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"Ecological Dynamics Of Trematode Parasitism In Freshwater Fish Channa Spp. From The River 'Rapti' Uttar Pradesh, India"

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Abstract

The present study investigated the ecological dynamics of trematode parasitism in freshwater fish *Channa* spp. From the river Rapti, Uttar Pradesh, India, during January-December 2025. Monthly and seasonal sampling was conducted to assess variations in infection parameters in relation to environmental and water quality factors. Fish hosts were analyzed for trematode parasites, and ecological indices for instance, prevalence, average intensity, relative density, abundance, dominant percentage, and infestation index calculation were performed. The results revealed pronounced monthly and seasonal reflection in trematode infection, with peak prevalence and parasite load recorded during late summer and early monsoon months, while the lowest values were noted during winter. Seasonal analysis indicated highest infection spring and summer, suggesting favorable environmental conditions for the transmission of parasites during warmer periods. Physico-chemical and microbiological parameters of water showed noticeable variation across months, which appeared to influence parasite prevalence and host susceptibility. Pearson correlation analysis demonstrated strongly significant positive correlation between the number of infected hosts and major infection indices. Overall, the findings highlighted the strong influence of seasonal and environmental factors on trematode parasitism in *Channa spp.,* emphasizing the ecological sensitivity of host-parasite interactions in freshwater ecosystems.

Keywords- Trematode parasites, *Channa spp.,* Prevalence, Seasonal variation, Ecological indices and River Rapti.

Introduction

Freshwater fish serve as important intermediate and definitive hosts for a wide variety of trematode parasites, which play an important part in aquatic ecosystem. Trematode infections not only affect fish health and population dynamics but also serve as indicators of environmental quality and ecological stability. The distribution and abundance of these parasites are strongly influenced by biotic and abiotic factors such as temperature, humidity, water quality, host availability, and seasonal changes. In tropical and subtropical regions like India, seasonal fluctuations in climate conditions exert a considerable impact on parasite life cycle and transmission dynamics. Freshwater fish of the genus Channa are widely distributed in Indian rivers and are of ecological and economic importance. Due to their predatory nature and wide habitat range, *Channa spp.* is particularly suitable for studying parasite ecology.

The river Rapti, a major tributary in eastern Uttar Pradesh, experiences marked seasonal variation in temperature, rainfall, and anthropogenic influences, which may affect parasite diversity and infection patterns. However, systematic ecological studies on trematode parasitism in *Channa* spp. from this river system have remained limited.

Therefore, the current research was conducted to analyse the ecological dynamics of trematode infections in *Channa* spp. by examining monthly and seasonal variation in infection indices and assessing their connection to the environment and water quality parameters.

Methodology

Collection of Host and Parasites

Fish were gathered from nearby fisheries market and **river 'Rapti' Uttar Pradesh, India** (North, Lat. 26.766° and East Long 83.368°, North, Lat. 27°.220° and East Long 82.517° & North Lat. 27.213° and East Long 82.653°), monthly and seasonally at the river side with the help of fisherman. Fishes were transported to laboratory in live condition. 'Fishes of UP and Bihar' (Gopal Ji Srivastava) and 'Fish and Fisheries of India' (V.G. Jhingran) were used to identify the hosts. Following dissection, the fish's heart, gills, kidney, gall bladder, and alimentary canal were placed in physiological saline (0.89%), organs from fish that have been isolated are carefully examined for trematodes.

Digenetic trematodes were isolated normal saline (0.89%) and fixed in **A. F. A.** (50% Alcohol, Formaldehyde and Glacial Acetic Acid **100:6:2.5**) fixative for a full day before being stored in 70% alcohol more than 24 hours for further study and counted one by one. Following fixation, parasites were restored to normal by rehydrating alcohols in decreasing grades (70%, 50%, and 30%) before being rinsed into the water. Dyed with aqueous aceto-alum carmine, and differentiated with the help of acid water. The parasites were then dehydrated in ascending grades of alcohol (30%, 50%, 70%, 90%, and 100%). Following xylene clearance, dehydrated parasites were mounted in DPX. Camera Lucida, which is connected to an Olympus CX-23 phase contrast microscope, was used to draw the diagram. Oculometers were used to take all measurements, which were in millimetres (mm). The parasites were recognised by applying standard morphological standards (Key to the Trematode, Yamaguti, 1935; Bray and Gibson, 1990; Bray, 1991; Bray and Cribb, 1997; Bray, 2004; Madhvi and Bray, 2018).

