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Fish Parasites in Zarivar Lake

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ABSTRACT

Twenty four ecto- and endo- parasite species were found in different organs of eight native and exotic fish species in Zarivar Lake situated in the far west of Iran. Overall, 1000 fish specimens belonging to the Dactylogyridae, Gyrodactylidae families the Cyprinidae, Poeciliidae and Mastacembelidae families were examined during 2001 and 2002. Of them, five Protozoans, including *Trichodina pediculus, Trichodina* sp and *Myxobolus molnari,* a pansporogenic stage of the *Myxosporean plasmodia* and *Ichthyophthirius multifiliis* were recorded. Of the Metazoan parasites, 12 monogenean species, mostly belonging to the Dactylogyridae, Gyrodactylidae families and the Ancyrocephalinae subfamily, were found and identified at species and genus level. The number of helminthes reached 15 by adding one Digenea metacercaria (*Diplostomum spathaceum*) and 2 coelozoic Cestoda species. Crustacean species found on both of native and exotic fishes, belonging to Copepoda and Branchiora orders comprised of *Argulus foliaceus* and *Lernaea cyprinacea,* in addition an unknown *Argulus* was also found on skin and gills of spiny eel which identified to genus level. The only nematode found in the intestine of common carp was identified as *Pseudocapillaria tomentosa*. Besides the first record of parasites of spiny eel, the seasonal prevalence of ligulosis is presented. Additionally, zoogeographical analysis and species composition of parasitic fauna of Zarivar Lake are discussed.

Keywords: Fish parasites, Iran, Kurdistan, Zarivar Lake.

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INTRODUCTION

Zarivar lake is a small, freshwater body in the far west of Iran (Mesopotamian subregion, Tigris basin), situated in the north Kurdistan Province close to the city of Marivan, with an area of about 750 ha and average water depth of 4-5 meters. The continued existence of the lake is mostly dependant upon the quantity of water coming up through natural springs on the lake bottom. The annual average temperature of the water ranges from 0.5 to 27.3ºC. The volume of Zarivar lake has been calculated to range from about 22 to 47 million cubic meters of water. The introduction of exotic fish species to Zarivar lake with the aim of improving commercial fisheries activity, was begun by the Fisheries Company in 1982 (Abzigostar, 2004a) and now the species composition includes six exotic transplants of Chinese carps, common carp, randomly introduced *Psuerasbora parva* and *Gambusia affinis* which introduced in order to control mosquitos and four native species of fishes. Studies of the parasitic fauna of fishes in Zarivar Lake was recently started. Our knowledge concering this fauna is limited to the preliminary research work carried out by Jalali *et al*. (2001) who reported parasites species in/or three native and six exotic fish species in the lake. The present research work as the most complete survey is aimed to introduce a parasitofauna and parasite

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system, as well as the epidemiological, economical and ecological importance of the most dangerous ones in Zarivar Lake.

MATERIALS AND METHODS

Fish samples were acquired, using a gillnet, bag net and hook by local fishermen from Zarivar Lake during Winter 2001 and the Spring, Summer and Autumn of 2002 and transported live to the laboratory. Both commercial-and non commercial-sized fish were collected. Only fresh or already killed fish samples were subjected for parasitological investigation. Approximately 1000 fish specimens belonging to 3 families, 10 genera and 10 species were examined. The list of fish species used for the parasitological study is given in Table 1.

The identification of fish hosts was carried out by an Iranian Ichthyologist in accordance with Berg (1964-5), Coad (1992), Yarshater (1988) and Abdoli (1999) and then whole specimens were fixed in 4% formalin and transferred to the Zoological Institute of the Slovak Academy of Sciences for confirmation.

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

Protozoa: For the detection of protozoa, the mucus was (scraped separately from the skin, gills) onto a microslide and then spread the mucus carefully with a cover slip. The protozoa to exposed a fixative for about 15 minutes and then washed for several minutes in alcohol containing a drop of added Iodine solution. Next, both wet and dry were smears mounted in canada balsam after dehydration in accordance with Fernando *et al.* (1972).

