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ORIGINAL ARTICLE

Morphotaxonomic Studies on Caryophyllidean Cestode Genus *Lytocestus cohn*, 1908 from Freshwater *Catfish clarias* Batrachus with Description of New Speecies

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ABSTRACT

Present investigation deals with taxonomic studies of Piscean tapeworm Lytocestus elongates Sp.Nov. collected from intestine of freshwater catfish host Clarias batrachus at Ahmedpur, District Latur (M.S.) India during the period of February, 2012 to January, 2014. Present Worm comes closer to all known the worm and Vitellaria follicular, arranged in two rows.species of Lytocesus in general topography of organs but differs due to Mature specimens long, elongated, single segmented, 15.50× 0.55 mm, Testes rounded to oval in shape, 750-850 in number, pre-ovarian, evenly distributed, cirrus pouch fusiform, cylindrical, pre-ovarian, transversely placed, muscular, genital pore small, oval , vagina long, thin, tube like, Ovary bilobed, branched, 'V' shaped, situated near the posterior region of.

Key words: *Caryophyllidean Cestode, Clarias batrachus, Lytocestus indica Sp.Nov., Taxonomic studies*

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INTRODUCTION

Genus *Lytocestus* was erected by Cohn, 1908 with its type species L.adhaerens in siluroid host, Clarias fuscus, from Hongkong. Generic diagnosis was given as: holdfast undifferentiated and not broader than the body, parenchyma muscles in a ring around the testes, and no postovarian yolk glands present. To the type species *L.* adherens Cohn, 1908, several species have been added to date. They are *L. filiformis* (Woodland, 1923) Fuhrmann and Baer, 1925 [=*Caryophyllaeus filiformis* Woodland, 1923; *Monobothrioides filiformis* (Woodland, 1923) Woodland, 1937; *L. alestesi* Lynsdale, 1956 fide Mackiewicz. (1962)] from Mormyrus coschive of river Nile at Khartoum; *L. indicus* (Moghe, 1925) Woodland, 1926 [=*Monobothrioides indicus* (Moghe, 1925) according to Woodland (1937)] from *C. batrachus* in India; *L. javanicus* (Bovien, 1926) Furtado, 1963 from *C. batrachus* in Java [=*Caryocestus javanicus* (Bovien, 1926)]; *L. birmanicus* Lynsdale, 1956 [=*L. alestesi* Lynsdale, 1956, according to Johri (1959)] from *C. batrachus* from Rangoon, Burma; *L. parvulus* Furtado, 1963 from *C. batrachus* in Singapore and Malacca; *L. longicollis* Rama Devi, 1973 from *C. batrachus* in India; *L. lativitellarium* Furtado et Tan, 1973 from *C. batrachus* in Malaysia; *L. puylaerti* Khalil, 1973 from *C. liberiensis* in Sierra Leone(Africa); *L. fossilis* Singh, 1975 from *H. fossilis* from Kathmandu (Nepal); and *L. marcuseni* Troncy, 1978 from *Marcusenius harringtoni* from Chad basin in Africa. *L.* fossilis is the only species included in the genus which possesses post-ovarian vitelline follicles. Though its author placed this species under the genus *Lytocestus* the histological details for ascertaining the family or genus allocation are lacking in its account, thus raising a doubt for including the form with post-ovarian vitelline follicle in the genus.

Likewise another genus LucknowiaGupta, 1961 that was erected as a new genus distinct form *Lytocestus* on the basis of the extension of vitelline glands up to the posterior end of the body (Gupta, 1961) was considered synonymous with *Lytocestus* by Mackiewicz (1994), who opined that the ovarian follicles of Lucknowia were mistaken for postovarian vitelline follicles (Mackiewicz, 1981).

Shinde and Phad, 1988 reported *L.* marathwadensis from Clarias batrachus. Jadhav and Gavhane, 1991 described L.alii and *L. clariasae* from Clarias batrachus. *Lytocestus* naldurgensis was reported by Kadam *et. al.,* 1998 in Clarias batrachus. Kolpuke Shinde and Begum, 1999 reported *L. teranaensis* from Wallago attu. *L. kopardaensis* Shinde and Borde, 1999 and *L. chalisgaonensis* Kalse *et.al.,*1999 were described from Clarias batrachus. *L.* govindae D.N. Patil and B.V. Jadhav, 2002, *L.* batrachusae Shinde and Pawar, 2002, *L.* clariasae (minor) Pawar and Shinde, 2002 L.shindae Khadap *et. al.*, 2004, *L.* nagapurensis Lakhe, 2004 were reported from Clarias batrachus. Tandon Veena et al., 2005 erected L.clariae, *L.* attenuateus, *L.* assamensis in intestine of Clarias batrachus and L.heteropneustii in host Heteropneustes fossils from Guwahati (Assam) and Shella (Meghalaya). Subsequently *L.* mujumdari and *L.* bokaroensis Poonam, 2007 in Clarias batrachus, *L.* paithanensis (Shelke, 2007), from Clarias batrachus, *L.* jagtai (Tripathi et al., 2007) from Heteropneustes fossilis, *L.* punensis (Jadhav *et. al.*, 2008) from cat fish Clarias batrachus of Maharashtra, L.subhapradhi (Jawalikar et al.,2008) *L.* follicularae and *L.* osmanabadensis (Bhure *et. al.*,2010), *L.* puranensis (Kasar et.al.,2010), *L.* shindei (Surayawanshi *et. al.*, 2010), *L.* murhari (Kaul *et. al.*, 2010), L.*vyasaei* and L.purnensis (Pawar and Hiware,2011), *L. gariepinusae* (Kadam *et. al.*, 2011), *L.* khami (Jawale *et. al.*, 2011), *L.* manjaraensis (Salunke *et. al.*, 2012), *L.* thapari and *L.* alii (minor) (Sawarkar B. W, 2012), *L.* godavariensis (Pawar and Dandwate,2013), *L.* indica (Deshmukh et.al.,2015) from freshwater fish Clarias batrachus were described and reported.

