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ON THE PRESENT STATUS OF CARYOPHYLLIDEA WITH A REPORT ON SOME CARYOPHYLLID INFECTIONS IN THE FRESH-WATER CATFISH *CLARIAS BATRACHUS* (L.) IN NORTH-EAST INDIA AND A RECORD OF AN ANOMALOUS FORM

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ABSTRACT

Four species of the caryophyllid genus ***Lytocestus***, namely, ***L. indicus*** (Moghe, 1925) Woodland, 1926, ***L. birmanicus*** Lynsdale, 1956, ***L. filiformis*** (Woodland, 1923) Fuhrman and Baer, 1925 and ***L. longicollis*** Rama Devi, 1973, and ***Djombangia penetrans*** Bovien, 1926 are reported from the catfish, ***Clarias batrachus*** in the north-eastern region of India. An anomaly involving duplication of the post-neck but pre-equatorial region of the body in ***L. indicus*** is also recorded.

INTRODUCTION

Caryophyllids are widely distributed cestodes of the fresh-water siluriform and cypriniform fishes of the world. Comprising 126 species and 45 genera, they constitute approximately one-fourth of the cestode fauna of the fresh-water fishes (Mackiewicz, 1972).

They are unique in having a single set of reproductive organs within a non-segmented body and in utilising aquatic oligochaetes as their intermediate hosts. These cestodes are considered a very ancient group that originated from acoelomate turbellarian larvae and branched out at the beginning of Paleozoic era as parasites of aquatic invertebrates (Kulakovskaya and Demshin, 1978). Although caryophyllids have been known for more than 200 years, their taxonomy is not yet stable and there is disagreement regarding the genera and species within the group. This is because all the workers do not agree as to whether these unsegmented worms constitute a separate order or represent a pseudophyllidean family. However, from the time of their initial discovery, these tapeworms were being placed in a separate, non-pseudophyllidean, non-cestodarian group by few authors. Then, with the emergence of a more stable classification, Leuckart (1878) considered the group a separate family. Beneden (in Olsson, 1893) raised its status to the rank of an order Caryophyllidea, after which Woodland (1923) placed the order within Cestodaria, a subclass of tapeworms established by Monticelli (1892). Later, Hunter (1927) treated Caryophyllaeidae as an independent family of Pseudophyllidea and he divided it into four sub-families, viz., Caryophyllaeinae Nyebelin, 1922 ,Capingentinae Hunter, 1927; Lytocestinae Hunter, 1927; and Wenyoninae Hunter, 1927. Many years after this Wardle and Mcleod (1952) raised the family Caryophyllaeidae to the rank of an order Caryophyllidea and the four sub-families, to the rank of families. However, there was disagreement regarding the acceptance of their view because Fotedar (1958) followed the classification of Hunter (1927). Yamaguti (1959) suggested

a single family Caryophyllaeidae under the order Caryophyllidea and included three subfamilies, instead of four, within it-- Caryophyllaeinae, Lytocestinae and Capingentinae, the subfamily Wenyoninae having been considered a synonym of Caryophyllaeinae. Wardle, McLeod and Radinovsky (1974) retained the four subfamilies of Hunter (1927) as the families under the order Caryophyllidea. Mackiewicz (1972) accepted the classification proposed by Wardle and McLeod (1952) but he regarded the three subfamilies of Yamaguti (1959) as the only family under the order Caryophyllidea. Though the systematics of Caryophyllidea is complex, at present the group comprises four distinct families that have been erected on the basis of the distribution of testes and vitellaria in relation to the cortical and medullary zones of the body proper (see Mackiewicz, 1972, 1981a and 1982). These are : ***Caryophyllaeidae*** Leuckart, 1878(In Luhe, 1910)(= Caryophyllaeinae Nyebelin, 1922; Caryophyllaeinae Hunter, 1927)[includes Wenyoninae Hunter, 1927 and Wenyonidae Wardle and McLeod 1952 fide Yamaiguti (1959), Mackiewicz (1963a) 7],with small forms having varying shapes of holdfast, genital pores opening together on the last quarter of the ventral surface, utero-vaginal atrium present but without a sphincter muscle, parenchymal muscle in two layers, and Yolk glands in the medulla; ***Capingentidae*** Wardle and McLeod 1952 (= Pseudolytocestinae Hunter, 1929: Capingentinae Hunter, 1930) the members in which have yolk glands cortical for only one third to one half of their bulk and the remainder in the medulla and ***Lytocestidae*** Wardle and McLeod 1952 (=Lytocestinae Hunter 1927) [includes Bovieninae Fuhrmann, 1931 and Lallidae Johri, 1959 fide Mackiewicz (1963a)] which includes forms having vitellaria disposed in the cortex, testes medullary, holdfast commonly undifferentiated, cirrus pouch and genital atrium opening separately, and ovarian wings in the cortex but ovarian bridges in the medulla and ***Balanotaeniidae*** Mackiewicz and Blair, 1979, having the yolk glands and testes disposed in the cortex. Later Satpute and Agarwal (1980a) suggested that the family Lytocestidae which accommodated 17 genera and 37 species be redivided into two subfamilies, viz., Lytocestinae and Djombanginae, the latter having been erected by these authors as a new subfamily. The subfamily Djombanginae shares the characters of the subfamily Lytocestinae such as cortical vitelline follicles and medullary testes, but it is distinctly different from the latter in possessing a feeble sucker at the tip of the hold-fast, in the extension of the uterus throughout the testicular field and in having embryonated eggs in the uterus.

