Advances in Bioresearch
Adv. Biores., Vol 13 (3) May 2022: 280-287
©2022 Society of Education, India
Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.13.3.280287

Advances in Bioresearch

REVIEW ARTICLE

Biodiversity Checklist of *Lytocestus* Cohn, 1908 (Caryophyllidea: Lytocestidae) species from Different Aquatic Vertebrates

Sushil Kumar Upadhyay* and Babita
Department of Biotechnology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala (Haryana)-133207, India
***Corresponding author's Email:** sushil.upadhyay@mmumullana.org

ABSTRACT
The genus Lytocestus Cohn, 1908 belong to the order Caryophyllidea and member of this order are very interesting group of cestode parasites firstly discovered from a fish host in Hong-Kong. Members of this family have unique morphology, evolutionary status and genetic variability. The worms are comprising dorsoventrally flattened, elongated and anteriorly tapering body, undifferentiated scolex, and inner longitudinal muscles in a ring around broad testes. Testes preuterine, cirrus pouch is strongly muscular, ovary bilobed, lateral lobes outside of inner longitudinal muscles, and uterus looped behind shell gland and closely coiled between ovary and male terminalia. These parasites are reported from fish hosts including, Clarias fuscus, Clarias batrachus, Clarias gariepinus, Clarias magur, Channa striatus, Heteropneusteus fossilis, Mastacembelus armatus, Mormynus caschive, Mystus seenghala, Wallago leerii, etc. from India and abroad. Since then numerous species of Lytocestus were reported from various aquatic vertebrate hosts worldwide. In the present review authors compiled a checklist of 61 species of Lytocestus recovered and described in yesteryears from different aquatic hosts. This review paper showed the immense diversity of Lytocestus and hosts range.
Keywords: *Lytocestus; Parasitic Helminthes, Caryophyllidea, Cestode, Fish host, Tapeworms.*

Received: 08.10.2021 Revised 19. 01.2022 Accepted: 20.02.2022

How to cite this article:
Upadhyay SK, Babita. Biodiversity Checklist of *Lytocestus* Cohn, 1908 (Caryophyllidea: Lytocestidae) species from Different Aquatic Vertebrates. Adv. Biores. Vol 13 [3] 2022 : 280-287

INTRODUCTION

Parasitism is a negative association between two different species, where one organism (parasite), inhabit on or inside the other organism (host) and apposing causing harm as well [1,2]. Thus it is a type of symbiotic relationship in which the smaller one (parasite) utilized the larger one (host) for the purpose of food, shelter, site of reproduction, and to achieve these targets these are adapted and equipped structurally (morphologically and anatomically) and physiologically for this way of life [3-5]. Hence parasites are organism that lives in or on an organism to gets its nourishment for survival at the expense of its host [6,7]. These parasites which can cause disease in their hosts including human beings are primarily categorized as Protozoa, Helminthes and Arthropoda (8-10]. Some of the parasites don't conspicuously affect their hosts but many others grow, reproduce, or assault organ systems to build their hosts sick physically, physiologically and behaviorally, resulting as a symptom parasitic infection [11-14]. The infections (random or aggregated) of these parasites are huge predicament in tropical and subtropical parts worldwide including Africa, Australia; United States and India as well (10,15-18). The parasitic helminthes are triploblastic, multicellular, acoelomate/ pseudocoelomate invertebrates and most commonly called as worms including flatworms (trematodes), tapeworms (cestodes), thorny-headed worms (acanthocephalans), and roundworms (nematodes) [10; 19-21]. The mature cestodes are dorsoventrally flattened, elongated, segmented (chain of proglottids called strobila from 3 to several thousand segments), hermaphroditic endoparasites of gut, but the developmental forms (larvae) may be cystic in the extra-intestinal tissues [22-25]. These parasites have exterior delimitation of the cuticle or tegument, prominent anterior framework scolex, or bothria (false suckers), rostellum and internally lacking alimentary canal [26,27]. The new proglottids after the neck region called immature proglottids, however those more posterior are mature possessing well developed male and female reproductive

structures. On contrary the few terminal proglottids or segments are known as gravid which comprising egg-filled uterus which shed into the intestine of host by apolysis phenomenon [24,27]. Thus cestodes are immensely diversified collection of exclusively parasitic platyhelminthes with significant medical and veterinary importance [28-30]. However, substantial gaps subsist in knowledge of the species diversity, host specificity, life cycles, and geographical allocation of many of them [31]. Principally the authors in the present review tried to explore the diversity of caryophyllidean cestodes (monozoic means single set of genital organs) more specially *Lytocestus* Cohn, 1908 [32] and their stochastic assemblage from different aquatic vertebrates.

