Seasonal Occurrence of *Ligula intestinalis* Infection in Cyprinids from Almus Dam Lake, Turkey

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ABSTRACT: This study was conducted during one year period from 2005 to 2006. Some Cyprinid fish species including *Alburnus orontis*, *Chondrostoma regium*, *Leuciscus cephalus*, *Barbus plebejus*, *Cyprinus carpio*, *Capoeta tinca* and *Capoeta capoeta* were monitored for *Ligula intestinalis* (Cestoda: Diphyllobothridae) infection during a one year period. In general, prevalence and mean abundance of *L. intestinalis* plerocercoid was higher in *A. orontis*, *C. regium* and *L. cephalus* in the autumn (73.3%, 50.0%, 34.8% and 1.06, 0.78, 0.83 parasite/fish, respectively) than spring and summer. However, *L. intestinal* infection was not observed for *B. plebejus*, *C. carpio*, *C. tinca*, and *C. capoeta*. Seasonal changes in *L. intestinalis* infection were discussed in this study.
Key Words: *Ligula intestinalis*, Cyprinidae,, Infection parameters, Almus Lake

Almus Baraj Gölü`ndeki Bazı Cyprinidae`lerde Görülen *Ligula intestinalis* Enfeksiyonunun Mevsimsel Dağılımı

ÖZET: Bu çalışma 2005-2006 yıllarında bir yıl boyunca Cyprinidae ailesine ait *Alburnus orontis*, *Chondrostoma regium*, *Leuciscus cephalus*, *Barbus plebejus*, *Cyprinus carpio*, *Capoeta tinca* ve *Capoeta capoeta* gibi bazı balıklarda *Ligula intestinalis* (Cestoda: Diphyllobothridae) enfestasyonunun mevsimsel olarak incelenmesi amacıyla yapılmıştır. Genel olarak, *L. intestinalis* enfestasyon yaygınlığı ve bolluğu *A. orontis, C. regium* ve *L. cephalus*`ta sonbahar da (73.33%, 50.0%, 34.8% and 1.06, 0.78, 0.83 parazit/balık) yüksek bulunmuştur. Ancak, *L. intestinalis* enfestasyonu *B. plebejus, C. carpio, C. tinca* ve *C. capoeta* balıklarında yıl boyunca gözlenmemiştir.
Anahtar Kelimeler: *Ligula intestinalis*, Cyprinidae, Enfeksiyon değerleri, Almus Gölü

INTRODUCTION

The plerocercoid of *Ligula intestinalis* have been recorded from the body cavity of a wide range of fish hosts, particularly members of the Cyprinidae, from worldwide locations (Innal et al., 2007; Hajirostamloo, 2008; Hoole et al., 2010).

This cestode present a complex life cycle with a copepod as a first intermediate host and fish becomes infected consuming the infected copepod. Fish eating birds serve as the final host in which *L. intestinalis* quickly reaches sexual maturity and releases eggs into water. It develops in the abdominal cavity of the second intermediate host fish and has effect on fish health, inhibiting gametogenesis and behavior (Brown et al., 2002; Carter, 2005; Trubiroha et al., 2009). As a result it can cause heavy losses in freshwater pisciculture and reduce economic value of fish.

The plerocercoids *L. intestinalis* have been recorded from different fish species in Turkish freshwater (Innal et al., 2007). Despite these intensive studies, there is inadequate study on Almus Dam Lake which is on the main branch of the Yeşilırmak River and an important reservoir for fisheries in the Northern Anatolian region. There is only one study from Almus Dam Lake, Yeşilırmak River, recording *L. intestinalis* from *A. orontis* (Cengizler et al., 1991). In the present study, *L. intestinalis* infection of 7 freshwater fish species were examined to determine the seasonal changes in prevalence and abundance of *L. intestinalis* infection and their effect on fisheries.

