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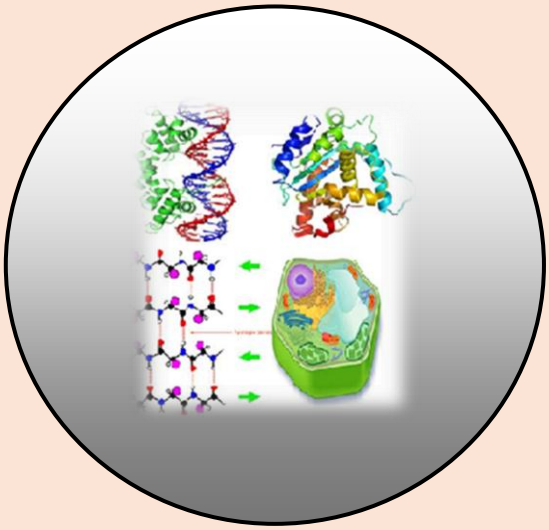
ISSN 2319-3077 Online/Electronic
ISSN 0970-4973 Print

UGC Approved Journal No. 62923
MCI Validated Journal
Index Copernicus International Value
IC Value of Journal 82.43 Poland, Europe (2016)
Journal Impact Factor: 4.275
Global Impact factor of Journal: 0.876
Scientific Journals Impact Factor: 3.285
InfoBase Impact Factor: 3.66

J. Biol. Chem. Research
Volume 36 (1) 2019 Pages No. 359-366



Journal of Biological and Chemical Research
An International Peer Reviewed / Referred Journal of Life Sciences and Chemistry

Indexed, Abstracted and Cited in various International and National Scientific Databases

Published by Society for Advancement of Sciences®

J. Biol. Chem. Research. Vol. 36, No. 1:, 359-366, 2019
(An International Peer Reviewed / Refereed Journal of Life Sciences and Chemistry)
Ms 36/02/8789/2019

ISSN 2319-3077 (Online/Electronic)
ISSN 0970-4973 (Print)

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RESEARCH PAPER
Received: 06/05/2019 Revised: 07/06/2019 Accepted: 08/06/2019

Seasonal variation and microhabitat distribution of *Thaparocleidus clampai* n.sp. (Monogenea; Dactylogyridae) on the gills of fresh water fish *Mystus blekeeri*.

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ABSTRACT

Seasonal changes in occurrence and microhabitat distribution of the monogenean parasites of freshwater fish were studied during year 2016-2018 in the river Gomti, Lucknow. About 278 specimens were examined and a total of 5051 specimens of T. clampai n.sp. were recorded. The occurrence and microhabitat distribution of parasite correlated with seasonal changes of water temperature and intensity of infection.

Keywords: T. clampai n. sp., Microhabitat distribution, Monogenean Parasites, Seasonal changes and Temperature.

INTRODUCTION

Monogeneans are common members of fish parasite communities in freshwater and marine habitat. Most of the monogenean species are host specific; other can infect several hosts from different families (Poulin, 1992). Environmental factors, such as water temperature, play a significant role in the seasonal variation of parasite populations. Temperature is likely the most important abiotic factor influencing the population dynamics of monogeneans (Lambert, 1990, Xenopoulos *et al*, 2005).

Jain (1952) established the genus *Thaparocleidus* with *T. wallagonius* as its type species of the gills of *Wallago attu* at Lucknow, India. The genus *Thaparocledius* is restricted to the fresh water siluriformes. According to Srivastava, 1997 the piscine order siluriformes is represented in Uttar Pradesh (India) by seven families, of which three genera of fishes, belonging to the family Bagridae, were screened for monogeneans. The present paper deals with genus *Thaparocleidus* Jain, 1952 (Family Ancylodiscoidinae Gusev, 1976), which were described from catfishes of family Bagridae. It has greatest species diversity among the members of Ancylodiscoidinae.

