National Journal of Life Sciences, Vol. 17(1) June 2020 : 43-48 ISSN : 0972-995X (Print), 2321-7960 (Online)

NEW RECORDS OF TURBELLARIA, CESTODES, NEMATODE AND PENTASTOMIDA FROM SNAILS IN BANGLADESH

HAMIDA KHANUM*, SUVRA ROY and RIMI FARHANA ZAMAN

Department of Zoology, University of Dhaka, Dhaka (Bangaladesh)

ABSTRACT : The present study was conducted at twenty three locations which include eleven from Dhaka region, six from Khulna region and an overview study was also carried another six from Kishoreganj region from different ponds during July,2011-June,2013 on a once in a month basis for helminth infection in freshwater molluscs. various parasites and their diseases. A total of three species of freshwater molluscs belonging to two families that comprises of Viviparidae and Ampullariidae out on the known molluscs, three genera (*Bellamya*, *Pila* and *Brotia*) were selected in the pond eco-systems. As the molluscs are intermediatory hosts between the parasites and animals. Among 23 locations, nematode infection was very rare. Rather than two Cestodes, one Turbellarian and one Pentastomida were also found in *Pila globosa*.

Key words : *Freshwater mollusc, Helminth, Turbellarian & Pentastomida infection.*

INTRODUCTION

Parasites may be directly or indirectly involved in the ecology and evolution of a broad range of phenomena: host population dynamics and extinctions, maintenance of genetic diversity, sexual selection, evolution of genetic systems, and evolution of sexual recombination, to name just a few. Certainly, parasites possess features that make them very attractive as explanatory factors in the evolution and ecology of their hosts. These features include their high abundance in nearly every ecosystem, their typically narrow host range (compared with typical predators), their adverse effects on their hosts (*e.g.* reduced fecundity & survival) and density dependence during horizontal transmission (Price,1980). On the other hand, hosts are the environment for the parasites and thus define their niche. Most parasites are not viable outside of their hosts for extended periods (not considering resting stages) and therefore from the parasite's point of view-parasite and host form an inseparable biological unit. Thus, parasite ecology is closely linked to the ecology of its hosts and the parasite's natural history is best seen in the light of its host's biology.

Global climate change is predicted to influence disease dynamics particularly for pathogens with complex life cycles (Harvell *et al.*,2002). Many pathogens with complex life cycles have free-living infectious stages that are exposed to environmental conditions and are thus subject to the same changes experienced by their hosts (Pietrock and Marcogliese,2003). For example, free-living trematode parasite cercariae have been shown to be vulnerable to a variety of abiotic factors (Pietrock and Marcogliese,2003). With respect to parasitic disease in aquatic organisms, climate change is expected to have effects via alterations in temperature, water level, salinity and pH (Marcogliese,2001 and Hakalahti *et al.*, 2006) or modifications of host susceptibility to infection (Harvell *et al.*,2002), but could also directly affect free-living stages of parasites. For parasites with complex life cycles involving multiplication within and transmission among various hosts, it is critical to understand the survival and rate of transmission of free-living stages in order to estimate the basic reproduction ratio (RO) of the parasite (Karvonen *et al.*, 2003).

Changes in temperature, salinity, UV light, and oxygen level can all affect the viability of nematode infective larvae in water (Thurston *et al.*,2000 and Grewal *et al.*,2003). The level of infectivity of these larvae varies considerably among species, possibly related to foraging strategies, which incur different metabolic demands. Survival is related to declining energy reserves. Metabolic rates increase dramatically after a few weeks in water (Morley,2010).

Bartlett and Anderson (1985) studied the 3rd stage larvae of *Spiroxys contortus*, *Falcaus trawardi* and *Serpinematris inosus* in acquatic snails *Lymnaea stagnalis* and the prevalence were 79.8%, 22.5% & 1.6% respectively, in 110 snails. Khromovas suggestion that snails are parasitic hosts of *S.contortus* was confirmed by these two authors. Snails were also likely paratenic hosts of *S.trispinosus*.

Skorping (1985) reported the *Lymnae astagnalis* as experimental intermediate host for the protostrongylid nematode *Elaphostrongylus rangiferi*, a neurotrophic parasite of reindeer, *Rangifer tarandus*. All juvenile snails exposed to first-stage larvae of *E.rangiferi* were reported to be infected.

Natural variations and fluctuations have been shaping ecosystems over evolutionary timescales. However, changes in abiotic and biotic factors are occurring in this period of global change at unprecedented rates, scales and combinations (Vitousek,1994). These changes include a whole range of variables, well beyond climatic aspects only, which affect individual species as well as species interactions. The consideration of multiple environmental factors is of great importance in order to more accurately address ecologically relevant consequences of these factors in general and of global change in particular.

