

Biochemical Characterization of Cestode Parasites Infecting Freshwater Fishes of Latur District, Maharashtra, India

Amol Thosar and Suraj Kolhe

Department of Zoology and Fishery Science, Dayanand Science College, Latur

Email- amol.thsar27@gmail.com

ABSTRACT

The present study investigates the biochemical characteristics of the cestode parasite *Senga* sp. recovered from the freshwater fish *Mastacembelus armatus* (L.) inhabiting Latur District, Maharashtra, India. To understand the biochemical interactions between the parasite and its fish host, the concentrations of three major biochemical constituents' protein, glycogen, and lipid were estimated in the parasite and in the intestinal tissues of both infected and uninfected fish. The findings revealed that the levels of protein and glycogen in *Senga* sp. were comparatively lower than those recorded in the intestinal tissues of infected as well as uninfected hosts. In contrast, the parasite exhibited a considerably higher lipid content than the corresponding host tissues. A comparative assessment of the intestinal tissues further demonstrated that protein, glycogen, and lipid levels were consistently higher in uninfected fish than in infected individuals. The observed biochemical differences indicate the nutritional dependence of the cestode on host-derived resources and suggest that parasitic infection may induce considerable alterations in the metabolic composition of the host intestinal tissue. Overall, the study provides evidence of significant biochemical interactions between *Senga* sp. and *Mastacembelus armatus* (L.) and contributes to a better understanding of host-parasite metabolic relationships.

Keywords: Biochemical characterization, Cestode parasite, *Mastacembelus armatus*, Parbhani district, *Senga* sp., Yeldari dam.

INTRODUCTION

Freshwater fishes constitute an important component of aquatic ecosystems and serve as a valuable source of animal protein, essential nutrients, and livelihood for human populations. However, freshwater fishes are frequently affected by a variety of parasitic infections that can influence their growth, physiological condition, nutritional status, and overall health. Among the diverse groups of fish parasites, cestodes are important endoparasites that inhabit the digestive tract and other internal organs of their hosts. Their occurrence may result in competition for nutrients, tissue damage, altered physiological functions, and changes in the biochemical composition of host tissues.

Fish are commonly regarded as a valuable natural resource because of their substantial economic importance and their role as a rich source of high-quality animal protein for the expanding human population. They contribute significantly to food security and livelihoods, especially in developing nations where fish constitute a major component of daily nutrition. Despite their importance, fish populations are often challenged by parasitic infestations, which adversely affect their growth, health status, and survival, resulting in considerable economic losses in capture fisheries and aquaculture systems (Sharma et al., 2012). Among various parasitic groups, cestodes or tapeworms are particularly important due to their high pathogenic potential and their capacity to induce marked physiological and biochemical disturbances in infected hosts.

Parasitic infections represent a major biological stressor in freshwater fish, often leading to significant physiological and biochemical disturbances in the host organism. Cestode parasites are a widespread group of intestinal helminths that derive nutrients from their hosts and can alter host metabolism, growth, and nutrient allocation. Changes in key biochemical constituents such as proteins, glycogen, and lipids are commonly used as indicators of host physiological responses to parasitic infestation and to understand host-parasite metabolic interactions (Gaikwad et al., 2018).

Cestodes are metabolically specialized parasites that depend largely on their hosts for nutrients required for growth, development, and reproduction. Since they lack a functional digestive system, nutrients are absorbed directly through the tegument from the surrounding host environment. Consequently, the biochemical composition of cestodes reflects their nutritional requirements and adaptation to the internal environment of the host. The assessment of biochemical

constituents such as proteins, glycogen, and lipids therefore provides useful information about the metabolic activities and nutritional strategies of parasitic organisms.

