



Revision of caryophyllidean cestodes from catfishes of Bangladesh

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Abstract

In Bangladesh all caryophyllidean cestodes so far described were recorded from different catfishes only and reported to occur various parasitic disease problem and result poor growth rate and reduction of total fish production. But still there is no valid list of caryophyllidean cestodes in Bangladesh that infects our culture system. This work is much important for the further study in this field and act as basis for future work on parasitology. Revision of caryophyllidean cestodes parasitic in important catfishes like walking catfish- *Clarias batrachus* (Linn.), stinging catfish- *Heteropneustes fossilis* (Bloch), pabda catfish-*Ompok pabda* (Ham.) and Garua bacha-*Clupisoma garua* (Ham.) was carried out. The work was based on several newly collected specimens as well as previously described specimens from Bangladesh catfishes. To make this revision few hundred caryophyllidean cestodes were collected from *Clarias batrachus* and *Heteropneustes fossilis* from Mymensingh and other districts of Bangladesh. The parasites were isolated from the host intestine and prepared very carefully for their morphological study. Related literatures were collected from different journals on caryophyllidean cestode parasites of Bangladesh. Several theses submitted for degrees in different universities of Bangladesh were also consulted. In spite of a number of species described sporadically by different authors only eight species belonging to five genera of caryophyllidean cestodes are considered to be valid. The recognized species are- *Djombangia penetrans*, *Lytocestoides pabdai*, *Bovienia serialis*, *Lytocestus birmanicus*, *Lytocestus indicus*, *Lytocestus parvulus*, *Pseudocaryophyllaeus indica* and *Pseudocaryophyllaeus heteropneustus*. It is hoped that this revision will act as a basis for future work on fish parasite and help workers to clear the existing confusion.

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Introduction

The order Caryophyllidea of the tapeworms are all parasitic in the alimentary canal of freshwater fishes almost worldwide (Mackiewicz, 1972). In Bangladesh the worms are frequently reported but only from catfishes. Caryophyllidean is a peculiar nature of cestodes, they lack internal or external segmentation with a single set of reproductive organs, unlike that of other eucestodes. Considerable numbers of works on aspects of infestations have been done particularly in different educational institutions/universities in Bangladesh for academic interests. However, huge amount of works have been conducted on this group of cestodes in India. Very recently through an outstanding survey and revision it is learnt that a total of 55 and 19 species of caryophyllideans have been reported from *Clarias batrachus* and *Heteropneustes fossilis* respectively from this region (Ash *et al.*, 2011a and Ash *et al.*, 2011b). Mackiewicz (1981) the leading authority of caryophyllidean cestodes critically reviewed the fauna of this group of India, Nepal and Pakistan and provided suggestions for the preparation of the material for their identification. He (op.cit) further assumed that many of the previously described taxa might be invalid and called for reexamination of the taxonomic status of species. In view of this Kundu (1992) probably the first who initiated to review the available species and prepared an index catalogue and bibliography of freshwater cestodes of India. He tried to make a preliminary review and listed 29 species out of huge number of caryophyllidean species. *Bovienia ilishai* Zaidi and Khan, 1976 probably the single species of caryophyllidean cestode reported from Pakistan (Zaidi and Khan, 1976) was not included in the catalogue. Subsequently, Hafeezullah (1993) made a very critical review on the available Indian species of caryophyllidean cestodes fauna on the basis of their systematic characters and finally proposed only valid 16 species. Many of the synonymies proposed by Hafeezullah (1993) appeared to be correct, though have been ignored by the subsequent many Indian workers. Recently Ash *et al.*, (2011a, 2011b) made an extensive work on caryophyllidean cestode parasites of *Clarias batrachus* in Indomalayan region and

caryophyllideans of *Heteropneustes fossilis* from Asia. They critically reviewed the Asian species of caryophyllidean fauna from the examination of newly collected specimens or from the holotypes. Only 9 species of caryophyllidean cestode species were finally proposed by them to be valid out of 74 species have been reported from *C. batrachus* and *H. fossilis*. Actually no comprehensive works were carried out concerning particularly on systematic or general review on the caryophyllidean cestodes of Bangladesh fishes. Most of the records are on the infestations, distribution on host organs, and their seasonal variation of infestation in host fishes. Many of the species identification were inadequate, unsatisfactory based on deformed or not properly prepared specimens. Original description followed from the Indian publications with the superficial observation on their morphological characters. However, Arthur and Ahmed (2002) for the first time prepared the checklist of fish parasites of Bangladesh where they reported 8 different species of this group of parasite and other six kept up to genus as reported by the workers. Their compilation concerned only to accumulate all available literature related to caryophyllidean infestations. Kabir *et al.* (2008) edited to prepare a list of cestode fauna in the Encyclopedia of Flora and Fauna of Bangladesh as the compilation of Bangladeshi fauna from published papers both in home and abroad. Fourteen species of caryophyllidean cestodes were accommodated there. A numbers of contributors, many of them are not experienced in the field of parasitology prepared the manuscript without consulting the relevant papers of the original documents. Many of the parasites included there are not reported from Bangladesh or even from Asia. Only two species of caryophyllidean cestodes *Pseudocaryophyllaeus heteropneustus* Chandra and Khatun, 1993 and *Lytocestoides pabda* Biswas, Chandra and Das, 2006 have been published from Bangladesh based on original works on systematic were excluded from the compilation of the Encyclopedia due to unaware of the recent publication in the field though Arthur and Ahmed (2002) included *P. heteropneustus* in FAO checklist. The identification and availability of caryophyllidean

cestode species of catfishes described from Bangladesh therefore remained questionable. With this view several new materials were collected, consulted the available literature and attempted to review and to provide a reliable list of caryophyllidean cestodes reported from Bangladesh. Description or re-description of valid species were made, few new combination or new synonyms was proposed.

It is hoped that this revision will help workers to take up the work in this group to clear the existing confusion.

Material and methods

To make this revision few hundred caryophyllidean cestodes were collected from *Clarias batrachus* and *Heteropneustes fossilis* from Mymensingh and other districts of Bangladesh. The parasites were isolated from the host intestine and prepared very carefully

for their morphological study. Related literatures were collected from different journals on caryophyllidean cestode parasites of Bangladesh. Several theses submitted for degrees in different universities of Bangladesh were also consulted.

Accordingly a revised list of this group of parasites was prepared with their description. In some cases as felt compared with the existing species some the forms were synonymized or combined.

Result and discussion

Arthur and Ahmed (2002) prepared the checklist of fish parasites of Bangladesh belonging to different groups where they listed (Table 1) 10 species and 6 genera of caryophyllidean cestodes of catfishes. But in the recent compilation of Encyclopedia 14 species of caryophyllideans cestodes have been enlisted (Table 2) by Kabir *et al.* (2008).

Table 1. List of caryophyllidean cestode parasites reported from Bangladesh catfishes (After Arthur and Ahmed, 2002).

