

## Detection of Ectoparasite *Lernaea cyprinacea* (Copepoda: Lernaeidae) on some Cypriniformes Fish from the Mediterranean Region of Turkey

Deniz INNAL

Burdur Mehmet Akif Ersoy University, Department of Biology, Burdur, Turkey  
ORCID ID: Deniz INNAL: <https://orcid.org/0000-0002-1686-0959>

Received: 17.07.2020

Accepted: 28.10.2020

Published online: 05.11.2020

Issue published: 31.12.2020

**Abstract:** *Lernaea cyprinacea* L., 1758 is a lernaeid copepod species usually known as anchor worm. It is usually reported as having a wide range of host susceptibility. Parasites belonging to the genus *Lernaea* can have serious deleterious effects on their freshwater fish hosts. Parasites belonging to the genus *Lernaea*, it has been reported from several host fish species to date in Turkey. Mediterranean region of Turkey supports a rich diversity of Cypriniformes fish fauna, with a high percentage of endemic species. This study reports the infection of *L. cyprinacea* on some native and alien Cypriniformes fish in the Mediterranean region of Turkey. *Barbus xanthos*, *Alburnus baliki*, *Pseudophoxinus zekayi* and *Pseudorasbora parva* were found as new host records for *L. cyprinacea*.

**Keywords:** Endemism, non-indigenous species, ectoparasite, freshwater.

### Türkiye'nin Akdeniz Bölgesi'nden Bazı Cypriniformes Balıklarında Ektoparazit *Lernaea cyprinacea*'nin (Copepoda: Lernaeidae) Tespit Edilmesi

**Öz:** *Lernaea cyprinacea* L., 1758, çapa kurdü olarak bilinen bir lernaeid kopepod türüdür. Genellikle geniş bir konakçı duyarlılığına sahip olduğu bildirilmektedir. *Lernaea* cinsine ait parazitlerin tatlı su balıkları konakçıları üzerinde ciddi zararlı etkileri bulunmaktadır. *Lernaea* cinsine ait parazitler, Türkiye'de bugüne kadar birçok konak balık türünden bildirilmiştir. Türkiye'nin Akdeniz bölgesi, yüksek endemik tür yüzdesi ile zengin bir Cypriniformes balık faunası çeşitliliğini barındırmaktadır. Bu çalışma, Türkiye'nin Akdeniz bölgesindeki bazı yerli ve yabancı Cypriniformes balıklarında *L. cyprinacea* enfeksiyonunu açıklamaktadır. *Barbus xanthos*, *Alburnus baliki*, *Pseudophoxinus zekayi* ve *Pseudorasbora parva*, *L. cyprinacea* için yeni konak kayıtları olarak bulunmuştur.

**Anahtar kelimeler:** Endemizm, yabancı türler, ektoparazit, tatlısu.

#### 1. Introduction

The order Cypriniformes is the most diverse order of freshwater fish. In the inland waters of Turkey, this order is represented by 278 species according to Çiçek, Sungur, and Fricke (2020). Ecology of parasites of the order Cypriniformes has been the center of an increasing attention for two decades (Dorovskikh & Stepanov, 2009; Soylu, Uzmanoğlu, Çolak, & Soylu, 2017; Gabagambi & Skorping, 2018; Czerniejewski, Rybczyk, Linowska, & Sobecka, 2019).

Copepod parasites have recently been highlighted as serious pathogenic problems in order Cypriniformes (Unal et al., 2017). Among the Copepod parasites, *L. cyprinacea* was mostly described from the gills, skin or fins of wild and cultured Cypriniformes fish (Boane, Cruz, & Saraiva 2008; Novakov et al., 2015; Demir & Karakisi, 2016; Soylu et al., 2017).

There have been numerous reports of *L. cyprinacea* from Turkey and adjacent regions: Iraq (Mhaisen, 1982), Iran (Barzegar, Raeisi, Bozorgnia, & Jalali, 2008; Raissy & Ansari, 2012; Raissy, Sohrabi, Rashedi, & Ansari, 2013; Daghigh Roohi, Sattari, Nezamabadi, & Ghorbanpour, 2014) as well as Mediterranean countries (Nofal, Zaki, & El-Shebly, 2016; Ahnelt et al., 2018).