TAXONOMIC STATUS

Phylum: Platyhelminthes
Class: Cestoda Southwell, 1930 [33]
Subclass: Eucestoda Yamaguti, 1934 [34]
Order: Caryophyllidea van Beneden, 1858 [35]
Family: Lytocestidae Wardle and McLeod, 1952 [36] Syn. Lytocestinae Hunter, 1927 [37]
Genus: *Lytocestus* Cohn, 1908 [32]
[Synonym = *Lucknowia* Gupta, 1961 [38]; Niyogi et al., 1982 [39]]

BIODIVERSITY OF *LYTOCESTUS*

The genus *Lytocestus* was recovered and established by Cohn, 1908 [32] with *L. adhaerens* from bony fish *Clarias fuscus* in Hong-Kong. The generic diagnosis of worm was performed on the basis of elongated, flat body without segmentation and bluntly tapering anterior extremity with undifferentiated smooth, unarmed scolex followed by short neck [40]. The body proper was divisible cortex and medulla by two layers of longitudinal muscles. The cortical part comprising dispersed vitellaria, however the reproductive structures like testes and ovary in the medullary zone ascertains the inclusion of the worms in the family Lytocestidae [40]. Further, the postovarian yolk glands absentia, thick coating of accompanying cells around uterine coil and ejaculatory duct enclosed within a compact parenchymatous bulb, confirmed the recovered forms as to the genus *Lytocestus* Cohn, 1908 [32]. At the outset, Woodland established the type species of this genus as *Lytocestus adhaerens* [41] from *Clarias fuscus* and four more species including *L. chalmersius* [42], and *L. cunningtoni* [43], *L. indicus* [44-46], Syn. *Caryophyllaeces indicus* from *C. batrachus* in India as well as *L. filiformes* [47] from *Mormyrus caschive* in Sudan. Later on Wardle and Mcleod [36], Yamaguti [40], Gupta [38], Murhar [48] in respect to Hunter's classification system [37] explored immense microfauna or infracommunity and proposed the best possible rectified classificatory system as well. There after *L. javanicus* [49], *L. alestesi* [50], *L. birmanicus* [50] recovered but later on the *L. alestesi* [50] was confirmed as Syn. *L. filiformis* [47]. Murhar [48] reported the *L. moghei*, Ramadevi [51] described *L. longicollis* from *C. batrachus*; however Singh [52] published *L. fossilis* from *Heteropneusteus fossilis* in India. Shindhe and Deshmukh [53] redescribed two *Lytocestus* species from Marathwada region, however during 1988 in Marathwada region of India. Shinde and Phad [54] started to study the cestode fauna in *C. batrachus* and recovered *L. marathwadaensis.* Afterward Jadhav and Gavhane [55] find out two species *L. alii* [56-58] and *L. clariasae*, Kadam et al. [59] investigated *L. naldurgensis,* Kalse and Shinde [60] reported *L. chalisgaonesis,* Shinde and Borde [61] documented *L. kopardaensis* from the same cat fish. However, Kolpuke [62] recovered and published *L. teranaensis* from *Wallago attu* from the same region in the same year.

Subsequently *L. govindae* [63], *L. batrachusae* [64] and *L. clariasae* [65], *L. teranaensis* and *L. shindae* [66], *L. nagapurensis* [67] recovered, documented and reported from cat fish *C. batrachus* as well. Meanwhile, Shomendra et al. [68] reported *L. bishnupurensis* from *Mystus seenghala* which critically reevaluated by Singh et al. [69]. Tandon et al. [70] reported four new species including *L. attenuateus, L. assamensis* and *L. clariae* from *C. batrachus* and *L. heteropneustii* Syn. *Lucknowia fossilisi* [71] from *H. fossilis* that was later redescribed by Sahay et al. [72] as valid species under the genus *Lytocestus*. Two new species *L. bokaroensis* and *L. mujumdari* [73] and *L. paithanensis* [74] were reported from *C. batrachus*. However, Tripathi et al. [75] recovered *L. jagtai* from *H. fossilis* in the same year which further described in detail by Sahay and Ekka [76]. In the next consecutive year Jawalikar et al. [77], Jadhav et al. [78], Kaul et al. [79], Bhure et al. [80], and Surayawanshi et al. [81] isolated *L. subhapradhi*, *L. punensis, L. murhari*, *L. osmanabadensis* and *L. follicularae,* and *L. shindei* from *C. batrachus* respectively. Further, Jawale and Borde [82], Pawar and Hiware [83] successfully reported new species *i.e. L. khami*, *L. purnensis* and *L. vyasaei* from the same cat fish respectively, while, Kadam and Dhole [84] described *L. gariepinusae* from *Clarias gariepinus* of Marathwada region in the same year. Sawarkar and Kale [85], Solunke et al. [86] added *L. thapari* and *L. manjaraensis* from *C. batrachus* respectively; however, Nimbalkar et al. [87]

contributed *L. rekhaensis* from *H. fossilis* that was further critically studied by Sahay and Khalkho [88]. Deshmukh et al. [89], Pawar and Dandwate [90], Kale [91], Kankale [92] recovered and reported *L. indica, L. godavariensis, L. paithanensis, L. ambe* from the *C. batrachus* respectively. The further critical studies of many of these species were carried out by Sahay et al. [93,94]. Meanwhile a new species *L. mastacembellusi* [95] was reported from *Mastacembelus armatus* that further redescribed by Sahay et al. [58]. Barshe et al. [96], Dandawate [97], Patil [98] reported *L. elongates, L. mulaansis*, *L. bharatae* from *C. batrachus* respectively and further thoroughly studied by Sahay et al. [93,94]. Recently, Bhavsar et al. [99] Narayan and Srivastav [100] reported *L. sahayi* from *C. batrachus* and *L. chhaviensis* from *H. fossils* respectively.