Several species under seven genera represent the subfamily Lytocestinae in Indian subscontinent. These are: ***Lytocestus indicus*** (Moghe, 1925) Woodland, 1926 (= ***Monobothrioides indicus)*** Moghe, 1925); ***L. longicollis*** Rama Devi, 1973; ***L. fossilis*** Singh, 1975; ***Lucknowia fossilis*** Gupta, 1961; ***L. Indica*** Niyogi, Gupta and Agarwal, 1982a; ***Crescentovitus biloculus*** Murhar, 1963; ***Lytocestustoides aurangabadensis*** Shinde, 1970 (= ***L. aurangabadensis*** var. minor Shinde, 1970 and ***L.a.*** var. ***minuta*** Shinde, 1970, fide Kundu (1985); ***L. paithenensis*** Shinde and Deshmukh, 1975; ***L. lepidocephali*** Kundu, 1985; ***Bovienia serialis*** (Bovien, 1926) Fuhrmann, 1931 (described by Mackiewicz and Murhar, 1972); and ***Introvertus raipurensis*** Satpute and Agarwal, 1980b. Further, the genus ***Hunteroides***, erected and placed under the subfamily Lytocestinae by Johri (1959) turned out to be a cestodarian (Joyeux and Baer, 1962; Mackiewicz, 1972).

To the genus ***Djombangia*** Bovien, 1926 (now under the subfamily Djombanginae) which includes ***D. penetrans*** recovered from the duodenum of ***Clarias batractus*** from Brantas river near Djombang in East Java. Satpute and Agarwal (1974) added another species, ***D. indica,*** from India and provided its detailed description later (Satpute and Agarwal, 1980a). Sahay and Sahay (1977) also described a new species, ***D. cabaleroi,*** from the stomach of ***Heteropneustes fossilis*** in India, but Mackiewicz (1981b) doubts the validity of this species as its description is based on flattened

specimens only and there appears no significant difference from the type species, *D. penetrans*. Kundu, Bhattcharya and Datta (1985) described one more new species, *D. clariae* from Bongaon in West Bengal.

The family Capingentidae is also well represented in the Indian caryophyllid fauna. Contributions made for the family include the descriptions of several forms like: ***Adenoscolex oreini*** Fotedar, 1958; ***Pseudolytocestus clarii*** Gupta, 1961; ***Capingentoides batrachii*** Gupta, 1961; ***C. Singhii*** Verma, 1971; ***C. moghei*** Pande, 1973; ***Pseudocaryo phyllaeus indica*** Gupta, 1961; ***P. ritai*** Gupta and Singh, 1984; ***p. mackiewiczi*** Gupta and Parmar, 1984; ***P. lucknowensis*** Gupta and Sinha, 1984; ***Pliovitellaria osteobramensis*** Gupta and Sinha, 1984; ***Pseudocapingentoides indica*** Verma, 1971 and ***P. cameroini*** Gupta and Sinha, 1984. However, serious doubts have been raised regarding the validity of many of these forms (see Mackiewicz, 1981b).

Of the caryophyllids known from India, a single report of a member of Caryophyllaeidae is available. Mehra (1930) described in an abstract form ***Caryophyllaeus kashmirensis*** from ***Schizothorax micropogon***. Leavaing this record which also needs verification there is no other report of any representative of the family from India.

During the two-year exploration of caryophyllids of the edible catfish, ***Clarias batrachus***, in the north-eastern region of India, several species of ***Lytocestus*** and one of ***Djombangia*** were recovered. While some of them included new forms (to be published elsewhere), the rest represented the already known species. The present communication deals with a short description of these forms. It is for the first time that their occurrence is being reported from this region.