After the first report of *L. cyprinacea* in Turkey, several studies have demonstrated that the parasite is

widespread in this country and identified as a possible threat to the endemic and economic fish stocks. *L. cyprinacea* has been found infesting Cypriniformes host species in Turkey, as follows, *Carassius carassius* in Kovada Lake (Geldiay & Balık, 1974); *Cyprinus carpio* (Burgu, Oguz, Korting, & Guralp, 1988), *Chondrostoma nasus* in Tahtalı Dam Lake, Izmir (Demir, 2008); *Cyprinus carpio* in Tahtalı Dam Lake, Izmir (Karakisi & Demir, 2012); *Carassius gibelio* in Karacaören II Dam Lake, Burdur (Kır & Samancı, 2012); *Tinca tinca* in Seyhan Dam Lake, Adana (Ince, 2013); *Cyprinion macrostomus* in Murat River, Bingöl (Koyun, Ulupınar, & Mart, 2015); *Pseudophoxinus burduricus* and *Oxyneomacheilus anatolicus* in Düğer Creek, Burdur (Innal et al., 2017); *Pseudophoxinus egridiri* in Eğirdir Lake, Isparta (Akcimen et al., 2018); *Chondrostoma beysehirense* and *Squalius cephalus* from the Üzümlü pond, Konya (Erbaatur, Yağcı, Öktener, & Akcimen, 2018).

Mediterranean region of Turkey supports a rich diversity of Cypriniformes fish fauna with a high percentage of endemic species. Although a large number of endoparasite species has been reported in this order, studies on ectoparasite species are very limited. The present study was conducted to identify the parasitic infections of *L. cyprinacea* on some native and alien Cypriniformes species in the Mediterranean region of Turkey.

## 2. Material and Methods

Overall, 679 individuals belonging to seven fish species (Table 1) were analyzed: *Pseudophoxinus burduricus* Küçük, Güllü, Güçlü, Çiftçi, & Erdoğan, 2013 (Burdur spring minnow); *Pseudophoxinus zekayi* Bogutskaya, Küçük & Atalay, 2006 (Ceyhan spring minnow); *Barbus xanthos* (Güçlü, Kalaycı, Küçük, Turan 2020); *Tinca tinca* (Linnaeus, 1758) (Tench); *Pseudorasbora parva* (Temminck & Schlegel, 1846) (Stone moroko); *Carassius gibelio* (Bloch, 1782) (Prussian carp); *Alburnus baliki* Bogutskaya, Küçük & Ünlü, 2000 (Antalya bleak).

The investigation was carried out from May 2013 to July 2020. Fish were collected using beach seine nets, longline nets, and electroshock methods in ten aquatic

systems (Fig. 1) (on the map; 1: Lake Gölhisar; 2: Dalaman River; 3: Değirmendere Creek; 4: Lake Karataş; 5: Soğanlı Pond; 6: Çanaklı Pond; 7: Onaç Reservoir; 8: Lake Beyşehir; 9: Karpuzçay Creek; 10: Ceyhan River).

Fish were transported immediately to the Burdur Mehmet Akif Ersoy University Ichthyology Laboratory in plastic bags. Each fish was measured (total length in cm) and weighed (g) before observation. Fish species were examined for the presence of *L. cyprinacea*. Areas around the fins, nostril, opercular cavity, and skin were examined with a dissecting microscope. *L. cyprinacea* was identified using a dissecting microscope and according to Bauer (1987). Prevalence and intensity of infection were recorded (Bush, Lafferty, Lotz, & Shostak, 1997).

