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Seasonal Dynamics Of Trematode Parasite, *Opisthorchis Pedicellata* Infection In *Rita Rita* (Hamilton, 1822) Of Gomti River, Lucknow, Uttar Pradesh, India.

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Abstract

Opisthorchis pedicellata (Verma, 1927) a common trematode parasite was recovered from the gallbladder of the freshwater catfish species *Rita rita* (Ham.) from Gomti riverine ecosystem of Lucknow, India. The study is focussed on the seasonal and monthly variation in helminth infection represented by parameters like prevalence % and Mean Intensities. This is assessed for the fluke *Opisthorchis pedicellata* that was recovered from the catfish *Rita rita* for two annual cycles (July 2021 to June 2023). A total of 840 *Rita rita* fish were randomly collected from local fisherman from Pipraghat of Gomti river, Lucknow. The fishes were dissected for investigating the parasitological presence of fluke *Opisthorchis pedicellata*. Presence of the fluke was recorded throughout the study period but in varying intensities and seasonal cycle of occurrence. The prevalence% ranged between 37.43% to 71.43%. In the month of August 2022, 71.43% of the total examined fishes were found infected with the fluke. The prevalence% was least during the month of December 2021 when only 37.43% of the fishes examined were found infected. The maximum mean intensity was seen in the month of July 2022 while the minimum was observed during the month of February 2022.

Keywords: Fluke, Riverine, Helminth, Gallbladder, Prevalence

Introduction:

India, ranking third amongst largest fish producing countries, contributes 8% to the global fish production and ranks second in aquaculture production. Fisheries sector being so important that it not only strengthens Indian economy but also it employs people, suffice the rich nutritional needs of the country, and builds foreign exchange earnings. The fish production in 2021-22 is 16.24 Mt including 4.12 Mt of Marine Fish production and 12.12 Mt from aquaculture. (https://pib.gov.in/).

With great economic importance catfishes are the admired ichthyofauna of wetlands with rich taste and protein content (Nimbalkar and Deolalikar 2015). *Rita rita* (Hamilton 1822), a member of the Bagridae family, having a commercial and economic significance with high nutritional value and palatability, is found inhabiting in

Indian freshwaters as well as many other Asian countries. (Gupta 2015). This fish seems to possess high export potential as it is used as ornamental fish (Gupta and Banerjee 2014). Due to loss of breeding sites and overexploitation, *Rita rita* fish is documented as low risk, near threatened in the Indian riverine system, and as critically endangered in Bangladesh. (Gupta 2015, Mishra *et al.,* 2009).

Diseases resulting from parasitic infestation in fish fauna causes major threat to aquaculture industry. The helminths like Lytocestus Cohn, (1908), Senga Dollfus (1964), Spinitectus Fourment, (1883) and Diphyllobothrium (1758) are some of the common fish parasites that effects the growth of the fisheries industry which further led to cause economic loss in Indian economy. (Soofi, *et al.,* 2016). Food-borne trematodes transmission is increasingly causing intestinal infestations in Southeast Asia and the Western Pacific. The most prevalent causes of food-borne trematodiasis are intestinal flukes (*Echinostoma spp*., *Fasciolopsis buski*, heterophyids), pulmonary flukes (*Paragonimus spp*.) and liver flukes (*Clonorchis sinensis, Fasciola spp., Opisthorchis spp*.) (Keiser and Utzinger 2005). *Opisthorchis viverrini, O. felineus,* and Clonorchis sinensis are still a major public health issues in many regions of the world, notably in Asia. (Sripa *et al.,* 2010). Small liver flukes from the family Opisthorchiidae (class Trematoda, phylum Platyhelminthes: Digenea) (Jones *et al.,* 2005) can be transmitted to fish-eating birds and mammals via raw and undercooked fish, causing pathological changes in their livers and bile ducts (Lim *et al.,* 2008; Marcos *et al.,* 2008).

