ISSN 2321–340X

Journal of Aquatic Biology & Fisheries | Vol. 3 | 2015 | pp. 115-120

SEASONAL VARIATIONS IN THE INFECTION OF ANTHOCEPHALAN PARASITE *ECHINORHYNCHUS VELI* (GEORGE & NADAKAL) ON ORIENTAL SOLE *BRACHIRUS ORIENTALIS* (BLOCH & SCHNEIDER)

Sheema, S. H.[1]*, John, M. V.[1] and George, P. V.[1]

Department of Zoology, Mar Ivanios College, Nalanchira, Thiruvananathapuram-695 015, Kerala, India
**Email: sheemash81@gmail.com*

Abstract: The seasonal variations of acanthocephalan parasite *Echinorhynchus veli* (George & Nadakal, 1978) infecting the oriental sole *Brachirus orientalis* (Bloch & Schneider, 1801) was studied a period of two years from 2011 to 2013 through regular sampling of fish from brackish water Veli Lake, on the southwest coast of Kerala. A total of 4,127 parasites were collected from 448 fish examiend. The highest prevalence (86.01) and abundance (6.96) of infection was observed in summer season and the seasonal variations were significant in the case of prevalence. The intensity of infection was high (11. 39) during northeast monsoon. The populations of the acanthocephalan parasite, *E. veli* were observed to be in a dynamic state, determined by abiotic factors including water temperature, tidal movements and water currents and biotic factors in feeding behaviour of the host and availability of infected intermediate hosts.

Key words: Prevalence, intensity, abundance, fish parasite, seasons

INTRODUCTION

Infections with helminth parasites remain as one of the most important problems confronting aquaculture. Among helminth groups, adult acanthocephalans are endoparasitic worms infecting the vertebrates, while they lead larval life in crustaceans. A large number of marine, brackish and freshwater fishes are infected by acanthocephalans and occasionally their immature juveniles emigrate and encyst in visceral organs of host fish. There are few recent published reports highlighting the population dynamics and seasonal variations in acathocephalan infections on fish (Boping and Wenbin, 2007; Amin and Burrows, 2011; Gupta *et al.*, 2011; Khurshid and Ahmad, 2014; Kundu *et a;.*, 2015). This paper document the seasonal variations in prevalence and intensity of acanthocephalan *Echinorhynchus veli* on the oriental sole *Brachirus orientalis.*

MATERIALS AND METHODS

A total of 664 specimens of the host fish *Synaptura orientalis* were collected from Veli Lake, Thiruvananthapuram during April 2011 to March 2013**.** Intestines of fish was carefully cut open longitudinally and examined for the worms; the worms recovered were washed in 0.7% saline, counted and fixed in 10% neutral buffered formalin or in 70% ethanol (Horobin, 1988; Ash and Orihel, 1991).

The data obtained were analysed (month wise and season wise) for parameters such as prevalence (% of infection), intensity (total worm burden/ number of hosts infected) and abundance (total worm burden/ number of hosts examined). The seasons considered in the study based on meteorological data are winter (January and February), summer (March-May), southwest (SW) monsoon (June-September) and northeast (NE) monsoon (October-December). One-way ANOVA and F- test were performed to find out the variations in parasitic infections.

RESULTS

The prevalence of acanthocephalan infection was high (86. 01%) during the summer season in the two annual cycles and gradually decreasing to 66. 87, 54. 33 and 49. 92% in southwest monsoon, northeast monsoon and winter respectively (Table 1; Fig. 1). In each annual cycle, the peak prevalence

Table 1. Monthly and seasonal and variations in the prevalence of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis*

Months and Seasons	2011- '12			2012- '13		
	Total Hosts	Infected Hosts	% Prevalence	Total Hosts	Infected Hosts	% Prevalence
March	33	27	81.82	33	28	84.85
April	28	23	82.14	45	37	82.22
May	13	12	92.31	58	55	94.83
Summer	74	62	83.78	136	120	88.24
June	17	13	76.47	19	13	68.42
July	14	11	78.57	48	31	64.58
August	25	16	64	20	14	70
September	26	15	57.69	21	14	66.67
SW Monsoon	82	55	67.07	108	72	66.67
October	31	19	61.29	31	20	64.52
November	43	25	58.14	30	16	53.33
December	26	10	38.46	14	5	35.71
NE Monsoon	100	54	54	75	41	54.67
January	32	12	37.5	11	4	36.36
February	16	9	56.25	30	19	63.33
Winter	48	21	43.75	41	23	56.1
Total	304	192	62.15	360	256	66.42
F	24.18269**					

