

Fish lice (Argulidae: *Argulus* spp.) infestations detected on freshwater fish in Türkiye: *Argulus foliaceus* (Linnaeus, 1758) and *Argulus japonicus* Thiele, 1900

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Abstract. *Argulus* (Crustacea: Branchiura) species, also known as fish lice, are among the most important aquatic ectoparasites infesting fish in Türkiye and worldwide because of their low host specificity and widespread distribution. Approximately 130 species have been identified within this genus, which inhabit freshwater, marine, and estuarine environments. To date, only two species have been reported from Türkiye: *Argulus foliaceus* (Linnaeus, 1758) and *A. japonicus* Thiele, 1900. This study aimed to determine the host diversity of *Argulus* species reported in Türkiye through a literature review. Additionally, we aimed to report *A. japonicus* infestations detected in common carp (*Cyprinus carpio* L.) and Amur carp (*Cyprinus rubrofasciatus* Lacepède) (ornamental form; koi) during routine parasitological surveys conducted at the Mediterranean Fisheries Research, Production, and Training Institute (Antalya, Türkiye). *Argulus japonicus*, a parasite found on common carp (*C. carpio*), represents a new host–parasite association for the parasitic fauna of Türkiye.

Keywords: Aquaculture parasites, Branchiura, Crustacea, parasitic crustaceans

Introduction

Many aquatic vertebrates, including fish, are frequently infested by various parasitic crustaceans (pathogenic or apathogenic), some of which may cause significant health problems and economic losses in aquaculture. Argulids are among the most important crustacean groups of parasitological significance in fish (Lester and Hayward 2006, Boxshall and Hayes 2019). In the current taxonomy, the family Argulidae, within the order Argulida of the subclass Branchiura, comprises four genera: *Argulus* Müller, 1785; *Chonopeltis* Thiele, 1900; *Dipteropeltis* Calman, 1912; and *Dolops* Audouin, 1837 (Poly 2008). Among these, only the genus *Argulus* has a cosmopolitan distribution. *Chonopeltis* is restricted to Africa, *Dipteropeltis* to South America, and *Dolops* is found in Africa, Tasmania, and South America (Ringuelet 1943, Yamaguti 1963, Fryer 1968, Tam 2005). Members of the order Branchiura, which are characterized by low host specificity, are commonly referred to as fish lice. However, in Turkish scientific literature and common usage in Türkiye, the term “fish lice” (balık biti in Turkish) is used exclusively for species belonging to the genus *Argulus* (Tınar and Umr 2024).

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Table 1*Argulus* species and their hosts reported in Türkiye to date

Argulus species	Host		References
	Family	Species	
<i>Argulus foliaceus</i>	Cichlidae	<i>Astronotus ocellatus</i> (Agassiz, 1831)	25
	Cyprinidae	<i>Abramis brama</i> (Linnaeus, 1758); <i>Barbus plebejus</i> Heckel, 1843; <i>Capoeta trutta</i> (Heckel, 1843); <i>Carassius auratus</i> (Linnaeus, 1758); <i>Carassius gibelio</i> (Bloch, 1782); <i>Carassius</i> sp.; <i>Capoeta tinca</i> (Heckel, 1843); <i>Ctenopharyngodon idella</i> (Valenciennes, 1844); <i>Cyprinus carpio</i> Linnaeus, 1758; <i>Luciobarbus pectoralis</i> (Heckel, 1843)	1, 3, 5, 7-17, 19-21, 23, 24, 27, 28, 31, 32, 34, 35, 39, 42
		<i>Esox lucius</i> Linnaeus, 1758	10
		<i>Alburnus chalcoides</i> (Güldenstädt, 1772); <i>Alburnus escherichii</i> Steindachner, 1897; <i>Alburnus</i> sp.; <i>Scardinius erythrophthalmus</i> (Linnaeus, 1758); <i>Squalius cephalus</i> (Linnaeus, 1758); <i>Squalius</i> sp.; <i>Vimba vimba</i> (Linnaeus, 1758)	1, 4, 12, 16, 18, 26, 29, 33, 36, 39
	Mastacembelidae	<i>Mastacembelus mastacembelus</i> (Banks & Solander, 1794)	30, 38
	Mugilidae	<i>Planiliza abu</i> (Heckel, 1843)	30
	Salmonidae	<i>Oncorhynchus mykiss</i> (Walbaum, 1792)	20
	Siluridae	<i>Silurus glanis</i> Linnaeus, 1758; <i>Silurus triostegus</i> Heckel, 1843	2, 4, 6, 22, 30
		<i>Tinca tinca</i> (Linnaeus, 1758)	4, 6, 12
	Cyprinidae	<i>Carassius auratus</i> (Linnaeus, 1758); <i>Cyprinus carpio</i> Linnaeus, 1758; <i>Cyprinus rubrofasciatus</i> Lacepède, 1803 (ornamental form; koi)	32, 37, 38, 43