Table 1. Systematic overview of host fish species

No	Host	Common name	Order	Family
1	<i>Pseudophoxinus burduricus</i>	Burdur spring minnow	Cypriniformes	Leuciscidae
2	<i>Alburnus baliki</i>	Antalya bleak	Cypriniformes	Leuciscidae
3	<i>Pseudophoxinus zekayi</i>	Ceyhan spring minnow	Cypriniformes	Leuciscidae
4	<i>Barbus xanthos</i>	Eşen barbel	Cypriniformes	Cyprinidae
5	<i>Tinca tinca</i>	Tench	Cypriniformes	Tincidae
6	<i>Pseudorasbora parva</i>	Stone moroko	Cypriniformes	Gobionidae
7	<i>Carassius gibelio</i>	Prussian carp	Cypriniformes	Cyprinidae

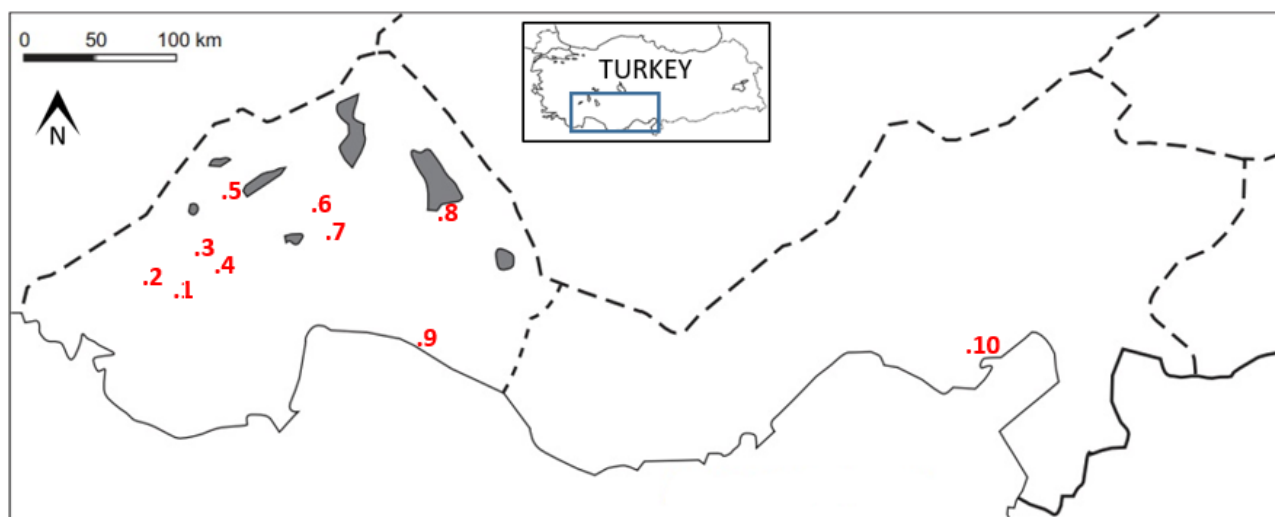


Figure 1. Sampling localities [1. Lake Gölhisar (37° 07'16.27"N 29°35'35.31"E); 2. Dalaman River (37°13'35.33"N 29°32'57.54"E); 3. Değirmendere Creek (37°25'29.85"N 29°49'19.34"E); 4. Lake Karataş (37°23'42.37"N 29°58'40.75"E); 5. Soğanlı Pond (37°38'29.60"N 30° 3'14.68"E); 6. Çanaklı Pond (37°36'15.21"N 30°32'25.25"E); 7. Onaç Reservoir (37°29'37.12" N 30°34'3.42"E); 8. Lake Beyşehir (37°41'4.83"N 31°40'39.57"E); 9. Karpuzçay Creek (36°42'57.03"N 31°33'1.22"E); 10. Ceyhan River (36°39'2.28"N 35°33'46.79"E)].