Monogenea: Fish gills were cut out and examined under a microscope at x40-100 magnification. Vigorously moving worms were separated from the gills with a pipette and fixed under a coverslip according to Fernando *et al*. (1972) and Gussev (1983) in ammonium picrate and glycerol-gelatine, respectively.

Digenea: Metacercaria were collected in a 0.6% saline solution. The sample was placed with a little saline on a glass slide and appropriate pressure applied. It was fixed with

Table 1. examined native and exotic fish species in Zarivar lake.

Scientific name	English name	Locality	No of examined specimens
Family: Cyprinidae			
Cyprinus carpio Linnaeus, 1758 [a]	Common carp	Zarivar Lake	114
Ctenopharyngodon idella Valenciennes in Cuvier Valenciennes, 1844 [a]	Grass carp	Zarivar Lake	23
Hypophthalmichthys molitrix Valenciennes in Cuvier and Valenciennes, 1844*	Silver carp	Zarivar Lake	152
Carassius carassius Linnaeus, 1758 [a]	Crucian carp	Zarivar Lake	42
Barbus cyclolepis Heckel, 1837	Kura barbell	Outflow	5
Capoeta damascina Valenciennes in Cuvier and Valenciennes, 1842	Minnow	Outflow	6
Chalcalburnus sp [b]	Bleak	Zarivar Lake	587
Pseudorasbora parva Temmink & Schlegelin Siebold, 1842	Pseudorasbora	Zarivar Lake	10
Family: Poeciliidae			
Gambosia affinis Baird & Girard, 1853	Gambusia	Zarivar Lake	15
Family: Mastacembelidae			
Mastacembelus mastacembelus Banks and Solander in Russel, 1794	Spiny eel	Zarivar Lake	40

[a] Exotic fish species
[b] Under Identifying by Zoological Institute, Slovak Academy of Sciences.

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90% alcohol and washed in 70% alcohol and then stained with alum haematoxylin according to Fernando *et al*. (1972).

Cestoda: The collection of live cestoda was carried out from the intestine and body cavity of the infected fish. The parasites were then washed in a 0.6% saline solution and fixed in 70% alcohol/ They were stained with carmine, then cleared in xylene and mounted in canada balsam according to Fernando *et al*. (1972) and Roberts (2001).

Crustacea: Specimens of crustacea were collected from various locations on the fish (skin, fins, gill), cleaned in saline and preserved in 70% alcohol. They were then stained and cleared with polyvinyl lactophenol and mounted in canada balsam according to Fernando *et al*. (1972).

Nematoda: Live nematode specimens were collected from the fish intestine and washed in saline (0.6-0.8%). With the nematode kept extended, they were fixed in 70% alcohol and cleared in lactophenol for several days. Permanent mounts were made by using carmine stains according to Fernando *et al*. (1972) and Roberts (2001).

The identification of parasites was carried out in accordance with the keys given by Gussev (1985), Lom and Dykova (1992) and Jalali (1998).

RESULTS

In all, 24 protozoan and metazoan parasites, most of them known species, were found in/on dissected fish inhabiting Zarivar Lake. These parasites, collected from eight fish species, included 12 monogeneans, 5 protozoans, 1 digenea metacercaria, 3 crustaceans, 2 cestodes and 1 nematode. Among them, 17 species proved to be known species. But two protozoan (*Trichodina* sp, *Myxosporean* plasmodia), one monogenean (*Gyrodactylus* sp), one crustacean (*Argulus* sp) and one cestode (*Polyonchobothrium sp)* totally 5 species were identified only to genus level and require further studies for detailed identification (Table 2).