Geldiay and Balık 1974 (1), Ekingen 1976 (2), Soylu 1985 (3), Burgu et al. 1988 (4), Altın 1989 (5), Soylu 1990 (6), Oğuz 1991 (7), Sarıeyyüpoğlu and Sağlam 1991 (8), Özer 1995 (9), Öztürk 1995 (10), Aydoğdu 1997 (11), Koyun et al. 1997 (12), Aydoğdu et al. 1997 (13), Becer and Kara 1998 (14), Cengizler et al. 2001 (15), Öztürk and Altunel 2003 (16), Şahan and Cengizler 2003 (17), Kahveci 2004 (18), Karatoy 2004 (19), Kır et al., 2004 (20), Öztürk 2005 (21), Soylu 2005 (22), Tabakoğlu 2006 (23), Tepecik 2006 (24), Tokşen 2006 (25), Yıldırım 2006 (26), Karatoy and Soylu 2006 (27), Öztürk and Bulut 2006 (28), Uzunay and Soylu 2006 (29), Öktener et al. 2006 (30), 2007 (31), Koyuncu 2009 (32), Öztürk 2010 (33), Alaş et al. 2010 (34), Pekmezci et al. 2011 (35), Açıkel and Öztürk 2013 (36), Koyuncu 2020 (37), 2021 (38), Öztürk 2020 (39), Öktener and Ünal 2020 (40), Koyun 2021 (41), Gümüş 2024 (42), Present study (43)

Although they primarily parasitise freshwater fish, they can also infest marine fish and, on rare occasions, amphibians and reptiles (Piasecki and Avenant-Oldewage 2008, Möller 2009, Tanzola and Villegas-Ojeda 2017).

The genus *Argulus*, comprising approximately 130 species, is one of the most important ectoparasites of fish, exhibiting a cosmopolitan distribution and broad host range (Poly 2008, Aguiar et al. 2017, Souza et al. 2019). These parasites cause infestations by attaching to the host, primarily at the bases of the fins, gills, and buccal cavity (Tinar and

Umur 2024), and feed on the blood of the host (Walker et al. 2011a). Three species of this genus are known in Europe: *Argulus coregoni* Thorell, 1864; *A. foliaceus* (Linnaeus, 1758); and *A. japonicus* Thiele, 1900 (Lester and Hayward 2006). All three species are found in freshwater environments. *Argulus foliaceus*, which prefers cold and eutrophic lakes, is common on carp (Cyprinidae) in Europe and Asia but also infests fish belonging to the families Acipenseridae, Gasterosteidae, Gobiidae, and Salmonidae (Yamaguti 1963). *Argulus japonicus* has a cosmopolitan distribution through the ornamental

goldfish trade and has been reported in various fish species wherever goldfish are present (Cressey 1978). This species particularly prefers warmer waters and has been detected in various species belonging to the genera *Carassius*, *Cyprinus*, *Esox*, *Perca*, *Sardinus*, and *Tinca* in Europe (Stammer 1959). *Argulus coregoni* is primarily found on salmonid hosts (Salmonidae), but it has also been recorded on carp (Cyprinidae). It is distributed in cold lakes across Europe, Asia, and North America (Yamaguti 1963, Kennedy 1974, Lester and Hayward 2006, Nagasawa 2023, Turbanov and Zhokhov 2024). Of these three species, only *Argulus foliaceus* and *A. japonicus* have been reported in Türkiye (Table 1).

Argulus species cause significant economic losses in fish, particularly in freshwater aquaculture, by inducing epidermal damage (during attachment and feeding), fin and scale loss, increased mucus production, anemia, behavioral changes (such as rubbing and splashing to dislodge parasites), loss of condition, reproductive disorders, secondary infections (bacterial, viral, and fungal), stress, and even mortality (Walker et al. 2004, Steckler and Yanong 2013, Shinn et al. 2015). Various chemicals have been used to treat *Argulus* infestations, including trichlorphon, diflubenzuron, lufenuron, malathion, pyrethrum, quinine hydrochloride, emamectin benzoate, salt (NaCl), formaldehyde, potassium permanganate, and formalin (Schmahl et al. 1989, Lester and Hayward 2006, Noga 2010, Wafer et al. 2015). In biological control, mosquito fish (*Gambusia* sp.), angelfish (*Pterophyllum scalare*), silver barb (*Puntius gonionotus*), and sticklebacks (Gasterosteidae) have also been used. In addition, control strategies such as pool water filtration, tank disinfection, and temporary placement of wooden or wood-like materials into pools to provide egg-laying surfaces for *Argulus* species have also been implemented (Lester and Hayward 2006, Ni et al. 2010).

