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Distribution of two monogenean (*Dactylogyrus Vastator* & *Gyrodactylus*) in fish fauna of Barganatu Dam, FR Bannu, KPK, Pakistan

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Abstract
The present study was conducted to study the distribution of two monogenean parasite and the biodiversity of different fish species in Barganatu Dam, FR Bannu, KPK, Pakistan. A total of 180 species of fish were collected from Barganatu Dam. Out of 180 fish, a total of six species of fish were examined and identified. During the study, two Monogenean parasite were identified, namely *Dactylogyrus vastator* and *Gyrodactylus* spp. *Dactylogyrus* were the most prevalent gill parasite observed, followed by the prevalence of *Gyrodactylus* in fish species. The infection rate were also studied, showing a high infection rate of 120 out of 180 in fish species by *Dactylogyrus vastator*. The low rate of infection in fish were studied 44 (24.45%) out of 180 by *Gyrodactylus* Spp. Present study concludes that Monogenean parasite namely *Dactylogyrus* species and *Gyrodactylus* species, were the most common parasites found in Barganatu Dam.

Keywords: gills parasite, biodiversity, fresh water, infection, Barganatu Dam

Introduction
Fish are cold-blooded aquatic chordates because they have gills, fins, and a body covered with a variety of distinct scales. Fishes are the most diverse and prolific group of vertebrates on the planet, and they have colonized nearly every niche in the hydrosphere [1]. Fish are the most abundant vertebrate species on the planet [2]. A parasite is an organism that lives and occupies another larger species in its life cycle, which causes numerous conditions [3]. Ectoparasitic organisms are exposed to fish gills and skin, which are constantly in contact with the surrounding water. The mucus layer that covers the skin and gills can serve as a first line of defense against these harmful organisms [4]. Infested fish's gills were congested or pale hemorrhagic, with mucus hypersecretion. These symptoms could be the result of extreme irritation induced by monogenean worm mobility, eating activity, adhesion, and attachment. Furthermore, the presence of sticky mucus discharge causes respiratory distress and osmotic pressure, resulting in the death of the fish [5]. Researchers can understand the role of host fish in the food web or ecosystem when they have a better understanding of parasites and parasitic communities. They can also better assess the role of parasites in affecting fish health when they have a better understanding of parasites and parasitic communities. The invasion of parasites into the gills might result in changes in proliferative cells as well as significant epithelial hyperplasia [6].
Monogeneans are fish parasites living on both freshwater and saltwater fish worldwide. They require a single host and can reproduce at different temperatures. For host attachment, they used a hook-like structure. Infestations caused by monogeneans cause irritation, cause higher slime, and open the door for bacterial attack [7]. Over 246 monogenean species have been reported in South-East Asia that have infected fish, with 69 of them being observed in cyprinids, with *Ancyrocephalus*, *Dactylogyrus*, *Gyrodactylus*, and *Paradiplozoon* being the most abundant [8]. Fish gill parasite *Dactylogyrus* is a kind of monogenean parasite that infects the gills of a wide variety of fish. These ectoparasitic worms, also known as Gill fluke, are parasites that infect the gills of cyprinids and other aquatic animals. Excessive mucus secretion, epithelial hyperplasia, edoema, gill bleeding, and a shortage of oxygen are all observed in infected fish, and all of these symptoms commonly result in death. *Dactylogyrus* species are typically highly host specific in the Cyprinidae family, with the majority being reported from only one host [9].

Different researchers in different parts of the world have conducted studies on parasite populations by various epidemiological methods, due to the serious damage caused by parasites in the fishing sector. Research on fish diseases is early in Pakistan, with the exception of taxonomy studies. There has been little work in Pakistan on deadly fish parasites that could be helpful for fisheries experts and in the FR Bannu region. This study was designed to investigate Monogenean parasite infections, including their identification, potent frequencies, and host selectivity in the Barganatu Dam in FR, Bannu, KPK. A current study has also been conducted to explore the fish fauna of the Barganatu Dam in the FR, Bannu, KPK regions in Pakistan.

