

Infection of snail host with trematode larval stages in India: A minireview

Abstract:

Digenetic life cycle is very complex completing in intermediate and definitive hosts. In trematode parasites, snails serve as the first intermediate host harbouring its larval stages such as sporocyst, redia and cercaria and the vertebral host serving as their definitive host. So, snail infection with trematode parasite indirectly results in the infection of the definitive host including human. In India, limited studies are available on the infection status of snail hosts with different trematode larval stages. Most of the studies are confined to the central India, a few from the southern region but almost no reports are available from the northeastern states. But, native peoples in some states of northeastern India, usually consume snails as their delicacy. From the review analysis, snail species of the genus *Melanoides*, *Lymnae*, *Thiara*, *Bithynia*, *Malenoides*, *Indoplanorbis*, *Thiara* found infected with trematode cercarial stage of different types: furcocercous, xiphidiocercous, monostome, gymnocephalous, Echinostome, parapleurolophocercous cercaria. Studies revealed that there arises urgency for an extensive survey in the infection status of snail host with various parasites in every corner of the country.

Keywords: Snails, trematode, cercaria, intramolluscan, India,

1. Introduction

India lies in the sub-tropical region which has a rich flora and fauna. The environment has favourable conditions for the growth and propagation of helminthic parasites thus they are highly diverse in nature. They are found parasitizing and infecting a wide range of vertebrate hosts. Most of the parasitic infections are highly concern as they pose important public health issues, particularly in tropical and subtropical regions [1].

Among the helminth parasite, the digenetic trematode also known as flukes are common parasites of wild and domestic animals [2]. Some of them are medically important, as causing various diseases in humans such as paragonimiasis, Opisthorchis, Clonorchis, Schistosomiasis, fasciolosis, etc, especially in south-east Asia countries [3,4,5]. The life cycle of digenetic trematode is very complex completing in one or more than one intermediate host depending on the type of species [6,7,8, 9]. In its life cycle, molluscs or freshwater snail serve as the first intermediate host where its asexual reproduction occurs, harbouring the larval stages- Radia, sporocyst, cercaria, metacercaria. The sexual reproduction of the parasite occurs in vertebrate definitive host ranging from fish, amphibians, reptiles, birds and mammals, thus affecting their health and can even lead to their death [10, 11,12].

2. Snail-borne parasitic diseases (SBPD)

Snails are a good source of proteins and minerals and have been used as food supplements. They inhabit in all forms of water bodies ranging from ponds, small streams, large lakes and rivers [13]. They are consumed widely by the local population especially in south-East Asian countries as a delicacy and also as a part of customary. Many freshwater snails have been harvested in Indo-Burma region for consumption process [14,15]. The digenean trematodes commonly used two major snails groups namely prosobranchs and pulmonates for completing their life cycle (16). In at least 71 species of trematode, snails in the group of *Lymnaea* are responsible for establishing their infection (17). So, they are highly significant medically as their consumption has been associated with various food-borne trematodiasis (18). Among them, snail-borne parasitic diseases (SBPD) are one of the major parasitic diseases which are clinically important and are widely prevalent particularly in underdeveloped countries. Because the snails serving as an intermediate host for different trematode harbouring its larval stages have contributed important role in transmitting many helminthic diseases (19,20). SBPD has been reported in approximately 90 countries with millions of people are being infected. For some trematode species namely *A. cantonensis* and *S. mansoni*, snails are the only intermediate hosts, and for some species namely *C. sinensis*, *P. westermani*, *F. buski*, and *F. hepatica* snail host serve as the first intermediate hosts. These undergo several larval stages development within the snails, thus showing that the snail host are very important for the completion of their life cycle.

3. SBPD in India

In India, snails that belong to a class of gastropods have been reported to serve as an intermediate host for parasites belonging to families Heterophyidae, Schistosomatidae, Fascioleidae, Opisthorchiidae, Cryptogonimidae, Echinostomatidae and amphistome (2, 21, 22,23,24,25). So, the presence and abundance of snail species in the region indicates the possibility of spreading trematode infection (26). Several workers have worked on the trematode intra-molluscan larval stages from different parts of India (26, 27,28,29; 30, 31; 32; 33,34, 35; 36; 37) and has observed infections with different kinds of trematode cercarial stage (amphistome, echinostome, furcocercous, gymnocephalous, monostome, xiphidiocercous etc.) and metacercariae (aspidogaster, echinostome, opisthorchid, plagiarchiid, strigeid etc.). The information regarding trematode larval infection in freshwater snails is limited in the public domain (38).

