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Prevalence of ectoparasites in carp fingerlings of Chashma Lake in District Mianwali Punjab Province, Pakistan

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Abstract

The Parasites attack causing massive destruction and serious diseases in fish, leading them to extinction, and is also harmful for the public health after its consumption (through food chain). The current study was designed to investigate the prevalence of ectoparasites in fish fingerlings of the family *Cyprinidae* which have very high market value in Pakistan. This study was conducted during March 2018 to February 2019 of Chashma Lake, district Mianwali Punjab, Pakistan. The aim of the study was to find out the number of ectoparasites prevalence in fish fingerlings and the correlation between the impacts of water quality parameters to parasitic prevalence in fish fingerlings. A total of 300 carp fingerlings of *Catla catla, Cirrhinus mrigala, Labeo rohita, Channa punctatus,* and *Cyprinus carpio* were collected from Chashma Lake with the help of local fishermen. The water quality parameters including water temperature, dissolved oxygen, pH and water hardness were measured immediately after sampling by using kit box. After identification in laboratory three groups of ectoparasites were recorded (ciliates, myxozoa and monogeneans). The highest prevalence ratio was recorded in winter (33.4%) while lowest was in rainy (12.3%) season. The study explored that the period of winter season is more favorable for ectoparasites and the fingerlings are more exposed to infection in this season. The findings of the current study suggested that with the seasons changing the deterioration of water quality parameters due to anthropogenic activities in Chashma Lake lead to more stress response in fishes and making them susceptible to pathogen infection.

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Introduction

Fish is one of the diverse and most important fundamentals that have a very important role in the wealth of large number of countries which have been found a constant product in the food of most of the nations (Essetchi *et al.*, 2003). Pakistan has a very abundant fish fauna, which includes both the cultured and exotic species over more than 190 valid species (Rafique and Khan, 2012). The aquatic species inhabited different forms of aquatic habitats; the fish being a significant constituent (Mirza and Bhatti, 1999).The most imperative need in aquaculture is to raise solid fish stock. Parasitic contaminations in fishes immensely upset aquaculture management and its financial growth (Rameshkumar and Ravichandran, 2010).

The frequency and rate of pervasion of parasites are related with physico-chemical parameters of water and fish wellbeing (Hossain *et al.*, 2008). The fish parasite network shows a huge variety with clean states of water in which they live. Parasites species can be found everywhere and on each living life form. Their existence in their host is commonly at stability in water living organisms and the most widely recognized way of life on the planet (Marcogliese, 2005). With the passage of time the changes within the earth climatic condition (normal or anthropogenic) can change the condition of equilibrium of the parasite between host and nature, hence bringing infection.

These variations can be natural, for example, temperature, and atmosphere or anthropogenic, contamination and urbanization (Lafferty and kuris, 1999). At the point when particular parasite can be seen with the exposed eye, a depth dimension is frequently used to depict the infectivity level inside the fish host (Siquier and Ostrowski, 2009).It was recorded that in the winter season the parasites prevalence was more (Ahmed *et al.*, 1991). The present study was arranged to examine the prevalence, specificity of host and invasion of ectoparasites in fingerlings of carp family of Chashma Lake in Mianwali district.

Materials and methods

Study site

The study was conducted in Chashma lake (32° 25 N, 71° 22 E) located on the Indus River in district Mianwali. It is the Pakistan third largest water reservoir after Tarbela and Mangla. The total area covered by the Chashma reservoir is 34,099 ha. It was constructed in 1967 for irrigation purposes. The topography of the surrounding areas of the lake is rough sandy soil and the dominant crops in the area are wheat, rice, cotton and sugarcane. The reservoir plays important role in flood control, power generation, irrigation, wildlife sanctuary for migratory birds and important habitat of fish production.