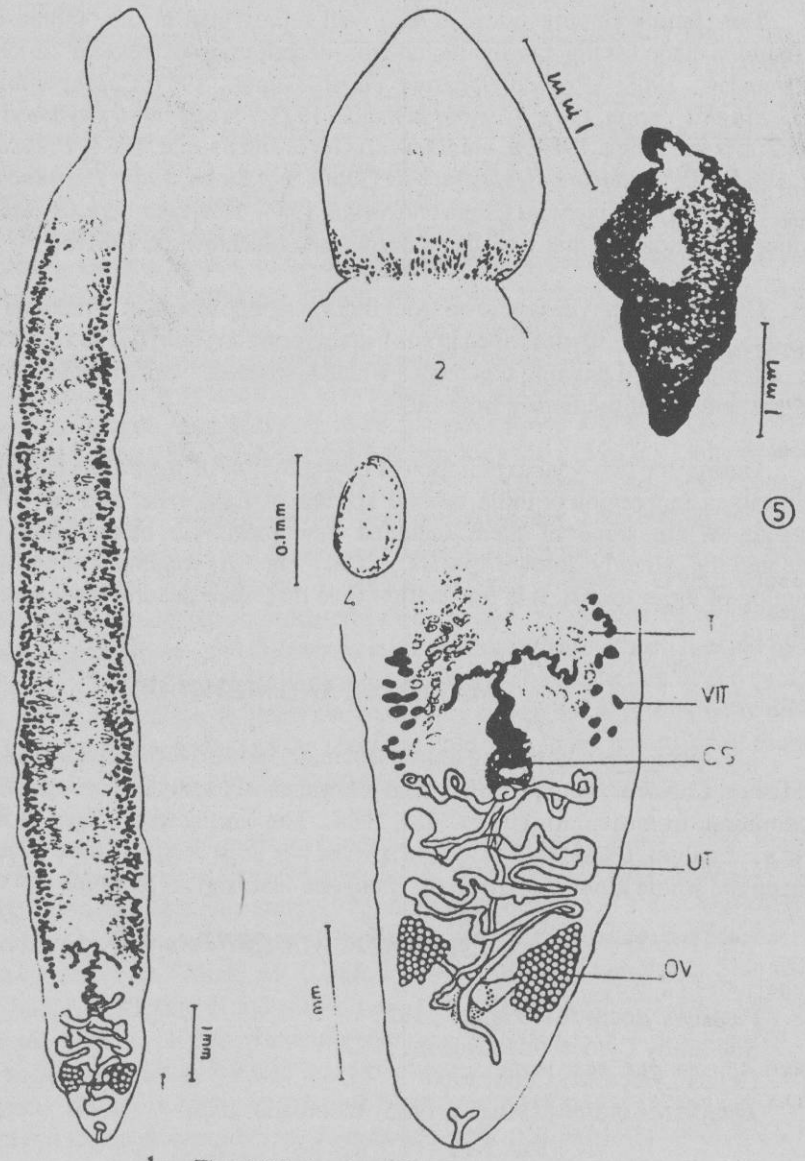
MATERIAL AND METHODS

The specimens comprising the present material were recovered from the intestine of freshly killed fishes, ***C. batrachus*** (collected from Guwahati (Assam) and brought to shillong markets in live condition, from time to time in 1982-1984. The worms were fixed in Bouin's and stained in Gower's carmalum. Identification of the species has been accomplished after Mackiewicz (1972), based on the whole mounts (10 nos. of each) and histological sections.

SYSTEMATIC ACCOUNT

Family Lytocestidae Hunter , 1927
Subfamily Lytocestinae Hunter, 1927
Genus ***Lytocestus*** Cohn, 1908
Lytocestus indicus (Moghe, 1925) Woodland, 1926.
(Fig. 1-6)
A total of 455 specimens of ***L. indicus*** were collected.

Body broad and flat, with traces of external segmentation; body proper divided into an outer cortex and an inner medulla by two layers of longitudinal muscles. Scolex unarmed, short and bluntly rounded, markedly narrower than the body and provided with longitudinal furrows in some specimens. Neck very short and indistinct. Testes numerous, 212-438 in number, occupying the medullary region of the body, ovoid in shape, larger than vitelline follicles and extending from the base of the neck to the cirrus sac region posteriorly; cirrus sac prominent, opening separately



Figs. 1-6 *Lytocestus indicus*

1. Full worm (whole mount); 2. scolex end (enlarged); 3. posterior portion of the worm (enlarged) to show disposition of the various components of the reproductive system; 4. egg; 5. an anomalous specimen showing longitudinal division of the worm into two separate Parts immediately posterior to the short neck and reunion of the same a little anterior to the cirus sac (scale bar = 0.5 mm); 6. the same at higher magnification (scale bar = 0.15 mm). /5& 6 - photomicrographs /.

TABLE 1: LYTOCESTUS INDICUS(MOGHE,1925) WOODLAND, 1926 MORPHOMETRIC MEASUREMENTS.

Characters	Present observation (based on ten mature specimens) Range (mm)	Mean	Moghe's (1931) observation
Length of the body	10.56-19.8	14.50	15-29
Maximum breadth of the body at the level of cirrus sac	1.45-:3.6	2.60	1.82-2.73
Length of the Scolex	1.06- 1.98	1.62	3
Length of the neck	0.46- 1.32	0.74	-
Testicular follicles			
(a) Length	0.08- 0.22	0.14	0.119
(b) Breadth	0.04- 0.14	0.09	0.002
Overian lobes			
(a) Length	0.26- 0.85	0.56	-
(b) Extent	0.99- 2.11	1.65	-
Vitelline follicles			
(a) Length	0.07- 0.19	0.12	0.077-0.088
(b) Breadth	0.04- 0.12	0.07	0.088-0.112
Pre-testes distance (Commencement of testicular follicles from anterior extremity)	1.99- 3.66	2.80	-
Pre-vitellaria distance	1.58- 3.36	2.32	-
Distance between anterior extent of testes and vitellaria	0.19- 0.99	0.46	-
Position of the genital pore from the posterior extremity	1.43- 3.63	1.08	-
Eggs			
(a) Length	0.06- 0.08	0.05	0.088
(b) Breadth	0.02- 0.03	0.01	0.44

below the utero-vaginal pore. Ovary bilobed, wing like in shape, follicular, the two lobes of ovary joined to each other by an ovarian isthmus posteriorly; Mehlis' gland well developed, located behind ovarian isthmus; vagina distinct, joining the terminal end of the uterus to open unitedly to the exterior at the utero-vaginal pore. Vitelline follicles corticular, in a ring around the testes, no post-ovarian vitelline follicles present. Excetory pore terminal. Eggs oval in shape, smooth, embryonated and operculated.

