

Parasites of the eyes of fresh and brackish water fishes in Iran

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Summary

In the present investigation a total of six parasite species, some eye-specific and others non-organ specific parasites were found in the eyes of 48 examined fish species, collected from fresh and brackish waters of Iran during 2004-2006. *Ichthyophthirius multifiliis* was isolated from the external surface of the eyes of *Oncorhynchus mykiss*, *Gyrodactylus stankovici* from *Cyprinus carpio* and *Lernaea cyprinacea* from *Cyprinus carpio* and *Hypophthalmichthys molitrix*. In the vitreous humor parasite species were *Tylodelphys clavata* (metacercaria) observed in *H. molitrix*, *Alburnus alburnus*, *Carassius auratus*, *Cyprinus carpio*, *Chondrostoma regium*, *Ctenopharyngodon idella* and *Capoeta capoeta*, and *Ornithodiplostomum* sp. (metacercaria) in *Aphanius vladykovi*. *Diplostomum spathaceum* (metacercaria) was found in the lens of eyes of 40 out of 48 fish species. Among parasite species identified, *Tylodelphys clavata* and *Ornithodiplostomum* sp. are recorded in Iran for the first time. Additionally, the geographical distribution and host range of *Diplostomum spathaceum* metacercaria is also presented in this study.

Key words: Parasites, Eye, Fish, Fresh and brackish water, Iran

Introduction

Previously, little attention was paid to the eye parasites of fishes in Iran and the records were limited mostly to infection and disease caused by *Diplostomum spathaceum* metacercaria in the lens of eyes of several freshwater fish species. However, extensive studies have recently been carried out on the parasites of eyes in riverine and lacustrine fishes inhabiting waters in the Zagros mountain area in western Iran. Therefore, our knowledge about the parasites of fish eyes has increased enormously and several new species have been identified (Barzegar and Jalali, 2002, 2006; Jalali and Barzegar, 2005, 2006; Raeisi *et al.*, 2006).

The economic significance of the eye diseases of cultured fish, is associated with specific effects or non-specific side effects of

parasites, including impairment of vision that leads to exophthalmus, cataract and even complete collapse of the eye, which may be the cause of growth inhibition and death of significant portions of cultured fishes.

In the present study, parasites of the eyes of fishes from fresh and brackish waters of Iran, with special attention to the host range of *D. spathaceum* metacercaria are reported. Of these parasites, two new digenean metacercaria species (*Tylodelphys clavata* and *ornithodiplostomum* sp.) found in the vitreous humor are recorded in Iran for the first time.

Materials and Methods

The present study was carried out in several areas of three different zoogeographical regions (Sarmatian,

Mesopotamian and Oriental) of Iran (Fig. 1) during 2004-2006. The fresh fishes were caught and transported to the laboratory, where their eye balls were completely separated and examined with naked eye and under a stereomicroscope at magnification of $\times 4$ to 40. The identification of fish hosts was carried out by an Iranian ichthyologist according to Coad (1992), Berg (1964-65) and Abdoli (1999). In doubtful cases, the whole specimens were fixed in 4% formalin and preserved for more investigation.



Fig. 1: Collection sites of examined fish species in Iran (Coad, 1992)

Methods used for collecting, fixing, staining and mounting of parasite specimens were as follows:

Protozoa: for collection of *Ichthyophthirius multifiliis* specimens, eye conjunctiva were finely scraped onto a microslide, and covered carefully with a coverslip. The samples were exposed to Bouin's fluid for about 15 min and then mounted in Canada balsam after dehydration in accordance with Lom and Dykova (1992).

Digenea: metacercaria was collected in a 0.9% saline solution. The sample was placed with a little saline on a glass slide and appropriate pressure was applied; it was fixed and washed in 90 and 70% alcohol, respectively, and then stained with alum haematoxylin according to Roberts (2001).

Crustacea: specimens of *Lernaea* sp. were collected from the eyes of the infected fish and cleaned in saline. The samples were

preserved in 70% alcohol, stained and cleared with polyvinyl lactophenol and mounted in Canada balsam according to Fernando *et al.* (1972).

Results

Six parasite species, found on the surface or in the eyes of the examined fishes are listed in Table 1.

