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# *Ligula intestinalis* infection in a native Leuciscid hybrid (*Alburnus derjugini* x *Squalius orientalis*) in the Kürtün Dam Lake, Northeast Anatolia

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**Summary**

Taxonomic evaluations are needed to accurately determine the host selection of fish parasites. The present study is a multidisciplinary research in the field of basic and fish diseases sciences. The description of the hybrid species of *Squalius orientalis* and *Alburnus derjugini* and infection of *Ligula intestinalis* in these hybrid fish were reported for the first time from the Kürtün Dam Lake in north-east Turkey. A total of 450 fish were sampled in March, August, and October in 2020 using gillnets. Detailed morphological characteristics (n = 24) were compared to determine the difference among ancestors and hybrid species. The prevalence of *L. intestinalis* between the sampling periods and the size groups of fish (0 – 10, 11 – 15, and ≥16 cm in length) were examined. Moreover, the highest prevalence of the parasite was observed in October (78.94 %), with a size range of 0 – 10 cm in length (77.8 %). In addition, the total prevalence of the parasite was 48.44 %. The results revealed that most of the diagnostic metric and meristic features of hybrid fish were ranging between the data of *S. orientalis* and *A. derjugini*. According to previous reports, when hybrid individuals were compared with their ancestors in terms of prevalence, hybrid individuals were more susceptible to *L. intestinalis* infections. This study was unique as it provided the first record of *L. intestinalis* in a hybrid fish population.
**Keywords:** Hybridization; fish; disease; parasite; cestode; prevalence

## Introduction

The diseases caused by parasites are one of the most common and crucial topics in the study of fish diseases. *Ligula intestinalis*, belonging to the Cestoda class, is a crucial endoparasite, particularly isolated from different wild fish (Loot *et al.*, 2002). This parasite has a multi-host life cycle and thus uses copepod species belonging to the crustacean group, fish, and birds as hosts. Eggs found in fish-eating bird droppings develop into free-swimming coracidium larvae when they pass into the water. These larvae that are later eaten by copepods become procercoid larvae inside the copepod (*Cyclops* sp., *Diaptamus* sp.). After the second intermediate host fish eat the copepods, the procercoid larva attaches to the intestinal cavity of the fish and develops there to become a segmentless plerocercoid larva and then completes its life cycle on the bird by predation of the fish by fish-eating birds (Innal *et al.*, 2010; Arslan *et al.*, 2015). Fish are the most affected host in the life cycle of *L. intestinalis* because this parasite occupies the body cavity of the fish for several years and is cause harmful effects on them (Geraudie *et al.*, 2010).

There are several studies on Ligulosis in fish worldwide and in Turkey. Generally, studies can be classified on the basis of the reporting of *L. intestinalis* in fish and determination of pollution parameters in the region where plerocercoid larvae are found in fish.

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*L. intestinalis* has been reported worldwide from the families Cobitidae, Cyprinidae, Salmonidae, Esoxcidae, Pleuronectidae, and Siluridae and mostly found in the family Cyprinidae (Innal *et al*., 2007; Bouzid *et al*., 2008; Yoneva *et al*., 2015). Therefore, large-scale studies are examining the distribution of *L. intestinalis* in China (Liao & Liang, 1987), and some local studies are examining *L. intestinalis* infection in *Engraulicypris sardella*, an endemic and pelagic cyprinid in Lake Nyasa (Gabagambi & Skorping, 2018). Studies in Turkey mostly focused on the reporting of *L. intestinalis* in fish. *L. intestinalis* was first reported by Güralp (1968) from Lake Eğirdir and later reported from various Cyprinoid species such as *Tinca tinca*, *Alburnus orontis*, *Capoeta capoeta*, *Esox lucius,* and *Alburnus derjugini*, generally from lentic systems in Anatolia (Innal vd., 2007; Korkmaz & Zencir, 2009; Demirtaş, 2011; Turgut *et al*., 2011; Kayiş *et al*., 2020). Moreover, it was recently reported from the families Gobionidae and Atherinidae in Turkey (Benzer, 2020a; Benzer, 2020b).