*Corresponding author (email : hamida_khanum@yahoo.com) Received 15.03.2020 Accepted 25.05.2020

MATERIAL AND METHODS

Site-1 Dhaka and surrounding regions : (Ramna Park pond, Dhaka; Curjon hall pond, Dhaka; Jagannath hall pond, Dhaka; Keranigonj pond, Dhaka; Tongi railway Station pond, Dhaka; Jaydebpur railway station pond, Gazipur; Bhawal-Gazipur railway station pond; Salna BSMAU pond, Gazipur; Mawna bazar pond, Gazipur; Tongi Bari bazar pond, Munshiganj; Lahajang bazar pond, Munshiganj).

The study area : Snails *viz.*, *Bellamya bengalensis*, *Pila globosa* and *Brotia costula* were collected from different localities of Bangladesh. The collected samples were from different types of ecosystem :

Collection of parasites : The snails were carried in bucket to the Department of Zoology (Parasitology branch). The collected snails kept under observation at for some time. The snails which are fully grown showed larval infection while the young ones normally free from larval infection. For study of parasites two methods were used for the observations.

1. Natural emerging method : In natural emerging method, the snails were kept in separate test tubes. This was a constant source of living parasites naturally emerging from the snails. The sunlight and artificial light play an important positive role in stimulating the emergence of parasites.

2. Crushing method : This method of investigation of parasite collection found suitable for observations. This quick method was useful for studying the seasonal percentage of infection of parasites.

Identification of the parasites : Eggs of various parasites were identified with the help of compound (10x) microscope. The 40x objective was also used for the confirmation of ova, larvae and cysts. For taxonomic classification of parasites (egg/cyst and larva) Yamaguti (1958,1959,1961,1963), Cheng (1964), Soulsby (1982), (Cheesbrough,1987) and other references and published articles were consulted. Representatives of each parasite were photographed by a digital camera.

RESULTS AND DISCUSSION

The present study was conducted at twenty three locations which include eleven from Dhaka region, six from Khulna region and an overview study was also carried another six from Kishoreganj region from different ponds during July, 2011-June,2013 on a once in a month basis for helminth infection in freshwater molluscs. various parasites and their diseases. A total of three species of freshwater molluscs belonging three genera (*Bellamya*, *Pila* and *Brotia*) were collected from the pond eco-systems. As the molluscs are mostly intermediatory hosts between the parasites and animals, nematode infection was very rare. Two species of cestodes, one Turbellarian and one Pentastomida were also found in *Pila globosa*. The classification and description of the parasites are as follows :

Identification of parasites collected from snails

Genus : *Paravortex* sp.

Phylum : Plathyhelminthes, **Class :** Turbellaria, **Order :** Rhabdocoela, **Family :** Graffillidae

Genus : Paravortex sp.

Description : They are small, flattened organisms. They are generally colorless and somewhat transparent. They are all ecto-commensals on fresh-water animals, primarily crayfishes, prawns, isopods and other crustaceans. They are less frequently found on turtles and snails, on which are attached to the external surface or in the branchial chamber. They are characterized by the absence of cilia or reduced cilia, tentacles, a single genital pore and one or two adhesive discs at the posterior end of the body (Fig.1).

