Eco. Env. & Cons. 29 (April Suppl. Issue) : 2023; pp. (S181-S185)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i02s.034

Occurrence of *Argulus* (Crustacea: *Branchiura*) in fishes of the freshwater reservoirs and aquarium shops of Vadodara, Gujarat (India)

Gazala Sheikh[1], Smit Lende[2], Rajesh Vasava[3], Chirag Bhadesiya[4] and Pradeep Mankodi[5]

[1, 5]Division of Freshwater and Marine Sciences, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India
[2, 3]Centre of Excellence in Aquaculture, Ukai, Tapi, Gujarat, India
[4]Postgraduate Institute of Veterinary Education and Research (PGIVER) and Veterinary Hospital, Kamdhenu University, Rajpur (Nava), Himmatnagar, Gujarat, India

(Received 6 September, 2022; Accepted 18 November, 2022)

ABSTRACT

Aquaculture is one of the fastest growing food producing sectors in the world and it is a highly risky business. It is greatly dependent on health of fishes and higher economic losses can be incurred due to disease problems. In India, major freshwater fishes are affected by parasitic diseases. *Argulus* is a major ectoparasite that can cause clinical infestation and moderate to severe disease causing huge losses to the fish farmer or aquaculturist. Moreover, occurrence of *Argulus* has not been investigated in many regions of Gujarat state, India. Their abundance and clinical lesions can reduce the productivity. Hence, a study was undertaken to investigate the presence and abundance of the *Argulus* parasite from the freshwater resources and Aquarium shops, including the cultivable and ornamental fishes in and around Vadodara district, Gujarat (India). A total of 212 specimens of cultivable and ornamental fishes were sampled and subjected to laboratory examination. The parasites were mostly collected from the body's surface. The specimens collected from infected fishes were identified as *Argulus* belonging to Subphylum *Crustacea* and Subclass *Branchiura*. It was observed that *Argulus* affects ornamental fish and IMCs where the total incidence and abundance was observed higher in ornamental fishes (49.50 % and 2.50, respectively) as compared to Indian major carp (IMCs; 25.22 % and 1.59, respectively). Ornamental fishes were infested with a large number of parasites as compared to IMCs. The present study is the first ever report of parasitic infection in freshwater fishes from the study area.

Key words: *Fish parasites, Cultivable and Ornamental fishes, Abundance, Incidence, Argulus*

Introduction

Aquaculture is one of the fastest growing food producing sectors in the world. It provides nutrition, food security, income and livelihoods for millions of people, contributing to approximately 46% of world total food fish production. In 2018, the global fisheries production was 179 million tons of which, aquaculture production was reported to be 82.1 million tons (Anonymous, 2020a).

India is blessed with vast biodiversity and has remarkable number of freshwater resources which serve as a platform for survival of various indigenous freshwater fishes. Additionally, coastal areas (marines) serve as a main source of income and livelihood for an enormous fishermen population of the

country. India has showcased phenomenal growth in fisheries production rising from 0.75 MT in 1950-51 to around 12.89 MT of seafood worth Rs 46,662.85 crore during 2019-20 (Anonymous, 2020b). Currently, freshwater fisheries is growing faster compared to marine fisheries (Muruganandam *et al*., 2019). Freshwater aquaculture contributes to over 95% of the total aquaculture production. Fish farming is a highly risky business for fish farmers mainly due to the disease problems because insidious diseases pose a major threat to fish population. Fish production is often reduced due to diseases and parasites by affecting the normal physiological condition of fish and it can result in mass mortalities (Kabata, 1985). Death or mortality due to such diseases can account to 10-15% loss. Fish in aquaculture ponds are generally affected by diseases of parasitic, fungal, and bacterial in origin. Above all, parasitic infestations are frequently encountered; however, they are studied to a limited extent in some regions of the world. The production from culture system is remarkably hampered by the infestation of various fish parasites. The common parasites of fishes causing substantial economic loss in fish culture system in India. The world's approximate 20% freshwater fish is already extinct due to parasitic influence (Moyle and Leidy, 1992). Huge species diversity of parasites can be found in infected fishes. There is a very less known diversity of species fish parasite of India compared with other regions of the continent. Hence, it is need of the hour to identify existing prevalence of parasites from fish (such as *Argulus*) at different culture pond and aquarium shops. The present study places special emphasis on occurrence of *Argulus* parasites in the freshwater resources of the Vadodara district of Gujarat state, India.