Ecological Indices

Prevalence, mean intensity, relative density, dominant percentage, abundance and infestation index value were all used while analysing the data. Morgolis et al. (1982) developed the parameters listed above.

$$\text{Prevalence} = \frac{\text{Total No. of Infected Hosts}}{\text{Total No. of Hosts Examined}} \text{ X } 100$$

$$\text{Mean Intensity} = \frac{\text{Total No. of Infected Hosts}}{\text{Total No. of Examined Hosts}}$$

$$\text{Relative Density} = \frac{\text{Total No. of Trematode Parasites}}{\text{Total No. of Infected Hosts}}$$

$$\text{Infestation Index Value} = \frac{\text{AXB}}{\text{C}^2}$$

A= Number of Parasites, B= Number of Infected Hosts, C= Number of Examined Hosts

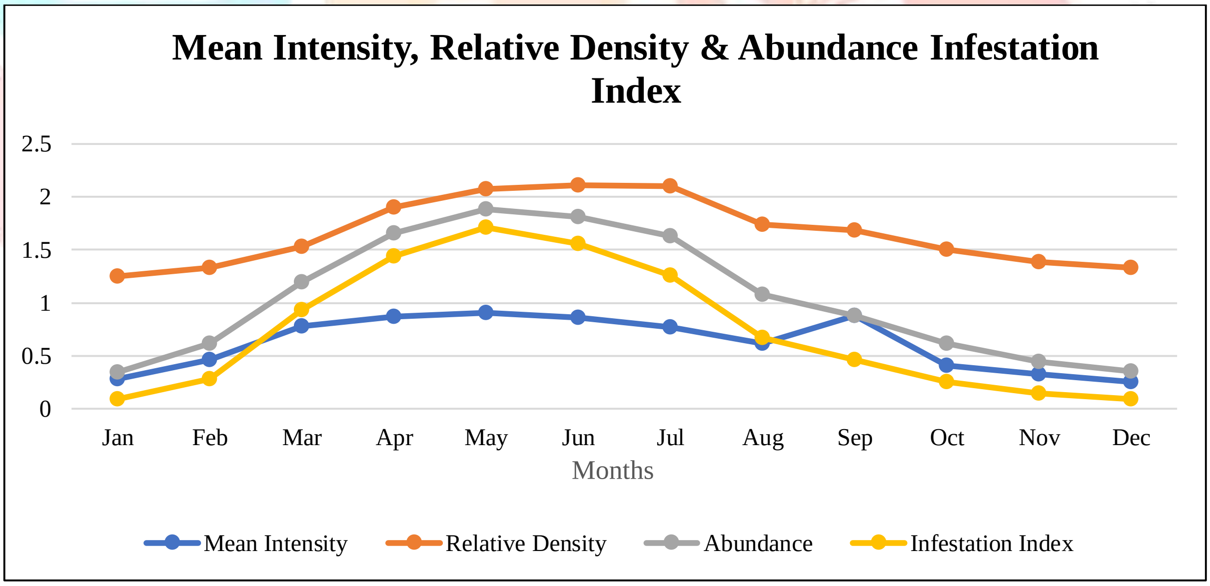
$$\text{Dominant \%} = \frac{\text{Worm Burden Monthly}}{\text{Worm Burden Annually}} \text{ X } 100$$

$$\text{Abundance} = \frac{\text{Total No. of Parasites}}{\text{Total No. of Examined Hosts}}$$

Results and Discussion

Table: 1- Monthly Variation in Trematode Infection Indices in Freshwater Fish *Channa spp.* (January-December 2025)

Month / Year	Examined Hosts	Infected Hosts	Prevalence	No. of Trematode Obtained	Mean Intensity	Relative Density	Abundance	Dominant %	Infestation Index
Jan-25	43	12	27.906	15	.279	1.25	.348	2.929	0.097
Feb-25	39	18	46.153	24	.461	1.33	.615	4.687	0.284
Mar-25	41	32	78.048	49	.780	1.53	1.195	9.570	.932
Apr-25	38	33	86.842	63	.868	1.90	1.657	12.304	1.439
May-25	44	40	90.90	83	.909	2.075	1.886	16.210	1.714
Jun-25	43	37	86.046	78	.860	2.108	1.813	15.234	1.560
Jul-25	40	31	77.5	65	.775	2.096	1.625	12.695	1.259
Aug-25	37	23	62.162	40	.621	1.739	1.081	7.812	0.672
Sep-25	42	22	52.380	37	.880	1.681	.880	7.226	0.461
Oct-25	39	16	41.025	24	.410	1.5	.615	4.687	0.252
Nov-25	40	13	32.5	18	.325	1.384	.45	3.515	0.146
Dec-25	45	12	26.66	16	.260	1.33	.355	3.125	0.094



Graph: 1- Monthly Variation in Trematode Infection Mean Intensity, Relative Density & Abundance Infestation Index in Freshwater Fish *Channa spp.* (January-December 2025)

Table: 2- Seasonal Variation in Trematode Infection in Freshwater Fish *Channa spp.*

