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Population dynamics of a parasite *Pallisentis* in two species of fish *Channa punctatus* and *Channa striatus*

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Abstract

In an aquatic environment, there is a profound and inverse relationship between environment quality and disease status of fish. Parasites are one of the most serious limiting factors in aquaculture. Therefore, the present investigation has been undertaken to sort out the population dynamics of *Pallisentis* (Acanthocephala), in relation to host sex from freshwater fishes, *Channa* of Rohilkhand region. A total of 517 fishes (*Channa punctatus,* n= 198 and *C. striatus*, n= 319) were examined regularly from August 2006 to February 2010. Overall prevalence of *Pallisentis* in *C. striatus* was higher in females (67.78%) as compared to males (63.52%). In case of *C. punctatus,* overall prevalence of *Pallisentis* was higher in males (53.77%) as compared to females (52.17%) whereas, relative density was higher in females (61.41%) than in males (52.72%). Intensity (2-3 parasite/host, in both sexes), density (1.36 in males and 1.69 in females) and infection index (0.73 in males and 0.88 in females) were recorded.

Key words

Channa punctatus, *Channa striatus*, Parasite, *Pallisentis*, Population dynamics

Introduction

Acanthocephalans are endoparasitic worms and about one third of the species parasitize the intestine of fishes as adults. They occasionally perforate the intestinal wall and protrude into the coelom or attach their proboscis to another organ. The genus *Pallisentis* Van Cleave, 1928 is a common parasite of freshwater fishes and infection with this parasite is known to cause disturbances in the intestinal morphology with destruction of intestinal villi and necrotic and degenerative changes in the mucosal epithelium. The parasite causes adverse effects on the absorptive efficiency of fish intestine leading to detoreation in general health and growth of fish (Woo, 1995; Sinha *et al*., 2005). Several reports have been conducted on this important group on various aspects of parasite morphology and pathogenesis (Koul *et al.,* 1991; Boping and Wenbin, 2007; Selvamani and Mahadevan, 2008).

However, investigations on the population dynamics of *Pallisentis* in relation to ecobiological aspects are less reported. The present investigation deals with the comparative studies on the prevalence, intensity, density, relative density and index of infection of the parasite in relation to host sex in *Channa punctatus* and *Channa striatus*.

Materials and Methods

Live specimens of the host fishes (*C. punctatus* n= 198 and *C. striatus* n= 319) were procured from different river tributaries or from the local fish markets of Bareilly, Uttar Pradesh, India (28.35° N; 79.42°E). Freshwater fishes were transported to the Parasitology laboratory of M.J.P. Rohilkhand University in large containers along with the water of same tributary. Fishes were maintained in aquaria in the animal house of the department. They were desensitized by a blow on the head and thoroughly examined for possible ecto and endo parasites by dissecting under a compound microscope (OLYMPUS O/C 91525). The parasite collected from the intestine of the host was identified as *Pallisentis* according to Yamaguti (1985), fixed in 70% ethanol, transferred to fresh glycerin alcohol and placed in desiccators for dehydration. Dehydrated worms were mounted on slides in anhydrous glycerin. The prevalence, intensity, density, relative density and index of infection were recorded and calculated according to Margolis *et al*. (1982).

Results and Discussion

The prevalence was highest (100%) both in male and female hosts (*C. punctatus*) from February to March (Table 1). Sudden retardation in the infectivity was recorded and it was minimum during June (7.14% in males) and in May (14.28% in females). On the other hand, the month of October was devoid of any infection. In case of *C. striatus* (Table 2) prevalence was highest in February (85.71%) in males whereas during September (100%) in female hosts and it was minimum during June in females (16.66%) and in May in males (11.11%).

The intensity was highest in March (11 parasites/host) in female *C. punctatus* but 2-3 parasite/host in males throughout the year. This host species was totally infection-free in October. In case of *C. striatus,* intensity was highest (4 parasites/host) in February and June in males and in November (5-6 pararasite/host) in females.

The density of the parasite was maximum (3.5 and11) both in male and female hosts (*C. punctatus*), respectively in March whereas in *C. striatus* density was highest (3.57) in February in males and (4.5) in December in females.

The relative density of both male and female *C. punctatus* was highest in March being 87.5% and 100%, respectively except for October where it was nil. In case of *C. striatus* it was highest (79.36%) in February in males and (77.77%) in August in females.

The index of Infection was again highest (3.5 and 11) in male and female *C. punctatus*, respectively during March. Similarly, in *C. striatus,* index of infection was highest in February in males (3.06) and in December (4.17) in females.

The percentage of infection and mean number of specimens per infested fish of all parasite species undergo seasonal variations. Several authors from varied places have worked on the impact of season on the prevalence and intensity of helminth parasites of fishes (Mathur and Srivastav, 1999; Jadhav and Bhure, 2006; Sinha *et al*., 2008). In the present investigation, interestingly, all parameters, incidence, intensity, density, relative density and index of infection were highest at low temperature, *i.e.*, from November to March both in male and female fishes. The lowest prevalence was recorded during the summers (May 11.11%; June 7.14%) in contrast to absolute infectivity recorded in winters (February and March, 100%). Results of the present study are contrary to those of Less (1962) where highest incidence of parasitization by helminthes was recorded in autumn.