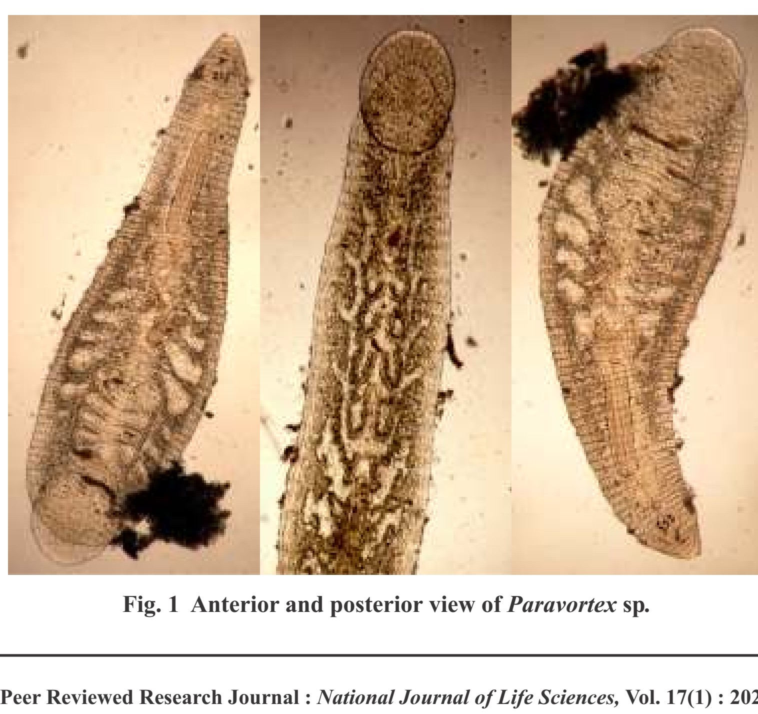

Fig. 1 Anterior and posterior view of *Paravortex* sp.

They generally live on the gills or on the body surface of freshwater crustaceans of more rarely on gastropod mollusc or turtle. They usually have a ciliated epidermis, an undivided body and a simple life cycle. They are usually flattened dorso-ventrally without segmentation and are bilaterally symmetrical. They possess an incomplete digestive tract lack a body cavity and are without special skeleton, circulatory or respiratory structures. They have a flame- cell type of excretory system (after Cheng,1964 and Noble,1971).

Genus : *Trilocularia* sp.

Phylum : Plathyhelminthes, **Class :** Cestoda, **Order :** Tetraphylidea,

Family : Triloculariidae,

Description : The tetraphylldean cestodes are recognizable by four prominent outgrowths on the scolex. Scolex with four saccular or auricular bothridia and large myzorhynchus, without hooks or suckers. Strobila distinctly segmented proglotides acraspedote. Inner longitudinal musculature strongly developed. Scolex unarmed, with four sessile bothridia. Each bothridium triangular, with rounded corners, divided into three suckers like loculi placed in a triangle, one in front and two behind side by side. Neck long, anteriorly thick. Proglottides crowded anteriorly, then subquadrate to trapezoidal, longer than broad posteriorly. Common atrium is marginal. Vitellaria are in two lateral fields. Uterus appears as small uterine duct dorsal to vagina or as stem like median uterine sac ventral to vagina. Gravid uterus is broad, occupying most of proglottid. Each proglottid contains single set male and female reproductive organs. Larvae have been found in cephalopod molluscs. The adults are all parasiticin the intestines of elasmobranch fish (after Cheng,1964; Yamaguti,1961 and Noble,1971) (Fig.2).

Fig. 2 Anterior and posterior view of *Trilocularia* sp.

Genus : *Polypocephalus* sp.

Phylum : Plathyhelminthes, **Class :** Cestoda, **Order :** Lecanicephalidea,

Family : Lecanicephalidae,

Description : Scolex subglobular, flat and square In front view, anterior region represented by a crown of 14-16 retractile tentacles and posterior regions with four suckers symmetrically. Neck present or absent. Strobila more or less cylindrical. Proglottides craspedote. Cirrus pouch oblique may push inward the poral side of uterine sac. Genital pores irregularly alternating. Vitelline follicles large, extending in two lateral rows anterior to ovary. Uterus median, occupying most of proglottis length anterior as well as posterior to overy. Parasitic in elasmobranchus (after Cheng,1964; Yamaguti, 1961 and Noble,1971) (Fig.3).

Genus : *Polypocephalus* sp.

Phylum : Arthropoda (Pantastomida), **Class :** Maxillopoda, **Order :** Porocephalida,

Family : Linguatulidae,

Genus : *Linguatula* sp.

Description : They are legless and worm like, but near the mouth are two pairs of hollow, curved, retractile hooklets that are rudimentary appendages. Sharp hooks on the anterior end are anchoring devices. Pentastomids posses elongate bodies that are cylindrical. Externally the bodies are annulated, but these rings are not true segments. Adults do not posses legs, but four or six rudimentary legs are present on larvae. Because of their vermiform bodies, these animals are referred as worms. The larvae are found in the viscera of the intermediate host, which is usually a mammal or other vertebrates.

Adult are parasitic in the respiratory tract and lungs of vertebrates. The mouth is located anteriorly and is sub terminal. The mouth leads into a buccal cavity, which is linked by a narrow pre-pharynx with the muscular pharynx. They have two pairs of hollow fang like hooks, one pair on each side of the mouth which can be retracted into grooves. Their body surface is covered with a layer of chitin. The adult female is tongue-shaped, 100-130 mm long and up to 10 mm wide, whereas the male is about 20 mm long and 3-4 mm wide. Egg containing embryos with rudimentary legs are deposited in the nasal passages and frontal sinuses of mammals and are discharged in nasal secretions.

