejen, 2003).

Materials and Methods

The data, given in this study, were presented by scanning the resources that were discovered thanks to scientific researches carried out in the inland waters of Turkey and published. The new species infected with *Ligula intestinalis* given as new records were observed by authors in the land studies (from 1995 till 2005) which consist of host fish and locations and years. The cestodes were identified according to Chubb *et al.* (1987).

Results

Water sources and fish species observed to have *Ligula intestinalis* infection, are given in Table 1.

L. intestinalis infections observed in the studies that we carried out, are given in Table 2. The distribution of *L. intestinalis* in the inland waters of Turkey is given in the map below (Figure 1).

Discussion

L. intestinalis plerocercoids were reported firstly from inland waters of Turkey by Güralp (1968) in four fish species living in Eğirdir Lake, Hirfanlı, Mamasın, Porsuk and Kesikköprü Dam Lakes. Host fish species were given only Turkish names (Curulya, Beneklikaya, Karagöz, Kepenez). *L. intestinalis* plerocercoids exist in many aquatic systems and these records of infection have increased in recent years. Although *L. intestinalis* infection exists in many fish species, *L. pavlovskii* was found only in *Gobius fluviatilis* that inhabits Manyas Lake by Oztürk (2000). Plerocercoids of *Ligula* sp. caught in Kapulukaya Dam Lake were detected in *Tinca tinca*, (Yıldız, 2003). Host species and their record numbers of *L. intestinalis* are given in Table 3.

Table 1. Records related to *L. intestinalis* in the inland waters of Turkey

Host	Location	Author and Record
Capoeta capoeta umbla	Keban Dam Lake	Cantoray and Ozcan (1975)
Leuciscus cephalus orientalis	Keban Dam Lake	Cantoray and Ozcan (1975)
Barbus plebejus escherichii	Keban Dam Lake	Cantoray and Ozcan (1975)
Acanthobrama marmid	Devegecidi Dam Lake	Başaran and Kelle (1976)
Chalcalburnus mossulensis	Devegecidi Dam Lake	Başaran and Kelle (1976)
Silurus glanis	Sarıyar Dam Lake	Keskin and Erk'akan (1987)
Chondrostoma regium	Keban Dam Lake	Keskin and Erk'akan (1987)
Vimba vimba tenella	Kumkaya- Ankara	Keskin and Erk'akan (1987)
Capoeta capoeta	Demirkopru Dam Lake,	Keskin and Erk'akan (1987)
Alburnus orontis	Kızılırmak Stream, Enne Dam Lake, Kurtboğazı Dam Lake, Kumkaya- Ankara, Osmaneli-Adapazarı, Cayırhan-Ankara Yeniköy- Porsuk	Keskin and Erk'akan (1987)
Leuciscus cephalus	Hamidiye-Eskişehir Pazar-Ankara	Keskin and Erk'akan (1987)
Garra rufa	Cağ-cağ Stream	Keskin and Erk'akan (1987)
Alburnus sp (orontis)	Some aquatic habitats	Burgu *et al.* (1988)
Esox lucius	Some aquatic habitats	Burgu *et al.* (1988)
Tinca tinca	Mogan Lake	Burgu *et al.* (1988)
Vimba vimba tenella	Sarıyar Dam Lake	Ekmekçi (1989)
Alburnus orontis	Almus Dam Lake	Cengizler *et al.* (1991)
Barbus capito pectoralis	Keban Dam Lake	Ozdemir and Sarıeyüboğlu (1993)
Alburnus alburnus	Upper Porsuk Basin	Yılmaz *et al.* (1996)
Silurus glanis	Iznik Lake	Aydoğdu *et al.* (1996)
Tinca tinca	Ankara Region Lakes	Erkul (1997)
Barbus capito pectoralis *Cyprinus carpio*	Karacaören I Dam Lake	Kır (1998)
Cyprinus carpio	Kovada Lake	Becer and Kara (1998)
Alburnus alburnus	Kutahya Region Lakes	Koyun *et al.* (1999)
Leuciscus cephalus	Yeşilköy Pond-Balıkesir	Bulgen (1999)
Acanthobrama marmid	Keban Dam Lake	Türk (2000)
Chalcalburnus chalcoides	Manyas Lake	Ozturk (2000)
Rutilus rutilus	Manyas Lake	Ozturk (2000)
Ctenopharyngodon idella	Pond condition	Kırkağaç and Yıldız Y. (2002)
Cyprinus carpio	Eğirdir Lake	Ceylan (2002)
Tinca tinca	Beyşehir Lake	Yıldız Y. *et al.* (2003)
Platichthys flesus	Dalyan Lagoon	Aydoğdu and Oztürk (2003)
Rutilus rutilus	Yenice Pond	Oğuz *et al.* (2004)
Leuciscus cephalus	Gelingüllü Dam Lake	Ekmekçi and Kırankaya (2004)
Leuciscus cephalus *Alburnus orontis*	Camkoru Pond	Innal (2004)
Tinca tinca	Kovada Lake	Kır and Tekin-Ozan (2005)
Capoeta capoeta bergamae	Topcam Dam Lake	Saşı (2005)
Leuciscus cephalus	Caparlı Patlak Dam Lake	Torcu-Koç *et al.* (2006)