## 3. Results

Among the seven species examined for infestation with *L. cyprinacea*, the highest prevalence of infection was reached in *Pseudophoxinus burduricus*, a native fish from Değirmen Creek, followed by Çanaklı Pond population of *C. gibelio* and Onaç Reservoir population of *C. gibelio* (48%; 15.38%; 11.02%, respectively) (Fig. 2). With respect to mean intensity, the highest values were recorded in Gölhisar Lake population of *Tinca tinca*, Beyşehir Lake population of *Carassius gibelio*, Karataş Lake Population of *Carassius gibelio* (3.7; 3.5; 3 parasites/fish, respectively).

## 4. Discussion

*Lernaea* is a copepod, which is parasitic on many species of freshwater fish and is extremely common among the Cypriniformes fish. In Turkey, previous records of the

genus *Lernaea* on order Cypriniformes are provided by Geldiay and Balık (1974); Burgu et al. (1988); Demir (2008); Karakisi and Demir (2012); Kir and Samancı (2012); Ince (2013); Koyun et al. (2015); Innal et al. (2017); Akcimen et al. (2018); Erbatur et al. (2018). To date, 11 Cypriniformes species have been reported as host of *L. cyprinacea* in Turkey. This study documents the expanded geographical and host distribution of *L. cyprinacea* in Turkey. The present findings of *L. cyprinacea* from *Barbus xanthos*, *Alburnus baliki*, *Pseudophoxinus zekayi*, and *Pseudorasbora parva* represent the first records of the copepod from these fish in Turkey. This copepod is characterized with a wide host and geographic distribution and adapted to a large variety of habitat in Turkey.

In this study, *Lernaea* parasites were collected from the skin, gills, opercular cavity, and fins of *Pseudophoxinus*

*burduricus*, *Pseudophoxinus zekayi*, *Barbus xanthos*, *Tinca tinca*, *Pseudorasbora parva*, *Carassius gibelio* and *Alburnus baliki* in different water bodies. The highest infection prevalence value was found in *Pseudophoxinus burduricus* from Değirmendere Creek (48%) and the lowest in *Carassius gibelio* from Beyşehir Lake (3%). The mean intensity varied from 1 parasite in *Alburnus baliki* in Karpuzçay Creek and *Carassius gibelio* in Soğanlı Reservoir to 3.7 in *Tinca tinca* from Gölhisar Lake.

Different prevalence and intensity values in *L. cyprinacea* infections between the localities and hosts may depend on the changing habitat conditions such as temperature, pH, salinity and dissolved oxygen, and biotic parameters. For some populations, the data of infections were not representative for four seasons. In addition to seasonality and habitat conditions, the observed difference in infection parameters could be due to the sample size, sampling differences, feeding habits of fish species, sex ratio, length range, and host resistance.

A number of studies have investigated the differences in parasitism levels of *L. cyprinacea* on host Cypriniformes species (Gutiérrez-Galindo & Lacasa-Millán, 2005; Barson et al., 2008; Pérez-Bote, 2010; Stavrescu-Bedivan, Popa, Aioanei, & Popa, 2011). In some cases, they can be very abundant: in *Chondrostoma orientale*

