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SEASONAL VARIATIONS IN PREVALENCE OF ECTOPARASITIC INFESTATION IN INDIAN MAJOR CARPS AT BALRAMPUR, U.P., INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Author SP designed the study, performed the statistical analysis and wrote the protocol. Author AKV wrote the first draft of the manuscript, analyses the study and managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The present investigation was conducted during April 2019 to March 2020 to find out the seasonal variation in prevalence of ectoparasites of Indian major carps. Total 10 species of ectoparasites were collected from 360 fishes. Out of ten, three belong to Myxozoan (*Myxobolus* sp*., Thelohannellus* sp. and *Henneguya* sp.), three Ciliophporans (*Trichodina* sp., *Tripertiella* sp. and *Ichthyophthirus* sp.), two Monogeneans (*Dactylogyrus* sp. and *Gyrodactylus* sp.) and two Crustaceans (*Ergasilus* sp*.,* and *Argulus* sp.). Among the different groups of ectoparasites, Myxozoan has shown highest prevalence (19.91%) throughout the year followed by Ciliophorans (17.31%), Crustaceans (9.63%) and Monogenean (1.95%). Among the ectoparasites, *Myxobolus* sp. is the most prevalent ectoparasites followed by *Trichodina* sp., *Thelohannellus* sp*., Tripertiella* sp. and *Argulus* sp. It was observed that the infection was the maximum during winter, moderate in summer and minimum in monsoon season.

Keywords: Parasites; environmental factors; *Catla catla; Labeo rohita; Cirrhinus mrigala.*

1. INTRODUCTION

Health of any population depends on the control of disease and maintenance of a healthy relationship between living organisms and their environment. The parasitic community of fish normally show considerable variation with the environmental conditions in which fish live [1]. Certain environmental conditions are more conducive to disease among which water temperature is one of the important criteria associated with disease outbreak. It was observed that the prevalence of the disease was

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more in the winter season than the other months of the year [2].

Fishes are the aquatic vertebrates found both in marine and fresh water [3] and beneficial for human health. Fish culture is one of the most economically important applied strategies all over the world and fishes are one of the most beneficial and nutritional resources of human beings [4]. Parasitic diseases are the limiting factors in fish culture, because of increased density of fish in lentic water bodies where the fish pathogens can easily transmit from one fish to another. These pathogens may cause fish mortality in cultural fishes where the entire fish population of pond may be killed, resulting the great economic loss of fish farmers. Some parasites are serious pests in fish culture; others are probably potential threats to fish culture. On the other hand, blue revolution and success of fisheries development programme depends on the intensification of fish parasitological research, as the improvement of fish yield can mainly be achieved from healthy fish stock. Thus to prevent the economic loss and to present fish production, proper fish health management is necessary.

The ectoparasites of fish constitute one of the most important problems associated with pond fish culture. Fish disasters in fish farms were caused by different ectoparasites (protozoa, monogenetic trematoda and crustacea), which have direct life cycle and facilitate translocation from host to host making huge damages to fish wealth [5].

The most important prerequisite of fish production is availability of healthy fish fingerlings of carps [6]. Because of easily availability of fish seed (fry and fingerlings) of the indigenous major carps, *Catla catla, Labeo rohita* and *Cirrihinus mrigala* have become the most common culturable freshwater fishes of eastern Uttar Pradesh. Studies on parasitic diseases of fishes particularly in this tarai region of eastern Uttar Pradesh are fragmentary [7]. Considering the above facts, the present study was aimed to find out the ectoparasitic prevalence of indigenous major carp fingerlings as well as the correlation between ectoparasitic prevalence and environmental conditions.