Proteins play a fundamental role in the structural organization, enzymatic activity, growth, and reproduction of parasites, whereas glycogen serves as an important energy reserve, particularly in organisms inhabiting environments where oxygen availability and metabolic conditions may fluctuate. Lipids contribute to energy storage, membrane formation, and several physiological processes. Variations in these biochemical constituents between parasites and their hosts can provide valuable insights into nutrient acquisition, metabolic dependence, and host-parasite interactions.

The freshwater fish *Mastacembelus armatus* (Linnaeus) is widely distributed in Indian freshwater ecosystems and forms an important component of inland fisheries. Like other freshwater fishes, it may harbour a variety of helminth parasites, including cestodes. Species of the genus *Senga* are commonly reported from the intestine of freshwater fishes and have attracted attention because of their host associations and biological adaptations. The presence of such parasites may influence the biochemical status of intestinal tissues by competing with the host for available nutrients and modifying normal metabolic processes.

Comparative biochemical characterization of parasite tissue and host intestinal tissue can consequently provide a better understanding of the physiological relationship between the cestode and its fish host. In the present investigation, protein, glycogen, and lipid contents were estimated in *Senga* sp. isolated from *Mastacembelus armatus* collected from, Latur District, Maharashtra, India. The biochemical composition of the parasite was compared with that of intestinal tissues from infected and non-infected fish. The study aims to assess variations in major biochemical constituents and to elucidate the possible metabolic interactions associated with cestode infection in the freshwater fish host.

MATERIAL AND METHODS

Sample collection- The Cestode specimens were recovered from the intestinal region of *Mastacembelus armatus* and carefully processed prior to biochemical estimation. The collected parasites were repeatedly washed with distilled water to eliminate mucus, intestinal contents, and other adhering materials. Excess water was removed by gently placing the specimens on clean filter paper. The washed parasites were subsequently transferred to a pre-weighed watch glass, and their mass was determined accurately using an analytical balance. The specimens were then subjected to oven drying at 50-60°C for 24 h to obtain a constant dry weight. The resulting dry mass was recorded and used for subsequent biochemical analyses.

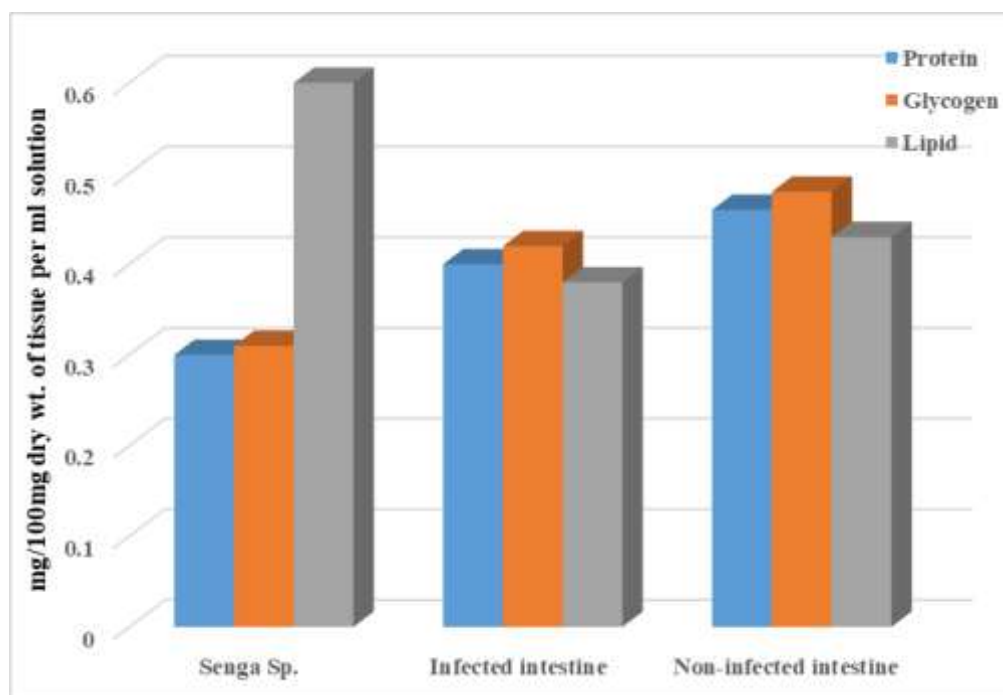
Biochemical estimation- The estimation of biochemical components in the cestode parasites was carried out using standard protocols. The total protein concentration was determined following the method of Lowry et al. (1951). Glycogen estimation was performed according to the procedure described by Kemp et al. (1954), while the lipid content was analysed using the method proposed by Folch et al. (1957).