Materials and Methods

Study Area: The current study was conducted from February to May, 2018. The present research were conducted at Barganatu Dam, located over a stream called Bargantu Algad, Frontier Range Bannu, KPK Pakistan. The Barganatu Algad is an intermittent stream type having a latitude of 33° 1' 6.7" (33.0185°) on the north side; a longitude of 70° 44' 15.6" (70.7377°) towards the east; and an elevation of 347 meters (1,138 feet). Using a hand net, fish were collected from the dam. Small sized fish were collected with the help of a mosquito net. The fish were taken to the Fishery Laboratory, Zoology Department of GPGC, Bannu, in plastic bags, where lab work were done.

Research Procedure: By using chloroform, fish were killed and then dissected to take out their gills by using razors and forceps. Gills were then shifted to a petri dish with filtered water. The gills were split into small pieces by the use of a camel hair brush, rubbed and shaken. Then a microscopic examination of the gills and their contents were carried out. With the help of a camel hair brush and glass dropper, existing parasites were taken from the dish and placed in an isolated bottle containing 70 per cent of alcohol and 5 per cent of glycerin. The gill parasite were recovered after examination of all samples of fish (Figure 1).

Fig 1: Gills infected by Monogenean.

Identification of Monogeneans Parasite: After examination of a parasite, the parasite was transferred from the petri dish to clean slides for the staining process using Oceto-Alam Carmine. Firstly, the parasites were dehydrated with 50-30% alcohol for up to 5 minutes. Rehydration of the parasite were done after 2-5 minutes. Final dehydration of parasites was followed by using 50 per cent, 70 per cent alcohol for 5 minutes. The parasite was then moved to a clean slide mounted on Canada Balsam and was covered with a coverslip. For drying, the parasites were placed on a heating plate. The Collected Monogenean parasite was examined and identified by following available literature and the protocol of Yamaguti, 1963. The rate of infection were found out by using a simple percentage formula.

Results

In the current study, six different species namely *Oreochromis aureus*, *Oreochromis niloticus*, *Barilius vagra*, *Cirrhinus mrigala*, *Puntius sarana and Labeo rohita* of fish were observed in Baganatu Dam FR, Bannu (Figure 2). *Oreochromis niloticus* were the most common fish 55(30.55) and *Puntius sarana* were very rare about 8(4.48) (Table 1).

Oreochromis niloticus *Oreochromis aureus* *Barilius vagra*

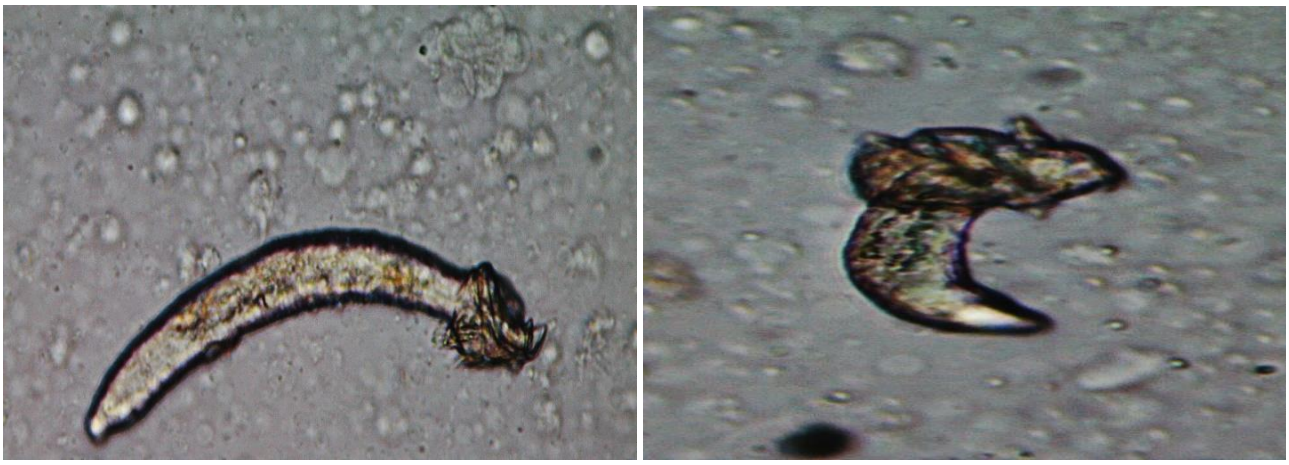
Labeo rohita *Cirrhinus mrigala* *Puntius sarana*