Table 1: Checklist of caryophyllidean parasites *Lytocestus* Cohn, 1908 from different aquatic vertebrates hosts.

S.No.	Parasites sp.	Host	Place	References
1.	*Lytocestus adhaerens*	*Clarias fuscus*	Hong Kong	[32,41]
2.	*L. filiformes*	*Mormyrus caschive*	Sudan	[41,47]
3.	*L. chalmersius*	*Clarius batrachus*	India	[42]
4.	*L. cunningtoni*	*Clarius batrachus*	India	[43]
5.	*L. indicus*	*Clarius magur, Channa striatus*	India	[44-46,101]
6.	*L. javanicus*	*Clarius batrachus*	Java	[49,102]
7.	*L. follicularae*	*Clarius batrachus*	Java	[49]
8.	*L. birmanicus*	*Clarius batrachus*	Burma and Sudan	[50]
9.	*L. alestesi*	*Clarius batrachus*	Burma and Sudan	[50,103]
10.	*L. fossilisi*	*Heteropneustus fossilis*	India	[38,104]
11.	*L. moghei*	*Clarius batrachus*	India	[48,105]
12.	*L. parvulus*	*Wallago leerii*	Malaysia	[106]
13.	*L. lativitellsrium*	*Clarias batrachus*	Malaysia	[107]
14.	*L. longicollis*	*Clarias batrachus*	India	[51]
15.	*L. puylaerti*	*Fresh water fish*	Africa	[16]
16.	*L. fossilis*	*Heteropneustus fossilis*	Nepal	[52,75]
17.	*L. marcusenii*	*Marcusenius*	Chadbad	[108]
18.	*L. marathwadaensis*	*Clarias batrachus*	India	[54]
19.	*L. alii*	*Clarias batrachus*	India	[55,56]
20.	*L. clariasae*	*Clarias batrachus*	India	[55,65]
21.	*L. naldurgensis*	*Clarias batrachus*	India	[59]
22.	*L. chalisgaonesis*	*Clarias batrachus*	India	[60]
23.	*L. teranaensis*	*Wallago attu*	India	[62,66]
24.	*L. kopardaensis*	*Clarias batrachus*	India	[61]
25.	*L. batrachusae*	*Clarias batrachus*	India	[64]
26.	*L. caryophyllid*	*Clarias batrachus*	India	[63]
27.	*L. govindae*	*Clarias batrachus*	India	[63]
28.	*L. bishnupurensis*	*Mystus seenghala*	India	[68,69]
29.	*L. cohn*	*Clarius batrachus*	India	[66]
30.	*L. shindei*	*Clarias batrachus*	India	[66,81]
31.	*L. nagapurensis.*	*Clarias batrachus*	India	[67]
32.	*L. heteropneustii*	*Heteropneustes fossilis*	India	[70]
33.	*L. clariae*	*Clarias batrachus*	India	[70]
34.	*L. attenuateus*	*Clarias batrachus*	India	[70]
35.	*L. assamensis*	*Clarias batrachus*	India	[70]
36.	*L. majumdari*	*Clarias batrachus*	India	[73]
37.	*L. bokaronensis*	*Clarias batrachus*	India	[73]
38.	*L. paithanensis*	*Clarias batrachus*	India	[57,74,91]
39.	*L. jagtai*	*Heteropneustes fossilis*	India	[75]
40.	*L. subhapradhi*	*Clarias batrachus*	India	[77]
41.	*L. punensis*	*Clarias batrachus*	India	[78]
42.	*L. follicularіae*	*Clarias batrachus*	India	[80]
43.	*L. osmanabadensis*	*Clarias batrachus*	India	[80]

44.	*L. murhari*	*Clarias batrachus*	India	[79]
45.	*L. gariepinusae*	*Clarias gariepinus*	India	[84]
46.	*L. vyasaei*	*Clarias batrachus*	India	[83]
47.	*L. purnensis*	*Clarias batrachus*	India	[83]
48.	*L. khami*	*Clarias batrachus*	India	[82]
49.	*L. manjaraensis*	*Clarias batrachus*	India	[86]
50.	*L. thapari*	*Clarias batrachus*	India	[56]
51.	*L. rekhaensis*	*Heteropneutes fossilis*	India	[87]
52.	*L. godavariensis*	*Clarias batrachus*	India	[90]
53.	*L. indica*	*Clarias batrachus*	India	[89,94]
54.	*L. mastacembellusi*	*Mastacembelus armatus*	India	[95]
55.	*L. ambe*	*Clarias batrachus*	India	[92]
56.	*L. mulaansis*	*Clarias batrachus*	India	[97,109]
57.	*L. bharatae*	*Clarias batrachus*	India	[98]
58.	*L. elongates*	*Clarius batrachus*	India	[96]
59.	*L. sahayi*	*Clarias batrachus*	India	[99]
60.	*L. chhaviensis*	*Heteropeustes fossils*	India	[100]
61.	*L. punensis*	*Clarias batrachus*	India	[110]

CONCLUSIONS

Parasitism is a symbiotic association between two organism in which the smaller one (parasite) utilized the larger one (host) for the purpose of food, shelter, site of reproduction. For achieving the key objectives, these parasites are adapted and equipped structurally (morphologically and anatomically) and physiologically. Among the group of parasites; cestodes are greatly diversified collection of exclusively parasitic platyhelminthes with significant economic, medical and veterinary importance. Total 61 species of *Lytocestus* Cohn, 1908 (Caryophyllidea: Lytocestidae) presented in the current manuscript from different vertebrate hosts including 11 species recovered from other countries, however, the rest 50 belonging to India. Therefore, this compilation of host biased occurrence of *Lytocestus* with immense diversity will be an excellent venture from where any new researcher of the Parasitology can obtain population diversity information of *Lytocestus* species.