1.1 Study Area

The study area was Balrampur town (Image 1) which is situated in North-Terai region of Uttar Pradesh adjacent to Indo-Nepal border at 27°16' N to 27°32' north latitude and 82°03'E to 82°22' east longitude and an altitude of about 113 meters above the mean sea level. The selected lentic water bodies *namely* Mavalal Talab, Rani Talab and Tulsidas Talab (Image 2) were small perennial fresh water ponds, situated at a distance of 596.3 m, 792.0 m and 831.6 m, to the M.L.K.P.G. College Balrampur campus. The maximum area occupied by the Mavalal Talab, Rani Talab and Tulsidas Talab was 0.8 ha, 1.38 ha and 0.9 ha, respectively.

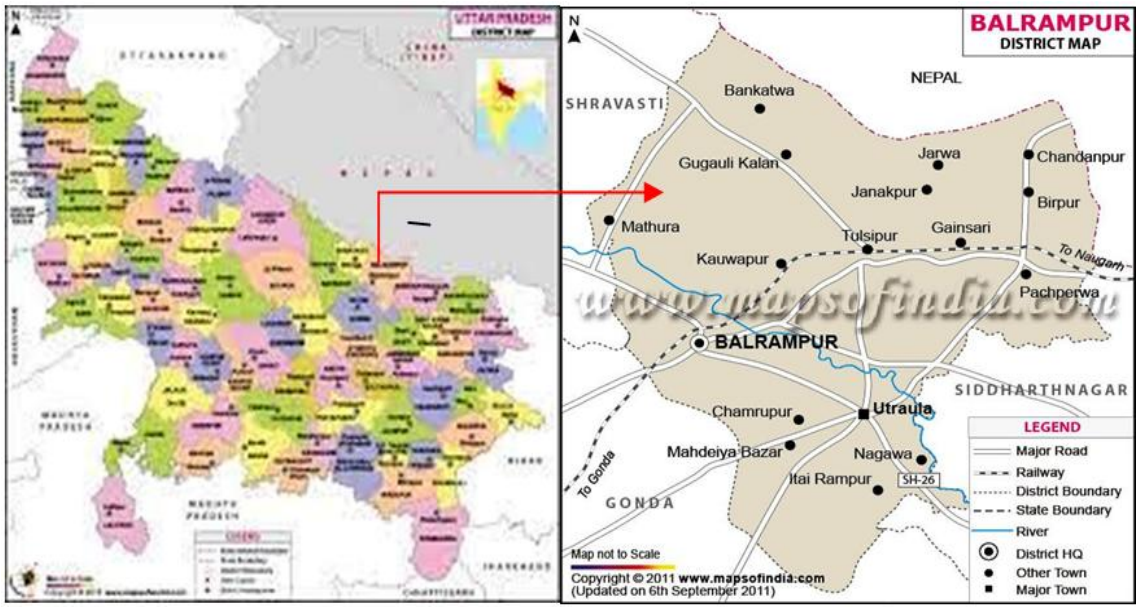

Image 1. Map of Uttar Pradesh and Balrampur District

Image 2. Satellite view of Balrampur showing study sites

2. MATERIALS AND METHODS

2.1 Fish Collection

From the three fishery ponds *viz,* Tulsidas talab, Mavalal talab and Rani talab of Balrampur districts of eastern U.P., 120 live host or freshly dead specimen of each indigenous carp, Catla (*Catla catla*), Rohu (*Labeo rohita*) and Mrigal (*Cirrhinus mrigala*) were randomly sampled and collected from April 2019 to March 2020 and transported to the Ichthyology lab, Department of Zoology, M.L.K.P.G. College, Balrampur. The fishes were examined immediately after collection for detailed investigation of ectoparasites.

2.2 Examination of Host Fishes and Collection of Parasites

For observation and identification of parasites, indigenous carps were collected from these three local talab (ponds). The external surface such as scales, fins, skin and fin base of host fishes were examined under a magnifying glass for ectoparasites or any kind of lesions. Then scrapping of the skin was done by a scalpel to collect the mucus in a petri dish for microscopic examination. After that gills were removed from the bronchial cavity and placed on a glass slide for microscopic examination. From this, lice, large nematodes and helminthes were collected by a hairbrush, protozoan parasites were collected from the mucus or body surface by pipette, dropper and needle in a slide.