Parasites	Reporter (s)	Locality
Lytocestidae <i>Bovienia serialis</i> (Bovien, 1926)	Ahmed (1981); Ahmed <i>et al.</i> (1984, 85); Ahmed and Ezaz (1997)	Barishal, Dhaka
<i>Bovienia</i> sp.	Ahmed and Sanaullah (1976, 1977a); Sanaullah and Ahmed (1978)	Dhaka, Rajshahi
<i>Djombangia penetrans</i> Bovien, 1926	Ahmed and Sanaullah (1976, 1977a, 1977b, 1979); Sanaullah and Ahmed (1978); Ahmed (1981); Mammur Rashid <i>et al.</i> (1983, 1985); Rashid and Haque (1984); Ahmed <i>et al.</i> (1984, 1985); Ahmed and Ezaz (1997)	Chittagong, Rajshahi, Sylhet, Barisal, Dhaka, Mymensingh
<i>Lytocestus birmanucus</i> Lynsdale, 1956	Ahmed (1981); Ahmed <i>et al.</i> (1984,1985); Ahmed and Ezaz (1997)	Barisal, Dhaka
<i>Lycocestus indicus</i> (Moghe, 1925)	Ahmed and Sanaullah (1976, 1977a, 1977b, 1979); Sanaullah and Ahmed (1978); Ahmed (1981); Mammur Rashid <i>et al.</i> (1983, 1985); Rashid and Haque (1984); Ahmed <i>et al.</i> (1984, 1985); Chandra <i>et al.</i> (1997); Ahmed and Ezaz (1997)	Barishal, Dhaka, Sylhet, Chittagong, Rajshahi, Mymensingh
<i>Lytocestus lativittarium</i> Furtado and Tan, 1973	Ahmed and Ezaz (1997)	Bangladesh
<i>Lytocestus parvulus</i> Furtado, 1963	Ahmed and Sanaullah (1976, 1977a, 1977b, 1979); Sanaullah and Ahmed (1978); Ahmed (1981); Mammur Rashid <i>et al.</i> (1983, 1985); Rashid and Haque (1984); Ahmed <i>et al.</i> (1984, 1985); Ahmed and Ezaz (1997)	Barisal, Dhaka, Sylhet, Chittagong, Rajshahi, Mymensingh
<i>Lytocestus</i> sp.	Ali (1968); Anon (1974); Ahmed (1981, 1996); Ahmed <i>et al.</i> <i>Lytocestus</i> sp. (1984, 1985); Ahmed and Ezaz (1997)	Barisal, Dhaka
<i>Monobothrioides</i> sp.	Mammur Rashid <i>et al.</i> (1983, 1985); Rashid and Haque (1984)	Mymensingh
Family Caryophyllaeidae <i>Bialovarium</i> sp.	Amin <i>et al.</i> (1982)	Mymensingh
<i>Caryophyllaeus</i> sp.	Chandra (1993)	Mymensingh
Family Capingentidae <i>Capingentoides batrachii</i> Gupta, 1961	Ahmed (1981); Ahmed <i>et al.</i> (1984); Ahmed and Ezaz (1997)	Dhaka, Chittagong, Sylhet
<i>Pseudocaryophyllaeus heteropneustus</i> Chandra and Khatun, 1997	Chandra and Khatun (1997)	Mymensingh
<i>Pseudocaryophyllaeus indica</i> Gupta, 1961	Ahmed (1981); Ahmed <i>et al.</i> (1984, 1985); Ahmed and Ezaz (1997)	Barisal, Dhaka
<i>Pseudocaryophyllaeus</i> sp.	Chandra (1993, 1994a)	Mymensingh
<i>Pseudolytocestus clariae</i> Gupta, 1961 Includes: <i>Lytocestus clariae</i> of Anon (1974); <i>Pseudocaryophyllaeus clariae</i> of Ahmed and Ezaz (1997)	Anon (1974); Ahmed <i>et al.</i> (1984, 1985); Ahmed and Ezaz (1997)	Barisal, Chittagong, Dhaka, Sylhet
Unidentified caryophyllaeidea Caryophyllaeidea gen. sp.	Chandra (1992, 1994b); Akhtar <i>et al.</i> (1992); Khanum and Begum (1992); Khanum <i>et al.</i> (1996); Ahmed (1996) and Ahmed and Ezaz (1997)	Dhaka, Mymensingh

After careful examination of our collected materials and review of original descriptions of the parasites so far available it was revealed that there are following 8 species of caryophyllidean cestodes parasitizing the catfishes of Bangladesh. According to Mackiewicz (1994) they were placed under two different Families, Lytocestidae Hunter, 1927 with four genera

(*Djombangia* Bovien, 1926; *Lytocestoides* Baylis, 1928; *Bovienia* Fuhrmann, 1931 and *Lytocestus* Cohn, 1908) and Capingentidae Hunter, 1930 of one genus (*Pseudocaryophyllaeus* Gupta, 1961).

The revised species are described herein based on the specimens studied.

Table 2. Compilation of caryophyllidean cestodes of fishes of Bangladesh as presented in Encyclopedia (after Kabir *et al.*, 2008).

Species	Host(s)	Contributors
Family Capingentidae	<i>Clarias batrachus</i>	Ahmed, A.T.A.
<i>Capingentoides batrachii</i> Gupta, 1961		
<i>Pseudocaryophyllaeus indica</i> Gupta, 1961	<i>Clarias indicus</i>	Ahmed, A.T.A.
<i>Pseudocaryophyllaeus singhi</i> (Verma, 1971)	<i>Heteropneustes fossilis</i>	Tandon, V.
Synonyms: <i>Capingentoides singhi</i> Verma, 1971; <i>Capingentoides moghei</i> Pandey, 1973; <i>Capingentoides heteropneustii</i> Gupta and Sinha, 1979; <i>Capingentoides fotedari</i> Gupta Parmar, 1985; <i>Pseudocaryophyllaeus singhi</i> Mackiewicz, 1994		
Family Caryophyllaeidae	Common carp, Mirror carp	Ahmed, A.T.A.
<i>Caryophyllaeus laticeps</i> (Pallas, 1781)		
Synonyms: <i>Caryophyllaeus communis</i> Schrank, 1788; <i>Caryophyllaeus mutabilis</i> Rudolphi, 1802		
Family Lytocestidae	Clariid fishes	Ahmed, A.T.A.
<i>Bovienia serialis</i> (Bovien, 1926)		
Synonyms: <i>Djombangia serialis</i> Bovien, 1926; <i>Bovienia serialis</i> Fuhrmann, 1931		
<i>Djombangia penetrans</i> Bovien, 1926	Clariid catfishes	Ahmed, A.T.A.
<i>Lytocestus assamensis</i> Tandon, Chakravarty and Das, 2005	Silurid catfishes	Tandon, V.
<i>Lytocestus birmanicus</i> Lynsdale, 1956	<i>Clarias batrachus</i>	Tandon, V.
Synonym: <i>Lytocestus alestesi</i> Lynsdale according to Johri (1959), 1956	Walking catfish	Ahmed, A.T.A.
<i>Lytocestus clariae</i> Tandon, Chakravarty and Das, 2005	<i>Clarias batrachus</i>	Tandon, V.
<i>Lytocestus heteroneustii</i> Tandon, Chakravarty and Das, 2005	<i>Heteropneustes fossilis</i>	Tandon, V.
<i>Lytocestus indicus</i> (Moghe, 1925)	<i>Clarias batrachus</i>	Ahmed, A.T.A.
Synonyms: <i>Caryophyllaeus indicus</i> Moghe, 1925; <i>Lytocestus indicus</i> Moghe, 1931		
<i>Lytocestus lativitellarium</i> Furtado and Tan, 1973	<i>Clarias batrachus</i>	Tandon, V.
<i>Lytocestus parvulus</i> Furtado, 1963	Ahmed, A.T.A.

