Study of Various Ecological Aspects on Digenetic Trematode Parasites in Important Food Fish *Rita rita* (Ham.) from Lucknow (India)

Shilpi Yadav¹, Satish Chandra² and A. M. Saxena³

¹Department of Zoology, University of Lucknow, Lucknow, U.P., INDIA
²Department of Zoology, University of Lucknow, Lucknow, U.P., INDIA
³Department of Zoology, University of Lucknow, Lucknow, U.P., INDIA

¹Corresponding Author: shilpi2028@gmail.com

**ABSTRACT**

Fish fauna is an important component of fresh water ecosystem and considered as gold of water due to their high nutritional and economical value. However, high water pollution and disruption in water ecosystem causes parasite infections in fishes. Fishes bear heaviest burden of helminth parasites because these parasites use the fish for their shelter and food. Digeneans trematodes are an important group of parasites which complete their life cycles in vertebrate and invertebrate host. Since, fishes are the important constituent of human food, these parasites readily passed to the human and causes various diseases. Therefore, it is very important to study the impact of various seasonal variations such as temperature, relative humidity and time-period on prevalence, mean intensity and relative density of trematode parasites infection in fishes. In this paper, we have systematically studied all these seasonal variations on the trematode parasites infection in common food fish *Rita rita* (Ham.) from January, 2009 to December, 2009 in Lucknow region of Uttar Pradesh. Our results suggest that the highest prevalence, mean intensity and relative density of trematode parasites infection occurred in summer season followed by rainy and winter season.

**Keywords** - Helminth parasites, Digenean trematode, Seasonal variations, *Rita rita* (Ham.)

**I. INTRODUCTION**

Consumption of infected fishes are very potent source of helminth infection to humans as fishes are an important component of human food. Helminth infection affects the health of fishes and causes deterioration in the food value. These infections also adversely affect the human health and causes retardation of growth in children, abnormal metabolic activities and even death. Health of any population depends on the control of disease and maintenance of a healthy relationship between living creatures and their environment[1]. However, five factors directly influence the parasite fauna of fishes like age, diet, abundance of fishes, independent number of a parasite within the fish and season[2]. Control and therapeutics of any parasitic disease are only possible when taxonomy, physiology and ecology of these parasites are well known[3].

Digeneans are important group of animal parasites, adults occurring in the vertebrate host, invading in almost every organ system of the host. The larval stages usually found in the invertebrate host. These worms are wide spread in almost all animals in every part of the world, though the intensity of infection may differ from time to time or place to place[4, 5]. They produce a wide variety of direct effects in host with which they are associated to a smaller or greater extent. Digenean trematodes are flat, thick, oval, leaf-like, non-segmented worms, all of which are obligate parasites. Body is covered by a tegument usually smooth, but may be spiny. They attach to host via two suckers i.e. oral sucker and ventral sucker[6]. They can also absorb nutrients via smooth or rough tegument[7]. Digenean trematodes reproduce in three possible ways; some worms contain both male and female sexual organs (hermaphrodite) and are capable of auto fertilization, while others contain both male and female organs, but must meet up with another worm for cross-fertilization. Only in two families, the Schistosomatidae and the Didymozoidae have distinct male and female individuals[8].

Assessment of infection levels in the host as well as host population provides important information about the successful parasitic life. The high infection rate directly reflect successful parasitic invasion, can be moderated by host-defensive response and other behavioral influences. The high infection rate interferes with the nutrition, metabolism and secretary function of alimentary canal, damage nervous system and even upset the normal reproduction of the hosts[9, 10]. The study of prevalence, abundance and intensity of infection is an important area of research. The distribution of digenean trematodes in host, their incidence and intensity of infestation varies from one place to another. The parasitic infection is greatly influenced by the season, which interferes with the ecology and physiology of the fish. *Rita rita* (Ham.) is an important food fish and carnivorous in habit, mainly feed upon crustaceans, insects, mollusks. Therefore, prone to helminth infection including digenean. Crustaceans and mollusks are the host for various developing larval stages of helminth parasites.