Discussion

Various parasite species at different stages of life span have been found in the eye and associated structures of fish. Roberts (2001) stated that few *Myxobolus* spp. infected the sclera (*M. hoffmani*, *M. scleroperca*), anterior chamber and iris (*M. coseii*) of both fresh- and seawater fishes of Canada. Vitreous body, lens and retina are the predilection site of several metacercaria of Strigeidida order, where pressing against the cornea and other orbital locations cause collapse of the eye. Probably the most significant damage, called worm cataract and subsequent growth retardation, caused by *Diplostomum* spp. metacercaria; this parasite is now widespread throughout Iran. Høglund (1991) reported that at least 125 fish species are considered as the second intermediate host of *D. spathaceum* in the world, of these, more than 40 fish species are recorded to be infected with *D. spathaceum* (metacercaria) in Iran (Table 1). Common carp and Chinese carp in ponds are seriously threatened by the eye parasites either due to diplostomiasis, the causative agent of blindness and subsequent emaciation or by spending more time at the surface of pond waters where they can be readily eaten by the piscivorous bird species. In addition to *D. spathaceum* metacercaria which is the most well known fish digenean parasite in Iran, in this study two new digenean metacercaria, namely *Tylodelphys clavata* and *Ornithodiplostomum* sp. are reported for the first time in Iran. These two new parasites were found in the vitreous humor of the eyes of exotic and native cyprinid fishes inhabiting Chaghakhour and Gandoman Lagoon. *Tylodelphys* sp. was

Table 1: Parasites found on or in the eyes of freshwater fishes of Iran

Parasite group	Parasites		Host(s)	Locality(s)	Region(s)	Reference(s)
	Species	Family	Species			
Protozoan	<i>Ichthyophthirius multifiliis</i> (Fouquet, 1876)	Salmonidae	<i>Oncorhynchus mykiss</i>	Haraz Ri	East of Caspian	Present study
Monogenean	<i>Gyrodactylus stankovici</i> (Ergens, 1970)	Cyprinidae	<i>Cyprinus carpio</i>	Gilan fish hatcheries	West of Caspian	Jalali, 1998
Digenean	<i>Diplostomum spathaceum</i> (Rudolphi, 1819) (metacercaria) Fig. 2	Acipenseridae	Acipenser fish	Shahid Beheshti fish hatchery	West of Caspian	Ghoroghi, 1991
				Gilan fish hatcheries	West of Caspian	Mokhayer, 1989; Jalali, 1998; Nezam abadi and Abdi, 2002
		Clupeidae	<i>Alosa caspia persica</i>	Caspian Sea*	Caspian Sea	Present study
		Cyprinidae	<i>Abramis brama</i>	Gilan fish hatcheries	West of Caspian	Nezam abadi and Abdi, 2002
			<i>Alburnus alburnus</i>	Chaghakhour Lag	Tigris	Present study
			<i>Alburnoides bipunctatus</i>	Gandoman Lag	Tigris	Present study
			<i>Aspius vorax</i>	Saryson Ri	West of Caspian	Rahanandeh, 2006
			<i>Barbus lacerta</i>	Khuzestan fish hatcheries	Karoon	Jalali, 1998
			<i>Barbus sharpeyi</i>	Vahdat Res	Tigris	Barzegar and Jalali, 2006
			<i>Barbus sp.</i>	Khuzestan fish hatcheries	Karoon	Jalali, 1998
			<i>Blicca bjoerkna</i>	Amirkalayeh Lag	East of Caspian	Khara <i>et al.</i> 2005
			<i>Capoeta aculeata</i>	Golestan fish hatcheries	East of Caspian	Mokhayer, 1989
			<i>Capoeta damascina</i>	Chaghakhour Lag	Tigris	Present study
			<i>Capoeta capoeta</i>	Zayande-rud Ri	Esfahan	Present study
				Makoo Res	Azərbayjan	Abdolmaleki, 2000
				Baroun Res	Azərbayjan	Masoumian <i>et al.</i> 2005
				Ghalae-jough	Azərbayjan	Pazooki <i>et al.</i> 2007
				Golestan fish hatcheries	East of Caspian	Mokhayer, 1989
				Sanandaj fish hatcheries	Tigris	Khancheh-sepehrredin, 2000
		<i>Carassius auratus gibelio</i>		Makoo Res	Azərbayjan	Abdolmaleki, 2000
				Hamoon Lag	Sistan	Sharif Rohani, 1994
				Chaghakhour Lag	Tigris	Present study
				Boojagh Lag	West of Caspian	Khara <i>et al.</i> 2004
				Telar Ri	East of Caspian	Present study
				Amirkalayeh Lag	East of Caspian	Khara <i>et al.</i> 2005
		<i>Chalcalburnus mossulensis</i>		Kaftar La	Neyriz	Barzegar and Jalali, 2002
		<i>Chalcalburnus sp.</i>		Zarivar La	Tigris	Jalali and Barzegar, 2006
		<i>Chondrostoma regium</i>		Zayande-rud Ri	Esfahan	Present study
				Kaftar La	Neyriz	Barzegar and Jalali, 2002
				Chaghakhour Lag	Tigris	Present study
		<i>Ctenopharyngodon idella</i>		Hamoon Lag	Sistan	Sharif Rohani, 1994
				Kaftar La	Neyriz	Barzegar and Jalali, 2002
				Chaghakhour Lag	Tigris	Present study
				Gilan fish hatcheries	West of Caspian	Rahanandeh, 2006
				Mazandaran and Gilan fish hatcheries	Caspian	Mokhayer, 1989 and Jalali, 1998
		<i>Cyprinus carpio</i>		Vahdat Res	Tigris	Barzegar and Jalali, 2006
				Hamoon Lag	Sistan	Sharif Rohani, 1994
				Hoorolazim Lag	Karoon	Moghainemi, 1995
				Kaftar La	Neyriz	Barzegar and Jalali, 2002
				Chaghakhour Lag	Tigris	Present study
				Hatcheries fish in Gilan pro	West of Caspian	Rahanandeh, 2006
				Aras Res	Azərbayjan	Masoumian <i>et al.</i> 2005
				Boojagh Lag	West of Caspian	Khara <i>et al.</i> 2004
				Mazandaran and Gilan fish hatcheries	Caspian	Mokhayer, 1989
				Sanandaj fish hatcheries	Tigris	Khancheh-sepehrredin, 2000
		<i>Hypophthalmichthys molitrix</i>		Zarivar La	Tigris	Jalali and Barzegar, 2006
				Chaghakhour Lag	Tigris	Present study