Materials and Methods

The material for this study was obtained from Crustacea specimens collected from common carp

(*Cyprinus carpio* L.) (collected on October 27, 2021) and Amur carp (*Cyprinus rubrofasciatus* Lacepède) (ornamental form; koi) (collected on November 10, 2022) during routine parasitological screenings conducted at the Mediterranean Fisheries Research, Production and Training Institute (Antalya, Türkiye). Crustacean specimens were preserved in microtubes containing 70% ethanol until microscopic examination. They were subsequently identified under a stereo microscope (Nikon SMZ 745T, Tokyo, Japan) based on descriptions and illustrations in the relevant literature (Thiele 1904, Wilson 1944, Rushton-Mellor 1994, Møller 2015, Hunt 2021). The identified specimens were photographed using a microscope-integrated camera (Figure 1). All specimens were deposited in the parasitology collection at the Demre Campus Laboratory of the Mediterranean

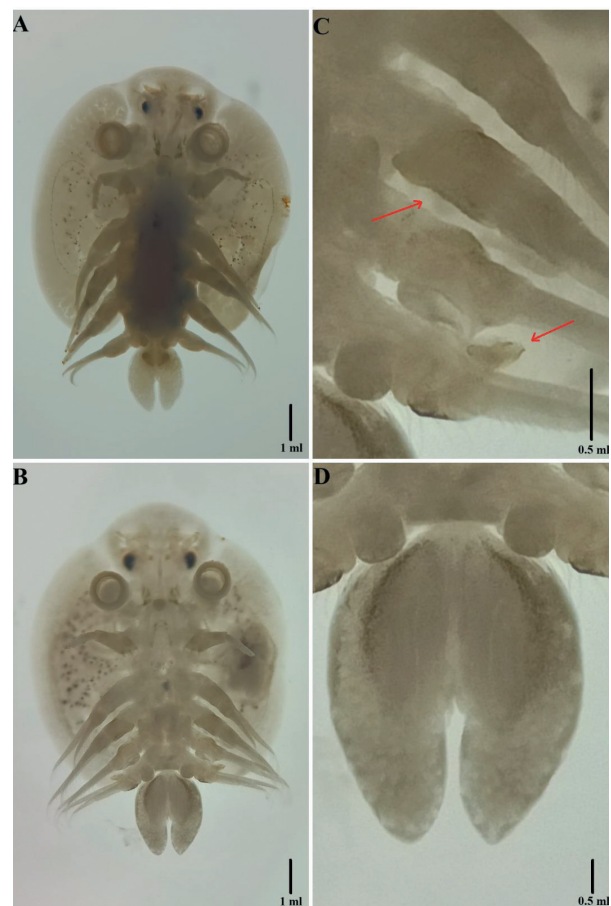


Figure 1. Original micrographs of female (A) and male (B) *Argulus japonicus* specimens detected in this study (male 2nd and 4th swimming leg at red arrows in C, and male abdominal lobe shape in D).

Fisheries Research, Production, and Training Institute.

For the literature review, academic databases such as DergiPark, Google Scholar, PubMed, ResearchGate, and the YÖK National Thesis Center were used to examine previous studies on *Argulus* species conducted in Türkiye.

Results and Discussions

Microscopic examination of Crustacea samples collected from common carp (*C. carpio*) and Amur carp (*C. rubrofasciatus*) (ornamental form; koi) identified the specimens as *Argulus japonicus* Thiele, 1900 (Figure 1). Although *Argulus japonicus* has been reported in previous studies in Türkiye from goldfish (*Carassius auratus* (Linnaeus, 1758)) and Amur carp (*C. rubrofasciatus*) (ornamental fish; koi), its detection on common carp (*C. carpio*) in the present study represents a novel host-parasite association for the ectoparasite fauna of freshwater fish in Türkiye.