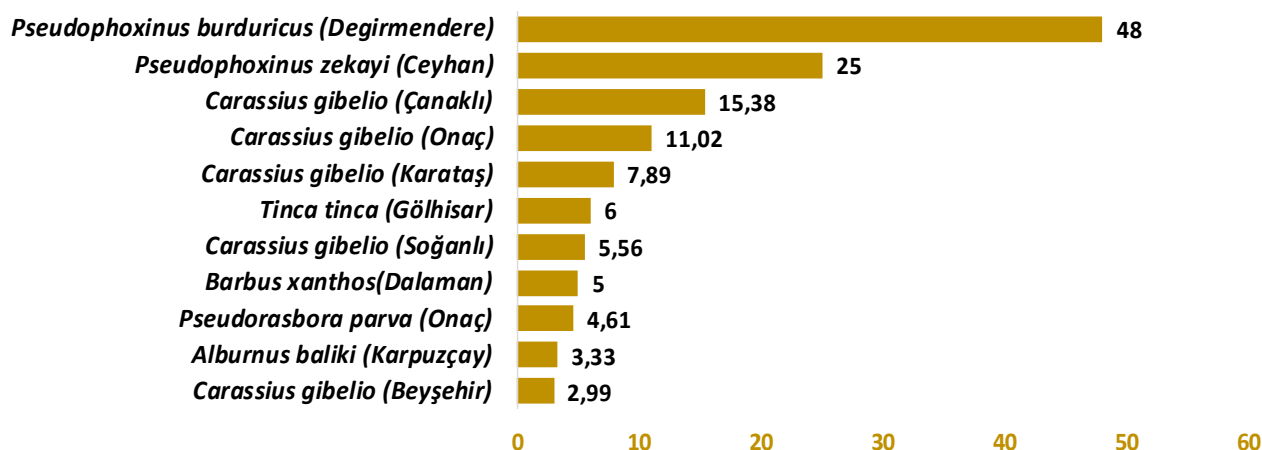
Bianco & Banarescu, 1982 from the Kor River Basin, southwestern Iran the prevalence of *L. cyprinacea* infections reached 100%, with a mean intensity of 10,3 parasites per fish (Sayyadzadeh & Roudbar, 2015), and in *Hypophthalmichthys molitrix* from Manzala area 64% of the specimens were infected (Nofal et al., 2016).

In this study, it was determined that *L. cyprinacea* affected native and introduced Cypriniformes fish in Turkey. The results of this study encourage further investigations in different aquatic systems of the Mediterranean region of Turkey in order to identify prevalence and intensity of *L. cyprinacea* infestation for other Cypriniformes fish species. Moreover, the differences in morphological structure of the parasite individuals (*L. cyprinacea*) between regions and hosts should be investigated by molecular genetic methods.

**Acknowledgements:** The author would like to thank Prof. Dr. Iskender Gülle who helped the field studies in some regions. Field studies in Ceyhan river was financially supported by Scientific and Technological Research Council of Turkey (Tübitak) under the Project numbered KBAG, 114 Z 259.

**Conflict of interest:** The author declares that there is no conflict of interest.

## Prevalence %



## Intensity

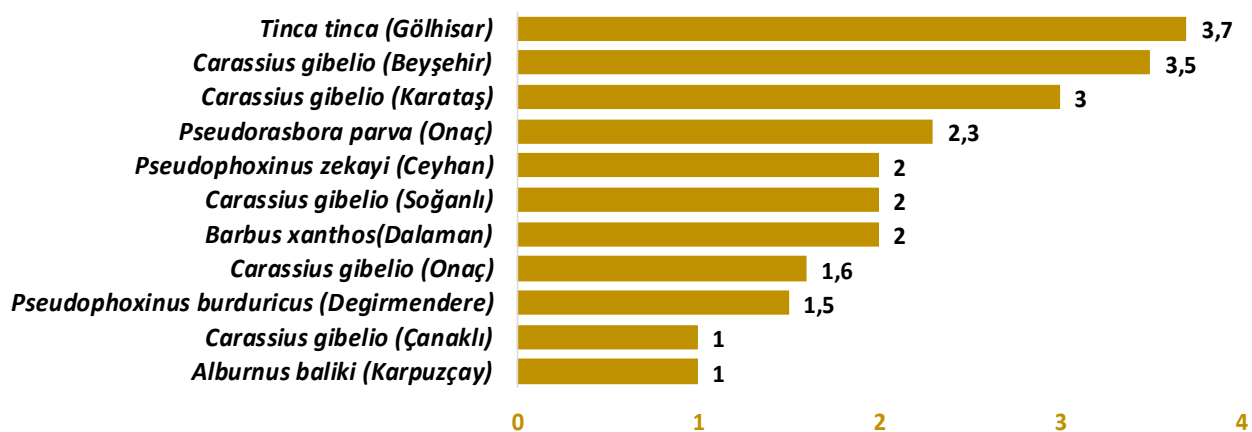


Figure 2. Prevalence and intensity values of host fish species

Table 2. Occurrence of *Lernaea cyprinacea* infestation in host fish species (N=total number of hosts examined; N'= number of infected fishes)

