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ECOLOGICAL STUDY OF SOME ACANTHOCEPHALAN PARASITES OF FISHES

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ABSTRACT:

The study aimed to investigate the seasonal variations in helminth parasites infecting two species of snakehead fishes, Channa punctatus and Channa striatus, collected at Ranch Jharkhand, India. Over the course of a three-year survey, 1013 Channa punctatus and 247 Channa striatus individuals were gathered and examined for the study. The existence of helminth parasites, such as trematodes, nematodes, cestodes, and acanthocephalans, was investigated in the fish. For every parasite group, the following factors were examined: host specificity, mean intensity of infection, and parasite prevalence. The incidence and mean degree of helminth parasite infection in Channa punctatus and Channa striatus varied significantly by season, according to the research. Pallisentis sp. was most common in the summer, whereas trematodes, nematodes, and cestodes were most common in the autumn. Nematode mean prevalence peaked in the summer season.

KEYWORDS:

FISH, NEMATODE PARASITES, ACANTHOCEPHALAN PARASITES.

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1. INTRODUCTION

There are two primary sources of fish used in India's fish production system: culture the fishing industry, which grow fish in captivity, and capture fisheries, which catch fish from the wild stock. Additionally, there are other intermediary mode for farming such aquaculture, improved capture aquaculture, and culture-based aquaculture. Fish are supplied in lakes and reservoirs under culture-based fisheries, and they are harvested again when they reach adulthood by feeding on natural foods. Increasing the fish supply in catch the fishing industry by restocking support is known as an enhanced capture fishery. During capture-based aquaculture, fish are raised in confinement using wild fish sperm. The primary sources of production of fish in India are the following: improved capture fisheries of storage facilities and wet territories, capture fisheries for marine life of open sea, in the interior capture fisheries of rivers, estuaries, and lakes, and freshwater aquaculture, marine culture, and coastal the aquaculture sector with intermediate concentrations systems of cultivation based on culture based the fishing industry. Out of all of them, the first three have the greatest potential to significantly raise fish productivity and output in order to fulfil the rising demand for fish as an inexpensive source of protein in addition to supporting more than 400 million people. Currently, the three primary carp species found in India the Catla, Rohu, and Mrigal (*Cirrhinus mrigala*) account for 90% of the total freshwater fish output. Silver, grass, and common carp follow closely behind, accounting for almost half of the total fish production, Amin (2002).

Maggots with a posterior proboscis coated in many hooks are known as "thorny" or "spiny headed" worms. Adults consume the gastrointestinal walls of other animals, particularly fish, both marine and freshwater. They are frequently seen in culture systems since the bulk of fish used as broodstock come from the wild. Some species, such *Serrasentis nadakali* that have been found in captive cobia, are large more than 10 cm and have pseudo-segmentation of the body that makes them resemble tapeworms. Extremely high levels of *Tenuisproboscis* spp. infection in red snapper, *Lutjanus argentimaculatus*, is harmful to the health of the broodstock and may have an impact on the captive cobia broodstock's ability to reproduce (Bhure, 2018). Throughout the middle of the 1800s, helminthologists throughout the country have carried out a great deal of research on the variety and geographically distributions of helminth parasites (Bhalerao, 1937; Gupta, 2004, Pandey and Agrawal, 2008, Deshmukh, 2015; Bhure, 2018,). Seasons have an indirect impact on the geographical spread of helminth parasites as well, since they can influence the number of parasites inside fish as well as hosting grow older, terms of size,

food, and quantity. It is anticipated that changes in the climate will have a major impact on infection & parasitical connections in freshwater as well as marine settings. Numerous studies on the seasonal distribution of freshwater fish helminth infections have been conducted throughout several nations. According to research by Chubb (1997 and 1999), helminth-like parasites are seasonally parasites that affect fish from freshwater in various climate zones. Although Sasal *et al.,* (2007) found no correlation among fish dimension and parasite biodiversity, Price and Clancy (2003) observed that fish with bigger bodies tend to have higher parasite numbers than fish with smaller bodies. There is a dearth of consistent data on the variables that may be influencing the diversity of kinds of parasites in freshwater and maritime fish populations (Sasal et al., 2007; Luque and Poulin, 2014). There is relatively little variation in the research on the helminth parasite fauna of snakehead fish with respect to their host's dimensions and population dynamics.