ACKNOWLEDGEMENT

Authors are sincerely grateful to the Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala (Haryana), India for invariable prop up during experimentation and assemblage of findings.

CONFLICT OF INTEREST

The authors claim no conflicts of interest because none financial support was received from any government, non-government agency or organization to conduct this research work.

REFERENCES

1. Malhotra A, Jaiswal N, Upadhyay SK, Kumar S, Malhotra SK (2009). Parasite stress response in zoonoses of *Cephalogonimus* sp. Indian J Helminthol (NS) 27:73-80.
2. Babita, Panwar P, Upadhyay SK (2019). A review on ecosegregation and parasitocoenosis of helminthes: Perspective to health and sustainability. Bull Pure Appl Sci Zool 38A (1):40-51. https://doi.org/10.5958/2320-3188.2019.00005.6.
3. Rani K, Upadhyay SK (2019). An introduction of monogenean parasites of fishes: Taxonomy and parasitocoenosis. In: Parasitology Taxonomy and Bioecology (ed. Upadhyay, Sushil K.). Write and Print Publ, New Delhi pp:84-99.
4. Upadhyay SK, Babita, Panwar P, Kumar S, Nanware, SS (2019a). Parasite-host interactions: A negative symbiotic association between organisms perspective to health and sustainability. In: Parasitology Taxonomy and Bioecology (ed. Upadhyay, Sushil K.). Write and Print Publ, New Delhi pp:164-183.
5. Upadhyay SK, Babita, Panwar P, Singh M, Singh R (2019b). Linking of DNA sequences and molecular heterogeniety with phylogeny for morphotaxonomic validation of parasites: A modern reliable technique in taxonomy. In: Parasitology Taxonomy and Bioecology (ed. Upadhyay, Sushil K.). Write and Print Publ, New Delhi pp:134-154.
6. Upadhyay SK, Jaiswal N, Malhotra A, Malhotra SK (2013a). Ecological morphotaxometry of trematodes of garfish (Teleostomi: Belonidae) from Gangetic riverine ecosystem in India. I. Morphology and taxometric assessment of by *Cephalogonimus yamunii* n.sp. J Parasit Dis 37(2):218-224.

