“Bio-Systematic Studies of Some Cestode Parasites from Fresh Water Carnivorous Fishes of Baramati Region”.

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For
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By

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Certificate

This is to certify that the work entitled "***Bio-Systematic Studies of Some Cestode Parasites from Fresh Water Carnivorous Fishes of Baramati Region***". is a piece of research work done by **Mr. Nale V. B**. Research scholar, Department of Zoology, Deogiri College, Aurangabad 431005 (Maharashtra). Under my supervision and guidance for the degree of Doctor of Philosophy in Zoology at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, (Maharashtra) India, is the record of his own work carried out under my guidance and supervision. The matter embodied in this thesis has not been submitted or published previously in the form of thesis for the award of degree, diploma, associate ship or any other similar title to this or any other university.

(DR. R.K. Nimbalkar)
Research Guide

DECLARATION

I hereby declare that the present work completed in the form of thesis entitled ***"Bio-Systematic Studies of Some Cestode Parasites from Fresh Water Carnivorous Fishes of Baramati Region".*** an original work carried out by me, at the Department of Zoology, Deogiri College, Aurangabad. (Maharashtra) India. has not been submitted or published previously in the form of thesis, diploma, degree, associate ship or any other similar title to this or any other university.

Dr. R.K. Nimbalkar
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The thesis entitled "***Bio-Systematic Studies of Some Cestode Parasites from Fresh Water Carnivourous Fishes of Baramati Region***" deals with the seven species of the Cestode parasites, from 635 fresh water carnivorous fishes of six different fish species from Baramati region of the Pune District.

The thesis comprises of following parts.

1. Abstract
2. Introduction
3. Review of Literature
4. Material and Methods.
5. Result.

Part A- Taxonomy

Part B- Diversity

Part C- Histopathology

Part D- Population dynamics of cestode parasites from fresh water carnivorous fishes at Baramati Tehsil of Pune District.

All specimens of cestode parasite from different carnivorous fishes are collected by the author, for which he is solely responsible. It is illustrated by 13 plates, 3 maps, 4 comparative charts, and 8 tables. A list of references having direct bearing with the work is given in the form of Bibliography at the end of the thesis.

The present study deals with the importance of edible fishes to human being and importance of studies of cestode parasites. The Historical Review devoted with the history of helminth parasites of freshwater fishes throughout the world and its present status.

The Material and Methods deals with the methodology, which are used in the present investigations. The Results and Discussion divided into following sections.

Part A deals with the **taxonomy** of cestode parasites of freshwater fishes from Baramati region of Pune District of Maharashtra state, India. This part is illustrated with the help of seven photo plates, seven figures, four comparative charts and four tables.

Part B deals with the **diversity** of cestode parasites and in this study; we record the data of collected cestode parasites of freshwater fishes from different places of Baramati region of Maharashtra state. After the identification of parasites, the data was process and the diversity of parasites in relations with geographical area was calculated.

Part C deals with the **histopathological Studies** for Host-Parasite Relationship. For this study infected and un-infected intestine was cut in small pieces and fixed in Bouin's fluid. After 48 hours, these tissues were cleared, dehydrated and embedded in paraffin wax. The fixed blocks were cut at 7µ. These slides were stained with Eosin-Haematoxylin double stain.

Part D deals with the study of **Population Dynamics** of cestode parasites in Fishes. The freshwater fishes were collected from fish market, fisherman and from the different places of Baramati region during two annual cycles. The fishes were dissected; the various organs of the viscera such as stomach and intestine are collected; all these was kept in separate Petri dishes containing normal saline water. The organs were teased with niddle and observed thoroughly under the microscope and after the examination of infected and un-infected intestine of the collected fishes, the data was recorded.

After the separating and counting the population of different cestode parasites from different fishes, the parasites were preserved in separate sample bottles. Some of those were used for the taxonomic study.

Calculations was based on the following formulas

1) Incidence of infection- It is the percentage of host infected by particular species of helminth parasites. Observation are recorded annually and calculated by the following formula.

$$\textit{Incidence of Infection (I)} = \frac{\textit{Infected hosts}}{\textit{Total hosts examined}} \times 100$$

2) Intensity of infection- It takes in to account the total number of worms of helminth parasites in infected host population, observation are recorded annually and calculated by following formula.

$$\textit{Intensity of Infection} = \frac{\textit{Number of parasites collected in a sample}}{\textit{Number of infected hosts}}$$

3) Density of infection – It is the measure of concentration of helminth parasites per unit space (single host), observations are recorded annually and calculated by following formula.

$$\textit{Density of Infection} = \frac{\textit{Number of parasites collected in a sample}}{\textit{Total hosts examined}}$$

4) Index of infection – It is calculated with the help of the formula given by Tenoru and Zejde, 1974, observations are recorded annually and calculated by following formula

$$\textit{Index of Infection}(Z) = \frac{\textit{No. of hosts examined}(b) \times \textit{No. of parasite collected } (a)}{(\textit{Total hosts examined})^2 (c)}$$

Where z = Index of infection
a= Number of parasites collected
b = Number of host examined
c = Total number of host examined

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a) ***Transverse Section*** of normal intestine of ***Mastacembelus armatus***

b) ***Transverse Section*** of infected intestine of ***Mastacembelus armatus***

Plate 9

a) ***Transverse Section*** of normal intestine of ***Clarias batrachus***

b) ***Transverse Section*** of infected intestine of ***Clarias batrachus***

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a) ***Transverse Section*** of normal intestine of ***Mystus seenghala***

b) ***Transverse Section*** of infected intestine of ***Mystus seenghala***

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a) ***Transverse Section*** of normal intestine of ***Heteropneustes fossilis***

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Index of Comparisons of cestode species

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Abstract

Baramati is a city and a municipal council in Pune district in the state of Maharashtra, India. Baramati is located at 18°09′N 74°35′E / 18.15°N 74.58°E. It has an average elevation of 538 metres (1765 feet). In the present study we collected seven species of the Cestode parasites, from 635 fresh water carnivorous fishes of six different fish species from Baramati Tehsil of Pune District. The main focus of the study is on the infection causes due to the different tapeworms from this region. All these species are differs from each other in general topography of taxonomy. The parasites belonging to the class Cestoda are highly diversified. The infections are host-specific because the morphological, physiological and ecological factors affect the host specificity. The morphological factors are those which like a parasite with its host at the site of attachment. The ecological factors are such as, distribution and environment of the host, the diet and mode of feeding. These adaptations often provide important role for limiting a parasite to a particular host species, particular season. This type of results indicates the morphological, physiological and ecological factors affecting the distribution and diversity of parasites. *Circumoncobothrium sindhuensis* sp. nov. and *Circumoncobothrium puneensis* collected from the fresh water fish *Mastacembelus armatus. Senga jadhavensis* sp. nov. and *Senga govindae* sp. nov. collected from the fresh water fish *Mastacembelus armatus. Lytocestus niraensis* sp. nov. and *Lytocestus baramatiensis* sp. nov. from the fresh water carnivorous fishes *Heteropneustes fossilis. Silurotaenia karhawagajensis* sp. nov. is recorded from the fresh water fish *Mystus seenghala.*