DISCUSSION

The results presented here and data reported by Molnar and Baska (1993) and Jalali *et al.* (2001) on the parasites of fishes that inhabit Zarivar Lake, indicate that the parasitofauna of the Zarivar basin traditionally belong to the Mesopotamian transitional region. This hypothesis is proved by the presence of native fish (*Mastacembelus mastacembelus* and *Capoeta damascina*) with their host specific monogenean parasites (*Mastacembelocleidus heteranchorus, Dactylogyrus carassobarbi and Dogielius molnari).*

The introduction of new fish parasites, along with their host species, has resulted in increasing the parasitofauna of the lake. The new species composition has affected both ichthyofauna and parasitofauna. The list of species of parasites now comprises 12 monogenean species (50%), 5 protozoan species (21%), 3 crustacean (12.5%), 2 cestodes (8%), 1 digenea (4.25%) and 1 nematode (4.25%). Among the monogeneans, 8 species are introduced species (Table 2).

Another result of the transplantation of new fish species is the prevalence of parasitic diseases among both native and exotic fish populations and this adversely effects the fisheries activity on the lake. Lernaeasis is one of the most dangerous diseases appearing among different native and exotic fish species in Zarivar lake and it has had a seriously disastrous influence on the economically important fish species (Jazebizadeh, 1983).

The course of epizootic lernaeasis in Zarivar lake in 1983 which caused mass and intensive economic problem in fisheries activity as interpreted by the Molnar hypothesis (Molnar, Personal communication). According to his opinion, the number of voracious cyclops, a predator of *Lernaea* naupli stages, decreased in the fresh water system due to the introduction of silver carp and particulary big head carp, which help the survival of *Lernaea* naupli in ecosystem. The

Table 2. List of parasite species found in/on fish samples from Zarivar Lake

	Parasites	Infected organs	Host
Protozoans	*Trichodina pediculus* Ehrenberg, 1838 (Figure 1)	Gills	-Common carp, Minnow, Spiny eel
	Trichodina sp (Figure 2)	Gills	-Bleak
	Ichthyophthirius multifiliis Fouquet, 1876 (Figure 3)	Gills & Skin	-Bleak, Spiny eel
	Myxobolus molnari Baska & Masoumian 1996 (Figure 4)	Gills	-Bleak
	Myxosporean plasmodia (pansporogenic stage) (Figure 5)	Gills	-Silver carp
Monogeneans	*Mastacembelocleidus heteranchorus* Kulkarni, 1969 (Figure 6)	Gills	-Spiny eel
	Dactylogyrus extensus Mueller et Van Cleave, 1932 (Figure 7)[a]	Gills	-Common carp
	D. alatus Linstow, 1878 (Figure 8)[a]	Gills	-Bleak
	D. hypophthalmichthys Achmerov, 1952 (Figure 9)[a]	Gills	-Sliver carp
	D. carassobarbi *Gussev et al,* 1993 (Figure 10)	Gills	-Minnow
	D. lenkorani Mikhailov, 1967 (Figure 11)	Gills	-Minnow
	D. lamellatus Achmerov, 1956 (Figure 12)[a]	Gills	-Grass carp
	D. goktschaicus Gussev, 1966 (Figure 13)	Gills	-Kura barbell
	D. Suchengtaii Gussev, 1962 (Figure 14)[a]	Gills	-Silver carp
	Dogielius molnari Jalali, 1992 (Figure 15)	Gills	-Minnow
	Gyrodactylus sp (Figure 16)	Gills	-Minnow
	Gyrodactylus stankovici Ergens, 1970 (Figure 17)[a]	Gills	-Common carp
Digenea	*Diplostomum spathaceum* Rudolphi, 1819 (Figure 18)	Lens of eyes	-Crucian carp, Silver carp, Grass carp, Bleak, spiny eel
Crustacean	*Argulus* sp1 (Figure 19)	Gills & Skin	-Silver carp, Common carp, Bleak, Spiny eel
	Argulus sp2 (Figure 20)	Gills & Skin	-Silver carp, Common carp, Bleak, Spiny eel
	*Lernaea cyprinacea (*adult*)* Linnaeus, 1758 (Figure 21)	Skin	-Common carp, Spiny eel
	Lernaea cyprinacea (Copepodid stage) (Fig. 22)	Gills	-Common carp, Spiny eel
Cestodes	*Ligula intestinalis* Linnaeus, 1758 (Figure 23)	Body cavity	-Bleak
	Polyonchobothrium sp (Figure 24 & 25)	Intestine	-Spiny eel
Nematoda	*Pseudocapillaria tomentosa* Dujardin, 1843 (Figure 26)	Intestine	-Common carp