T. clampai n. sp (the structural detail of parasite will be described later) is seems to be very perspective model for the study of parasite spatial distribution including analysis of niche segregation, intra and inter-specific competition and aggregation. The genus *Mystus*, inhabiting a large geographical area of Bangladesh, Burma, Thailand, Indochina, Malaya, Singapore, and East Indies to China is a moderately large genus of some three dozen nominal species. *Mystus bleekeri* screened for monogeneans are economically important because they are more often seen in aquarium trade and also consumed as food fish by local people.
Equally important aspect is "ecological studies" on monogeneans. Science of ecology deals with interaction of organisms, and the environment. The environment includes all physical and biological variables affecting a population including interaction between individuals of population and between individuals of different species. This aspect is analysed with help of statistical analysis of data collected during research. The ecological indexes of infection during that period were calculated as the prevalence, mean intensity and abundance.

MATERIALS AND METHOD

The live host were brought to the laboratory and maintained in an aquaria. They were identified by using "Fish base" version 4.0. Live fish were then isolated and killed, and their gills were either gently scraped to dislodge the live monogeneans or left in water to allow the parasite to detach. Examination of these gills was done under stereomicroscope to ensure collection of monogeneans. The detached worms were then transferred on slides to small droplets of water, covered by clean coverslips and studied alive under phase-contrast microscope for morphological and taxonomical studies. For studying hard parts glycerine and Hoyer's medium were used. These semi-permanent preparations were sealed with sealant. Permanent preparations were made by fixing the worms in 5% formalin, staining with aceto-alum-carmine and Gomori's trichrome. All parasites were dehydrated in an ethanol series, cleared in xylene, and mounted in Canada balsam. For the image analysis live parasites were studied under Image analyser attached to a digital camera.

Statistical Analysis

The month wise and parasite wise data was collected and subjected to statistical analysis for the following parameters:

1. Intensity
2. Density
3. Dominance percentage.

Formula used for above parameters:

$$\text{Intensity} = \frac{\text{Total worm Burden}}{\text{Number of fish infected}}$$

$$\text{Density} = \frac{\text{Total worm Burden}}{\text{Number of fish examined}}$$

$$\text{Intensity} = \frac{\text{Total worm Burden for the month}}{\text{Total worm burden for the year}} \times 100$$

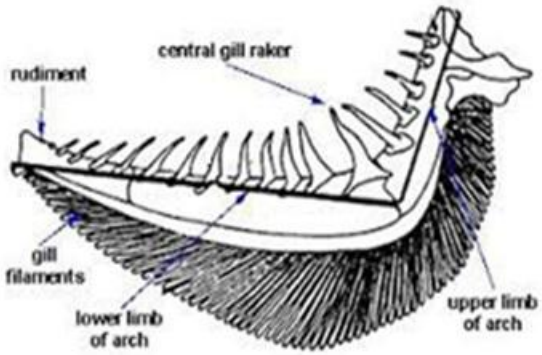
The observations are being presented in the form of tables and graphs

Distribution

The gills from live fishes were excised and placed in separate petridishes containing water and examined using microscope. For each host, parasite number on each gill arch, anterior and posterior gill filament of right and left side gills were recorded. The four gill arches were designated as 1-4, beginning with the gill arches below the operculum.

To provide information on site preference, the position of parasites along the length of each gill filament was recorded. Each gill arch was divided into following equal regions:

1.Anterior dorsal 2. Posterior dorsal 3. Anterior medial 4.Posterior medial 5.Anterior ventral 6.Posterior ventral.



Data collected for each host given in form of tables.

Observation

1. (a) Seasonal distribution of *T. clampai* n. sp. on Gills of *M. bleekeri*

(1). Worm Burden / Percentage of Infection (Table No 1):

Maximum number of worms were recorded in month of May & minimum in September whereas no infection is recorded in August. Highest percentage of Infection in February 83.3% and lowest in September 42.1%.

(2). Intensity of Infection (Table No 2):

181 infected fishes having 5015 parasites at the rate of 27.0 mean burden. Season wise intensity of First half of the year was 134.0; whereas during next half it was 78.4. Highest record was in May (36.7%) and lowest in September (6.7%).

(3). Dominance Percentage (Table 3):

In the first six month it was 65.0. During the other half, it was 34.6. Highest was in month of May (19.6) and lowest in September (2.5 %).

Table 1.

Months	No. of Fishes Examined	No. Of Fishes Infected	Percentage of Infection
January	22	18	81.8%
February	24	20	83.3%
March	20	15	75.0%
April	28	23	82.1%
May	27	21	77.7%
June	25	15	60.0%
July	22	12	54.5%
August	23	0	0%
September	19	8	42.1%
October	21	14	66.6%
November	24	17	70.8%
December	23	18	78.2%

Table 2.