The measurement of the body and its organ are given in Table I.

REMARKS

The species, ***L. indicus***, was first described by Moghe (1925) as ***Caryophyllaeus indicus*** from the common Indian siluroid, ***Clarias batrachus***. Woodland (1926) raised a doubt regarding the presence of post-ovarian vitelline follicles and maintained that they were in reality ovarian follicles, suggesting thereby shifting of the species from ***Caryophyllaeus*** to ***Lytocestus***. Moghe (1931) redescribed the species in view of Woodland's (1926) remarks and placed it under the genus ***Lytocestus***. The present observations are in conformity with those of Moghe (1925), except for minor deviations with regard to the measurements as shown in Table I.

Of all the specimens of ***L. indicus*** collected during the present investigation, a single specimen showed a longitudinal division of the worm immediately posterior to the short neck into two separate parts which reunited a little anterior to the cirrus sac. Such anomalies amongst caryophyllids are rare (Janiszewska, 1954) but Simha and Rasheed (1981) reported an anomaly in ***L. indicus***, in which the anterior end of the worm was duplicated for about one-fourth of the body length, into two complete bothria along with the testes and vitellaria.

Amongst other caryophyllidean anomalies, ***Archigetes brachyurus*** was reported to possess post-ovarian vitellaria by Mrazek (1908). Absence of post-ovarian vitellaria in ***Caryophyllaeus laticeps*** and ***Glaridacris laruei*** was observed by Janiszewska (1954) and Mackiewicz (1965a), respectively. Similarly, Mackiewicz (1963b) reported presence of vitellaria in ***Monobothrium hunteri***. Fusion of posterior lobes of ovary in ***G. laruei,*** isolated vitelline follicles in the neck of ***G. catastomi*** and shortened posterior ovarian lobes in ***Isoglaridacris hexacotyle*** were reported by Mackiewicz (1965a, 1968a). Duplication of reproductive system was recorded by Mackiewicz (1978) in the genus ***Glaridacris*** and ***Penarchigetes***. Jones and Mackiewicz (1969) observed the testes of ***Atractolytocestus huronensis*** to be posterior to the ovary.

There are reports of anomalies occurring in polyzoic cestodes also. Therefore Braun (1900), on summarizing the recorded cases of anomalies in polyzoic cestodes, attributed forking of the strobila to metabolic disturbance or fenestration in the region of proliferation. Chandler (1930) recorded an abnormal ***Taenia pisiformis*** with a normal scolex but with two chains of strobila. Clapham (1939) also reported duplication of the reproductive system along with the gonopores in ***Taenia pisiformis*** and ***Dipylidium caninum***.The anomaly observed in the present form can be attributed to a possible mechanical injury to the tegument which could have triggered secondary growth. This seems probable as caryophyllids are known to have a diffuse type of growth (Nyebelin, 1922) and are regarded to be monozootic (Wardle ***et al.***, 1974).

The rare occurrence of anomalies amongst the caryophyllids, however, is indicative of a high degree of genetic stability in the group (Mackiewicz, 1972).

Lytocestus birmanicus Lynsdale, 1956
Fig.7-10

362 number of specimens of *L. birmanicus* were collected during the exploration.

Description

Body elongated, flattened, posterior end broader than the anterior, with traces of external segmentation present; body proper divided into an outer cortex and an inner medulla by two layers of longitudinal muscles. Scolex lanceolate, smooth and narrows to form the neck that gradually widens into the posterior part of the body. Testes numerous, 170-384 in number, medullary in disposition, spherical or oval in shape, extending a short distance from behind the anterior vitellaria to cirrus sac posteriorly; cirrus sac oval, lined by a thick muscular wall, opening slightly anterior to the utero-vaginal pore. Ovary bilobed, follicular, cortical and extends posteriorly behind the Mehlis gland, united by a median isthmus; Mehlis' gland prominent behind ovarian isthmus; uterine coils glandular, extending up to the level of cirrus sac;; vagina a straight tube, joins the uterus at the proximal part to open unitedly at the utero-vaginal pore. Vitellaria transversely elongated, cortical, arranged in an annular manner in the space between the two longitudinal muscle layers, extend as far as the utero-vaginal aperture; the vitelline follicles appear concentrated in two lateral bands on either side of the body but some are also scattered in the median field, no posot-ovarian vitelline follicles present. Eggs smooth and oval in shape.