Kanth and Srivastava (1987) showed that *Pallisentis ophiocephali* had two peak periods during May and August and then the infestation rate declined gradually through September to February and rose through March to have peaks in May and August. Khan *et al.* (1991) studied seasonal variation in the occurrence of *P. ophiocephali* and *Acanthosentis betwai* in relation to their fish hosts. *C. striatus* showed greater prevalence of *P. ophiocephali* infection between March and May and males were more heavily infected than females. *P. ophiocephali* collected from *C. punctatus* showed highest prevalence in the month of September, the intensity of infection being highest in August (Jha *et al.*, 1992). Malhotra and Banerjee (1997) observed peak infectivity in October of *P. allahabadi*. The above authors reported the initiation of infection in August when the higher peak of mean worm burden and relatively higher degree of infection were encountered. Higher prevalence of infection was retained until winter period and the peak infection incidence occurred during October. Thereafter, infection declined consistently during spring and early summer period before finally disappearing by the end of summer period. These findings are in contrast to the findings of the present work where October month was devoid of any infection in case of *Channa punctatus*. According to Kim *et al*. (2001) abundance of *P. gotoi* sharply increased to a peak in the late fall (November) then declined gradually to May. Vincent and Font (2003) observed that the prevalence, mean abundance and mean intensity of *Camallanus cotti* were higher in summer than in winter whereas the prevalence and mean abundance of *Bothriocephalus acheilognathi* showed no significant difference between the seasons. Khan *et al*. (2004) inferred that the prevalence of infection of *Diplozoon kashmirensis* and *Pomphorhynchus* in *Schizotlhorax* was highest during spring, while the minimum value was recorded in autumn whereas *Adenoscolex* showed a marked seasonal occurrence as the infection was observed only during spring and summer seasons. Ibiwoye *et al*. (2004) concluded that fishes are generally susceptible to heavy infestations during rainy season when they are weakened by hibernation.

Li *et al.* (2005) observed that *P. pawlovski* infection in the bullhead catfish started in February with a high prevalence of 46.0%. However, it declined sharply in March, raised from April and remained at high level, except for slight drop in June and July. In the findings of Genc *et al.* (2005) the parasite infection showed seasonal variations with the highest prevalence in summer season.

Rauque *et al.* (2006) noticed maximum prevalence in spring and autumn, and minimum in summer and winter. It had been depicted by Singh (2006) that the prevalence of trematodes in *Clarias batrachus* was highest in April while it was minimum in October. The maximum mean intensity was recorded in March whereas minimum in January while the relative density was maximum in April and minimum in October. Similarly, in the present study, prevalence of the parasite was maximum from February to March and minimum in the month of October. Monthly fluctuation in prevalence, mean intensity and abundance of parasites in *Labeo rohita* were studied by Bhuiyan *et al.* (2007) where the highest abundance was recorded in September and minimum in July. The authors suggested that decrease in water volume during the dry season caused nutritional imbalance resulting in less production of fish food organisms and moreover, fall in water temperature during cooler months reduced the immune response in fish and made them more vulnerable to disease agents. Boping and Wenbin (2007) studied the seasonal population of *Pallisentis (Neosentis) celatus* in the intestine of rice –

Table - 1: Population dynamics of *Pallisentis* in *Channa punctatus*

Months	Prevalence (%)		Intensity (Parasite/Host)		Density		Relative density (%)		Index of infection	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
January	63.63	60.00	3	3-4	2.00	2.30	47.91	69.69	1.33	1.38
February	100.00	100.00	2	3	2.20	3.30	50.00	71.42	2.2	3.33
March	100.00	100.00	3	11	3.50	11.00	87.50	100.00	3.5	11
April	50.00	66.66	1-2	1	0.81	0.77	50.00	41.17	0.40	0.51
May	11.11	14.28	1	4	0.11	0.57	16.66	44.44	0.01	0.08
June	7.14	27.27	3	1-2	0.21	0.45	60.00	45.45	0.01	0.12
July	60.00	100.00	2	2	1.20	2.50	66.66	51.72	0.72	2.5
August	71.42	55.55	1-2	2	1.35	1.22	55.88	50.00	0.96	0.67
September	60.00	100.00	3	3-4	2.00	3.60	66.66	85.91	1.2	3.60
November	73.33	54.54	3	5	2.26	2.80	72.34	73.80	1.66	1.53
December	50.00	50.00	3	3	1.50	1.75	36.00	51.21	0.75	0.87
Mean±SE	**58.78 ±8.98**	**66.20 ±9.21**	**-**	**-**	**1.56 ±0.29**	**2.75 ±0.88**	**55.41 ±5.70**	**62.23 ±5.77**	**1.15 ±0.30**	**2.32 ±0.94**