To date, two *Argulus* species have been reported in the fish fauna of Türkiye: *Argulus foliaceus* and *Argulus japonicus* (Table 1). Adult *A. foliaceus* and *A. japonicus* typically measure between 6–8 mm in length, with females being larger than males (Figure 1A-B). These two species can be easily distinguished based on their morphological characteristics. In males, differentiation is primarily based on the sexual ornamentation of swimming legs (thoracopods). The ventral side of the second coxa is slightly curved and pointed in *A. foliaceus*, whereas the thorax is concave and curved with small projections at both ends in *A. japonicus* (Figure 1C). The claspers on the coxa of the fourth legs are small and rounded in *A. foliaceus*, whereas they are large and pointed in *A. japonicus* (Figure 1C). The sinus of the abdominal lobe is less than half the lobe length in *A. foliaceus* and approximately half the lobe length in *A. japonicus* (Figure 1D). The posterior ends of the abdominal lobes are rounded in *A. foliaceus* but slightly pointed in *A. japonicus* (Figure 1D) (Møller 2015, Hunt 2021).

Based on our literature review using academic search engines, previous studies in Türkiye have reported *Argulus* infestations in 25 different host species from 10 families, including those in the present study. Most of these records involved *A. foliaceus*, while *A. japonicus* infestations were detected in only three host species within the Cyprinidae family, including those reported in the current study (Table 1).

Argulus species are regarded as significant parasites in cultured fish because of the direct damage they cause and the secondary infections they may induce (Bandilla et al. 2006, Alsarakibi et al. 2014). The low host specificity of argulid species, combined with their high reproductive output during the breeding season, has resulted in numerous reports of infestations in both aquaculture and wild fish populations (Taylor et al. 2006). *Argulus foliaceus*, in particular, has been detected in many cultured fish species across the Palearctic region, such as *Cyprinus carpio*, *Oncorhynchus mykiss* (Walbaum, 1792), and *Oreochromis niloticus* (Linnaeus, 1758), and is considered a significant threat (Walker et al. 2008, 2011b; Table 1). The exotic *A. japonicus*, accepted to have spread via the ornamental goldfish trade (Poly 2008), has been recorded in various fish species from the genera *Carassius*, *Cyprinus*, *Esox*, *Perca*, *Tinca*, and *Scardinius* in the Western Palearctic region (Stammer 1959, Rushton-Mellor 1992, Holdich and Pöckl 2007, Soes et al. 2010, Keve et al. 2025, present study), posing a serious risk to both the aquaculture industry and native fish fauna. This species is also considered an invasive fish parasite worldwide (Eren et al. 2025). Routine parasitological screenings of cultured and ornamental fish in Türkiye and globally are essential not only for clarifying host-parasite relationships but also for enabling early diagnosis and effective treatment of infestations.

The parasitological findings in the present study are based on specimens obtained during routine examinations conducted at a single research institute; therefore, they reflect a limited sample size and geographical scope. Furthermore, the literature-based assessment of the host diversity of *Argulus* species in Türkiye relies on published records, which may not

fully reflect their actual distribution. Nevertheless, the present findings provide valuable baseline data and contribute to the understanding of *Argulus* host associations in Türkiye and worldwide, particularly by documenting a new host–parasite record.

In conclusion, the present study reports the first record of *A. japonicus* on common carp (*C. carpio*) in Türkiye and highlights the significance of *Argulus* infestations in both aquaculture and wild fish populations.

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Conflict of interest. The authors declare no conflict of interest.

Statement of ethics approval. Ethics committee approval was not required for this study, as it was based on parasite specimens collected during routine fish examinations.