REMARKS

L. birmanicus was first described by Lynsdale (1956) from the intestine of *Clarias batrachus* in Rangoon, Burma. The present observations are in conformity with those of Lynsdale (1956) in all the aspects except for minor deviations with regard to the measurements of the various organs that are represented in Table II.This species is being reported for the first time from India.

Lytocestus filiformis (Woodland, 1923) Fuhrmann and Baer, 1925
Fig. 11-14)

209 specimens of *L. filiformis* were collected during the two year study.Body flat, elongated, ribbon like, posterior end broader than the anterior end, longitudinal muscle fibres disposed in two distinct zones of cortex and medulla. Scolex smooth, undifferentiated, variable in shape, may be flat or pointed in some. Neck l0ng, slender. Testes numerous, 232-532 in number, occupying the medullary region of the body, spherical or oval in shape extending from behind the neck up to the cirrus sac posteriorly; cirrus lined by a thin muscular wall, opening separately from the utero-vaginal pore. Ovary bilobed, follicular, cortical, the two lobes joined to each other by an ovarian isthmus; Mehlis' gland well developed, behind ovarian isthmus; uterine coils glandular, extending from behind the isthmus beyond the anterior horns of ovary up to the cirrus sac; vagina distinct, joins the uterus distally to open at the utero-vaginal pore. Vitellaria cortical, smaller than testes, spherical or oval in shape, form a crescent around the testes, no post-ovarian vitelline follicles present. Excretory pore terminal. Eggs smooth, operculate and oval in shape.

REMARKS

L. filiformis was first described by Woodland(1923) as *Caryophyllaeus filiformis* from a mormyrid fish host,*Mormyrus cashive*, of river Nile at Khatoum. Later, Fuhrmann and Baer