MATERIALS AND METHODS

One Hundred Forty Eight cestode parasites were collected from Ninety Four infected intestine out of Two Hundred Forty examined freshwater fish host Clarias batrachus (Linneus, 1758) at Ahmedpur, District Latur (M.S.) India during the period of February, 2012 to January, 2014. These cestodes were preserved in hot 4% formalin, Five specimens are stained with Borax carmine, dehydrated in series of alcoholic grades, cleared in xylol, mounted in DPX and drawings are made with the help of camera lucida attachments. Measurements are recorded in millimeters. Cestode were prepared for identification by standard methods (Schmidt Gerald D.; Yamaguti, S.; Wardle, R.A., Mcleod, J.A. and Radinovsky; Khalil, Jones and Bray and Bhure D.B.).

DESCRIPTION (Based on Four Specimens)

Mature specimens are long, elongated, single segmented, tapering at Posterior ends and blunt at anterior end, and measures 15.50 (14.50-16.50) mm in length and 0.55 (0.50-0.60) mm in width. The head is long, well marked off from the body and measures 1.85 (1.8- 1.9) mm in length and 0.45 (0.4-0.5) mm in width. Testes are rounded to oval in shape, 750-850 in number, pre-ovarian, evenly distributed and measures 0.070 (0.056-0.084) mm in length and 0.063 (0.056-0.070) mm in width. The cirrus pouch is fusiform, cylindrical, pre-ovarian, transversely placed, muscular and measures 0.926 (0.855-0.997) mm in length and 0.370 (0.228-0.513) mm in width. The cirrus is thin, within cirrus pouch and measures 0.826 (0.798-0.855) mm in length and 0.057 (0.028-0.085) mm in width. The vas deferens is medium, curved tube, thin and measures 0.541 (0.513-0.570) mm in length and 0.071 (0.057-0.085) mm in width.

Vagina and cirrus pouch opens a common pore viz. genital pore, which is small, oval in shape and measures 0.185 (0.142 -0.228) mm in length and 0.085 (0.057-0.114) mm in

width.The vagina is long, thin tube like, starts from genital pore, runs posteriorly to cirrus pouch, forms receptaculum seminis and measures 1.396(1.368-1.425) mm in length and 0.071(0.057-0.085) mm in width. The receptaculum seminis is thin tube, it opens into the ootype and measures 1.068 (0.997-1.140) mm in length and 0.099 (0.085-0.114) mm in width. The ootype is rounded to oval in shape and measures 0.0356 (0.285-0.427) mm in length and 0.370 (0.285-0.456) mm in width. From the ootype ovarian lobes start. The ovary is bilobed, branched, 'V' shaped, situated near the posterior region of the worm and measures 3.847 (3.705-3.990) mm in length and 0.926 (0.285-1.567) mm in width. Vitellaria are follicular, arranged in two rows and measures 0.57 (0.0285-0.0855) mm in length and 0.042 (0.028-0.057) mm in width.

DISCUSSION

Cohn 1908 established the genus *Lytocestus* with its type species *L.* adhaerens in siluroid host Clarias fuscus from Hong-Kong. So far several species have been added to the genus *Lytocestus*.

On comparision with known species of *Lytocestus*, the present form stands close to them in general topography of organs but differs from L.adhaerens Cohn, 1908 in having undifferentiated head from body, strongly muscular cirrus pouch, looped uterus, granular vitellaria, collected from Clarias fuscus in Hong Kong.*Lytocestus* elogatus Sp.Nov. differs from *L.* filiformis (Woodland, 1923) Fuhrmann et Baer,1925 in having body elongated, 7.5-24 ×1-2 mm receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.025 mm, postoverian vitellaria absent, eggs 0.062-0.070× 0.029-0.033 mm and recovered from Mormyrus caschive; Egyptian Sudan.

The present parasites *L. elongatus* Sp.Nov. differs from *L. indicus* (Moghe, 1925) Woodland, 1926 in having body 15-29 ×1.82-2.73 mm, Testicular follicles 0.095-0.119 ×0.002 mm, ovary 'H' shaped, receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.220-0.270 mm, vitelline follicles 0.077-0.088× 0.088-0.112mm and postovarian vitellaria absent, eggs 0.080×0.040 mm.

It differs from *L.* alestus Lynsdale, 1956 in having testes more or less spherical, numerous and uterus short collected from Alestes nurse in Sudan.