RESULT AND DISCUSSION

Table No. 1:- Biochemical estimation of *Senga* Sp. species from Fresh water fish *Mastacembalus armatus* (L) from Latur district (M.S.) India.

Name of Parameter	<i>Senga</i> Sp.	Host intestine	
		Infected	Non-infected
Protein (mg/100mg dry wt. of tissue per ml sol ⁿ)	0.30 ± 0.016	0.40 ± 0.021	0.46 ± 0.015
Glycogen (mg/100mg dry wt. of tissue per ml sol ⁿ)	0.31 ± 0.022	0.42 ± 0.027	0.48 ± 0.017
Lipid (mg/100mg dry wt. of tissue per ml sol ⁿ)	0.60 ± 0.009	0.38 ± 0.039	0.43 ± 0.015

Graph No. 1:- Biochemical estimation of *Senga* Sp. species from Fresh water fish *Mastacembalus armatus* (L.) from Latur district (M.S.) India.



The present study was carried out to estimate the biochemical composition of *Senga*, sp. recovered from the intestine of the freshwater fish *Mastacembelus armatus* (L.) collected from Latur district, Maharashtra, India. The biochemical constituents, namely protein, glycogen and lipid, were estimated in *Senga*, sp. and compared with those of infected and non-infected host intestinal tissues. The results presented in Table No.1 and Graph No.1 revealed considerable variations in the concentration of these biochemical constituents among the parasite, infected host intestine and non-infected host intestine.

The protein content of *Senga*, sp. was recorded as 0.30 ± 0.016 mg/100 mg dry weight of tissue per ml solution, whereas the infected and non-infected host intestinal tissues showed protein contents of 0.40 ± 0.021 and 0.46 ± 0.015 mg/100 mg dry weight, respectively. Thus, the protein content was comparatively lower in the parasite than in both infected and non-infected host tissues. The infected host intestine also exhibited a lower protein concentration than the non-infected intestine, showing a reduction of approximately 13.04%. This decrease may be associated with changes in host protein metabolism following parasitic infection. The parasite inhabiting the intestinal region may utilize nutrients available in the host intestinal environment for its metabolic requirements, growth and development. Protein is an essential biochemical constituent required for the maintenance of cellular structure, enzymatic activity, growth and reproduction. Therefore, the lower protein concentration observed in infected host tissue may reflect altered protein utilization or metabolic changes associated with the presence of the parasite. However, the present observations alone cannot establish direct depletion of host protein by the parasite.

The glycogen content also showed a similar pattern. The glycogen concentration in *Senga*, sp. was 0.31 ± 0.022 mg/100 mg dry weight of tissue per ml solution, while the infected and non-infected host intestinal tissues contained 0.42 ± 0.027 and 0.48 ± 0.017 mg/100 mg dry weight, respectively. The glycogen concentration of infected intestinal tissue was approximately 12.50% lower than that of non-infected tissue. Glycogen serves as an important carbohydrate reserve and provides readily available energy for various physiological activities. The comparatively lower glycogen concentration in infected host tissue may indicate changes in carbohydrate metabolism associated with parasitic infection. The parasite may obtain and utilize nutrients from the intestinal environment, while the host may simultaneously undergo metabolic alterations in response to infection. In *Senga*, sp., the relatively lower glycogen content may be related to its metabolic requirements and utilization of carbohydrate reserves for maintenance, growth and reproductive activities. The observed reduction in glycogen in infected host tissue may therefore represent an alteration in the normal carbohydrate balance of the host; however, additional metabolic studies would be required to determine the precise mechanism responsible for this change.