No	Host	Location	Status	N	N'	Total length (cm) Range (Min-Max)	Weight (g) Range (Min-Max)
1	<i>Pseudophoxinus burduricus</i>	Degirmendere Creek	Endemic	25	12	4.9-10.7	1.4-16
2	<i>Alburnus baliki</i>	Karpuzçay Creek	Endemic	60	2	4.2-10.8	0.6-15.7
3	<i>Pseudophoxinus zekayi</i>	Ceyhan River	Endemic	4	1	9.5-12.8	9.1-30.4
4	<i>Barbus xanthos</i>	Dalaman Stream	Native	60	3	3.5-20	0.5-80
5	<i>Tinca tinca</i>	Göhlhisar Lake	Alien	50	3	16.2-39.3	78.5-1056
6	<i>Pseudorasbora parva</i>	Onaç Reservoir	Alien	217	10	2.8-6.7	0.143-2.9
7	<i>Carassius gibelio</i>	Onaç Reservoir	Alien	127	14	3.4-27.9	0.5-470.4
8	<i>Carassius gibelio</i>	Çanaklı Reservoir	Alien	13	2	4.4-12.6	1.2-35.7
9	<i>Carassius gibelio</i>	Soğanlı Reservoir	Alien	18	1	8.4-14.1	10.1-48
10	<i>Carassius gibelio</i>	Karataş Lake	Alien	38	3	20-33	153-560
11	<i>Carassius gibelio</i>	Beyşehir Lake	Alien	67	2	18.1-24.2	86-263

**Ethics committee approval:** This study was performed in accordance with ethical standards of animal experiments. Legal research ethics committee approval permissions for the study were obtained from the Burdur Mehmet Akif Ersoy University, Animal Experiments Local Ethics Committee (No: 659)