Sampling and procedure

The current study was conducted from March 2018 to February 2019. The carp fingerlings of *Catla catla, Cirrhinus mrigala, Labeo rohita, Channa punctatus,* and *Cyprinus carpio* were collected with the help of local fishermen. The fingerlings were brought to the research laboratory of the University and were kept in small water tubs. A total of about 300 fish fingerlings were examined for ectoparasites infection. The infected fishes were gathered and inspected in each month of the year. The fins, gills, caudal fins and the body smear were set up on contamination free hygienic slides with a drop of solution of 0.5% NaCl and air-dried. All smears were analyzed under a simple light compound magnifying microscope at 40–100× magnification. The greater part of protozoan was analyzed straightforwardly with no strategy; by smear preparation and essential estimation were taken for every protozoan. The Indian ink technique for (Lom and Vavra, 1963) used to recognize the myxozoan spore and for persistent slides, the air-dried smears were dye with Giemsa. Monogenean parasites were analyzed by followed the explanation and figures of (Yamaguti, 1963). Protozoan parasites were determined by the depiction of (Kabata, 1985; Hoffman, 1998). The water quality parameters including temperature of water, pH, dissolved oxygen and total hardness of water were seasonally measured by using kit box. The prevalence of ectoparasites was

determined as number of infested species of fish divided by the number of observed fish and were multiplied by hundred. The seasons were analyzed by dividing the months in the year into July-October (rainy season), November-February (winter season) and March-June (summer season).

Results and discussion

Variation in ectoparasites prevalence seasonally

The ectoparasites prevalence of carp fingerlings in three seasons (rainy, winter and summer) with months has been shown (Tables 1, 2 and 3).

From the result it has been explored that the infection of ectoparasites varies seasonally. In winter i.e. November-February the prevalence rate of ectoparasites increased enormously (Tables 1, 2 and 3). In all three groups the highest prevalence was shown by monogeneans (34.1 %), followed by ciliates (32.7 %) and myxozoa (24.1 %).

Table 1. Prevalence of ciliates parasites in different months of the year.

Months	Seasons	Phylum Protozoa (Ciliophora)	Parasites	Prevalence (%)
July-October	Rainy	Ciliates	*Chilodonella Sp.*	30
			Ichthyophthirius sp.	5
			Trichodina sp.	35
November-February	Winter		*Chilodonella Sp.*	45
			Ichthyophthirius sp	50
			Trichodina sp.	55
March-June	Summer		*Chilodonella Sp.*	30
			Ichthyophthirius sp	25
			Trichodina sp.	20
Absolute Average in year		Ciliates		32.7

Table 2. Prevalence of myxozoa parasites in different months of the year.

Months	Seasons	Phylum Cnidaria	Parasites	Prevalence (%)
July-October	Rainy	Myxozoa	*Thelohanellus* sp.	15
			Myxobolus sp.	0
November-February	Winter		*Thelohanellus* sp.	40
			Myxobolus sp.	40
March-June	Summer		*Thelohanellus* sp.	30
			Myxobolus sp.	20
Absolute Average in year		myxozoa		24.1

Table 3. Prevalence of monogeneans parasites in different months of the year.

Months	Seasons	Phylum Flatworm	Parasites	Prevalence (%)
July-October	Rainy	Monogeneans	*Gyrodactylus sp.*	0
			Ancyrocephalids sp.	5
November-February	Winter		*Gyrodactylus sp.*	75
			Ancyrocephalids sp.	60
March-June	Summer		*Gyrodactylus sp.*	35
			Ancyrocephalids sp.	30
Absolute Average in year		Monogeneans		34.1

The average ectoparasites prevalence of all the three groups was shown in the (Table 4). Among the all groups of parasites the maximum prevalence was recorded in winter season > summer and rainy season as shown (Table 4). From the seasonal data it was cleared that the parasitic attacked on the host was

increased in winter season which might be due to the fluctuation in water quality parameters. In the group myxozoa the ectoparasite *Myxobolus* sp. was totally absent in rainy season. Also in the group monogeneans *Gyrodactylus* sp. was not observed in rainy season. This illustrate that the infection of ectoparasites varies as the season changes.

As the fingerling is weak and delicate that's why they are more prone to infection.

Table 4. Monthly Prevalence (%) of ectoparasites in carp fingerlings.

Ectoparasites	Months (July-October)	Months (November-February)	Months (March-June)
Ciliates	12	30	15.5
Myxozoa	10	30	12.5
Monogeneans	15	40	17.5
Prevalence of total parasites (Average)	12.3	33.3	15.1

Table 5. Seasonal variation of water quality variables in Chashma Lake.