Table 2. New records of *L. intestinalis* in the present study

Host	Location	Observation Year
Alburnus escherichii	Camlıdere Dam Lake-Ankara	2002
	Kirmir Creek- Ankara	2001
	Bulak Stream-Ankara	2002
	Mogan Lake-Ankara	2002
Alburnoides bipunctatus	Kirmir Creek- Ankara	2001
Cyprinus carpio	Camlıdere Dam Lake-Ankara	2002
	Aksu River-Antalya	2004
Tinca tinca	Abant Lake-Bolu	2001
	Yeniçağa Lake-Bolu	2001
Vimba vimba tenella	Yamansaz Lake-Antalya	2004
Barbus plebejus	Cıldır Lake-Ardahan	1995
	Barhal Creek-Artvin	2004

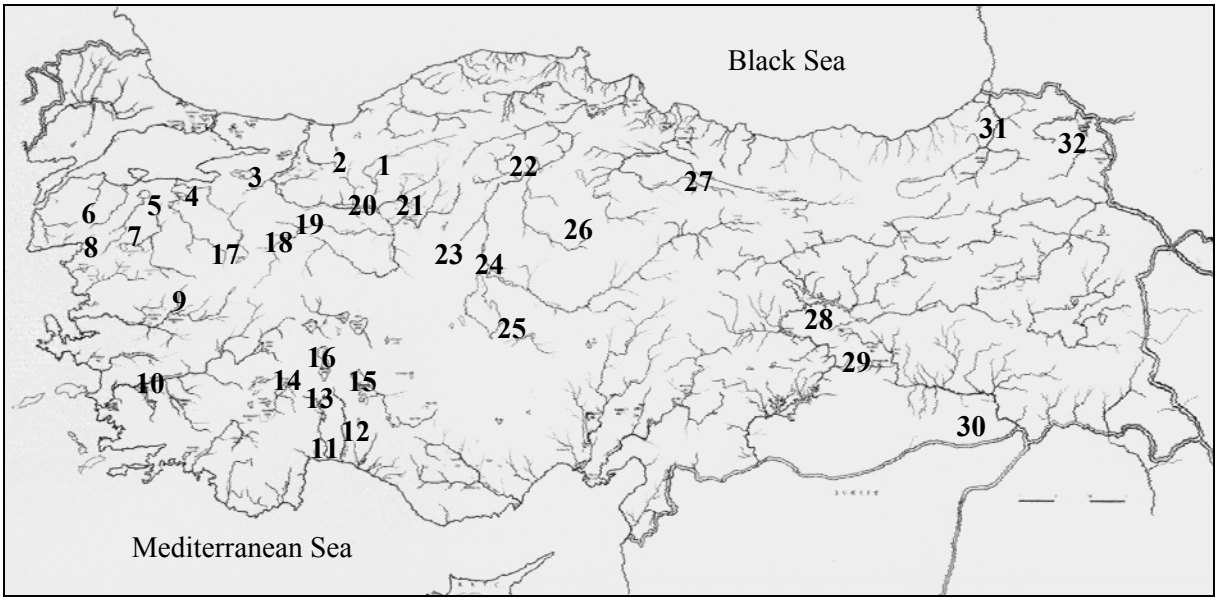

Figure 1. Map of Turkey showing water drainage containing *Ligula intestinalis.*
1) Yeniçağa Lake, 2) Abant Lake, 3) İznik Lake, 4) Dalyan Lagoon, 5) Manyas Lake, 6) Yenice Pond, 7) Yeşilköy Pond-Balıkesir, 8) Caparlı Patlak Dam Lake 9) Demirköprü Dam Lake, 10) Topcam Dam Lake, 11) Yamansaz Lake, 12) Aksu River, 13) Karacaören I Dam Lake, 14) Kovada Lake, 15) Beyşehir Lake, 16) Eğirdir Lake, 17) Kütahya Region Rivers and Lakes 18) Enne Dam Lake, 19) Porsuk Dam Lake, 20) Sarıyar Dam Lake, 21) Ankara Region Rivers and Lakes, 22) Kızılırmak River, 23) Kesikköprü Dam Lake, 24) Hirfanlı Dam Lake, 25) Mamasın Dam Lake, 26) Gelingüllü Dam Lake, 27) Almus Dam Lake, 28) Keban Dam Lake, 29) Devegecidi Dam Lake, 30) Çağcağ, Stream, 31) Barhal River, 32) Çıldır Lake.

Table 3. Host record numbers of *Ligula intestinalis* in the present study and literature

Host	Family	Record numbers
Esox lucius	Esocidae	1
Platichthys flesus	Pleuronectidae	1
Silurus glanis	Siluridae	2
Acanthobrama marmid	Cyprinidae	2
Alburnoides bipunctatus	Cyprinidae	1
Alburnus alburnus	Cyprinidae	2
Alburnus escherichii	Cyprinidae	14
Barbus capito	Cyprinidae	2