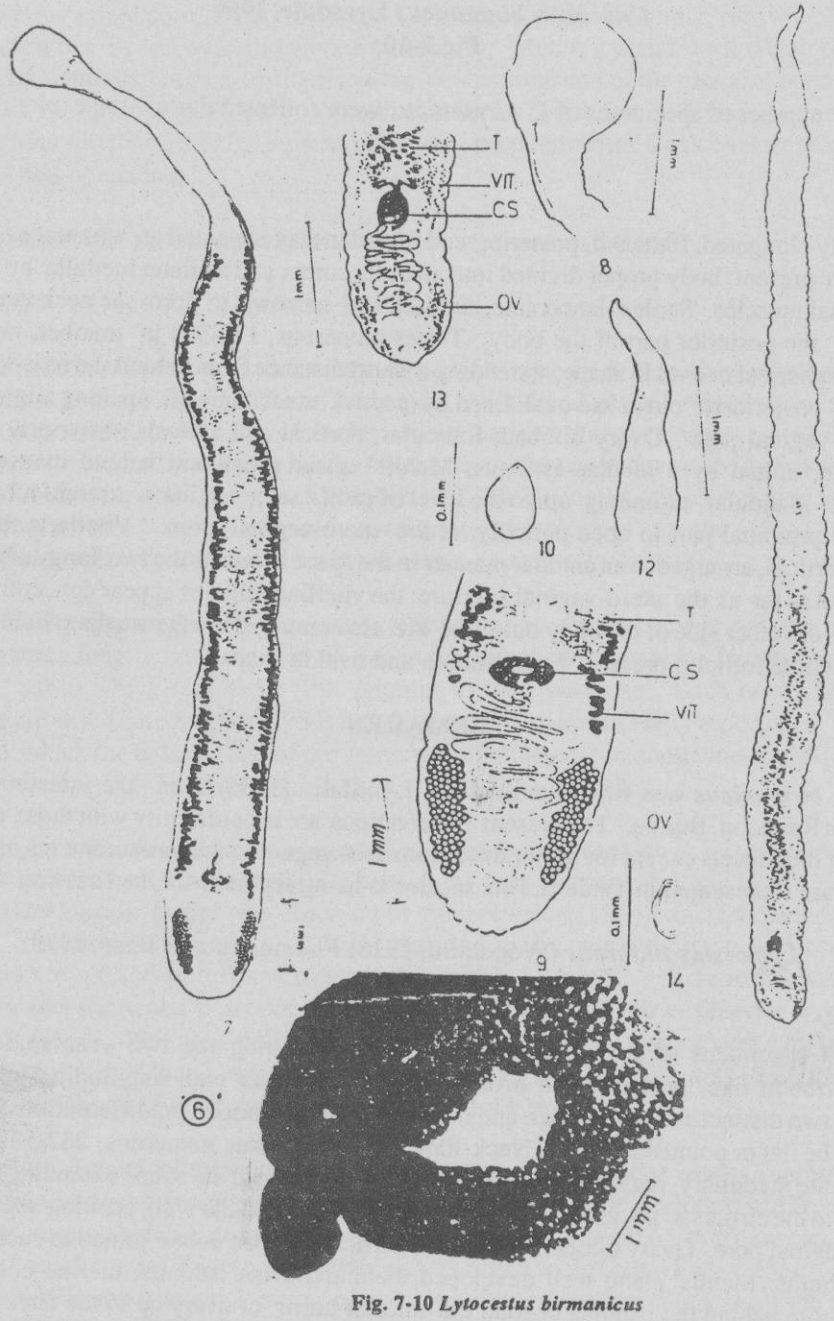


Fig. 7-10 *Lytocestus birmanicus*

7. Full worm (Whole mount); 8. scolex end (enlarged) 9. posterior portion of the worm (enlarged); 10. egg.

Fig. 11-14 *Lytocestus fillformis*

11. Full worm (whole mount); 12. scolex end (elarged); 13. posterior portion of the worm (enlarged); 14. egg.

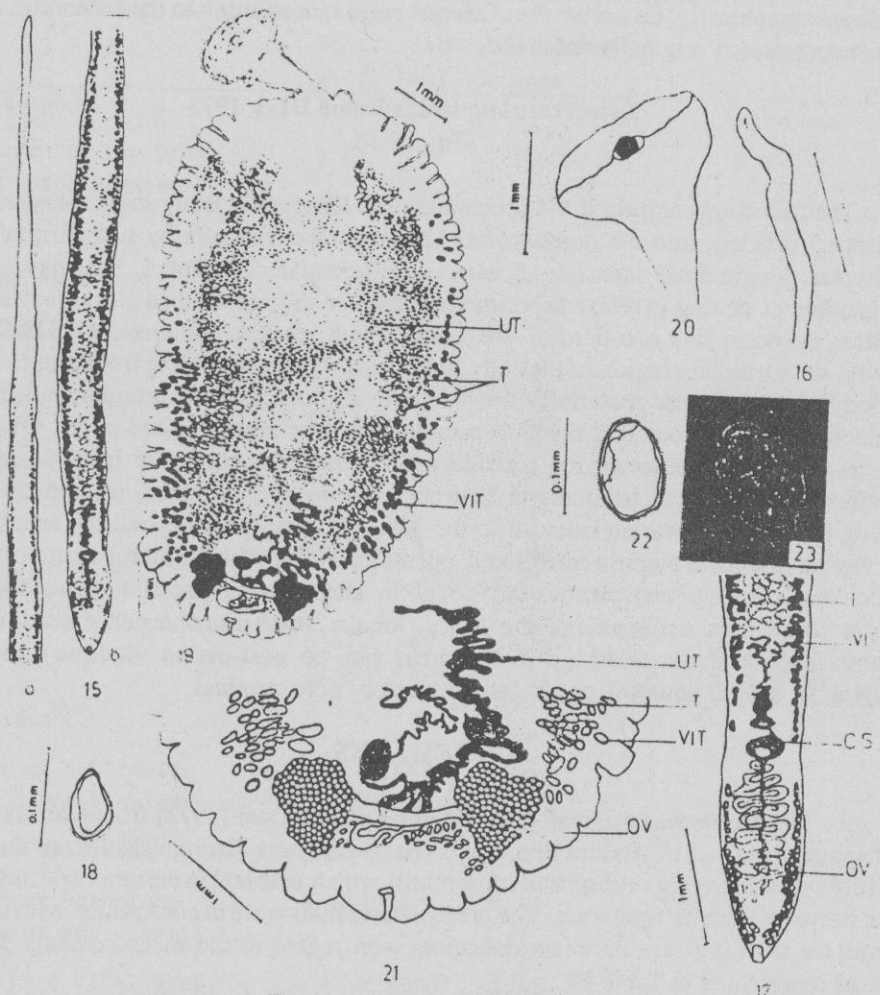


Fig. 15-18 *Lytocestus longicollis*

15.Full worm (whole mount) - a. anterior half, b. posterior half; 16. scolex end (enlarged); 17. posterior portion of the worm enlarged; 18. egg.

Fig. 19-23. *Djomobangia penetrans*

19. Full worm (whole mount) ; 20. scolex end having sucker at the tip (enlarged); 21. posterior portion of the worm enlarged; 22.egg; 23. potomicrograh of the operculate and spinose egg as seen under phase contrast (scale bar = 0.01).

(**Abbreviations** : C.S. - cirrus sac; O.V. - Ovarian lobe; T - testes; U.T. - Uterus; VIT - Vitellaria)

(1925), on the basis of cortical disposition of vitellaria and medullary disposition of testes, shifted it to the genus *Lytocestus*.The present description supplements the original one by providing measurements of the various organs (Table III).*Clarias batrachus* represents a new host for *L. filiformis*. Further, its occurrence from the north-eastern region of India constitutes a new locality report Zoogeographically, *i.e.*, from the Oriental region, in addition to the Palearctic realm, from where the species was originally described.