Months (Seasons)	Temperature (°C)	pH	Dissolved oxygen (ppm)	Total hardness (ppm)
Jul-Oct (Rainy)	33.6	5.3	6.0	128.4
Nov- Feb (Winter)	19.2	8.2	7.4	115.2
Mar-Jun (Summer)	24.5	7.6	7.1	119.3
Mean ± SD	25.7±7.2	7.03±1.5	6.8±0.73	120.9±6.7

Effect of the water quality parameters on ectoparasites prevalence

The water quality dimensions including temperature, dissolved oxygen, pH and hardness of water are the basic parameters of water that are connected to diseases as they fluctuate more. The Table 5 has shown the seasonal variation of water quality parameters in Chashma Lake with their mean ± SD (water temperature 25.7±7.2, pH 7.03±1.5, DO 6.8±0.73 and hardness 120.9±6.7).

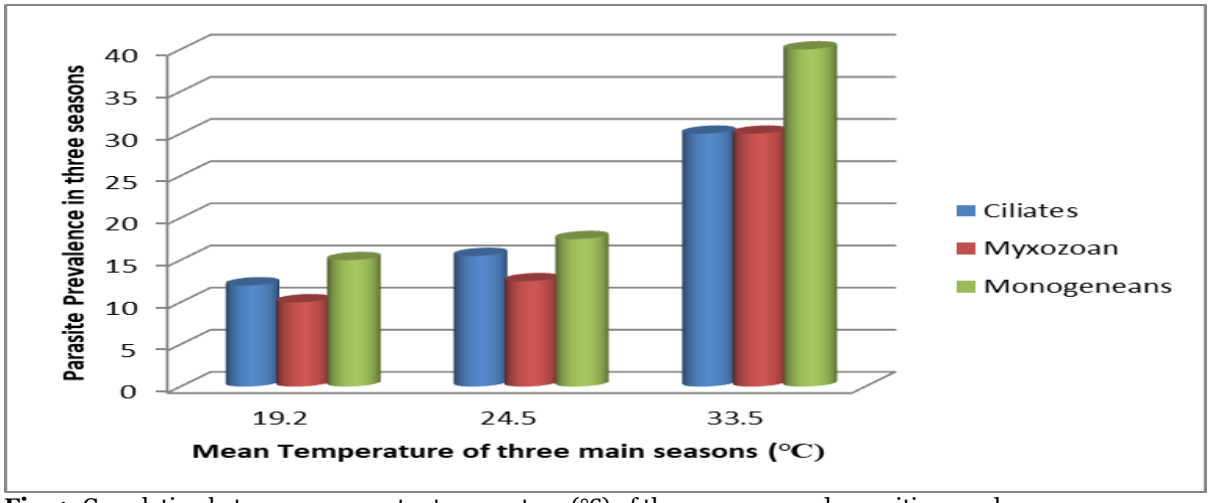

Fig. 1. Correlation between mean water temperature (°C) of three seasons and parasitic prevalence.

The correlation between mean of water quality parameters i.e. water temperature, pH, dissolved oxygen and water hardness of three seasons (rainy, winter and summer) with the prevalence rate of three parasitic groups ciliates, myxozoan and monogeneans respectively (Figs 1, 2, 3 and 4). A particular fish host correlated with the habitat of parasites which can be both freshwater, marine or brackish water and also

the water temperature along with environmental fluctuation are important index for parasites identification (Bruno *et al.*, 2006). Due to weak immune system the fish fingerlings become more prone to pathogen (Anderson, 1974) which was associated with the present findings. In Philippines, the most prevalent ectoparasites were reported as *Trichodina* sp. followed by *Dactylogyrus* sp. (Lumanlan *et al.*, 1992; Banerjee and Bandyopadhyay, 2010). Same in Malaysia the most active prevalence was shown by these two species (Shariff and Vijiarungam, 1986).