Fig 2: Different Fish species fauna found in Barganatu Da, FR Bannu.

Table 1: Biodiversity of fish fauna in Barganatu Dam.

No	Fish Species	English Name	Local Name	Total Number (N%)
1	*Oreochromis niloticus*	Nile tilapia	Tilapir	55(30.55)
2	*Oreochromis aureus*	Blue tilapia	Tilapir	43(23.88)
3	*Barilius vagra*	Vagrabaril	chal	32(17.77)
4	*Labeo rohita*	Rohu	Rahu	25(13.88)
5	*Cirrhinus mrigala*	Mori	Mori	17(9.44)
6	*Puntius sarana*	Olive Barb	kharni jundoor	8(4.48)

Monogenean fish parasites were identified in the current study from the gills of different fish. Two monogenean species, e.g. Dactylogyrus vastator and Gyrodactylus Spp, were identified (Figure 3a and b). A total of 180 fish species were examined in which 120 (66.67%) were infected from *Dactylogyrus vastators* and 44 (24.45%) were from *Gyrodactylus*. Rate of infection *Dactylogyrus Vastator* were also studied among different species of fishes. The highest rate of infection 100% were studied in *Labeo rohita* infected by *Dactylogyrus vastato.* The lowest rate of infection 30% were found in Tilapia infected by *Dactylogyrus vastator*. The infection rate of Gyrodatylus were also studied. The highest rate of infection were found in *Puntius sarana* 53.3% and the lowest rate of infection 10% were found in Tilapia *Oreochromis niloticus*. (Table 2).



(a) *Dactylogyrus vastator* (b) *Gyrodactylus*

Fig 3: (a) Microscopic Examination of *Dactylogyrus vastator*; *Dactylogyrus vastator* were identified on the basis of their generic character. fourteen hook were present at the margin on opisthaptor in which two are close to anchor away from rim. Eyes spot were present with two pairs of eyes. Head lobe are four in number. **(b)** Microscopic examination of *Gyrodactylus*; *Gyrodactylus* were also examined and identified on the basis of generic character. Sixteen hook were present. Two pairs of anchor were examined on ventral and dorsal side. Eyes spot and vagina were absent.

Table 2: Prevalence and infection rate of *Dactylogyrus vastator* and *Gyrodactylus* in difference species of Fish.

No	Fish Species	No. of Fish Species Examine	*Dactylogyrus* Vastator (N)	Percentage of Infection	Percentage of Infection	Percentage of infection
1	*Oreochromis niloticus*	30	10	33.3	03	10
2	*Oreochromis aureus*	30	09	30	00	00
3	*Barilius vagra*	30	21	70	11	36.6
4	*Labeo rohita*	30	30	100	10	33.3
5	*Cirrhinus mrigala*	30	25	83.3	15	50
6	*Puntius sarana*	30	25	83.3	16	53.3
	Total	180(100%)	120	66.67%	44	24.44%

Gender wise infection rate were studied in different species of fish infected by *Gyrodactylus* parasite. High rate of infection 39 (43.33%) were found in male species as compared to female having 16(17.78%) rate of infection. Out of six different male species, *Cirrhinus mrigala* were most effected fish with infection rate of 11(73.33%) out of 15 followed by 9(60%) in *Puntius sarana* and *Barilius vagra*, 07(47.76%) in *abeo rohita* and 3(20%) in *Oreochromis Niloticus*. Rate of infection from *Gyrodactylus* parasite were also studied in female species in which *Puntius sarana were most infected fish species in female with rate of infection* 07(46.67%) followed by 04(26.76%) in *Cirrhinus mrigala*, 03(20%) in *Labeo rohita* and 02(13.33) in *Barilius vagra*. (Table 3).