The fish fauna of the Kürtün Dam and Harşit River where this study was conducted has not been studied in detail yet. *Salmo coruhensis* (Turan *et al*., 2010) was reported from Yağmurdere stream drainage and *A. derjugini* (Kayiş *et al*., 2020) from the Kürtün Dam Lake. In addition, *Salmo coruhensis*, *Capoeta banarescui*, *Barbus tauricus*, *A. derjugini*, *Alburnoides fasciatus,* and *Squalius orientalis* were found in the drainage of the Kürtün Dam (Bingöl, 2018). Both *S. orientalis* (Nordmann, 1840) and *A. derjugini* Berg, 1923 are common in streams and rivers in the southeast of the Black Sea (Bayçelebi *et al*., 2017). Hybridization between fish species living in the same region and close to each other in terms of relationship level is a common phenomenon. However, it is uncommon for these hybrids to form dense populations and become much more dominant than their ancestors (Costedoat *et al*., 2005). Moreover, hybridization is common between the genera *Squalius* and *Alburnus*. Recently, Turan *et al*. (2020) described a natural hybrid population between *Squalius semae* and *Alburnus sellal* in the upper Euphrates River.

This study aimed for the following:

(i) Providing a description of the hybrid fish population sampled in the Kürtün Dam Lake;

(ii) Determining *L. intestinalis* prevalence in hybrid individuals;

(iii) Comparing length parameters of the hybrid population and the prevalence of *L. intestinalis* according to these groups; and

(iv) Presenting new records of *L. intestinalis* reported from different aquatic systems and hosts in Turkey in recent years (as a review).

## Material and Methods

*Sampling area and fish collecting*

Kürtün dam is located within the borders of Gümüşhane Province in Turkey (Fig. 1). Its construction began in 1986 and was com-

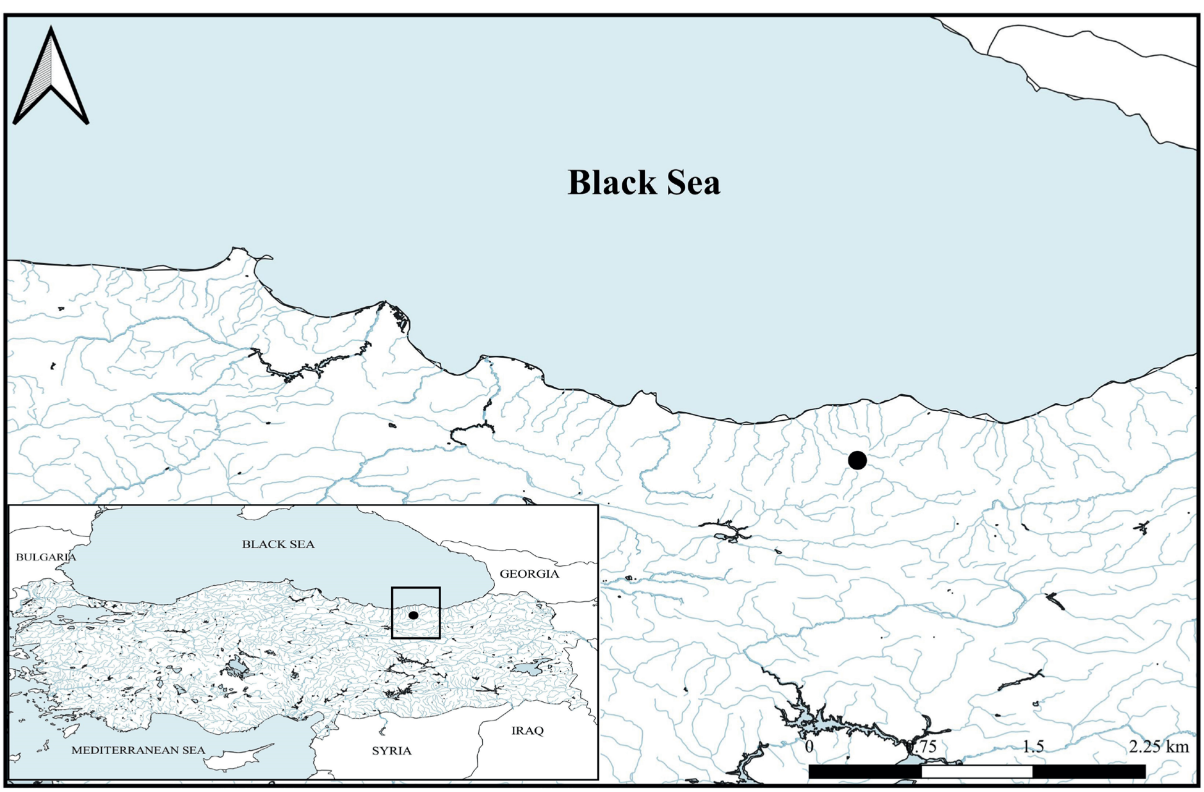


Fig. 1. Map of sampling area (Kürtün Dam Lake).

