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Menba Kastamonu Üniversitesi Su Ürünleri Fakültesi Dergisi 2021; 7(1): 58-63 Derleme Makalesi/Review Article

Geographical Distribution of Freshwater Fish Parasite *Clinostomum* spp.

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Abstract

Clinostomum species a digenean trematoda belonging to the Clinostomidae family have a complex life cycle and can infect freshwater fish . These parasites are important for fish health and aquatic ecosystems. Those who use freshwater snails as the first host can follow the steps of these parasite species of nutrients followed by freshwater fish as hosts, the species of parasites as swarm hosts, and even birds that feed them with infected fish. They are seen as subcutaneous infections of the head, abdomen, and tail of freshwater fish. Birds feeding on infected fish by the parasite and their esophagus can be seen there have been reported in the literature studies. *Clinostomum*'s first case report on human infection was seen in 1995 in Korea, was considered zoonotic parasite which is called as yellow groups diseases, they can be passed on to humans in places where raw fish meat. This parasite species in recent years, Japan, China, Iran to the west, Taiwan, Turkey began to be reported from countries in countries. Attention is drawn to identifying the types of *Clinostomum* that terminates for public health. In addition to morphological properties, molecular identification features are identified and differentiated from other parasite species. Here, the geographical distribution of *Clinostomum* species and infected fish species was reported. It was assessed that this parasite can migrate to other countries from the places reported in the literature in the generation of international fishes and migrants and may cause these parasites.

Tatlı Su Balıkları Paraziti Olan *Clinostomum* spp'nin Coğrafik Dağılımı

Makale Bilgisi

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Anahtar Kelimeler:
- Clinostomum spp.
- Coğrafik dağılım
- Tatlı su paraziti

Öz

Karmaşık bir yaşam döngüsüne sahip yassı trematod *Clinostomum* türleri, *Clinostomidae* familyasına ait tatlı su balıklarını da enfekte edebilen parazitlerdir. Bu parazitler balık sağlığı ve sucul ekosistem açısından önem arz etmektedir. İlk konak olarak tatlı su salyangozlarını kullanan bu parazit türleri besin zinciri basamaklarını takip ederek ara konak olarak tatlı su balıklarını, son konak olarak söz konusu parazit türleri tarafından enfekte balıklar ile beslenen kuşları kullanabilmektedirler. Tatlı su balıklarının baş, karın ve kuyruk bölgelerinde deri altı enfeksiyonu olarak görülmektedirler. Parazit tarafından enfekte balıkla beslenen kuşların özofaguslarında görülebildiği literatür çalışmalarında rapor edilmiştir. *Clinostomum'* un insan enfeksiyonu ile ilgili ilk vaka raporu 1995 yılında Kore' de kabul edilmiş olup, 'sarı grup' hastalıkları olarak adlandırılan zoonotik parazit olarak kabul edilmekte ve çiğ balık etiyle insanlara bulaşabilmektedir. Bu parazit türü son yıllarda Japonya, Çin, İran'ın batısı, Tayvan, Türkiye gibi çeşitli ülkelerden de rapor edilmeye başlanmıştır. Halk sağlığı için *Clinostomum* türlerinin tanımlanmasına dikkat çekilmektedir. Morfolojik özelliklerinin yanı sıra moleküler tayin yöntemleri kullanılarak yapılan çalışmalarda diğer parazit türlerinden ayrımı ve tanımlanması yapılmaktadır. Bu çalışmada, *Clinostomum* türlerinin coğrafik dağılımı ve enfekte ettiği balık türleri bildirilmiştir. Uluslararası yapılan balık ticareti ve göçmen kuşlar aracılığıyla bu parazitin literatürde bildirilen ülkeler dışında başka ülkelere taşınabileceği ve gelecekte farklı ülkelerde enfeksiyona neden olacağı değerlendirilmiştir.

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INTRODUCTION

Clinostomum species are parasites reported to be included in the "yellow group" diseases list (Okumura et al., 1999), which can also be transmitted to humans through consumption of raw fish (Khan et al., 2018). These parasite species, which can also infect freshwater fish, a digenean trematoda belonging to the Clinostomidae family, have a complex life cycle. Changes in the surface air temperature will contribute to increased infection in its fish host (Rizvi et al., 2020). These parasite species can feed on the mucus of organs, food content ingested by the host, blood, and tissue from eroding epithelial surfaces (Anonim 2021). The biological life cycle of these species is given in Figure 1.

