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First Occurrence and Intensity of *Posthodiplostomum cuticola* (Nordmann, 1832) (Digenea; Diplostomatidae) Metacercariae in Monkey Goby (*Neogobius pallasi berg, 1916*) In the Zarringol Stream, Golestan Province, Iran

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Abstract: *Posthodiplostomum cuticola* metacercariae infection has reported for the first time from monkey goby in the Zarringol Stream. In this study, 30 specimens were examined, at summer 2008. Range of frequency of *P. cuticola* was 7-218 per host. The dorsal and pectoral fins had the highest significant number of cysts metacercariae than other organs ($p<0.05$). The significant differences between the fish age and the average of parasites was also recorded. As the age increases, intensity and abundance of parasitic infection also increased ($p<0.05$). It seems, increasing of the infection in elder of individuals is due to larger size of the fish body surface area and long duration of parasite exposure.

Key words: Monkey goby · *Posthodiplostomum cuticola* metacercariae · Zarringol stream

INTRODUCTION

Most species of Gobiidae live in marine ecosystems and some species inhabit permanently in inland water [1-3]. There are about 37 species and subspecies of Gobiidae in the Caspian Sea [4]. Gobiidae has wide distribution in the southern part of Caspian Sea basin and its adjacent rivers [5]. One of the species of this family is *Neogubius pallasi* Berg, 1916 (Monkey goby) which has a wide distribution in the south Sea Caspian basin and it's the Rivers.

Within the complicated cycles of digeneans, cestodes and nematodes, the gobies are frequently second intermediate hosts [6, 7]. *Posthodiplostomum cuticola* (Digenea: Diplostomatidae) (Nordmann, 1832) is a digenean trematode parasitizing different fish, but occurring most frequently in the family cyprinidae [8]. The different species of *Posthodiplostomum* genus are known as Posthodiplostomasis disease [9]. During the developmental stages of *Posthodiplostomum cuticola* (von Nordman, 1832), fish encycled around the metacercariae cyst by melanin leading to the production of remarkable black cysts [10].

The metacercariae of *P. cuticola* encyst in the fins, skin, sub-epidermal tissue, gills and muscle under beneath the skin of host fishes [11, 12]. Infection of metacercariae *Posthodiplostomum cuticola* has mainly been reported in Cyprinid [13, 14, 9, 11, 15, 16, 12, 17]. *P. cuticola* metacercariae was rarely reported in the fish farming in Iran, however it has been recognized in Cyprinidae of Sefidrood River and some other water bodies in Iran [9, 12]. Parthenogenetic generations parasitize the snails *Planorbis planorbis* and *P. carinatus*, the intermediate hosts in which abundant cercariae develop. *P. cuticola* has been reported as pathogenic for fish hosts and the infection may be lethal, especially during the first months of life cycle [9, 15].

Study on parasites of Iranian fishes dates back to 1949, when Bychowsky reported three Dactylogyrus species and one Ancyrocephalus on the gills of fishes in Karkheh River. Since then other researchers reported more parasites from Iranian freshwater fish [18, 19, 20, 21, 12, 22, 23]. In addition to the rivers, various parasites have been reported from reserves and lakes in Iran [24, 25, 26, 27, 28, 29, 30, 31]. The purpose of this study was to determine the prevalence, intensity and Range of *Posthodiplostomum cuticola* metacercariae in infected monkey goby.

MATERIALS AND METHODS

Study Area and Sampling: The study area located in Zaringol Stream- Golestan Province, Iran (54°59′50 - 55°05′E, 36°55′12- 37°00N) (Fig. 1).

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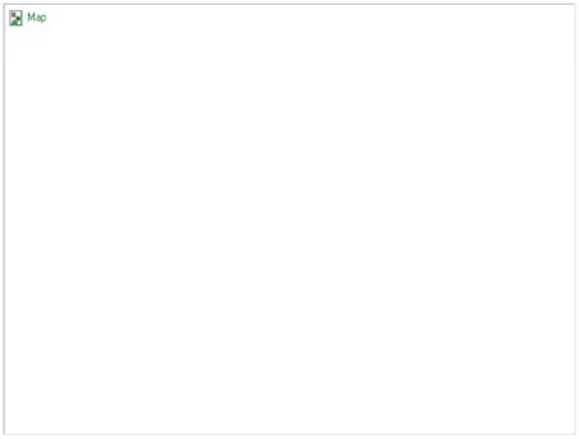

Fig. 1: Location of studied area- Zarringol Stream

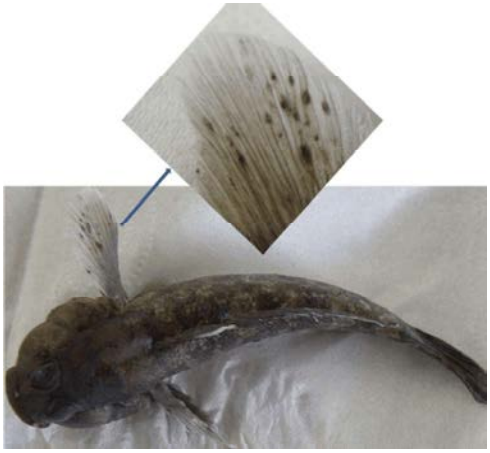

Fig. 2: *P. cuticola* metacercariae in the pectoral fin; *Neogobius Pallasi* Berg, 1916) (photo by author)

Specimens of monkey goby were collected by electrofishing (battery-powered unit IUP-12, 120/200 V, 6A, 50-90 Hz) in the sub branches channel (Station 6) that it's source is spring then connects to the main channel of Zarringol Stream (22 km) at summer 2008.