Opisthorchis felineus (Rivolta, 1894), *Opisthorchis viverrini* (Poirier, 1886), and *Clonorchis sinensis* (Cobbold, 1875) are currently recognized as epidemiologically significant in the aetiology of chronic hepatobiliary disorders and are intimately connected with cholangiocarcinoma. (Beer 2005; Keiser and Utzinger 2005; Lun *et al.,* 2005; Sripa *et al.,* 2011).

Material and Methods:

Study Area: The study is based on Catfishes of Gomti river in Lucknow, Uttar Pradesh, India located at the Latitude 26° 50' 21.41" N and Longitude 80° 55' 23.27" E. River Gomti exists year-round, but the volume of water fluctuates seasonally as it overflows during monsoon (May- October) but declines in dry season (November – April)**.** The Gomti riverine ecosystem harbours a rich biodiversity of freshwater cat fishes such as *Rita rita, Mystus tengra, Heteropneustes fossilis* etc. For conducting parasitological investigation, The *Rita rita* cat fishes were collected from Pipraghat with latitude 26° 49' 58.58" N and longitude 80° 58' 6.88" E.

Fish Collection and Identification

A total of 840 *Rita rita* catfish samples were collected from local fisherman at Pipraghat of Gomti River, Lucknow over a period of 2 years from July 2021 to June 2023 covering summer, rainy, winter seasons. Fish samples were transported to parasitology laboratory for identification and parasitological investigation. Sampled fish were identified with the keys provided by Talwar and Jhingran 1991. The dissection of fishes was done by the technique of (Omeji *et al.,* 2015) to expose their alimentary canal using sharp scissors and a scalpel in order to record the helminthic infection. Incision was also made in the intestine area, liver and gallbladder and was thoroughly analysed through the microscope and binocular (Cable and Linderoth 1963). for the presence of helminth parasite. Isolated parasites were identified with the help of (Yamaguti 1963). The identified helminth parasites were counted and recorded. Thereafter the collected trematode parasites were preserved.

Prevalence %, Mean intensity, were calculated using the formulae:

i. $\text{Prevalence percentage} = \frac{\text{No.of fish host infected}}{\text{Total no.of fish host examined}} \times 100$

ii. $\text{Mean intensity} = \frac{\text{Total no of parasite}}{\text{No. of fish infested}}$

Results:

Table-1 Monthly variation in prevalence and mean intensity of *Rita rita*.