Upon reaching water or moist vegetation, embryogination is completed and if the eggs are ingested by the intermediate host hatching occurs in the digestive tract and the larvae migrate through the intestinal wall and lodged in the liver and other viscera. After number of molts the nymph stage is attained. Nymphs lie encapsulated with the tissue and they are the infective stage for carnivorous animals that feed on the herbivorous intermediate hosts. Although the general belief is that nymphs are digested out of their capsule and immediately migrate to the nasal passages of the definitive host (after Cheng,1964 and Noble,1971) (Fig.4).

Genus : *Angiostrongylus* sp.

Phylum : Nematoda, **Class :** Secernentea, **Order :** Strongylida, **Family :** Metastrongylidae

Genus : *Angiostrongylus* sp.

Description : Nematodes are usually round in cross section; hence they are called round worms. Compared with trematodes and cestodes, the life histories of nematodes are less varied and their anatomy less adapted to parasitism. In case of *Angiostrongylus* sp. definitive host rats and intermediate host snails and slugs. In infected rats, eggs containing uncleaved zygotes are deposited in the blood streams, where they become lodged as emboli in the smaller vessel in the lungs. Embryonic development occurs here.

However, these flatworms cannot be infected with first stage larvae and presumably serve as paratenic hosts, which acquire third stage larvae from feeding on naturally infected snails and slugs. The first stage larvae actively penetrate molluscs. Within the intermediate host, the larvae undergo two molts but do not exsheath. When an infected mollusk is ingested by a rat, the larvae exsheath in the rodents' stomach and burrow through the ileum and become blood-borne and finally they become mature in the rat (after Cheng,1964 and Noble,1971) (Fig.5).

Snails usually play a dominant role in the ecology of fresh waters by providing food for many other animals and by grazing on vast amounts of algae and detritus (debris). Freshwater snails occur across a variety of habitats, ranging from small temporary ponds and streams to large lakes and rivers, reflecting the wide-ranging biology of many different species (Harvell *et al.*,2002). Many species spend their entire lives in a few square meters of habitat, making them extremely vulnerable to localized environmental habitat degradation. Although most species prefer clean, stable, and firm river bottoms, some prefer the soft substrates more common to ponds and lakes. Ponds are amongst the most diverse freshwater habitats and have been recently found to support more species, as well as more uncommon, rare, and threatened species compared to lakes, rivers, and streams (Wright,1971).

Though water levels in these water sources are mainly depended on temperature and rainfall, human activities also play a crucial role in maintaining or otherwise the levels throughout the year. The prime reason is enhancing irrigation facilities which resulted in increase in inundated areas and prolongation of water in the water sources. Whether temporary water sources are used for agriculture or not also influences water levels during the year (Noble,1971). For using ponds for fish culture, animal fecal material is added, which helps in the survival of snails; likewise, the ponds are used for cultivation of water chestnuts/lily or other aquatic crop, and the snails utilize the crop both as its food as well as for laying eggs. There are other human activities which affect snail population adversely by destroying their habitats. The first is adding pollutants in the form of detergents, chemicals, and industrial wastes which destroy ecological system of aquatic fauna, thus helping in destroying snail population. Other is urbanization or colonization in new areas resulting in filling of the ponds, tanks and lakes for construction of the buildings.

