

Infections of *Ligula intestinalis* on Freshwater Fish in Kars Plateau of North-Eastern Anatolia, Turkey

Türkiye'nin Kuzey Doğu Anadolu Bölgesi Kars Platosundaki Tatlı Su Balıklarında *Ligula intestinalis* Enfeksiyonları

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ABSTRACT

Objective: This study was conducted to determine the prevalence of *Ligula intestinalis* and infections caused by these on freshwater fish in rivers and streams in the Kars plateau of north-eastern Anatolia, Turkey.

Methods: This research was conducted between April and July 2011. Fish samples were caught via a casting net and an electro-shocker. The samples were immediately examined to determine the prevalence of *L. intestinalis* plerocercoids.

Results: In this research, 310 stream fishes were studied to determine the prevalence of *L. intestinalis* plerocercoids. Detected fishes included 55.8% *Capoeta capoeta*, 24.2% *Squalius cephalus*, 11.0% *Alburnus filippii*, 5.8% *Barbus plebejus lacerta*, and 3.2% *Alburnoides bipunctatus*. *L. intestinalis* plerocercoids were found in 2.6% (8/310) of the examined fishes. The percentage of this parasite was found to be 38.9% (7/18) on *B. plebejus lacerta* and 0.6% (1/173) on *C. capoeta*. *L. intestinalis* plerocercoids were not observed on the other three fish species (*S. cephalus*, *A. filippii*, and *Al. bipunctatus*).

Conclusion: In this study, *L. intestinalis* plerocercoids were reported for the first time in the Kars stream and its distributaries on the Kars plateau in north-eastern Anatolia, Turkey. (*Türkiye Parazitol Derg* 2015; 39: 218-21)

Keywords: *Ligula intestinalis*, ligulosis, freshwater fish

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ÖZ

Amaç: Araştırma Türkiye'nin Kuzey Doğu Anadolu Bölgesi'nde bulunan Kars Platosunda yer alan dere ve çaylardaki tatlı su balıklarında *Ligula intestinalis* parazitlerinin yaygınlığını ve bunların neden olduğu enfeksiyonları bildirmek amacıyla yapıldı.

Yöntemler: Çalışma Nisan–Temmuz 2011 tarihleri arasında yürütüldü. Materyali oluşturan balık örnekleri serpmeye ağı ile avlamak süratıyla yakalandı. *Ligula intestinalis* plerocercoidleri yönünden avlama sonrası hemen parazitolojik olarak incelendi.

Bulgular: Araştırmada 310 adet akarsu balığı *Ligula intestinalis* plerocercoidi yönünden incelendi. Bu balıkların %55.8'ini *Capoeta capoeta*, %24.2'sini *Squalius cephalus*, %11.0'ini *Alburnus filippii*, % 5.8'ini *Barbus plebejus lacerta* ve %3.2'sini ise *Alburnoides bipunctatus* türleri oluşturdu. İncelenen balıkların %2.6 (8/310)'unda *L. intestinalis* plerocercoidi saptandı. Bu parazitin görülme oranı *Barbus plebejus lacerta*'da %38.9 (7/18) ve *Capoeta capoeta*'da %0.6 (1/173) olarak bulundu. Diğer üç balık türü olan *Squalius cephalus*, *Alburnus filippii* ve *Alburnoides bipunctatus*'ta ise cestod larvasına rastlanmadı.

Sonuç: Bu çalışmada Kars Platosunda yer alan Kars Çayı ve kollarındaki tatlı su balıklarında *L. intestinalis* plerocercoidleri ilk olarak bildirildi. (*Türkiye Parazitol Derg* 2015; 39: 218-21)