Months	No. of Fishes Examined	No. Of Parasite collected	Intensity of Infection
January	22	385	17.5 %
February	24	425	17.7%
March	20	502	25.1%
April	28	587	20.9%
May	27	993	36.7%
June	25	403	16.1%
July	22	374	17.0%
August	23	0	0%
September	19	129	6.7%
October	21	273	13.0%
November	24	483	20.1%
December	23	497	21.6%

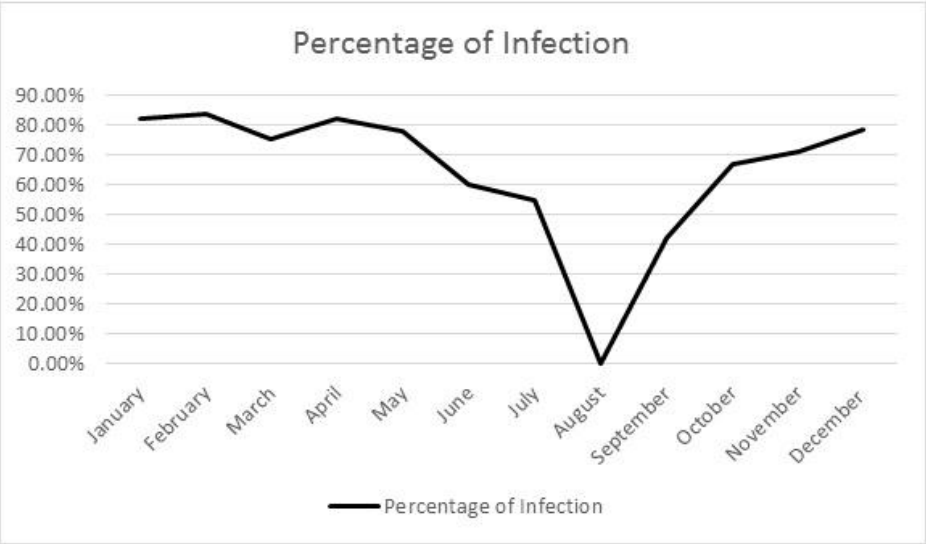
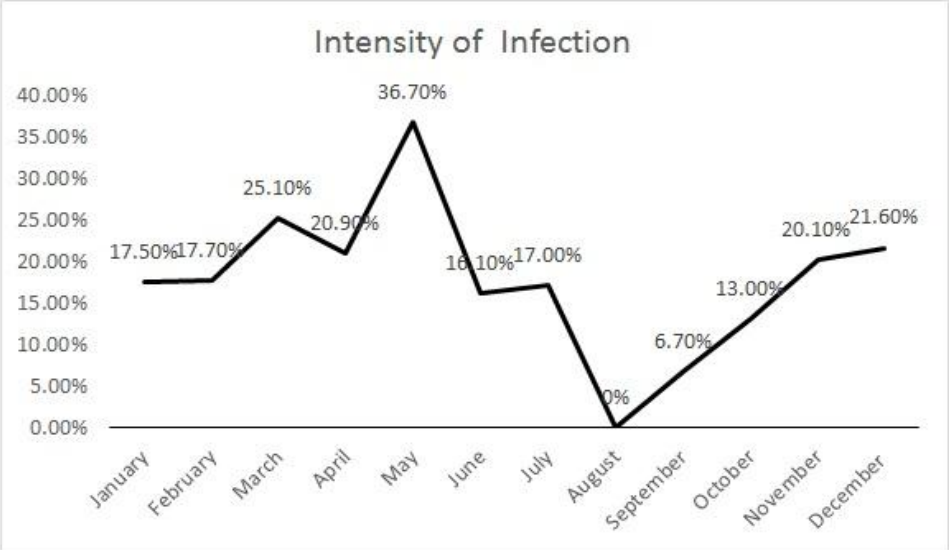
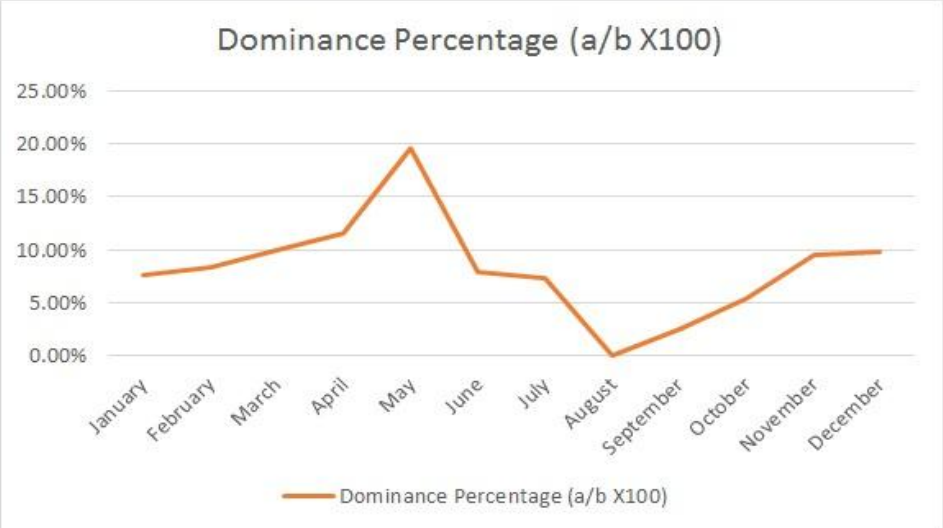