2.3 Identification of Parasites

Parasites were identified under a compound microscope and following the description and figures of Gupta [8], Yamaguti [9], Lucky [10], Kabata [11], Hafizuddin and Shahabuddin [12] and Mukherjee et al. [2].

2.4 Prevalence Study

The parasitic prevalence was estimated with the help of parasitic frequency index (PFI) which was calculated by taking the percentage of the number of hosts infected by an individual parasite species against the total number of hosts examined in a particular area under investigation. Prevalence frequency index (PFI) was estimated following the formula given by Margolis et al. [13].

$$\text{Prevalence (\%)} = \frac{\text{Total no. of infected fishes}}{\text{Total no. of fish host examined}} \text{X } 100$$

2.5 Study of Water Quality

The water quality parameters *viz*, water temperature, pH, DO and hardness are directly related to fish health [2]. These were measured per month from the three local fishery ponds. The temperature and pH of water

sample were analyzed on spot by using a mercury bulb thermometer, and pH meter, respectively. Dissolved oxygen (DO) and hardness of water samples were analyzed by following standard titrimetric methods [14].

3. RESULTS AND DISCUSSION

In the present study, a total of 10 genera belong to 4 group of ectoparasites were collected from indigenous carps, Catla (*Catla catla*- surface feeder), Rohu (*Labeo rohita* -column feeder) and Mrigal (*Cirrhinus mrigala* - bottom feeder). Among the collected parasites, three were Myxozoan parasites (*Myxobolus* sp., *Thelohannellus* sp.and *Henneguya* sp.), three Ciliophporans parasites (*Trichodina* sp., *Tripertiella* sp. and *Ichthyophthirus* sp.), two Monogeneans (*Dactylogyrus* sp. and *Gyrodactylus* sp.) and rest two were Crustaceans (*Ergasilus* sp., *Argulus* sp.). Myxozoan were found on gills and fins of host fishes except Calta where they were found only on fins. Ciliophorans were found on skin and gill but *Tripertiella sp.* was found only on the skin of host fishes. Monogeneans were found alive and strongly attached to gill, skin and fins base but the *Dactylogyrus* sp. was found gills of host fishes. Crustaceans were mostly found abundantly attached to the fin and skin and rarely on operculum (Table 1).

Table 1. List of ectoparasites, host fishes and their infection sites

Parasitic Group		Infection sites of host fishes		
		Catla catla	***Labeo rohita***	***Cirrhinus mrigala***
Myxozoan	*Myxobolus* sp.	Fins	Gill, Fins	Gill
	Thelohannellus sp.	Fins	Gill, Fins	Fins
	Henneguya sp.	-	Fins	Gill
Ciliophorans	*Trichodina* sp.	Skin, Gill	Skin, Gill	Skin, Gill
	Tripertiella sp.	Skin	Skin	Skin
	Ichthyophthirus sp.	-	Skin, Gill	Skin
Monogeneans	*Dactylogyrus* sp.	Gill	Gill	Gill
	Gyrodactylus sp.	-	Skin, Fin base	Skin
Crustacean	*Ergasilus* sp.	Skin, Gill	Skin, Gill	Skin, Gill
	Argulus sp.	Skin, Fins, Operculum	Skin, Fins base	Skin, Fins,

