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Study on Morphology of freshwater Snail and Cercariae present on *Bellamya bengalensis* in and around Meerut District (UP), India

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ABSTRACT

Snail is known to serve as an intermediate host for several species of larval trematodes some of which are highly pathogenic for their second intermediate host i.e., fishes. If we want the fisheries development programmes to be successful, we need to intensive research on the fish parasites and their intermediate host. These parasites also provoke remarkable mortality to human and cause serious damages to aquaculture, which is a valuable source of food and employment in developing countries, basically deals with the studies on effect of parasite i.e. cercariae that were found in various water bodies of Meerut region infecting the host *B. bengalensis*. Recent investigations have shown that some of the molluscs are sources of important bio medical compound. The World Health Organization (WHO) is therefore, paying special attention to this dynamic host-parasite interaction of larval trematodes and snail control. Although the effects of digenetic trematodes on their vertebrate hosts have been studied, comparatively little attention has been paid towards the host-parasite relationship between the larval trematodes and their molluscan hosts.

Keywords- Bellamya, Cercaria, Host, Digenetic

Introduction:

Studies on freshwater snails and larval trematodes has been receiving much attention since last three decades. With very few exceptions molluscs serve as the only or as one of the intermediate hosts of the digenetic trematodes. Among this group of endoparasites, a number of species are of public health and veterinary importance, since they are known to cause debilitating diseases, with some being more severe than others. The World Health Organization (WHO) is therefore, paying special attention to this dynamic host-parasite interaction of larval trematodes and snail control. Although the effects of digenetic trematodes on their vertebrate hosts have been studied, comparatively little attention has been paid towards the host-parasite relationship between the larval trematodes and their molluscan hosts.

Irrespective of whether the mollusc is the intermediate, definite or only host in the developmental cycle of the parasite, one can expect to find pathological manifestations induced by the parasite. Such alterations from the normal can be appreciated as histopathological, physiological as well as biochemical changes. Although a large number of helminths have been reported as parasites of economically important molluscs all over the world.

Material and Method:

A total of around 250 freshwater snails were collected monthly during May 2015 to April 2016 from various water reservoirs of Meerut region viz., Ram Taal Vatika, Chittora Powerhouse, Diggi Shastri Nagar, Village Shobhapur, Village Kunda, Kanker Khera near 510 Army Workshop, Bhola Power House, Pond near Railway Cantt. Station, Nanu Ki Nahar near Sardhana, Pond in village Rohta, Kali Nadi near Medical College, Ashram Pond in Parikshit Garh, Pond in Ganga Nagar near Hastinapur.

Snails were collected and identified by the method suggested by **Subba Rao (1989)**. The snails identified were found to be Bellamya bengalensis / wypioa (Lamarlo). Lymnaea (Pseudosuccina) luteola / typica (Lamark).

Collected snails were thoroughly washed in running tap water, arranged specieswise, counted and then kept in 5 to 10ml dechlorinated tap water in large specimen bottles (5 x 3 cm) and placed beneath either a light source for twenty-four hours or exposed daily in the morning sunlight for one hour. The snails were then kept in individual tubes. Individual tubes were then examined by a hand lens for shedding of cercarine as it stimulates the positively phototrophic cercariae to come out of the infected snails. The snails which did not release cercariae were examined three times on alternate days as above and finally before discording them, were crushed between two glass slides and examined under a compound microscope to determine for the presence of larval trematodes and developing stages of cererise in the hepatopancreas. All the positive snails were maintained in the separate aquaria in dark corner of the room duly covered with black cloth. Pieces of calcium carbonate were added to aquaria.

Each snail that shed cercariae under these conditions was considered to have a patent infection. These snails were maintained in the laboratory in glass beaker and were fed a twig of Hydrilla plant of Spinacea oleracea or lettuce. Distilled water was used in initiating and keeping a constant water volume in the aquaria. The water of beaker was changed daily. The snails which on repeated examination were found negative of trematode infection were separated species wise and transferred into big glass jars, enamel basins or big earthen tube and maintained in the laboratory on boiled algae and on well washed aquatic plants.