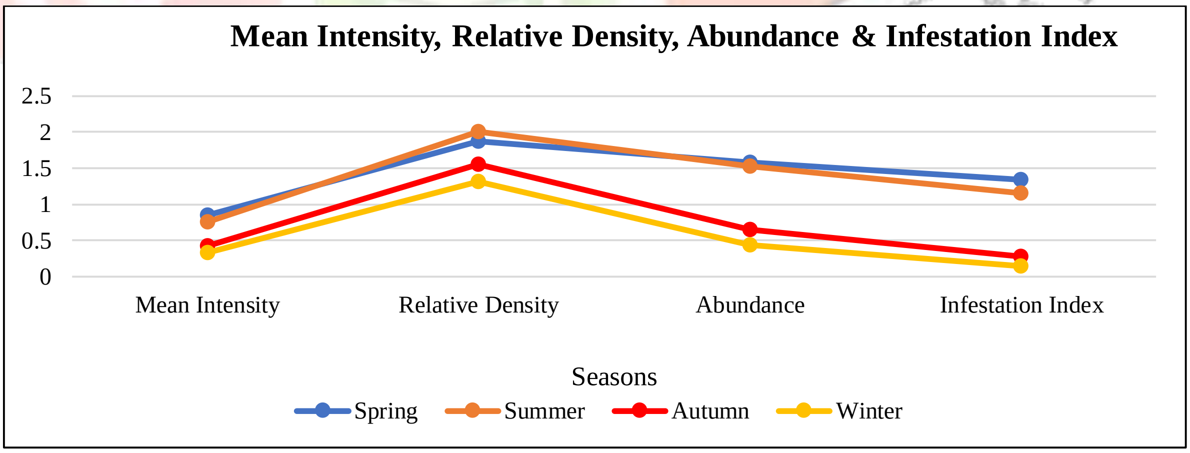
Seasons	Examined Hosts	Infected Hosts	Prevalence	No. of Trematodes	Mean Intensity	Relative Density	Dominant %	Abundance	Infestation Index
Spring	123	104	84.55	195	.845	1.875	38.085	1.585	1.340
Summer	120	91	75.83	183	.758	2.010	35.742	1.525	1.156
Autumn	121	51	42.14	79	.421	1.549	15.429	0.652	.275
Winter	127	42	33.07	55	.330	1.309	10.742	0.433	0.143

Table: 2- The table showed seasonal variation in trematode infection parameters among freshwater fish hosts. A total of 491 hosts were examined across four seasons, with marked differences observed in infection levels. The peak occurrence of infection was noted in spring (84.55%), followed by summer (75.83%), indicating that warmer seasons supported higher rates of trematode infestation. These seasons also showed elevated values of mean intensity, relative density, abundance, and infestation index, reflecting favourable conditions for parasite survival and transmission.

Spring recorded the maximum number of trematodes (195) and the highest abundance (1.585), infestation index (1.340), and dominant percentage (38.09%), suggesting peak parasite activity during this season. Summer showed comparable trends, with high relative density (2.010) and substantial abundance (1.525), although slightly lower than spring.

In contrast, autumn and winter exhibited a pronounced decline in all infection parameters. Prevalence dropped to 42.14% in autumn and further to 33.07% in winter, accompanied by reduced mean intensity, relative density, abundance, and infestation index. Winter showed the lowest values for all parasitological indices, indicating minimal parasite transmission under cooler environmental conditions.

Overall, the results demonstrated a strong seasonal influence on trematode infestation, with spring and summer emerging as the most favourable periods for infection, while autumn and winter represented comparatively unfavourable conditions for trematode proliferation in freshwater fish hosts.



Graph: 2- Seasonal Variation in Trematode Infection Mean Intensity, Relative Density, Abundance & Infestation Index in Freshwater Fish *Channa spp.*

Table: 3- Monthly Variation in Environmental Parameters and Infection Indices of Trematode Parasites in Freshwater Fish *Channa spp.* (January – December 2025)

