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European Journal of Zoological Research, 2014, 3 (2):103-107
(http://scholarsresearchlibrary.com/archive.html)

ISSN: 2278–7356

Occurrence and intensity of *Tracheliastes polycolpus* on *Capoeta capoeta gracilis* (Pisces: Cyprinidae) in Tajan River from the Southeast of the Caspian Sea

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ABSTRACT

A total of 540 individuals of Capoeta capoeta gracilis *were collected from two sampling sites, one each from upstream (36°11'24.91"N, 53°19'32.13"E) and downstream (36°16'15.36"N, 53°12'51.44"E) of Shahid-Rajaei dam on Tajan River in February 2010. In the present study, a total of 545 individuals of* Tracheliastes polycolpus *were found in* C.c. gracilis*. The prevalence (P), mean intensity of infection (MI), range and mean abundance (MA) of the parasite are as follow: P= 46.7%, MI= 2.2±1.9, MA= 1.0±1.7. The parasite wa s found in highest prevalence (23.7%) on dorsal fin than on the other fins. The infestation of pelvic and pectoral fins were the second and third highest respectively. The prevalence, mean intensity of infection and mean abundance of* T. polycolpus *were significantly higher in spring and summer than in autumn and winter. There were also found significant differences in infestation with* T. polycolpus *between different age and sex classes of fish and different localities.*

Keywords: Fish, Parasite, Crustaceans, Copepods, Caspian Sea.

INRTRODUCTION

Tajan is one of the most important rivers in southern Caspian basin with 19.4 m3/s flow in this region [23]. The predominant fish in this river is Siah Mahi, *Capoeta capoeta gracilis* (Keyserling, 1861). The genus *Capoeta*, is potamodromous cyprinid fish, inhabiting both lotic and lentic habitats [41] and generally occurs in lakes and streams with fast and slow-flowing waters [52]. It is also distributed throughout the freshwater river systems of the South Caspian Sea basin [3, 42]. *C. c. gracilis* is an omnivorous species and feeds on detritus, ooze, some higher plants and small amounts of blue-green algae, phytoplankton, diatoms, chironomids, Ephemeroptera, mollusks, etc. [5, 8, 42]. In addition to its ecological significance, *C. c. gracilis* is an important species harvested in sport and inland water fishing [20].

Crustaceans cause clogging of capillary vessels and necrosis and destruction of tissues, leading to impairment of normal function of organs, anemia and emaciation of host organism, by feeding on blood or epithelium of host and by mechanically compressing and injuring tissues of fish with their holdfast organs.
Parasites of bony fish species in the Caspian Sea and its basin have been reported by several authors [10, 43, 44, 45, 34, 46, 9, 19] but there has been found few reports about copepodids from fishes of Iran. So, in the present study

attempts were made to indicate the occurrence of these parasites on *C.c. gracilis* of Tajan River and also their intensity of infection and abundance.

MATERIALS AND METHODS

A total of 540 individuals of *Capoeta capoeta gracilis* were collected from two sampling sites in Tajan River in the southeast of the Caspian Sea basin (Mazandaran province, Iran) in February 2010. Fish were captured with electrofishing and transported to the laboratory of Fish Diseases in Faculty of Natural Resources, University of Guilan, Iran. Water temperature was determined at collection site.Upon arrival, fish were weighed and measured and then examined externally for gross signs of parasitism.The *C.c. gracilis* (540 in number) averaged 24.37g (±25.90g, range=0.2-180.1g) in weight and averaged 94.49mm (±36.79mm, range=24.70-243.17mm) in total length. A gill biopsy was collected from the specimen's second left arch. A fin biopsy was collected from the specimen's caudal fin. Wet mounts of all biopsied tissues were prepared for further analysis.

After recording biometric characteristics, common necropsy and parasitology methods were used. All organs of the fish were examined except for blood. Live acanthocephalans were relaxed in distilled water at 4 ºC for 1 h and fixed in 10% hot buffered formalin. All specimens were stained with aqueous acetocarmine, dehydrated and mounted in Permount. The worms were identified using parasite identification keys [54, 7, 22] and then were deposited at the Laboratory of Fish Diseases, Faculty of Natural Resources, the University of Guilan, Iran.