Ri = River, La = Lake, Lag = Lagoon, Pro = Province, Spi = Spring water, Res = Reservoir and *Brackish water

Table 1 Continued

Parasites		Host(s)		Locality(s)	Region(s)	Reference(s)		
Parasite group	Species	Family	Species					
Diginean	<i>Diplostomum spathaceum</i> (Rudolphi, 1819) (metacercaria)	Cyprinidae	<i>Hypophthalmichthys molitrix</i>	Gilan fish hatcheries	West of Caspian	Rahanandeh, 2006		
			Mazandaran and Gilan fish hatcheries	Caspian	Mokhayer, 1989 and Jalali, 1998			
			<i>Leuciscus lepidus</i>	Sanandaj fish hatcheries	Tigris	Khancheh-sepehrredin, 2000		
				Zayande-rud Ri	Esfahan	Present study		
			<i>Hypophthalmichthys nobilis</i>	Sanandaj fish hatcheries	Tigris	Khancheh-sepehrredin, 2000		
				Gilan fish hatcheries	West of Caspian	Rahanandeh, 2006		
			<i>Rutilus rutilus caspicus</i>	Mazandaran and Gilan fish hatcheries	Caspian	Mokhayer, 1989 and Jalali, 1998		
				Boojagh Lag	West of Caspian	Khara <i>et al.</i> 2004		
			<i>Rutilus rutilus kutum</i>	Sijoal	East of Caspian	Present study		
				Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005		
			<i>Schizothorax zarudnyi</i>	Caspian Sea	Caspian Sea	Masoumian <i>et al.</i> 2001		
				Boojagh Lag	West of Caspian	Khara <i>et al.</i> 2004		
			<i>Schizothorax pelzami</i>	Shahid Rajaei fish hatchery	East of Caspian	Present study		
				Kileh Spi	East of Caspian	Present study		
			<i>Tinca tinca</i>	Mazandaran and Gilan fish hatcheries	Caspian	Mokhayer, 1989		
				Hamoan Lag	Sistan	Sharif Rohani, 1994		
			Cyprinodontidae	<i>Aphanius vladykovi</i>	Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005	
					Chaghakhour Lag	Tigris	Present study	
			Esocidae	<i>Esox lucius</i>	Gandoman Lag	Tigris	Present study	
					Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005	
Mugilidae	<i>Liza abu</i>	Boojagh Lag	West of Caspian	Khara <i>et al.</i> 2004				
		Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005				
Mastacembelidae	<i>Mastacembelus mastacembelus</i>	Gilan fish hatcheries	West of Caspian	Nezam abadi and Abdi, 2002				
		Hoorolazim Lag	Karoon	Moghainemi, 1995				
Percidae	<i>Perca fluviatilis</i>	Zarivar La	Tigris	Jalali and Barzegar, 2006				
		Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005				
Salmonidae	<i>Oncorhynchus mykiss</i>	Gillan fish hatcheries	West of Caspian	Nezam abadi and Abdi, 2002				
		Makoo Res	Azərbayjan	Masoumian <i>et al.</i> 2005				
Siluridae	<i>Silurus glanis</i>	Fish farms in Azerbaijan	Azərbayjan	Nekoe fard and Dini talatapeh, 2000				
		Urmia fish Hatcheries	Azərbayjan	Asadzadeh Mangili and Ghorbanzadeh, 1998				
Percidae	<i>Perca fluviatilis</i>	Urmia fish Hatcheries	Azərbayjan	Naghili, 2001				
		Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2005				
<i>Tylodelphys clavata</i> (Nordman, 1832) (metacercaria) Fig. 3	Cyprinidae	<i>Alburnus alburnus</i>	Amirkalayah Lag	East of Caspian	Khara <i>et al.</i> 2004			
		<i>Capoeta aculeata</i>	Chaghakhour Lag	Tigris	Present study			
		<i>Carassius auratus</i>	Chaghakhour Lag	Tigris	Present study			
			Gandoman Lag	Tigris	Present study			
		<i>Chondrostoma regium</i>	Chaghakhour Lag	Tigris	Present study			
		<i>Ctenopharyngodon idella</i>	Chaghakhour Lag	Tigris	Present study			
		<i>Cyprinus carpio</i>	Chaghakhour Lag	Tigris	Present study			
		<i>Hypophthalmichthys molitrix</i>	Chaghakhour Lag	Tigris	Present study			
		<i>Barbus grypus</i>	Hoor-o-Azim Lag	Tigris	Moghainemi, 1995			
		<i>Cyprinus carpio</i>	Hoor-o-Azim Lag	Tigris	Moghainemi, 1995			
		Mugilidae	<i>Liza abu</i>	Hoor-o-Azim Lag	Tigris	Moghainemi, 1995		
				Chaghakhour Lag	Tigris	Present study		
		Crustacean	<i>Lernaea cyprinacea</i> (adult) Fig. 4	Cyprinodontidae	<i>Aphanius vladykovi</i>	Chaghakhour Lag	Tigris	Present study
				Cyprinidae	<i>Cyprinus carpio</i>	Gandoman Lag	Tigris	Present study
		Crustacean	<i>Lernaea cyprinacea</i> (adult)	Cyprinidae	<i>Cyprinus carpio</i>	Mazandaran fish hatcheries	East of Caspian	Jalali, 1987
Cyprinidae	<i>Hypophthalmichthys molitrix</i>			Mazandaran fish hatcheries	East of Caspian	Jalali, 1987		