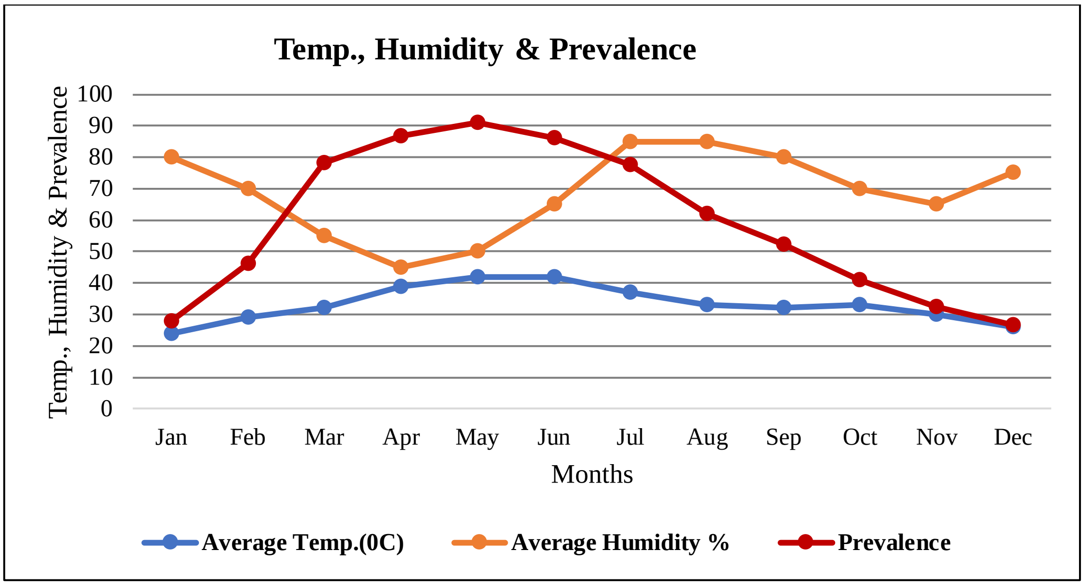
Months/Year	Average Temp.(^{0}C)	Average Humidity %	Prevalence	Mean Intensity	Relative Density	Abundance
Jan-25	24	80	27.906	.279	1.25	.348
Feb-25	29	70	46.153	.461	1.33	.615
Mar-25	32	55	78.048	.780	1.53	1.195
Apr-25	39	45	86.842	.868	1.90	1.657
May-25	42	50	90.90	.909	2.075	1.886
Jun-25	42	65	86.046	.860	2.108	1.813
July-25	37	85	77.5	.775	2.096	1.625
Aug-25	33	85	62.162	.621	1.739	1.081
Sep-25	32	80	52.380	.880	1.681	.880
Oct-25	33	70	41.025	.410	1.5	.615
Nov-25	30	65	32.5	.325	1.384	.45
Dec-25	26	75	26.66	.26	1.33	.355

Table: 3- The table presented monthly changes in average temperature and humidity concerning trematode infection parameters - prevalence, mean intensity, relative density, and abundance - during the study period from January to December 2025. A clear seasonal pattern was evident. Lower temperatures and higher humidity during the winter months (December–January) were linked to a lower prevalence (26.66–27.91%), mean intensity (0.26–0.28), relative density (1.25–1.33), and abundance (0.35–0.36), indicating minimal parasite transmission under cooler conditions.

As temperature increased from February onward, all infection indices increased consistently, attaining maximum values during the late summer and early monsoon months. Maximum prevalence (90.90%), mean intensity (0.909), relative density (2.075), and abundance (1.886) were recorded during May–June, coinciding with higher temperatures (42 °C) and moderate humidity. These observations suggested that warmer conditions fevered parasite development, transmission, and host–parasite interactions.

During the monsoon period (July–August), although temperature slightly declined, high humidity supported sustained infection levels, as reflected by relatively high prevalence and abundance. From September onward, a gradual decline in all parasitological indices was noted that the temperature was decreasing and humidity, indicating reduced transmission efficiency.

Overall, the data demonstrated a strong influence of seasonal environmental factors—particularly temperature and humidity—on the dynamics of trematode infections in freshwater fish, highlighting summer and early monsoon as critical periods for parasite proliferation



Graph: 3- Monthly Variation in Environmental Parameters and Prevalence of Trematode Parasites in Freshwater Fish *Channa spp.* (January – December 2025)

Table: 4- Monthly Variation in Physico-chemical and Microbiological Water Quality Parameters (January-December 2025)

Month / Year	pH	DO(mg/l)	BOD(mg/l)	COD(mg/l)	Total Coliform (MPN/100ml)	Faecal Coliform (MPN/100ml)
Jan-25	7.88	8.0	2.4	10.0	18000	10000
Feb-25	7.76	8.2	2.2	8.0	16000	9000
Mar-25	7.78	8.0	2.3	10.0	18000	10000
Apr-25	7.72	7.9	2.4	10.0	16000	9000
May-25	7.72	7.8	2.6	10.0	18000	9000
Jun-25	7.8	7.6	2.8	12.0	20000	10000
Jul-25	7.82	8.0	2.6	10.0	18000	8000
Aug-25	7.86	8.2	2.4	10.0	16000	6000
Sep-25	7.62	7.6	3.0	16.0	20000	8000
Oct-25	7.58	7.5	3.2	18.0	22000	10000
Nov-25	7.62	7.6	3.4	22.0	24000	12000
Dec-25	7.56	7.8	3.0	18.0	22000	10000

The table showed month-wise variation in physico-chemical and microbiological parameters of water throughout the research duration from January to December 2025. The pH levels remained slightly alkaline throughout the year, ranging from 7.56 to 7.88, indicating relatively stable buffering conditions in the aquatic environment. Dissolved oxygen (DO) levels varied between 7.5 and 8.2 mg/l, with elevated values documented during winter and post-monsoon months, reflecting comparatively better oxygenation of the water.

Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) exhibited noticeable seasonal fluctuations. Lower BOD (2.2–2.4 mg/l) and COD (8–10 mg/l) data was collected throughout the winter and early summer months, whereas higher BOD (3.0–3.4 mg/l) and COD (16–22 mg/l) values were observed from September to November. This increase indicated enhanced organic load reduced water quality during the late monsoon and post-monsoon periods.

Microbiological parameters also showed marked temporal variation. The count of total coliforms varied from 16,000 to 24,000 MPN/100 ml, while the counts of faecal coliforms varied between 6,000 and 12,000 MPN/100 ml. Higher coliform densities were recorded during the post-monsoon and winter months, particularly in October and November, suggesting increased faecal contamination and surface runoff inputs during these periods.

Overall, the findings suggested that parameters of water quality varied considerably across months, with deterioration in organic and microbial load during the monsoon and post-monsoon seasons. These changes were likely to influence aquatic health and may have contributed to seasonal variations in parasite prevalence and host susceptibility in the studied freshwater ecosystem.

Table: 5- Descriptive Statistical Summary of Trematode Infection Parameters in Freshwater Fish Channa spp.

Parameters	Infected Hosts	Prevalence	Mean Intensity	Relative Density	Dominant %	Abundance	Infestation Index Value
Mean	24.08	59.01	0.619	1.660	8.333	1.043	0.743
Median	22.50	57.27	0.698	1.606	7.519	0.981	0.567
Variance	102.99	589.66	0.066	0.103	23.060	0.340	0.353
SD	10.15	24.28	0.256	0.321	4.802	0.583	0.594
SE	2.93	7.01	0.074	0.093	1.386	0.168	0.171

Table: 5- The table summarized the descriptive statistical parameters of trematode infection indices recorded throughout the duration of the study period. The mean number of infected hosts was 24.08, with a median value of 22.50, indicating a relatively symmetrical distribution of infection among the examined the samples. Prevalence showed a mean value of 59.01% and a median of 57.27%, suggesting moderate to high levels of trematode infection within the host population.

Mean intensity exhibited an average value of 0.619, while the median value was marginally elevated (0.698), indicating minor variability in parasite burden among infected hosts. Relative density showed a mean of 1.660 with a median of 1.606, reflecting consistent parasite distribution across the sampled population. Dominant percentage recorded a mean of 8.33% , suggesting that a limited proportion of hosts contributed disproportionately to the overall parasite load.

Measures of dispersion revealed notable variability in several parameters. Variance and values of standard deviation were comparatively high for prevalence (variance = 589.66, SD = 24.28) and infected hosts (variance = 102.99, SD = 10.15), indicating considerable fluctuations in infection level over the study period. Abundance showed a mean value of 1.043 with moderate variability (SD = 0.583), while the infestation index had a mean of 0.743 and a SD of 0.594, reflecting variation in overall infecting severity.

Standard error values throughout all parameters indicated acceptable precision approximately means. Overall, the descriptive statistics demonstrated moderate to high infection levels with noticeable temporal variability, highlighting the dynamic nature of trematode infestation in freshwater fish hosts during the study period.

Table: 6- Pearson Correlation Analysis Between Infected *Channa spp.* and Trematode Infection Parameters