Introduction

Parasitology is the scientific discipline dealing with the association of two organisms that may result in disease in one of the species. The word ‘parasite’ is derived from Greek; it means ‘situated beside’. Parasite was used in ancient Greece to describe people who ate beside or at tables of others. In spite of this ’social’ background of the word, scientists started to use it in a specific way: parasites are defined as organisms residing on or within another living organism.

Parasites may, therefore, be organisms that are either animals or plants, including a diversity of species such as bacteria, yeasts, fungi, algae, viruses, protozoa, helminths, and arthropods. From a biological point of view, parasitology may be defined as that branch of ecology in which one organism constitutes the living environment of another.

From the medical point of view, parasitism is a specialized, dependent mode of life. Furthermore, parasitism represents a subgroup of symbiosis; there are thousands of species that use the symbiotic way of life and only some of these may cause disease in man, animals, or plants. Further restriction of the domain of parasitology occurred between the 17th and 19th centuries. Parasitology became the science dealing with zooparasites, that is, organisms that belong to the animal kingdom.

The history of parasitology does not give a clear idea of the development of the discipline. Anthony van Leeuwenhoek has been credited with seeing the first protozoan using a simple microscope. Between 1674 and 1716 he described many free-living protozoa and also the first parasitic protozoan, *Eimera stiedai*.

Origin of parasites

Parasites originated from their free-living ancestors; they evolved along with their hosts. Consequently certain groups of parasites are limited to specific groups of hosts. This evolutionary relationship between parasites and their hosts may give valuable information about the relationship between different groups of hosts. For example, the moderately evolved monogenetic trematodes parasitize only fish, while the highly evolved digenetic trematodes are found not only in fish but more commonly in higher vertebrates. Furthermore, the more advanced digenetic trematodes tend to occur in the highest host groups.

Parasites may need more than one group of hosts. A definitive host is the one that harbors the adult stage of a parasite while the larval forms are located in an intermediate host. Some parasites may have more than one intermediate host. A vector is an arthropod, mollusc, or other agent which transmits the parasite from one vertebrate host to another. If parasite development occurs within the vector it is called biological to differentiate it from mechanical vectors, where parasites are simply passively transmitted.

Host-Parasite Relationship

Entry of a specific parasite into a specific host is called infection. The outcome of such a process determines the survival of the parasite and occurrence of untoward effects, such as disease. Parasites invade their hosts through skin or mucous membranes, or by ingestion, or they may be transmitted through the placenta from the mother during birth, or by blood transfusion. On entry into the host, parasites may die or be killed, or may go through the host unchanged; in both cases no major pathological consequences of infection can be detected in the host. Alternatively, parasites may survive within the host or may proceed to develop and multiply. In both circumstances disease may occur. It is, therefore, important to differentiate between infection and disease due to zooparasites.

The host–parasite relationship is a dynamic process; the host uses several natural (innate) and acquired protective mechanisms. The complex structure of zooparasites in contrast to bacteria and viruses poses a significant challenge to host immune responses. Furthermore, not all of these responses are protective. In fact, protective immunity is the exception rather than the rule after a specific parasitic infection. Successful survival of parasites has dictated that several mechanisms of evasion of host protective mechanisms have been developed to ensure their propagation. Parasites evade their host's immune responses either by simple mechanisms such as intracellular location or by more elaborate processes involving changing their antigenic structure or altering the host responses in a way that favors their survival.

Zooparasites constitute a major group of infectious diseases of humans and animals. Their prevalence and intensity have not been drastically changed in most of the developing world. By Keeping this view in mind the economical, nutritional, and medicinal value of freshwater fishes, the author has undertaken the work of taxonomy, diversity, histopathology and population dynamics of some cestode parasites of freshwater fishes from Baramati region of Pune District of Maharashtra. The present investigation was started in July 2007.

The major objectives of the work are

- To make the general survey of freshwater fishes from Baramati region for observations of infection causes due to cestode parasites.
- Taxonomic identification of new cestode parasites.
- Study of host-parasites relationship as well as histopathology.
- Study of the population dynamics of cestode parasites i.e. incidence, intensity, density and index of infections.

Review of Literature

Parasitology has traveled a long way, and covered a wide area to secure its place today as a distinct scientific discipline. What is more, its ever-expanding frontier continues to bear an eloquent testimony to its vibrant viability. During the long process of growth and evolutionary run, however it has accommodated a diverse flow of contributions from many other disciplines, which in their turn have provided nourishment, enrichment and at times embellishment. Parasitology in its literal sense may go to encompass a wide canvas and parasites like many other organisms have made suitable models for valuable studies on what may be called fundamental biology. However it should be admitted, that all the information's thus obtained have not always lent them to be exploited meaningfully to answer the needs and problems of parasitology with its conventional and pragmatic connotation. Sanction of usage demands that we look at the parasites and usage with respect to their involvement and responsibility for diseases and disabilities in man and animals. Parasitic diseases continue to be a cause of major concern to human and animal health in several parts of the globe including India, causing high morbidity, mortality and economic losses. Many worms infection prevail in animal hosts, which in turn, may become natural reservoirs of infection to human host. The nature and extent of worm types that occur in food giving animals like fishes, poultry and livestock mammals depend on, and are influenced by the ambient environmental factors and socio-cultural practices prevailing in a region.

There are some pioneer workers in the world: like Yamaguti (1959), Woodland (1923 and 1924), Southwell (1925), etc. In India various workers are working on various aspect i.e. Taxonomy, histopathology, biochemistry, ecology and population dynamics of helminth parasites since last 50 years. These are Singh (1948 and

1975), Johri (1950 and 1956), Moghe (1925), G.S. Thapar (1938), Rama Devi et al., (1966 and 1973), S.P.Gupta (1961), Shinde et al. (1961-2002), Nama (1974 and 1979), K.C. Pandey (1973), Jadhav et al., (1976-2005), Malhotra et al., (1982), C.J. Hiware (1995-2002), etc. who are working on the various aspects of helminth parasites of different vertebrates.