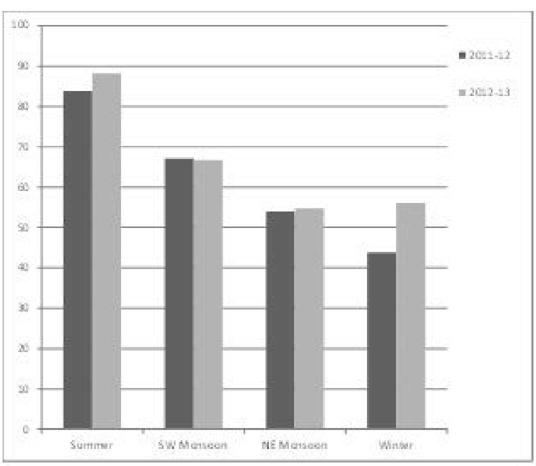

Fig. 1. Seasonal variations in the prevalence of infection of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis*

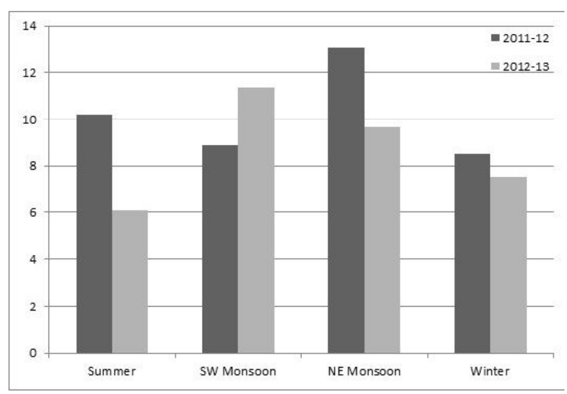

Fig. 2. Seasonal variations in the intensity of infection of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis*

was observed in March, April and May and lowest during December and January (Table 1) and the seasonal variations were significant (Table 1).

The intensity of infection was high (11. 39%) during the NE monsoon in both annual cycles, and gradually decreasing to 10.13, 8.15 and 8.02% in South West (SW) Monsoon, summer and winter, respectively (Table 2 and Fig. 2). In each annual cycle, the peak intensity was observed in June, July and November and lowest in March, April and May (Table 1). The variations are however not significant.

Table 2. Seasonal and monthly variations in the intensity of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis*

Months and Seasons	2011- '12 Total parasites	Total infected hosts	Intensity	2012- '13 Total parasites	Total infected hosts	Intensity
March	302	27	11.19	235	28	8.39
April	223	23	9.7	222	37	6
May	107	12	8.92	275	55	5
Summer	632	62	10.19	732	120	6.1
June	35	13	2.69	218	13	16.77
July	99	11	9	376	31	12.13
August	231	16	14.44	116	14	8.29
September	124	15	8.27	108	14	7.71
SW Monsoon	489	55	8.89	818	72	11.36
October	194	19	10.21	179	20	8.95
November	341	25	13.64	183	16	11.44
December	172	10	17.2	35	5	7
NE Monsoon	707	54	13.09	397	41	9.68
January	107	12	8.92	49	4	12.25
February	72	9	8	124	19	6.53
Winter	179	21	8.52	173	23	7.52
Total	2007	192	10.18	2120	256	8.67
F	1.193815					

Abundance of infection was high during summer season in two annual cycles, the mean abundance being 6.96 and gradually decreasing to 6.77, 6.18 and 3.97 in SW monsoon, NE monsoon and winter respectively (Table 3; Fig. 3) in each annual cycle. The peak abundance was observed in June, July and August and lowest in December and January, and the variations were not statistically significant (Table 3).

Table 3. Seasonal and Monthly variations in the abundance of the parasite *E. veli* in the fish *S. orientalis*

Months and Seasons	2011- '12 Total parasites	Total hosts	Abundance	2012- '13 Total parasites	Total hosts	Abundance
March	302	33	9.15	235	33	7.12
April	223	28	7.96	222	45	4.93
May	107	13	8.23	275	58	4.74
Summer	632	74	8.54	732	136	5.38
June	35	17	2.06	218	19	11.47
July	99	14	7.07	376	48	7.83
August	231	25	9.24	116	20	5.8
September	124	26	4.77	108	21	5.14
SW Monsoon	489	82	5.96	818	108	7.57
October	194	31	6.26	179	31	5.77
November	341	43	7.93	183	30	6.1
December	172	26	6.62	35	14	2.5
NE Monsoon	707	100	7.07	397	75	5.29
F	1.88689					