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References

- Açıkel, M., Öztürk, M.O. (2013). Investigations on *Argulus foliaceus* (Crustacea, Branchiura) Infestation fauna of chub (*Squalius cephalus*, L. 1758) from lake dam Serban, Afyonkarahisar. *Journal of Fisheries Sciences.com*, 7, 344-1350.
- Aguiar, J.C., Rosim, D.F., Santos, S.M., Luque, J.L., Ceccarelli, P.S., Adriano, E.A., Tavares, L.E. (2017). A new species of *Argulus* (Crustacea, Branchiura, Argulidae) from the skin of catfish, with new records of branchiurans from wild fish in the Brazilian Pantanal wetland. *Zootaxa*, 4320, 447-469.
- Alaş, A., Öktener, A., Solak, K. (2010). A study on the morphology of *Argulus foliaceus* Lin., 1758 (Crustacea; Branchiura) procured from Çavuşcu Lake (Central Anatolia-Turkey) with scanning electron microscopy. *Turkish Journal of Biology*, 34, 147-151.
- Alsarakibi, M., Wadeh, H., Li, G. (2014). Parasitism of *Argulus japonicus* in cultured and wild fish of Guangdong, China with new record of three hosts. *Parasitology Research*, 113, 769-775.
- Altın, H. (1989). Some Parasites on Carp (*Cyprinus carpio* L.). University of Uludağ, Bsc Thesis. Science Institution, Bursa, Türkiye, 33 p.
- Aydoğdu, A. (1997). Studies on Determine the Platyhelminth Parasites of Common Carp in Iznik Lake. Master Thesis. Science Institution, Uludag University, Bursa, Türkiye, 82 p.
- Aydoğdu, A., Yıldırımhan, H.S., Altunel, F.N. (1997). An investigation on some metazoon parasites of common carp (*Cyprinus carpio* L.) in Iznik Lake. *Türkiye Parazitoloji Dergisi*, 21, 442-445.
- Bandilla, M., Valtonen, E.T., Suomalainen, L.R., Aphalo, P.J., Hakalahti, T. (2006). A link between ectoparasite infection and susceptibility to bacterial disease in rainbow trout. *International Journal for Parasitology*, 36, 987-991.
- Becer, Z.A., Kara, D. (1998). An investigation on population structure and parasites of common carp (*Cyprinus carpio* L., 1758) which were caught in Kovada Lake. *Türkiye Parazitoloji Dergisi*, 22, 199-203.
- Boxshall, G., Hayes, P. (2019). Biodiversity and taxonomy of the parasitic Crustacea. In: *Parasitic Crustacea: State of Knowledge and Future Trends* (Eds) N. Smit, N. Bruce, K. Hadfield. *Zoological Monographs*, Vol 3. Springer, Cham, 73-134.
- Burgu, A., Oğuz, T., Korting, W., Güralp, N. (1988). Parasites of freshwater fishes in some areas of central Anatolia. *Etlık Veteriner Mikrobiyoloji Dergisi*, 3, 143-166.
- Cengizler, İ., Aytac, N., Sahan, A., Ozak, A.A., Genç, E. (2001). Ecto-endo parasite investigation on mirror carp (*Cyprinus carpio* L., 1758) captured from the river Seyhan, Turkey. *Ege Journal of Fisheries and Aquatic Science*, 18, 87-90.
- Cressey, R.F. (1978). Marine flora and fauna of the northeastern United States. Crustacea: Branchiura. NOAA Technical Report NMFS Circular 414, 1-10.
- Eren, G., Yılmaz, M., Karakuş, M. 2025. Parasites detected in invasive fish species in Türkiye. *Proc. 24. Parazitoloji Kongresi*, Bursa 30.10–02.11.2025, Türkiye Parazitoloji Derneği, İzmir, 147–158 (in Turkish).
- Fryer, G. 1968. The Parasitic Crustacea of African freshwater fishes; their biology and distribution. *Journal of Zoology*, 156, 45-95.