Djombangia penetrans Bovien, 1926 (Fig. 1) 1926. *Djombangia penetrans* Bovien, *Vidensk. Medd. Dansk Naturh. Foren.*, 82:167-181. 1974. *Djombangia indica* Satpute and Agarwal, *Indian J. Exptl. Biol.*, 12:373. 1977. *Djombangia cabelleri* Sahay and Sahay, *Excreta Parasit. Et memoria del doctor Eduardo Caballero Y Cabellero*. Inst. De Biol Publ. Especials 4. Maxico: 374. 1985. *Djombangia clariae* Kundu, Bhattacharya and Datta, *Bull. zool. Surv. India*, 7:151. From Bangladesh the species reported by Ahmed and Sanaullah (1976, 1977a, 1977b, 1979.); Sanaullah and Ahmed (1978); Ahmed (1981); Mamnur Rashid *et al.* (1983, 1985); Rashid

and Haque (1984); Ahmed *et al.* (1984, 1985) and Ahmed and Ezaz (1997).

Host: Walking catfish, *Clarias batrachus* (Linn.) and Stinging catfish, *Heteropneustes fossilis* (Bloch).

Description

The parasite was mainly found in the posterior part of stomach of the host. Body milky white when freshly recovered from host, divisible into scolex, neck and flat trunk, posterior end broadly rounded. Segment thick with deep denticulations due to contraction after treatment with fixative. Scolex 0.455-1.015 mm

long and 0.750-1.566 mm wide, globular or roughly triangular, distinctly marked off from rest of body, with a terminal introvert (without sucker). Neck narrow, distinctly separating scolex from trunk, short or long depending upon state of contraction or

relaxation when fixed. About 0.506-1.245 mm long and 0.456-0.920 mm wide. Main body or trunk flattened, fleshy. The worm was 7.350-9.850 mm long and 3.750-4.450 mm wide.

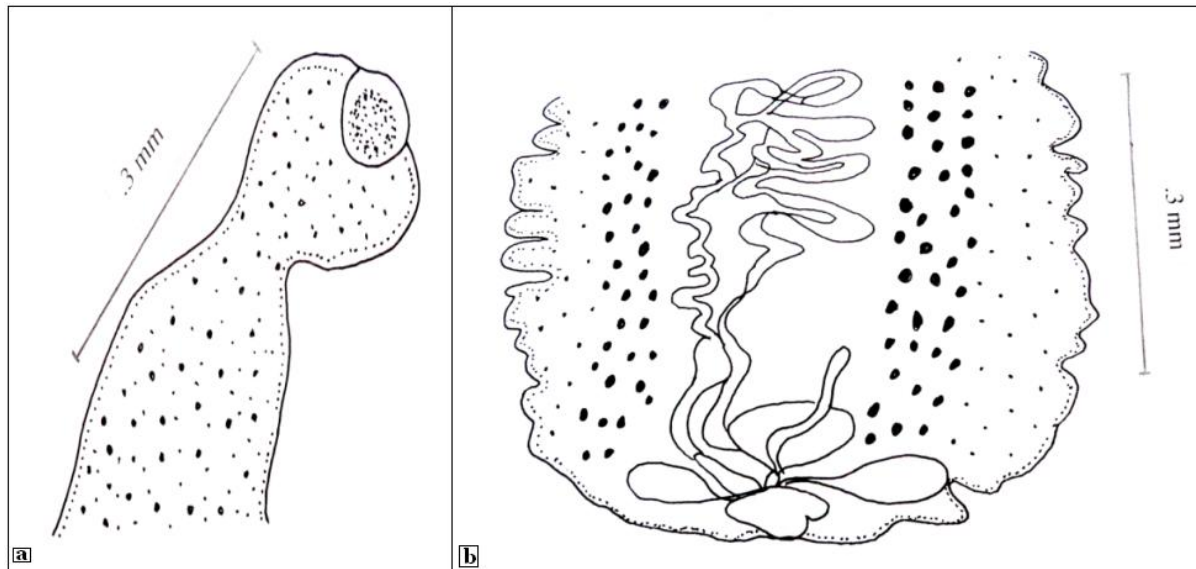


Fig. 1. *Djombangia penetrans* Bovien, 1926, a. anterior part with terminal introvert, b. posterior end with reproductive organs (modified after Hafeezullah, 1993).

Testes numerous rounded or ovoid. 0.095-0.154 mm in diameter, larger than vitelline follicles. Vas deferens tubular, narrow coiled. External and internal seminal vesicles absent. Cirrus sac globular or oval. Ovary dumbbell-shaped, bilobed; follicular, connected by a strip of isthmus, situated in posterior part of body in medullary zone. Ootype and mehlis' gland complex posterior or ovarian isthmus. Uterus extending in median medulla to almost anterior level of testes. Vagina a long canal connecting oviduct behind isthmus and uterovaginal canal. Seminal receptacle absent. Vitellaria spherical to ovoid, smaller than testes, cortical. Post ovarian set of vitelline follicles absent.

Distribution

Bangladesh, India and East Java.

Lytocestoides pabdai Biswas, Chandra and Das, 2006 (Fig. 2)

2006. *Lytocestoides pabdai* Biswas, Chandra and Das, *Sind. Univ. Res. Jour. (Sci.Ser.)*, 38: 45-62.

Host: *Ompok pabda* (Ham.) and *Clupisoma garua* (Ham.)

Description

Body elongated, unsegmented, slightly tapering posteriorly. Length of body 3.03-4.77 mm long and 0.48-0.87 mm wide. Scolex reduced, unspecialized. Neck absent. Testes follicular, numerous (about 80-150), medullary, distributed from the base of scolex to cirrus sac, size 0.21 x 0.18 mm to 0.42 x 0.37 mm.