MATERIALS and METHODS

The study was conducted in Almus Dam Lake (40° 22' 348" N - 36° 55' 789" E) which is on the main branch of the Yeşilırmak River and an important reservoir for fisheries in the Northern Anatolian region. It has a surface area of 31.3 km^2, 950 hm^3 of water reserves and a maximum depth of 78 m. The lake exhibits oligotrophic characters during winter and mesotrophic characters during summer.

Sampling was carried out on a three monthly basis from April 2005 to January 2006. A total of 320 fish belonging to 7 fish species including, a total of 40 *Alburnus orontis* (15.4±3.5), 76 *Chondrostoma regium* (20.2±4.4 cm), 60 *Leuciscus cephalus* (19.5±5.3 cm), 40 *Barbus plebejus* (20.6±10.4 cm), 59 *Cyprinus carpio* (26.2±7.3 cm), 66 *Capoeta tinca* (22.3±8.4 cm), 19 *Capoeta capoeta* (24.7±6.1 cm) were studied. During the winter months no fish were sampled due to low water temperature (4.0±0.9°C). The number of fish sampled seasonally is shown in Table 1. Seasonal ranges and means for water temperature (°C) were recorded using WTW Multi 340I/SET during the study.

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For parasitological dissection, fish were killed and total length was recorded. Routine procedures were used to collect the parasites. The prevalence and mean intensity levels of the parasite species were determined according to Bush et al. (1997).

RESULTS

The number of fish sampled seasonally and seasonal changes of parasitism values are shown in Table 1. Prevalence levels of *L. intestinalis* plerocercoids in the body cavity of *A. orontis*, *L. cephalus* and *C. regium* were generally higher in the autumn (73.3%, 50.0% and 34.8%, respectively) compared to the spring and summer, 11% and 12.5% for *A. orontis*, respectively.

No infection was reported during summer and spring for *C. regium* and *L. cephalus*. However, there was no infection for *B. plebejus, C. carpio*, *C. tinca* and *C. capoeta* during the study period.

Mean abundance and mean intensity of *L. intestinalis* also showed similar result for all fish species examined (Fig 1, 2; Table 1). Seasonal changes in the mean abundance of *L. intestinalis* showed high abundance in autumn (1.06, 0.83 and 0.78 parasite/fish for *A. orontis*, *L. cephalus* and *C. regium*, respectively. Mean intensity of *L.* intestinalis was 1.45, 2.25 and 1.66 parasite/fish for *A. orontis*, *L. cephalus* and *C. regium*, respectively.

Table 1. Seasonal changes in prevalence, mean abundance and mean intensity of *Ligula intestinalis* from fish species in Almus Dam Lake

	Spring			**Summer**			**Autumn**		
Fish Species (N:320)	Prevalence (%)	Mean abundance	Mean intensity	Prevalence (%)	Mean abundance	Mean intensity	Prevalence (%)	Mean abundance	Mean intensity
Alburnus orontis (n:40)	11 (n: 9)	0.11	1	12.5 (n: 16)	0.125	1	73.33 (n:15)	1.06	1.45
Chondrostoma regium (n: 76)	- (n:23)	-	-	- (n:30)	-	-	34.78 (n: 23)	0.78	2.25
Leuciscus cephalus (n:60)	- (n: 25)	-	-	- (n: 23)	-	-	50 (n: 12)	0.83	1.66
Barbus plebejus (n:40)	- (n: 8)	-	-	- (n: 27)	-	-	- (n: 5)	-	-
Cyprinus carpio (n:59)	- (n: 10)	-	-	- (n: 11)	-	-	- (n: 38)	-	-
Capoita tinca (n: 66)	- (n: 12)	-	-	- (n: 29)	-	-	- (n:25)	-	-
Capoita capoeta (n: 19)	- (n: 4)	-	-	- (n: 6)	-	-	- (n: 9)	-	-
Water temperature	10.6°C (10.5-10.8)			21.3°C (20.5-22.5)			17.1°C (11.5-22.8)		