- Geldiay, R., Balık, S. (1974). Ecto and Endoparasites Found the Freshwater Fish of Turkey. Ege University, Science Faculty Monographies, No: 14, İzmir, Türkiye 34 p.
- Gümü, N.E. (2024). Blood serum IgE and muscle element levels in *Cyprinus carpio* infested by *Argulus foliaceus* in Lake Çavuşçu (Konya/Turkey): Assessment of their impact on human health. Oceanological and Hydrobiological Studies, 53, 424-434.
- Holdich, D.M., Pöckl, M. (2007). Invasive crustaceans in European inland waters. In: Biological invaders in inland waters: profiles, distribution and threats (Eds) F. Gherardi. Springer Dordrecht, 29-76.
- Hunt, R. (2021). *Argulus* infections in fisheries: status, control, and future prospects. PhD Thesis. Cardiff University, Wales. 147 p.
- Karatoy, E. (2004). Durusu Gölü Çapak (*Abramis brama* L., 1758) Balığının Metazoon Parazitleri. Master Thesis, Marmara University, Istanbul, Türkiye, 54 p.
- Kahveci, S. (2004). Durusu Gölünden Yakalanan Kızılkanat (*Scardinius erythrophthalmus* Lin., 1758) Balığının Metazoon Parazitleri, Master Thesis, Marmara University, İstanbul, Türkiye, 51 p.
- Karatoy, E., Soylu, E. (2006). Durusu (Terkos) gölü çapak balıkları (*Abramis brama* L., 1758) nın metazoon parazitleri. Türkiye Parazitoloji Dergisi, 30, 233-238.
- Kennedy, C.R. (1974). A checklist of British and Irish freshwater fish parasites with notes on their distribution. Journal of Fish Biology, 6, 613-644.
- Keve, G., Tóth, A.G., Katics, M., Baska, F., Eszterbauer, E., Hornok, S., Németh, T., Solymosi, N. (2025). First record of *Argulus japonicus* infestation on *Cyprinus carpio* in Hungary, and the first description of *Argulus japonicus* subsp. *europaeus* subsp. nov. Keve, 2025. bioRxiv, 2025-04.
- Kır, İ., Ayvaz, Y., Barlas, M., Tekin-Özan, S. (2004). Karacaören I baraj gölünde yaşayan sazan (*Cyprinus carpio* L., 1758) 'lardaki parazitlerin mevsimsel dağılımları ve etkileri. Türkiye Parazitoloji Dergisi, 28, 45-49.
- Koyun, M. (2021). Prevalence and intensity of metazoan parasites of Mesopotamian spiny eel, *Mastacembelus mastacembelus* (Banks & Solander 1794) according to some parameters of the host, inhabiting in Euphrates-Tigris Basin. Biharean Biologist, 15, 117-123.
- Koyuncu, C.E. (2009). Parasites of ornamental fish in Turkey. Bulletin of the European Association of Fish Pathologists, 29, 25-27.
- Koyuncu, C.E. (2020). *Argulus japonicus* (Thiele, 1900) infestation in Koi (*Cyprinus carpio* Linnaeus, 1758) culture. Acta Aquatica Turcica, 16, 66-70.
- Koyuncu, CE. (2021). The first record of *Argulus japonicus* Thiele, 1900 infestations on Telescope fish (*Carassius auratus*) of Mersin in Turkey. Advanced Underwater Sciences, 1, 16-20.
- Koyun, M., Bulut, S., Alas, A., Solak, K. (1997). An investigation on *Argulus foliaceus* L. seen some fishes in Kütahya region. IX. National Aquatic Products Symposium, 17-19 September 1997, Isparta, Türkiye. 245-253.
- Lester, R.J., Hayward, C.J. (2006). Phylum Arthropoda. In: Fish diseases and disorders. Volume 1: protozoan and metazoan infections (Ed) P.T.K Woo, CABI Publishing, Wallingford, UK, 466-565.
- Møller, O.S. (2009). Branchiura (Crustacea) - Survey of Historical Literature and Taxonomy. Arthropod Systematics & Phylogeny, 67, 41-55.
- Møller, O.S. (2015). Class Branchiura, Order Arguloida. Revista IDE@ - SEA, n° 103B, 1-8.
- Nagasawa, K. (2023). Distribution of fish parasites *Argulus japonicus* and *Argulus coregoni* (Crustacea: Branchiura: Argulidae) in the Lake Biwa Basin, Central Japan. Species Diversity, 28, 217-223.
- Ni, L.S., Sani, A., Matori, F. (2010). Abiotic and biotic control of *Argulus* sp. among goldfish (*Carassius auratus*). In 5th Proceed Seminar Veter Sci, 12, 92-101.
- Noga, E.J. (2010). Fish Disease: Diagnosis and Treatment. Wiley-Blackwell, New Jersey, United States, 544 p.
- Oğuz, M.C. (1991). An investigation on the carps (*Cyprinus carpio* L.) which were caught from some freshwaters of Bursa. Türkiye Parazitoloji Dergisi, 15, 103-110.
- Öktener, A., Trilles, J.P., Leonardos, I. (2007). Five ectoparasites from Turkish fishes. Türkiye Parazitoloji Dergisi, 31, 154-157.
- Öktener, A., Ünal, A. (2020). Infestation of fish louse *Argulus foliaceus* (Linnaeus, 1758) (Crustacea: Branchiura) on rainbow trout farm in Manyas Dam Lake, Turkey. Journal of Wetlands Biodiversity, 10, 95-111.
- Öktener, A., Ali, A.H., Gustinelli, A., Fioravanti, M.L. (2006). New host records for fish louse, *Argulus foliaceus* L., 1758 (Crustacea, Branchiura) in Turkey. Ittiopatologia, 3, 161-167.
- Özer, A. (1995). Sinop Yöresinde Yetiştiriciliği Yapılan Sazan Balığının Ektoparazitleri Üzerine Bir Araştırma. Master Thesis, Ondokuz Mayıs University, Samsun, Türkiye, 75 p.
- Öztürk, M.O. (1995). Studies on Determine the Endohelminths of Pike (*Esox lucius*) Living Uluabat Lake. Master Thesis. Uludağ University, Bursa, Türkiye, 53 p.
- Öztürk, M.O. (2005). Eber Gölü (Afyon)'ndeki sazan (*Cyprinus carpio* L.)'ların metazoon parazitleri üzerine bir araştırma. Türkiye Parazitoloji Dergisi, 29, 204-210.
- Öztürk, M.O. (2010). An investigation on *Argulus foliaceus* infection of rudd, *Scardinius erythrophthalmus* in Lake Manyas, Turkey. Scientific Research and Essays, 5, 3756-3759.
- Öztürk M.O. (2022). An Investigation on *Argulus foliaceus* (Crustacea) infestation of fishes in the Kunduzlar Dam Lake. Journal of Limnology and Freshwater Fisheries Research, 8, 282-288.