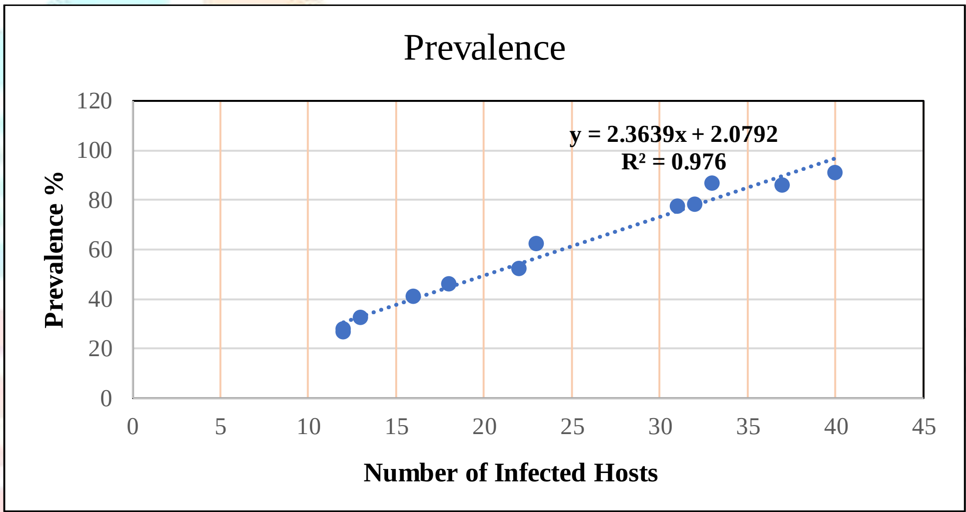
Variables Compared	Pearson Correlation Coefficient (r)	Significance Testing	Statistical Significance
Infected Hosts v/s Prevalence (%)	r ≈ 0.97	p < 0.001	Highly significant
Infected Hosts v/s Mean Intensity	r ≈ 0.91	p < 0.001	Highly significant
Infected Hosts v/s Relative Density	r ≈ 0.885	p < 0.001	Highly significant
Infected Hosts v/s Dominant (%)	r ≈ 0.998	p < 0.001	Highly significant
Infected Hosts v/s Abundance	r ≈ 0.986	p < 0.001	Highly significant

Table: 6- The table presented the results of Pearson correlation analysis between the number of infected hosts and various trematode infection parameters. A significant positive correlation was noted between infected hosts and their prevalence ($r \approx 0.97$), indicating that increases in the quantity of infected hosts was strongly linked to increased prevalence rates. This correlation was determined to be highly significant ($p < 0.001$).

Similarly, infected hosts showed a robust positive correlation with average intensity ($r \approx 0.91$) and relative density ($r \approx 0.885$), both of which were statistically highly significant ($p < 0.001$). These results indicated that as the number of infected hosts increased, the parasite burden per host and the overall parasite density also increased correspondingly.

The strongest correlation was recorded between infected hosts and dominant percentage ($r \approx 0.998$), suggesting an almost perfect a favorable correlation between these variables. Infected hosts also exhibited a highly significant positive correlation with abundance ($r \approx 0.986$), further emphasizing the close relationship between host infection levels and overall parasite abundance. Both correlations were highly significant at $p < 0.001$.

Overall, the analysis demonstrated that the number of infected hosts was strongly and significantly associated with all major trematode infection parameters, highlighting the interdependence of host infection levels and parasite population dynamics in the studied freshwater ecosystem



Graph: 4- Relationship Between Number of Infected Hosts (*Channa spp.*) and Prevalence of Trematode Infection

Graph: 4- The graph illustrated the relationship between the number of infected hosts and the prevalence (%) of trematode infection. A strong positive linear relationship was noted between the two variables, as evidenced by the fitted regression line. Prevalence increased consistently with a growth in the quantity of infected hosts, indicating that higher host infection counts were directly associated with greater prevalence levels.

The regression equation ($y = 2.3639x + 2.0792$) indicated that for each unit growth in the quantity of infected hosts, prevalence increased by approximately 2.36%. The coefficient of determination ($R^2 = 0.976$) showed that about 97.6% of the variation in prevalence was explained by changes in the number of infected hosts, reflecting an excellent model fit.

Overall, the results demonstrated a highly significant and strong positive association between infected hosts and prevalence, confirming that host infection intensity played a significant part in determining the prevalence of trematode parasites present in the examined fish population.

Discussion

The present investigation revealed significant monthly and seasonal variation in trematode infection among *Channa* spp. inhabiting the river Rapti. Monthly analysis showed that infection parameters such as frequency, average intensity, comparative density, abundance, dominant percentage, and infestation index gradually increased from winter to summer months, reaching peak values during May and June, and subsequently declined towards winter.

The highest prevalence (90.90%) and parasite abundance were recorded during May, which coincided with elevated temperature and moderate humidity. These conditions were considered favourable for trematode development, survival of larval stages, and enhanced transmission between intermediate and definitive hosts. Similar seasonal peaks in trematode infection during warmer months have been reported by earlier workers, who attributed this trend to accelerated parasite metabolism and increased host activity.

Seasonal analysis further supported these findings, as spring and summer exhibited significantly higher infection levels compared to autumn and winter. Spring recorded the maximum number of trematodes and the highest infestation index, suggesting peak parasite activity during this season. In contrast, winter showed the lowest prevalence and infection indices, indicating reduced parasite transmission under cooler environmental conditions.

Environmental parameters such as temperature and humidity exhibited a strong relationship with infection indices. Increasing temperature from February onward was associated with a steady rise in prevalence, mean intensity and abundance. During the monsoon period, high humidity appeared to sustain relatively elevated infection levels despite a slight decline in temperature. Physico-chemical and microbiological analysis of water revealed increased BOD, COD and coliform counts during monsoon and post-monsoon months, indicating organic enrichment and environmental stress, which may have enhanced host susceptibility to parasitic infection.