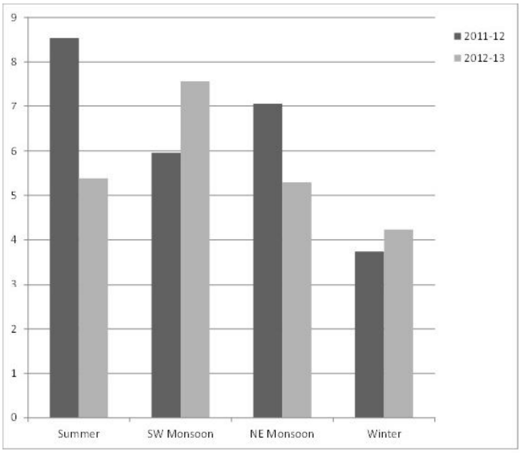

Fig. 3. Seasonal variations in the abundance of infection of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis*

DISCUSSION

In the present study prevalence of infection of the parasite *Echinorhynchus veli* in the fish *Brachirus orientalis* was significantly high (86. 01%) during the summer season. Hundred percent prevalence of infection with the parasite *Tenuiproboscis* sp. was reported by Sanil *et al.* (2010), According to Khurshid and Ahmad (2012) the rainy season which started in spring and continued to early summer, made environmental conditions more favourable for development in intermediate host of helminth parasites and led to an increased availability of infective stages in rainy and post-rainy seasons. This resulted in higher prevalence in summer and post-summer months. The present study also is in conformity with these observations. Another pattern of acanthocephalan infection in fishes of Wular Lake, Jammu and Kashmir reports high infection during spring and low in summer. In the acanthocephalan *Acanthosentis dalti*, Jha *et al.* (1992) reported prevalence varying from 11.1 to 76% in different months, highest in the month of May. In the present study the prevalence was above 90% in May.

Infection rate is greatly influenced by feeding behaviour, temperature, fish species, availability of intermediate hosts and type of water body (Moravec *et al.*, 1997). The high rate of infection with *E. veli* during summer can be attributed to the abundance of a large number of intermediate hosts in the water and increase in the feeding activity of the fishes. The low rate of infection during winter may be due to non-availability of infected intermediate host activity of the fishes and the rarity of infective larval stages as well as less number of intermediate hosts. Similar trends in prevalence were noted *Neoechonorhynchus agilis* (Khamees and Mhaisen, 1988) and *N. rutili* (Abdullah and Ali, 1999).

In this study a higher intensity of infection was noted in NE Monsoon (11. 39) followed by SW Monsoon (10. 13), summer (8. 15) and winter (8. 02). In a study on parasites of edible fish species, Shaheena and Zarrien (2012) reported a mean intensity of 3. 8 parasites per fish, *Lecithochirium furcolabiatum*. The highest mean intensity (9. 5) was recorded in April and zero intensity in May. In the present study the lowest intensity was recorded in May (6. 96). The higher intensity observed in two monsoon seasons in the present study strengthens the view that feeding behaviour influences intensity or the density of parasite population in host fish.

Polyanski (1961) reported that the major factors determining prevalence and intensity the fish parasite fauna can be diet of the host, lifespan of the host, the mobility of host throughout its life including the variety of habitats it encounters, its population density and size attained, i.e., large hosts providing more space for parasites than small ones. In this study, the hosts of intermediate length and weight had a higher prevalence and intensity than those of smaller and larger length and weight. It has previously been suggested (Kennedy, 1968) that the seasonal prevalence of *Caryophyllaeus laticeps* is related to changes in the fishes resistance to infection and that it is least in winter and greatest in summer. Lawrence (1970) suggested that seasons, as with most ecological parameters, have varied effects on parasitic infection, depending on the species considered and the combination of different parameters in any given area.

Parasitic abundance is usually estimated to know the relative density of parasite population over the host population. In the present study mean abundance is high in summer (6. 96) and is low in winter (3. 97). As it has a direct role in rate of reproductive and developmental process, the abundance increases with rising temperature in summer and slows down during winter (Ritika *et al.*, 2012). Temperature is the most important environmental factor, influencing population dynamics of the parasites (Koskivaara *et al.*, 1991). By and large, in winter, reproductive rate of parasites declines (Jansen and Bakke, 1993a, b); this is evident in the present study. A higher abundance is observed in summer when the water temperature is moderate to high.