Vitellaria extending throughout in cortical parenchyma, in double field. Postovarian vitellaria absent. Vitelline follicles, 38-57 in no., regular in shape, forming a continuous layer surrounding testes. Ovary bilobed, butterfly-shaped, in the posterior region of body, length 0.50-0.65 mm, width 0.54-0.58 mm, lobes connected by narrow isthmus measuring about 0.07 mm. Uterine region comparatively short, not extending anterior to cirrus sac. Gonoducts separate. Intrauterine eggs numerous, 0.021 x 0.020 mm to 0.023 x 0.022 mm in size.

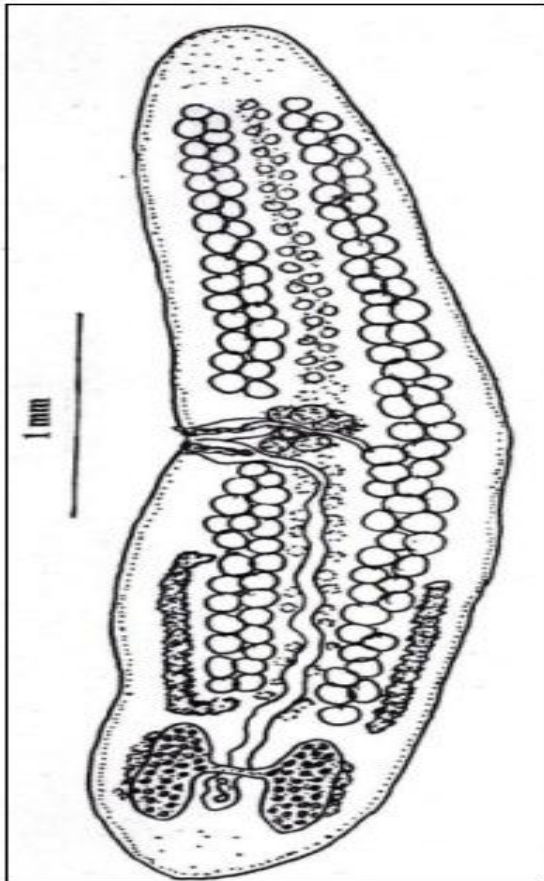


Fig. 2. *Lytocestoides pabdai* Biswas, Chandra and Das, 2006, the entire worm showing the internal organs (redrawn after Biswas *et al.*, 2006).

Distribution

Bangladesh, another species *L. paithanensis* Shinde and Desmukh, 1975 was reported from India.

Bovienia serialis (Bovien, 1926) (Fig. 3) 1926. *Caryophyllaeus serialis* Bovien, *Vidensk. Medd. Dansk. Natur. Forening: Kobenbaum*, 82: 157-181.

1931. *Bovienia serialis* Fuhrmann, *Handbuch der Zoologie* (W.Kokenthal and T. Krumbach, eds.). Bd. 2: 141-416.

From Bangladesh this species was previously reported by Ahmed (1981); Ahmed *et al.* (1984, 85) and Ahmed and Ezaz (1997).

Host: *Clarias batrachus* (Linn.)

Description

Body elongated, narrow, tapering

anteriorly, posterior and pointed, about 20.30-37.65 mm long, 0.90-1.20 mm in maximum width, scolex not distinctly demarcated from neck, unspecialised, 0.20-0.40 mm wide, not broader than body. Neck present, long, narrow. Male and female gonopores in beginning of last eight of body length on ventral surface. Common genital atrium absent.

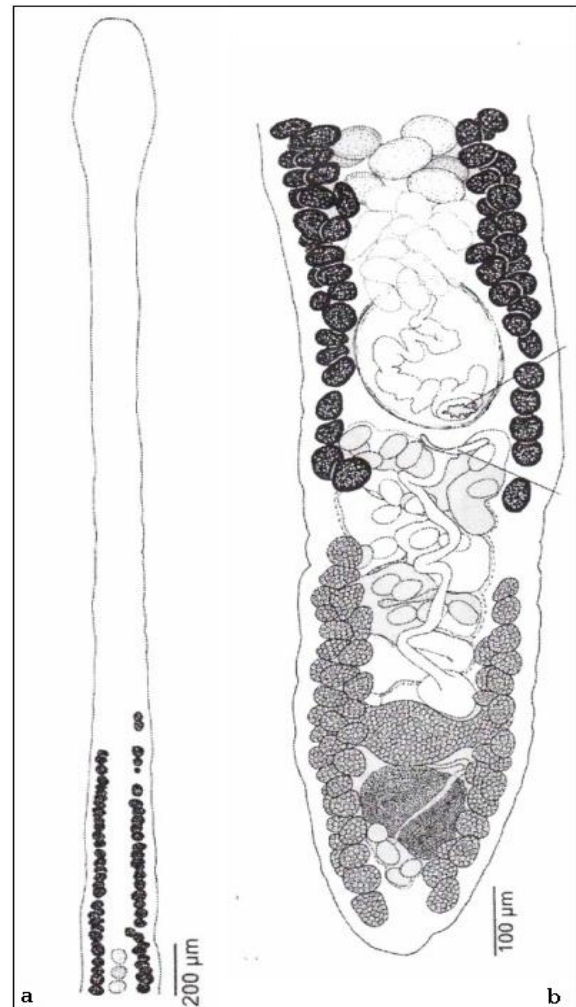


Fig. 3. *Bovienia serialis* (Bovien, 1926), a. anterior part of the body with first vitelline follicles and testes, b. posterior part of the body showing the vitelline follicles and female structure (after Ash *et al.*, 2011a).

Testes ovoid or spherical, 213-479 in number, 0.05-0.25 mm in diameter, medullary, extending from slightly behind anterior most vitellaria to coils of vas deferens, surrounded by a ring of inner longitudinal muscles. Vas deferens a much convoluted narrow tube. External and internal seminal vesicles absent.

Cirrus sac ovoid, 0.50-0.80 mm in diameter, anterior to ovary, enclosing convoluted ejaculatory duct and

unspined cirrus, opening on ventral body surface as male gonopore.

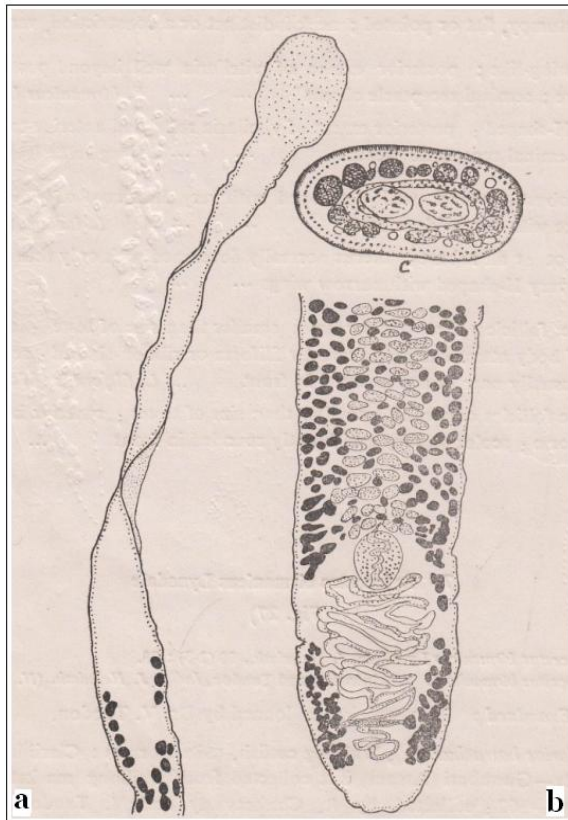


Fig. 4. *Lytocestus birmanicus* Lynsdale, 1956, a. scolex and neck, b. posterior half of body, c. cross section of body through testicular region (after Hafeezullah, 1993).