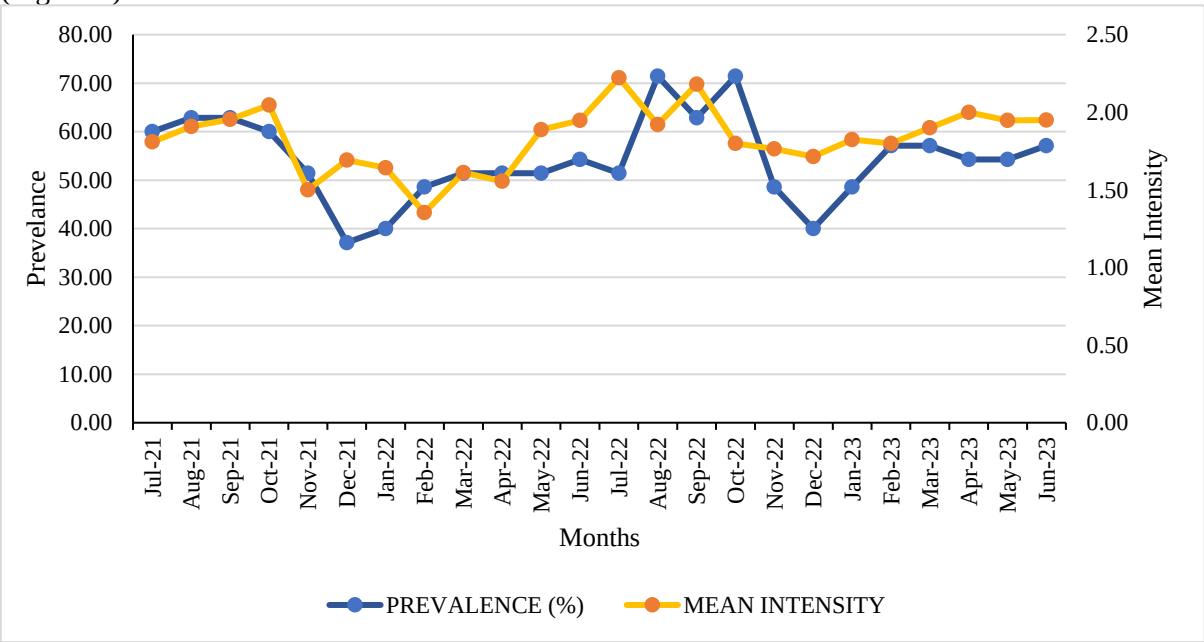
MONTH	Host Examined	Host Infected	Prevalence % of Infection	No. of Flukes Collected	Mean Intensity of Infection
Jul-2021	35	21	60.00	38	1.81
Aug-2021	35	22	62.86	42	1.91
Sep-2021	35	22	62.86	43	1.95
Oct-2021	35	21	60.00	43	2.05
Nov-2021	35	18	51.43	27	1.50
Dec-2021	35	13	37.14	22	1.69
Jan-2022	35	14	40.00	23	1.64
Feb-2022	35	17	48.57	23	1.35
Mar-2022	35	18	51.43	29	1.61
Apr-2022	35	18	51.43	28	1.56
May-2022	35	18	51.43	34	1.89
Jun-2022	35	19	54.29	37	1.95
Jul-2022	35	18	51.43	40	2.22
Aug-2022	35	25	71.43	48	1.92
Sep-2022	35	22	62.86	48	2.18
Oct-2022	35	25	71.43	45	1.80
Nov-2022	35	17	48.57	30	1.76
Dec-2022	35	14	40.00	24	1.71
Jan-2023	35	17	48.57	31	1.82
Feb-2023	35	20	57.14	36	1.80
Mar-2023	35	20	57.14	38	1.90
Apr-2023	35	19	54.29	38	2.00
May-2023	35	19	54.29	37	1.95
Jun-2023	35	20	57.14	39	1.95
Total	840	457		843	
O A P			54.40		
O M I					1.84
Mean ± Standard Deviation		19.04±3.04		35.12±7.97	1.83±0.21

(OAP: Overall prevalence, OMI: Overall mean intensity)

840 fishes were sampled and examined for parasitological presence from July 2021 to June 2023 i.e., for the duration of two years. A total of 457 fishes were found to be infected with fluke *Opisthorchis pedicellata* comprising of overall prevalence percentage and overall mean intensity to 55.40 and 1.84 respectively (Table-1).

The presence of trematode was recorded throughout two consecutive years in varying intensity. For the period of 24 months the prevalence percentage was found to vary between 37.14 to 71.43%. The maximum and minimum prevalence percentage was observed in month of October and August 2022 (71.43%) and December 2021 (37.14) respectively (Table-1). For remaining months, the prevalence percentage showed different percentages ranging from 68.57 (April 2023) to 40.00% (January and December 2022). Within the time frame of 24 months the mean intensity and prevalence percentage was almost found to exhibit almost same pattern

(Figure-1).



The maximum mean intensity was observed in the month of July 2022 (an average of 2.22 fluke per infected host). While the minimum intensity was seen in February 2022 (an average of 1.35 fluke per infected host) (Table-1). Except for the month of February 2022 and July 2022 the mean intensity variation between 1.50 to 2.18.

Figure-1 Monthly variation in Prevenance and Mean Intensity

Gender wise variation in prevalence percentage and mean intensity.

The total sample population of 840 host fishes *Rita rita* comprised of 437 male (52.02%) and 403 female (47.97%).