Jadhav and Bhure (2006) reported that high temperature, low rainfall and sufficient moisture are necessary for development of parasite. Hence prevalence is high in summer. Kennedy (1976) explained that temperature, humidity, rainfall, feeding habits of hosts, availability of infective intermediate hosts and parasite maturation are responsible factors influencing parasitic infections. Dobson (1990) points out that the abundance and distribution of parasites are the direct result of the characteristics of life cycles of parasites and species interactions. The hosts with larger body size are generally older and usually more heavily parasitized due to higher nutritional needs (Mccornmick and Nickol, 2004). Also, higher values of intensity of infection in larger specimens may be related to the accumulation of larvae in the host by repeated processes of infection (Luque *et al.*, 1996). Abiotic factors, including tidal movements, water currents, and sediment size are suggested to play a potential role intransmission of acanthocephalan eggs to prospective intermediate hosts (Latham and Poulin, 2003). Water temperature, water quality, and tidal and current movements can potentially influence host and parasitesurvival and transmission efficiency (Pietrock and Marcogliese, 2003).

Several biological features of parasites will tend to produce similar population characteristics wherever the parasite becomes established. For instance, life history traits such as body size, life span and reproductive output, although variable among individuals of the same species are constrained within species-specific limits and thus remain species traits. Therefore, the potential for a parasite species to spread many hosts and accumulate in these hosts is, to some extent, determined by its life history strategy. On the other hand, local factors can have such an impact on parasite populations that the link between life history traits and population parameters can be broken. For example, local abiotic conditions can regulate the survival and transmission success of infective stages (Pietrock and Marcogliese, 2003) and consequently cause variation in prevalence, intensity or abundance in a given parasite species.

It has been revealed that seasonal variation plays a vital role in infection pattern of the acanthocephalan parasite, *E. veli*. The parasite population appeared to be in a dynamic state, determined by abiotic factors including water temperature, tidal movements and water currents and biotic factors in feeding behaviour of the host and availability of infected intermediate hosts.

ACKNOWLEDGEMENTS

Authors wish to express sincere thanks to the Principal, Head of Zoology department, Mar Ivanios College Thiruvananthapuram, Kerala, India for providing necessary facilities for carrying out research. The first author would like to thank the University of Kerala for financial assistance. The authors are thankful the anonymous reviewers for their inputs to improve the quality of the paper.

REFERENCES

Abdullah, S.M. and Ali, L.A. 1999. Effects of sex and length of *Barbus esocinus* from Dokan Lake, and seasons of the year on the infection with *Neoechinorhynchus rutili. Zanco Journal of Pure and Applied Sciences*,11: 17-25.

Amin, O.M. and Burrows, J.M. 2011. Host and seasonal associations of *Echinorhynchus salmonis* (Acanthocephala: Echinorhynchidae) in Lake Michigan Fishes. *Journal of the Fisheries Research Board of Canada*, 34: 325-331.

Ash, L.R. and Orihel, T.C. 1991. Parasites: A guide to Laboratory procedures and identification. Chicago (IL). American society of clinical pathologists.

Boping, Z.J. and Wenbin, W. 2007. Seasonal population dynamics of *Pallisentis* (*Neosentis*) *celatus* (Acanthocephala: Quadrigyridae) in the intestine of the rice-field eel *Monopterusalbus* in China. *Journal of Helminthology*, 81(4): 415-420.

Dobson, A.P. 1990. Models of multi-species parasites-host communities. In: Esch, G.W., Bush, A.O. and Aho, J. (eds.), Parasite communities: Patterns and Process. New York: Chapman and Hall, pp. 261-287.

George, P.V. and Nadakal, A.M. 1978. Four new species of Acanthocephala from brackish and freshwater fishes of Kerala. *Aquatic Biology*, 3: 79-90.

Gupta, N.S. and Gupta, D.K. 2011. Population dynamics of a parasite *Pallisentis* in two species of fish *Channa punctatus and Channa striatus*. *Journal of Environmental Biology*, 33: 195-199.

Horobin, R. W. 1988. *Understanding Histochemistry*. Halsted press, New York.

Jadhav, B.V. and Bhure, D.B. 2006. Population dynamics of Helminth parasites in freshwater fishes from Marathwada region (M.S.) India. *Flora and Fauna an International Research Journal*, 12: 143-148.

Jansen P.A. and Bakke T.A. 1993a. Regulatory processes in the monogenean *Gyrodactylus salaris*–Atlantic salmon *Salmo salar* (L.) association. 2. Experimental studies. *Journal of Fisheries Research,* 17: 103-114.

Jansen, P.A. and Bakke, T.A. 1993b. Regulatory processes in the monogenean *Gyrodactylus salaries* Malberg-Atlantic salmon *Salmo salar* (L.) association. 1. Field studies in south-east Norway. *Journal of Fisheries Research,* 17: 87-101.