Fig. 2. *Squalius orientalis.*

pleted in 2003. The water temperature of the dam varies between +4°C and 25°C, and the water level of the dam lake varies between 35 and 100 meters (Kayiş *et al*., 2020). The map (Fig. 1) was created using the Qgis v. 3.8.3 - Zanzibar software available at http://diva-gis.org. Occurrence data in the map (Fig. 1) were based on our own material.

A total of 450 fish belonging to the family Leuciscidae from the Kürtün Dam Lake were sampled in March, August, and October 2020. Fish were caught using gillnets with an 8 mm mesh. Moreover, 10 fish from the collected samples were fixed in 5 % formaldehyde after being anesthetized with MS222 to be used in species determination and morphological studies. The samples to be examined for parasites were kept at +4°C and brought to the fish diseases laboratory.

In addition, during the sampling periods, temperature and pH values of dam lake water were recorded using a pH/ORP/Temperature Measuring Device (Isolab, Istanbul, Turkey).

*Morphological studies*

Fish were measured with a 0.1 mm precision digital caliper. Kottelat and Freyhof (2007) were followed for the metric and meristic features. The standard length (SL) was measured from the tip of the snout to the posterior extremity of the hypural complex. The length of the caudal peduncle was measured from behind the base of the last anal fin ray to the posterior extremity of the hypural complex at the mid-height of the caudal fin base. The last two-branched dorsal and anal rays articulated on a single pterygiophore were counted as “1½”. Metric and meristic data of *S. orientalis* samples were obtained from Bayçelebi (2019).

*Parasitic examination*

The fish length, fish weight, and the number of fish infected with *L. intestinalis* were recorded. Length was measured using a length board and weight using a scale with a 0.01 gr precision. Parasite prevalence (%) was calculated as the number of infected fish divided by the total number of fish × 100 (Bozorgnia *et al*., 2012). The length/prevalence relationship of *L. intestinalis* in the fish obtained was investigated. The fish were divided into three size groups: 0 – 10, 11 – 15, and ≥16 cm, and the prevalence was calculated for each group. The key to the identification of the parasite was taken into account by Chubb *et al*. (1987).

**Ethical Approval and/or Informed Consent**

Fish collections were approved and granted by the Ministry of Food, Agriculture and Livestock, General Directorate of Fisheries and Aquaculture**,** Turkey (codes for the protocols: 67852565-140.03.03-E.4052273 and 76000869-804.01-00000919222). All applicable international, national or institutional guidelines for the care and use of animals were followed.

Fig. 3. *Alburnus derjugini.*

Fig. 4. Hybrid of *Squalius orientalis* x *Alburnus derjugini.*

## Results

*Identification of hybrid population*

In this study, the metric and meristic data of the samples collected from the Kürtün Dam Lake were examined to determine the taxonomic position. The data obtained showed that the samples, which were dominantly distributed in the reservoir, belong to a hybrid population of *A. derjugini* and *S. orientalis*. Most of the crucial meristic (lateral line scales, transversal scale rows, gill rakers, and branched anal fin rays) and metric (head depth, body depth) features of the hybrid population ranged between the data of *A. derjuguni* and *S. orientalis* (Table 1).

The general appearance of ancestors (*S. orientalis* and *A. derjuguni*) and a hybrid individual are shown in Figures 2, 3, and 4, respectively. Also, the hybrid individual with *L. intestinalis* is shown in Figure 5. Morphologic data of them are presented in Tables 1 and 2.

Table 1. Morphometric comparison of *S. orientalis* x *A. derjugini* and its ancestors.