A distinct pattern was observed in the lipid content. *Senga*, sp. recorded the highest lipid concentration of 0.60 ± 0.009 mg/100 mg dry weight of tissue per ml solution, whereas the infected and non-infected host intestinal tissues showed lipid contents of 0.38 ± 0.039 and 0.43 ± 0.015 mg/100 mg dry weight, respectively. Thus, the lipid content of *Senga*, sp. was approximately 57.89% higher than that of infected host intestine and 39.53% higher than that of non-infected

host intestine. In contrast, the infected host intestine showed an approximately 11.63% lower lipid concentration than the non-infected intestine. The comparatively high lipid content of *Senga*, sp. may indicate that lipids constitute an important metabolic reserve in the parasite. Lipids play significant roles in energy storage, membrane formation, cellular organization and reproductive processes. The accumulation of lipid reserves in the parasite may therefore be an adaptation to its endoparasitic mode of life and the nutritional conditions prevailing within the host intestine. The reduction in lipid concentration of infected host tissue may indicate alteration in host lipid metabolism associated with parasitic infection. Such changes may result from altered nutrient utilization, metabolic responses of the host or competition for available nutrients within the intestinal environment.

When the three biochemical constituents are considered together, *Senga*, sp. exhibited a characteristic biochemical profile, with comparatively lower protein and glycogen contents but markedly higher lipid content than the host intestinal tissues. The non-infected host intestine showed the highest concentrations of protein and glycogen, whereas the infected host intestine showed intermediate values. The reduction in protein, glycogen and lipid contents of infected intestinal tissue compared with non-infected tissue suggests that parasitic infection is associated with changes in the biochemical composition of the host intestine. These alterations may be related to the nutritional interaction between *Senga*, sp. and its host, as the parasite depends on the host environment for nutrients required for its survival and development. The particularly high lipid content recorded in *Senga*, sp. suggests that lipid metabolism and storage may have an important role in its physiology. Overall, the present findings indicate that the presence of *Senga*, sp. is associated with measurable biochemical alterations in the intestinal tissue of *Mastacembelus armatus* (L.). The observed variations in protein, glycogen and lipid contents provide useful information regarding the nutritional physiology and possible host-parasite interactions of *Senga*, sp. Nevertheless, further investigations involving statistical analysis, enzyme assays, detailed lipid profiling, carbohydrate metabolism and histopathological observations would be useful to establish the precise physiological mechanisms underlying these biochemical changes.

CONCLUSION

The present study revealed noticeable variations in the biochemical composition of *Senga*, sp. and the intestinal tissue of its host, *Mastacembelus armatus* (L.). The parasite showed comparatively lower protein (0.30 ± 0.016 mg/100 mg dry weight) and glycogen (0.31 ± 0.022 mg/100 mg dry weight) contents, whereas its lipid content (0.60 ± 0.009 mg/100 mg dry weight) was considerably higher than that of both infected and non-infected host intestinal tissues. The infected host intestine showed reduced levels of protein, glycogen and lipid in comparison with the non-infected intestine. These variations suggest that parasitic infection may influence the normal biochemical metabolism of the host intestinal tissue and may be associated with changes in nutrient utilization between the host and parasite. The relatively high lipid content of *Senga*, sp. indicates the possible importance of lipid reserves in its energy metabolism, growth and reproductive activities. Overall, the findings provide useful evidence of biochemical alterations associated with *Senga*, sp. infection in *Mastacembelus armatus* (L.) and contribute to understanding the nutritional physiology and host-parasite relationship of this cestode. Further biochemical, histopathological and molecular investigations are required to elucidate the precise mechanisms responsible for these biochemical changes.

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