Helminths are the most common and abundant parasites of fishes. They are occurring as endoparasites usually in the gut and associated organs of fishes. Taxonomic studies on helminth parasites of fishes were initiated in the early 19th century it self by scientists, but they received momentum in the 20th century. To date around 30,000 species of helminth parasites were recorded from freshwater fishes. The present investigation deals with taxonomy of cestode parasites include the genera like *Circumoncobothrium* Shinde, 1968, *Senga* Dollfus, 1934, *Lytocestus* Cohn, 1908, *Silurotaenia* Nybelin, 1942.

Cohn, 1908 erected the genus *Lytocestus* with type species *Lytocestus adharens* in Hong-Kong. Woodland described *Lytocestus filiformes* (1923) and *Lytocestus chalmersius* (1924). Fuhrmann and Baer, 1925 added *Lytocestus cunningtoni*. Moghe, 1925 described *Lytocestus indicus* in India. Lynsdale, 1956 added *Lytocestus biraminicus* and *Lytocestus alestes*. In India, Rama Devi, 1923 added *Lytocestus longicollis*; Singh, 1975 added *Lytocestus fossilis*. Shinde, 1988 added *Lytocestus marathwadensis*; Jadhav et al., 1991 described two species *Lytocestus alii* and *Lytocestus clariasae*. In 1998 Kadam et al., added *Lytocestus naldurgensis*; Kolpuke et al., 1999 added *Lytocestus teranaensis*; Kalse et al., 1999 described *Lytocestus chalisgaonensis*. Jadhav and Patil, 2002 added *Lytocestus govindae*; *Lytocestus batrachusae* is added by Pawar et al., 2002. In 2004 two new species are added in this genus *Lytocestus shindei* by Jadhav et al., and *Lytocestus nagapurensis* by Lakhe et al., In 2005 V. Tandon et al., described *Lytocestus clariae, Lytocestus attenuatus, Lytocestus assamensis* and *Lytocestus heteropneustii.* Recently Poonam, 2007 added *Lytocestus mujumdarii.*

The genus *Senga* was erected by Dollfus in 1934 with its type species *Senga besnardi.* Later on many species are added in this genus. In 1933 Teseng described *Senga ophiocephalina*; Woodland, 1934 added *Senga pcynomera*. Johri, 1956 described *Senga lucknowensis*. In 1964, Furnando and Furtado added *Senga malayana* and *Senga parva.* Later on Furtado et al, 1971 added *Senga pahangesis*. In 1973 Rama Devi P., described *Senga visakhapatnamensis.* In 1980 three species are added i.e. *Senga khami* by Shinde and Deshmukh; *Senga godavarii* by Shinde et al. and *Senga aurangabadensis* by Jadhav et al., Kadam et al., 1981 added *Senga paithanensis*. Majid et al., 1984 described *Senga raoi* and *Senga jagannathae.* In 1991 Jadhav et al., added *Senga gachuae* and *Senga maharashtrii*; Monzer Hasnain, 1992 added *Senga chauhani.* Tat et al., 1997 added *Senga mohekarae*. In 1993 Hiware C.J. described *Senga armatusae*. Patil et al., 2003 added *Senga tappi.* Lastly in 2006 Pande et al., described *Senga ayodhensis* and *Senga baughi*.

Shinde, 1968 erected the genus *Circumoncobothrium* with its type species *Circumoncobothrium ophiocephali*. In 1976 Jadhav et al., described three more species of this genus such as, *Circumoncobothrium aurangabadensis*, *Circumoncobothrium raoii* and *Circumoncobothrium gachuai.* Chincholikar et al., 1976 added *Circumoncobothrium shinde* and *Circumoncobothrium bagariusi.* Shinde added *Circumoncobothrium khami* in 1977, *Circumoncobothrium alii* in 1994; *Circumoncobothrium armatusae* in 1999; *Circumoncobothrium mastacembelusae* in 2002. Jadhav et al., 1990 described *Circumoncobothrium yamagutii*. In 1998 added

Circumoncobothrium vadgoanensis by Patil et al., and *Circumoncobothrium baimii* by Wongsawad et al. Kalse et al., 1999 added *Circumoncobothrium punctatusi*. In 2002 Pawar et al. described *Circumoncobothrium armatusae minor*. Tat et al., 2004 described *Circumoncobothrium manjari* from *Ophiocephalus gachuva*.

The genus *Silurotaenia* was erected by *Nybelin*, 1942 with its type species *Silurotaenia siluri*. Later on Shinde et al., 1975 added *Silurotaenia nybelin*. In 1984 added four species to this genus i. e. *Silurotaenia macroni, Silurotaenia seenghala*, *Silurotaenia barbusi* and *Silurotaenia ticto*. Deshmukh et al., 1989 added *Silurotaenia behairvnathi*. Later on Gavhane et al., 1991 described *Silurotaenia shastri*.

The present work will also helpful to focusing the distribution and diversity of cestode parasites from freshwater fishes from Baramati region of Pune district, Maharashtra state.

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Jammu & Kashmir
Himachal Pradesh
Punjab
Chandigarh
Uttranchal
Haryana
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Uttar Pradesh
Sikkim
Assam
Nagaland
Bihar
Meghalaya
Manipur
Jharkhand
Tripura
Mizoram
Gujarat
Madhya Pradesh
West Bengal
Chattishgarh
Diu
Daman & Diu
Orissa
Maharashtra
BAY OF BENGAL
AREBIAN SEA
Andhra Pradesh
Goa
Karnataka
Narcondam I.
Lakshdweep
Pondicherry
Barren I.
Andaman & Nicobar Islands
Tamilnadu
Kerala
INDIAN OCEAN

Map of India

Map of Maharashtra

Part A
Taxonomy

Eucestoda	Wardle, McLeod and Radinovsky, 1974.
Psuedophyllidea	Carus, 1863.
Ptychobothridae	Luhe, 1902.
Circumoncobothrium	Shinde, 1968.

On a new species of Circumoncobothrium Shinde, 1968 from fresh water catfish *Mastacembelus armatus* (Lacepede, 1800). at Baramati District Pune.