The *L. elongatus* Sp.Nov. differs from *L.* biramanicus Lynsdale, 1956, in having body Elongated, 10-12 × 0.9 mm, Testicular follicles 0.15-0.18× 0.10-0.13 mm, 'H' shaped ovary, receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.180 mm, previteline distance 4.0 mm, vitelline follicles 0.10-0.12× 0.04-0.06mm, vitelline follicles distributed in two lateral bands and postovarian vitellaria absent, eggs 0.050×.030 mm and reported from Clarias batrachus; Burma.Present worm differs from L.parvulus Furtado,1963 in having body 3.6-5.7 × 0.24-0.90 mm, neck 0.75-2.10 mm, Testicular follicles 0.10-0.15× 0.05-0.10 mm, Cirrus sac 0.12-0.15 mm, ovary 'H' shaped, measures 0.3-0.45 mm, receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.045 mm, vitelline follicles 0.100× 0.050 mm, vitelline follicles distributed in five rows encircling testes, postovarian vitellaria absent, eggs 0.026-0.033×0.023-0.045 mm and recovered from Clarias batrachus; Singapur and Malacca.

The worm *L. elongatus* Sp.Nov. under discussion differs from *L.* lativitellarium Furtado et Tan, 1973 in having body 25-31 × 1.35-1.95 mm, neck 9.9-10.6 mm, pre testes distance 0.6-0.8 mm, Testicular follicles 0.105-0.325× 0.030-0.90 mm, Cirrus sac 0.225-0.238 mm ,ovary 'H' shaped, 0.094-0.138 ×0.044-0.067 mm, receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.150 mm, vitelline follicles 0.067-0.086× 0.030-0.050 mm, vitelline follicles concentrated laterally, postovarian vitellaria absent, eggs 0.019-0.023×0.030-0.033 mm and collected from Clarias batrachus; Malaysia.Present Cestode differs from *L.* longicollis Ramadevi, 1973 in

having body elongated, 10.8-20 ×0.5-0.84 mm; neck 5.36-7.6 mm, Testicular follicles 0.10-0.16 mm, Cirrus sac 0.24-0.31 × 0.16-0.23 mm, Ovary 'H' shaped, 0.46-0.78 mm, presence of receptaculum seminis, male and female genital pore separate, genital atrium absent, interpore distance 0.05-0.08 mm, vitelline follicles 0.0339-0.07 mm, postovarian vitellaria absent, eggs 0.046-0.054×0.023-0.031 mm.

The *L. elongatus* Sp.Nov. differs from L.puylaerti Khalil,1973 in having body 3.06-4.12 × 0.67-0.7 mm, pre testes distance0.602-0.723 mm, testicular follicles 0.058-0.14× 0.105-0.195 mm, Cirrus sac 0.27-2.29 × 0.105-0.195 mm, Ovary 'H 'shaped, 0.046-0.058 × 0.035-0.039 mm, absence of receptaculum seminis, male and female genital pore separate, genital atrium absent, interpore distance very short, 0.602-0.723 mm, vitelline follicles , 0.58-0.116 ×0.015-0.027 mm, annular distribution of Vitelline follicles, postovarian vitellaria absent, eggs 0.046-0.058×0.035-0.039 mm and recovered from Clarias liberiensis; Sierra Leone (Africa).

The new species *L. elongatus* Sp.Nov. differs from *L.* fossilis Singh, 1975 in having body 16.0-20.5× 2.4-3.2 mm, neck 1.6-1.9×0.86-1.2 mm, testicular follicles 0.16-0.22× 0.35-0.44 mm, cirrus sac 0.72-0.8× 0.54-0.62 mm, ovary 'H' shaped, receptaculum seminis absent, male and female genital pore common, genital atrium present, pre vitelline distance 3.5-4.0 mm, vitelline follicles 0.15-0.19 × 0.30-0.35 mm, post ovarian vitellaria present, eggs 0.32-0.04×0.024-0.028 mm, collected from H. fossilis;Nepal.

The *L. elongatus* Sp.Nov. further differ from *L.* marcuseni Troncy, 1978 in possessing bvody 8-11 × 1.1 mm, testicular follicles 0.480-0.375 mm, receptaculum seminis absent, male and female genital pore separate, genital atrium absent, interpore distance 0.065 mm, previtlline distance 2.5 mm., vitelline follicles 0.30-0.60 × 0.010-0.020 mm, postovarian vitellaria absent, eggs 0.045-0.055×0.030-0.035 mm and recorded from Marcusenius harringtoni; Chad Basin in Africa.

It differs from *L.* marathwadensis Shinde and Phad, 1986 in having testes 100-105, arranged in 2 or 3 rows, in central medulla,0.005×0.006mm, cirrus pouch large, oval,0.04×0.03mm, ovary 'H' shaped, closely packed with follicles, receptaculum seminis absent and vitellaria follicular, small, and arranged in single row on lateral side, 0.03×0.04mm.

The present form differs from *L.* alii Jadhav and Gavhane, 1991 in having head bluntly rounded, 6.248×0.893-1.607mm, testes 460-480 in numbers, in 2-3 rows, 0.005×0.006 mm, cirrus pouch small, oval, vas deferens short, ovary bilobed, butterfly shaped, receptaculum seminis small, ootype round, posterior to isthmus, uterus wide, convoluted tube, vitellaria follicular, arranged in 4-5 rows, corticular in position.