Table-2: Gender wise variation in prevalence percentage and mean intensity

MONTH	Host Examined		Host Infected		Prevalence % of Infection		No. of Flukes Collected		Mean Intensity of Infection	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Jul-2021	11	24	7	14	63.64	58.33	10	28	1.43	2.00
Aug-2021	17	18	9	13	52.94	72.22	16	26	1.78	2.00
Sept-2021	13	22	8	14	61.54	63.64	16	27	2.00	1.93
Oct-2021	15	20	9	12	60.00	60.00	18	25	2.00	2.08
Nov-2021	19	16	8	10	42.11	62.50	12	15	1.50	1.50
Dec-2021	11	24	7	6	63.64	25.00	14	8	2.00	1.33
Jan-2022	19	16	8	6	42.11	37.50	15	8	1.88	1.33
Feb-2022	12	23	7	10	58.33	43.48	13	10	1.86	1.00
Mar-2022	22	13	11	7	50.00	53.85	15	14	1.36	2.00
Apr-2022	25	10	12	6	48.00	60.00	13	15	1.08	2.50
May-2022	21	14	9	9	42.86	64.29	14	20	1.56	2.22
Jun-2022	23	12	12	7	52.17	58.33	19	18	1.58	2.57
Jul-2022	22	13	10	8	45.45	61.54	18	22	1.80	2.75
Aug-2022	10	25	6	19	60.00	76.00	13	35	2.17	1.84
Sep-2022	15	20	7	15	46.67	75.00	15	33	2.14	2.20
Oct-2022	13	22	9	16	69.23	72.73	16	29	1.78	1.81
Nov-2022	19	16	10	7	52.63	43.75	20	10	2.00	1.43
Dec-2022	17	18	8	6	47.06	33.33	16	8	2.00	1.33
Jan-2023	21	14	10	7	47.62	50.00	17	14	1.70	2.00
Feb-2023	20	15	12	8	60.00	53.33	19	17	1.58	2.13
Mar-2023	27	8	14	6	51.85	75.00	25	13	1.79	2.17
Apr-2023	23	12	11	8	47.83	66.67	22	16	2.00	2.00
May-2023	18	17	9	10	50.00	58.82	18	19	2.00	1.90

Jun-2023	24	11	13	7	54.17	63.64	24	15	1.85	2.14
Total	437	403	226	231			398	445		
O A P					51.72	57.32				
O M I									1.76	1.93
Mean ± Standard Deviation	18.21± 4.85	16.79± 4.85	9.42± 2.12	9.63± 3.74			16.58± 3.67	18.54± 7.97		

(OAP: Overall prevalence, OMI: Overall mean intensity)

When parasitological investigation was conducted for the sampled population; it was found that out of 437 male 226 male (51.71%) was found infected and out of 403 female 231 female (57.32%) was found infected (Table-2). From this we can conclude that females are more infected than males. In every month of two year (July 2021 to June 2023) significant different between male and female was observed in the level of infection. Prevalence was recorded maximum for the infected female population in the month of August 2022 (76.00%) and minimum in the month of December 2021 (25.00%). In reference to the infected male population the prevalence was calculated maximum in the month of October 2022 (69.23%) and minimum in the month of November 2021 and January 2022 (42.11%) (Figure-2).