Materials and Methods

The study site included the freshwater resources in and around Vadodara city of Gujarat state, India which is located in the central part of mainland Gujarat at 22º31′ N latitude and 73º18′ E longitude, having a total area of 7548.50 sq. km. During the investigation period, cultivable fishes (*Catla catla, Labeo rohita, Cyprinus carpio*; random sampling; n=111) were collected from freshwater resources, whereas ornamental fishes (*Carassius auratus* and *Siamese splendensis*; convenient sampling; n=101) were collected from aquariums of the Vadodara district with the assistance of a local fisherman and owners. All the fish samples (N=212) were subjected to detailed physical examination to detect presence of parasites and clinical symptoms associated with clinical infestation.

The parasite specimens were preserved, either in 70% alcohol or in 4% formalin depending on requirement and brought to the laboratory for further investigations. *Argulus*, a crustacean parasite, was found on the skin's surface among fishes screened during the study period. Under a low power binocular microscope, the parasites were carefully observed and photographic evidence was taken for proper identification. The *Argulus* parasites' permanent mounts were prepared in accordance with the National Wild Fish Health Survey (NWFHS) Laboratory Procedure Manual-2004. The specimens were stained with acetocarmine, destained in 1% acid alcohol, dehydrated in a series of rising alcohols of 30%, 50%, 70%, 90%, and absolute alcohol and then cleaned in xylene before mounting using DPX mountant. The stereo microscope was used to observe the gross specimens. Identification and classification of *Argulus* was based on descriptions mentioned by Yamaguti (1963). The prevalence and abundance of parasites was observed and analysed among screened population of fishes by using formulae given by Parveen and Gaikwad (2018).

$$\text{Incidence \%} = \frac{\text{Infected Host x 100}}{\text{Total Host examined}}$$

$$\text{Abundance} = \frac{\text{No. of Parasites}}{\text{No. of Host examined}}$$

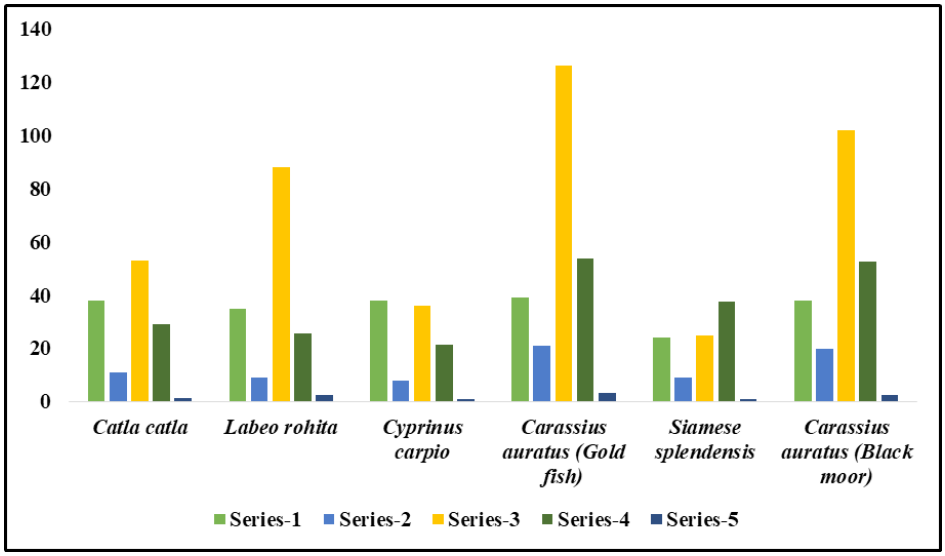
Results

During the present study, a total of 212 fishes were screened between October-2021 to September-2022 which included 111 fish specimens from freshwater reservoirs and 101 ornamentals fishes from aquarium shops in and around Vadodara, Gujarat. Detailed analysis of sampling, incidence and abundance is shown in Table 1 and Graph 1. Parasitic infestation significantly affected the ventral side of the body as shown in Fig. 1 & 2; hence, the parasites were collected mostly from the ventral side of the body.