Jha, A. N., Sinha, P. and Mishra, T. N. 1992. Seasonal occurrence of helminth parasites in fishes of Sikandarpur reservoir, Muzaffarpur (Bihar). *Indian Journal of helminthology,* 44: 1-8.

Kennedy, C.R. 1976. *Ecological Aspects of Parasitology*. North Holland Publishing Co., Amsterdam.

Kennedy, C.R. 1968. Population biology of the cestode *Caryophyllaeus laticeps* (Pallas, 1781) in dace, *Leuciscu leuciscus* (L.) of the river Aron. *Journal of Parasitology*, 538-543.

Khamees, N.R. and Mhaisen, F.T. 1988. Ecology of parasites of the cyprinid fish *Carasobarbus luteus* from Mehaijeran creek, Basrah. *Journal of Biological Science and Research*, 19: 409-419.

Khurshid, I. and Ahmad, F. 2012. A short note on heavy infection of acanthocephalan worm (*Pomporhynchus kashmiriensis*) in the alimentary canal of naturally infected snow trout, *Schizothorax niger* (Heckel). *International Journal of Advanced Life Sciences,* 5: 79-84.

Koskivaara, M., Valtonen, E.T. and Prost, M. 1991. Seasonal occurrence of gyrodactylidmonogeneans on the roach *Rutilus rutilus* and variation between four lakes of differing water quality in Finland. *Aqua Fennica,* 21: 47-55.

Kundu, I., Bandyopadhyay, P.K. and Mandal, D.R. 2015. Prevalence of helminth parasites infecting *Channa punctatus* Bloch, 1793 from Nadia district of West Bengal. *Journal of Agriculture and Veterinary Science*, 8: 41-46

Latham, A.D.M. and Poulin. R. 2003. Spatiotemporal heterogeneity in recruitment of larval parasites to shore crab intermediate hosts: The influence of shorebird definitive hosts. *Canadian Journal of Zoology,* 81: 1282-1291.

Lawrence, J.L. 1970. Effects of season, host age and sex on endohelminths of *Catqstomus commersoni*. *Journal of Parasitology,* 56: 567-571.

Luque J.L., Amato J.F.R. and Takemoto, R.M. 1996. Comparative analysis of the communities of metazoan parasites of *Orthopristis ruber* and *Haemulon steindachneri* (Osteichthyes: Haemulidae) from the southeastern Brazilian litoral. I. Structure and influence of the size and sex of the hosts. *Revista Brasileira de Biologia,* 56: 279-292.

McCormick, A.L. and Nickol, B.B. 2004. Post cyclic transmission and its effect on the distribution of *Paulisentis missouriensis* (Acanthocephala) in the definitive host *Semotilusatro maculatus*. *Journal of Parasitology,* 90: 103-107.

Moravec, F., Vidal-martínez, V.M., Vargas-vázquez, J., Vivas-rodríguez, C., González-solís, D., Mendozafranco, E., Simá-alvarez, R. and Güemez-ricalde, J. 1997. Helminth parasites of *Epinephelus morio* (Pisces: Serranidae) of the Yucatan Peninsula, south-eastern Mexico. *Folia Parasitology,* 44: 255-266.

Pietrock, M. and Marcogliese, D.J. 2003. Free-living endohelminth stages: at the mercy of environmental conditions. *Trends in Parasitology*, 19: 293-299.

Polyanski, Y.I. 1961. Zoogeography of parasites of the USSSR marine fishes. In: Dogiel, V.A., Petrushevskii, G.K. and Polyanski, Y.I. (eds.), *Parasitology of Fishes* (English translation) Edinburgh and London: Oliver and Boyd, pp. 230-246.

Ritika R.S., Girdhar, G.A. and Agrawal, N. 2012. Seasonal variation in monogenoid abundance on *Puntius* sp. *Research Journal of Biology*, 2: 186-190.

Sanil, N.K., Asokan, P.K., Lijo John. and Vijayan, K.K. 2010. Pathological manifestations of the acanthocephalan parasite, *Tenui proboscis* sp. in the mangrove red snapper (*Lutjanus argentimaculatus*) (Forsskål, 1775), a candidate species for aquaculture from Southern India. *Aquaculture,* 310: 259-266.

Shaheena Q. and Zarrien A. 2012. Prevalence and intensity of parasites in edible fishes landing at Karachi fish harbor, Pakistan. *Journal of Zoology*, 44: 1467-1471.