Circumoncobothrium sindhuensis sp. nov. (Plate 1)

Introduction

The genus *Circumoncobothrium* is erected by Shinde G.B., 1968 from the intestine of fresh water fish *Ophiocephalus leuconpunctatus* as a type species *Circumoncobothrium ophiocephali.* Jadhav and Shinde, 1976 added three new species of this genus viz*., Circumoncobothrium aurangabadensis* and *Circumoncobothrium raoii* from *Mastacembelus armatus* and *Circumoncobothrium gachuai* from *Ophiocephalus gauchua.* Chincholikar and Shinde, 1976 described two new species of this genus *Circumoncobothrium shindei* from fresh water fish *Mastacembelus armatus* and *Circumoncobothrium bagariusi* from *Bagarius* species. Shinde, 1977 reported *Circumoncobothrium khami* from *Ophiocephalus striatus*. Jadhav et al., 1990 described *Circumoncobothrium yamaguti* from *Mastacembelus armatus* Shinde et al., 1994 created *Circumoncobothrium alii* from *Mastacembelus armatus.* Patil et al., 1998 added *Circumoncobothrium vadgaonensis* as a new species to this genus from *Mastacembelus armatus*. Wongsawad and Jadhav, 1998 added *Circumoncobothrium baimaii* from *Mastacembelus armatus. Circumoncobothrium punctatusi* is added by Kalse and Shinde, 1999 from *Ophiocephalus punctatus.* Shinde et al., 2002 described *Circumoncobothrium mastacembelusae* as a new species from *Mastacembelus armatus.* Pawar et al., 2002 reported *Circumoncobothrium armatusae* (*minor*) from *Mastacembelus armatus* to this genus. Tat and Jadhav, 2004 reported *Circumoncobothrium manjari* from *Ophiocephalus gachuva*.

Materials and Methods

A total of one Hundred Twenty samples of five fish species collected with hoop net fyke net, two-man seines, and gill net namely, *Wallago attu* (n=30), *Clarias batrachus* (n=30), *Mastacembelus armatus* (n=25), *Heteropneustes fossilis* (n=25), *Tilapia mossambica* (n=10), and were collected in December to January 2008 from the different part of Baramati Tehsil of Pune District Maharashtra State. An attempt was made to collect nearly an equal number of fishes of which most were of the small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Forty Six species of the cestode parasites was collected from the intestine of *Mastacembelus armatus* (Lacepede, 1800).

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996).

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observation

All the cestodes collected from *Mastacembelus armatus* are long, consisting of scolex, immature, mature and gravid proglottids. The scolex is conical in shape, tapering at the apex and broad at the base, distinctly marked off from the strobila and measures 2.036mm (1.211-2.862mm) in length and 0.876mm (0.464-1.289mm) in width. The Scolex is having two fleshy bothria, which extends from the anterior end to posterior end of scolex and measures 1.660mm (1.357-1.964mm) in length and 0.347mm (0.153-0.541mm) in width. The anterior end of scolex bears rostellum, which is armed, oval to rounded in shape and measures 0.115mm (0.086-0.144mm) in length and 0.264mm (0.201-0.328mm) in width. The rostellum armed with 40-42 hooks, which are of two types i.e. long and short. The long hooks measure 0.091mm (0.088-0.095mm) in length and 0.010mm (0.008-0.012mm) in width while short hooks measures 0.064mm (0.062-0.065mm) in length and 0.008mm (0.005-0.012mm) in width respectively. Neck absent.

Mature proglottids are 2-3 times broader than long and measures 0.447 (0.427-0.470mm) in length and 1.080 (1.039-1.122mm) in width. Testes are oval to rounded in shape, 72-80 in numbers, scattered lateral side of the segment on either side of ovary and cirrus pouch and measures 0.022m (0.018-0.028mm) in length and 0.019mm (0.012-0.022mm) in width. The cirrus pouch is small, oval, transversely placed, and pre-ovarian and measures 0.078mm (0.070-0.085mm) in length and 0.041mm (0.032-0.046mm) in width. The cirrus is thin, straight within the cirrus pouch and measures 0.082mm (0.074-0.089mm) in length and 0.009mm (0.004-0.014mm) in width. The vas deferens is short, thin tube and measures 0.025mm

(0.020-0.031mm) in length and 0.012mm (0.009-0.014mm) in width. Vagina and cirrus pouch open at the distal end by a common genital pores, which is small, oval and measures 0.019mm (0.014-0.024mm) in length and 0.012mm(0.009-0.014mm) in width.

The vagina arises from the gonopore, which is thin tube, runs towards posterior side, forms receptaculum seminis and measures 0.050mm (0.043-0.058mm) in length and 0.007mm (0.004-0.009mm) in width. The receptaculum seminis is thin, short tube, it opens into ootype and measures 0.032mm (0.029-0.034mm) in length and 0.012mm (0.009-0.014mm) in width. The ootype is small, oval to round in shape and measures 0.027mm in diameter. From the ootype ovarian lobes start. The ovary is large, distinctly bilobed, each lobe like a nut shaped, situated near the posterior margin of the segment and measures 0.437mm (0.410-0.464mm) in length and 0.077mm (0.053-0.101mm) in width.

The uterus is saccular, filled with numerous egg and measures 0.194mm (0.124-0264mm) in length and 0.413mm (0.300-0.517mm) in width. The eggs are oval, non-operculated and measures 0.032mm (0.030-0.037mm) in length and 0.014mm (0.012-0.018mm) in width. The uterine port is rounded, touching to the anterior side of the segment and measures 0.033mm in diameter. The vitellaria are granular, arranged in 2-3 rows, on each lateral side from anterior to posterior margin of proglottids.

Result and Discussion

The genus *Circumoncobothrium* was established by Shinde in 1968 as a type species *Circumoncobothrium ophiocephali* from *Ophiocephalus leucopunctatus.* The present worm comes closer to all the known species of the genus *Circumoncobothrium* Shinde, 1968 in general topography of organs but differs due to some characters from following species.