7. Upadhyay SK, Jaiswal N, Malhotra A, Malhotra SK (2013b). Ecological morphotaxometry of trematodes of garfish (Teleostomi: Belonidae) from Gangetic riverine ecosystem in India. II. Correlation of seasonality and host biology with distribution pattern of *Cephalogonimus yamunii* n.sp. J Parasit Dis 37(2):211-217.
8. Upadhyay SK, Jaiswal N, Malhotra A, Malhotra SK (2009). An aspidoderid round worm *Pseudaspidodera cordinae* n.sp. from rodents at Allahabad. Indian J Helminthol (NS) 27:89-94.
9. Kumar S, Jaiswal N, Malhotra A, Upadhyay SK, Capoor VN, Malhotra SK (2011). Application of numerical taxonomy for morphological and taxometric substantiation of cystidicolid nematodes, *Ascarophis alatae* n.sp. from Indian eels. Proc Zool Soc India 1:45-50.
10. Upadhyay SK (2012). Transmission dynamics and environmental influence on food borne parasitic helminthes of the Gangetic plains and central west coast of India. Unpubl D.Phil Thesis Univ Allahabad pp:1-400.
11. Jaiswal N, Upadhyay SK, Malhotra A, Malhotra SK (2013). Multifactorial etiology of infections by larvae of *Eustrongylides tubifex* (Nematoda: Dioctophymidae) in silver whiting of the Central West Coast of India at Goa. Asian J Biol Sci 6(1):21-39.
12. Jaiswal N, Upadhyay SK, Malhotra A, Blend CK, Dronen NO, Malhotra SK (2014a). A new species of *Neolebouria* Gibson, 1976 (Opecoelidae: Plagioporinae) from the whitecheek monocle bream, *Scolopsis vosmeri* (Perciformes: Nemipteridae), from the Panjim coast at Goa, with a checklist of parasites previously reported from this fish. Zootaxa 3802(1):098-108.
13. Upadhyay SK (2017a). Histopathological and distribution aspects of natural enoplid infections in hepatic tissue of wild rat, *Rattus rattus* in Allahabad. Indian J Helminthol (NS) 36&37:51-55.
14. Upadhyay SK (2020a). Autogenicity and precocious development of *Sturdynema multiembryonata* in *Xenentodon cancila* (Osteichthyes: Belonidae) from the Gangetic ecosystem. Bull. Pure App Sci Zool 39A(1):36-45.
15. Johnston TH, Mawson PM (1940). Some nematodes parasitic in Australia freshwater fish. Trans Royal Soc Australia 64:340-352.
16. Khalil LF (1973). Some helminth parasites from African freshwater fishes with the description of two new species. Rev Zool Bot Africains 87(4):795-807.
17. Khalil LF, Jones A, Bray RA (1994). Keys to the cestode parasites of vertebrates. CAB Int Pub UK 751p.
18. Upadhyay SK (2017b). Morphotaxometry and molecular heterogeneity of *Sturdynema multiembryonata* gen. et sp.n. (Spiruroidea: Gnathostomatinae) of fresh water garfish, *Xenentodon cancilla* from the Gangetic riverine ecosystem in northern India with a revised key to genera of Gnathostomatinae. Species 18(58):1-13.
19. Jaiswal N, Upadhyay SK, Malhotra A, Malhotra SK (2014b). Ecological morphotaxometry of trematodes of garfish (Teleostomi: Belonidae) from Gangetic riverine ecosystem in India. III. Principal Component Analysis for hydrobiological correlates to dynamics of infections by *Cephalogonimus yamunii* (Upadhyay et al., 2012). J Parasit Dis 38(2):153-162.
20. Upadhyay SK, Nanware SS (2020). Parasitoses and histological consequences of *Trichuris trichiura* (Nematoda: Enoplida) in rodents, *Rattus rattus* (Mammalia: Rodentia). Asian J Biol Life Sci 9(1):74-78.
21. Upadhyay SK (2020b). Parasitology: Taxonomy and bioecology. Write and Print Publ, New Delhi pp 1–209.
22. Luhe M (2004). Cestoden. In Die Susswasser Fauna Deutsch lands Hefl 28 (Ed. A. Brauer). Gustav Fisher Jana 153p.
23. Schmidt GD (1970). How to know the tapeworm, WM. *C.* Brown Com Pub Colorado pp:2-266.
24. Ahmed ATA, Sanaullah M (1976). Organal and percentage distribution of some metazoan parasites in *Heteroneustes fossilis* (Bloch) and *Clarias batrachus* (L.). Asian Soc Bangladesh (Sci) 2:7-15.
25. Agarwal SM (1985). Caryophayllaeids and Caryophyllidiasis in India. Indian Rev Life Sci 5:139-161.
26. Ahmed ATA, Sanaullah M (1977). Observation on the incidence and intensity of infestation of some helminthes in different length groups of *Heteropneustes fossilis* (Bloch) and *Clarias batrachus* (L.). Dacca Univ Stud (Sci) 25:91-98.
27. Ahmed ATA, Mustafa G, Roy P (1985). Organal distribution of some Caryophyllid cestode parasites and their seasonal fluctuation of infestation in the gut of two freshwater catfishes. Bangladesh Agri 10:59-63.
28. Chandra KJ, Islam KZ, Wootten R (1997). Some aspects of association and development of *Lytocestus indicus* Moghe in catfish *Clarias batrachus* (Lin.). Bangladesh Fish Res 1 (2):31-38.
29. Roberts LS, Janovy JR (2005). Foundations of parasitology. McGraw Hill Comp Inc Boston Massachussetts 702p.
30. Olson PD, Scholz T, Poddubnaya LG, Littlewood DTJ. (2008). On the derived position of Archigetes and the early evolution of the tapeworms (Platyhelminthes: Cestoda). J Parasitol 94:898–904.
31. Ash A, Scholz T, Oros M, Kar PK (2011). Tapeworms (Cestoda: Caryophyllidea), parasites of *Clarias batrachus* (Pisces: Siluriformes) in the Indomalayan region. J Parasitol 97(3):435-59.
32. Cohn (1908). Die Anotomiaeine nanen Fistodes control. Bl. Bankt. Parasitenki, 46: 134-139. Riv Di Parasitol 8 (1):19-22.
33. Southwell T (1930). Cestoda, Vol. I. *In: The fauna of British India*. Ceylon and Burma. Taylor and Francis 262p.
34. Yamaguti S (1934). Studies on the helminth fauna of Japan. IV. Cestodes of fishes. Jpn J Zool 6:1-112.
35. Von Beneden (1858). In: Cestoda, vol. I. In: The fauna of British India (ed. T. Southwell). Ceylon and Burma. Taylor and Francis 186p.
36. Wardle RA, McLeod JA (1952). The Zoology of tapeworms. University of Minnesota Press, Minneapolis, 780p.
37. Hunter GW (1927). Studies on the caryophyllaeidae of North America. Illin Biol Monogr 11:1-186.
38. Gupta SP (1961). Caryophyllaeids (Cestoda) from fresh water fishes of India. Proc Helminthol Soc Washington 28:38-50.