From the beaker containing infected snails, cercariae were taken from the water for the study of various morphological structures. Cercariae were identified by the method suggested by **Schell (1985)**. For morphological studies cercariae were taken on a glass slide with the help of a fine dropper and covered under living condition under the microscope. The drawings were made with the help of camera lucida. Measurements were taken for at least 12 specimen for each cercarial species with the help of ocular micrometre. Uniform results were obtained by measuring heat killed cercariae.

Morphology of snails:

Systematic position of *Bellamya bengalensis* (Lamarck, 1822)

Phylum: Mollusca
Class: Gastropoda
Sub class: Prosobranchia
Order: Mesogastropoda
Super family: Viviparoidea
Family: Viviparidae
Sub family: Bellamyinae
Genus: Bellamya (Jousseaume, 1886)
Species: bengalensis (Lamarck, 1822)

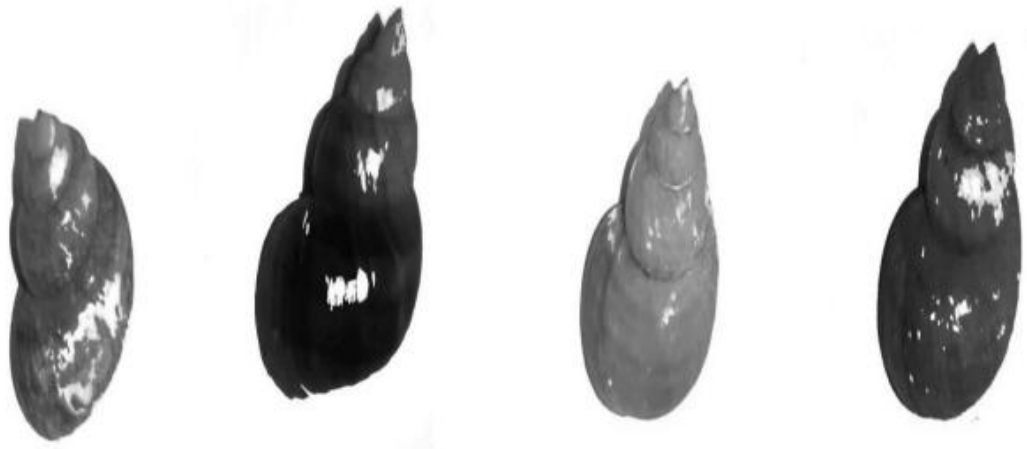

Fig. 1: Bellamya bengalensis f. typica (Lamark)

Shell thin, more or less smooth with three or more colour bands embryonic shell delicate and thin with three rows of chaetae, low ridges, lower most well developed. Sometimes developing into a keel, secondary ridges bearing chaetae may develop between the primary ones. Spire acuminate body whorl convex in profile without delicate ridge.

Head small margin of the mantle moderately thick with three short processes corresponding in position. Young ones leave the mother at the stage of about three whorls. Apex of the embryonic shell pointed with ridges on the earliest whorls, which bears spiral rows of short bristle of periostracum. Aperture subcircular or broadly ovate; operculum corneus concentric. Shell unbanded in the embryonic stages. Respiration with monopectinate ctenedium or gill. Sexually dimorphic. Male with a big bean shaped complex testis on the right side of the roof of the mantle cavity. Female with complex seminal receptacle.

On the basis of above morphological characters the present form is, therefore regarded as *Bellamya bengalensis* (Lamarck,1822).

Type Species	:	*Bellamya bengalensis*
Locality	:	Makbara Diggi, Diggi Shastri Nagar, Village Shobhapur
Measurements	:	Height (mm): 14.00-33.90
Diameter (mm)	:	9.78-24.00
Height of Aperture (mm):		5.40-18.20

Discussion:

Lamarck, (1822) and again described by **Mitra, Dey and Ramakrishna, (2005)**, genus Bellamya bengalensis.