Lytocestus longicollis Rama Devi, 1973
Fig. 15-18

The collection comprised 141 specimens of *L. longicollis*. Body long, slender, ribbon like; body proper divided into an outer cortex and an inner medulla by two distinct layers of parenchymal longitudinal muscles. Scolex undifferentiated, unarmed, but may vary in shape from spatulate or oblong in relaxed specimens to swollen and pear shaped in contracted ones. Neck long, slender, occupying one-third of the body length. Testes numerous, 213-520 in number, occupying the medullary region of the body, spherical in shape, extending from anterior narrow end of the body to the cirrus-sac posteriorly; currus sac oval, lined by thin muscular wall, enclosing the long ductus ejaculatorious that opens separately from the utero-vaginal pore. Ovary bilobed, follicular, H-shaped, connected by bandlike ovarian isthmus, corticular in disposition; Mehlis' gland situated posterior to isthumus in between the two ovarian lobes, uterine coils glandular, extending from behind ovarian isthmus to the level of cirrus pore beyond the anterior horns of ovary; vagina straight or slightly convoluted, opening unitedly with the uterus as utero-vaginal pore; receptaculum seminis a conspicuous sac, oval in shape, lying anterior to ovarian isthmus. Vitellaria cortical, in a ring around the testes, lobular, smaller than testes, extending from a few milimeters anterior to the testes up to the cirrus sac, no post-ovrian vitelline follicles present. Eggs oval in shape, smooth, operculate. Excretory pore terminal.

REMARKS

L. longicollis was originally described by Rama Devi (1973) from *Clarias batrachus* in Visakhapatnam district of Andhra Pradesh. The species was distinguished from the rest of the lytocestiid types in having a receptaculum seminis, which is absent in the other species. The species derived its name from its long neck. The present observations are in conformity with those of Rama devi in all the aspects except for minor deviations with regard to the measurements of the various organs as represented in Table IV.

Subfamily Djombanginae Satpute and Agarwal, 1980
Djombangia penetrans Bovien, 1926.

398 specimens of this species were collected Body short, broad and fleshy; body proper divided into an outer cortex and an inner medulla by two layers of longitudinal muscles. Scolex globular with a terminal sucker. Neck marked off from the body. Testes 155-383 in number, spherical or ovoid, extending in two lateral rows from some distance behind the neck up to the level just in front of the ovary; cirrus pouch not well defined, opening into a common atrium close to posterior extremity, just in front of the ovarian isthmus. Ovary bilobed, at posterior extremity, follicular, the two lobes joined to each other by an ovarian isthmus; uterus partly glandular, its coils large in the median field of medulla, and reaching cephalad upto the comencement of testicular region. Vitellaria globular, extending in cortical parenchyma of testiculalr and ovarian zone;

TABLE II: LYTOCESTUS BIRMANICUS LYNSDALE 1956: MORPHOMETRIC MEASUREMENTS

Characters	Present observation (based on ten mature specimens		Lynsdale's (1956) observation
	Range (mm)	Means	
Length of the body	5.28-16.36	10.92	10-12
Maximum breadth of the body at the level of cirrus sac	0.53-1.45	1.08	0.9
Length of the scolex	0.46-1.18	0.80	0.8
Length of the neck	1.32-5.47	3.18	-
Testicular follicles			
(a) Length	0.06-0.21	0.14	0.15-0.18
(b) Breadth	0.02-0.11	0.06	0.10-0.13
Ovarian lobes			
(a) Length	0.33-1.25	0.81	-
(b) Extent	0.33-1.18	0.88	-
Vitelline follicles			
(a) Length	0.04-0.14	0.09	0.10-0.12
(b) Breadth	0.02-0.10	0.04	0.04-0.06
Pre-testes distance			
(Commencement of testicular follicles from anterior extremidy)	1.52-2.20	1.86	-
Pre-vitellaria distance	1.18-1.94	1.56	-
Distance between anterior extent of testes and vitellaria	0.01-0.06	0.03	-
Position of the genital pore from the posterior extremigy	0.46-2.50	1.41	-
Eggs			
(a) Length	0.05-0.07	0.06	0.05
(b) Breadth	0.02-0.03	0.025	0.03

TABLE III: LYTOCESTUS FILIFORMIS WOODLAND, 1923: MORPHOMETRIC MEASUREMENTS.

Characters	Present observation (based on ten mature specimens)		Woodland's (1923) observation
	Range (mm)	Mean	
Length of the body	5.94-33.00	17.10	7.5-24
Maximum breadth of the body at the level of cirrus sac	0.59-1.65	0.99	1-2
Length of the neck	1.98-12.54	6.3	-
Testicular follicles			
(a) Length	0.04-0.14	0.09	-
(b) Breadth	0.01-0.08	0.04	-
Ovarian lobes			
(a) Length	0.53-1.5	0.77	-
(b) Extent	0.46-1.32	0.73	-
Vitelline follicles			
(a) Length	0.02-0.07	0.03	-
(b) Breadth	0.01-0.04	0.02	-
Pre-testes distance (Commencement of testicular follicles from anterior extremity	2.31-16.50	7.6	-
Pre-vitellaria distance	2.11-14.19	6.92	-
Distance between anterior extent of testes and vitellaria	0.13-2.31	1.08	-
Position of the genital pore from the posterior extremigy	0.73-2.3	1.18	-
Eggs			
(a) Length	0.03-0.05	0.03	0.0622-0.0695
(b) Breadth	0.01-0.03	0.01	0.292-0.0329

TABLE IV: LYTOCESTUS LONGICOLLIS RAMA DEVI 1973: MORPHOMETRIC MEASUREMENTS.