Table 2. Seasonal variation in PFI (%) of Indian major carp fingerlings

Parasitic Groups		PFI % of the affected Indian major carp			
		Catla catla	***Labeo rohita***	***Cirrhinus mrigala***	**Average % PFI**
Monsoon season (July- October)					
Myxozoan	*Myxobolus* sp.	20.4	28.5	24.2	24.37
	Thelohannellus sp.	11.4	15.2	13.5	13.37
	Henneguya sp.	0.0	0.0	0.0	0.0
Ciliophorans	*Trichodina* sp.	15.4	22.4	18.6	18.80
	Tripertiella sp.	18.5	22.4	20.2	20.37
	Ichthyophthirus sp.	0.0	0.0	0.0	0.0
Monogeneans	*Dactylogyrus* sp.	0.0	0.0	0.0	0.0
	Gyrodactylus sp.	0.0	0.0	0.0	0.0
Crustacean	*Ergasilus* sp.	0.0	0.0	0.0	0.0
	Argulus sp.	0.0	0.0	0.0	0.0
Seasonal Average % PFI		**6.57**	**7.33**	**7.65**	**-**
Winter season (November-February)					
Myxozoan	*Myxobolus* sp.	42.8	58.6	46.4	49.27
	Thelohannellus sp.	36.2	48.2	42.5	42.30
	Henneguya sp.	0.0	6.2	3.4	3.20
Ciliophorans	*Trichodina* sp.	28.3	40.2	32.5	33.67
	Tripertiella sp.	25.4	32.1	28.6	28.70
	Ichthyophthirus sp.	0.0	7.4	6.8	4.73
Monogeneans	*Dactylogyrus* sp.	4.6	7.8	6.6	6.33
	Gyrodactylus sp.	0.0	2.4	1.8	1.40
Crustacean	*Ergasilus* sp.	9.4	16.4	14.8	13.53
	Argulus sp.	34.2	48.8	42.6	41.87
Seasonal Average % PFI		**18.09**	**26.81**	**22.60**	**-**

Parasitic Groups		PFI % of the affected Indian major carp			
		Catla catla	*Labeo rohita*	*Cirrhinus mrigala*	Average % PFI
Summer season(March-June)					
Myxozoan	*Myxobolus* sp.	25.2	33.4	27.4	28.67
	Thelohannellus sp.	15.4	20.2	18.5	18.03
	Henneguya sp.	0.0	0.0	0.0	0.0
Ciliophorans	*Trichodina* sp.	20.4	30.4	24.6	25.13
	Tripertiella sp.	20.5	28.4	24.2	24.37
	Ichthyophthirus sp.	0.0	0.0	0.0	0.0
Monogeneans	*Dactylogyrus* sp.	0.0	4.6	3.6	2.73
	Gyrodactylus sp.	0.0	2.0	1.4	1.20
Crustacean	*Ergasilus* sp.	0.0	0.0	0.0	0.0
	Argulus sp.	0.0	4.8	2.4	2.4
Seasonal Average % PFI		**8.15**	**12.38**	**10.21**	-
Yearly Average % PFI		**10.94**	**15.51**	**13.49**	-

Table 3. Seasonal variations in PFI % age of individual ectoparasite within the Group

Parasitic Groups		Seasons variations in PFI% age			
		Monsoon	**Winter**	**Summer**	**Average % PFI**
	Myxobolus sp.	24.37	49.27	28.67	34.10
Myxozoan	*Thelohannellus* sp.	13.37	42.30	18.03	24.57
	Henneguya sp.	0.0	3.20	0.0	1.07
	Average PFI%	**12.58**	**31.59**	**15.57**	**19.91**
	Trichodina sp.	18.80	33.67	25.13	25.87
Ciliophorans	*Tripertiella* sp.	20.37	28.70	24.37	24.48
	Ichthyophthirus sp.	0.0	4.73	0.0	1.58
	Average PFI%	**13.06**	**22.37**	**16.50**	**17.31**
	Dactylogyrus sp.	0.0	6.33	2.73	3.02
Monogeneans	*Gyrodactylus* sp.	0.0	1.40	1.20	0.87
	Average PFI%	**0.0**	**2.58**	**1.31**	**1.95**
	Ergasilus sp.	0.0	13.53	0.0	4.51
Crustacean	*Argulus* sp.	0.0	41.87	2.4	14.75
	Average PFI%	**0.0**	**55.40**	**0.8**	**9.63**
Seasonal average % age PFI		**6.41**	**27.94**	**8.55**	-