Table - 2: Population dynamics of *Pallisentis* in *Channa striatus*

Months	Prevalence (%)		Intensity (Parasite/Host)		Density		Relative density (%)		Index of infection	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
January	60.86	69.23	3	2	2.17	1.50	64.10	63.93	1.32	1.03
February	85.71	88.88	4	3	3.57	3.11	79.36	75.67	3.06	2.76
March	73.33	77.77	2	1-2	1.53	1.33	54.76	60.00	1.12	1.03
April	40.00	36.84	2	1-2	0.86	0.68	41.93	27.08	0.34	0.25
May	11.11	71.42	1	1	0.11	0.85	14.28	60.00	0.01	0.61
June	14.28	16.66	4	1	0.57	0.16	36.36	16.66	0.08	0.02
July	70.00	63.63	2	1	1.60	0.81	53.33	37.50	0.12	0.52
August	73.91	85.71	2-3	2	2.00	2.00	73.01	77.77	1.47	1.71
September	75.00	100.00	3	2-3	2.58	2.75	70.45	75.86	1.93	2.75
October	28.57	57.14	1	1	0.42	0.57	37.50	40.00	0.12	0.32
November	83.33	57.89	2-3	5-6	2.16	3.36	54.16	77.10	1.80	1.95
December	78.26	92.85	3-4	4-5	2.91	4.50	65.68	63.63	2.27	4.17
Mean±SE	**57.86 ±7.81**	**68.17 ±6.93**	**-**	**-**	**1.71 ±0.31**	**1.80 ±0.39**	**53.74 ±5.38**	**56.27 ±6.05**	**1.22 ±0.28**	**1.43 ±0.37**

field eel *Monopterus albus* and inferred that the prevalence of parasite undergoes a distinct seasonal trend being highest in spring and decreased corresponding to a fall in temperature. Further, no significant seasonal differences were found in mean intensities. Results of Singh and Sahay (2007) indicate that all parameters *i.e.*, prevalence, intensity, density and index of infection show highest values in June. These results clearly suggest that they are related to the rise of water temperature and the availability of secondary host.

Bhuiyan *et al.* (2008) recorded the maximum prevalence of parasites in *Cirrhinus mrigala* from October to December followed by January and April. The minimum prevalence was recorded in June. Observations of Sinha *et al*. (2008) revealed higher prevalence of *Pallisentis pandei* during rainy season which was attributed by the larger availability of food organisms during rainy season. In the present studies too, the parasite showed resurgence during the rainy season. As the seasons are correlated with temperature, the records mentioned above indicate that temperature seems to have no direct influence on the occurrence pattern of parasites in majority of the cases. Wani and Magray (2008) reported highest prevalence of *Adenoscolex* during spring and winter seasons in river Jhelum and in winter in Anchar Lake. The authors further noted highest prevalence of *Bothriocephalus* during autumn season, followed by spring in both the water bodies. Interestingly, *Pomphorhynchus* was found throughout the year with peaks during spring and summer season in river Jhelum.

The results of the authors indicate that temperature does not play an important role on the incidence of parasite fauna. This is supported by Madhavi (1979), who held similar views for the seasonal occurrence of *A. fasciatusi* where the infectivity was correlated with the prevalence of intermediate host, copepod which controlled the incidence of parasites.

Reports on the prevalence of parasites with respect to host sex are diversified. Records on higher prevalence in male hosts is supported by the work of Zelmer and Arai (1998) who observed that the slope of relationship between number and abundance of

Bothriocephalus species and *Proteocephalus* species was greater for male perch than for females. Takemoto and Pavanelli (2000) reported that male hosts had significantly higher parasite intensity than females. Similarly, in the present study, the prevalence of *Pallisentis* in *C. punctatus* was higher in males as compared to females.

There are also reports on higher parasite infectivity in females as compared to males. Ibiwoye *et al.* (2004) recorded that female fishes were more prone to parasite infestation than males. Maan *et al.* (2006) inferred that low parasite load in *P. nyererei* males were associated with high body redscores. Similarly, Singhal and Gupta (2009) reported comparatively higher trematode infection in female fish hosts (10.75%) than the male hosts (9.40%). Findings of *C. striatus* of present investigation agree with the views of above authors. No significant differences in infection rate of male and female hosts were observed by Jarkovsky *et al.* (2004).

Factors responsible for causing variations in parasite infectivity due to seasonal variations and host sex are debatable. Changes in the fish feeding behavior and annual temperature regime have been considered as the principal factors responsible for the seasonal incidence and intensity pattern of parasites (Eure, 1976). Higher prevalence of parasites in female hosts may be due to the fact that they are equipped with a positive stimulus which may preferentially be attracting the cercariae and other helminth parasites. Conversely, the male fish may be having a stronger in-built resistance to the infection, leading to the establishment of fewer parasites in them (Siddiqui and Nizami, 1982). Thus, it can be concluded that the present work showed noticeable variations in the population dynamics statistics from that of the other researchers which may be due to different host species, feeding biology of the host, diversity of the climatic conditions and the availability and infectivity of the intermediate host.

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