Age determination of specimen was done by otolith. In the Laboratory, individuals of monkey goby were fixed by formaldehyde (4%). To detect of metacercariae *P. cuticola* on skin, fins, gills, mouth cavity and eyes were examined under a stereo-microscope. Then, monkey goby parasite was described according to parasite keys [32, 33, 34]. The severity of parasite infection expressed as prevalence (percentage of the fish infected), intensity (mean value and range of the parasite number per the infected fish) and abundance (mean number of the parasite per fish), were carried out according to [34]. The Infection parameters (Intensity and abundance of infection) were compared between different ages with the non-parametric, Kruskal Wallis and Man Wittney U, tests.

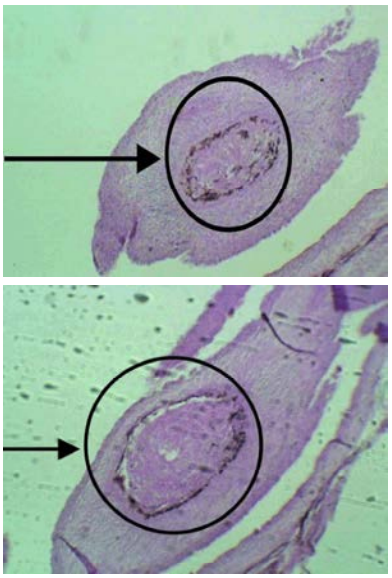

Fig. 3: Skin lesions of cellular response in monkey goby caused by infestation of *P.cuticola* metacercariae with tissue slices of skin (Magnification × 40).

RESULTS

In this study, 30 individuals of monkey goby were captured and examined. Results were showed that all of them were infected to *P. cuticola*. Determination of age showed five age class (0^+- 4^+) that the largest male specimens measured with total length of 114.1 mm and age 4^+ as the greatest female 108.5 mm and 4^+ (Table 1).

In this study, *P. cuticola* metacercariae species for the first time has reported from monkey goby (Fig. 2).

In parasitological examination of *P. cuticola* metacercariae in monkey goby, all specimens were infected (Fig. 3).

There was infection at all ages and range of number parasites was reported 7-218. The lowest and highest intensity and abundance of infection were found in monkey goby 0^+ and 4^+, respectively. Results of data analysis showed significant difference between intensity and abundance of infection in all of age groups, except in monkey goby 2^+ and 3^+ which had no significant difference. Abundance of infections was increased with increasing of age and very low in small sizes (Table 2).

Infection of *P. cuticola* metacercariae been recorded in all organs of fish. Of the 2422 *P. cuticola* metacercariae that was found, 2226 were located on the surface of the

Table 1: Total length and weight in monkey goby in age class in Stream Zarringol

	TL (mm)		Weight (gr)	
Age	Male	Female	Male	Female
0^+	37.7 ± 2.7 (4) (nd*)		0.55 ± 0.08	
1^+	52.3 ± 7.6 (9)	57.1 ± 10.6 (9)	1.8 ± 0.8	2.3 ± 1.4
2^+	91.1 ± 0.9 (2)	91.1 ± 1.3 (3)	9.4 ± 0.7	9.3 ± 0.2
3^+	-	102.3 ± 1.6 (2)	-	14.4 ± 2.4
4^+	114.1 (1)	108.5 (1)	18.9	17.4

*Non distinguished (sex)

Table 2: Infection of *P. cuticola* metacercariae in monkey goby- Zarringol Stream

Age	Prevalence	Intensity and abundance of infection	Range of infection
0^+ (4)	100	18.25^d	7-24
1^+ (16)	100	54.43^c	13-125
2^+ (6)	100	151.2^b	128-169
3^+ (2)	100	154.5^b	145-164
4^+ (2)	100	204^a	190-218
Total (30)	100	83.51	7-218

^{a,b,c,d}Means in a row without a common superscript are significantly different (P<0.05)

Table 3: Number of *P. cuticola* metacercariae cysts on the body of monkey goby in Zarringol Stream.

Sector	Dorsal fins	Pectoral fins	Ventral fins	Anal fin	Caudal fin	Gills	Body sides	Eye socket	Head
Number of parasite	593	724	125	87	228	209	260	85	101

Table 4: Infection of *P. cuticola* metacercariae in difference sex of monkey goby.