In this study, we have explored the different aspects of seasonal variation on trematode infection in common food fish *Rita rita* (Ham.). We have reported the...
Prevalence, Mean intensity, Relative density of digenean trematodes infection in *Rita rita* (Ham.) from January, 2009 to December, 2009 in Lucknow region of Uttar Pradesh.

II. MATERIALS AND METHODS

1) Sampling and Collection of Parasites

We have collected the fish *Rita rita* (Ham.) from the Gomti river at Lucknow (U.P., India) with regular periodicity, fishes were autopsied and examined for trematode infection every month in the whole year January 2009 to December 2009. The fish intestine is opened in petridish and its contents were examined thoroughly under a binocular microscope. The trematode parasites were examined, flattened and stored in 70% ethanol for 24 to 48 hours. All the parasites stained with Acetoalum carmine, dehydrated through grades of alcohol, cleared in xylol, mounted in DPX and identified.

2) Study of Ecological Aspects

The data obtained throughout the year was processed, scrutinized and analysed to derive the various biostatistical parameters such as prevalence, mean intensity and relative density of infection using following formulae derived by Margolis *et al.*[11] and previously reported in Yadav *et al.*[12].

\[
\text{Prevalence} = \frac{\text{Total number of hosts infected}}{\text{Total number of hosts examined}} \times 100
\]

\[
\text{Mean intensity} = \frac{\text{Total number of trematodes obtained}}{\text{Total number of hosts infected}}
\]

\[
\text{Relative density} = \frac{\text{Total number of trematodes obtained}}{\text{Total number of hosts examined}}
\]

III. RESULTS

1) Prevalence, Mean Intensity, Relative Density of trematode parasites infection in *Rita rita* (Ham.) from January, 2009 to December, 2009.

The minimum and maximum temperatures and humidity as recorded from January, 2009 to December, 2009 in Lucknow (Table. 1). We found that the maximum temperature went to 41.5°C in the month of June and minimum temperature recorded as 4.7°C in the month of January.

Table 1: Average temperature and humidity as recorded in Lucknow from January, 2009 to December, 2009.

| Months     | Temperature in °C | Humidity in % |
|------------|-------------------|---------------|
|            | Maximum           | Minimum       |               |
| January    | 14.7              | 4.7           | 90            |
| February   | 26.9              | 11.7          | 100           |
| March      | 31.2              | 15.0          | 77            |
| April      | 35.4              | 20.4          | 75            |
| May        | 39.4              | 26.5          | 56            |
| June       | 41.5              | 33.1          | 43            |
| July       | 33.4              | 24.5          | 89            |
| August     | 34.2              | 22.2          | 87            |
| September  | 35.1              | 21.6          | 70            |
| October    | 33.6              | 24.8          | 78            |
| November   | 29.8              | 18.6          | 82            |
| December   | 24.7              | 12.4          | 85            |

We have examined the prevalence, mean intensity and relative density of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009 in Lucknow region (Table 2). We have found that maximum prevalence of parasites was in the month of May and minimum was in the month of December. Furthermore, mean intensity and relative density were highest in the month of April and minimum was in the month of December.
Table 2: Monthly variation in Prevalence, Mean Intensity and Relative Density of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009.

| Month | Number of hosts Examined | Prevalence % | Number of trematodes Obtained | Mean Intensity | Relative Density |
|-------|--------------------------|--------------|-------------------------------|----------------|-----------------|
| Jan.  | 8                        | 25           | 3                             | 1.5            | 0.37            |
| Feb.  | 6                        | 50           | 5                             | 1.66           | 0.83            |
| Mar.  | 18                       | 83.33        | 45                            | 3              | 2.5             |
| Apr.  | 12                       | 91.66        | 49                            | 4.45           | 4.08            |
| May   | 16                       | 93.75        | 52                            | 3.46           | 3.25            |
| June  | 10                       | 80           | 28                            | 3.5            | 2.8             |
| July  | 9                        | 66.66        | 12                            | 2              | 1.33            |
| Aug.  | 7                        | 28.57        | 3                             | 1.5            | 0.42            |
| Sept. | 6                        | 50           | 5                             | 1.66           | 0.83            |
| Oct.  | 10                       | 40           | 5                             | 1.25           | 0.5             |
| Nov.  | 11                       | 18.18        | 3                             | 1.5            | 0.27            |
| Dec.  | 9                        | 11.11        | 1                             | 1              | 0.11            |