The *L. elongatus* Sp.Nov. differs from *L.* clariasae Jadhav and Gavhane, 1991 in having head bluntly rounded,4.105×1.696-1.785mm, testes 700-750 in numbers, rounded,0.178-0.357mm, vas deferens coiled, cirrus pouch medium,0.499×0.089-0.196mm, ovary bilobed, ovarian follicle 36-42 in numbers, vagina wide, receptaculum seminis present, uterus convoluted, vitellaria follicular, corticular, arranged in 5-6 rows.

The present tapeworms under discussion differs from *L.* naldurgensis Kadam et.al., 1998 in having long, conical, blunt and spatulate head, short neck, testes 500-600 in numbers, distributed all over the body, small, oval, vertical and obliquely placed cirrus pouch, vagina wide, ovary butterfly shaped, uterus convoluted and vitellaria arranged in 3-4 rows.

L. elongatus Sp.Nov. differs from *L.* teranaensis Kolpuke et.al., 1999 in having long, conical head, it measures 2.522×0.398-0.717 mm, neck wide, 1.045×0.791-1.311mm, testes 1200-1250 in numbers, unevenly distributed, 0.034-0.008mm, cirrus pouch small, oval, transversely placed, 0.363-0.432×0.023mm, vas deferens long,wide, coiled, 0.646×0.011-0.023mm, ovary bilobed, large, each lobe triangular,0.738-1.045×0.043-0.125mm, vagina wide, 2.236×0.023-0.045mm, vitellaria follicular, arranged in 4-5 rows,0.023×0.011-

0.022mm, uterus wide, loop shaped, 4.249×0.068-0.114mm and reported from Wallago attu; Terna River, Aurad Shahajani, Latur (M.S.), India.

The present parasite differs from *L.* kopardaensis Shinde *et. al.*, 1999 in having long head, testes oval, 1650 in numbers, ovary distinctly bilobed with irregular margin, elongated cirrus pouch, coiled loop shaped uterus and vitellaria arranged in 2-3 rows;

L. elongatus Sp.Nov. differs from L.chalisgaonesis Kalse and Shinde, 1999 in having bluntly rounded head, 1.874 × 0.982 mm in size, testes 1500-1600 in numbers, unevenly distributed, 0.038×0.030 mm in size, cirrus pouch 1.533 ×0.247 mm, vas deferens coiled, 0.225 ×0.011 mm in size, ovarian lobes triangular, 1.33×0.77mm in size, vagina long, 0.965×0.136mm, uterus wide, convoluted tube, 4.203 × 0.147mm, vitellaria granular and corticular in position.

The present cestodes differs from *L.* govindae Patil and Jadhav, 2002 in having long, well marked head, testes 1425-1475 in numbers, pre-ovarian in position, evenly distributed, small cirrus pouch, ovary butterfly shaped and vitellaria granular.

The new form *L. elongatus* Sp.Nov. from *L.* batrachusae Shinde and Pawar, 2004 in having head spatulate, 1.963×0.624-1.428 mm, neck long, wide, 4.006×1.071-2.409 mm, testes medium, rounded, pre ovarian, 3800-4000 in numbers, 0.089-0.167mm, cirrus pouch long, elongated, 2.052×0.0891.998mm, cirrus thin, curved,1.774×0.034mm, vas deferens long, thin, curved, 1.982×0.0170.034mm,ovary bilobed, larged, butterfly shaped, 0.446-0.893×1.071-1.250 mm, uterus wide, Convoluted, loop shaped, 0.178× 0.107 mm and uterine pore small,oval.

The *L. elongatus* Sp. Nov. differs from L.clarisuae (Minor) Pawar and Shinde, 2004 in having body elongated with thin musculature, head spatulate, roughly triangular,0.681×0.454-0.737mm, neck long, wide, narrow anteriorly broad posteriorly, 4.589×0.965-1.361mm, testes small, rounded,5800-6000 in numbers, 0.089-0.160mm, cirrus pouch medium, cylindrical, 1.071×0.089-0.213mm, vas deferens thin, curved, 0.588×0.035mm, ovary bilobed, with loose, big, acini, 0.803×0.357mm, vagina thin, curved, 2.023×0.053mm, receptaculum seminis small, oval, posterior to isthmus, 0.107×0.089mm, ootype big, oval, bean shaped, 0.624×0.267mm, vitellaria arranged in single row,0.071×0.035mm, uterus wide, long, Convoluted, loop shaped, 8.925×0.160-0.267mm and uterine pore big, oval, 0.320×0.249 mm.

The new species *L. elongatus* Sp. Nov. differs from *L.* shindae, Khadap et.al., 2004 in having body long, 12.128-13.102×0.491-2.820 mm in size, head long, well marked from body, 1.421-2.245mm in size, testes small, 350-360 in numbers, evenly distributed, 0.096-0.102×0.050-0.065mm in size, cirrus pouch oval, pre ovarian, obliquealy placed, 0.303-0.374×0.036-0.090mm, cirrus thin straight, 0.219-0.226× 0.015-0.023mm, vas deferens short, straight, 0.642mm, ovary bilobed, butterfly shaped, follicle 33-36 in numbers, 0.893×0.464mm,vagina long, coiled, 2.678-3.202×0.015-0.107mm, uterus wide, transversly situated, 2.872-7.782×0.125-1.642mm, vitellaria granular, corticular in position and eggs operculate, oval, 0.080×0.034 mm.