Barbus plebejus	Cyprinidae	3
Capoeta capoeta	Cyprinidae	3
Chalcalburnus (*Alburnus*) *chalcoides*	Cyprinidae	1
Chalcalburnus (*Alburnus*) *mossulensis*	Cyprinidae	1
Chondrostoma regium	Cyprinidae	1
Ctenopharyngodon idella	Cyprinidae	1
Cyprinus carpio	Cyprinidae	5
Garra rufa	Cyprinidae	1
Leuciscus cephalus	Cyprinidae	7
Rutilus rutilus	Cyprinidae	2
Tinca tinca	Cyprinidae	6
Vimba vimba tenella	Cyprinidae	3

In the discoveries regarding to Ligula infections, observed in some species of Esocidae, Pleuronectidae, Siluridae and Cyprinidae families, inhabiting Turkish waters, it is found out that 20 fish species are infected with this parasite species, and that 17 out of 20 species (85%) belong to Cyprinidae, and that it was mostly observed in *A. escherichii* (14), *Leuciscus cephalus* (7), *T. tinca* (6) and *Cyprinus carpio* (5), respectively. In the studies carried out by Kırkağaç and Yıldız (2002), the infection was observed in *Ctenopharyngodon idella* under cultural conditions. In the areas in which Ligula infection in *C. carpio* and *T. tinca* were observed, it was found that stocking studies were done in certain periods.

We observed *L. intestinalis* in 6 different fish species in 10 different new locations. The *L. intestinalis* observed in *Alburnoides bipunctatus* inhabiting Kirmir Creek is a new host record for Turkish waters.

In the present study, the information related to the distribution of *L. intestinalis* infecting fish species in the Turkish waters is given. Besides stating the resource areas and species found in our studies, the other fish species infected by this parasite species infection, were detected.

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