Table 3: Gender wise rate of infection in different fish species by parasite *Gyrodactylus*.

No	Fish Species	No. of Fish examined		No. of infected Species		Rate of Infection (%)	
		Male	female	Male	female	Male	female
1	*Oreochromis Niloticus*	15	15	03	00	20	00
2	*Oreochromis aureus*	15	15	00	00	00	00
3	*Barilius vagra*	15	15	09	02	60	13.33
4	*Labeo rohita*	15	15	07	03	46.76	20
5	*Cirrhinus mrigala*	15	15	11	04	73.33	26.76
6	*Puntius sarana*	15	15	09	07	60	46.67
	Total	90	90	39	16	43.33%	17.78%

Gender wise rate of infection from *Dactylogyrus Vastator* parasite were also studied. Infection rate of parasite were most prominent 70(77.78%) in male species as compared to female having 50(55.56%) infection rate. In total six different male species, *Puntius sarana* and *Labeo rohita* were most commonly infected by parasite with rate of infection 15(100%) out of 15 species followed by 14(93.33%) in *Cirrhinus mrigala*, *Barilius vagra*, 07(46.67%) in *Oreochromis Niloticus* and 06(40%) in *Oreochromis aureus*. Infection rate were also studied among six different species of female in which high rate 15(100) of infection from *Dactylogyrus Vastator* were found in *Labeo rohita* followed by 11(73.33%) in *Cirrhinus mrigala*, 10(66.67%) in *Puntius sarana*, 08(53.33) in *Barilius vagra and* with 03(20%) rate of infection in both *Oreochromis aureus* and *Oreochromis niloticus* (Table 4).

Table 4: Gender wise rate of infection in different fish species by parasite *Dactylogyrus Vastator*

No	Fish Species	No. of Fish examined		No. of infected Species		Rate of Infection (%)	
		Male	female	Male	female	Male	female
1	*Oreochromis Niloticus*	15	15	7	03	46.67	20
2	*Oreochromis aureus*	15	15	06	03	40	20
3	*Barilius vagra*	15	15	13	08	86.6	53.33
4	*Labeo rohita*	15	15	15	15	100	100
5	*Cirrhinus mrigala*	15	15	14	11	93.33	73.33
6	*Puntius sarana*	15	15	15	10	100	66.67
	Total	90	90	70	50	77.78%	55.56%

Discussion

The present study was conducted to study the infestation of gill parasites and the biodiversity of different fish species in Barganatu Dam, FR Bannu, KPK, Pakistan. A total of 180 species of fish were collected from Barganatu Dam by using hand nets. Mosquito nets were used for the collection of small sized fish. Out of 180 fishes, a total of six species of fish were examined and identified, which are *Oreochromis aureus*, *Oreochromis niloticus*, *Puntius sarana*, *Labeo rohita*, *Cirrhinus mrigala* and *Barilius vagra*. In the current study, six different species, namely *Oreochromis aureus*, *Oreochromis niloticus*, *Barilius vagra*, *Cirrhinus mrigala*, *Puntius sarana and Labeo rohita* were observed in Baganatu Dam FR, Bannu. *Oreochromis niloticus* were the most common fish, 55 (30.55%) and *Puntius sarana* were very rare, 8 (4.48%). Ilyas *et al*. (2015), who found 5 species of the Damai stream, Domail, KPK, with two identity spp that are similar to our study [10]. Navid *et al*. (2017) have also observed fish species from the Cyprinidae family and Cichlidae from a diversity of fish fauna of the River Etai in District Shangla KP, Pakistan, in which two species, *Cirrhinus mrigala* and *Labeo rohita* are similar to existing findings from a study. One species of the Oreochromus genus is similar to the current study findings [11]. According to the findings of a recent study, the Cyprinidae and Bagridae families are the most prevalent in the Indus River [12]. A study conducted by Wahab and Ali, (2017) also showed similar findings to our results [13].