Present parasite from *Lytocestus* nagapurensis Lakhe *et. al.*, 2004 in having bluntly rounded head, 2.320-2.445×1.428-1.732mm in size, neck short,1.035-1.517×1.625-2.145 mm, testes 1100-1150 in numbers, 0.071-0.125×0.035-0.071mm,cirrus pouch cylindrical, pre ovarian, oblique, 0.357-0.392×0.125-0.160 mm, cirrus cuiled, curved, 0.357×0.035mm, vas deferens thin,curved, 0.340×0.017-0.035mm, ovary bilobed, with loose mass of acini, irregular in margin, 1.732-2.231×0.535-0.642 mm, isthmus long, wide, 0.767-0.820×0.089-0.142mm, vagina long, 1.714-1.749×0.017-0.035mm, ootype oval, 0.178×0.107-0.129 mm, uterus wide, Convoluted, loop shaped, 0.053-1.517×2.070-2.552mm and vitellaria granular.

The new species differs from *L.* clariae Tandon, 2005 in having elongated and flat body, 8.58-22.44× 0.66-2.31 mm in size, smooth, unarmed and undifferentiated scolex and

followed by short neck, neck measures 1.18-6.93 mm, testes 270 – 495 in numbers, ovoid, 0.06-0.22× 0.04-0.11 mm, cirrus sac compact, bulbous, ovary bilobed, 'H' shaped, follicular, 0.53-1.65× 0.46-1.32 mm, uterus glandular, vitelline follicles ovoid, pre ovarian, arranged in 2 rows, 0.05-0.18×0.02-0.08 mm, eggs oval, spinous, operculate, 30-50×20-30µm and erected from Clarias batrachus L.; Guwahati (Asam) Shella (Meghalaya), India.

The *L. elongatus* Sp. Nov. further differs from *L.* attenuatus Tandon et.a*L.* 2005 in having body thin, slender, elongated, flattned, 11.88-35.44 × 0.66-1.18 mm, scolex smooth, undifferentiated, unarmed, with bluntly rounded extremity, neck 6.14-7.06 mm, testes 155- 398 in numbers, ovoid, 0.08-0.18×0.03-0.15 mm, cirrus sac medullary, ovary bilobed, follicular, inverted 'A' shaped, 0.53-1.52× 0.53-0.92 mm, vagina distinct, uterus glandular, vitelline follicles ovoid, arranged in 2 rows, 0.05-0.17× 0.03-0.15 mm, excretory pore terminal, eggs smooth, operculate, 40-60×20-30 µm and recovered from Clarias batrachus L.; Guwahati (Asam) Shella (Meghalaya), India.

The present tapeworms differ from *Lytocestus* assamensis Tandon et.a*L.* 2005 in having body Very Long, slightly tapering anteriorly, 25.54- 50.82 × 1.32-4.62 mm, scolex undifferentiated, Smooth and unarmed, neck 4.62-15.18 mm, testes266 – 565 in numbers, ovoid, 0.10-0.53×0.06-0.15 mm, cirrus sac Prominent, ovary bilobed, bent inwards in shape of inverted 'A', 1.52-5.08× 0.79-2.62 mm, vagina distinct, joining terminal end of uterus, open unitedly to exterior at utero vaginal pore immediately posterior to male opening, uterus glandular, vitelline follicles corticle, 0.06-0.14× 0.04-0.08 mm, excretory pore at terminal hind end, eggs smooth, operculate, 30-50×20-30µm and collected from Clarias batrachus L.; Guwahati (Asam) Shella (Meghalaya), India.

The new form *Lytocestus elongatus* Sp. Nov. differs from *L.* heteropneustii Tandon et.a*L.* 2005 in possessing elongate, Flat body, 9.57-19.14 × 1.06-1.45 mm in size, Smooth, Unarmed, undifferentiated,scolex with conical base, neck 1.98-5.41 mm, testes 235 – 340 in numbers, ovoid, 0.11-0.19×0.03-0.08 mm, cirrus sac Prominent, ovary Bilobed, Follicular, 'H' Shaped, 0.99-3.10× 0.92-1.32 mm, vagina distinct, joining terminal end of uterus, open unitedly to exterior at utero vaginal pore, receptaculum seminis absent, uterus glandular, Vitelline follicles ovoid or spherical, corticle in disposition, 0.07-0.13× 0.03-0.08 mm, excretory pore terminal, eggs smooth, ovoid, operculate, 30-40×20-50µm and collected from Heteropneustes fossilis Bloch.; Guwahati (Asam) Shella (Meghalaya), India.

It differs from L.mujumdari Poonam, 2007 in having body thin, slender, elongated, flatten, 6.673×0.306 mm, scolex undifferentiated, oblong, 0.47×0.228mm, neck long, testicular follicles lie in medulary zone, cirrus sac 0.268×0.189mm, ovary cortical, 'H' shaped, uterus glandular, excretory pore terminal, egg smooth, operculated and presence of vitelline follicles.

The present worm under discussion differs from L.bokaronensis Poonam, 2007 in having body long, 7.154×0.603mm, scolex undifferentiated, smooth, unarmed, testicular follicles 0.058×0.043mm, ovary bilobed, bent, inverted 'A' shaped, 0.608-0.675mm, cirrus sac prominent, vagina distinct, which joins with the terminal end of uterus to open to exterior through uterovaginal pore, immediately posterior to male opening, receptaculum seminis absent, uterus glandular, excretory bladder at posterior end with the terminal pore, Vielline follicles present and eggs smooth, operculate, 0.04×0.02 mm.