Statistical analysis further confirmed these observations. Pearson correlation analysis demonstrated highly significant positive correlations between the number of infected hosts and all major infection parameters, particularly prevalence, dominant percentage, and abundance. The strong regression relationship between infected hosts and prevalence ($R^2 = 0.976$) indicated that host infection intensity played a critical role in determining overall parasite prevalence.

Overall, the findings emphasized that trematode infection dynamics in *Channa* spp. were governed by a complex interaction of seasonal, environmental, and host-related factors.

Conclusion

The present study concluded that trematode parasitism in freshwater fish Channa spp. From the river Rapti exhibited pronounced monthly and seasonal variation. Infection levels were highest during spring and summer, particularly in late summer and early monsoon months, while winter represented a period of minimal parasite transmission. Environmental factors such as temperature, humidity, and water quality parameters played a decisive role in shaping parasite prevalence and intensity.

The strong positive correlation observed between infected hosts and major infection indices underscored the interdependence between host population dynamics and parasite abundance. Deterioration in water quality during monsoon and post-monsoon periods appeared to further influence host susceptibility and parasite proliferation.

Overall, the study highlighted the ecological sensitivity of trematode-host interactions and emphasized the importance of seasonal and environmental monitoring in freshwater ecosystem. The finding contributed valuable baseline information on trematode ecology in Channa spp. and may assist in future studies related to fish health, parasite biodiversity, and aquatic ecosystem management.

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REFERENCES

1. Nitesh Kumar Mehta and Arti Kumari (2024), Seasonal Variation in the Infestation of Helminth Parasites in Indian Major Carps, Darbhanga, India. Uttar Pradesh Journal of Zoology. Vol.45, Issue 19, Page 142-147, 2024; Article no. UPJON>4088, ISSN:0256-971X(P).
2. Anam Sahreen and Mohammad Saifullah (2024), Epidemiological studies of Isoparorchis hypselobagri (Digenea: Trematoda) infecting freshwater catfish Wallago attu in the Aligrah region of Uttar Pradesh, India. Journal of Parasitic Diseases. DOI: 10.1007/s12639-024-01702-1.
3. Ankita Dey and Chirnjeeb Dey (2023), Seasonal Variation of Acanthocephala Infecting Snake Headed Fish in Hooghly District of West Bengal, India. Cutting Edge Research in Biology Vol. 9, DOI:10.9734/bpi/cerb/v9/6677A
4. Santi Ranjan Dey and Biplab Bhowmik (2023), Freshwater fish parasite diversity in West Bengal – A review. Ecology Environmental and Conservation, DOI: 10.53550/eec.2023.v29i01.026.
5. Olagbemide, P.T. and Owolabi (2022), Prevalence, intensity and influence of size and season of Oreochromis niloticus in Ekiti State dams, southwest, Nigeria. ABUAD INTERNATIONAL JOURNAL OF NATURAL AND APPLIED SCIENCES, ISSN: 2955-1021, Vol 2, Issue 2, pp 123-131.
6. Gopal Ji Kushwaha, Shivendra Mohan Pandey and Pradip Kumar (2021), Seasonal Variation in Water Quality: A Study with Reference to River Kuwano, Basti, (U.P.), India. Applied Ecology and Environmental Sciences. 9(11), 976-982. DOI: 10.12691/aees-9-119.
7. Melba G. Bondad-Reantaso (2021), FAO Fisheries and Aquaculture Report NFIA/R13(En). DOI:10.4060/cb2612en, ISSN 2070-6987 (print), ISSN 2707-546X (online), ISBN 978-92-5-133789-9.
8. Singh Prashant, Dev Brat Mishra, Dubey Jk and Hridaya Shankar Singh (2019), Ecological effect of parameters with digenetic trematode parasites in fresh water fish. International Journal of Zoology Studies, ISSN:2455-7269, Vol. 4, Page No. 01-04.
9. William G. McDowell and Ronaldo Sousa (2019), Mass Mortality Events of Invasive Freshwater Bialves: Current Understanding and Potential Direction for Future Research. Frontiers in Ecology and Evolution, DOI: 10.3389/fevo.2019.00331. Vol. 7.
10. Pooja Vishwakarma, Ramakant Maurya and A.M. Saxena (2018), Ecology of Digenetic Trematode Parasites of Fresh Water Fish Heteropneustes fossilis (Bloch, 1794) from River Gomti, Lucknow (Uttar Pradesh). Trends in Biosciences 11(3), Print: ISSN 0974-8431, 320-322.
11. N. KUMARI GAUTAM, P. KUMAR MISHRA and A. MURARI SAXENA (2018), Seasonal variation in helminth parasites of snakeheads Channa punctatus and Channa striatus (Perciformes: Channidae) in Uttar Pradesh, India. HELMINTHOLOGIA, 55, 230 – 239, DOI:10.2478/helm-2018-0020.
12. Abba, A.M., Mudassir, I., Abdulhamid, Y., Omenesa,R.L. Udoh and E.J. (2017), Seasonal Prevalence of Heliminth Parasites of Fishes and Relation with Water Quality Parameters in Ajiwa Reservoir, Katsina State, Nigeria. Allied Academies Journals, Allied Academies-18-844R1.
13. SATISH CHANDRA, NEELAM YADAV And A.M. SAXENA (2016), AN ECOLOGICAL ASPECT ON DIGENETIC TREMATODE PARASITE OF FRESH WATER FISHES FROM UTTAR PRADESH (INDIA). International Journal of Applied and Natural Sciences (IJANS), Natural Sciences (IJANS) ISSN(P): 2319-4014; ISSN(E): 2319-4022 Vol. 5, Issue 4, Page no. 93-102.