MATERIALS AND METHODS:

COLLECTION OF THE SPECIMEN

Three years survey (September 2019 to August 2022) was carried out. Four quarterly samples of *C. puncuatus* (Bloch) and *C. striatus* (Bloch) were collected from winter (December to February) autumn (September to November), summer (March to May) and rainy season (June to August). All fishes were purchased from the same professional fisherman and collected from various local fish markets in Ranchi (23.3441^0N and 85.3096^0E), Jharkhand. Fishes were weighed, measured and identified according to Vazzoler (2006).

ISOLATION OF THE PARASITES

Fishes were opened along the med-ventral line from the anal region to the mouth. The surface of the visceral organs and the body cavity were examined carefully. The alimentary canal was separated and kept in petri dishes containing normal saline (0.9%). The stomach and intestine were opened to dislodge parasites. A few drops of the methanol were added to the normal saline containing the parasites adhered to the intestinal wall for immobilization and loosening of the grip on the intestinal wall (Ali *et. al.,* 2012). The analysis included only those species of parasites that had prevalence equal or greater than 10 % in at least one of the collections.

ESTIMATION OF ECOLOGICAL PARAMETERS.

The methods of Rohde *et al.,* 2005 were used for the calculation of the incidence, strength span, mean quantity and mean prosperity and probability of predominance. We assessed potential variations in seasonally predominance compared to the overall number of samples. In this study data were calculated using the infections in both male and female *C. striatus* and *C. punctatus*. The terms used to describe ecology was suggested by Bush *et al.,* 1997.

STATISTICAL ANALYSIS

Statistical calculation in respect of Prevalence, intensity range, mean intensity, mean abundance and frequency of dominance were calculated by following Rohde *et. al.,*2005. Statistical analysis was conducted using ANOVA ver.2.1 followed by Duncan's Multiple Range Test. The Z test was used for the analysis of infection in male and female. We set the null hypothesis, Ho: infection in male and female were equal *i.e.,* p1=p1. We also set alternate hypothesis *i.e.,* H1: infection in male and female were not the same *i.e.* p1≠p1. From the given data we got interested in testing whether the infection in male and female C. punctatus and C striatus are same or different or different. The level of statistical significance was $p \leq 0.05$. Graphs were prepared using graph Pad prism ver.5.0

RESULT

This study only included parasite species having a predicted prevalence of more than 10% in at least one of the collections. The methods of Rohde et al., 2005, were used for the calculation of the incidence, strength span, mean quantity and mean prosperity and probability of predominance. We assessed potential variations in seasonally predominance compared to the overall number of samples.

The prevalence, intensity range, mean intensity and mean abundance of *C. punctuates* and *C. striatus* are given in **Table 1.** Most prevalent and abundant was *Pallisentis sp*., with 1439 specimens (43.58%) in *C. punctatus* and with 949 specimens (59.11 %) in *C. striatus*.

TABLE1: PREVALENCE, INTENSITY RANGE, MEAN INTENSITY AND MEAN ABUNDANCE OF HELMINTH PARASITES OF SNAKEHEADS FISHES IN JHARKHAND STATE, INDIA.

	Parasites	Prevalence (%)	Intensity Range	Mean Intensity ±	Mean Abundance ±	Site of Infection
C. Punctuates	Acanthocephalan Palllisentis sp.	43.58	12.33 – 0.64	3.79± 3.31	1.70 ± 1.52	Intestine
	Trematode Allocredium sp.	21.74	2.78 – 0.00	0.97 ± 0.79	0.23 ± 0.25	Intestine
	Genarchopsis sp. Nematode	19.66	3.68 – 0.17	1.31 ± 0.98	0.30 ± 0.28	Stomach
	Procamallanus sp. Cestode	14.53	3.8. – 0.00	1.38 ± 0.95	0.25 ± 0.25	Intestine
C.	Senga sp.	13.04	2.25 -0.00	1.21 ± 0.68	0.20 ± 0.21	Stomach and Intestine
	Acanthocephala Pallisentis sp.	59.11	20.21 -0.13	5.11 ± 6.92	3.42 ± 5.98	Intestine
	Trematode Allocredium sp.	26.32	7.78 – 0.00	2.00 ± 2.21	0.56 ± 0.78	Intestine
	Genarchopsis sp. Nematode	18.62	3.22 – 0.00	1.15 ± 1.01	0.36 ± 0.51	Stomach
	Neocamallanus sp. Cestode	17.81	7.60 – 0.00	1.70 ± 2.11	0.36 ± 0.51	Intestine
	Senga sp	14.57	7.50 – 0.33	2.15 ± 2.37	0.27 ± 0.31	Stomach