39. Niyogi A, Gupta AK, Agarwal SM (1982). Morphology of *Lucknowia indica* sp. nov. (Lytocestidae: Caryophyllidea). Proc Indian Acad Parasitol 3:17-22.
40. Yamaguti S (1959). Systema Helminthum. Volume II. The Cestodes of Vetebrates. (Part II) Intersci Publ Inc NY 860p.
41. Woodland WNF (1923). On some remarkable new forms of Caryophyllaeidae from the Anglo- Egyption Sudan and a revision of the families of the Cestodaria. Quart J Microbiol Sci (67):435-472.
42. Woodland WNF (1924).On a new genus of Proteocephalidae from Indian fresh water fishes. Parasitology 16:441-451.
43. Furhmann O, Bear JG (1925). Zoological results of the third Tanganyika Expendition conducted by Dr. W.A. Cunnigton, 1904-1905. Report on the Cestode. Proc Zool Soc London pp:79-100.
44. Moghe MA (1925). *Caryophyllideus indicus* n. sp. (Cestode) from the catfish *Clarius batrachus* (L.). Parasitol 17:232-335.
45. Moghe MA (1931). A supplementary description of *Lytocestus indicus* (Syn. Caryophyllaeus) from India. Parasitol (23):84-87.
46. Mehra HR (1930). On a new species of Caryophyllid of Muller from Kashmir with remarks on *Lytocestus indicus* (Moghe, 1925). Proc 17 Indian Sci Cong 247p.
47. Woodland WLN (1926). On the genera and possible affinities of the Caryophyllaeidae: A reply to Dr. Furhrmann O. and Baer JG. Proc Zool Soc London pp:49-69.
48. Murhar BM (1963). *Cresentovitus biloculus* gen. sp. A fish cestode (Caryophyllaeidae) from Nagpur, India. Parasit 53:413-418.
49. Bovien P (1926). Caryophyllaeidae from Java. Videnskabelige Meddeleserfra Dansk Naturhistorisk Forening L Kobenhavn 82:157-181.
50. Lynsdale JA (1956). On two new species of *Lytocestus* from Burma and Sudan respectively. J Helminthol 30(2&3):87-96.
51. Ramadevi P (1973). *Lytocestus longicollis* sp. nov. (Cestoda: Caryophylliaeda) from cat fish, *Clarias batrachus* in India. J Helminthol 47:415-420.
52. Singh SS (1975). On *Lytocestus fossilis* n. sp. (Cestoda: Lytocestidae) from *Heteropneustus fossilis* from Nepal. In Dr. B.S. Chauhan Commemoration Volume, 1975. (eds. Tiwari KK and Srivastava CB) Orissa, India. Zool Soc India pp:79-82.
53. Shinde GB, Deshmukh RA (1980). Redescription of two species of the genus *Lytocestus* Cohn, 1908 (Cestoda: Caryophyllidea) from fresh water fish. Rev Parasitol XLI (2):209-214.
54. Shinde GB, Phad AN (1988). On a new cestode *Lytocestus marathwadensis* from fresh water fish. Riv Parasitol 47(2):295-298.
55. Jadhav BV, Ghavane AV (1991). Two new cestode from Caryophylleidae at Aurangabad. Ind J Inv Zoo Aqu Biol 3(1):28-31.
56. Sawarkar BW (2012). Record of new tapeworm *Lytocestus alii* n. sp. from freshwater fish *Clarias batrachus* (Bleeker, 1862) at Amravati, Maharashtra, India. J Bio Life Sci 3(1):281-287.
57. Sahay U, Khalkho APV, Ekka P, Mandal D (2019a). The existence of *Lytocestus paithanensis* Kale, 2017 is questionable- a critical study. Trends Fisher Res 8(2):62-68.
58. Sahay U, Khalkho APV, Singh RR, Mandal D (2019b). Status of *Lytocestus mastacembellusi* (Caryophyllidea: Lytocestidae) Pardedhi, 2016- a critical study. Asian J Agri Life Sci 4(10):13-21.
59. Kadam MN, Hiware CJ, Jadhav BV (1998). On a new Caryophyllid cestode of genus *Lytocestus* Cohn, 1908 from *Clarias batrachus*. Dr Bhimrao Ambedkar Marathwada Univ Aurangabad J Sc. 29(6):143-148.
60. Kalse AT, Shinde GB (1999). *Lytocestus chalisgaonesis* n. sp. (Cestoida: Caryphyllidea) from the catfish *Clarias batrachus* at Chalisgaon, M.S. India. Riv Di Parasitol 16(60)N-1:39-42.
61. Shinde GB, Borde S (1999). On *Lytocestus kopardaensis* n. sp. cestode Lytocestidae Hunter from a fish in Maharashtra state, India. Uttar Pradesh J Zool 19(3):211-213.
62. Kolpuke (1999). On a new species of the genus *Lytocestus* Cohn, 1908 (Cestode Caryphyllidea) from *Wallago attu* from Terna river at Aurangabad, India. Uttar Pradesh J Zool 19(1):93-95.
63. Patil DN, Jadhav BV (2002). On a new caryophyllid cestode of the genus *Lytocestus* Cohn, 1908, from *Clarias batrachus*. Indian J Helminthol (NS) 20:45-48.
64. Pawar SB, Shinde GB (2002). A new species *Lytocestus batrachusae* n. sp. (Cotyloda- Lytocestidae) from *Clarias batrachus* at Aurangabad, India. Riv Di Parasitol 19:153-156.
65. Shinde GB, Pawar SB (2002). A new species *Lytocestus clarisae* n. sp. Riv Parasitol XIX (LXIII)N_2:157-160.
66. Khadap RM, Jadhav BV, Suryavanshi NV (2004). A new species of the genus *Lytocestus* (Cohn, 1908), from *Clarias batrachus* at Aurangabad. Nat J Life Sci 1(2):413-416.
67. Lakhe AD, Pawar SB, Shinde GB, Patil AS (2004). A new cestode *Lytocestus nagapurensis* n. sp. (Cotyloda-Lytocestidae). Riv Parasitol 11:95-98.
68. Shomendra M, Jha AN, Kumar P (2003). A new cestode *Lytocestus bishnupurensis* from a fresh water fish *Mystus seenghala* (Sykes). J Freshwater Biol 15(1-4):43-45
69. Singh RR, Sahay U, Sadaf F (2018). On the synonymy of *Lytocestus bishnupurensis* Shomendra et al. (2003) with *L. indica* Moghe (1925). J Exp Zool 21(2):893-896.
70. Tandon V, Chakravarty R, Das B (2005). Four new species of the genus *Lytocestus* (Caryophyllidea: Lytocestidae) from edible catfishes in Assam and Meghalaya, India. J Parasit Dis 29(2):131-142.