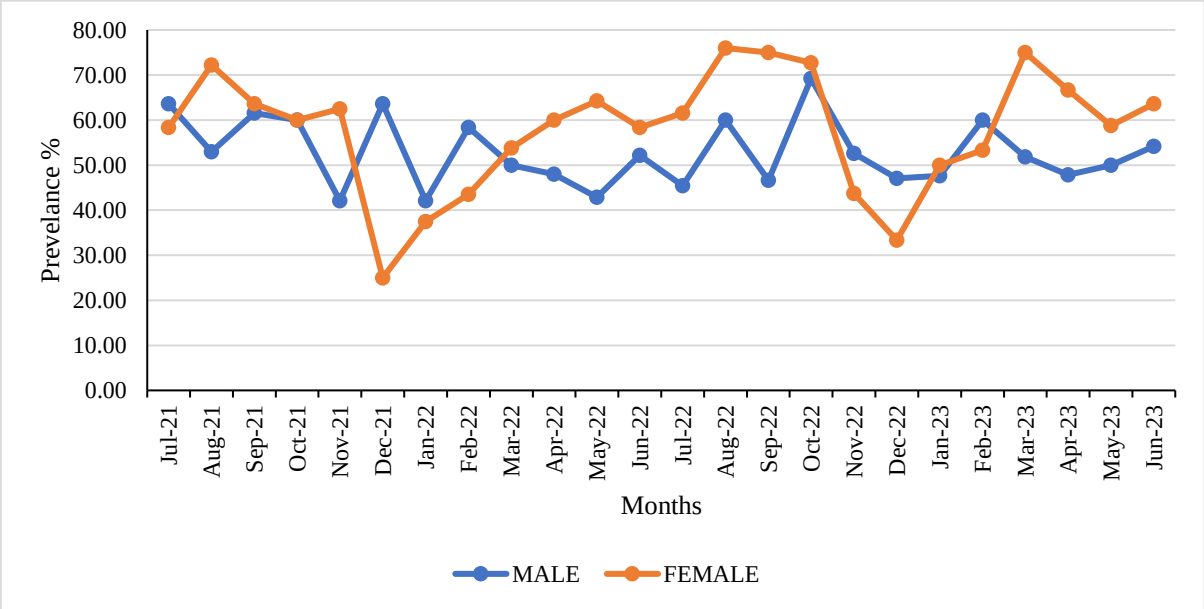


Figure-2: Gender wise variations in prevalence %

The prevalence percentage was found more in female than male in the month of August 2021 (72.22%), September 2021 (63.64%), November 2021 (62.50%), March 2022 (53.85%), April 2022 (60.00%), May 2022 (64.29%), June 2022 (58.33%), July 2022 (61.54%), August 2022 (76.00%), September 2022 (75.00%), October 2022 (72.73%), January 2023 (50.00%), March 2023 (75.00%), April 2023 (66.67%), May 2023 (58.82%) and June 2023 (63.64%) as shown in Table-2.

In the month of October 2021, the prevalence percentage of male (60.00%) and female (60.00%) is equal.

In case of infected male, the prevalence percentage was more in months of July 2021 (63.64%), December 2021 (63.64%), January 2022 (42.11), February 2022 (58.33%), November 2022 (52.63%), December 2022 (47.06%) and February 2023 (60.00%). (Table-2)

Mean intensity was recorded maximum for the infected female population in the month of July 2022 (2.75) and minimum in the month of February 2022 (1.00). In reference to the infected male population the mean intensity was calculated maximum in the month of August 2022 (2.17) and minimum in the month of April 2022 (1.08) (Figure-3).