The present parasite *L. elongatus* Sp.Nov. differs from *L.* paithanesis Shelke V.P., 2007 in having body long, thick, head long, elongated,3.106-3.427×0.267-1.285mm, neck short,0.624-0.714×1.856-1.963mm, testes oval, 1550-1575 in numbers, unevenly distributed, 0.035-0.125×0.035-0.107mm cirrus pouch medium, cylindrical, 0.446-0.535×0.053-0.160mm, cirrus thin,curved, 0.535×0.017mm, ovary big, distinctly bilobed, butterfly shaped,0.107-0.677×1.107mm, ovarian lobes triangular, ovarian follicle 47-75 in

numbers, vagina thin, 0.125×0.089-0.107mm, uterus coiled, loop shaped,11.816×0.071-0.267mm and vitellaria granular.

It differs from L.jagtai Tripathi et.al.,2007 in having body elongated, dorsoventrally flattened, scolex smooth unarmed, rounded and stumpy, posterior end of body is blunt and rounded, excreatory pore is terminal, testes numerous, uterus well developed, eggs oval and thick shelled, vitelline follicle oval and collected from Heteropneustes fossilis Bloch in Behar river Reva (M.P.).

The *Lytocestus elongatus* Sp.Nov. differs from *L.* punensis Jadhav *et. al.*, 2008 in having long, blunt head, testes oval, 1400-1500 in numbers, cirrus pouch oval, small, vas deferens short, vagina long, receptaculum seminis distinct, ovary butterfly shaped,uterus saccular and vitellaria granular.

L.*elongatus* Sp.Nov. differs differs from *L.* subhapradhi Jawlikar et.al.,2008 in having body 1.695-2.463× 2.248-2.552mm, head spatulate, narrower than body, neck short, testes 300-310 in numbers, 0.071-0.107mm, cirrus pouch oblong, 0.385 ×0.225mm, cirrus thin, zig-zag, 0.351×0.011mm, vas deferens coiled, 0.454×0.034mm, ovary bilobed, lobes triangular, 0.943-1.124×0.304-0.340mm, vagina thin, coiled, 1.305×0.022mm, Convoluted uterus, 4.374×0.079 mm in size and vitellaria follicular, arranged in 5-7 rows, 0.017mm in size.

The present new L.*elongatus* Sp.Nov. differs from *L.* follicularae Bhure et.al.,2010 in having mature specimens long, tapering at both ends, measures 32(31-33)× 2.5 (1.5-3.5) mm, head long, well marked off from body, 3.5 (3-4) × 2(1-3)mm, testes rounded, 400-500 in number, pre ovarian, placed centrally, evenly distributed, 0.106(0.087-0.126) × 0.152 (0.140-0.165) mm, large cirrus pouch, 0.696 (0.660-0.732) ×0.312(0.196-0.428)mm in size, thin, straight cirrus, 0.642 (0.607-0.678) ×0.035 (0.017-0.053)mm, short vas dererens, 0.142 (0.125-0.160) × 0.044 (0.035-0.053) mm in size, genital pore oval, 0.071(0.053-0.089) ×0.044(0.035-0.053) mm, long, tubular vagina, 2.258(2.107-2.410) × 0.053 (0.035-0.071)mm, receptaculum seminis thin tube, 1.098 (1.071-1.125)×0.071 (0.053-0.089) mm in size, ootype 0.107mm, ovary 'H' shaped, 1.723 (1.589-1.857)× 1.017 (0.964-1.071) mm, saccular uterus, 0.071 ×0.044 mm, eggs non-operculated, oval, 0.071 mm and vitellaria follicular, arranged in 2-3 rows.

The *L. elongatus* Sp.Nov. differs from *L.* osmanabadensis Bhure *et. al.*, 2010 in having mature specimens long, elongated, single segmented, tapering at both ends, measures 33 (32-34)× 2.8 (1.9-3.5) mm, head long, well marked off from body, 2.5 (2.0-3.0)×1.5 (1.0-2.0)mm, testes large, oval to rounded, having testicular follicles, 300-350 in number, pre-ovarian, scattered in central medulla, 0.132 (0.082-0.162)×0.179 (0.145-0.213) mm, cirrus pouch 0.660 ×0.312 mm, cirrus straight, 0.651 × 0.035 mm, vas deferens 0.169 × 0.053 mm, small and oval genital pore, 0.098 (0.071 -0.125)× 0.053 (0.035-0.071)mm in size, vagina long, thin tubular, 2.410(2.375-2.446) × 0.044(0.035-0.053) mm in size, receptaculum seminis thin tube, 0.928 × 0.062 mm, ootype small, 0.089 mm in size, ovary 2.321× 0.339 mm, uterus saccular, diverticular, 2.616 (2.517-2.714) × 0.687 (-0.357-1.017)mm and eggss non-operculated, oval, 0.071mm.