Characters	Present observation (based on ten mature specimens)		Rama Devi's (1973) Observation
	Range (mm)	Mean	
Length of the body	14.52-32.20	21.78	10.8-20
Maximum breadth of the body at the level of cirrus sac	0.53- 1.45	0.63	0.5-0.84
Length of the neck	4.62-12.08	6.77	5.36-7.6
Testicular follicles			
(a) Length	0.06-0.16	0.10	-
(b) Breadth	0.03-0.12	0.07	0.10-0.16
Ovarian lobes			
(a) Length	0.72-1.10	1.18	0.46-0.78
(b) Extent	0.26-0.79	0.47	-
Vitelline follicles			
(a) Length	0.03-0.11	0.06	0.039-0.07
(b) Breadth	0.02-0.07	0.04	-
Pre-testes distance (Commencement of testicular follicles from anterior extremity)	4.62-13.2	0.28	-
Pre-vitellaria distance	3.98-12.07	0.28	-
Distance between anterior extent of testes and vitellaria	0.64-1.19	0.91	-
Position of the genital pore from the posterior extremity	1.12-2.31	1.84	-
Eggs			
(a) Length	0.05-0.07	0.06	0.046-0.054
(b) Breadth	0.02-0.03	0.025	0.023-0.031

TABLE V: DJOMBANGIA PENETRANS : MORPHOMETRIC MEASUREMENTS AND THEIR COMPARISION WITH THE OTHER DJOMBANGIA SPECIES DESCRIBED FROM INDIA.

Characters	Present observation (based on ten mature specimens) Range (mm)	Mean	D. indica Satpute & Agarwal's (1980) observation	D. cabellaroi Sahay & Sahay's (1977) observation	D. clariae Kundu et al's (1985) observation
Length of the body	5.61 - 11.35	7.37	7.3 - 13.8	7.86 - 8.12	14.035
Maximum breadth of the body at the level of cirrus sac	2.97 - 5.28	3.82	1.8 - 4.3	2.70 - 2.76	5.087
Length of the scolex	0.53 - 1.12	0.71	0.9 - 1.5	0.52 - 0.6	1.033
Length of the neck	0.26 - 0.99	0.66	0.6 - 1.7	1.00 - 1.22	
Testicular follicles					
(a) Length	0.06 - 0.19	0.12	0.048- 0.168	-	0.165 (dia meter)
(b) Breadth	0.04 - 0.12	0.07	0.06 - 0.18	-	
Ovarian lobes					
(a) Length	0.26 - 0.66	0.49	0.425- 0.85	-	0.893 - 0.962
(b) Extent	0.99 - 1.32	1.09	0.17 - 0.493	-	0.485 - 0.55
Vitelline follicles					
(a) Length	0.06 - 0.19	0.10	0.024- 0.096	-	0.132 - (diameter)
(b) Breadth	0.04 - 0.11	0.06	0.024- 0.084	-	
Pre-testes distance (Commencement of testicular follicles from anterior extremity)	1.19 - 2.64	1.73	0.6 - 1.3	-	
Pre-Vitellaria distance	1.45 - 2.97	2.03	-	-	
Distance between anterior extent of testes and vitellaria	0.0028- 0.028	0.01	-	-	
Position of the genital pore from the postetior extremity	0.79 - 1.32	0.98	-	-	
Eggs					
(a) Length	0.056- 0.073	0.06	0.014- 0.081	0.08	0.082 - 0.96
(b) Breadth	0.028- 0.039	0.031	0.043- 0.068	0.04	0.041

no post-ovarian vitellin follicles present. Eggs oval, spiny and operculate.The measurements of the body and its organs are presented in Table V.

REMARKS

The present form is identified to be ***D. penetrans*** Bovien 1926 because it shared with the type species all the salient morphological features like a distinct sucker at the tip of the scolex, neck marked off from the body, no post-ovarian vitelline follicles, cirrus sac not prominent, and spinose eggs.

On comparison with the other known forms, the present form is found to be distinctly different from ***D. indica*** Satpute and Agarwal, 1980 described from ***C. batrachus*** in Raipur (M.P.), in not having the post-ovarian vitelline follicles and in the absence of a prominent cirrus sac and receptaculum seminis, though it shares the characters such as the presence of a sucker at the tip of the holdfast and spinose eggs. The other two Indian species of ***Djombangia, D. caballeroi*** Sahay and Sahay, 1977 from ***H. fossilis*** in Bihar and ***D. clariae*** Kundu, Bhattacharya and Datta, 1985 from ***C. batrachus*** in West Bengal are reported to be having smooth, nonspinous eggs. Since their observations are based on in utero eggs in one or a few flattened specimens, the presence or lack of spines on the egg surface needs to be further ascertained. Till more material is studied, it appears that the genus ***Djombangia*** is represented by 2 species in India, i.e., ***D. penetrans*** and ***D. indica.***

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