| | ***Squalius orientalis*** | | ***S. orientalis* x *A. derjugini* (Hybrid)** | | ***Alburnus derjugini*** | |
|---|---|---|---|---|---|---|
| N | 20 | | 10 | | 15 | |
| Standard Length (mm) | 145-185 | | 116-115 | | 83-132 | |
| **In percent of standard length** | Range (mean) | SD | Range (mean) | SD | Range (mean) | SD |
| Head length | 24.0 – 28.6 (27.0) | 1.0 | 21.5 – 23.7 (23.0) | 0.7 | 24.6 – 27.4 (26.0) | 0.8 |
| Body depth of dorsal-fin origin | 21.6 – 25.0 (23.4) | 0.1 | 23.4 – 27.3 (26.0) | 1.3 | 19.6 – 23.4 (21.0) | 1.2 |
| Predorsal length | 53.3 – 57.4 (55.4) | 1.1 | 52.3 – 56.6 (54.2) | 1.4 | 54.4 – 58.1 (56.0) | 1.1 |
| Prepelvic length | 50.3 – 55.4 (53.5) | 1.2 | 46.7 – 50.3 (48.5) | 1.0 | 47.8 – 50.5 (49.2) | 0.8 |
| Preanal length | 71.6 – 75.6 (73.7) | 1.2 | 63.8 – 70.0 (67.4) | 1.9 | 65.3 – 69.6 (67.4) | 1.2 |
| Pectoral-fin origin to anal fin | 47.8 – 52.3 (49.6) | 1.3 | 43.2 – 47.7 (45.6) | 1.4 | 40.5 – 45.7 (42.6) | 1.2 |
| Pectoral-fin origin to pelvic fin | 26.4 – 30.8 (28.2) | 1.2 | 23.4 – 27.1 (25.5) | 1.1 | 22.2 – 25.2 (23.8) | 0.9 |
| Pelvic-fin origin to anal fin | 19.8 – 23.8 (21.7) | 1.1 | 19.2 – 24.8 (21.1) | 1.8 | 16.9 – 21.5 (19.0) | 1.0 |
| Dorsal-fin height | 18.6 – 21.2 (19.9) | 0.8 | 19.3 – 22.1 (20.4) | 0.8 | 16.7 – 19.5 (18.2) | 0.8 |
| Anal-fin length | 16.2 – 18.8 (17.5) | 0.7 | 14.5 – 18.5 (16.0) | 1.2 | 12.5 – 15.8 (14.6) | 0.8 |
| Pectoral-fin length | 17.6 – 20.8 (19.4) | 0.8 | 15.2 – 18.9 (17.3) | 1.1 | 19.5 – 22.1 (20.8) | 0.7 |
| Pelvic-fin length | 14.5 – 16.7 (15.7) | 0.5 | 13.7 – 17.4 (15.5) | 0.9 | 14.1 – 16.2 (15.4) | 0.6 |
| Upper caudal-fin lobe | 24.2 – 29.5 (26.3) | 1.2 | 23.4 – 27.0 (25.4) | 1.0 | 24.4 – 28.9 (26.6) | 1.4 |
| Length of middle caudal-fin ray | 13.7 – 17.4 (16.1) | 0.9 | 10.6 – 13.0 (12.3) | 0.7 | 11.8 – 13.8 (12.6) | 0.7 |
| Length of caudal peduncule | 18.1 – 20.7 (19.4) | 0.8 | 20.9 – 24.6 (22.2) | 1.2 | 17.8 – 20.3 (18.8) | 0.9 |
| Depth of caudal peduncle | 10.7 – 12.2 (11.6) | 0.4 | 8.9 – 10.9 (10.0) | 0.6 | 8.1 – 9.3 (8.7) | 0.3 |
| **In percent of head length** | | | | | | |
| Snout length | 29.7 – 34.6 (32.0) | 1.4 | 24.4 – 30.4 (26.3) | 1.7 | 27.2 – 30.1 (28.3) | 0.9 |
| Eye diameter | 17.2 – 21.1 (19.3) | 1.1 | 28.2 – 31.4 (30.1) | 1.1 | 26.5 – 31.7 (29.7) | 1.5 |
| Interorbital width | 39.4 – 43.3 (41.1) | 1.1 | 29.9 – 33.8 (31.5) | 1.4 | 25.5 – 31.0 (28.0) | 1.7 |
| Head width at nape | 56.4 – 63.8 (59.5) | 2.3 | 46.2 – 51.9 (49.8) | 1.8 | 45.3 – 51.0 (47.6) | 1.6 |
| Head depth at nape | 63.4 – 72.7 (67.8) | 2.8 | 67.8 – 76.5 (70.5) | 2.7 | 61.1 – 67.5 (63.8) | 1.6 |
| Snout width at nostrils | 35.1 – 39.4 (37.0) | 1.2 | 27.6 – 33.7 (30.0) | 1.7 | 28.1 – 34.5 (30.2) | 1.6 |
| Mouth width | 25.3 – 32.4 (28.3) | 1.8 | 20.5 – 25.0 (22.0) | 1.5 | 20.1 – 25.0 (22.1) | 1.4 |

Table 2. Frequency distribution of meristic features of hybrid population and its ancestors.