Ovary H-shaped, situated near posterior end of body; ovarian arms 1.20-2.30 mm long, follicular, cortical, connected by transverse medullar isthmus, occasionally follicles of posterior horns of ovary intermingling near posterior end to give ovary an invested 'A' shape. Uterus thrown in lateral coils in median field, not extending anterior to cirrus sac, pre-isthmus uterine extent somewhat longer anterior horns of ovary. Vaginal tube, narrow, straight. Uterus-vaginal canal short, opening as female gonopore close behind male gonopore. Seminal receptacle large, well developed, immediately anterior to ovarian isthmus. Vitelline follicles cortical, external to inner longitudinal muscles in two lateral rows, pre-ovarian, extending from a level slightly anterior to anterior most testes to region of cirrus sac or female gonopore, follicles 0.06-0.23 mm in diameter. Post-ovarian vitelline follicles absent.

Distribution

Bangladesh, India, Malaysia and Java. *Lytocestus birmanicus* Lynsdale, 1956 (Fig. 4).

1956. *Lytocestus birmanicus* Lynsdale, *J. Helminth.*, 30: 88.

Lytocestus birmanicus was recorded from Bangladesh by Ahmed (1981); Ahmed *et al.* (1984, 1985) and Ahmed and Ezaz (1997) from walking catfish.

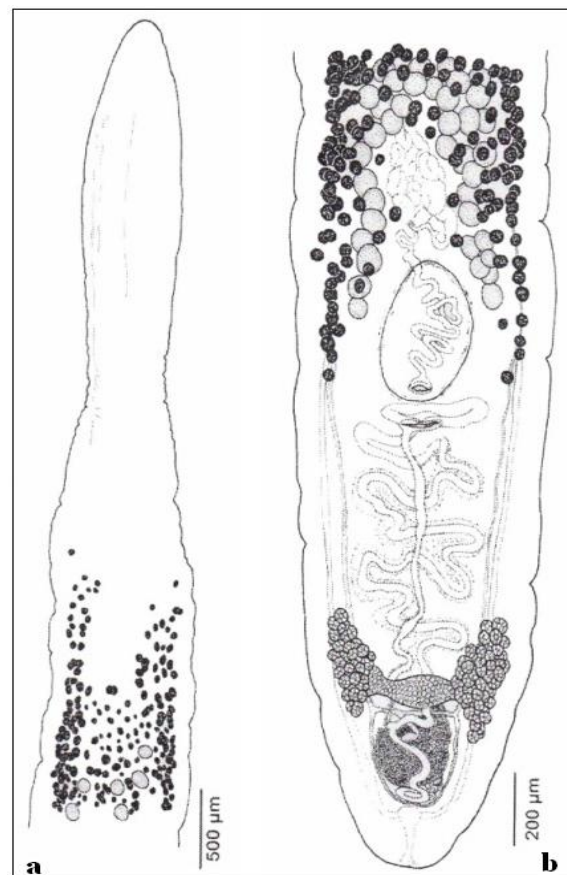


Fig. 5. *Lytocestus indicus* (Moghe, 1925), a. anterior part of the body with the first vitelline follicles and testes, b. posterior part of the body (after Ash *et al.*, 2011a).

Host: *Clarias batrachus* (Linn.)

Description

Body elongated flattened. Scolex globular, 0.30-1.24 mm long, distinctly marked off from neck behind. Neck present, narrow, 1.32-5.37 mm long. Anterior part of trunk (main body) devoid of any organ. Body size : 5.28-16.36 mm long, and 0.50-1.45 mm wide.

Testes medullary, oval or spherical, extending from a short distance behind anterior vitellaria to cirrus sac. Cirrus sac oval, opening as male gonopore in the beginning of last 1/7th of body. Ovary wing-like, near posterior end of body; wings cortical, follicular, connected by medullary band-like isthmus, extending posteriorly to some distance short of posterior end of the body. Shell gland complex posterior to ovarian isthmus, inconspicuously small. Uterus in a number

of loose coils, glandular, extending up to cirrus sac. Vagina a straight tube, joining distal most part of uterus to form utero-vaginal canal. No seminal receptacle. Vitellarium follicular, follicles transversely elongated, smaller than testes, cortical, annularly arranged outer to inner longitudinal muscle layer, extending posteriorly beyond level of utero-vaginal pore. Post ovarian set of vitelline follicles absent. Intra-uterine eggs oval shape.

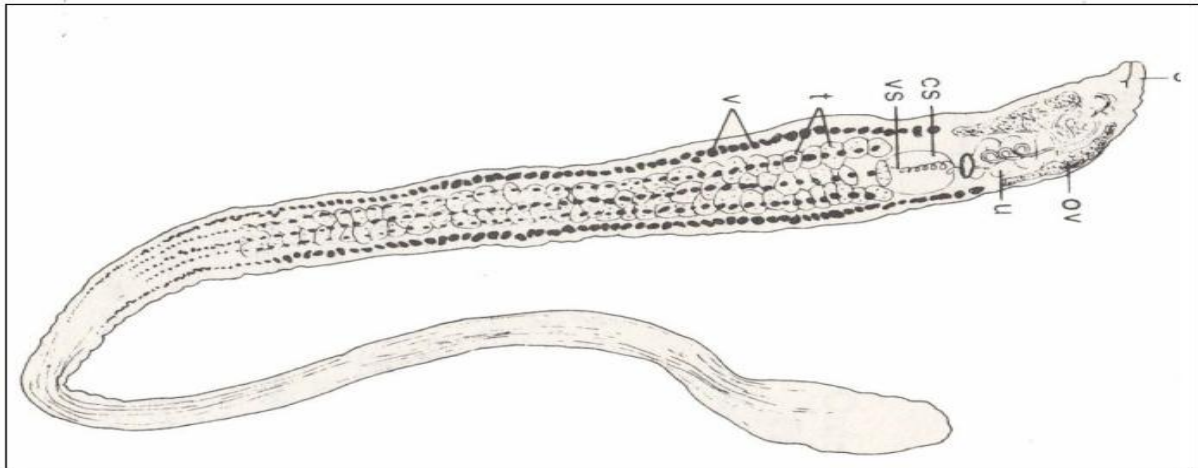


Fig. 6. *Lytocestus parvulus* Furtado, 1963, a. entire worm showing scolex and b. Posterior extremity (after Furtado, 1963).