Table 3: Seasonal variations in Prevalence, Mean Intensity and Relative Density of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009.

| Seasons | Number of hosts Examined | Prevalence % | Number of trematodes Obtained | Mean Intensity | Relative Density |
|---------|--------------------------|--------------|-------------------------------|----------------|-----------------|
| Winter  | 38                       | 23.68        | 12                            | 1.33           | 0.31            |
| Summer  | 52                       | 84.61        | 151                           | 3.43           | 2.90            |
| Rainy   | 32                       | 59.37        | 48                            | 2.52           | 1.5             |

Figure 1: Monthly variation in prevalence of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009.

This work is licensed under Creative Commons Attribution 4.0 International License.
Figure 2: Monthly variation in Mean Intensity of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009.

Figure 3: Monthly variation in Relative Density of trematode parasites of *Rita rita* (Ham.) from January, 2009 to December, 2009.

Figure 4: Seasonal variation in Prevalence of trematode parasites of *Rita rita* (Ham.) from January 2009, to December, 2009.
IV. DISCUSSION

Seasonal fluctuations in prevalence and abundance are common in many helminths infecting freshwater fishes. In the present observation, we have studied the seasonal changes of digenean trematodes in fresh water fish *Rita rita* (Ham.) from Gomti river and local fish market of Lucknow in Uttar Pradesh, India during the period from January, 2009 to December, 2009. The study was conducted in Lucknow, capital of Uttar Pradesh.

Total 122 hosts were examined and only 72 were found infected with trematode parasites. We observed that the maximum prevalence of trematode parasites in *Rita rita* (Ham.) was in the month of May (93.75%) while minimum prevalence was reported in December (11.11%) (Fig. 1). The maximum Mean intensity was reported in the month of April (4.45) whereas minimum was in December (1.0) (Fig. 2). The maximum relative density was reported in the month of April (4.08) and minimum in December (0.11) (Fig. 3). On the seasonal point of view, the maximum prevalence present in the summer (84.61%) while minimum prevalence was reported in winter season (23.68) (Fig. 4). The maximum Mean intensity was reported in the summer season (3.43) while minimum was in winter (1.33) (Fig. 5). The maximum relative density was reported in the summer (2.90) and minimum in winter (0.31) (Fig. 6). The major infection was found in the month of May and minimum infection in the month of December. This study suggests that highest prevalence of trematode parasites infection occurred in summer season followed by rainy and winter season.

The aquatic environment encompasses a wide variety of biological, chemical and physical parameters, which if altered beyond acceptable limits, such as under culture conditions, may weaken the fish leading to disease outbreaks [13]. Fish play an important role in economy too. Mortality of fishes occurs due to heavy infestation of parasites. This study was done to...
investigate the prevalence and intensity of trematode parasites of the host fish *Rita rita* (Ham.). Polanski[14] reported that the major factors determining the fish parasite fauna as well as intensity and prevalence of infestation in aquatic environments can be summarized as being: the diet of the host, lifespan of the host, the mobility of the host throughout its life including the variety of habitats it encounters, its population density and the size attained, with large hosts providing more habitats suitable for parasites than small ones. In most cases, intensity does not differ for sex in same habitat, but it is observable that intensity differs strongly for habitat. It also differs from species to species. In this study, the hosts of intermediate length and weight were found to be more infected than the hosts of smaller and larger length. Intestinal parasites inhibit the digestive activity of the host and indirectly inhibit vitamin and blood sugar metabolism and growth; parasites in the liver affect glycogen metabolism and growth[15]. Since fish play a vital role in the economy, more emphasis should be given on such type of negative interactions that can cause huge damage to the fish population and more importance should be given to the water quality because the prevalence of parasites can vary for different water bodies.