## References

- Ahnelt, H., Konecny, R., Gabriel, A., Bauer, A., Pompei, L., Lorenzoni, M., & Sattmann, H. (2018). First report of the parasitic copepod *Lernaea cyprinacea* (Copepoda: Lernaieidae) on gobioid fishes (Teleostei: Gobiionellidae) in southern Europe. *Knowledge and management of aquatic ecosystems*, (419) 34, 1-6.
- Akcimen, U., Apaydın Yağcı, M., Yeğen, V., Uysal, R., Bilgin, F., & Yağcı, A. (2018). First Report of *Eustrongylides excisus* Larvae and *Lernaea cyprinacea* on Eğirdir Minnow (*Pseudophoxinus egridiri*) 13th International Symposium on Fisheries and Aquatic Sciences Proceedings Book ISBN: 978-605-68894-0-0 Publication of e-book date: 17.12.2018
- Barson, M., Mulonga, A., & Nhwatiwa, T. (2008). Investigation of a parasitic outbreak of *Lernaea cyprinacea* Linnaeus (Crustacea: Copepoda) in fish from Zimbabwe. *African Zoology*, 43(2), 175-183.
- Barzegar, M., Raeisi, M., Bozorgnia, A., & Jalali, B. (2008). Parasites of the eyes of fresh and brackish water fishes in Iran. *Iranian Journal of Veterinary Research*, 9(3), 256-261.
- Bauer, O.N. (1987). Guide for identification of parasites of the freshwater Fish Fauna of the USSR, Vol 3. Zoological Institute, Academy of Sciences of the USSR, Leningrad.
- Boane, C., Cruz, C., & Saraiva, A. (2008). Metazoan parasites of *Cyprinus carpio* L. (Cyprinidae) from Mozambique. *Aquaculture*, 284(1-4), 59-61.
- Burgu, A., Oguz, T., Korting, W., & Guralp, N. (1988). Parasites of freshwater fishes in some areas of Central Anatolia. *Journal of Etik Veterinary Microbiology*, 6, 143-165.
- Bush, A.O., Lafferty, K.D., Lotz, J.M., & Shostak, A.W. (1997). Parasitology meets ecology on its own terms: Margolis et al, Revisited. *Journal of Parasitology*, 83(4), 575-583.
- Czerniejewski, P., Rybczyk, A., Linowska, A., & Sobocka, E. (2019). New location, food composition, and parasitic fauna of the invasive fish *Pseudorasbora parva* (Temminck & Schlegel, 1846) (Cyprinidae) in Poland. *Turkish Journal of Zoology*, 43(1), 94-105.
- Çiçek, E., Sungur, S., & Fricke, R. (2020). Freshwater lampreys and fishes of Turkey; a revised and updated annotated checklist 2020. *Zootaxa*, 4809(2), 241-270.
- Daghigh Roohi, J., Sattari, M., Nezamabadi, H., & Ghorbanpour, N. (2014). Occurrence and intensity of parasites in Prussian carp, *Carassius gibelio* from Anzali wetland, Southwest Caspian Sea. *Iranian Journal of Fisheries Sciences*, 13(2), 276-288.
- Demir, S. (2008). Metazoan parasites of nase (*Chondrostoma nasus* L., 1758) inhabiting in Tahtali Dam Lake (İzmir), (MSc thesis). Ege University, İzmir, Turkey.
- Demir, S., & Karakisi, H. (2016). Metazoan Parasite Fauna of the Prussian carp, *Carassius gibelio* (Bloch, 1782) (Cyprinidae), from Marmara Lake, Turkey. *Acta Zoologica Bulgarica*, 68(2), 265-268.
- Dorovskikh, G.N., & Stepanov, V.G. (2009). Structure of component parasite communities in the grayling, *Thymallus thymallus* L. (Salmoniformes, Thymallidae), and minnow, *Phoxinus phoxinus* L. (Cypriniformes, Cyprinidae), from the upper reaches of the Pechora River. *Biology Bulletin*, 36(3), 298-306.
- Erbatur, I., Yağcı, A., Öktener, A., & Akcimen, U. (2018). New Locality for *Lernaea cyprinacea* (Copepoda; Lernaieidae) in Turkey 13th International Symposium on Fisheries and Aquatic Sciences Proceedings Book ISBN: 978-605-68894-0-0 Publication of e-book date: 17.12.2018.
- Gabagambi, N.P., & Skorpung, A. (2018). Spatial and temporal distribution of *Ligula intestinalis* (Cestoda: Diphylobothriidea) in usipa (*Engraulicypris sardella*) (Pisces: Cyprinidae) in Lake Nyasa. *Journal of Helminthology*, 92(4), 410-416.
- Geldiyar, R., & Balık, S. (1974). Ecto and Endoparasites found the freshwater fish of Turkey. Ege University Science Faculty Monographs, 14.