Monogenean fish parasites were identified in the current study from the gills of different fish. Two monogenean species, e.g. *Dactylogyrus vastator* and *Gyrodactylus Spp*, were identified. A total of 180 fish species were examined in which 120 (66.67%) were infected from *Dactylogyrus vastators* and 44 (24.45%) were from *Gyrodactylus*. Rate of infection *Dactylogyrus vastator* were also studied among different species of fishes. The highest rate of infection 100% were studied in *Labeo rohita* infected by *Dactylogyrus vastato*. The lowest rate of infection 30% were found in Tilapia infected by *Dactylogyrus vastator*. Infection rate of Gyrodatylus were also studied. The highest rate of infection were found in *Puntius sarana* 53.3% and lowest rate of infection 10% were found in Tilapia *Oreochromis niloticus*. Similar Parasite Spp *Dactylogyrus vastator* and *Gyrodactylus* were also reported by recently [14, 15]. A study conducted by Slmkova *et al*., (2004) also reported parasites species including *Dactylogyrus* and *Gyrodactylus* from fishes that belong to Cyprinidae [16]. A recent study also shows that infection and transmission and infection rate of Dactylogyrus parasite is inceased in those fishes which are living in poor pond condition [17]. The result our study is also similar to the recent study another study [18].

Gender wise rate of infection of *Dactylogyrus vastator* and *Gyrodactylus spp* were also studied among all six species of fishes. Male fishes were most likely to be infected from *Dactylogyrus Vastator* and *Gyrodactylus spp* as compared to female. The highest rate of infection from *Gyrodactylus* parasite were found in male *Puntius sarana* fish while the lowest rate of infection was found in female Tilapia fish i.e. no fish was found infected. The rate of infection of Dactylogyrus Vastator were also studied showing the highest rate of infection in Male fishes of *Puntius sarana* and *Labeo rohita* while the lowest rate of infection in female fish of Tilapia. Mavuti *et al*., (2017) published similar findings to our study that male fish were more susceptible to infection with Dactylogyrus and Gyrodactylus. Out of 68 fish sample, 26.2% of which had one or more parasites infected. Male infection was higher, i.e. 25.3 per cent compared to female 22.6 per cent [19]. The result of our study is in contrast with some studies which show high infection rate of parasite in female

compared to male fish [20, 21, 22].

Conclusion

The present study proposed that in the Barganatu Dam FR Bannu, a variety of fish species were found. The findings indicate that the water is suitable for the survival of fish. Monogenean parasites are the most prevalent parasites found in the fish fauna of Barganatu Dam FR Bannu, according to the current research. The present research has identified that the two most prevalent monogenean parasites were *Dactylogyrus vastator* and the *Gyrodactylus*. The fish seemed to be healthy. On the other hand, these parasites could cause problems for fingerlings and fry in the dam.

Significance Statement

In systematic studies, modern molecular approaches should be used to bring Pakistan's monogenean fauna knowledge to the current level of global knowledge. The study of host-parasite relationships in natural ecosystems can help researchers better understand fish diseases in confined situations, where infestations are more likely. Monogenean parasites control should be considered an important aspect of the aquatic environment The findings of this research are still fascinating. However, it is advisable to delve further into the work in order to gain a better knowledge.

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Conflict of Interest

No conflict of interest were found during the study.

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