SBPD is one of the neglected tropical diseases which draw less attention by the helminthologist towards studying their prevalence, infection status, biology and other related aspects with the exception of some diseases like schistosomiasis, fasciolosis, etc. So, helminthologists need to focus and carry out more work on mollusc which is a mandatory intermediate host in order to bring out the clear picture of snail borne infection status, their biology and understanding the relationship with other species. Better understanding of the snail biology explains the difference in parasites community among different snail species which are attributed due to host growth, reproduction and life span (39). In addition to the certain factors of the intermediate host, environmental factors which include light, temperature, water quality also affects the infection of digenetic trematode in intermediate host (40; 41). The population dynamics of the infected intermediate host determines the infection prevalence in the definitive host (42).

In this paper, data on the infection status of trematode larval stages in various snail hosts prevailing in different regions, states in India are surveyed. This analysis will bring out the status of the infection in different

parts of the country. It will also bring out the gaps in research field needed to be addressed and focussed on, thus attracting the helminthology community in this field to give more importance.

4. Present State:

In India, very less information is available in the public domain on the occurrence of the intracellular larval stages of trematode in molluscan host. Most of the published reports are mainly the two medically important two flukes: *Paragonimus* and *Fasciola*. In this study, review is done on the reports of trematode larval stages in different molluscan host in different parts of the country. It is depicted in **table 1**. The data used in the study are available in the public domain. The papers that had reported intra-molluscan larval stages are cited in the reference section.

Sr. No	Parasites	Larval Stage	Snail Host	localition	Reference
1	-A gymnocephalous cercaria, <i>Cercaria johrii</i> n. sp.	Cercaria	- <i>Melanoidestuberculatus</i>	Rajasthan (Fateh Sagar Lake, Udaipur)	43
2	- furcocercous - xiphidio, -monostome -gymnocephalous cercariae - sporocysts contained numerous large sized active furcocercous cercariae	-Cercaria -Sporocyst	- <i>Melanoidestuberculatus</i>	-Rajasthan	44
3	-	-	- <i>Indoplanorbis</i> spp. - <i>Gyraulus</i> spp. - <i>Lymnaea</i> spp. - <i>Viviparas</i> spp	Jharkhand (Ranchi)	45
4	- <i>Fasciola gigantica</i> , - <i>Explanatum explanatum</i> , - <i>Paramphistomum epiclitum</i> , - <i>Fischoederius elongatus</i> - <i>Schistosoma spindale</i>	Cercaria	- <i>Lymnaea auricularia</i> , - <i>L. luteola</i> , - <i>Gyraulus convexiusculus</i> - <i>Indoplanorbis exustus</i>	-Uttar Pradesh (Meerut, Bareilly and Jhansi) - Madhya Pradesh (Jabalpur) - Jharkhand (Ranchi)	46
5	-Family: Transversotrematidae; transversotrematid cercaria; -Amphistome, - Echinostome, - monostome, - gymnocephalous, - furcocercous	cercaria	- <i>Melanoides striatella tuberculata</i> -pulmonate and operculate snails	Rajasthan (Udaipur)	47