- Gutiérrez-Galindo, J.F., & Lacasa-Millán, M.L. (2005). Population dynamics of *Lernaea cyprinacea* (Crustacea: Copepoda) on four cyprinid species. *Diseases of Aquatic Organisms*, 67(1-2), 111-114.
- Ince, H. (2013). *Adana ili Seyhan Baraj Gölünde Yetiştiriliciliği ve Avçılığı Yapılan iç su Balıklarındaki Parazitlerin Tespiti*, Selçuk Üniversitesi, Sağlık Bilimleri Enstitüsü (Yüksek Lisans tezi), Konya, Türkiye.
- Innal, D., Avenant Oldewage, A., Dogangil, B., Stavrescu Bedivan, M.M., Ozmen, O., & Mavruk, S. (2017). Susceptibility of endemic and non-indigenous fish to *Lernaea cyprinacea* (Copepoda: Lernaieidae): a case study from Düğer Spring, Turkey. *Bulletin of The European Association of Fish Pathologists*, 37(3), 100-109.
- Karakisi, H., & Demir, S. (2012). Metazoan parasites of the common carp (*Cyprinus carpio* L., 1758) from Tahtali Dam Lake (Izmir). *Türkiye Parazitoloji Dergisi*, 36(3), 174-177.
- Kır, I., & Samancı, I. (2012). The Parasite Fauna of Crucian Carp (*Carassius gibelio* Bloch., 1782) Inhabiting Karacaören II Dam Lake (Burdur, Isparta). *SDÜ Eğirdir Su Ürünleri Fakültesi Dergisi*, 8(2), 38-42.
- Koyun, M., Ulupinar, M., & Mart, A. (2015). First record of *Lernaea cyprinacea* L 1758 (Copepoda: Cyclopoidea) on *Cyprinion macrostomus* Heckel, 1843 from eastern Anatolia, Turkey. *Biharean Biologist*, 9, 44-46.
- Mhaisen, F.T. (1982). The anchor worm, *Lernaea cyprinacea*, in Basrah University Fish Farm. *Mesopotamian Journal of Marine Science*, 1, 3-11.
- Nofal, M.E., Zaki, V.H., & El-Shebly, A.A. (2016). Implications of heavy infestation of *Lernaea cyprinacea* (Crustacea: Copepoda) of Silver carp, *Hypophthalmichthys molitrix* at Manzala area, with trial for control using Trichlorfon. *International Journal of Fisheries and Aquatic Studies*, 4(6), 314-318.
- Novakov, N., Ćirković, M., Kartalović, B., Pelić, M., Matić, D., Ljubojević, D., & Božić, B. (2015). Infestation of *Lernaea cyprinacea* (Crustacea: Copepoda) in different categories of common carp (*Cyprinus carpio*) reared in Serbia. *Arhiv Veterinarske Medicines/Archives of Veterinary Medicine*, 8(2), 11-18.
- Pérez-Bote, J.L. (2010). *Barbus comizo* infestation by *Lernaea cyprinacea* (Crustacea: Copepoda) in the Guadiana River, southwestern Spain. *Journal of Applied Ichthyology*, 26(4), 592-595.
- Raissy, M., & Ansari, M. (2012). Parasites of some freshwater fish from Armand river, chaharmahal va Bakhtyari province, Iran. *Iranian Journal of Parasitology*, 7(1), 73-79.
- Raissy, M., Sohrabi, H.R., Rashedi, M., & Ansari, M. (2013). Investigation of a parasitic outbreak of *Lernaea cyprinacea* Linnaeus (Crustacea: Copepoda) in Cyprinid fish from Choghakhor lagoon. *Iranian Journal of Fisheries Sciences*, 12(3), 680-688.
- Sayyadzadeh, G., & Roudbar, A.J. (2015). Occurrence of *Lernaea cyprinacea* (Crustacea: Copepoda) in an endemic cyprinid fish, *Chondrostoma orientale* Bianco & Banarescu, 1982 from the Kor River Basin, southwestern Iran. *Iranian Journal of Ichthyology*, 1(3), 214-217.
- Soylu, E., Uzmanoğlu, S., Çolak, S.Ö., & Soyulu, M.P. (2017). Community Structure of the Parasites of the Endemic Chocolate Chub *Squalius carinus* Özüluğ & Freyhof, 2011 (Cyprinidae) from Işıklı Lake, Çivril, Turkey. *Acta Zoologica Bulgarica*, 69(3), 405-409.
- Stavrescu-Bedivan, M.M., Popa, O., Aioanei, F., & Popa, L. (2011). Infestation of the pumpkinseed *Lepomis gibbosus* (Teleostei: Cyprinidae) by the copepod *Lernaea cyprinacea* (Crustacea)-some ecological aspects. *Travaux du Muséum National d'Histoire Naturelle" Grigore Antipa"* 54(1), 63-68.

Unal, M.C., Innal, D., Civanova, K., Stavrescu-Bedivan, M.M., Koubkova, B., Ozmen, O., & Gelnar, M. (2017). Identification of two gill parasites *Lamproglena compacta* (Copepoda: Lernaecidae) and *Paradiplozoon bliccae* (Monogenea: Diplozoidae) from endemic Aegean chub (*Squalius fellowesii*), *Bulletin of The European Association of Fish Pathologists*, 37(4), 135-147.

---