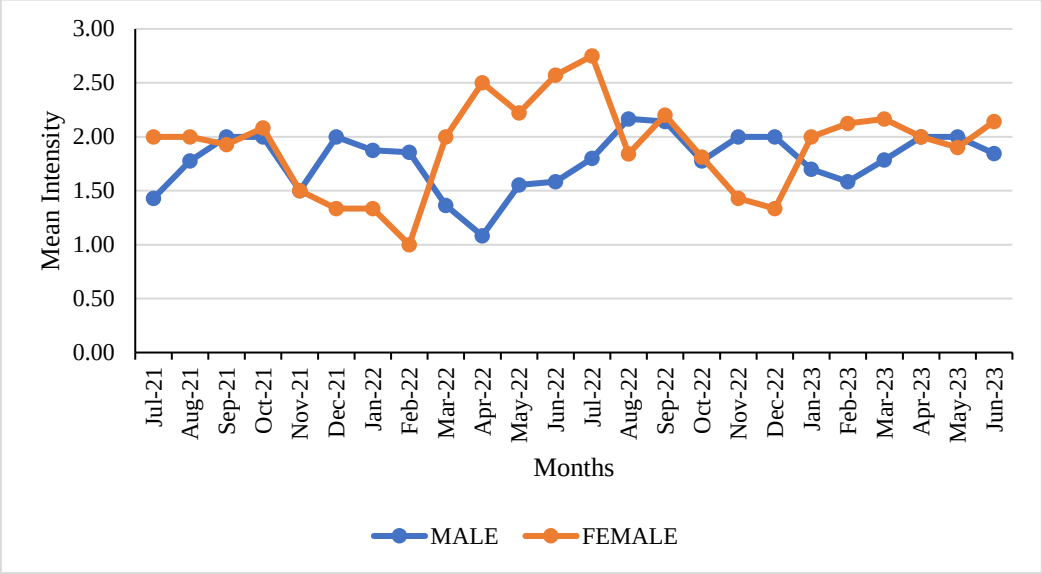


Figure-3: Gender wise variations in Mean Intensity

Season wise variation in prevalence and mean intensity:

The prevalence percentage and mean intensity of *Opisthorchis pedicellata* in summer, rainy and winter season for two year (July 2021 to June 2023) is shown in Table-3.

Table-3: Season wise variation in prevalence and mean intensity

Season	Host examined			Host infected			Parasite collected			Prevalence (%)			Mean intensity		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Rainy	56	84	140	33	53	86	60	106	166	59.53	63.55	61.43	1.80	2.00	1.93
Winter	61	79	140	30	32	62	54	41	95	51.55	42.12	44.29	1.81	1.29	1.55
Summer	91	49	140	44	29	73	61	67	128	48.26	59.12	52.14	1.40	2.32	1.75
Rainy	60	80	140	32	58	90	62	119	181	55.34	71.32	64.29	1.97	2.15	2.03
Winter	77	63	140	40	28	68	72	49	121	51.83	45.10	48.57	1.82	1.72	1.78
Summer	92	48	140	47	31	78	89	63	152	50.96	66.03	55.71	1.91	2.05	1.95

The maximum prevalence and mean intensity were observed in rainy season of two year (Figure 4,5).

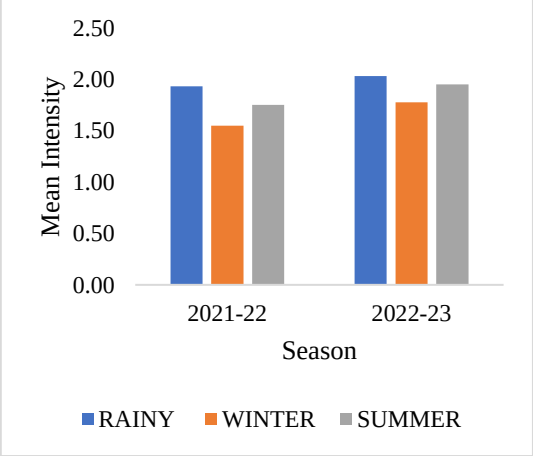


Figure-4: Season Vs Mean Intensity

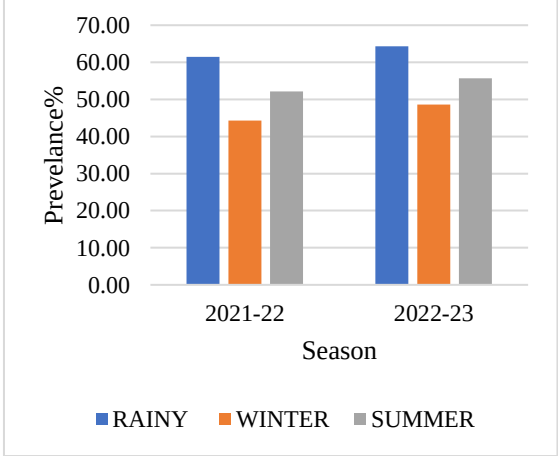


Figure-5: Season Vs Prevalence %

The prevalence percentage of female was found maximum in rainy season of (2022-23), but in case of male the prevalence percentage was found maximum in rainy season of (2021-22) (Figure-6).
For infected male and female population, the mean intensity was at the peak in rainy season (2022-2023).