n: number of fish examined

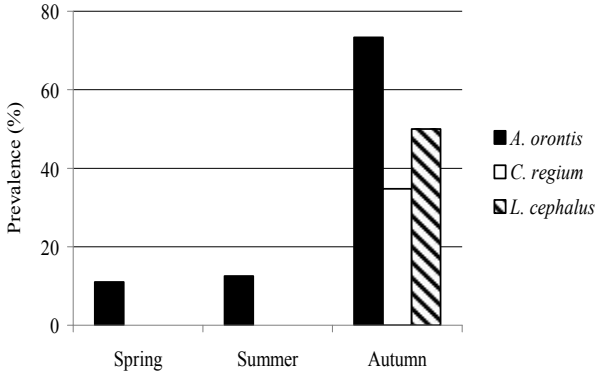

Fig. 1. Seasonal changes in prevalence of *L. intestinalis* from fish species in Almus Dam Lake.

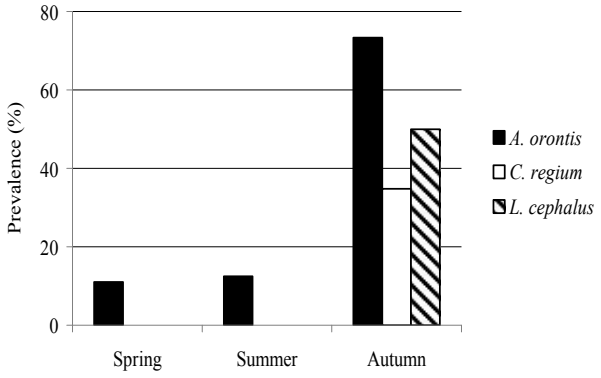

Fig. 2. Seasonal changes in mean abundance of *L. intestinalis* from fish species in Almus Dam Lake.

DISCUSSION

Plerocercoids of the tapeworm *L. intestinalis* are known to infect many freshwater fish species throughout the World. There are quite a few studies on effect of *L. intestinalis* on fisheries through retarding maturation of ovary, reducing growth, increase vulnerability of the intermediate host to predation by definitive host and effect the fish stock by damaging internal viscera

(Trubiroha et al., 2009 Bouzid et al., 2008). In the present study, *L. intestinalis* infection was examined from 7 freshwater fish species, occurring from *A. orontis*, *C. regium* and *L. cephalus*. However, no infection was observed from *B. plebejus*, *C. carpio*, *C. tinca* and *C. capoeta*. Innal et al (2007) have also listed previous records of *L. intestinalis* from *A. orontis*, *C. regium*, *L. cephalus*. *B. plebejus*, *C. carpio* and *C. capoeta.*

In this study, seasonal variation in the prevalence of *L. intestinalis* was found to be highest in the autumn for *A. orontis* (73.3%). *C. regium* and *L. cephalus* also had the highest prevalence during autumn (34.78% and 50%, respectively) and there was no infection observed during spring and summer. Our result shows similarity with other researchers. The highest prevalence of *L. intestinalis* have been reported during autumn from *T. tinca* (Korkmaz and Zencir 2009) and from *L. cephalus* (Inal and Keskin, 2006) and *L. cephalus*, *Alburnus escherichii* and *Chondrostoma nasus*`ta during summer and but lowest prevalence in spring and autumn (Ozbek and Ozturk, 2010). However, Ergonul and Altindag (2005) reported highest prevalence during summer and lowest in spring from *T. tinca*. Seasonal variation in the infection rate of these fish species might be caused by difference in their spawning season and feeding habits. Dejen et al. (2006) has reported that higher infection rate of *Barbus tanapelagius* as compared to *Barbus humilis* might be related to higher proportion of copepods in the diet of *B. tanapelagius* and also difference in their spawning seasons. This seasonal variation and difference in the infection rate *L. intestinalis* in host fish might be caused by host feeding pattern, availability of infected intermediate hosts, hormonal and immunological changes.

This study showed infection of plerocercoid *L. intestinalis* from fish species inhabiting Almus Lake which is an important reservoir for fisheries and aquaculture. As *L. intestinalis* is thought to be the most important tapeworm that infect freshwater fishes and can be a major threat to natural and farmed fish populations. It is important to have a knowledge of parasite distribution in water reserves for the development of suitable preventative and control measures and this information will help to make proper assessment of potential dangers in fisheries and aquaculture.