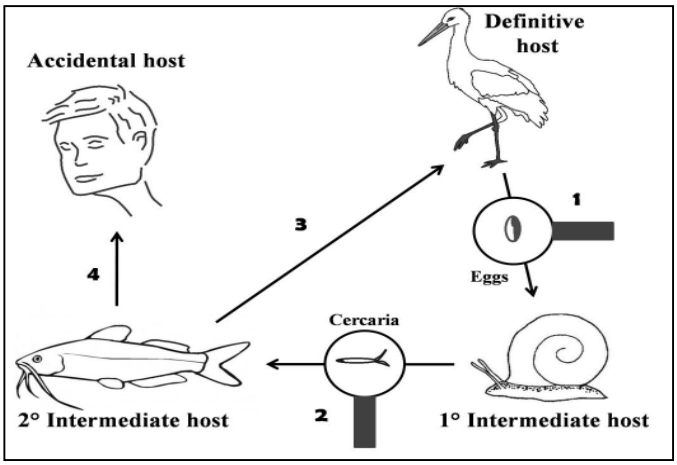

Figure 1. The life cycle of *Clinostomum* spp. (Sutll and Gressier, 2014)

These parasite species, which use freshwater snails as the first host, follow the food chain steps and use freshwater fish as intermediate hosts and as the last host, they can use birds and even humans fed by infected fish by the parasite species (Şimşek et al., 2018). The first reported Chung et al., (1995) that *C. complanatum*, one of these parasite species, is the source of human infection in Korea. In Korea, a 33-year-old man suffered a sore throat for 1 week and was reported to be infected by *C. complanatum* with the consumption of raw fish (Park et al., 2009). The type of parasite that infects the event and its damage to the esophagus is given in Figure 2. This parasite has broader implications in terms of parasitism of trematodes, including for human infections (Rizvi et al., 2020). Aim of this review to show the geographical distribution of *Clinostomum* species and infected fish species. It was assessed that this parasite can migrate to other countries from the places reported in the literature in the generation of international fishes and migrants and may cause these parasites.

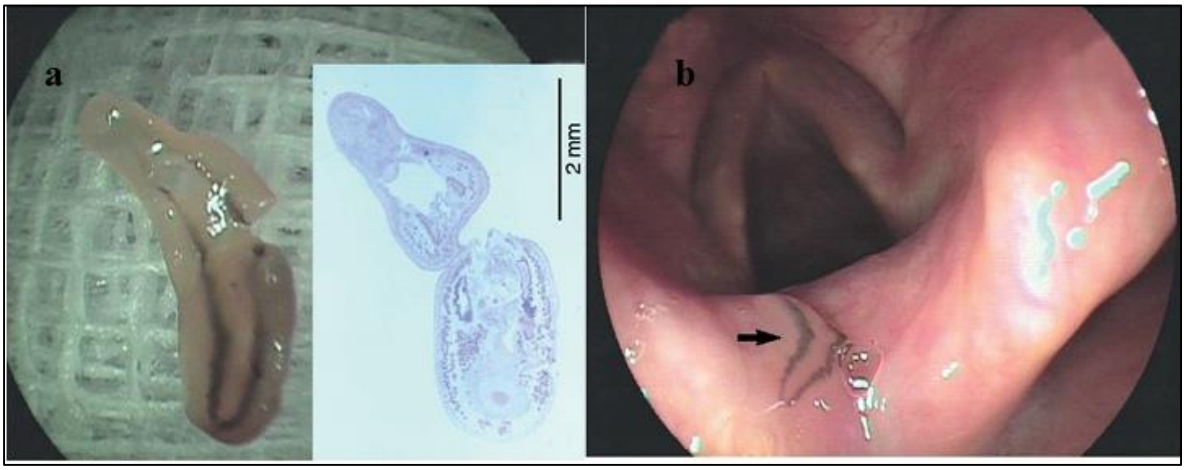

Figure 2. a. *C. complanatum* and **b.** Infected human esophagus (Park et al., 2009)

Structure of Clinostomum Species

Clinostomum species with freshwater fish parasites have two suction cups, mouth suction, and abdominal suction cups. Organelle structures such as anterior and posterior testes and uterus are present, as shown in Figure 3.