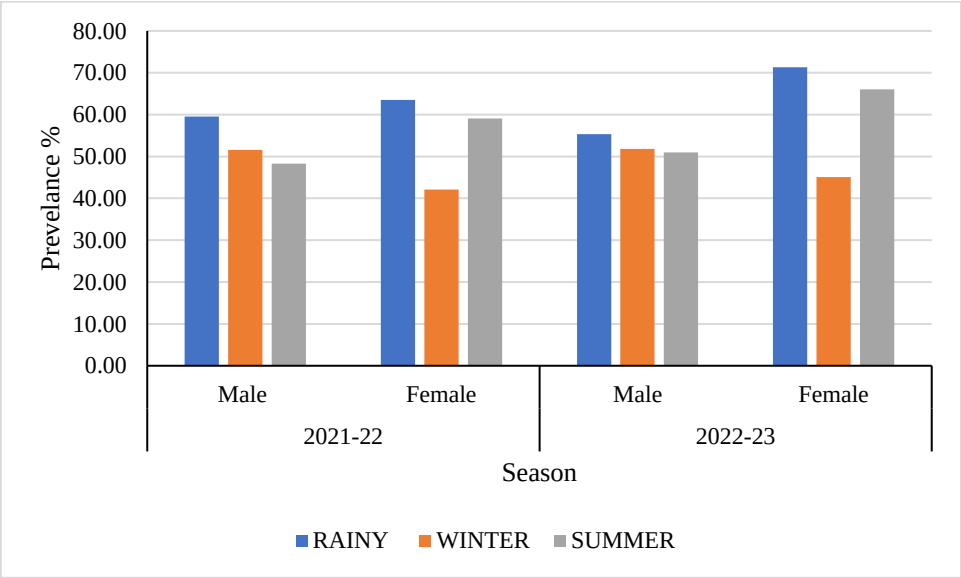


Figure-6: Gender wise seasonal variation in Prevalence %

Discussion:

A fluke, *Opisthorchis pedicellata* was recovered from the gallbladder of *Rita rita* during the course of this observation period which was also reported by Gupta (1953). As in the breeding season the female population of *Rita rita* is in physiological stress so they are more prone to parasitological infestation as comparative to males (Khanum *et al.*, 2008) this can be corborated with our study which reveals that female are showing more infection prevalence in rainy season as compared to the infected male population. Similar observations were also found by (Bibby, 1972; Watson and Dick, 1980; Thomas, 1964; Khanum, 2008). As reported by Uruku and Adikwu (2017) Variation in the frequency of interaction between the parasite's infective stage and the fish can result into the seasonal difference in prevalence % of infection (Tandon and Yadav 2010). Observations made on *Opisthorchis pedicellata* disclose that its seasonal cycle is dependent on the presence of infectious stage in intermediate hosts, which in turn is dependent on a number of physicochemical characteristics of the environment. There is a possibility that the peak invasion of *Opisthorchis pedicellata* in the month of August to October is connected to the peak invasion of snails that occurs during these months (Madhavi 1979). As reported by (Tchakonté *et al.*, 2014) the dynamics of snails revealed a seasonal pattern with peak population abundances and recruitment of new generations during the rainy season. When the snail population was at its largest, the fluke *Opisthorchis pedicellata* was transmitted to fish at a rate that was the highest overall.

Conclusion

The findings of this study indicate that morphological, physiological, and ecological factors all play a role in the prevalence and distribution of helminth parasite infection in *Rita rita*. The current study discovered that *Rita rita* suffered high levels of infection prevalence of trematode infection in the months of August 2022 and October 2022. But the mean intensity of trematode infection was recorded maximum during the month of July 2022. Seasonal variation was seen in the prevalence % and mean intensity of infected population of *Rita rita* fish. Host fish *Rita rita*, infected with *Opisthorchis pedicellata* shows maximum prevalence and mean intensity in rainy season during the period of study.

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