Table 4. Seasonal variations of water quality parameters of three water bodies

Seasons	Water Temp.(^{0}C)	Dissolved Oxygen (ppm)	pH	Hardness (ppm)
Tulsidas Talab				
Monsoon	30.7	6.24	6.5	138.5
Winter	18.8	7.88	7.7	114.4
summer	27.4	7.24	8.1	125.6
Mavalal Talab				
Monsoon	31.0	5.81	6.4	141.5
Winter	19.1	7.15	7.4	117.4
summer	27.6	6.85	7.8	129.6
Rani Talab				
Monsoon	30.5	6.1	6.6	135.5
Winter	18.9	7.85	7.8	115.2
summer	27.3	7.19	8.2	123.4

Table 2 revealed that some groups and some genera of ectoparasites are totally absent in particular season, such as Crustaceans are found only in winter season and rarely in summer season. The monogeans parasites were not found during monsoon season. The *Ichthyophthirus* sp. of Ciliophporans and *Henneguya* sp. of Ciliophporans were found only during winter season. The present study also revealed that some parasites such as *Henneguya* sp., *Ichthyophthirus* sp. and *Gyrodactylus* sp. were host specific because

these were not infect the *Catla catla* (Table 2). Among the ectoparasites, *Myxobolus* sp. is the most prevalent ectoparasites followed by *Trichodina* sp., *Thelohannellus* sp., *Tripertiella* sp. and *Argulus* sp. These ectoparasites are the most common parasites of Indian major carps in West Bengal, India [2], which support the present findings. Sharif and Vijarungam [15] reported that *Trichodina* sp. is the most common ectoparasite and caused mass mortality of carp fish in nursery pond.

The prevalence of ectoparasites of carp in different seasons has been presented in Tables 2 and 3. Among the different groups of ectoparasites, Myxozoan has shown highest prevalence (19.91%) throughout the year followed by Ciliophorans (17.31%), Crustaceans (9.63%) and Monogenean (1.95%). In winter season, the prevalence of ectoparasites reached at 27.94% and gradually decreased in summer (8.55%) and monsoon (6.41%). This indicates that the ectoparasitic infection changed with the change of season. All groups of ectoparasites have also been shown highest prevalence in winter followed by summer and monsoon season (Table 3). This indicates that abiotic and biotic factors of water body are responsible for infection. Mukherjee et al. [2], reported that low pH and low temperature were the major factor for spreading several parasitic diseases in fishes.

The water temperature, dissolved oxygen, pH and hardness are major water quality parameters that were found related to disease infection in fishes as they fluctuate more rapidly. The seasonal variation data of these parameters have been shown in the Table 4. The ectoparasitic prevalence has shown temperature sensitivity. Ectoparasitic prevalence increases when water temperature and hardness decreases [16]. The optimum levels of dissolved oxygen and neutral pH have a positive effect on the prevalence of ectoparasites [16], which supports the present finding. During winter season, environmental conditions such as water temperature, pH, hardness and dissolved oxygen were more suitable for the growth and multiplication of parasites. Winter season had already been identified as a period of high susceptibility of fish to parasites [17,18]. According to Mukherjee et al. [2], the prevalence of the parasites was maximum during winter due to high organic load in culture ponds which induces bio-ecological stress and made fish more susceptible to the parasitic infection.

The fingerlings are delicate and more susceptible to pathogenic infection because of their immature immune system [16], which corroborated with the present findings. Since the fingerlings require more O_2 and due to lack of O_2 they become more prone to infection. High stocking density of fingerlings is another reason for ectoparasitic diseases outbreak [1]. High stock density increases the possibility of transmission of ectoparasites from fish to fish easily.