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REFERENCES

Bouzid, W., Stefka, J., Hypsa, V., Lek, S., Scholz, T., Legal, L, Hassine, O.K.B., Loot, G. 2008. Geography and host specificity: Two forces behind the genetic structure of the freshwater fish parasite *Ligula intestinalis* (Cestoda: Diphyllobothriidae). International Journal for Parasitology, 38: 1465-1479.

Brown, S.P., Loot, G., Teriokhin, A., Brunel, A., Brunel, C., Guegab, J. F. 2002. Host manipulation by *Ligula intestinalis*: a cause or consequence of parasite aggregation? International Journal for Parasitology. 32: 817-824.

Bush, A.O, Lafferty, K.D., Lotz, J.M. and Shostak, A.W. 1997 Parasitology meets ecology on its own terms: Margolis et al. revisited. Journal of Parasitology. 83, 575–583.

Carter, V., Pierce, R., Dufour, S., Arme, C., Hoole, D., 2005. The tapeworm *Ligula intestinalis* (Cestoda, Pseudophyllidae) inhibits LH expression and puberty in its teleost host, *Rutilus rutilus*. Reproduction 130: 939-945.

Cengizler, I., Sarihan, E., Cevik, C. 1991. Almus (Tokat) baraj gölünde yaşayan Cyprinidlerde Ligulosis araştırması. E. U. Su Ürünleri Fakültesi, Su Ürünleri Sempozyumu, E.U. Bornova, Izmir.

Dejen, E., Vijverberg, J. and Sibbing, F. A. 2006. Spatial and temporal variation of cestoda infection and its effects on two small barbs (*Barbus humulis* and *Barbus tanapelagius*) in Lake Tana, Ethiopia. Hydrobiologica: 556: 109-117.

Ergonul, M.B. Altindag, A. 2005. The occurrence and dynamics of *Ligula intestinalis* in its cyprinid fish host, Tench, *Tinca tinca*, in Mogan Lake (Ankara, Turkey). Vet. Med- Czech, 50 (12): 537-542.

Hajirostamloo, M. 2008. The occurrence and parasite host of *Ligula intestinalis* in Sattarkhan Lake (East Azerbaijan-Iran). Journal of Animal and Veterinary Advances 7 (3): 221-225.

Hoole, D., Carter, V., Dufour, S. 2010. *Ligula intestinalis* (Cestoda: Pseudophyllidae): an ideal fish-metazoan parasite model? Parasitology 137: 425-438.

Innal, D., Keskin, N. 2006. The infection of European chub (*Leuciscus cephalus* L. 1758) with *Ligula intestinalis* plerocercoids in Çamkoru Lake (Turkey). J. Anim Vet Advances, 5(2): 108–110.

Innal, D., Keskin N., Erkakan, F. 2007. Distribution of *Ligula intestinalis* (L.) in Turkey. Turkish Journal of fisheries and Aquatic Sciences. 7: 19- 22.

Korkmaz, A.S. Zencir, O. 2009. Annual Dynamics of tapeworm, *Ligula intestinalis* parasitism in Tench (*Tinca tinca*) from Beysehir Lake, Turkey. Journal of Animal and Veterinary Advances 8 (9): 1790-1793.

Ozbek, M., Ozturk, M.O. 2010. Investigations on *Ligula intestinalis* plerocercoid L., 1758 infection of some fishes from Kunduzlar Dam Lake, (Kirka, Eskisehir). Turkish Journal of Parasitology. 34 (2): 112-117.

Trubiroha, A., Wuertz, S., Frank, S. N. Sures, B., Kloas, W. 2009. Expression of gonadotropin subunits in roach (*Rutilus rutilus*, Cyprinidae) infected with plerocercoids of the tapeworm *Ligula intestinalis* (Cestoda). International Journal for Parasitology 39: 1465-1473.