Distribution

Myanmar, India, Bangladesh.

Lytocestus indicus (Moghe, 1925) Woodland, 1926 (Fig. 5).

1925. *Caryophyllaeus indicus* Moghe, *Parasitology*, 17: 222. 1926. *Lytocestus indicus* Woodland, *Proc. zool. Soc. London*, 1926: 56. 1961. *Pseudolytocestus clariae* Gupta, *Proc. helminth. Soc. Wash.*, 28: 43.

2005. *Lytocestus clariae* Tandon, Chakravarty and Das, *J. Parasit. Dis.*, 29:131-142.

In Bangladesh this species is reported by Ahmed and Sanaullah (1976, 1977a, 1977b, 1979); Sanaullah and Ahmed (1978); Ahmed (1981); Mamnur Rashid *et al.* (1983, 1985); Rashid and Haque (1984); Ahmed *et al.* (1984, 1985); Chandra *et al.* (1997) and Ahmed and Ezaz (1997) from different parts of the country from the clariid catfish.

Host: *Clarias batrachus* (Linn.).

Description

Body robust, elongated, flat. Scolex stumpy bluntly rounded anteriorly, much narrower than rest of the body. The size of the worm was 14.85-29.55 mm long and 1.95-2.75 mm wide. Scolex stumpy, bluntly rounded anteriorly, much narrower than rest of the body 2.450-3.140 mm long and 0.95-1.30 mm wide in middle. Neck present, a constriction or very short and indistinct. Main body slightly tapering posteriorly with rounded end. Male and female gonopores mid-ventral in last seventh or eight of body length. Genital atrium absent. Testes 0.17-0.23 mm in diameter, medullary, extending from a short distance behind anterior most vitelline follicles to cirrus sac. Cirrus sac prominent large with thick muscular wall, oval or conical bell shaped. Ovary bilobed, wing-like in posteriorly part of the body; lobes cortical, irregular in shape, consisting of numerous loosely packed follicles, connected by medullary bagpipe like

transverse isthmus; shell gland complex posterior to ovarian isthmus. Vagina a narrow and slightly wavy tube, running ventrally along midline, dilating at anterior end. No seminal receptacle. No post-ovarian vitelline follicles.

Distribution

India, Bangladesh.

Lytocestus parvulus Furtado, 1963 (Fig. 6) 1963.
Lytocestus parvulus, *Anna. Mag. Nat. Hist. (ser. B)*, 6: 97-106.

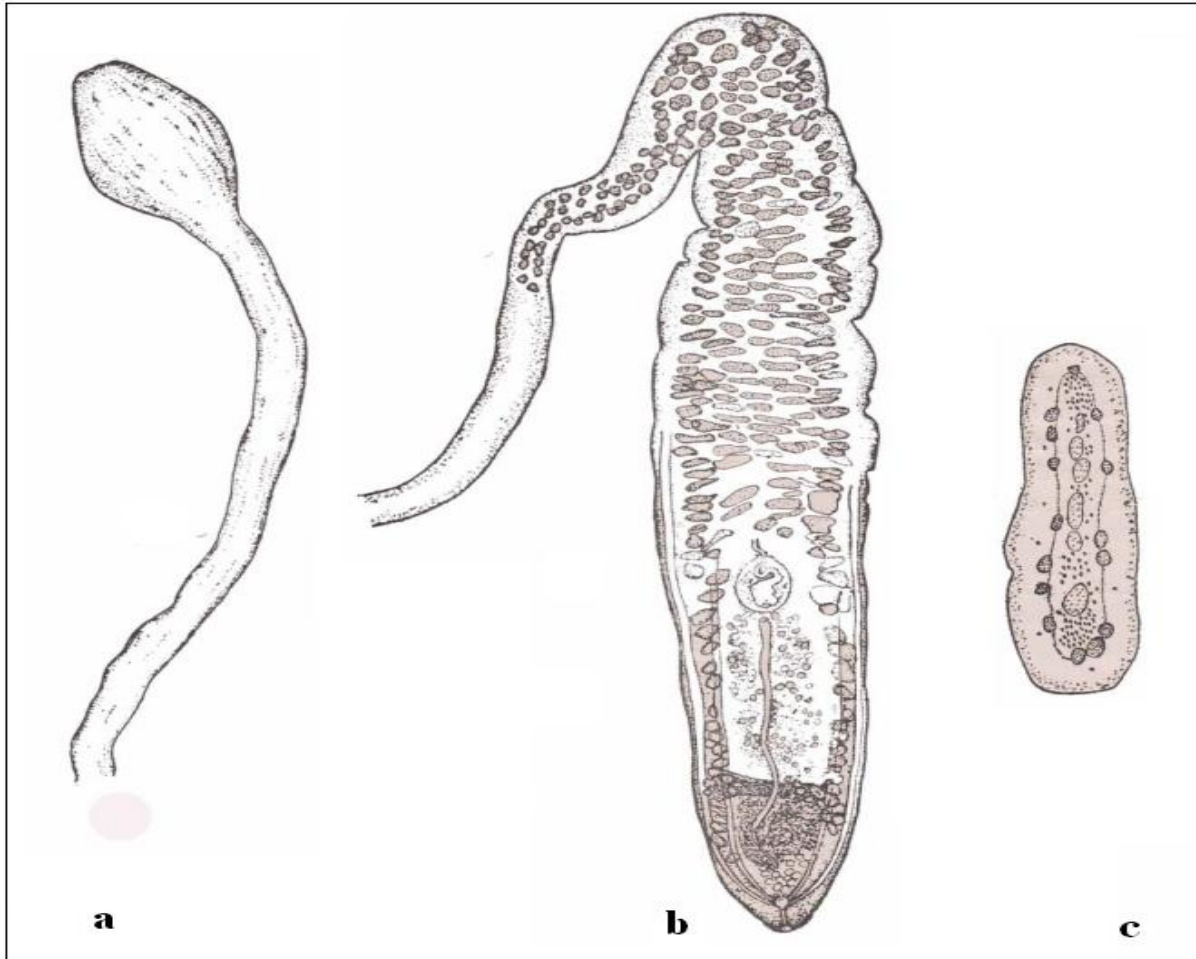


Fig. 7. *Pseudocaryophyllaeus indica* Gupta, 1961, a. scolex and part of neck, b. main body and part of neck, c. cross section of body (after Gupta, 1961).