Statistical analysis: Classical epidemiological variables (prevalence, intensity and abundance) were calculated according to Bush et al [6]. Mean intensity of infection was determined dividing the total number of recovered parasites by the number of infected fish samples, while calculating abundance was carried out dividing the total number of recovered parasites by the number of (infected and uninfected) fish samples. Prevalence was also calculated dividing the number of infected fish samples by the total number of examined ones and expressed as a percentage. Mean intensity of infection and abundances of parasite species (with prevalence>10%) among seasons, age classes and sexes were tested by the Kruskal-Wallis test (KW, multiple comparisons) and Mann-Whitney U test (MW, pairwise comparisons). Results were considered significant at the 95% level ($p<0.05$). Computations were performed using the SPSS version 16 software package and Microsoft office Excel 2010.

RESULTS AND DISCUSSION

In the present study, a total of 545 individuals of *T. polycolpus* were found in *C.c. gracilis.* The prevalence (P), mean intensity of infection (MI), range and mean abundance (MA) of the parasite are as follow: P= 46.7%, MI= 2.2±1.9, MA= 1.0±1.7.

The prevalence (P), mean intensity of infection (MI), range and mean abundance (MA) of the parasites in different seasons, sexes and age groups are presented Tables 1-5:

As shown in Table 1, 46.7% of the specimens were infested with *T. polycolpus* and the parasite were found in highest prevalence (23.7%) on dorsal fin than on the other fins. The infestation of pelvic and pectoral fins were the second and third highest respectively.

The mean intensity of infection and abundance of *T. polycolpus* on the fish fins were low (2.2 and 1.0 respectively).

As shown in Table 2, the prevalence of *T. polycolpus* was higher in spring and summer than in autumn and winter and the difference was significant (Z test, $p<0.05$). It was also true for mean intensity of infection and abundance of this parasite in different seasons (KW test, $X^2 = 13.754$, df=3, $p=0.003$ for mean intensity of infection and $X^2 = 28.695$, df=3, $p=0.000$ for abundance).

As shown in Table 3, the prevalence of *T. polycolpus* was higher in station 1 than in station 2 and the difference was significant (Z test, $p<0.05$). It was also true for mean intensity of infection and abundance of this parasite in different stations (KW test, $X^2 = 24.284$, df=1, $p=0.000$ for mean intensity of infection and $X^2 = 59.743$, df=1, $p=0.000$ for abundance).
As shown in Table 4, the prevalence of *T. polycolpus* was higher in females than in males and the difference was significant (Z test, $p<0.05$). It was also true for mean intensity of infection and abundance of this parasite in different

sex classes (KW test, X^2 = 22.583, df=1, p=0.000 for mean intensity of infection and X^2 = 27.327, df=1, p=0.000 for abundance).

As shown in Table 5, the prevalence of *T. polycolpus* was higher in the 3 years old specimens than in smaller ones and the difference was significant (Z test, p<0.05). It was also true for abundance of this parasite in different sex classes (KW test, X^2 = 6.210, df=2, p=0.045), but not for mean intensity of infection (KW test, X^2 = 0.808, df=2, p>0.05).

Parasites affect almost every conceivable level of biological organisms. Generally, the importance of these abundant, species-rich and wide-spread life forms is not well known [21]. The question then arises as to what extent does the presence of parasites influence the vulnerability or abundance of a particular species [55]. Crustaceans cause clogging of capillary vessels and necrosis and destruction of tissues, leading to impairment of normal function of organs, anemia and emaciation of host organism, by feeding on blood or epithelium of host and by mechanically compressing and injuring tissues of fish with their holdfast organs [7]. Some of these symptoms may also be found due to attaching *T. Polyculpus* on *C.c. gracilis*, but it is difficult to assess its effect on the fish mortality because of work in a natural environment (a river in this study).