| | | Lateral line scales | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | 43 | 44 | 45 | 46 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| *Squalius orientalis* | 20 | 1 | 4 | 7 | 7 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hybrid | 10 | - | - | - | - | - | - | - | 1 | 2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| *Alburnus derjugini* | 30 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 2 | 1 | 3 | 4 | 3 | 4 | 4 | 4 | 1 | 4 | - | - | 1 |

| | | Tranversal scales | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Above lateral line | | | | | | Below lateral line | | | Branched anal-fin rays | | | | | | | | | Gill rakers | | | | | | | | | | |
| | N | 7 | 8 | 9 | 10 | 11 | 12 | 4 | 5 | 6 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 10 | 11 | 12 | … | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| *Squalius orientalis* | 20 | 7 | 13 | - | - | - | - | 14 | 6 | - | 4 | 16 | - | - | - | - | - | - | - | 5 | 13 | 2 | | - | - | - | - | - | - | - |
| Hybrid | 10 | - | - | - | 9 | 1 | - | - | 10 | - | - | - | 7 | 3 | - | - | - | - | - | - | 1 | 9 | - | - | - | - | - | - | - | - |
| *Alburnus derjugini* | 30 | - | - | - | 2 | 16 | 12 | - | 13 | 17 | - | - | - | - | - | - | 16 | 13 | 1 | - | - | - | - | 1 | 5 | 3 | 2 | 1 | 1 | 4 |


Fig. 5. a, A hybrid individual with *Ligula intestinalis* plerocercoids; b, after removing *L. intestinalis* plerocercoids from the individual; c, removed *L. intestinalis* plerocercoids

The appearance of the hybrid individual was as follows; the body was slender and slightly compressed laterally, the upper profile was slightly arched, the ventral profile was more arched than the dorsal profile. The head was small, shorter than the highest body depth, and the dorsal profile was slightly convex. The snout was short, its length was 24 % – 30 % HL, and its tip was rounded. The mouth was small and superior, and its width was 21 % – 25 % HL. Eyes were big, and the horizontal eye diameter was 28 % – 31 % HL. The interorbital area was convex, and its width was 30 % – 34 % SL. The caudal peduncle was long (its length 21 % – 25 % SL).

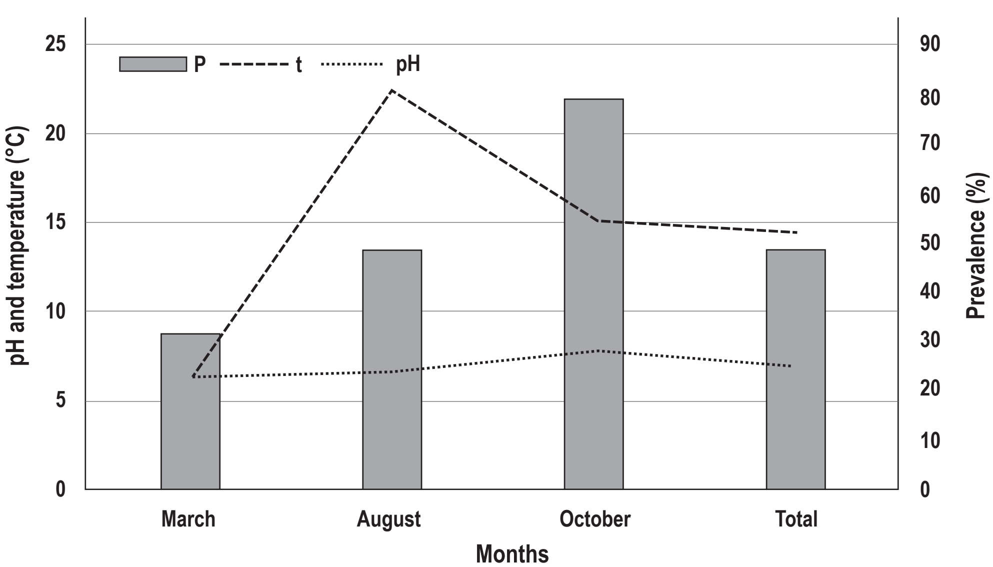


Fig. 6. *Ligula intestinalis* plerocercoids prevelance according to the different months.