The present cestode parasite differs from *Circumoncobothrium ophiocephali* Shinde, 1968 in having distinct scolex, broad in the middle and tapering at both the ends, rostellar hooks 80 in numbers, presence of neck, ovary compact, single conical mass, vitellaria follicular and reported from *Ophiocephalus leucopunctatus*, in India. The present worm differs from *Circumoncobothrium aurangabadensis* Jadhav and Shinde, 1976 in having the scolex broad in the middle and narrow at both the ends, hooks 42 in numbers, presence of neck and testes 135-145 in numbers. The present tapeworm differs from *Circumoncobothrium raoii* Jadhav and Shinde, 1976 in having scolex broad in the middle and narrow at both the ends, hooks 46 in numbers, arranged in single circle, neck present, testes 210-215 in numbers. The present parasite differs from *Circumoncobothrium gachuai* Jadhav and Shinde, 1976 in having the scolex pear shaped, hooks 46 in numbers, neck present, mature proglottids squarish, testes 375-400 in numbers, vitellaria follicular, arranged in two rows and reported from *Ophiocephalus gachua*, in India. The present tapeworm distinguish from *Circumoncobothrium shindei* Chincholikar and Shinde,1976 in having the scolex narrow anteriorly and broad posteriorly, hooks 49 in numbers, neck present, testes 260-275 in numbers, evenly distributed and ovary dumb-bell shaped.

The present worm differs from *Circumoncobothrium bagariusi* Chincholikar and Shinde,1976 in having the scolex narrow anteriorly and broad posteriorly, hooks 55 in numbers, testes 275-285 in numbers, arranged in two lateral fields, vitellaria follicular and reported from *Bagarius* Spp. in India.

The present parasite differs from *Circumoncobothrium khami* Shinde, 1977 in having the scolex cylindrical, hooks 48 in numbers, lancet shaped, mature proglottids squarish, testes 190-200 in numbers, evenly distributed, vitellaria follicular and reported from *Ophiocephalus* Spp. in India. The present cestode differs from *Circumoncobothrium yamaguti* Jadhav et al., 1990 in having the scolex distinct, narrow anteriorly and broad posteriorly and testes 130-150 in numbers. The present worm differs from *Circumoncobothrium alii* Shinde et al., 1994 in having scolex triangular, hooks 34 in numbers, neck present and testes 230-240 in numbers. The present tapeworm differs from *Circumoncobothrium vadgaonensis* Patil et al., 1998 in having the scolex triangular, hooks 56 in numbers, neck present, testes 490-510 in numbers and vitellaria follicular.

The present cestode differs from *Circumoncobothrium baimaii* Wongsawad and Jadhav, 1998 in having the scolex pear shaped, hooks 48 in numbers, neck present, testes 88-100 in numbers, ovary compact and reported from *Mastacembelus armatus* in Chang Mai.

The present worm differs from *Circumoncobothrium punctatusi* Kalse and Shinde,1999 in having scolex rectangular, hooks 40-50 in numbers, neck present, mature proglottids squarish, testes 140-150 in numbers, vitellaria follicular, arranged in 3-6 rows and reported from *Ophiocephalus punctatus*, in India.

The present worm differs from *Circumoncobothrium armatusae* Shinde et al., 1999 in having scolex triangular, hooks 58 in numbers, neck present, testes 90-100 in numbers, ovary compact and vitellaria follicular, arranged in 3-4 rows on lateral side of the segments. The present parasite differs from *Circumoncobothrium mastacembelusae*

Shinde et al., 2002 in having scolex pear shaped, hooks 30 in numbers, testes 130-140 in numbers, ovary compact and vitellaria follicular, arranged in 2-3 rows on each lateral side.

The present cestode differs from *Circumoncobothrium armatusae (minor)* Pawar et al., 2002 in having scolex triangular, hooks 58 in numbers, testes 190-200 in numbers and vitellaria follicular. The present form differs from *Circumoncobothrium manjari* Tat and Jadhav, 2004 in having the scolex triangular, hooks 48 in numbers, in single circle, neck present, testes 128-145 in numbers, vitellaria follicular and reported from *Ophiocephalus gachua,* in India.

In above afore said discussion on the present parasite deserves status of a new species and named *Circumoncobothrium sindhuensis* sp. nov. proposed in honour of author's mother name.

Taxonomic Summary

Genus	-*Circumoncobothrium* Shinde, 1968
Species	- *Circumoncobothrium sindhuensis* sp. nov. (Plate 1)
Type host	-*Mastacembelus armatus* (Lecepede, 1800)
Habitat (Site)	-Intestine
Type locality	-Baramati, District Pune, Maharashtra India
Date of collection	- January, 2008
Etymology	-Named in honour of author's mother name.

Eucestoda	Wardle, McLeod and Radinovsky, 1974.
Psuedophyllidea	Carus, 1863.
Ptychobothridae	Luhe, 1902.
Circumoncobothrium	Shinde, 1968.

Circumoncobothrium puneensis from fresh water fish *Mastacembelus armatus* in Nira River Baramati, Maharashtra.

Circumoncobothrium puneensis sp. nov. (Plate 2)

Introduction

The genus *Circumoncobothrium* is erected by Shinde G.B., 1968 from the intestine of fresh water fish *Ophiocephalus leuconpunctatus* as a type species *Circumoncobothrium ophiocephali.* Jadhav and Shinde, 1976 added three new species of this genus viz*., Circumoncobothrium aurangabadensis* and *Circumoncobothrium raoii* from *Mastacembelus armatus and Circumoncobothrium gachuai* from *Ophiocephalus gauchua.* Chincholikar and Shinde, 1976 described two new species of this genus *Circumoncobothrium shindei* from fresh water fish *Mastacembelus armatus* and *Circumoncobothrium bagariusi* from *Bagarius* species. Shinde, 1977 reported *Circumoncobothrium khami* from *Ophiocephalus striatus*. Jadhav et al., 1990 described *Circumoncobothrium yamaguti* from *Mastacembelus armatus* Shinde et al., 1994 reported *Circumoncobothrium alii* from *Mastacembelus armatus.* Patil et al., 1998 added *Circumoncobothrium vadgaonensis* as a new species to this genus from *Mastacembelus armatus*. Wongsawad and Jadhav, 1998 added *Circumoncobothrium baimaii* from *Mastacembelus armatus.* Shinde et al., 2002 described *Circumoncobothrium mastacembelusae* as a new species from *Mastacembelus armatus.* Pawar, 2002 reported *Circumoncobothrium armatusae* (*minor*) from *Mastacembelus armatus* to this genus. Tat and Jadhav, 2004 reported *Circumoncobothrium manjari* from *Ophiocephalus gachuva*.

Materials and Methods

A total of Ninety Five samples of four fish species collected with hoop net fyke net, two-man seines, and gill net namely, *Wallago attu* (n=20), *Clarias batrachus* (n=30), *Mastacembelus armatus* (n=25), *Heteropneustes fossilis* (n=20), were collected in December to January 2008 from the Nira River of Baramati Tehsil of Pune District Maharashtra State. An attempt was made to collect nearly an equal number of fishes of which most were of the small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Forty one species of the cestode parasites was collected from the intestine of *Mastacembelus armatus* (Lacepede, 1800).