Table 1. The prevalence, mean intensity of infection, abundance and range of *T. polycolpus* in *C.c. gracilis* (N = 540)

Variable infestation	No. of infested fish	No. of parasites	Prevalence (%)	Mean ± SD	Abundance ± SD	Range
Total infestation	252	545	46.7	2.2±1.9	1.0±1.7	1-18
Pectoral fin	74	105	13.7	1.4±0.8	0.2 ±0.6	1-5
Pelvic fin	111	162	20.6	1.5±0.9	0.3±0.7	1-6
Caudal fin	49	61	9.1	1.2±0.6	0.1±0.4	1-4
Anal fin	41	43	7.6	1.0±0.2	0.1±0.3	1-2
Dorsal fin	128	172	23.7	1.3±0.97	0.3±0.7	1-8

Table 2. The prevalence, mean intensity of infection, abundance and range of *T. polycolpus* in *C.c. gracilis* (N = 540) in different seasons

Infestation Season	Total infest Prev. (%) Mean± SD Range	Pectoral fin Prev. (%) Mean± SD Range	Pelvic fin Prev. (%) Mean± SD Range	Caudal fin Prev. (%) Mean± SD Range	Anal fin Prev. (%) Mean± SD Range	Dorsal fin Prev. (%) Mean± SD Range
Spring (N = 116)	53.4 2.4±2.9 1-18	18.97 1.7±1.2 1-5	29.3 1.5±1.1 1-6	5.2 1.5±1.2 1-4	5.2 1.0±0.0 1-1	26.7 1.5±1.7 1-8
Summer (N= 179)	55.3 2.4±1.8 1-12	11.7 1.5±0.8 1-4	28.5 1.5±0.8 1-4	9.5 1.2±0.5 1-3	11.2 1.0±0.0 1-1	36.9 1.3±0.6 1-3
Autumn (N= 199)	40.2 1.8±1.2 1-6	15.6 1.2±0.5 1-3	11.1 1.3±0.6 1-3	12.1 1.3±0.5 1-3	7.0 1.1±0.4 1-2	13.1 1.1±0.4 1-3
Winter (N= 45)	22.2 1.3±0.5 1-2	0	8.9 1.0±0.0 1-1	4.4 1.0±0.0 1-1	2.2 1.0±- 1-1	11.1 1.0±0.0 1-1

Parasites of bonyfish species including *C.c. gracilis* in the Caspian Sea and its basin have been reported by several authors. According to these reports, up to 48 parasite species have been found in *C.c. gracilis* including 9 ciliated protozoa (*Apiosoma* sp., *Chilodonella* sp., *Ichthyophthirius multifiliis*, *Tetrahymaena pyriformis*, *Trichodina* sp., *Trichodina polycolpus*, *T. perforate*, *Trichodinella* sp., *Vorticella* sp.); 3 myxozoans (*Myxobolus musayevi*, *M. samgoricus*, *M. cristatus*); 10 monogeneans (*Dactylogyrus* sp., *D. vastator*, *D. vistulae*, *D. pulcher*, *D. lenkorani*, *D. gracilis*, *D. chramulii*, *Gyrodactylus* sp., *Diplozoon* sp., *Paradiplozoon tadzikistanicum*); 6 digeneans (*Diplostomum spathaceum*, *Clinostomum complanatum*, *Allocreadium isoporum*, *A. pseudoaspi*, *Asymphylodora demelli*, *Bunocotyle cingulata*); 2 cestoda (*Digramma* sp., *Khawia armenica*); 10 nematoda (*Capillaria* sp., *Rhabdochona* sp. *R. acuminata*, *R. filamentosa*, *R. fortunatowi*, *R. hellichi*, *Camallanus lacustris*, *Contracaecum* sp., *Pseudocapillaria tomentosa*, *Raphidascaris acus*), 1 acanthocphalan (*Neoechynorhynchus* sp.); 7 crustaceans (*Argulus foliaceus*, *Ergasilus peregrinus*, *Lamproglena compacta*, *Lernaea* sp., *L. cyprinacea*, *Tracheliastes longiceps*, *T. polycolpus*) . (42, 2, 4, 11, 12, 13, 15, 16, 25, 26, 27, 28, 29, 30, 31, 32, 35, 36, 37, 38, 39, 40, 48, 49, 50, 52, 53, 55) but there has been found few reports about copepods in Tajan River and their ecological aspects in *C.c. gracilis* in this river.