Ri = River, La = Lake, Lag = Lagoon, Pro = Province, Spi = Spring water, Res = Reservoir and * Brackish water



Fig. 2: *Diplostomum spathaceum* (×400)

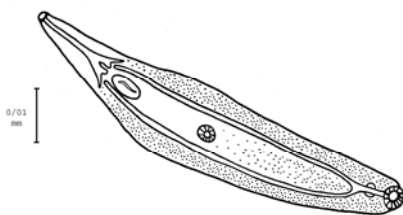


Fig. 3: *Tylodelphys clavata*

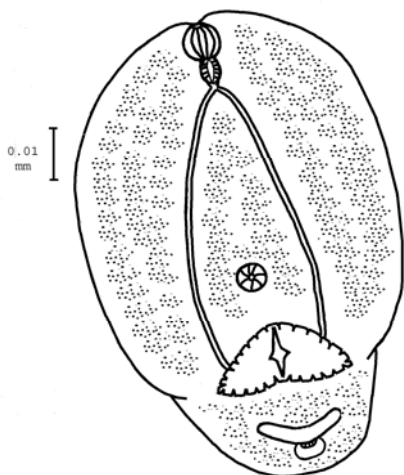


Fig. 4: *Ornithodiplostomum* sp.

first reported from the eyes of *Liza abu*, *Cyprinus carpio* and *Barbus grypus* in Hoor-o-Azim by Moghainemi (1995); however in this study, the parasite is identified to species level and in a new locality. The occurrence of *Ornithodiplostomum* sp. (metacercaria) is also reported for the first time in Iran.

From epidemiological point of view, both parasites are Palaearctic species therefore, they may be native or translocated by introduced fishes (common carp or silver carp) from the Caspian Sea to Chaghakhour Lagoon. Investigation on the relationship between the host-parasite systems may

elucidate the sources of two digenean metacercaria in Chaghakhour Lagoon. Additional investigations, including DNA analysis are the best option for specific recognition of metacercaria differences or similarities between species found in either Chaghakhour Lagoon or Caspian Basin and European species. *Ichthyophthirius multifiliis*, the most common external holotrich parasite, can be frequently seen on the eyes of fishes, particularly in fry and fingerlings during heavy infection. *Gyrodactylus stankovici* may sometimes infect the exterior part of fish eyes (Jalali, 1998).

Finally, *Lernaea cyprinacea*, the most common copepodid parasite in the freshwater aquaculture in Iran, is very pathogenic to small fish due to its relatively large size. In our finding, premetamorphosed females penetrate the margin of the eye ball of common carp fingerlings and cause exophthalmus.

In conclusion, most of the eye-specific parasites found in Iranian fresh and brackish water fishes cause various degrees of blindness. Although, the infected fishes are not killed directly by the parasite, however, related growth retardation, behavioural changes and associated secondary invaders (piscivorous bird, bacteria and external protozoa) may lead to death of the infected fish.

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