71. Ash A, Scholz T, Oros M, Levron C, Kar PK (2012). Cestode (Caryophyllidea) of the stinging catfish *Heteropneustes fossilis* (Siluriformis: Heteropneuestidae) from Asia. J Parasitol 97(5):899-907.
72. Sahay U, Mandal D, Saxena N, Singh RR (2017). On the validity of *Lytocestus heteropneustii* (cestoda) Tandon, Chakravarty and Das, 2005- a critical review. Biospectra 12(2):115-120.
73. Poonam (2007). On a new species of the genus *Lytocestus* (Caryophyllidea- Lytocestidae) from *Clarias batrachus*. Proc Zool Soc India 6(1):77-81.
74. Shelke VP (2007). *Lytocestus paithanensis* n. sp. from *Clarias batrachus*. Nat J Life Sci 4(3):151-152.
75. Tripathi NP, Singh SP, Mishra AK (2007). A new species of the genus *Lytocestus* (Cestoda: Lytocestiodae) from *Heteropneustes fossilis* at Rewa (M.P.). Natl J Life Sci 4(3):111-114.
76. Sahay U, Ekka P (2019). On the status of *Lytocestus jagtai* (Caryophyllidea: Lytocestidae) Tripathi Singh & Mishra 2007- a critical study. Trends Fisher Res 8(2):78-85.
77. Jawlikar JD, Pawar SB, Shinde GB (2008). A new species *Lytocestus subhapradhi* n. sp. (Eucestoda: Lytocestidae) from *Clarias batrachus*. Uttar Pradesh J Zool 28(3):354-369.
78. Jadhav BV, Bhure DB, Padwal N (2008). Caryophyllidean review from catfishes of Maharashtra (India). Flora Fauna 14(1):3-22.
79. Kaul SS, Kalse AT, Suryawanshi RB (2010). *Lytocestus murhari* sp. nov. (Cestode:Caryophyllidea) from the catfish *Clarias batrachus* (L) at Chaalisgaon. Decc Curr Sci 3(1):73-84.
80. Bhure DB, Waghmare SB, Kasar CR, Shaikh KM (2010). Taxonomic observation of the Caryophyllidean tapeworm *Lytocestus* Cohn, 1908 from *Clarias batrachus* (Linneus, 1758). J Ecol Environ Sci 1(1):01-06.
81. Surayawanshi SG, Maske DK, Shinde GB, Bhagwan HK (2010). A new tapeworm *Lytocestus shindei*n. sp. (Cestoda; Lytocestidae) from *Clarias batrachus* at Rahuri Dist. Ahmednagar (M.S.). Life Sci Bull 1:148-150.
82. Jawale S, Borde S (2011). New species of the genus *Lytocestus* (Caryophyllidea: Lytocestidae) from catfish in Aurangabad District (M.S.), India. Int Multidisc Res J 1(8):27-30.
83. Pawar SB, Hiware CJ (2011).Two new species of the genus *Lytocestus* (Caryophyllidea: Lytocestidae) from fresh water catfish *Clarias batrachus* (Linnaeus, 1758). Recent Res Sci Technol 3(12):25-28.
84. Kadam KN, Dhole JS (2011). New tapeworm *Lytocestus gariepinusae*n. sp. from a freshwater fish *Gariepinus* at Makani Dam, Dist. Osmanabad, M.S. India. Recent Res. Sci. Tech. 3(8):19-23.
85. Sawarkar BW, Kale GB (2012). New tapeworm *Lytocestus thapari* n. sp. from a freshwater fish *Clarias batrachus* (Bleeker, 1862) at Aurangabad, Maharashtra, India. UGC Spon Nat Conf Rec Trend Biosci 3(1):281-287.
86. Solunke R, Fadke S, Borde S, Jawale S (2012). New species of the genus *Lytocestus* (Caryophyllidea: Lytocestidae) from catfish in Latur dist. (M.S.), India. Trends Parasitol Res 1(2):25-30.
87. Nimbalkar RK, Deolalikar RV, Muleu SP (2012). Study on a new of *Lytocestus* (Cohn, 1908) from *Heteropnuestus fossilis* (Bloch) at Jaikwadi Dam of Aurangabad district M.S. Life Sci Bull 9(2):239-242.
88. Sahay U, Khalkho APV (2017). A discussion on the status of *Lytocestus rekhaensis* Nimbalkar et. al., 2012. Biospectra 12(1):1-8.
89. Deshmukh VS, Nanware SS, Bhure DB (2015). Biosystematic studies on Caryophyllidean cestoda genus *Lytocestus* from freshwater catfish *Clarias batrachus* with description of new species. Flora Fauna 21(2):179-190.
90. Pawar RG, Dandwate RR (2013). *Lytocestus godavarensis* new spp. From *Clarias batrachus* (Linnus, 1758) at Pravarasangam Dist. Ahmednagar, India. Deccan Curr Sci 9(1):183-187.
91. Kale SS (2017). A new species of cestode *Lytocestus paithanensis* (*Lytocestus* Cohn, 1908) from *Clarias batrachus* at Paithan, M.S. India. Int J Life Sci 5(3):455-458.
92. Kankale NM (2017). A new species of genus *Lytocestus ambe* from a fresh water fish *Clarias batrachus*. Int J Res Biosci Agri Technol 5(2):242-243.
93. Sahay U, Singh RR, Kamal S, Jha A (2018a). On resurrection of certain *Lytocestus* species (Caryophyllidae: Lytocestidea) showing granular vitellaria- A critical study. J Exp Zool 21(2):1271-1276.
94. Sahay U, Singh RR, Saxena N (2018b). On the status of *Lytocestus indica* (Lytocestida: Caryophyllidea) Deshmukh et al. 2015 - A Critical study. Trends Parasitol Res 7(1):1-7.
95. Pardeshi KS (2016). Cestode *Lytocestus mastacembellusi.* Int J Scient Res Edu Res 4(4):5140-5143.
96. Barshe MU, Bhure DB, Nanware SS (2018). Morphotaxonomic Studies on Caryophyllidean Cestode Genus *Lytocestus* Cohn, 1908 from freshwater catfish *Clarias batrachus* with description of new species. Ann Nat Sci 4(3):7-19.
97. Dandawate RR (2018). On *Lytocestus mulaansis* n. sp. from fresh water fish *Clarias batrachus* from Mula Dam at Baragaon, Nandur, Talukrahauri Dist. Ahmadnagar M.S. Aarhat Multidis Int Edu Res J 7(XV):37-43.
98. Patil DP (2018). A new species of the genus *Lytocestus* (Caryophyllida: Lytocestidae) from *Clarias batrachus*. Review Res 7(6):1-4.
99. Bhavsar K, Bhangale A, Kalse A (2020). Reporting a new Cryophyllidean worm from a freshwater *Clarias batrachus*. J Engg Technol Res 7(10):284-292.
100. Narayan A, Srivastav AK (2020). Study of Lytocestus species of the edible catfish *Heteropneustes fossilis* from central India. Pakistan J Parasitol 70:23-27.
101. Reddy L, Benarjee G (2011). Seasonal analysis of cestode parasite, *Lytocestus indicus* in fresh water fish, Channa striatus. Asian J Anim Sci 6(1):39-42.
102. Mackiewicz JS (1972). Caryophyllidea (Cestoidea): A review. Exp Parasitol 31:417-512.
103. Mackiewicz JS (1962). Systematic position of *Caryophyllaeus fuhrmani* Szidat, 1937 and *Lytocestus alestesi* Lynsdale, 1956 (Cestoidea: Caryophyllaeidea). Rev Swiss Zool 69:729-735.