It differs from L.puranensis Kasar *et. al.*,2010 in having size of worm 17× 3 mm, head long, blunt, conical, 1.704 (1.287- 2.121)×0.712 (0.454-0.969) mm in size, testes small, 1000-1200 in number, scattered in central medulla, 0.143×0.106 mm in length and width, obliquely placed cirrus pouch, 0.250×0.140 mm in length and width, cirrus thin, straight, 0.261× 0.011mm, vas deferens 0.344 × 0.018 mm, genital pore small, oval, 0.034× 0.026 mm in size, vagina long, thin tubular, 4.049 × 0.037 mm in size, absence of receptaculum seminis, ovary butterfly shaped, 0.575 (0.492-0.659)× 0.363 (0.340-0.386) mm, uterus wide, convoluted tube, 1.227 (1.143-1.310) × 0.681 (-0.371-0.992)mm, eggss operculated, oval, 0.037 (0.030-0.045) ×0.011(0.007-0.015) mm and granular vitellaria.

The *Lytocestus elongatus* Sp.Nov. differs from *L.* shindei Surayawanshi *et. al.*, 2010 in having medium head, testes 1580 in numbers, distinctly bilobed ovary with irregular lateral margin, transversely placed cirrus pouch, wide uterus and granular vitellaria arranged in corticular and subcorticular in position.

The new species differs from *Lytocestus* murhari Kaul *et. al.*, 2010 in having bluntly elliptical, elongated head, 0123×0.048 mm in size, medium neck, 0.082×0.10 mm in size, testes 600-650 in numbers, unevenly distributed, 0.06-0.014mm, cirrus pouch large, 0.131×0.034mm, vas deferens short, thin, coiled, 0.008×0.002mm, ovary large, bilobed, each lobe triangular, 0.062-0.069×0.02-0.03mm, ovarian follicles 25-40 in numbers, vagina long, slightly curved, 0.123×0.003mm, uerus wide, convoluted, 0.385×0.008mm, vitellaria granular, thin strip, corticular in position and eggs oval,operculate, 0.29×0.009mm.

It differs from *Lytocestus vyasaei* Pawar and Hiware,2011 in possessing long with thin musculature, 14.6786-15.7143 ×1.6964-2.2857 mm, head large, conical 1.3393-1.875 × 0.4464-1.01785 mm, reproductive organs situated at posterior region of body, testes medium , rounded,1022-1088 in numbers, 0.1071-0.1607 × 0.08929-0.1429 mm, cirrus pouch cylindrical, 0.3036-0.3571 ×0.08929-0.2321 mm, cirrus thin, with strong muscular wall, slightly curved, 0.1786-0.2321 × 0.01429-0.03571 mm, vas deference long, stout, convoluted, 0.500-0.5714 ×0.0125-0.03393 mm, ovary bilobed, butterfly shaped, lobes triangular 1.5179-1.75 ×0.5357-1.0179 mm, vagina long tube, 1.3214-1.4285 × 0.03571-0.07143 mm, ootype big, bean shaped, uterus wide, long, convoluted tube, eggs large, oval, 0.1786-0.02679 ×0.01429-0.01786 mm and Vitellaria follicular, rounded , corticular, 2-3 rows on each lateral side.

The present worm differs from *L.* purnensis Pawar and Hiware, 2011 in having body elongated, flattened, grass blade like, thin,12.1428-14.4642 × 1.0714-2.1429 mm, head large, with bluntly rounded extremity, 1.428-1.785×0.0.714-1.250 mm, neck short, wide, narrow, 0.535-0.804× 0.893-1.071 mm, testes ovoid, 844-859 in number, larger than vitelline follicles, 0.05357-0.08928×0.03571-0.07142 mm, cirrus pouch small, cylindrical, medullary, 0.3214-0.4464×0.0892-0.1428mm, ovary bilobed, 'H' shaped, 1.071-1.3928 ×0.0892-0.3214mm, ovarian lobes large, triangular, vagina long tube, 1.071-101607 ×0.0178-0.357 mm and uterus wide, coiled, loop shaped, convoluted tube, 0.3214-0.357×0.08928-0.1428mm.

The *Lytocestus elongatus* Sp.Nov. differs from *L. gariepinusae* Kadam and Dhole, 2011 in having short, elongated head, 0.500 -0.571× 0.303 - 0.552 mm in size, neck wide, medium, squarish, 0.642- 0.750× 0.642 - 0.893mm, gonads situated in posterior region, testes oval 1375 – 1385 in number, 0.053 - 0.125× 0.035 - 0.107mm,cirrus pouch small, oval, flask shaped, 0.161-0.178 × 0.035 - 0.089 mm, cirrus thin, coiled, 0.178 - 0.195 ×0.017mm, ovary large, butterfly shaped, distinctly bilobed, 0.893 - 1.124×0.053 - 0.464mm, ovarian follicles 40 - 49 in number, vagina thin, long tube, 1.903 - 2.000× 0.017mm, uterus large, loop shaped, 3.872 - 3.427× 0.011 - 1.696 mm, eggs medium, oval, 0.035× 0.017mm and vitellaria granular.

The present worm differs from *L.* khami Jawale and Borde, 2011 in having mature specimens long, elongated, and single segmented, 22.35× 4.02 mm, head long, 2.64 ×1.4 mm, testes medium, round to oval, 1350-1400 in number, 0.14× 0.11mm, cirrus pouch small, elongated, 0.51× 0.29 mm, Ovary bilobed, butterfly shaped, Vagina long, 1.7× 0.03 mm, uterus 4.30 × 1.33 mm in size, eggs non-operculated, 0.13×0.06 mm in size and granular vitellaria arranged in 2-3 rows.