Out of 111 fishes screened from freshwater reservoirs, 28 were observed to be infested with the *Argulus* parasites with an overall incidence of 25.22%. In cultivable fishes, greater number para-

Table 1. Incidence, abundance and number of parasites collected from fresh water fishes

Sr. No.	Name of Fish	Sample site	Number of fishes		Number of parasites collected	Incidence	Abundance
			Examined	Infected			
1.	*Catla catla*	Freshwater reservoirs	38	11	53	25.22 %	1.59
2.	*Labeo rohita*	Freshwater reservoirs	35	09	88		
3.	*Cyprinus carpio*	Freshwater reservoirs	38	08	36		
		Total	111	28	177		
4.	*Carassius auratus* (Gold fish)	Aquarium shop	39	21	126	49.50 %	2.50
5.	*Siamese splendensis* (Fighter fish)	Aquarium shop	24	09	25		
6	*Carassius auratus* (Black moor)	Aquarium shop	38	20	92		
		Total	101	50	243		



Graph 1. Incidence and abundance *Argulus* in Ornamental and Cultivable fishes [Series-1: Number of Examined fishes; Series-2: Number of Infected fishes; Series-3: Number of Parasites collected; Series-4: Incidence %; Series-5: Abundance]

sites were found in *Labeo rohita* (88), followed by *Catla catla* (53) and the least number of *Argulus* were found in *Cyprinus carpio* (36).

Out of 102 ornamental fishes screened at aquarium shops, 50 were observed to be infested with the *Argulus* parasites with an overall incidence

Fig. 1. *Argulus* infestation in *Labeo rohita*

Fig. 2. *Argulus* infestation in *Catla catla*

of 49.50%. *Carassius auratus* (Gold fish) had the most parasites (126), followed by *Carassius auratus* (Black moor) (92) and the least number of parasites found in *Siamese splendensis* (Fighter fish) (25).

The incidence of infection in cultivable fishes from freshwater reservoirs (25.22%) with an abundance of infection at 1.59 was significantly less than ornamental fishes (49.50%) with an abundance of infection at 2.50. Ornamental fishes found maximum number of parasites mainly the gold fishes (*Carassius auratus*) and minimum in *Siamese splendensis.* Fresh water fishes showed maximum number of parasites in Rohu (*Labeo rohita)* and minimum in *Cyprinus carpio.*

Discussion

Parasites are ubiquitous in nature. Endoparasites generally affect internal organs leading to clinical illness in chronic progression while ectoparasites often stay on body surface and thrive. Chemical treatment of externally parasitized fish is possible according to Hoffman (2019), but endoparasites are more difficult to treat. Ectoparasites are often associated with mild to severe clinical illness depending on numbers. Most of the ectoparasites produce lesions on external aspects of the body in severe infestation (e.g., scales, skin, fins, gills); but, their growth and survival often depends on host species which result in deleterious effects on appearance and health of the fish resulting in lower market values incurring significant economic losses to fish farmers and aquarium shop owners.

Fish parasites multiply quickly in poor water quality parameter, harming fish and often resulting in significant morbidity and fish comes under the stress condition. There are chances of disease outbreak in stress conditions. Parasitic crustaceans of the *Branchiura* subclasses are invariably ectoparasites on fish and have a direct life cycle. Parasitic stages are typically blood feeders on the host's gills, fins, and skin, and a large number can have major pathogenic effects (Lester and Hayward, 2006). *Argulus* is one of the major ectoparasite encountered in freshwater fishes.

In the present study, the incidence and abundance (number of parasites) was higher in *Labeo rohita*, *Catla catla* and *Cyprinus carpio* respectively in IMCs studied during the period. *L. rohita* had the highest infection, while other species had lower than *L. rohita* which coincides with descriptions of Jarfri and Ahmed (1994) and Singh and Khan (2014). Carps were more suitable host for *Argulus*. Infestation was noticeable in Rohu. This result was similar to the observations made by Bakshi *et al.* (2006).

In ornamental fish, major incidence and abundance (number of parasites) was higher in *Carassius auratus* (Gold fish), *Carassius auratus* (Black moor) and *Siamese splendensis* (Fighter fish), respectively. Researches carried out on goldfish and Koi confirms the *Argulus* as the most prevalent parasite (Noga, 2010). In both, black moor and fighter fish, the infection rate was low as compared to Goldfish which are similar to observations and descriptions given by Iqbal *et al.* (2013).