- Öztürk, M.O., Altunel, F.N. (2003). Kuş Gölündeki İki Cyprinid Balık Türü (*Cyprinus carpio*, *Scardinius erythrophthalmus*)'nın *Argulus foliaceus* Lin., 1758 Enfestasyonu. XII. Ulusal Su Ürünleri Sempozyumu, 2-5 Eylül 2003, Elazığ, Türkiye, 194 p.
- Öztürk, M., Bulut, S. (2006). Selevir baraj gölü (Afyonkarahisar)'ndeki *Cyprinus carpio* L. (sazan)'nın metazoon parazit faunası üzerine bir araştırma. Fırat Üniversitesi Mühendislik Bilimleri Dergisi, 18, 143-149.
- Pekmezci, G.Z., Yardımcı, B., Bolukbas, C.S., Beyhan, Y.E., Umur, S. (2011). Mortality due to heavy infestation of *Argulus foliaceus* (Linnaeus, 1758)(Branchiura) in pond-reared carp, *Cyprinus carpio* L., 1758 (Pisces). Crustaceana, 84, 553-557.
- Piasecki, W., Avenant-Oldewage, A. (2008). Diseases caused by Crustacea. In: Fish Diseases (2 Vols.) (Eds) J. Eiras, H. Segner, T. Wahli, B.G. Kapoor, CRC Press, USA, 1129-1214.
- Poly, W.J. (2008). Global diversity of fishlice (Crustacea: Branchiura: Argulidae) in freshwater. Hydrobiologia, 595, 209-212.
- Ringuelet, R. (1943). Revisión de los Argúlidos Argentinos (Crustacea. Branchiura) con el catálogo de las especies neotropicales. Revista del Museo de La Plata, (Sección Zoología), 19, 43-99.
- Rushton-Mellor, S.K. (1992). Discovery of the fish louse, *Argulus japonicus* Thiele (Crustacea: Branchiura), in Britain. Aquaculture Science and Management, 23, 269-271.
- Rushton-Mellor, S.K. (1994). The genus *Argulus* (Crustacea: Branchiura) in Africa: identification keys. Systematic Parasitology, 28, 51-63.
- Sarıyüyoğlu, M., Sağlam, N. (1991). *Ergasilus sieboldi* and *Argulus foliaceus* in *Capoeta trutta* caught from polluted region of Keban Dam Lake. Ege Journal of Fisheries and Aquatic Sciences, 8, 31-42.
- Schmahl, G., Taraschewski, H. Mehlhorn, H. (1989). Chemotherapy of fish parasites. Parasitology Research, 75, 503-511.
- Shinn, A., Pratoomyot, J., Bron, J., Paladini, G., Brooker, E., Brooker, A. (2015). Economic impacts of aquatic parasites on global finfish production. Global Aquaculture Advocate, September/October, 58-61.
- Soes, D.M., Walker, P.D., Kruijt, D.B. (2010). The Japanese fish louse *Argulus japonicus* new for the Netherlands. Lauterbornia, 70, 11-17.
- Souza, A.K., Porto, D.B., Malta, J.C. (2019). A new species of *Argulus*, a fish parasite from the Brazilian Amazon. Spixiana, 42, 7-14.
- Soylu, E. (1985). Sapanca Balık Üretme ve İslah İstasyonunda Balık Hastalıkları Çalışmaları. İstanbul Üniversitesi Su Ürünleri Yüksek Okulu Sapanca Balık Üretme ve İslah İstasyonu, Yayın No: 7, İstanbul, Türkiye, 22 p.
- Soylu, E. (1990). Surveys on the parasite fauna of the some fishes in Sapanca Lake. PhD Thesis. Istanbul University, Istanbul, Türkiye, 85 p.
- Soylu, E. (2005). Metazoan Parasites of Catfish (*Silurus glanis*, Linnaeus, 1758) from Durusu (Terkos) Lake. Journal of the Black Sea / Mediterranean Environment, 11, 225-237.
- Stammer, J. (1959). Beiträge zur Morphologie, Biologie und Bekämpfung der Karpfenläuse. Z Parasitenkd, 19, 135-208.
- Steckler, N., Yanong, R.P. (2013). *Argulus* (Fish Louse) infections in fish. Edis 2013, 1-4.
- Şahan, A., Cengizler, İ. (2003). Seyhan Nehri (Adana kent içi bölgesi)'nde yaşayan adi sazan (*Cyprinus carpio*) ve bıyıklı balık (*Barbus rajanorum*)'ta bazı hematolojik parametrelerin belirlenmesi. XII. Ulusal Su Ürünleri Sempozyumu, 2-5 Eylül 2003, Elazığ, Türkiye, 193 p.
- Tam, Q. (2005). Aspects of The Biology of *Argulus*. Master Thesis. University of Johannesburg, South Africa, 104 p.
- Tanzola, R.D., Villegas-Ojeda, M.A. (2017). *Argulus ventanensis* sp. n. (Crustacea, Branchiura) parasite of *Hypsiboas pulchellus tadpoles* (Anura, Hylidae). Pan-American Journal of Aquatic Sciences, 12, 218-226.
- Taylor, N.G.H., Sommerville, C., Wooten, R. (2006). The epidemiology of *Argulus* spp. (Crustacea: Branchiura) infections in Stillwater trout fisheries. Journal of Fish Diseases, 29, 193-200.
- Tepecik, R.E. (2006). Sazan balığında (*Cyprinus carpio* L.) İn vivo *Argulus foliaceus* L. İnfestasyonuna Karşı Gelişen İmmün Cevabın Elisa Tekniğiyle Belirlenmesi, Master Thesis, İstanbul University, İstanbul, Türkiye, 40 p.
- Thiele, J. (1904). Beitrage zur Morphologie der Arguliden. Mitteilungen aus dem Zoologischen Museum in Berlin, 2, 5-51.
- Tınar, R., Umur, Ş. (2024). Veteriner Parazitoloji: Hayvan Türlerine Göre (İkinci baskı). Güneş Tıp Kitabevleri, Ankara, Türkiye, 470 p.
- Tokşen, E. (2006). *Argulus foliaceus* (Crustacea: Branchiura) infestation on oscar, *Astronotus ocellatus* (Cuvier, 1829) and its treatment. Ege Journal of Fisheries and Aquatic Sciences, 23, 177-179.
- Turbanov, I.S., Zhokhov, A.E. (2024). A find of *Argulus coregoni* (Crustacea: Branchiura) on brook trout in the Western Dvina basin. Ecosystem Transformation, 7, 3-12.
- Uzunay, E., Soylu, E. (2006). Sapanca gölünde yaşayan sazan (*Cyprinus carpio* Linnaeus, 1758) ve karabalık (*Vimba vimba* Linnaeus, 1758)'ın metazoan parazitleri. Türkiye Parazitoloji Dergisi, 30, 141-150.
- Walker, P.D., Flik, G., Bonga, S.E.W. (2004). The biology of parasites from the genus *Argulus* and a review of the interactions with its host. Symposia of the Society for Experimental Biology, 55, 107-129.