Table 3.

Months	No. of Parasite collected	Dominance Percentage (a/b *100)
January	385	7.6%
February	425	8.4%
March	502	9.9%
April	587	11.6%
May	993	19.6%
June	403	7.9%
July	374	7.4%
August	0	0
September	129	2.5%
October	273	5.4%
November	483	9.5%
December	497	9.8%





a. Distribution Pattern

Out of 278 fishes examined, 181 were found to be infected with *T. clampai* n. sp. In all 5051 parasites were recovered. Their distribution on the gills was studied in detail and is being described below:

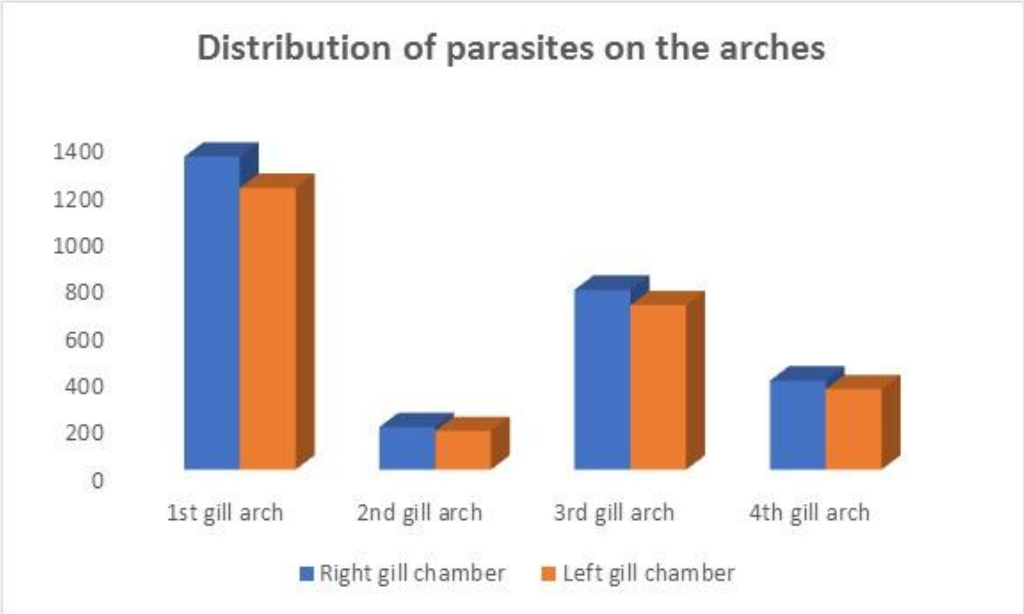
1 **Distribution of parasites on the arches:** During the present study it was found that these parasites showed greater concentration in the right gill chamber in comparison to the left one. A majority of these parasites showed preference for the first and third gill arches whereas the fourth and second remained lesser in number. However, the maximum concentration of these parasites was on the first gill arch.