The observations recorded in the present study have not been recorded in Vadodara region by other researchers in past. These observations indicate that *Argulus* is present in noticeable population of fish from freshwater reservoirs and aquarium shops in Vadodara district of Gujarat state, India. *Argulosis* disease is a serious threat in IMCs as well as ornamental fishes which can be extensively harmful to the yield of fishes. The observations recorded in the present study provides pioneer and baseline data on existing occurrence and abundance of *Argulus* which can be utilized for further research on disease investigation and pathological impacts of this parasite in fish. Chemical treatment of externally parasitized fish is possible (Hoffman, 2019) and concerned fishermen/shop owners can be advised accordingly to treat fishes and prevent economic losses when such parasites are identified in different regions. Similar investigation if conducted in different regions of Gujarat and other states can be expected to generate a larger database on *Argulus* infestation.

Conclusion

The present report is the first documentation on the occurrence of *Argulus* parasites in cultivable and ornamental fishes in and around Vadodara district, Gujarat (India). The total incidence and abundance were higher in ornamental fishes at aquarium shops as compared to IMCs/fishes of freshwater reservoirs in and around Vadodara district, Gujarat. Ornamental fishes were greatly infested by a large number of *Argulus* parasites as compared to IMCs. This fish parasite could multiply quickly in poor water quality parameter, harming fish and often resulting in significant morbidity in short period of time. Fish farmers and aquarium shop owners could

face financial losses due to *Argulosis*, Hence, more research is needed on this aspect considering aquaculture as a rising industry in developing countries.

Conflict of Interest

The authors declare no conflict of interest regarding the publication of this paper.

Funding Statement

The research work was funded by the Government of Gujarat under the ScHeme of Developing High quality research (SHODH) Fellowship.

Acknowledgement

Authors are thankful to the Head, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara for providing all the necessary permissions for the field study. Authors are also thankful to the Director, Centre of Excellence, Kamdhenu University, Ukai, for providing laboratory facilities during the study period. The local fishermen are gratefully acknowledged for their cooperation during field surveys. Authors acknowledge Ms. Tulsi Brahmbhatt for field assistance.

References

Anonymous, 2020a. The State of World Fisheries and Aquaculture. http://www.fao.org.

Anonymous, 2020b. Press report 2019-20 of Marine Product Export Development Authority, Ministry of Commerce India. Available at https://www.mpeda.gov.in.

Bakshi, A.K., Chandra, K.J. and Hoque, N. 2006. Argulosis in the fish culture ponds of selected areas of Mymensingh. *Journal of Bangladesh Agricultural University.* 4 : 305-312.

Hoffman, G.L. 2019. *Parasites of North American Freshwater Fishes*. Cornell University Press.

Iqbal, Zafar, Mumtaz, Rabia, and Sajjad, Ramsha, 2013. Argulosis, in some ornamental fishes imported to Lahore, Pakistan. *Eur. J. Vet. Med.* 2(3) : 171-178.

Jafri, S.I.H. and Ahmed, S.S. 1994. Some observations on mortality in major carps due to fish lice and their chemical control. *Pakistan J. Zool.* 26(2): 274-276.

Kabata, Z. 1985. *Parasites and Diseases of Fish Cultured in The Tropics*. Taylor and Francis. London and Philadelphia.

Lester, R.J. and Hayward, C.J. 2006. 14: Phylum Arthropoda. *Fish Diseases and Disorders*. 1: 463-562.

Moyle, P.B. and Leidy, R.A. 1992. Loss of biodiversity in aquatic ecosystems: Evidence from fish faunas. In: *Conservation Biology*, Springer, Boston, MA. Pp:127-169.

Muruganandam, M., Chipps, S.R. and Ojasvi, P.R. 2019. On the Advanced Technologies to Enhance Fisheries Production and Management. *Acta Scientific Agriculture*. 3(8): 216.

Noga, E. J. 2010. *Fish Disease: Diagnosis And Treatment.* Ames: Wiley.

Parveen, I. and Gaikwad, J.M. 2018. Diversity of Fish Parasites from fresh water fishes of Masooli Reservoir of Parbhani District. *International Journal of Scientific and Research Publications*. 8(10): 371-376.

Singh, P. and Khan, S. 2014. Studies on infection and relative density of Argulus in Indian and exotic major carps from mixed fish culture ponds at Faizabad, Uttar Pradesh. *Journal of the Kalash Science.* 2(2): 71-74.

Yamaguti, S. 1963. *Parasitic Copepoda and Branchiura of Fishes*. Wiley Interscience, New York.