This species has been reported from different parts of Bangladesh by Ahmed and Sanaullah (1976, 1977a, 1977b, 1979); Sanaullah and Ahmed (1978); Ahmed (1981); Mammur Rashid *et al.* (1983, 1985); Rashid and Haque (1984); Ahmed *et al.* (1984, 1985) and Ahmed and Ezaz (1997).

Host: *Clarias batrachus* (Linn.)

Description

Scolex undifferentiated, muscular, inflamed or not. Neck not clearly delimited from scolex or body; later

unsegmented, slightly fusiform, broadest at level of utero-vaginal orifice, internally differentiated into long vitellario-testicular region. Size 12.750-22.850 mm long, 0.480-0.850 mm wide in neck region and scolex 0.970-1.250 mm long, 0.450-0.950 mm wide.

Testes occupying almost entire medullary space in large part of worm distal to scolex, lobular, lobules arrange in three longitudinal rows, 0.950-1.250 mm in diameters. Cirrus sac large, vas deferens relatively long, fairly regularly coiled. Ovary follicular and H-shaped, follicles compacted, situated mainly in lateral cortical parenchyma, two lateral oviducts in center of

medulla to form common oviduct, eggs 0.025-0.038 mm long and 0.016-0.025 mm wide. Uterus greatly coiled, extending from near extremity to cirrus sac; uterine orifice medial, close to male orifice. Vitellaria extending from neck to level of female orifice, follicles grouped into lobules and arranged in five rows on dorsal and five on ventral side in cortical parenchyma.

Distribution

Bangladesh, Malaysia.

Pseudocaryophyllaeus indica Gupta, 1961 (Fig. 7) 1961. *Pseudocaryophyllaeus indica* Gupta, *Proc. Helminth. Soc. Washington*, 28: 43. 1961. *Capingentoides batrachii* Gupta, *Proc. Helminth. Soc. Washington*, 28: 46.

The species was frequently reported from Bangladesh by Ahmed (1981); Ahmed *et al.* (1984, 1985) and Ahmed and Ezaz (1997) from the walking catfish *Clarias batrachus* and *Heteropneustes fossilis*.

Host: *Clarias batrachus* (Linn.), *Heteropneustes fossilis* (Bloch).

Description

Body flat and elongated, about 11.0- 25.0 mm long and 0.62-1.30 mm in maximum width at the posterior region. Scolex conical or cone shaped truncated anteriorly, distinctly marked off from neck behind. Neck slender, long, 5.04-8.74 mm long and 0.175-0.365 mm wide. Main body or trunk is cylindrical, 5.50-14.96 mm long, posterior end rounded.

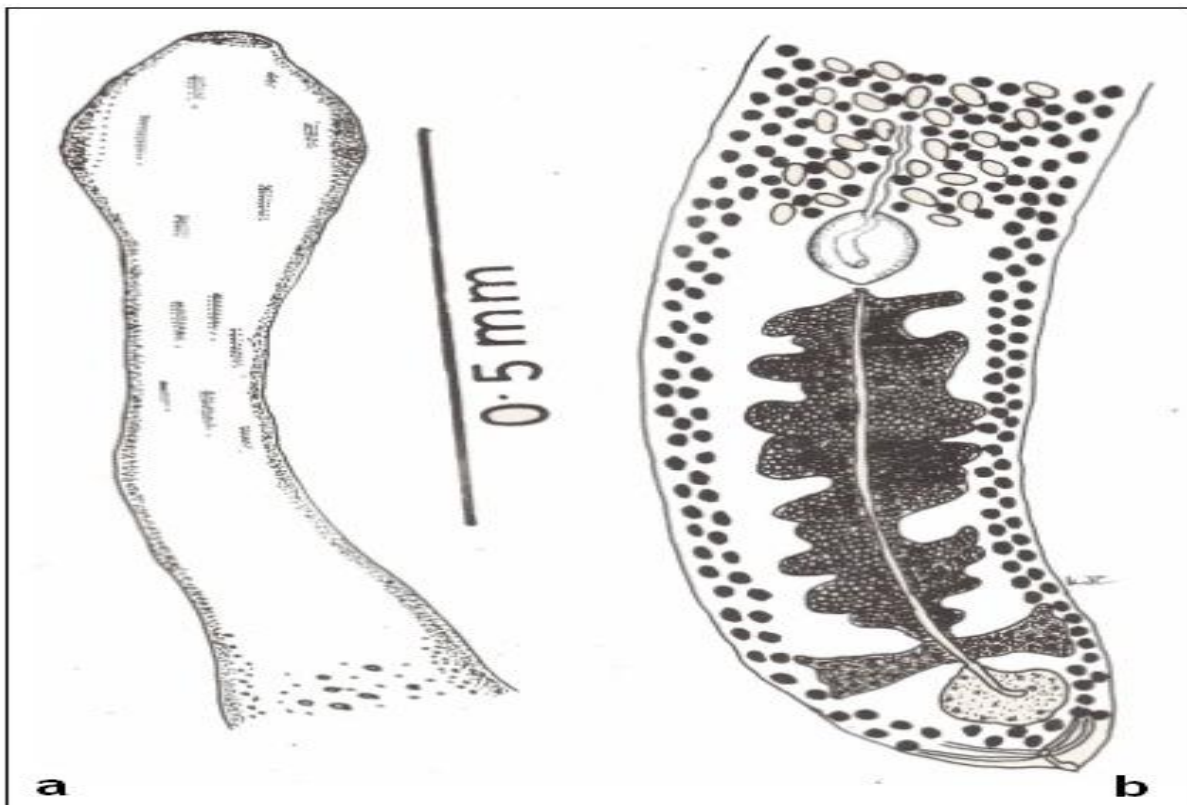


Fig. 8. *Pseudocaryophyllaeus heteropneustus* Chandra and Khatun, 1993, a. anterior part of scolex, b. posterior extremity (after Chandra and Khatun, 1993).

Testes numerous, spherical rounded to oval, 0.12-0.28 x 0.06-0.12 mm, medullary, extended from a level behind anterior-most vitelline follicles to cirrus sac, surrounded by annular vitelline follicles. Inner longitudinal muscle layer external to testes and vitellaria. Vas deferens loosely convoluted in from of

cirrus sac. Outer seminal vesicle absent. Cirrus sac large, oval placed medullary, 0.35-0.61 x 0.26 -0.41 mm, enclosing bell-shaped ejaculatory duct, situated at 1.75-2.98 mm from posterior end of body, opening midventrally by male gonopore.

Ovary H-shaped, follicular, irregular in outline, lateral posterior ovarian follicles may not be extending up to posterior end of body, connected by medullary isthmus.

Uterus in lateral coils in post and pre-ovarian parts, with uterine gland cells, not extending beyond cirrus sac. Vagina a slightly convoluted tube running medianly on ventral side, terminally joining with uterus to form a short utero-vaginal canal. Utero-vaginal canal opening mid-ventrally as female gonopore on ventral side just behind male gonopore. No common genital atrium. No seminal receptacle. Vitellaria medullary, internal to inner longitudinal muscle layer, annularly surrounding testes, extending from posterior region to neck to anterior horns of ovarian wings, follicles occasionally continuing with follicles of ovary. Shell gland complex posterior to ovarian isthmus. Eggs oval, non-operculated 0.04-0.06 x 0.035-0.045 mm.