[a] Introduced monogenean parasites

resulting large numbers of the copepodid stages produced from naupli successfully hide themselves in the gills of fish hosts. The occurrence of such a situation resulted in a prevalence of lernaeasis infection among fish species during the summer of the aforesaid year and continued for several years. Understanding of such condition favoring development of *Lernaea* in Zarivar Lake was the key to control of *Lernaea sp* epizootic among cultured and native fish. This was carried out by a decreasing in population density of big head carp by reducing the yearly introduction of big head carp fingerlings to the lake during the last decade. This resulted in a significant reduction in the prevalence and intensity of lernaeasis among all the fish population in lake

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Table 3. List of parasites species found in/on fish samples in Zarivar Lake according to host (s).

No	Hosts	Parasites	Infected organs
1	Bleak	*Trichodina* sp	Gills
		Myxobolus molnari Baska & Masoumian, 1996	Gills
		Ichthyophthirius multifiliis Fouquet, 1876	Skin
		Dactylogyrus alatus Linstow, 1878	Gills
		Diplostomum spathaceum (metacercaria) Rudolphi,1819	Lens of eyes
		Argulus sp1	Gills & Skin
		Argulus sp2	Gills & Skin
		Ligula intestinalis Linnaeus, 1758	Body cavity
2	Spiny eel	*Trichodina pediculus* Muller, 1786	Gills
		Ichthyophthirius multifiliis Fouquet, 1876	Gills
		Mastacembelus heteranchorus Kulkarni, 1969	Gills
		Diplostomum spathaceum (metacercaria*)* Rudolphi, 1819	Lens of eyes
		Argulus sp1	Gills & Skin
		Argulus sp2	Gills & Skin
		*Lernaea cyprinacea (*adult*)* Linnaeus, 1758	Skin
		*Lernaea cyprinicea (*Copepodid *stage)*	Gills
		Polyonchobothrium sp	Intestine
3	Common carp	*Trichodina pediculus* Muller, 1786	Gills
		Dactylogyrus extensus Mueller and Van cleave, 1932	Gills
		Gyrodactylus stankovici Ergens, 1970	Gills
		Argulus sp1	Gills & Skin
		Argulus sp2	Gills & Skin
		*Lernaea cyprinacea (*adult*)* Linnaeus, 1758	Skin
		*Lernaea cyprinacea (*Copepodid *stage)*	Gills
		Pseudocapillaria tomentosa Dujardin, 1843	Intestine
4	Silver carp	*Myxosporean plasmodia (pansporogenic stage)*	Gills
		Dactylogyrus hypophthalmichthys Achmerov, 1952	Gills
		D. suchengtaii Gussev, 1962	Gills
		Argulus sp1	Gills & Skin
		Argulus sp2	Gills & Skin
		Diplostomum spathaceum (metacercaria) Rudolphi, 1819	Lens of eyes
5	Minnow	*Trichodina pediculus* Muller, 1786	Gills
		Dactylogyrus carassobarbi Gussev *et al*. 1993	Gills
		Dactylogyrus lenkorani Mikhailov, 1967	Gills
		Dogielius molnari Jalali, 1992	Gills
		Gyrodactylus sp1	Gills
6	Grass carp	*Dactylogyrus lamellatus* Achmerov, 1956	Gills
		Diplostomum spathaceum (metacercaria) Rudolphi, 1819	Lens of eyes
7	*Kura barbell*	*Dactylogyrus goktschaicus* Gussev, 1966	Gills
8	Crucian carp	*Diplostomum spathaceum* (metacercaria Rudolphi, 1819	Lens of eyes

which was confirmed during the present studies. The general prevalence of lernaeasis was 6.3% in spiny eel and 0.9% in common carp.