Anahtar Kelimeler: *Ligula intestinalis*, ligulosis, balık

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INTRODUCTION

One of the most important health problems observed in fish farming is parasitic diseases, especially cestodes parasites. *Ligula intestinalis* is widely encountered in freshwater in the Northern Hemisphere, which includes Turkey. This parasite causes economic loss in the fish industry. *L. intestinalis* instances to the skin, connective tissue, and respiratory system. This helminth species is important in terms of fish health and causes ligulosis (1-3). *L. intestinalis* categorized in the Diphylobothrium family is a cestode that reaches 28 cm in adults and 40 cm in plerocercoids. The final host organism of the parasite is waterbirds. Coracidium in eggs excreted with the feces of waterfowl are taken by Crustacea (*Cyclops*, *Diaptomus*), which is the first intermediate host. Coracidium transforms into proceroids by penetrating the internal wall of these arthropods and by locating into the body tissue. Freshwater fish, which are the second intermediate host of *L. intestinalis*, ingest proceroids by eating the first intermediate hosts. Proceroids, locating in the body cavity by piercing through the intestinal wall of the fish, transform into plerocercoids. Plerocercoids transform into the adult form in birds that eat the second intermediate host fish of the main host waterfowl (1, 3).

Plerocercoids, filling the body cavity of the fish, cause pressure on the organs in the abdominal cavity. As a result of this, the heart is pushed toward the front, the liver becomes deformed, and abdominal wall thinning, loss in weight, and parasitic castration caused by suppressing the development of the gonads are seen. Death occurs in severe infections. Fishes infected by *L. intestinalis* plerocercoids are not able to swim properly, and their bellies are tumid; furthermore, it can be seen that bellies burst and the parasites get out (3-7).

In studies related to fish parasites, it was reported that *L. intestinalis* has been observed in many parts of lakes, dams, and rivers worldwide and in Turkey at varying rates between 0% and 97% (2, 4, 5, 8-13). However, to date, no research has been conducted that deals with this parasite on freshwater fish densely populated rivers in the north-eastern Anatolia region of Turkey.

Therefore, this research was made to determine the prevalence of *L. intestinalis* and infections caused by these on freshwater fish in river and stream in the Kars plateau in north-eastern Anatolia, Turkey.

METHODS

The study was conducted in 2011 between April and July in the Kars stream and its branches. Samples of fish were captured by casting a net and an electro-shocker. The fish samples were taken from Kırmızı Köprü on Kağızman Road, Aksu village of Susuz, Akçalar on Arpaçay Road, and Telek village of Arpaçay.

In the study, 310 fish families in Cyprinidae were examined to determine the prevalence of *L. intestinalis* plerocercoids. A total of 310 fish belonging to 5 different fish species, including a total of 173 *Capoeta capoeta*, 75 *Squalius cephalus*, 34 *Alburnus filippii*, 18 *Barbus plebejus lacerta*, 10 *Alburnoides bipunctatus*, were studied. After the fishes were caught alive, we waited for them to die by themselves. They were examined for the parasite of *L. intestinalis* plerocercoids. The abdomens of the fishes were dissected from the urogenital region to the pharyngeal region. The body cavity of the fishes was macroscopically examined for determining the prevalence of *L. intestinalis* plerocercoids. Collected plerocercoids were stored in 10% formaldehyde in the laboratory of parasitology department of Kafkas University. Additionally, fish species were determined according to literature (14).

RESULTS

In this research, 310 stream fishes were studied to determine the prevalence of *L. intestinalis* plerocercoids. In total, 173 *C. capoeta*, 75 *S. cephalus*, 34 *A. filippii*, 18 *B. plebejus lacerta*, 10 *Al. bipunctatus* were examined. In total, 2.6% (8/310) *L. intestinalis* plerocercoids were detected among the examined fishes. The percentage of this parasite was found to be 38.9% (7/18) on *B. plebejus lacerta* and 0.6% (1/173) on *C. capoeta*. *L. intestinalis* plerocercoids were not observed on the other three fish species: *S. cephalus*, *A. filippii*, and *Al. bipunctatus*.

While 7 out of the 8 fish were infected by one *L. intestinalis* plerocercoid, five plerocercoids were found in infected *B. plebejus lacerta*. This parasite was detected a lot on *B. plebejus lacerta*. Ligulosis was mostly prevalent in the Telek (carci) stream of Arpaçay town (Kars/Turkey). *B. plebejus lacerta* heavily infected by this parasites were caught in this river (Table 1).