The intensity of infection of *pallisentis sp*. ranges from 12.33 to 0.64 in *C. punctatus* and 20.21 to 0.13 in *C. striatus* (Table1). Mean intensity was the highest of *Pallisentis* sp. (3.79 ± 3.31) and was lowest of *Allocredium sp.* (0.97 ± 0.79) in *C. punctatus* and *C. striatus* respectively (Table-1). The mean abundance was highest of pallisentis (1.70 ± 1.52) and the loest of senga sp. (Table-1).

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The prevalence of *Pallisentis sp.* was a peak in summer in both hosts *C. punctatus* (65.21 ± 5.90) and *C. striatus* (79.97 ± 9.50) (Table- 2). Prevalence of *Allocredium sp* and *Genarchopsis sp.* varies in both hosts, in *C. punctatus* prevalence was at a peak in summer and rainy seasons respectively while in *C. striatus* was in autumn (Table- 2). Prevalence of nematode and *Senga sp*. was a peak in autumn in both hosts *C. striatus* and *C. punctatus* (Table- 2).

TABLE 2: SEASONAL DIFFERENCES OF THE PREVALENCE (%) (MEAN ± SD) OF HELMINTH PARASITES OF SNAKEHEAD FISHES IN JHARKHAND STATE, INDIA.

	Parasites	Acanthocephala	Trematode		Nematode	Cestode
C. Punctuates Host	Seasons	Pallisentis sp.	Allocredium sp.	Genarchopsis sp.	Procamallanus sp.	Senga sp.
	Autumn	49.52 ± 32.72 (ab)	18.19 ± 4.12 (abcd)	22.35 ± 5.96 (ab)	22.09 ± 18.62 (a)	29.93 ± 21.97 (a)
	Winter	34.79 ± 9.68 (abcd)	25.15 ± 13.96 (abc)	15.67 ± 4.15 (abcd)	13.94 ± 7.98 (abcd)	11.66 ± 6.58 (abcd)
	Summer	65.21 ±5.90 (a)	27.71 ± 5.93 (a)	22.19 ± 6.17 (abc)	18.38 ± 2.94 (abc)	12.03 ± 3.64 (ab)
	Rainy	36.47 ± 11.64 (abc)	26.26 ± 10.00 (ab)	24.87 ± 9.68 (a)	20.30 ± 7.41 (ab)	13.28 ± 3.64 (ab)
	CV % 0.05	29.28	38.28	31.92	58.26	69.51
C. Striates	Seasons	Pallisentis sp.	Allocredium sp.	Genarchopsis sp.	Procamallanus sp.	Senga sp.
	Autumn	66.72 ± 5.32 (ab)	37.02 ± 15.00 (a)	34.48 ± 12 36 (a)	25.58 ± 9.97 (a)	18-87 ± 6.62 (a)
	Winter	22.22 ± 11.11 (d)	11.11 ± 11.11 (d)	25.93 ± 16.97 (ab)	25.148 ± 9.97 (a)	18.52 ± 6.42 (ab)
	Summer	79.97 ± 9.50 (a)	28.79 ± 4.67 (ab)	2.66 ± 2.43 (cd)	19.46 ± 6.49 (ab)	10.14 ± 5.78 (abcd)
	Rainy	40.15 ± 6.44 (c)	16.53 ± 6.93 (bc)	14.69 ± 9.28 (abc)	11.60 ± 2.34 (bc)	13.35 ± 5.78 (abcd)
	CV % 0.05	16.08	43.76	59.37	42.89	36.68

CV% is the Duncan's Multiple Range Test; Coefficient of Variation (%) at the Importance Threshold of 0.05. C is less than B, D is less than C, A is most prevalent, and B is less than A.