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996).

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observations

All the cestodes are long, consisting of scolex, immature, mature and gravid proglottids. The scolex is triangular in shape, tapering at the apex and broad at the base, distinctly marked off from the strobila and measures 1.218mm (1.189-1.247mm) in length and 0.686mm (0.266-1.106mm) in width. The scolex is having two sessile bothria, which extends from the anterior end to posterior end of scolex and measures 1.072mm (1.029-1.116mm) in length and 0.266mm (0.121-0.461mm) in width. The anterior end of scolex bears rostellum, which is armed, oval in shape and measures 0.109mm (0.072-0.145mm) in length and 0.206mm (0.145-0.266mm) in width. The rostellum is armed with 18-20 hooks, arranged in a circle, which are of two types i.e. long and short. The long hooks measure 0.097mm (0.093-0.100mm) in length and 0.009mm (0.005-0.013mm) in width, while short hooks measures 0.085mm (0.083-0.088mm) in length and 0.007mm (0.005-0.010mm) in width respectively. Neck is absent. Mature proglottids are 8-9 times broader than long and measures 0.211mm (0.194-0.228mm) in length and 3.407mm (3.349-3.466mm) in width. Testes are small, oval to rounded in shape, 250-300 in numbers, scattered lateral side of the segment on either side of ovary and cirrus pouch and measures 0.016mm (0.014-0.019mm) in length and 0.019mm (0.014-0.024mm) in width. The cirrus pouch is small, elongated, transversely placed, and pre-ovarian and measures 0.060mm (0.053-0.067mm) in length and 0.029mm (0.019-0.038mm) in width. The cirrus is thin, short, straight, within the cirrus pouch and measures 0.038mm (0.033-0.043mm) in length and 0.012mm (0.009-0.014mm) in width. The vas deferens is short, thin tube and measures 0.016mm (0.014-0.019mm) in length and 0.009mm (0.004-0.014mm) in width. Vagina and cirrus pouch open at the distal end by a common genital pore, which is small, oval and measures 0.016mm (0.014-0.019mm) in length and 0.012mm (0.009-0.014mm) in width.

The vagina arises from the gonopore, which thin tube, runs towards posterior side, forms receptaculum seminis and measures 0.055mm (0.043-0.063mm) in length and 0.012mm (0.009-0.014mm) in width. The receptaculum seminis is thin, short tube, it opens into ootype and measures 0.021mm (0.019-0.024mm) in length and 0.012mm (0.009-0.014mm) in width. The ootype is small, oval to rounded in shape and measures 0.019mm in diameter. From the ootype ovarian lobes start. The ovary is large, distinctly bilobed, dumb-bell shaped, situated near the posterior margin of the segment and measures 0.538mm (0.524-0.533mm) in length and 0.041mm (0.024-0.058mm) in width.

The uterus is saccular, filled with numerous egg and measures 0.050mm (0.038-0.063mm) in length and 0.40mm (0.398-0.412mm) in width. The eggs are oval, non-operculated and measures 0.044mm (0.039-0.048mm) in length and 0.019mm (0.013-0.024mm) in width. The uterine port is rounded, touching to the anterior side of the segment and measures 0.032mm in diameter. The vitellaria are follicular, arranged in a line, on each lateral side from anterior to posterior margin of Proglottids.

Result and Discussion

The genus *Circumoncobothrium* was established by Shinde in 1968, as a type species *Circumoncobothrium ophiocephali* from *Ophiocephalus leucopunctatus*.

The present worm comes closer to all the known species of the genus *Circumoncobothrium Shinde*, 1968 in general topography of organs, but differs from *Circumoncobothrium ophiocephali* Shinde,1968 in having distinct scolex, hooks 80 in numbers, presence of neck, testes 70-80 in numbers and ovary compact, single conical mass; from *Circumoncobothrium aurangabadensis* Jadhav and Shinde,1976 in having the hooks 42 in numbers, presence of neck, testes 135-145 in numbers and vitellaria granular; from *Circumoncobothrium raoii* Jadhav and Shinde,1976 in having hooks 46 in numbers, neck present, testes 210-215 in numbers and vitellaria granular; from *Circumoncobothrium gachuai* Jadhav and Shinde,1976 in having the scolex pear shaped, hooks 46 in numbers, neck present, mature proglottids squarish and testes 375-400 in numbers; from *Circumoncobothrium shindei* Chincholikar and Shinde,1976 in having hooks 49 in numbers, neck present and vitellaria granular; from *Circumoncobothrium bagariusi* Chincholikar and Shinde,1976 in having hooks 55 in numbers; from *Circumoncobothrium khami* Shinde, 1977 in having the scolex cylindrical, hooks 48 in numbers, lancet shaped, mature proglottids squarish and testes 190-200 in numbers; from *Circumoncobothrium yamaguti* Jadhav et. al., 1990 in having hooks 56 in numbers, testes 130-150 in numbers and vitellaria granular; from *Circumoncobothrium alii* Shinde et al., 1994 in having hooks 34 in numbers, neck present, testes 230-240 in numbers and vitellaria granular; from *Circumoncobothrium vadgaonensis* Patil et al., 1998 in having hooks 56 in numbers, neck present and testes 490-510 in numbers; from *Circumoncobothrium baimaii* Wongsawad and Jadhav, 1998 in having the scolex pear shaped, hooks 48 in numbers, neck present, testes 88-100 in numbers, ovary compact and vitellaria granular; from *Circumoncobothrium punctatusi* Kalse and Shinde,1999 in having scolex rectangular, hooks 40-50 in numbers, neck present, mature proglottids squarish and testes 140-150 in numbers; from *Circumoncobothrium armatusae* Shinde et al., 1999 in having hooks 58 in numbers, neck present, testes 90-100 in numbers and ovary compact; from *Circumoncobothrium mastacembelusae* Shinde et al., 2002 in having scolex pear shaped, hooks 38 in numbers, testes 130-140 in numbers and ovary compact; from *Circumoncobothrium armatusae* (minor) Pawar et. al.,2002 in having hooks 58 in numbers and testes 190-200 in numbers; from *Circumoncobothrium manjari*, Tat and Jadhav,2004 in having hooks 48 in numbers, in single circle, neck present and testes 128-145 in number.

In above aforesaid discussion on the present parasite deserves the status of a new pecies to the science *Circumoncobothrium puneensis.* The name followed by the District of Baramati Tehsil of Pune district.