DISCUSSION

Considering nutritional problems as a result of the growing world population, fish products have become more important. Fish and fish products are important for human nutrition.

Table 1. Distribution of *Ligula intestinalis* on freshwater fish through the streams in the Kars plateau of north-eastern Anatolia, Turkey

Stream Name (Station Name)	Fish species, x/n* (Infection Rate)				
	<i>Capoeta capoeta</i>	<i>Squalius cephalus</i>	<i>Barbus plebejus lacerta</i>	<i>Alburnoides bipunctatus</i>	<i>Alburnus filippii</i>
Kırmızı Köprü on Kağızman Road	0/69	0/64	0/2	-	0/34
Aksu Village in Susuz	0/28	0/2	-	-	-
Akçalar on Arpaçay Road	0/8	-	-	-	-
Telek Village in Arpaçay	1/68 (1.5%)	0/9	7/16 (43.8%)	0/10	-
Total	1/173 (0.6%)	0/75	7/18 (38.9%)	0/10	0/34

*x/n : Number of fishes infected with *L. intestinalis* plerocercoids/Number of examined fishes

Therefore, both freshwater and sea fishing are common worldwide. The most important point in the consumption of fish is to get healthy fish. Parasites are the main factor affecting fish health and breeding. Parasites prevent fishes from growing properly and result in weak and powerless fishes. Moreover, these parasites cause health problems even in human beings if consumed. One of these parasitic diseases is ligulosis caused by *L. intestinalis* plerocercoids (1). There are many factors that affect the prevalence of ligulosis infection in freshwater fish worldwide and in Turkey. These are diet, age and sex of fish, length of plerocercoids, and intermediate and final host organisms. In particular, the rate of getting infected with parasites is related to variations in the diets and habitats of fishes in streams (5, 9). In this study, the most significant result is that *B. plebejus lacerta* found in the Kars stream was heavily infected with *L. intestinalis* at a rate of 38.9%. Additionally, compared with other species of infected fishes, *B. plebejus lacerta* was detected in a greater number of plerocercoids. It is thought that the reason why *B. plebejus lacerta* infected widely may be the result of the nutritional and habitat characteristics of these fish. Because these fish species adapt to swim and feed on the bottom of streams. Therefore, it is estimated that the first intermediate host water fleas such as *Cyclops* sp. and *Diaptomus* sp. of *L. intestinalis* are widely eaten by *B. plebejus lacerta*. It was also concluded that gulls in the Kars stream can be the main host in the biological development of *L. intestinalis*. Therefore, new research must be performed on gulls living in the Kars plateau, which is approximately 1800 m above sea level, to determine the prevalence of *L. intestinalis*.

It is reported that factors such as season, temperature, and a slight wave or shallow water affect the prevalence of *L. intestinalis*. It is mentioned that the low temperature of water slows down the speed of development of this parasite and sometimes even stops the development (5, 9, 15). With the results of these studies held in our country and worldwide, it is concluded that the prevalence of *L. intestinalis* infection on fish in our country was lower at a rate of 2.6% than that in other countries (2, 4, 5, 8-12, 15-22). Parasitic diseases cause important health and economic problems in farm animals in this region, which has the highest-altitude settlement in Turkey. In addition, ligulosis in freshwater fishes living around Erzurum has been reported (23). The low rate of *L. intestinalis* prevalence may be the result of the fact that this study was performed between April and July and low temperature of water. Additionally, the highest level of 38.9 % of the prevalence of *L. intestinalis* on *B. plebejus lacerta* is found to be remarkable. *L. intestinalis* was found on 20 fish species in 32 different localities in Turkey (11). However, *L. intestinalis* infection was not observed for *C. capota* and *B. plebejus lacerta* (13).

CONCLUSION

In this study, the existence of *L. intestinalis* plerocercoids in freshwater fishes in the Kars stream and its tributaries has been reported for the first time. The prevalence of this parasite in freshwater fishes has been calculated in light of this data. Considering the geographical location and meteorological condition of the Kars plateau, ligulosis cases have been encountered in rivers located in the Kars plateau.

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