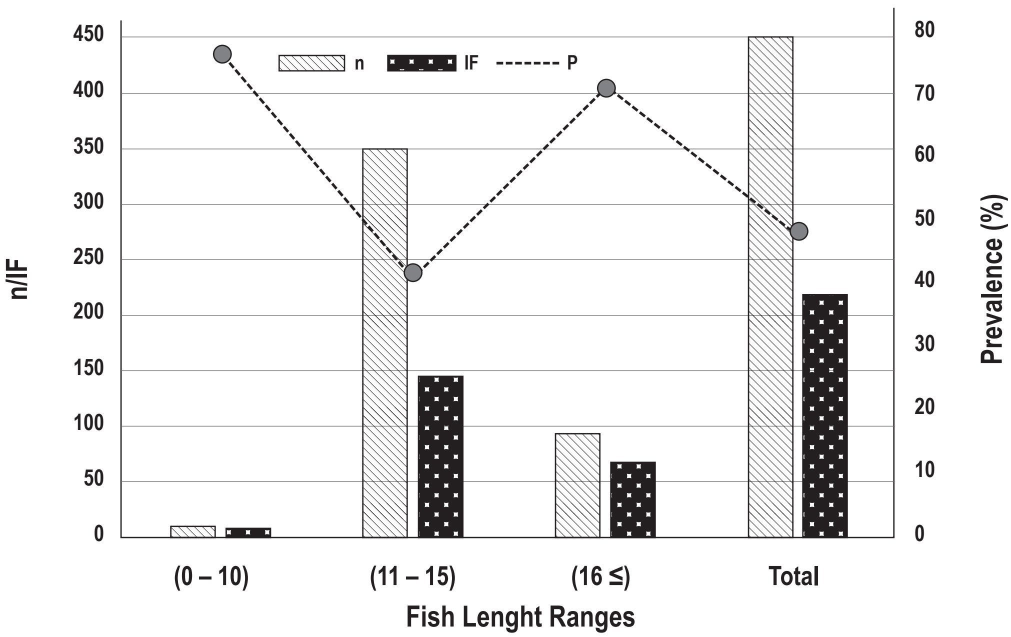


Fig. 7. *Ligula intestinalis* plerocercoids prevalence according to fish size ranges. n: sampled fish, IF: infected fish, P: prevalence.

The dorsal fin had 3 simple and 8½ branched rays, with a straight outer margin; the pectoral fin had 14 – 16 rays, with a slightly convex outer margin. The pelvic fin had 9 rays, with a slightly convex outer margin. Anal fin had 3 simple and 10 – 11½ branched rays, with a slightly concave outer margin. Caudal fin was markedly forked, with lobes pointed. Lateral line with 51 – 56 scales; 10 – 11 scale rows between lateral line and dorsal-fin origin; 5 scale rows between lateral line and anal-fin origin. Gill rakers were counted as 3–4 + 7–9 = 11–12 on the outer side of the first-gill arch.

Coloration: Freshly formalin preserved yellowish-green color on the upper half flank and back and silvery on the lower half of flank and belly in hybrid species. A black strip was present on the upper part of the flank from behind the eye to the hypural complex, and its width was narrower than the eye diameter. Moreover, a very narrow black strip was observed on the midpoint dorsal body from the nape to the caudal fin base. Dorsal and caudal fins were grey; anal, pectoral, and pelvic fins were whitish or hyaline.

*Temperature and pH value of the water*

Temperatures-pH values of dam lake water were recorded as 6.2°C-6.4 (March), 22.5°C-6.7 (August), and 15.2°C-7.8 (October).

*Identification and prevalence of the parasite*

As described by Chubb *et al*. (1987), it was observed that in the plerocercoid stage of the parasite is completely located in the body cavity. On the other hand, a single-line reproductive organ in the *Ligula intestinalis* plerocercoid was also observed in the examination performed under the stereo microscope.

The distribution of *L. intestinalis* plerocercoids in fish according to the sampling time as a result of the samplings made in the Kürtün Dam Lake is given in Figure 6. October (78.94 %) showed the highest prevalence, followed by August with 48.4 % and March with 31.34 %. The total prevalence was 48.44 %.

The fish used in the samples were classified into groups according to their size, and the distribution of the parasite was examined. The minimum and maximum lengths of all samples were recorded as 5 and 18.3 cm, respectively. There were nine fish in the 0 – 10 cm group, 348 in the 11 – 15 group, and 93 in the ≥16 group. The highest value in the prevalence of the parasite according to the length was in the range of 0 – 10 cm with 77.8 %, followed by ≥16 cm with 72.04 %, and finally 11 – 15 cm with 41.38 %. The prevalence of *L. intestinalis* plerocercoids according to length ranges is given in Figure 7.