The above facts indicate that comprehensive studies are absolutely necessary before the introduction of any new fish species to any lake. In addition, sanitary methods for the transfer of fish should be precisely taken account of, otherwise new parasites can be transmitted to lakes causing a possibility for a mass outbreak of parasitic diseases, especially among native fish which are often more sensitive to introduced parasites than the exotic ones.

Ligulosis is another disease which infects the *Chalcalburnus sp.* population of fish sized between 3-10 g and 1-2 summers old. The number of fish examined was 587 specimens and the general prevalence 43%. The seasonal variation of ligolosis reaches 15% in Summer, 60% in Autumn, 15% in Winter and 2% in Spring. Presumably, the

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Figure 1. *Trichodina pediculus* ×1000

Figure 2.*Trichodina* sp ×400

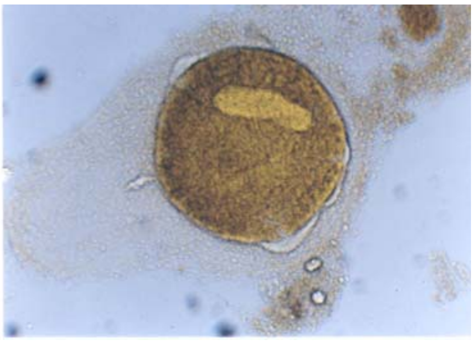

Figure 3. *Ichthyophthirius multifiliis* ×100

Figure 4. *Myxobolus molnari* ×1000

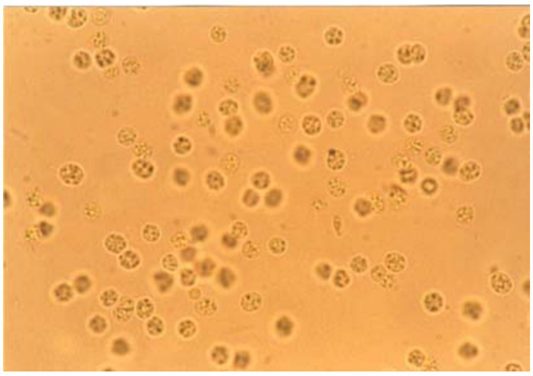

Figure 5. *Myxosporean plasmodia* (pansporogenic stage)×1000

Figure 6. *Mastacembelocleidus heteranchorus* ×400

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Figure 7. *Dactylogyrus extensus* ×400