The new species differs from *L.* manjaraensis Solunke *et. al.*, 2012 in having body long, buff coloured, single segmented, head big, cylindrical, slightly curved, 2.692 – 2.760× 0.749-1.067 mm, neck short, 1.272-1.4372× 1.112-1.128 mm, testes 460-470 in number, arranged in single field, unevenly distributed, 0.022-0.090 × 0.022-0.079 mm in size,

cirrus pouch cylindrical, globular, big, 0.236-0.281× 0.034-0.136 mm, ovary large, distinctly bilobed, 1.372× 0.488-0.670, ovarian lobes oval or triangular, uterus long, wide tube, loop shaped, 4.612× 0.045-0.136 mm, uterine pore large, oval and vitellaria granular, thin strips, corticular in position.

It differs from L. alii (minor) Sawarkar,2012 in having body long, cylindrical 4.805×0.674-1.484 mm, head bluntly oval, testes 580-590 in number, pre ovarian, arranged 9-11 rows, ovary bilobed, ovarian follicles 32-39 in numbers, vagina forms spindle-shaped receptaculum seminis, uterus wide, convoluted tube, coiled, uterine pore large, oval, with thick border and vitellaria follicular, oval, sub-corticular in position, arranged in 3-4 rows.

Fig. 1: Microphotograph of *Lytocestus elongatus* Sp.Nov.

The present tapeworm differs from *L. thapari* Sawarkar,2012 which is having body 13-12×0.81-1.9 mm in length and width, testes 480-500 in number, arranged in 8-12 rows, ovarian follicles 30-31 in number, cirrus oblong in shape, obliquely placed, vas-deferens coiled, extends, extends anteriorly and ootype large.

It differs from *L. godavariensis* Pawar and Dandwate, 2013 in having body long, 12.4-24.23×2.1-4.2mm, head long, well marked, 3.116×1.999mm, testes 400-500 in numbers, 0.151×0.103mm, cirrus pouch small, 0.121×0.019mm, cirrus straight, thin, 0.057×0.012mm, vagina long, coiled, 0.084×0.012mm, vas deferens short, thin, 0.055×0.075mm, ovary bilobed, 0.352×0.364mm, each ovarian lobe contain 24-26 ovarian follicles, uterus wide, Convoluted,0.167×0.034mm, eggs operculate, 0.181×0.220mm and vitellaria granular.

The *L. elongatus* Sp.Nov. differs from L.indica Deshmukh et.al.,2015 in having long, well marked head, testes oval to rounded, 1000-1100 in number, placed centrally, evenly distributed, Cirrus pouch large, Cirrus thin, coiled, short and thin vas deferens, small and oval genital pore, Vagina long, tubular and Uterus Saccular, filled with numerous no-operculated eggs.

In view of above differences, the present form stands out as a species distinct from the known species of genus *Lytocestus* Cohn, 1908 and is thereforeconsidered a new species and named as *Lytocestus elongatus* Sp. Nov. due to elongated body.

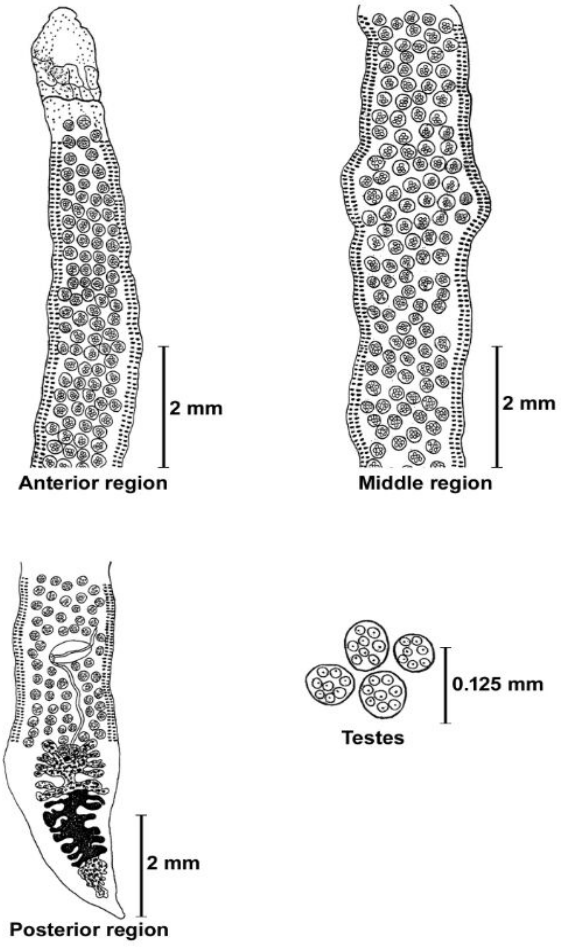

Fig. 2: Camera Lucida diagram of *Lytocestus elongatus* Sp.Nov.

TAXONOMIC SUMMARY

Type Species : *Lytocestus elongatus* Sp.Nov.
Type host : Clarias batrachus (Linneus, 1758)
Habitat (Site) : Intestine
Type locality : Ahmedpur, Dist. Latur, M.S., India.
Period of collection: February, 2012 To January, 2014.
Accession number : PGDZ/YMN/1-05/ February, 2012 to January, 2014
Deposition : Department of Zoology (UG&PG), Yeshwant Mahavidyalaya, Nanded.
Etymology : The present species is named after due to elongated body.

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