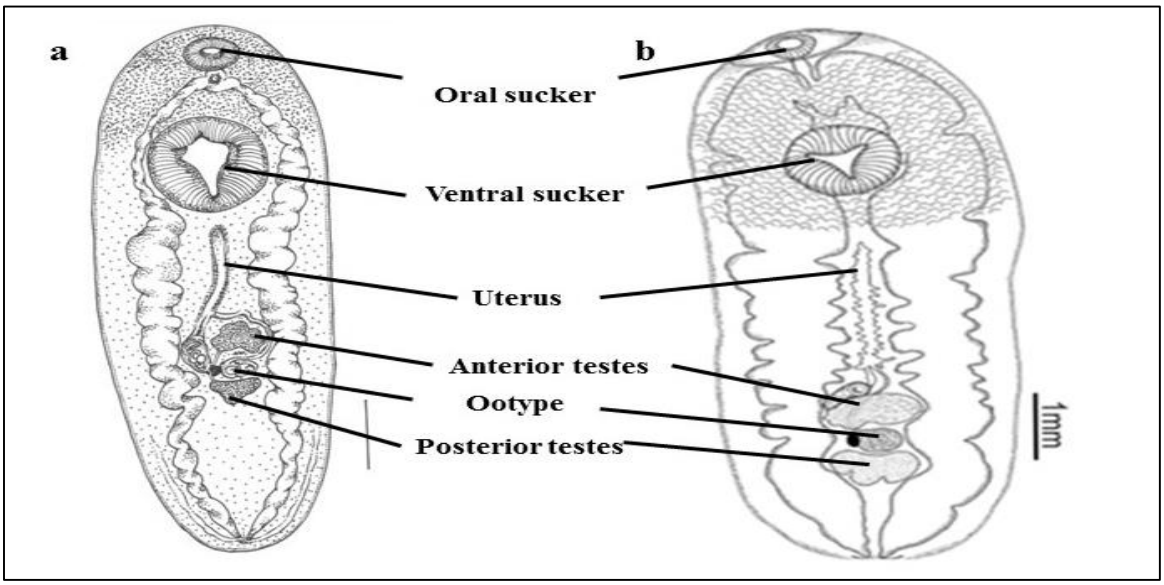

Figure 3. Species of *Clinostomum* a) *C. complanatum* (Caffara et al., 2014), b) *C. detruncatum* (Acosta et al., 2015)

C. complanatum lengths, which are commonly seen in the *Clinostomum* species, have been reported in studies conducted approximately 2 mm and less than 8 mm. Body widths were found to vary between 1-2 mm. Morphological measurements such as height body width are used to determine species. Table 1 shows the measurement results of some studies related to height and body width obtained in the literature review.

Table 1. Body lenght and body width data of some studies

Body length (mean ± SD) (µm)	Body width (mean ± SD) (µm)	References
3.998–6.718 (5.108 ± 0.34)	1.197–2.131 (1.697 ± 0.16)	Şimşek et al., 2018
2.470-3.287 (2.924±224)	1.071-1.507 (1.273±121)	Li et al., 2018
1.917-2.700 (2331±205)	646-1.058 (851±119)	Maleki et al., 2018
4.495-7.874 (5.741±1.223)	1.635-2.434 (1.934±239)	Caffara et al,. 2011

Infected Sites of Fish are Identified as *Clinostomum* spp.

Freshwater fish can be in the gill cavity, muscles, abdominal cavity, and fins (Gustinelli et al., 2010). The data obtained from the literature review studies are given in Table 2.

Table 2. Data from literature review studies

Fish Name	Species of Parasite	Country	References
Danio rerio	*Clinostomum sp.*	Brazil	Silveira et al., 2021
Trichogaster fasiatus	*C. complanatum*	India	Rizvi et al., 2020
Garra rufa	*C. complanatum*	Iranian	Meleki et al., 2018
Squalius cephalus	*C. complanatum*	Turkey	Şimsek et al., 2018
Lepomis macrochirus	*Clinostomum sp.*	United States of America	Calhoun et al., 2018
Myxocyprinus asiaticus	*C. complanatum*	China	Li et al., 2018
Hemibarbs labeo	*C. complanatum*	Taiwan	Wang et al., 2017
Synbranchus marmoratus	*C. complanatum*	Brazil	Acosta et al., 2016
Hoplias malabricus	*C. marginatum*	Brazil	Alcântara and Tavares-Dias, 2015
Capoeta damascina	*C. complanatum*	Israel	Caffara et al., 2014
Carassius carassius	*C. schizothoraxi*	India	Shah et al., 2013
Oreochromis nilocticus	*C. tilapiae*	Kenya	Ochieng et al., 2012
Oreochromis nilocticus	*C. tilapiae*	Nigeria	Echi et al., 2012
Etheostoma nigrum	*C. detruncatum*	Canada	Bonett et al., 2011