Table 3. The prevalence, mean intensity of infection, abundance and range of *T. polycolpus* in *C.c. gracilis* (N = 540) in different localities

Infestation Locality	Total infest Prev. (%) Mean± SD Range	Pectoral fin Prev. (%) Mean± SD Range	Pelvic fin Prev. (%) Mean± SD Range	Caudal fin Prev. (%) Mean± SD Range	Anal fin Prev. (%) Mean± SD Range	Dorsal fin Prev. (%) Mean± SD Range
Station 1 (N = 231)	62.8 2.6±2.3 1-18	17.7 1.5±0.9 1-4	33.3 1.6±0.96 1-6	13.9 1.3±0.7 1-4	12.6 1.1±0.3 1-2	35.9 1.5±1.2 1-8
Station 2 (N= 308)	34.4 1.5±0.9 1-5	10.7 1.3±0.8 1-5	11.0 1.1±0.4 1-2	5.5 1.2±0.4 1-2	3.9 1.0±0.0 1-1	14.6 1.1±0.3 1-2

Table 4. The prevalence, mean intensity of infection, abundance and range of *T. polycolpus* in *C.c. gracilis* (N = 540) in different sex classes

Infestation Sex	Total infest Prev.(%) Mean± SD Range	Pectoral fin Prev.(%) Mean± SD Range	Pelvic fin Prev.(%) Mean± SD Range	Caudal fin Prev.(%) Mean± SD Range	Anal fin Prev.(%) Mean± SD Range	Dorsal fin Prev.(%) Mean± SD Range
Male (N = 96)	43.8 1.4±0.7 1-3	9.4 1.2±0.4 1-2	22.9 1.1±0.4 1-2	4.2 1.0±0.0 1-1	2.1 1.0±0.0 1-1	16.7 1.2±0.4 1-2
Female (N= 163)	67.5 2.8±2.5 1-18	20.2 1.6±1.0 1-5	36.8 1.7±1.0 1-6	11.0 1.3±0.8 1-4	13.5 1.0±0.0 1-1	46.6 1.5±1.2 1-8

Table 5. The prevalence, mean intensity of infection, abundance and range of *T. polycolpus* in *C.c. gracilis* (N = 540) in different age classes

Infestation Age	Total infest Prev. (%) Mean± SD Range	Pectoral fin Prev. (%) Mean± SD Range	Pelvic fin Prev. (%) Mean± SD Range	Caudal fin Prev. (%) Mean± SD Range	Anal fin Prev. (%) Mean± SD Range	Dorsal fin Prev. (%) Mean± SD Range
1 Year Old (N = 50)	52 2.1±1.3 1-6	8 1.0±0.0 1-1	14 1.4±0.8 1-3	6 1.7±1.2 1-3	6 1.0±0.0 1-1	46 1.4±0.5 1-2
2 Years Old (N= 152)	55.9 2.3±2.2 1-18	13.2 1.3±0.6 1-3	30.3 1.5±1.0 1-6	9.2 1.3±0.8 1-4	9.2 1.0±0.0 1-1	35.5 1.4±1.0 1-8
3 Years Old (N= 57)	71.9 2.95±2.8 1-12	31.6 1.9±1.2 1-5	50.9 1.7±0.9 1-4	8.8 1.0±0.0 1-1	12.3 1.0±0.0 1-1	26.3 1.8±1.9 1-8

CONCLUSION

In the present study, the parasite was found in highest prevalence (23.7%) on dorsal fin than on the other fins. The infestation of pelvic and pectoral fins were the second and third highest respectively. The former fins may be more easy and convenient for the parasite to attach and support it against water currents in river.

The prevalence, mean intensity of infection and mean abundance of *T. polycolpus* were significantly higher in spring and summer than in autumn and winter which may be due to the better condition for its life cycle in spring and summer than in autumn and winter.

There were also found significant differences in infestation with *T. polycolpus* between different age and sex classes of fish and different stations. The older fish may have more surface area on their body to be attached by the copepod. Females also have bigger size than males for attaching it. The station 1 located in lower parts of the river with more slow current which may prepare more opportunity for attaching the copepod.

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