### ACKNOWLEDGEMENTS

Authors are thankful to the Head, Department of Zoology, University of Lucknow, for providing laboratory and infrastructure for completing the research work.

### REFERENCES

[1] Snieszko, S. F. (1983). Diseases of fishes: Research and Control. *Fisheries, 8*, 20-22.

[2] Kabata, Z. (1985). *Parasites and diseases of fish cultured in the tropics*. Taylor & Francis Ltd., London. pp. 318

[3] Lilley, J. H., Philips, M. J. and Tongutai, K. (1992). A review of epizootic ulcerative syndrome (EUS) in Asia. *Publ. Aquatic Animal Health Research Institute and Network of Aquaculture Center in Asia-Pacific, Bangkok, Thailand.*, 73.

[4] Bhalerao, G. D. (1936). Studies on the Helminths of India. *Trematoda I. Journal of Helminthology, 14*(3), 163–180. https://doi.org/10.1017/S0022149X00003679

[5] Bhalerao, G. D. (1937). Studies on the Helminths of India. *Trematoda IV. Journal of Helminthology, 15*(2), 97–124. https://doi.org/10.1017/S0022149X00030753

[6] Rai, S. L. (1964). Observations on the life-history of *Phyllodistomum srivastavai* sp.nov. (Trematoda: Gorgoderidae). *Parasitology, 54*(1), 43–51. https://doi.org/10.1017/S0031182000074308

[7] White, I. C. (1972). On the ecology of an adult digenetic, trematode *Protoecessubtenuis* from a lamellibranch hosts *Scrobicularia Plana*. *J. Marine Biol. Assoc. U.K.*, 52, 457-467.

[8] Chappell, L. H. (1980). *Physiology of parasites*. Blackie, Glasgow London. pp. 101.

[9] Rahman, M. R., Prvez, M. A., Jahan, M. S. and Sarker, M. M. (1998a). Histopathology of *Bellamya bengalensis* (Lamarck) by larval helminth. *Univ. J. Zool. Rajshahi Univ.*, 17, 19 – 27.

[10] Rahman, M. R., Parween, S. and Ara, H. (1998b). A brief report on two helminth endoparasites from *Mastacembelus armatus* (Lacepede). *Univ. J. Zool. Rajshahi Univ.* 17: 75 –77.

[11] Margolis, L., Esch, G. W., Holmes, J. C., Kuris, A. M., & Schad, G. A. (1982). The Use of Ecological Terms in Parasitology (Report of an Ad Hoc Committee of the American Society of Parasitologists). *The Journal of Parasitology, 68*(1), 131. https://doi.org/10.2307/3281335

[12] Yadav, S., Chandra, S., & Saxena, A. (2012). An ecological study on digenetic trematode parasite of *channa punctatus* of lucknow, Uttar Pradesh. *Lucknow journal of Science.*, 7(2), 1-8.

[13] Roberts, R.J. (1989). *Fish Pathology*. Bailier and Tindall, London.

[14] Polanski, Yu. I. (1961). Zoogeography of parasites of the USSR marine fishes. In: Parasitology of Fishes (English translation) (Eds. Dogiel, V.A. Petrushevskii, G.K & Polanski, Yu I.) Edinburgh and London: *Oliver and Boyd*, 230-246.

[15] Halvorsen, O. (1995). Ecology of marine parasites: An introduction to marine parasitology 2nd edn. *Parasitology Today, 11* (1), 43. https://doi.org/10.1016/0169-4758(95)80110-3

This work is licensed under Creative Commons Attribution 4.0 International License.