Figure 8. *Dactylogyrus alatus* ×400

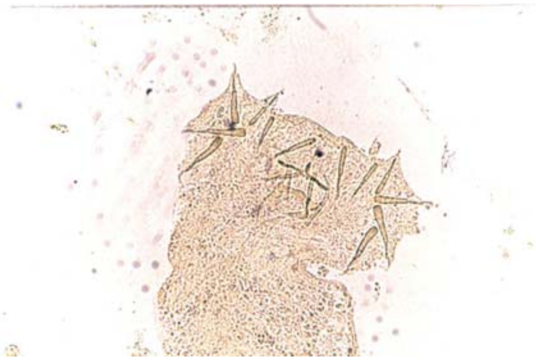

Figure 9. *Dactylogyrus hypophthalmichthys* ×400

Figure 9. *Dactylogyrus hypophthalmichthys* ×400

Figure 11. *Dactylogyrus* lenkorani ×400

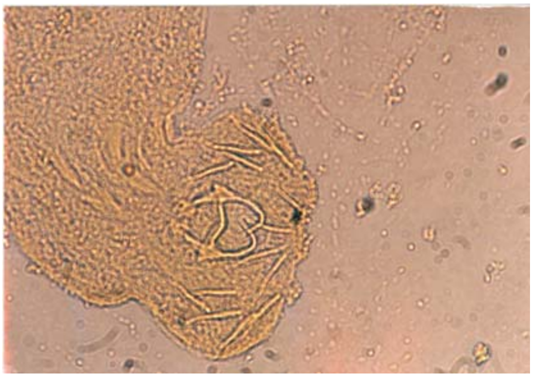

Figure 12. *Dactylogyrus lamellatus* ×400

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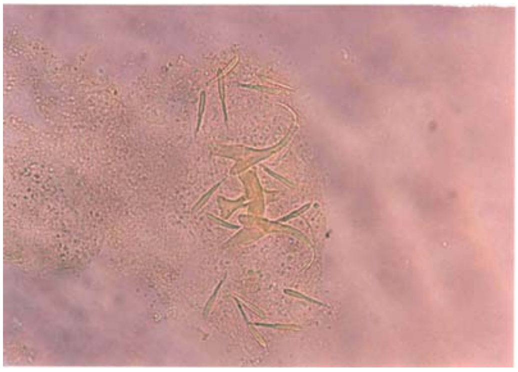

Figure 13. *Dactylogyrus goktschaicus* ×400

Figure 14. *Dactylogyrus Suchengtaii* ×400

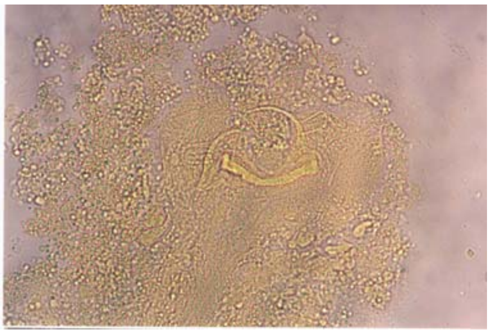

Figure 15. *Dogielius molnari* ×1000

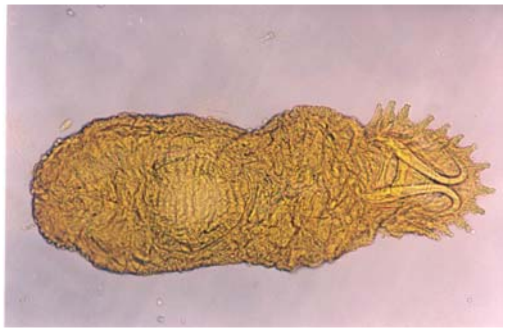

Figure 16. *Gyrodactylus sp* ×100

Figure 17. *Gyrodactylus stankovici* ×100

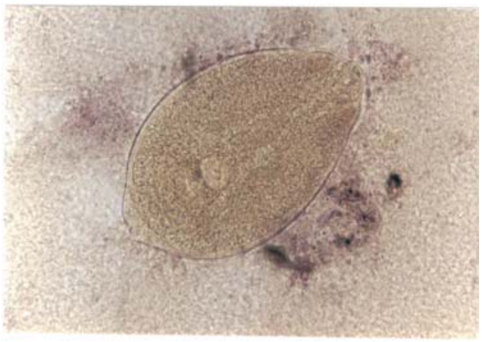

Figure 18. *Diplostomum spathaceum* ×100

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Figure 19. *Argulus foliaceus* ×100