The present form of genus Bellamya recognized on the basis of following characters:

Shell medium, more or less oblong, obtusely or strongly keeled at the periphery. Scarcely convex or rather flattened whorls, columellar margin thinner. Apex of the embryonic shell pointed with a ridge on the earliest whorls, which bear spiral rows of short bristles of periostracum **(Jousseaume, 1886).**

Shell medium to large, dextral and varying in shape convex to angular or carinate, obtusely or strongly keeled at the periphery. Apex of the embryonic shell pointed with ridges on the earliest whorls which bears spiral rows of short bristle periostracum. On the basis of above character, it is classified in to subfamily Bellamyinae (Vaught, 1989).

Male with the right tentacle elongated to serve as a copulatory organ. Fertilization internal, pallial oviduct elongated acting as the uterus. The viviparous female carries developing young in the lower part of the oviduct (Family: Viviparidae). **Annandale (1921**) discussed the systematic and the ornamentation of the shell. Prasad (1928) described the mantle and shell of the viviparidae.

Prasad (1928) made revisionary studies and Rao (1925) made the anatomical studies of the subfamily Bellamyinae. Bellamya is distinguished from viviparous of Europe by anatomical characters; it differs in the position of testis **(Rohrbach,1937).**

Morphology of Cercariae:

***Cercaria chinahatensis* (Srivastava, 1978)**

Body aspinose, blunt narrow anterior and broad round posterior end; body measures 0.44-0.48 X 0.24-0.27 in live specimens while 0.26 X 0.10-0.1t in tined specimens; tail aspinose, equal to or slightly longer than body, measures 0.44-0.51 in length and 0.06-0.08 in width near base in live specimens while 0.36-0.04 in fixed specimens, caudal fin fold absent, a large number of rounded nuclei embedded in tail parenchyma and arranged in slightly irregular parallel rows, tail on contraction gives an appearance of transverse striations throughout whole length; oral sucker terminal, ventral sucker longer than oral sucker, situated slightly posterior to equatorial line, measures 0.06-08 x 0.06-0.09 in live specimens;

cephalic collar feebly developed, armed with 26 collar spines arranged in single row, all spines of equal size, and group spines absent; pre pharynx short, measures 0.04-0.05in length in live specimens and 0.01 in length in fixed specimens; pharynx globular muscular measures 0.02 in diameter, oesophagus long measures 0.14-0.15 in length in live specimens while 0.06-0.07in length in fixed specimens, single row of longitudinal cells present, bifurcates at a short distant in front of ventral sucker into intestinal caeca which extend tortuously almost up to posterior end of body; a pair of oval sac like penetration glands-one on each side of body posterior to oral sucker present, each pear shaped gland contains a nucleus and fine granules opening separately close to mouth by short duets: cystogenous gland cells oval, triangular or irregular in shape contains small rod-like bodies which arranged in parallel row; rudiments of gonads oval or rounded in shape present behind ventral sucker, excretory system of echinostome type, excretory bladder rounded in shape, located at posterior end of body, two main collecting canals open one on each side of anterolateral margin of excretory bladder, three flame cells on each side in anterior third of body capillaries of which unite to form anterior collecting canal which runs posteriorly up to region of intestinal bifurcation, flame cells in posterior half of body three in region of ventral sucker, with flame cell formula of 2(3) + 2(3+3) = 18, capillaries of flame cells of posterior half of body unite to form posterior collecting canal which runs anteriorly up to region of intestinal bifurcation where it joins with anterior collecting canal and joins main collecting canal, on each side main collecting canal runs up to region of oral sucker which makes a loop and runs backward up to a short distance behind pharynx where it widens and runs up to middle region of ventral sucker where it again becomes narrow and proceeds posteriorly to open at anterior border of excretory bladder, caudal excretory canal runs into tail from posterior side of excretory bladder up to about 4/5 of tail length where a pair of lateral canals arise from it which runs outward and backward to open outside by separate pores, a short distance anterior to distal end of tail.