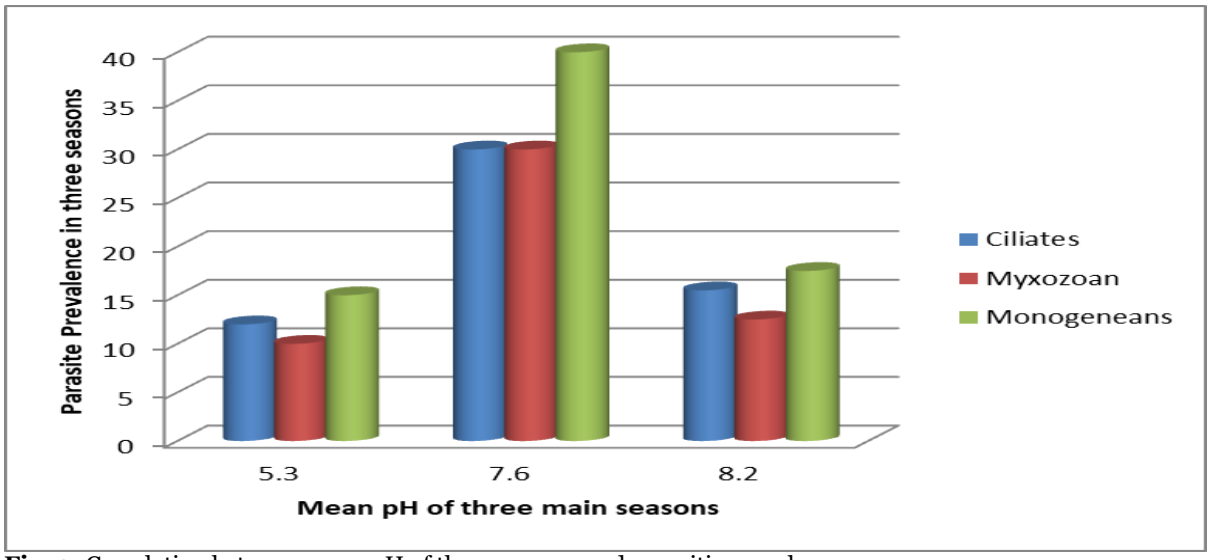

Fig. 2. Correlation between mean pH of three seasons and parasitic prevalence.

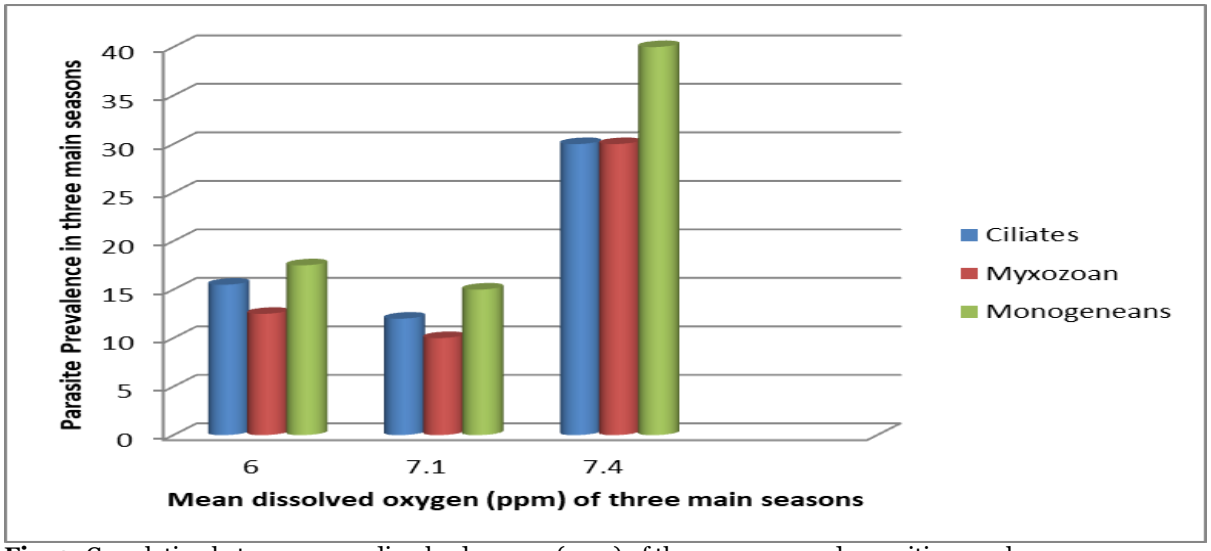

Fig. 3. Correlation between mean dissolved oxygen (ppm) of three seasons and parasitic prevalence.