## Discussion

Fish are extremely suitable hosts for parasites in aquatic systems. There is a wide range of literature worldwide on the serious harms of different parasite groups in fish. Factors such as the spread of aquaculture, training of scientists on the subject, technological changes, formation of new aquatic systems, and identification of new fish species affect the increasing number of reports on this subject (Sures *et al*., 2017). Therefore, there are several studies on the fish species in which *L. intestinalis* has been reported worldwide. The most striking detail in these reports was that all reported fish species belong to the herbivorous or omnivorous Cypriniformes order (Woo, 2006; Innal *et al*., 2007; Noga, 2010; Kayis *et al*., 2018). Other fish species in which *L. intestinalis* has been reported, apart from the Cypriniformes order species, was

Table 3. After 2007, records of *Ligula intestinalis* from some Cyprinids in Turkey.

| **Host species** | **Actual Taxonomic Status** | **Area** | **References** |
|---|---|---|---|
| *Ladigesocypris irideus* | *Ladigesocypris irideus** | Aegean | Doosti and Yılmaz, 2020 |
| *Tinca tinca* | *Tinca tinca*** | Mediterranean | Aydogan et al., 2018 |
| | | Aegean | Demirtaş, 2011 |
| *Vimba vimba* | *Vimba vimba** | Aegean | Aydoğdu et al., 2008. |
| *Alburnus escherichii* | *Alburnus escherichii** | Central Anatolian | İnnal et al., 2010. |
| *Gobio gobio* | *Gobio sakaryaensis**** | | |
| *Squalius cephalus* | *Squalius pursakensis** | | |
| *Leuciscus cephalus* | *Squalius fellowesi** | Aegean | Kurupınar and Öztürk, 2009 |
| *Rutilus rutilus* | *Rutilus rutilus** | Marmara | Saç et al., 2016 |
| *Alburnus orontis* | *Alburnus escherichii** | Central Anatolian | Turgut et al., 2011 |
| *Leuciscus cephalus* | *Squalius orientalis** | | |
| *Chondrostoma regium* | *Chondrostoma angorense** | | |
| *Alburnus derjugini* | *Alburnus derjugini** | Black Sea | Kayiş et al., 2020 |
| *Alburnoides fasciatus* | *Alburnoides fasciatus** | Black Sea | Kayis et al., 2018 |
| *Barbus artvinica* | *Barbus rionicus* | | |
| *Capoeta banarescui* | *Capoeta banarescui* | | |
| *Capoeta ekmekciae* | *Capoeta ekmekciae* | | |
| *Capoeta sieboldii* | *Capoeta sieboldii* | | |
| *Squalius orientalis* | *Squalius orientalis** | | |
| *Barbus plebejus* | *Barbus cyri* | North-Eastern Anatolia | Arslan et al., 2015 |
| *Capoeta capoeta* | *Capoeta capoeta* | | |

The species remarked with asterix currently placed in the following families: *Leuciscidae **Tincidae ***Gobioidae

the rainbow trout (*Oncorhynchus mykiss*) found in the natural environment of New Zealand and previously named as *Salmo gairdneri* and *Gobiomorphus cotidianus*, which belongs to the family Gobiidae (Weekes & Penlington, 1986). In addition, a study was published in 2007 in which reports on the host diversity of *L. intestinalis* in Turkey were compiled (Innal *et al*., 2007). According to this study, *L. intestinalis* has been reported in 20 different fish species, most of which belong to the Cyprinidae family. However, according to the present molecular data, the Cyprinidae family was divided into groups (Stout *et al*., 2016; Tan & Armbruster, 2018); therefore, some species have been moved to the Leuciscidae and Gobioidae families. Except for cyprinoid species, four cases belonging to Esocidae, Pleuronectidae, and Siluridae genera, which are rarely carnivorous, were also encountered (Innal *et al*., 2007). After this date, Cyprinoid species were again encountered in the studies of *L. intestinalis* from Turkey's inland waters (Table 3). The remarkable detail observed in the studies was that the recorded fish species were carnivores, except Cyprinoid species. Thus, it may strengthen the notion that *L. intestinalis* has been observed transiently in this species because of the consumption of infected fish. No host record of hybrid fish species was found in *L. intestinalis* cases, both worldwide and in Turkey. In this study, *L. intestinalis* was recorded for the first time in a hybrid of *A. derjugini* and *S. orientalis*. When *L. intestinalis* records on the genus belonging to the ancestral species which formed the hybrid species in Turkey were examined, it was found to be the *Alburnus* genus, namely, *Alburnus orontis*, *Alburnus alburnus*, *Alburnus escherichii,* and *A. derjugini* (Innal *et al*., 2007; Kayiş *et al*., 2020) and the *Squalius* genus including *Squalius cephalus* (now *Squalius pursakensis*) and *S. orientalis* (Innal *et al*., 2010; Kayiş *et al*., 2020).