Sex	Position	Parasite position in monkey goby	Mean ± St.Dev	Range
		0	3.2^c± 7.1	0-15
Female		1	4.8^b±40.7	11-103
	Fin	>2	0.9^a ± 123.2	102-156
		0	3.2^b ± 7.1	0-15
Male		1	4.1^b± 25	4-66
		>2	0.3^a ± 137.1	124-150
		0	0.3^a ± 4.3	2-7
Female		1	4.8^a ± 10.2	0-44
	Head	>2	0.25^a ± 16.8	13-24
		0	0.3^b ± 4.3	2-7
Male		1	3.2^{ab} ± 9.2	0-36
		>2	1.6^a ± 21	13-36
		0	1.4^b ± 3.2	0-7
Female		1	1.1^b ± 4.4	0-10
	Body	>2	0.3^a ± 15.2	10-20
		0	1.4^b± 3.2	0-7
Male		1	0.4^b ± 5.5	2-10
		>2	1.2^a ± 19.4	14-32

^{a,b,ab,c}Means in a row without a common superscript are significantly different (P<0.05)

body, including 1757 on the fins, 260 on the bilateral body. The remaining metacercariae occurred, 209 on the gills, 101 on the head and 85 in the eye sockets. The fins (mainly the dorsal and pectoral fins) had the highest number of cysts metacercariae than other organs (Table 3).

In different ages, infection of organs in females and males, the maximum average was in 2^+ (and higher) age group and the lowest in 0^+ classes were observed. On the other hand, to increase of age, infection average increased in both sex (P<0.05) (Table 4).

DISCUSSION

In this study, the prevalence, intensity and abundance of *P. cuticola* in monkey goby in comparison of other studies in different species of infected fish with *P. cuticola* metacercariae [35, 14, 10, 15, 36, 16, 17]. Were much higher. The relatively stable environmental conditions, the low velocity, the low length of sub branches (100 m) so that leading to separated environment and also very high abundance of aquatic snails (64%) (planorbidae) as the primary intermediate host of *P. cuticola*, can cause high parasitic infection in monkey goby in one of branch belong to Zarringol Stream.

The parasitological examination of Roach (*Rutilus rutilus*) in inland waters Lithuania from 2005 to 2008, the highest prevalence of parasite after the *Diplostomum sp*, is belonging to *P. Cuticola* that are coincident with those of other roach parasitological studies [37, 38, 39, 40] and also the prevalence and intensity of *P. cuticola* infection in rivers was significantly more of the lakes [17]. In other study on 11 species of fishes in the Danube Delta from 2003 to 2007, 4 fishes species infected with *P. cuticola* were identified and most of the Infection was observed in *Hypophtalmichthys molitrix* and *Scardinius erythrophthalmus* with a mean prevalence 30.26 and 26.56, respectively that most of the infection was occurred in skin, fins and muscles under the skin [14]. In this study, a higher number of *P. cuticola* metacercariae was recorded on the dorsal fin and pectoral fins. To a lesser degree they attach to the lateral parts of the head and eye socket.

The parasite examination in 13 species of Cyprinids in the Vistula Lagoon Poland has been showed that six species were infected by *P. cuticola* metacercariae and of the 1287 *P. cuticola* metacercariae found, 780 were located in the fins [11]. The other studies infection of *P. cuticola* metacercariae in fins, skin and gills has been reported [14, 17]. It seems, the fins were more prone to attack than were the remaining sectors. This is doubtless related to the fact that it is easier for the parasite to penetrate the soft fold of the skin on fins than a layer of scales, so that in our study 72.54% of metacercariae were located in fins.

During a survey in Ilvay River of Croatia, 8 fish species infected by *P. cuticola* metacercariae were identified and the prevalence of infection was (47.83-100%). The relationship between the total and standard length, weight and condition factor with the number of parasite *P. cuticola* was significant in specimens of Leuciscus Cephalus [41]. In our study, the all of specimens of *Neogobius pallasi* infected. It seems to increasing of the infection in higher ages are because of increase of the fish body surface area and long duration of parasite exposure.

The seasonal dynamics of *P. cuticola* metacercariae in 0^+ juvenile fish in three species of Cyprinidae on the floodplain of the Dyje River, Czech Republic have shown that parasite prevalence and abundance differed among fish species and months with the highest values found in roach and October (65.5%). In larval digeneans, seasonality is triggered by water temperature which affects the emergence of cercariae from the snail intermediate host [13]. In *P. cuticola*, the optimum temperature for parasite development in the first intermediate host is 10°C [42]. According to the conditions of station 6 (sub branche and its source is spring) and stable temperature (12°C), high abundance of snails (Palnorbidae) and also because of benthic and sedentary of monkey goby and consequently the more contact with the macroinvertebrates, we can say that the monkey goby was more prone to attack with this parasite. So depending on environmental conditions, the high abundance of primary intermediate host (snails) and fish behavior, the levels of infection is different.

Mierzejewska and Własow [8] established that *P. cuticola* are sensitive indicators of environmental changes as it reflects spatial differences and long-term changes in ecological conditions. Since environmental and natural and human stressful factors and host population composition were determined the presence of local fauna or population composition of the parasite [43], allowing using of fish parasites as biotic indices can be considered.

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