	- xiphidiocercous				
6	- <i>Fasciola hepatica</i> - <i>Plagiorchis vespectilions</i> - <i>Echinostome sp.</i> - <i>Pseudoechinoparyphium</i> sp. - <i>Trichobilharzia ocellata</i> - <i>Diplostomum hepaticum</i>	Cercaria	- <i>Lymnaea acuminata</i>	Maharashtra, Aurangabad	48
7	Two new species of -furcocercous cercariae	Cercaria	- <i>Thiara tuberculata</i>	Kerala (Kozhikode and Malappuram)	49
8	Two new species of -furcocercous cercariae	Cercaria	- <i>Lymnaea luteola</i> - <i>Gyraulus convexiusculus</i>	Malabar	50
9	Two new species of -furcocercous cercariae	Cercaria	- <i>Indoplanorbis exustus</i> - <i>Thiara tuberculata</i>	Western Ghats (Wayanad region)	51
10	Two new cercaria - parapleurolophocercous cercaria -furcocercous cercaria	cercaria	- <i>Digoniostoma pulchella</i> - <i>Indoplanorbis exustus</i>	Western Ghats (Wayanad region)	52
11	<i>Artyfechinostomum</i> <i>sufartyfex</i>	metacercaria	- <i>Pila globosa</i>	Bihar	53
12	Four new species of virgulate xiphidiocercariae	Cercaria	- <i>Bithynia (Digoniostoma) pulchella</i>	Kerala (Malabar)	54
13	Echinostome	Cercaria	- <i>Indoplanorbis exustus</i> - <i>Lymnaea luteola</i>	Kerala (Palakkad)	55
14	Three new species of virgulate xiphidiocercariae	Cercaria	- <i>Bellamyia bengalensis</i> - <i>Thiara tuberculata</i> - <i>Paracrostomahuegelii</i>	- Kerala (Malappuram) - Kerala (Wayanad)	56

Table 1. Snail host infection with trematode larval stages from different parts of India.

In this analysis, focus has been made on the reports of trematode cercarial infection in snail host. Through the study, it was observed that, the snail hosts *Lymnaea*, *Indoplanorbis* are serving as potent intermediate host for the trematode parasites belonging to the genus *Fasciola*, *Explanatum*, *Paramphistomum*, *Fischoederius*, *Schistosoma*, *Plagiorchisvespectilionis*, *Echinostome*, *Pseudoechinoparyphium*, *Trichobilharzia*, *Diplostomum* especially in the regions of Uttar Pradesh and Maharashtra. Other genus of the snail host *Melanooides*, *Thiara*, *Bithynia* also found harboured furcocercous, xiphidiocercous, monostome, gymnocephalous, Echinostome, parapleurolophocercous cercaria (Table 1). The available studies on this aspect are very limited. So, there is high probability that many infected snail host remain unexplored. Studies on the intramolluscan larval stages of trematode parasite in India are mainly restricted in the states of Rajasthan, Kerela, Bihar, Tamil Nadu, Uttar Pradesh, Madhya Pradesh, Jharkhand, Maharashtra, Western Ghats and Malabar (Table 1). In some states of Northeast region, native peoples consumed snails as their delicacy and also as a part of their customs, but no research or studies are available from this part of the region. So, there is a need to be focus by the helminthologist and correlate with any trematode infection in the region.

5. Perspective:

There is a need for further research on the biology of the trematode, prevalence on the infection status, dominant parasite infection in the region. There are many untouched parameters in the parasite biology, their life cycle and the possible intermediate host which can also serve as the intermediate host for SBPD. With this study, we can get the detailed biology of the life cycle of the parasites, and can even study the relation between the larval stages through in vitro studies. So far, no study has been carried out regarding the complete larval development in the lab. In present situation, there is limited information available regarding the SBPD although variety of snail species are available in the country and are also consumed as a food supplement. So, an extensive and detailed study of the biology of SBPDs and their relation with their intermediate hosts will help in understanding their geographical distribution and its expanding nature.

6. Conclusion

The present review on the larval stages in commonly edible freshwater snail hosts reveals that helminthologists have mainly focussed on only the cercarial spp. parasitizing the intermediate host in the Indian mainland. The most commonly reported cercaria include monostome, amhistome, echinostome, furcocercous, gymnocephalous and xiphidiocercous. Studies are only restricted mainly in the mainland of the country, almost no information is available in several parts of the country, northeastern states in particular. Also study on the biology of the larval stages and their association with the host are also lacking. It becomes a prerequisite to get the baseline information on the probable snail intermediate host, types of parasites and transmission types. So the scientific community need to focus to study on the various aspects on the host parasite relationship, their intensity of damage caused by the parasite. Importantly need for extensive studies for finding the infection prevalence in every regions of the country, if any.

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