104. Sharma B, Arora N, Singh B, Singh D (2010). Population dynamics of Caryophyllid cestode *Lytocestus Fossilisi* (Gupta 1961) from *Clarias batrachus* in Meerut (U.P.). J Environ Biol Sci 24 (1):99-101.
105. Sharma B, Singh HS (1995). Two new Caryophylleids from *Heteropneustes fossilis* (Bloch), at Meerut. Bull Ass Zool 2(1):11-16.
106. Furtado JI (1963). A new caryphyllaeid cestode, *Lytocestus parvulus* sp. nov. from a Malayan cat fish. Ann Magz Nat His (Ser B) 6: 93-106.
107. Furtado JI, Kimlow J (1973). Incidence of some helminth parasites in the Malaysian catfish *Clarias batrachus* (L.). Verhandlungen Int TheorAngew Limnol 18(3):1674-1685.
108. Troney PM (1978). New parasites records from Chadbad in freely water fields. Bull Inst Franc Afriq Noire Ser A 40(3):528-552.
109. Sahay U, Lal K (2019). A critical study of the taxonomic status of *Lytocestus mulaansis* Dandawate, (2018). J Emerg Technol Inno Res 6(6):457-468.
110. Pendharkar KD (2021). A new species from Genus: *Lytocestus*, Cohn, (1908) (Cestoda: Lytocestidae) at Pune District. J Emerg Technol Innov Res 8(1):129-134.