- Walker, P.D., Harris, J.E., van der Velde, G., Bonga, S.E.W. (2008). Differential host utilization by different life history stages of the fish ectoparasite *Argulus foliaceus* (Crustacea: Branchiura). *Folia Parasitologica*, 55, 141-149.
- Walker, P.D., Russon, I.J., Haond, C., van der Velde, G., Wendelaar-Bonga, S.E. (2011a). Feeding in adult *Argulus japonicus* Thiele, 1900 (Maxillopoda, Branchiura), an ectoparasite on fish. *Crustaceana*, 84, 307-318.
- Walker, P.D., Russon, I.J., Duijf, R., van der Velde, G., Bonga, S.E.W. (2011b). The off-host survival and viability of a native and non-native fish louse (*Argulus*, Crustacea: Branchiura). *Current Zoology*, 57, 828-835.
- Wafer, L.N., Whitney, J.C., Jensen, V.B. (2015). Fish lice (*Argulus japonicus*) in goldfish (*Carassius auratus*). *Comparative Medicine*, 65, 93-95.
- Wilson, C.B. (1944). Parasitic copepods in the United States National Museum. *Proceedings of the United States National Museum*, 94, 529-582.
- Yamaguti, S. (1963). *Parasitic Copepoda and Branchiura of fishes*. Wiley Interscience Publishers, New York, USA, 1104 p.
- Yıldırım, M. (2006). *Chalcalburnus chalcoides* Populasyonunun (Tödürge Gölü) Ekto ve Endo Parazitlerinin Mevsimsel Değişimi. Master Thesis, Cumhuriyet University, Sivas, Türkiye, 87 p.