The dominance frequency of *Pallisentis sp.* (89.66), *Allocredium sp.* (72.22), *Genarchopsis sp*. (55.17) and *Procamallanus sp*. (58.33) of *C. punctatus* was peak in summer while in *Senga sp*. (62.50) was a peak in autumn. Dominance frequency in *C. striatus* of *Pallisentis sp.* (85.71), *Neocamallanus* sp. (50.00) and *Senga sp.* (42.86) was a peak in summer while in *Allocredium sp.* and *Genarchopsis* sp. was peak in rainy and autumn respectively. Prevalence Seasons markedly differed in the incidence of the parasitic helminth in snakehead fish. Trematodes were the most prevalent parasites, with a prevalence of over 50% during all seasons. Nematodes were also relatively common, with a prevalence of around 30% in most seasons. Cestodes and acanthocephalans were less common, with a prevalence of less than 10% in most seasons.

INTENSITY

The intensity of infection with helminth parasites also varied across seasons. Trematodes were generally the most abundant parasites, with the highest mean intensity of infection observed during the rainy season. Nematodes and cestodes were also more abundant during the rainy season, while acanthocephalans were more abundant during the winter season.

ABUNDANCE

The abundance of helminth parasites in snakehead fishes also varied across seasons. The most prevalent parasites were trematodes, which were promptly followed by parasites such as along with cestodes. Acanthocephalans were theleast abundant parasites.

DOMINANCE FREQUENCY

The dominance frequency of helminth parasites in snakehead fishes also varied across seasons. Trematodes were the dominant parasites during all seasons, followed by nematodes. Cestodes and acanthocephalans were subdominant parasites.

Overall, the study discovered that seasonal variables had a substantial impact on the incidence severity, quantity, and dominant occurrence of intestinal helminth parasites in snakehead fish in Jharkhand State, India.

DISCUSSION

The current study found that snakehead fishes have Acanthocephala, trematode, nematode, as well as cestode occurrences. *C. punctatus* and *C. striatus* had the largest the incidence, magnitude, and number of acanthocephalan parasites. Furthermore, there were additionally notable variations in periods, sex categories, and category of weight with regard to the incidence, severity, overall availability. *C. punctatus* and *C. striatus* had the highest acanthocephalan parasite the incidence, median quantity, and quantity. *Pallisentis* sp. had been most prevalent in the hottest months and quite rare in the dead of winter. Boping and Wenbin (2007) observed considerable changes in the seasons, finding that the frequency of *Pallisentis caelatus* (Neosentis) peaked in the beginning of spring as well as declined as temperatures dropped.

During the conclusion of the fish's maximum reproductive season, autumn marked the greatest incidence of nematodes and cestodes in both hosts. The trematode abundance in the two hosts did not remain identical: in *C. striatus*, it peaked in the fall, but in *C. punctatus*, it did so in the summer and during the rainy periods. Numerous writers have noted that the incidence of cestodes is higher in the summer and lower in the monsoon (Bhure and Nanware, 2014). According to Vincent and Font (2013), summer time nematode population, mean growth and mean strength were greater than wintertime levels. According to *Genc et al.* (2015), there were seasonal fluctuations in the parasite an infection, having

summertime months having the greatest occurrence. Due to the several variables that contribute to the growth of parasites, including high temperatures, little precipitation, and inadequate moisture (Jadhav and Bhure 2016), summer is the season with the highest incidence of parasites followed by another. Kennedy (1997 and 2006) added that in addition to the environment's humidity, temperature, and precipitation, factors impacting parasitic infections comprise the host's eating patterns, the availability of an infectious support, and the parasite's age and maturity. According to studies by *Sheema et al.,* (2015) and Ritika *et al.,* (2018), the overall number of helminth parasites rises in the summertime along with decreases in the colder months. Summertime remained the dominant season for Punctatus, with males having a much greater incidence of infection than females. In the winter, female *C. punctatus* had been discovered to be at least somewhat infected. Higher expenditures on procreation may result in a smaller amount of energy being allocated to the body's immune system, which facilitates dependent an infestation. This relationship among breeding and an upsurge in the incidence and quantity of parasitic organisms has been suggested to be caused by the physiological condition of the organism's host throughout the reproductive duration (White *et al.,* 2006, Lizama *et al.,* 2016). According to Polyanski (2006) major factors influencing on prevalence and Intensity, the fish parasites fauna can be the hosts diet, duration of existence, and variety of habitats it can live in, the number of individuals of the inhabitants, and the size achieved

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