The *Trichodina* sp. it was observed by (Winaruddin and Eliawardani, 2007) not only attacked on the fish gills but also infect on the fish body scales, different fins and operculum of carp species. This external parasite (*Trichodina* sp.) was also observed as infecting parasite on rainbow trout (*Oncorhynchus mykiss*) in Iran (Mehdizadeh-Mood *et al.*, 2011). The reproduction of Monogeneans parasites depends on water quality parameters and spread largely on host body and has variation in their modes of attachment, related to chemical and mechanical factors (Buchmann and Lindenstrom, 2002). According to (Kabata, 1985) the stagnant and shallow pond water allow ciliate like *Trichodina* for multiplication. In Srilanka, the same findings were also reported by (Subashinghe, 1992). In other study report from

Bangladesh, *Trichodina* was found the more prevalent fish ectoparasites next by *Myxobolus* sp. (Hossain *et al.*, 2008).During November-February the infection of ectoparasites reached to peak, because the condition of water quality parameters (Temperature, Dissolved oxygen etc.) in the Lake deteriorates. So, the fingerlings need more dissolved oxygen and oxygen deficiency can cause disease outbreak and they get infection (Hossain *et al.*, 2008).

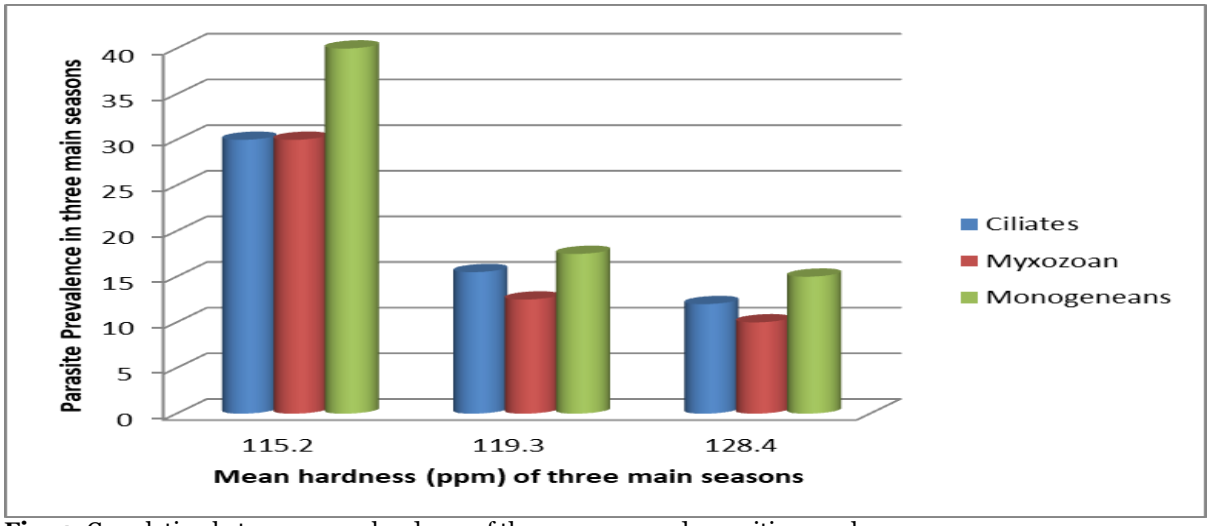

Fig. 4. Correlation between mean hardness of three seasons and parasitic prevalence.

The different studies (Mofasshalin *et al.*, 2012; Rahman *et al.*, 2007) showed that in the winter season as the water quality characteristics varies the fish becomes highly susceptible to parasitic infection.

Conclusion

It can be concluded that the enormous increase in parasitic abundance and their attacked on host has a greater connection with water quality parameters. The parasite prevalence level and intensity of infection was also associated with the season's changes and host specific fish species. It is recommended to reduce the pollution level near the lake, hence to maintain the water quality which in turn maintains the aquatic life.

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