Figure 20. *Argulus sp* ×100

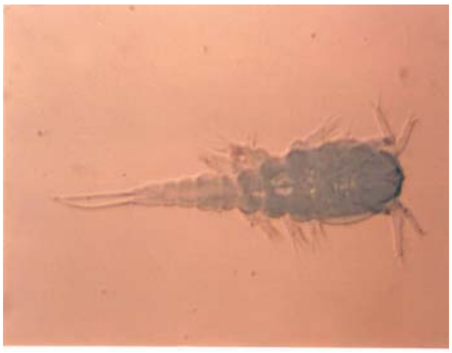

Figure 21. *Lernaea cyprinacea* (adult) ×100

Figure 22. *Lernaea sp*(Copepodid stage) ×8

Figure 23. *Ligula intestinalis* ×11

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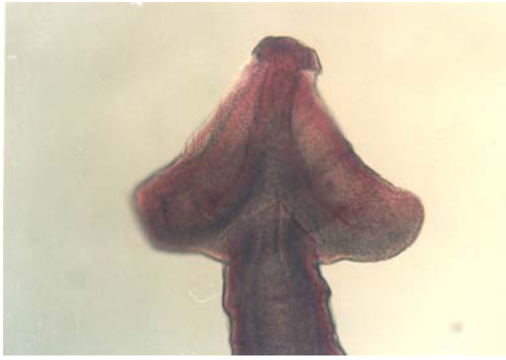

Figure 24. *Polyonchobothrium sp* ×400

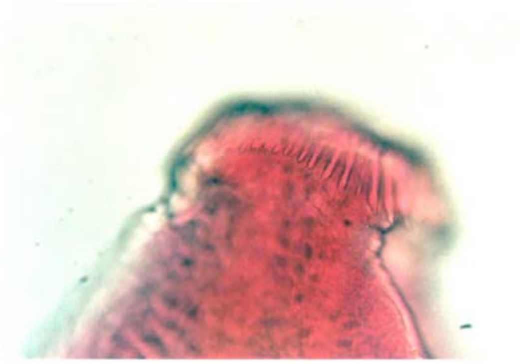

Figure 25. *Polyonchobothrium sp* ×1000

Figure 26. *Pseudocapillaria tomentosa* ×100

Figure 27. *Pseudocapillaria tomentosa* ×400

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infected fishes die one by one or are eaten by fish-eating birds during winter and their number will be decrease. Although the fish species mentioned above is not an economically important one, it has a definite ecological importance which is still not clearly understood and needs special study. According to Dubinina (1980), ligulosis epizootics among Cyprinidae, usually arise in stagnant or slowly moving areas of water (lakes, reservoirs) with a well heated shoal area covered with aquatic vegetation. Here, abundant zooplankton (Cyclopids and Diaptomids, the first intermediate hosts of the Ligulidae) develop and these areas are frequently visited or populated by fish-eating bird species, which are the final hosts of Ligulidae. The same situation exists in Zarivar Lake (Abzigostar, 2004b, c) where the shoals are per dominantly populated by cyclops, schools of *Chalcalburnus sp,* and several species of fish-eating birds like *Anas platyrhynchus* or *Ardea cinerea* are commonly found. This situation leads to a complete *Ligula intestinalis* life cycle in Zarivar Lake. The maximum size a plerocercoid measured was with a length of 12.5 cm, width 0.75 cm. A significant decrease in the weight of fish suffering from ligulosis has also been observed, which was 50% lower than that of healthy individuals of the same age.

Among the fishes found to be infected by varying parasites (parasites system) in Zarivar Lake, *Mastacembelus mastacembelus* and *chalcalburnus sp.* with 8 species each infected by most various types of parasites and *Barbus cyclolepis* and *Carassius carassius* with one species each had no variation in their parasites-system in their parasitofauna (Table 3).

According to the present study, one of the most fascinating findings is a new record of parasites in *Mastacembelus mastacembelus.* This native fish of the Tigris region is now known to be infected at least by 8 species of parasites. Of these, only a nematode, *Contracaecum sp,* was previously reported, by Mokhayer (1981b) in the intestinal wall of the aforesaid fish species.