14. Malang Kawe Simon, Godspower Richard Okoh and Balarabe Rabiu Mohammed (2016), Prevalence of gastrointestinal helminth parasites of Clarias gariepinus in Abuja, Nigeria. Sokoto Journal of Veterinary Sciences, DOI:10.4314/sokjvs.v14i2.4.
15. Ivy Kundu, Probir Kumar, Bandyopadhyay and Dipak Ranjan Mandal (2015), Prevalence of heliminth parasites infecting Channa punctatus Bloch, 1793 from Nadia District of West Bengal, India. DOI:10.9790/2380-0884146.
16. Tawewan Tansatit, Prasert Sobhon, Somphong Sahaphong and Panpanga Sangsuriya (2014), Prevalence and Histopathology of Trichogaster Pectoralis Harbouring Metacercaria of Clinostomum piscidium (Southwell and Prashad, 1918) in Central Thailand. The Thai veterinary medicine 44(2):223-230, DOI: 10.56808/2985-1130.2564.
17. Krishna Singh and Abha Mishra (2013), A comparative study on seasonal distribution of the helminth communities of some catfishes. International Journal of Pharma and Bio Sciences 4(3).
18. Tariq Ahmed Raja and Ibraq (2013), Parasitic distribution in relation to gender, season and length of fish hosts in Shallabugh wetland. International Journal of Scientific and Engineering Reasearch 4(4):1083-1089.
19. M.M. Alam, M.A. Khan, Muhammad Afzal Hussain and Moumita De (2012), Intensity of parasitic infestation in silver carp, Hypophthalmichthys molitrix. Journal of Zhejiang University SCIENCE B13(12):1024-8, DOI: 10.1631/jzus B1200121.
20. Clement Lagrue, D W Kelly, Andy Hicks and R Poulin (2011), Factors influencing infection patterns of trophically transmitted parasites among a fish community: Host diet, host-parasite compatibility or both. 79(2):466-85, DOI:10.1111/j.1095-8649.2011.03041.x
21. Hamida Khanum, Salma Begum and Aleya Begum (2011), Seasonal prevalence, intensity and organal distribution of Helminth parasites in macrognathus aculeatus. Dhaka University of Journal of Biological Sciences 20(2), DOI: 10.3329/dujbsv20i2.8971.
22. Ryan Hechinger, Kevin Lafferty, Todd C Huspeni, Andrew J Brooks and Armand Kuris (2007), Can parasites be indicators of free-living diversity? Relationship between species richness and the abundance of larval trematodes and of local benthos and fishes. Oecologia 151(1):82-92, DOI:10.1007/s00442-006-0568-z.
23. Tom Cribb (1997), uide to the parasites of fishes of Canada. Part IV. Trematoda: D. I. Gibson (Edited by L. Margolis & Z. Kabata). Canadian Special Publication of Fisheries and Aquatic Sciences 124, Ottawa (1996). 373 pp. US$42.95. ISBN 0-660-16403-5. International Journal for Parasitology 27(9):1115
24. Kevin Lafferty, Albert O., Allen W. Shostak and Jeffrey M. Lotz (1997), Parasitology Meets Ecology on Its Own Terms: Margolis et al.Revisited. Journal of Parasitology. DOI: 10.2307/3284227.
25. L.Margolis, G.W. Esch, J.C. Holmes, A.M. Kuris and G.A. Schad (1982), The Use of Ecological Terms in Parasitology (Report of an Ad Hoc Committee of the American Society of Parasitologists). The Journal of Parasitology, Vol.68, No.1, pp. 131-133.