Host: *Bellamya bengalensis* f. typica (Lamark)

Locality: Diggi colony, Shastrinagar

No. of snails collected: 200

No. of snails found infected: 21

Percentage of infection: 10.5%

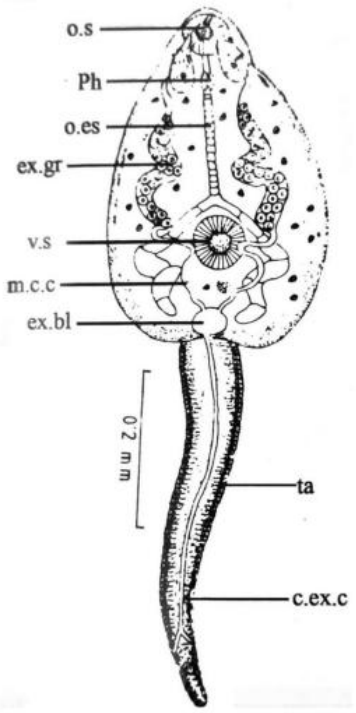

Fig. 2: Cercaria chinahatensis (Drawn froma livesp.) 0.s. - Oral sucker, Ph - Pharynx, O.es. - Oesophagus, Ex – Excretory granules, V.s. - Ventral sucker, M.c.c. - Main collen canal, Ex. bl. - Excretory bladder, Ta - Tail, C.ex.c. - excretory canal.

Cercaria narindapurensis **(Pandey and Singh, 1984)**

Body elongated oval with blunt anterior and broad round posterior end, covered with thick cuticle and measures 0.48-0.51 X0.28-0.30inlive and 0.19.0.24 X 0.09 0.12 in fixed specimens, vertical strations present on whole body surface, tail about one and half times longer than body, measures 0.76 0.80 x 0.09.0.11 in live and 0.44-0,54X0,03-0,04 on fixed specimens, provided with longitudinal and circular muscles, toll fin entirely absent, rounded caudal bodies irregularly arranged in tail parenchyma; oral sucker spherical and measures 0.07-0,08 in diameter in live and 0.03-0,04 in fixed specimens; ventral sucker larger than oral sucker and situated posterior two third of body, measures 0.08-0.09 in diameter in live and 0.04-0,05 in fixed specimens; a distinct collar present at anterior end of body; it bears a single row of 58 uninterrupted spines including three large spines; numerous irregular refractile bodies scattered throughout body surface of cercaria; mouth situated in middle of oral sucker and leads into a pre pharynx, measuring 0,04-0.06 in length in live and 0,01-0,02in fixed specimens; pharynx globular in shape and measures 0.03-0.04 in diameter in live and 0.01-0.02 in fixed specimens; pharynx leads into a short oesophagus, measuring 0.07-0,08 in length in live and 0.03-0,04 in fixed specimens and bifurcates in front of ventral sucker, intestinal cacca simple, extends up to posterior margin of ventral sucker; intestinal cacca simple, extends up to posterior margin of ventral sucker, three pairs of penetration glands located in collar region at posterior lateral sides of oral sucker, each gland oval in shape with prominent central nucleus, these glands open out separately by fine ducts; oval to rounded cystogenous cells nill entire space of body, rudiments of genital organs represented by two groups of cell masses and a streak of cells joining them, large cell mass located at