2 **Distribution of parasites on the sides of hemibranchs:** The distribution of *T. clampai* n. sp. was preferred the anterior side of hemibranchs. Both the gill chambers followed the same pattern of distribution.

3 **Distribution of parasites on the sections of hemibranchs:** These parasites preferred the dorsal and medial sections of both the sides of hemibranchs. Whereas, very few were found in the ventral sections of both the sides. However, the medial sections were the second preference of parasites. Both the gill chambers followed the same pattern.

(Distribution of parasites on the arches).

	Right gill chamber	Left gill chamber
1st gill arch	1329	1196
2nd gill arch	181	164
3rd gill arch	764	698
4th gill arch	378	341
Total number	2652	2399



DISCUSSION

Conclusion drawn by Statistical study on seasonal distribution of *T. clampai* n. sp., that in May parasitic burden per fish was very high, with the highest rate of infection. This fact is also supported by the development of *Thaparocleidus*, where larvae hatches in 4-5 days at 30-38º C (Pandey *et al*, 2003) (i.e. in summer season more frequent egg hatching take place and development is also very fast). Therefore, the highest rate of infection was observed in months of April and May. In June the parasitic count decreased to a certain extent. This trend was followed in month of July, whereas the infection was completely nil in August being the mid monsoon month. In September again infection was encountered but with very few worms. The months of October onwards shows further increase in rates of infection. April shows remarkable increase in infection of parasites.

The remarkable decrease in rate of infection in the pre-monsoon months and no infection in the mid monsoon, this can be accounted by the fact that due to flooded conditions probably the worms got washed away with water currents, from the fish host, the same trend was observed in other variables also.

On the whole a definite trend could be observed here. The overall infection remains high in summer months. Thus, as far the data has been showed that there is a richer parasitic fauna in the summer months as compared to the winter. It is, thus, generally accepted that the temperature is most important single factor determining the seasonal distribution of parasites on the gills of host. This fact also proves that *Thaparocleidus* are not only site and host specific but also specific to choose the seasons for their infection and to increase their number.

Distribution pattern of parasites in its host (in this case, the gills of fishes) is very important statistical aspect to study the microenvironment (niche) of a particular species of parasite. Monogeneans are mainly ecto parasites and thus different from free living animal. In general a parasite is exposed two environments:

(1) Microenvironment (within the host i.e. gills)

(2) Macro environment (around the host)

Here we only concentrate on microenvironment. The ecological niche for *Thaparocleidus* is gills of a free-living fish. *Thaparocledius* have shown that they are site and gill specific on their host. Variation in response to ventilation, water current flowing over gills, mode of swimming of host, interspecific competition among parasites have been suggested as determinants for site specificity (Distribution of parasites on different gill arches and different positions). Rhode 1989 postulate a non-competitive mechanism where selection favours intra-specific contact such that mating is stronger factor (Copulatory complex and vagina of all the species inhabiting same gill differs in their structure to avoid mating between individuals of two different species) influencing microhabitat restriction than interspecific competition. Reinforcement of reproductive barriers would therefore be responsible for site segregation among related species and distinct genera inhabiting same gill arch. The above hypothesis was proved with help of following observations –

(a) Distribution of *Thaparocleidus* species is often not affected by occurrence of other species of same genera or other genera, even if there is microhabitat overlap.

(b) Between different gill arches of different fishes *Thaparocleidus* shows a preferential order varying from species to species; this difference is due to difference in ecology and behaviour of host and parasite, and, also, depends on their interaction.

(c) Parasites occur together in same host species, that they are segregated in different microhabitats, thus possibly avoiding interspecific competition.

In all the data obtained from different individuals i.e. different species of *Thaparocledius* showed that, like other monogeneans, they are site and gill specific on their specific fish host, reasons for this restricted distribution are niche selection, to avoid competition of all kinds (food, space and reproduction) and to successfully flourish that particular species for a very long duration on their host and to avoid mixing of species of same and different genus etc.

ACKNOWLEDGEMENTS

The author is thankful to the Principal, Shri JNMPG College, Lucknow for providing the facilities.

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