Genera *Alburnus* and *Squalius* generally occur as syntopic in both lakes and streams. These two genera are known to propagate several hybrids in nature. Often these hybrids are considered to be distinct species; however, this has still not been confirmed. The hybrids of these two genera are typically found in a few specimens in nature; however, they form considerable stocks in degraded habitats such as reservoirs. This reinforces the idea that hybrids have the ability to reproduce. Recently, a hybrid population between *Alburnus sellal* and *Squalius semae* has been found from upper Euphrates River (Turan *et al*., 2020).

The prevalence of the parasites in different hosts and the water quality of the aquatic system in which they are sampled are generally accepted as an indicator of the ecological area and host selection (Sures *et al*., 2017). The prevalence of *L. intestinalis* in the hybrid species was 48.44 % in total, although there were differences because of the variation in the number of samples and water temperature-pH changes in different months. Considering the studies on the ancestor species, the prevalence of *L. intestinalis* for *A. derjugini* was reported as 44 % (Kayiş *et al*., 2020) and 43.3 % for *S. orientalis* (Kayis *et al*., 2018). Considering that *S. orientalis* was named as *Squalius cephalus* or *Leuciscus cephalus* in the classification before 2010, different prevalence values can be mentioned for *L. intestinalis*. For *S. cephalus* or *L. cephalus*, the prevalence of *L. intestinalis* has been reported in different studies as 7.07 % (Innal *et al*., 2010) and 34.8 % (Turgut *et al*., 2011). In some studies, lower prevalence values, particularly in the *Squalius* genus, or no *L. intestinalis* record was found despite sampling (Arslan *et al*., 2015). Therefore, it can be said that hybrid individuals are slightly more susceptible to *L. intestinalis* infections when compared with the ancestors in terms of prevalence. The susceptibility of fish to diseases at different stages can be further studied. Sures *et al*. (2017), reported in their review study that some parasites may have different prevalence tendencies on invasive and natural host populations. The hybrid population mentioned in our study was defined for the first time in this study for the aquatic area where they were sampled. Therefore, the history of the hybrid population in the aquatic system in which the study was conducted is unknown. When the host prevalence values of *Ligula intestinalis* in the previous literature on ancestral individuals are compared with the prevalence values of the hybrid population in this study, it can be said that the parasites prefer hybrid individuals. This situation confirms the statements of Sures *et al*. (2017) about the prevalence trends of parasites.

The minimum and maximum length range of the prevalence of *L. intestinalis* in individuals belonging to the *Alburnus* genus was 7 – 15 cm in *Alburnus escherichii* (Koyun, 2006; Özbek & Öztürk, 2010). For *A. derjugini*, the size range of the ancestor of the hybrid species varies between 9 and 15 cm (Kayiş *et al*., 2020). For the ancestral species of *S. orientalis*, this length ranged 7.9 – 24.1 cm (Kayis *et al*., 2018). In particular, it is emphasized that the prevalence of the parasite in fish belonging to the *Alburnus* genus increases in those with long stature (Özbek & Öztürk, 2010). In this study, when the prevalence distribution of *L. intestinalis* according to size groups in hybrid individuals was examined, the highest value was 0 – 10 cm. However, the fact that the number of fish sampled in this value range was lower than other groups may restrict in making a clear decision. Moreover, the second-highest prevalence was noted in ≥16 cm group, represented by a relatively higher number of individuals. The length range represented by the highest number of individuals but had the lowest prevalence was the 11 – 15 cm group. Therefore, the prevalence of *L. intestinalis* in hybrid individuals was more similar to the genus *Alburnus* from the ancestral species compared to the size groups. As a result, the existence of a fish species that reproduces from *A. derjuguni* × *S. orientalis* species living in the Kürtün Dam Lake and has a natural distribution in the aquatic system as a hybrid and the *L. intestinalis* infection in this species have been revealed.

We examined the hybrid population between *A. derjugini* and *S. orientalis* from the Kürtün Dam Lake. During the examination, most of the diagnostic characteristics (particularly meristic) for both genera were found to be between the range of the two species (see Tables 1 and 2 for details). In addition, the presence of *L. intestinalis* in hybrid fish individuals was demonstrated for the first time in the world literature, which distinguishes this study from other studies.

**Conflicts of Interest**

The authors declare that we have no conflict interests.

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