posterior border of ventral sucker and smaller one on anterior margin of ventral sucker; excretory bladder four chambered, situated at posterior end of body, posterior chamber oval and anterior chamber transversely elongated, main excretory canals arise from each side of excretory bladder and run anteriorly in convoluted manner, on reaching ventral sucker they dilate to accommodate a large number of rounded excretory corpuscles, in collar region they become narrow and make loop and run posteriorly as descending canals along outer margins of main excretory canals, at level of ventral sucker they divide into two branches-an anterior and a posterior collecting canals, anterior collecting canal gives rise to two branches, each divides into two capillaries ending into flame cells, similarly posterior collecting canal also gives rise to three branches, each dividing into two capillaries ending into flame cells with flame cell formula of 2[(2+2) +(2+2+2)]= 20, a caudal excretory canal arises from posterior chamber of excretory bladder and runs up to anterior one third of tail where it divides into two short lateral branches each opening outside through separate pores.

Host: Bellamya bengalensis. f. typica

Locality: Ganga Nagar

No. of snails collected: 130

No. of snails found infected: 05

Percentage of infection: 3.84%

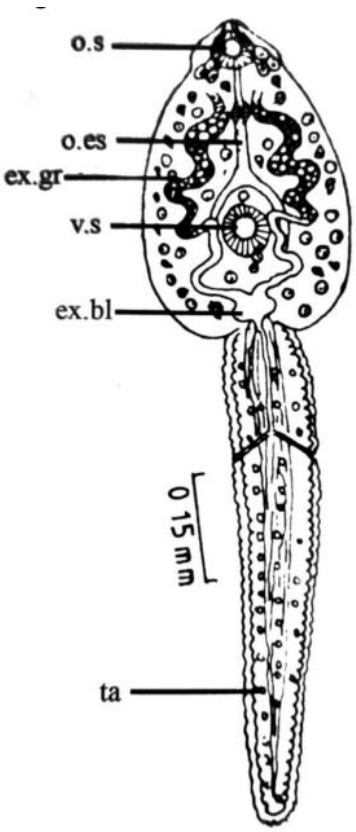

Fig. 3: Cercaria narindapurensis (Drawn fromalivesp.)

0.s. - Oral sucker, O.es. - Oesophagus, Ex. gra – Excretorygranu, V.s. - Ventral sucker, Ex. bl - Excretory bladder, Ta – Tail

***Cercaria laungakheraii* (Srivastava,S. and Saxena. V., 1992)**

The body of the cercariae is aspinose, somewhat pear shaped, measuring 0.26-0.45 mm in length and 0.18-0.26 mm in width in live specimen and 0.18-0.22 mm in length and 0.08-0.12 mm in width in fixed specimen. The tail of the cercaria is slightly longer than the body and measures 0.27-0.48 mm in length and 0.05-0.07mminwidth in live specimen and 0.18-0.20 mm in length and 0.03-0.05mmin width in fixed specimen. The fur case of the tail are shorter than the tail stem and measure 0.18-0.28 mm in length and 0.03-0.05mminwidth in live specimen and 0.16-1.20 mm in length and 0.01-0.02mmin width in fixed specimen. Both the tail stem and the furcal rami are without any spines or fin fold. A number of rounded bodies are scattered all over the tail stem and furcal rami.

The oral sucker is in the form of a pyriform anterior protrusible organ, measuring 0.07-0.08 mm X 0.04-0.06 mm in live specimen and 0.05-0.07 mm X 0.03-0.04 mm in fixed specimen. A number of spines are present on the anterior protrusible organ, which are arranged in few transverse rows. The ventral sucker is feebly developed, located behind the middle region of the body and measures 0.03 mm in diameter in live specimen and 0.02 mm in diameter in fixed specimen.

The digestive system is well developed. A short, somewhat triangular pre pharynx is prest measuring about 0.02 mm in length in live specimen and 0.016 mm in length in fixed specimen. The muscular pharynx, measures 0.03-0.04 mm in diameter in live specimen and 0.02-0.027 mm in diameter in fixed specimen. The pharynx leads into a short oesophagus which is in the form of a slightly bent tube measuring 0.05 in length in live specimen and0.042mm in length in fixed specimen. The oesophagus bifurcates into two intestinal cacca which run posteriorly in a tortuous manner up to the region of the excretory bladder where they terminate blindly. The penetration glands are arranged in two groups, one on each side. Each group consists of 5-7 penetration glands, located just posterior to the anterior protrusible organ. Each group opens to the outside, by a single duct. The cystogenous cells are irregular in shape and contain very fine granules. The rudiments of genital organs are present in the form of single mass of dark staining cells, located posterior to the ventral sucker.