Taxonomic Summary

Genus	-*Circumoncobothrium* Shinde, 1968
Species	- *Circumoncobothrium puneensis* sp. nov. (Plate 2)
Type host	-*Mastacembelus armatus* (Lecepede, 1800)
Habitat (Site)	-Intestine
Type locality	-Nira River, Baramati, District Pune, Maharashtra India
Date of collection	- January, 2008.

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Eucestoda	Wardle, McLeod and Radinovsky, 1974.
Pseudophyllidea	Carus, 1863.
Ptychobothridae	Luhe, 1902.
Senga	Dollfus, 1934.

On a new species of ***Senga*** (Dollfus, 1934) from Karha River of Baramati Region, Pune District Maharashtra.

Senga jadhavensis sp. nov. (Plate 3)

Introduction

The genus *Senga* was established by Dollfus, 1934 with its type species *Senga besnardi* from *Betta splendens*. The Siamese fighting fish in an aquarium at Vinecunes, France. *Senga ophiocephalina* Tseng, 1933 as *Anchistrocephalus ophiocephalina* from *Ophiocephalus argus* at Taimen, China and identified with a form previously recorded by Southwell, 1913 as *Anchitrocephalus polyptera* (Anchitrocephalus) Monticelli, 1890 - Syn. Anchistrocephalus Luhe, 1899 from *Ophiocephalus striatus* in Bengal, India *Senga pcynomera* Woodland, 1924 as *Bothriocephalus pcynomera* from *Ophiocephalus marulius* at Allahabad, India. *Senga lucknowensis*. Johri, 1956 from *Mastacembelus armatus* in India. Fernando and Furtado, 1963 recorded *Senga malayana* from *Channa striata*, *Senga parva* and *Senga filiformis* from *Channa micropeltes* at Malacca. Ramadevi and Hanumanh Rao, 1966 reported the plerocercoid of *Senga* sp. from Panchax panchax. Tadros, 1968 synomised the genus *Senga* with the genus *Polyonchobothrium* and proposed new combinations for the species. Furtado and Chauhan, 1971 reported *Senga pahangensis* from *Channa micropeltes* at Tesak Bera. Rama Devi, 1973 reported *Senga visakhapattanamensis* from India.

Wardle, McLeod and Radinovsky, 1974 put *Senga* as a distinct genus in the family Ptychobothridae. Jadhav and Shinde, 1980 reported *Senga godavari* from *Mastacembelus armatus* at Nanded, Maharashtra State, India. One more species *Senga aurangabadensis* was added by Jadhav and Shinde, 1980 from *Mastacembelus armatus* at Aurangabad Maharashtra, India. A new addition made by Kadam et al., 1981 as *Senga paithaniensis* from host *Mastacembelus armatus*. Majid et al., 1984 added *Senga raoi* and *Senga jagannathae* from *Channa punctatus* at Orisa. Two more new species erected by Jadhav et al., 1991 as *Senga maharashtrii* and *Senga gachuae* from the intestine of *Mastacembelus armatus*. Monzer Hasnain, 1992 added *Senga chauhani* from *Channa punctatus*. Tat and Jadhav, 1997 added *Senga mohekarae* from the intestine of the *Mastacembelus armatus*, at Parli, Dist. Beed, Maharashtra, India. Patil and Jadhav added *Senga tappi* from *Mastacembelus armatus* in 2003. Jadhav, 2005 give a detail account of genus *Senga* from freshwater fishes from Maharashtra state, India. Recently Pande et al., 2006 added two new species i.e. *Senga ayodhensis* from *Amphinuous cuchia* and *Senga baghui* from *Rita rita*.

Materials and Methods

A total of Ninety samples of five fish species collected with hoop net fyke net, two-man seines, and gill net namely, *Wallago attu* (n=13), *Clarias batrachus* (n=27), *Mastacembelus armatus* (n=13), *Heteropneustes fossilis* (n=23), *Tilapia mossambica* (n=14), and were collected in December, 2008 to January, 2009 from the different part of Baramati Tehsil of Pune District Maharashtra State. An attempt was made to collect nearly an equal number of fishes of which most were of the small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Thirty Two species of the cestode parasites was collected from the intestine of *Mastacembelus armatus* (Lacepede, 1800).

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996)

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observation

After the removal of alimentary canal of fresh water spiny eel fish *Mastacembelus armatus* (Lecepede, 1800), Twenty Eight cestode parasites were collected during the period of December, 2008 to January, 2009.

All the cestodes are long, consisting of scolex, immature, mature and gravid Proglottids. The scolex is triangular, tapering anteriorly and broad posteriorly and measures 0.908mm (0.871-0.944mm) in length and 0.515mm (0.238-0.792mm) in breadth.

The scolex, with the pair of bothria, extends from the anterior end to posterior end. The bothria measures about 0.955mm (0.929-0.982mm) in length and 0.102mm (0.015-0.190mm) in breadth. The anterior end of the scolex terminates in a rostellum. Rostellum is some what round in shape and measures about 0.103mm (0.090-0.119mm) in length and 0.24mm (0.216-0.274mm) in breadth. The rosetellum is armed with 42-46 hooks, which are arranged in two semicircle unequal lengths. The long hooks measures 0.110mm (0.097-0.123mm) in length and 0.011mm (0.007-0.014mm) in breadth, while the short hooks measures about 0.83mm (0.081-0.86mm) in length and 0.007mm (0.006-0.008mm) in breadth. The neck is absent.

The mature proglottids are about 5-6 times broader than long and measures 0.274mm (0.236-0.313mm) in length and 2.196mm (2.176-2.215mm) in breadth. The testes are small, oval in shape, 200-225 in numbers, scattered throughout the segment and measures about 0.022mm (0.015-0.025mm) in length and 0.033mm (0.026-0.035mm) in breadth. The cirrus pouch is oval in shape, pre-ovarian in position, situated in the centre of the segment and measures about 0.056mm (0.051-0.061mm) in length and 0.023mm (0.0013-0.032mm) in breadth. The cirrus is short, thin, and present within the cirrus pouch and measures about 0.044mm (0.036-0.054) in length and 0.008mm (0.003-0.013mm) in breadth. The vas deferens is short, thin and straight tube measures about 0.017mm (0.012-0.022mm) in length and 0.008mm (0.006-0.0011mm) in breadth. The vagina and cirrus pouch open in a common pore known as genital pore. Genital pore is small in size, oval shape and measures about 0.014mm (0.11 - 0.016mm) in length and 0.10mm (0.05 - 0.015mm) in breadth.