Distribution

India, Bangladesh

Pseudocaryophyllaeus heteropneustus Chandra and Khatun, 1993 (Fig. 8) 1993. *Pseudocaryophyllaeus heteropneustus* Chandra and Khatun, *Riv. Parassitol.* 10: 235-239. Chandra and Khatun (1993) described this species from *Heteropneustes fossilis* (Bloch) in Mymensingh. Host: *Heteropneustes fossilis* (Bloch).

Description

Body elongated, flat with fairly smooth margins and measures 14.15-22.72 x 1.05-2.54 in anterior region of cirrus sac. Scolex smooth, somewhat elongated, truncated anteriorly, undifferentiated from remaining anterior part of body and measures 0.78-1.86 x 0.62-0.98, followed by neck, 5.61-9.22.

Testes numerous, rounded to ovoid, 0.11-0.17 in diameter, bounded on lateral sides by vitelline follicles; extends posteriorly to neck up to cirrus sac. Cirrus sac large, oval organ, medially at 1.89-2.09 from posterior end and measures 0.34-0.92 in length. Vesicula seminalis convoluted.

Ovary transversely elongated, band shaped, 1.12-1.24 at posterior end of body. Vitellaria follicular, occupying lateral position, some medullary, extends from posterior end of neck up to posterior extremity, post ovarian median vitelline glands present. Uterine coils never extended beyond cirrus sac. Receptaculum seminis absent. Genital apertures situated 1.95-3.09 from beginning of posterior 1/7th of body length. Uterus and vagina open by a common aperture, situated below cirrus sac. Uterus arises from ootype, extends posteriorly forming thin walled loops and opens into vaginal opening.

Excretory system consists of four lateral channels, two on each side, uniting posteriorly to form short muscular thick walled vesicle, opening through a tube on ventral side at posterior end of body.

Distribution

Bangladesh. A number of reports have been made in Bangladesh on caryophyllidean cestode parasites from catfishes by several workers (Ahmed, 1976; Ahmed and Sanullah, 1977a; Ahmed *et al.*, 1984; Ahmed *et al.*, 1985) but did not provide detailed description of the parasites. Arthur and Ahmed (2002) complained that in the works of Ahmed and Sanaullah (1976, 1977a, 1977b) specific collection localities for individual hosts or parasite species were not indicated for the examined catfishes. However they mentioned that *Djombangia penetrans* occurred in *Clarias batrachus* in all study sites. Mamnur Rashid *et al.*, (1983, 1985) and Rashid and Haque (1984) recorded *Monobothriodes* sp. from the catfish of Mymensingh, authors are agree with Mackiewicz (1994) that records are misidentification as the genus is the parasitic of African Bagridae and Clariidae fish. Authors also considered *Capingentoides* Gupta, 1961 a synonym of *Pseudocaryophyllaeus* Gupta, 1961 after Mackiewicz (1994). Similarly the reports of *Bialovarium* and *Caryophyllaeus* are also misidentification as they are the parasites of North American and Paelearctic cyprinid fishes respectively (Mackiewicz 1994). *Pseudocaryophyllaeus* sp. reported by Chandra (1993b, 1994b) was later confirmed as the *Pseudocaryophyllaeus*

heteropneustus Chandra and Khatun, 1993. The reports of *Pseudolytocestus clariae* Gupta, 1961 was also uncertain (Mackiewicz, 1994) as Wardle and McLeod (1992) considered this genus are the parasites of North American catostomid fish.

The species *Lytocestus lativitellarium* Furtado and Tan, 1973 described from Malaysia from *Clarias batrachus* which has not been so far reported from Indian fishes. Ahmed and Ezaz (1997) reported its presence in the abstract form. However, Ash *et al.*, (2011a) synonymized this Malayan species with *Lytocestus microcephalus* (Bovien, 1926). The figures used in the encyclopedia written by the contributor (Veena Tandon) seems to coincide with the figures of *Capingentoides heteropneusti* Gupta and Sinha, 1980 (Fig. 41 in Hafeezullah, 1993). However, Hafeezullah (1993) synonymized *C. heteropneusti* with *Bovienia bilocula* (Murhar, 1963). Inclusion of *Lytocestus lativitellarium* in the Encyclopedia as the fauna of Bangladesh needed further examinations.

Another interesting caryophyllidean cestodes species, *Caryophyllaeus laticeps* (Pallas, 1781) included in the encyclopedia is believed to be a lapsus again. There is no previous record of the presence of this species in Bangladesh and even in Indian subcontinent. Only one species *Caryophyllaeus kashmirensis* Mehra, 1930 of the genus *Caryophyllaeus* has described by Mehra (1930) from *Schizothorax micropogon* (= *Oriinus sinuatus*) in abstract form. Mackiewicz (1981) put it as *sp. inq.* However, Agarwal (1985) considered it conspecific with *Adenoscolex oreini* Fotedar, 1958. Subsequently this synonymy was accepted by Kundu (1992) and considered it as the type species of the genus.

Similarly a number of other caryophyllidean cestodes have been included in the encyclopedia as the fauna of Bangladesh. These species are *Lytocestus assamensis* Tandon, Chakravarty and Das, 2005; *Lytocestus attenuatus* Tandon, Chakravarty and Das, 2005; *Lytocestus clariae* Tandon, Chakravarty and Das, 2005 and *Lytocestus heteropneustii* Tandon, Chakravarty and Das, 2005.

The authors Tandon *et al.*, (2005) described these tapeworms from the catfishes *Clarias batrachus* (Linn.) and *Heteropneustes fossilis* (Bloch) collected from Guwahati (Assam) and Sheila (East Khasi Hills, Meghalaya). All four of these caryophyllidean cestodes were synonymized by Ash *et al.*, (2011a, 2011b) as *Lytocestus attenuates* and *L. clariae* conspecific of *Bovienia indica* (Niyogi, Gupta and Agarwal, 1982); *Lytocestus heteropneustii* conspecific of *Lucknowia fossilisi* Gupta, 1961 and *Lytocestus assamensis* conspecific of *Lucknowia microcephala* (Bovien, 1926). Accepting of these species as the faunas of Bangladesh and their recognition in the encyclopedia could be done after careful review of literature.

Conclusion

Parasitic disease is a major issue in the aquaculture sector in Bangladesh and still there is limited research in this field. There is no valid report on the type and number of total parasites that affect the aquaculture system in this country. So in this prospect present work will be very much helpful for the future fish parasite researcher in Bangladesh especially who will work on Caryophyllidean cestodes parasite and also act as the baseline for further parasitology research in world.

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