The excretory bladder is transversely elongated chamber, situated at posterior end of the body. The anterior collecting canal, on each side, is formed by the union of the capillaries of three flame cells near the anterior end of the body. It runs posteriorly and receives, on each side, capillaries from three flame cells in the pharyngeal region and capillaries from three cells in the region a little posterior to the intestinal bifurcation. The posterior collecting canal is formed, on each side, by the union of the capillaries of three flame cells in the tail stem. It runs anteriorly on each side and enters the body of the cercaria and receives capillaries from three flame cells in the posterior region of the body and capillaries from three flame cells in the region of the feebly developed ventral sucker. The anterior and posterior collecting canals, on each side, unite together at the level of the anterior margin of the ventral sucker to form the main collecting canal. The main collecting canal, on each side, divides into two branches, one each branch runs posteriorly and opens directly into the excretory bladder, while the other branch of the main collecting canal, on each side, runs anteriorly up to the level of the intestinal bifurcation bends towards the middle region of the body and unites with each other to form a common collecting canal which runs posteriorly in between the two intestinal caeca and again divides in two small branches at the level of the posterior

margin of ventral sucker. Both these smaller branches run posteriorly and open into the excretory bladder. From the posterior region of the excretory bladder, arise two small canals which unite together after a short distance to form the caudal excretory canal. It runs posteriorly through the tail stem and divides into two small branches, each branch running up to the tip of the furcal rami. In the tail stem seven pairs of small transverse branches appear to arise from the caudal excretory canal which run up to the lateral margin of the tail stem. The flame cells are arranged in triples and the flame cell formula is 2[(3+3+3) (3+3) + (3)] = 36.

Host: Bellamya bengalensis

Locality: Ram Taal Vatika, Meerut City

Number of snails collected: 130

Number of snails found infected: 12

Percentage of infection: 9.23%

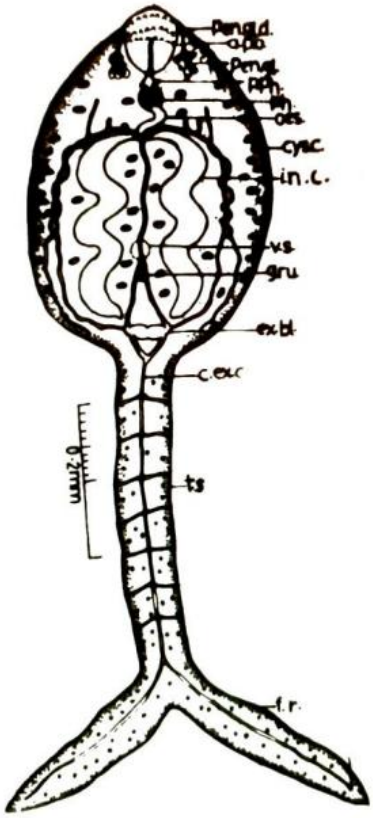

Fig. 4: Cercaria laungakheraii (Drawn from a live sp.)

A.p.o. - Anterior protrusible organ, C.ex.c. - Caudal excre canal, Cys.c. - Cystogeneous cell, Ex.bl. - Excretory bladder, Furcal ramus, G.ru. - Genital rudiments, In.c. – Intestinal, cu O.es. - Oesophagus, Pen.gl. - Penetration glands, Pen.gl.d., - du penetration glands, P.Ph. - Prepharynx, Ph. - Pharynx, Ts stem, V.s. - Ventral sucker

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