4. CONCLUSION

On the basis of present investigation, it can be concluded that the post monsoon season, *i.e.* winter season, along with the low water temperature, high level of dissolved oxygen, moderate pH and low hardness provides favorable environmental conditions for the ectoparasitic infections, specially *Myxobolus* sp. *Thelohannellus* sp. *Trichodina* sp. *Tripertiella* sp. and *Argulus* sp. Due to low water temperature, fish reduces metabolic activities, which in turn also made the fishes more susceptible during winter season towards ectoparasitic infestations. Thus, it could be concluded that the water quality has a great impact on the abundance of pathogens and their ability to survive on host. So the stocking density of fish seed and water quality parameters should be maintained properly to avoid parasitic infestation in pond fishes.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Hossain MD, Hossain MK, Rahaman MH, Akter A and Khanom DA. Prevalence of ectoparasites of carp fingerlings at Santaher, Bogra. University Journal of Zoology, Rajshahi University. 2008;27:17-19.
2. Mukherjee D, Soni M, Sanyal KB and Dash G. Prevalence of ectoparasitic infestation in Indian major carps during winter at different blocks of South 24-Parganas District, West Bengal, India. Journal of Fisheries Science. 2019;1(1): 7-14.
3. Verma AK, Prakash S. Status of animal phyla in different kingdom systems of biological classification. International Journal of Biological Innovations. 2020;2(2):149-154. Available:https://doi.org/10.46505/IJBI.2020.2211
4. Banerjee S, Bandyopadhyay PK. Observation on prevalence of ectoparasites in carp fingerlings in two districts of West Bengal. Journal of Parasitic Diseases. 2010;34(1):44-47.

5. Al-Marjan KSN, Abdullah SMA. Some ectoparasites of the common carp (*Cyprinus carpio*) in Ainkawa fish hatchery, Erbil province. J. Duhok Univ. 2009;12(1):102-107.
6. Chakraborty BK, Shahroz MH, Bhuiyan AB, Bhattacharjee S, Chattoraj S. Status of Indian major carps spawns in the Halda River along with marketing and economic condition of the Fishers and related collectors. International Journal of Biological Innovations. 2019;1(2): 40-50.
   Available:https://doi.org/10.46505/IJBI.2019.1202
7. Prakash S, Verma AK. Incidence of parasites in *Labeo rohita* (Hamilton) at Balrampur (U.P.). Life science Bulletin. 2017;14(2):181-183.
8. Gupta SP. Nematode parasites of vertebrates of East Pakistan III. Camallandidae from fishes, amphibian and reptiles. Can. J. Zool. 1959;86: 771-779.
9. Yamaguti S. Systema Helminthum-IV: Monogenea and Aspidocotylea. Interscience Publication, NewYork. 1963;699.
10. Lucky Z. Methods for the diagnosis of fish diseases. Amerind Publishing Co. Pvt. Ltd. New Delhi, New York; 1971.
11. Kabata Z. Parasites and diseases of fish cultured in the Tropics. Taylor and Francis, London and Philadelphia; 1985.
12. Hafizuddin AKM, Shahabuddin M. Parasitic monogeneans from some freshwater fishes of Comilla, Bangladesh. Chittagong Univ. Stud. Sci. 1996;20:113-126.
13. Margolis L, Esch GW, Holmer JC, Kuris AM, Schad GA. The use of ecological terms in parasitology. Journal of Parasitology. 1982;68: 131-133.
14. APHA. Standard methods for Examination of water and waste water. American Public Health Association 21st Ed. APHA, New York; 2005.
15. Sharif M, Vijiarungam AF. The occurrence of parasites at fish breeding station in peninsular Malaysia and their control. Proc. Intercont. Dev. Managem.Trop. Living Aquat. Resources. Serdang, Malaysia. 1986;68-73.
16. Mortuza M, Golam, Fahad A. Al-Misned. Prevalence of ectoparasites in crop fry and fingerlings of Rajshahi district, Bangladesh. J. Parasitic Diseases. 2015;39(2):130-133.
17. Rahman MR, Akter MA, Hossain MD. Parasitic diseases of exotic carp in Bangladesh. J. Agric. Rural Dev. 2007;5(1&2):127–134
18. Farhaduzzaman AM, Alam MM, Hossain M, Hussain MA, Rahman MH. Prevalence of parasites in the Indian major carp, *Labeo rohita* (Hamilton) in Rajshahi, Bangladesh. Univ. J. Zool. Rajshahi Univ. 2010;28:65–68.
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