Other new records in our investigation can be summarized as follows. A new host for *Myxobolus molnari* was recorded in the gills of *Capoeta damascina,* formerly reported by Baska and Masoumian (1996) in *Capoeta trutta. Dogielius molnari* was found in the gills of *Capoeta damascina,* formerly reported by Jalali (1992) in *Cyprinion macrostomum. Trichodina pediculus,* the first record in Iran, was found on the gills of *C. damascina and M. mastacembelus.* An unknown Cestoda belonging to *Polyonchobothrium* genus was found in the intestine of spiny eel (Moobedi, Personal communicatin). This needs more specimens and further study for identifying to the species level.

Other findings included*: D. suchengtaii,* a specific monogenean parasite, has been found in fish samples identified as Silver carp, but not morphologically the same host. These fishes, however could have been hybrids of the Big head and the Silver carp. On the basis of research carried out by Molnar *et al*. (1984), a usually host-specific parasite of the female breeder occurred in a hybrid form, therefore we can conclude that at least some of the 'Silver carp' fingerlings introduced to lake every year are actually hybrids of big head carp and silver carp. Thus, in the artificial propagation of fish species in hatcheries precise attention in the selection of pure breeders for fingerling production purposes should be considered, otherwise hybrids introduced in natural waterways or reservoirs may endanger fisheries activity.

Diplostomum spathaceum metacercaria was found to be the most common parasite species which infected the lens of eyes of five fish species. Studies show this has occurred in at least 125 fish species in the world (Woo, 1995). Its life cycle is completed through several species of snails (*Limnea, Planurbis)* acting as intermediate hosts and with several species of fish eating it as a definitive host, of which all are present in Zarivar Lake.

The only nematode, in the intestine of common carp, was identified as *pseudocapillaria tomentosa* (Pazooki, Personal communication). The parasite was first reported in the intestine of *Barbus sharpei* in Karoon River by Pazooki (1996).

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انگل های ماهیان دریاچه زریوار

ب. جلالی و م. برزگر

چکیده

24 گونه انگل خارجی و داخلی در اندام‌های مختلف 8 گونه ماهی بومی و معرفی شده جداسازی و گزارش گردیدند. در مجموع 1000 نمونه ماهی متعلق به دو خانواده کپورماهیان و مارماهیان خاردار در اندازه‌های مختلف در طی سال های 1380 و 1381 مورد بررسی قرار گرفتند که از میان انگل‌های یافت شده 5 گونه متعلق به تک یاختگان شامل: *تریکودینا پدیکولوس*، *تریکودینا sp*، مرحله *پان اسپوروسیست میکسوسپوره آ*، *ایکتیوفمتریوس مالتی فیلی ایس* و *میکسوبولوس مولناری*، ثبت شدند. از انگل‌های پریاخته 12 گونه از رده مونوژنه آ که به خانواده های *داکتیلوژیریده*، *ژایروداکتیلیده* تعلق دارند، جداسازی و تا حد گونه و جنس شناسایی گردیدند. تعداد کرم‌های یافت شده با اضافه شدن متاسرکر *دیپلوستوموم اسپاتاسئوم* و دو گونه سستد در حفره بطنی و روده ماهیان به 15 گونه میرسد. سخت پوستان انگل ماهی شامل سه گونه بوده، 2 گونه *آرگولوس* و یک گونه *لرنئا* به ترتیب تا حد جنس و گونه شناسایی شدند. تنها گونه انگل از شاخه نماتدآ در روده ماهی کپور به نام *سودوکاپیلاریا تومنتوزا* نیز تا حد گونه تشخیص داده شد. به علاوه انگل‌های یافت شده، 8 گونه انگل در مارماهی خاردار نیز یافت شد که برای فون انگلی مارماهیان خاردار ایران جدید می باشند. تغییرات فصلی شیوع لیگولوزیس، تجزیه و تحلیل انتشار جغرافیایی و ترکیب گونه‌ای یافت شده نیز در این مقاله مورد بحث قرار می گیرند.

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