Rhamdia guatemalensis	*Clinostomum sp.*	Mexican	Pérez Ponce de León et al., 2009
Lepomis macrochirus	*C. marginatum*	North America	Zimmermann and Ingold., 2008
Capoeta capoeta	*C. complanatum*	Iranian	Malek and Mobedi, 2001
Acheilognathus rhombea	*C. complanatum*	Korea	Chung et al., 1995
Microphysogobio yaluensis	*C. complanatum*	Korea	Chung et al., 1996
Carassius carassius	*C. complanatum*	Japan	Aohagi et al., 1992
Perca fluviatilis	*C. complanatum*	Poland	Grabda-Kazubska, 1974
Alosa sapidissima	*C. marginatum*	United States of America	Hollis and Coker, 1948

DISCUSSION AND CONCLUSION

This parasite has been reported in almost all regions of the world since 1948. The first notification was in the United States. *Clinostomum* species have been also reported especially in the rivers of North America as weight in the study, Asia (Japan, China, Taiwan, Iran, Turkey), the African continent (Nigeria, Kenya, Tanzania, Egypt) Europe (Poland). The freshwater fish species such as *Squalius cephalus* and *Perca fluviatilis* were reported from Turkey (Şimsek et al., 2018; Soylu, 2013), *Barbus meridionalis , B. barbus,* and *S. cephalus* from Italy (Caffara et al., 2011), *Cobitise longatoides* from Ukraine (Fedorčák et al., 2019), *Alburnoides bipunctatus* and *Capoeta gracilis* from Iran (Aghlmandi et al., 2018), *Carassius auratus* and *Microphysogo bioyaluensis* from Korea (Chung et al., 1995a; Sohn et al., 2019), *Rhamdi quelen* from South Brazil (Vianna et al., 2005). *Carassius cuvieri* and *Rhodeus ocellatus* from Japan (Aohagi et al., 1992), *C. complanatum* has been reported to infecting humans as a definite host (Chung et al., 1995b; Kitagawa et al., 2003; Lee et al., 2017; Menconi et al., 2020; Park et al., 2009). The studies on this parasite are of very importance, given the increase in zoonotic diseases.

Aohagi et al. (1992) reported that three out of five fish species are economically important and that their raw consumption by the locals poses a risk of infection in humans. They revealed that new species were added to infected fish species and the parasite spread with their study. Furthermore, Fedorčák et al. (2019) recorded an infection of zoonotic *C. complanatum* metacercariae with potential human transmission close to fish farms in the Tisa River Basin of Slovakia and Ukraine. Silveira et al., (2021) were reported first record of *Clinostomum* spp. (Digenea: Clinostomidae) in *Danio rerio* from Brazil therefore, the transition of these parasite species to other fish species and new notifications may continue. Therefore, studies have revealed the importance of this parasitic infection.

The prevalence of this parasite species can vary depending on the biotic and abiotic factors of environments (Eiras, 1994) and probably also affected by global warming (Mouritsen et al. 2005). A higher prevalence (52.6%–100%) has been found in warmer climate areas of South America (Vianna, 2001) and Asia (Shareef and Abidi, 2012; Siddiqui and Nizami, 1982).

As a result, we believe that this parasite can be transported to other countries through international fish trade and migratory birds and may be reported from different countries in the future. We think that it is necessary to demonstrate the geographical distribution of the parasite in order to minimize its dispersion, if possible, to eliminate it. Knowing the biology, life cycle and identification of the parasitic organisms is important in terms of creating solutions for the prevention, control and reduction of harmful species that affect farm fish species. In this review, we tried to indicate the geographic distribution of the parasite and emphasize its importance.

COMPLIANCE WITH ETHICAL STANDARDS

Author contributions

All authors contributed equally to the writing of the manuscript.

Conflict of interest

Authors declare that they have no conflict of interest.

Animal welfare statement

No animals were used in this study.

Human rights statement

Official approval is not required for this type of study.

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