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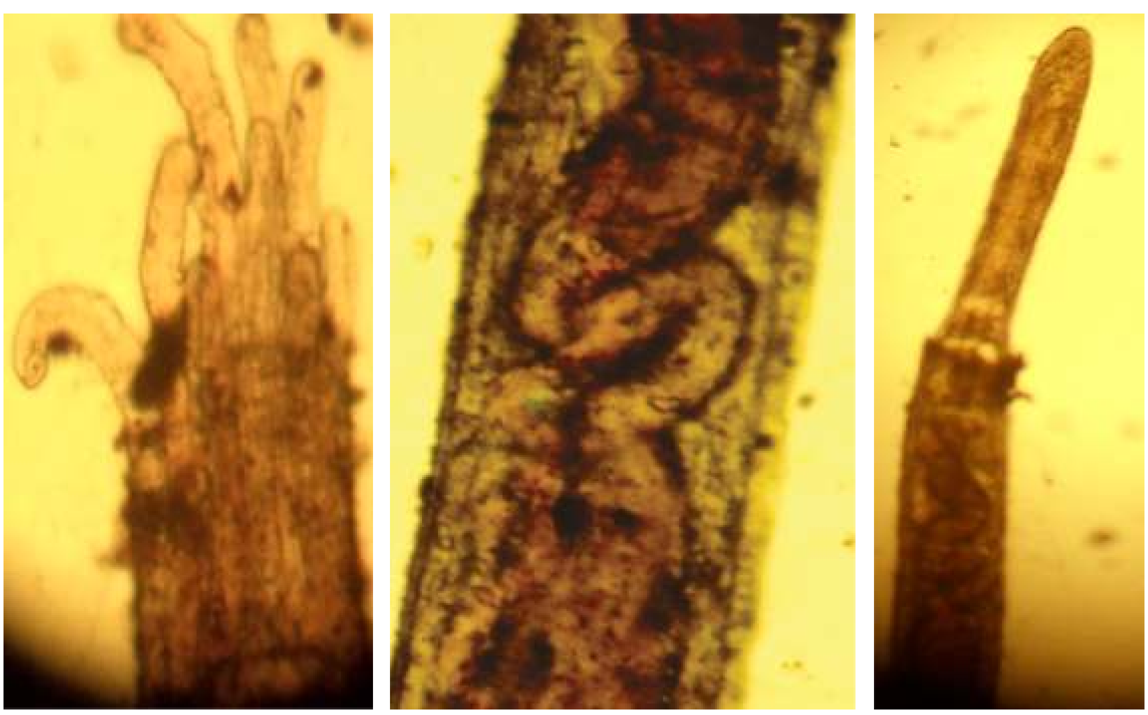

Fig. 3 Anterior and posterior view of *Polypocephalus* sp.

Fig. 4 Anterior and posterior view of *Linguatula* sp.

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Snails serve as natural and parasitic hosts of nematodes. A good number of reports are available on the occurrence of nematodes in snails. Some of them are : Richards and Merritt (1967) studied on *Angiostrongylus cantonensis* in molluscan intermediate hosts. He found first- stage larvae of this species from rat feces developed to infective third stage larvae in 20-26 species of freshwater mollusks. Numbers of larvae up to 2,000 per snail and survival of larvae for a year were observed in *Biomphalaria glabrata*. First-stage larvae were susceptible to drying but survived at least 3 weeks in freshwater and were infective to snails after at least 2 weeks in either freshwater or seawater. *B.glabrata* was routinely infected by ingestion of infected rat feces and first-stage larvae were observed penetrating the wall of the intestine of snails. Isolated third-stage larvae were susceptible to drying but survived up to 11 days in *B.glabrata* removed from water, larvae also remained alive 4 days after death of the snails. Rats became infected by drinking water containing third-stage larvae which were observed active in freshwater for up to a week.

Chao *et al.* (1993) studied on the prevalence of larval helminth in freshwater snails of the Kinmen islands, Thaiwan, Republic of China and reported third-stage larvae of *Parastrongylus cantonensis* in *Ampullarius canaliculatus* (5/103), *Sinotaia quadrata* (20/141), *Hippeutis umbilicalis cantor* (1/70) and *Gyraulus spirillus* (2/87) *Segmentina hemisphaerula* were not infected. Seehabutr (2005) recorded nematodes *Rhabditis* sp. In alimentary tracts of giant African snail (terrestrial) (*Achatina fulica*) in Thailand, the nematodes of this species were also found in terrestrial snails (*Hemiplecta distinct*) and slugs (*Psrmarion* sp.).

Fig. 5 The whole worm, Anterior and posterior view of *Angiostrongylus* sp.

Farahnak *et al.* (2006 b) studied the nematode association with *Bellamya bengalensis* snail and evaluated its medical and veterinary importance in Khouzestan province (South West of Iran). From the total of *Bellamya* snails examined for nematodes, 27(2.36%) snails were found to be infected with *Oionchus* nematode parasite. These results have been recorded for the time and showed the importance of *Bellamya* snails in the region.

Komalamisra *et al.* (2009) reported *Pila ampullacea* and *Pomacea canaliculata*, as new paratenic hosts of *Gnathostoma spinigerum*. Aquatic snails, *Pilaampullacea* and *Pomacea canaliculata* were experimentally found to be suitable paratenic hosts for advanced third-stage larvae (L3) of the nematode *Gnathostoma spinigerum*, the causative parasite of gnathostomiasis in humans. *G.spinigerum* (L3) were found to be encapsulated in the tissue of the snails foot and its organs. This was the first evidence to reveal that not only vertebrates but also invertebrates (snails) could serve as paratenic hosts to this parasite.

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