The vagina is a thin tube, slightly curved, arises from the genital pore, runs posteriorly and forms receptaculum seminis and measures about 0.092mm (0.085-0.99mm) in length and 0.008mm(0.003-0.013mm) in breadth. The receptaculum seminis is straight tube, open into ootype and measures about 0.027mm (0.022 - 0.031mm) in length and 0.008mm (0.003 - 0.013mm) in breadth. The ootype is oval, medium in size and measures 0.025mm in diameter. From the ootype ovarian lobes start. The ovary is large, distinctly bilobed, dumb-bell shaped transversely placed at posterior margin of the proglottids and measures about 0.991mm (0.979-1.003mm) in length and 0.114mm (0.085-0.143mm) in breadth. The vitellaria are granular, on each lateral side from anterior to posterior margin of the proglottids. The uterus is saccular, filled with eggs and measures about 0.064mm (0.052-0.076mm) in length and 0.536mm (0.527-0.546mm) in breadth. Eggs are elongated, tapering at both ends and measures about 0.045mm (0.041-0.048) in length and 0.014mm (0.008-0.019mm) in breadth. The uterine pore is rounded, towords anterior region of the proglottids and measures about 0.025mm in diameter.

Result and Discussion

The genus *Senga* was established by Dollfus, 1934 with the type species *Senga besnardi* from *Betta splendens*. The present worm comes closer to all the known species of the genus *Senga* Dollfus, 1934 in general topography of organs, but differs from *Senga ophiocephalina* Tseng, 1933 in having pear shaped scolex, testes 50-55 in numbers and vitellaria lobate; from *Senga besnardi* Dollfus, 1934 in having scolex triangular, hooks 50 in numbers, testes 160-175 in numbers and compact ovary; from *Senga pcynomera* Woodland, 1924 in having elongated scolex, hooks 60 in numbers, ovary discontinuous in two groups and indistinct segmentation; from *Senga lucknowensis* Johri, 1956 in having pear shaped scolex, hooks 60 in numbers and vitellaria lobate; from *Senga malayana* Furnando and Furtado,1964 in having scolex circular, hooks 60 in numbers and vitellaria lobate; from *Senga parva* Furnanado et al., 1964 in having pear shaped scolex; from *Senga pahangensis* Furtado et al., in having scolex triangular, 52 hooks, neck present and vitellaria lobulate; from *Senga visakhapattanmensis* Ramadevi et al., 1973, in having circular scolex, 46-52 hooks and testes 50-55 in numbers; from *Senga khami* Shinde et al., 1980 in having rectangular scolex, hooks 55-57 in numbers, neck present and testes 155 in numbers; from *Senga aurangabadensis* Jadhav et al., 1980 in having oval scolex, hooks 50-52 in numbers, testes 240-260 in number and vitellaria follicular; from *Senga godavarii* Shinde et al., 1980 in having pear shaped scolex, testes 220-230 in numbers, vagina anterior to cirrus pouch and vitellaria follicular; from *Senga paithanensis* Kadam et al., 1981 in having triangular scolex, hooks 54 in numbers, neck present, testes rounded, oval, 130-135 in numbers, scattered in two lateral groups and vitellaria follicular; from *Senga raoi* Majid et al., 1984 in having pear shaped scolex, hooks 46 in numbers and testes 65-170 in numbers; from *Senga jagannathae* Majid et al., 1984 in having pear shaped scolex, testes small, rounded and 240-250 in numbers; from *Senga gachauae* Jadhav et al., 1991 in having pear shaped scolex, hooks 22-25 in numbers, testes 60-70 in numbers, oval, arranged in two fields and vitellaria follicular; from *Senga maharashtrii* Jadhav and Tat, 1991 in having oval scolex, hooks 45-47 in numbers, testes oval, arranged in two fields, 80-90 in numbers and vitellaria follicular; from *Senga chauhani* Monzer Hasnain, 1992 in having scolex large, oval, testes 200-210 in numbers and vittelaria non-lobate to lobate; from *Senga mohekarae* Tat and Jadhav, 1997 in having elongated scolex, hooks 151 in numbers, arranged in two semicircle groups, testes 300-310 in numbers and vitellaria follicular; from *Senga armatusae* Hiware, 1999 in having scolex triangular, 32-40 hooks, testes 230-240 in numbers, vagina anterior to cirrus pouch and vitellaria follicular from *Senga tappi* Patil et al., 2003 in having scolex triangular, 42-44 hooks, testes 285-295 in numbers, rounded, distributed in two fields, vagina anterior to cirrus pouch and vitellaria follicular; from *Senga ayodhensis*, Pandey 2006 in having hooks 25-30 in numbers, dagger shaped, testes numerous and vitellaria follicular; from *Senga baghuae*, Pandey, 2006 in having scolex pear shaped, hooks 28 in numbers, neck short, testes 40-50 in numbers, ovary compacts and vitellaria follicular.

As per the discussion and on the present parasite, according to its morphological status deserves the status of a new species and named *Senga jadhavensis* sp.nov. in the honour of Late Prof. Baba Jadhav.

Taxonomic Summary

Genus	-*Senga* Dollfus, 1934
Species	-*Senga jadhavensis* sp. nov. (Plate 3)
Type host	-Mastacembelus armatus (Lecepede, 1800)
Habitat (Site)	-Intestine
Type locality	-Karha Reiver, Baramati, Maharashtra, India
Date of collection	-December 2008 to Jannuary 2009.
Etymology	-Named in the momeries of eminent helminthologist Late Prof. Baba Jadhav.

Eucestoda Wardle, McLeod and Radinovsky, 1974.
Pseudophyllidea Carus, 1863.
Ptychobothridae Luhe, 1902.
Senga Dollfus, 1934.

On a new species of ***Senga*** (Dollfus, 1934) from Baramati Region, Pune District Maharashtra.

Senga govindae sp. nov. (Plate 4)

Introduction

The genus *Senga* was established by Dollfus, 1934 with its type species *Senga besnardi* from *Betta splendens*. The Siamese fighting fish in an aquarium at Vinecunes, France. *Senga ophiocephalina* Tseng, 1933 as *Anchistrocephalus ophiocephalina* from *Ophiocephalus argus* at Taimen, China and identified with a form previously recorded by Southwell, 1913 as *Anchitrocephalus polyptera* (Anchitrocephalus) Monticelli, 1890 - Syn. Anchistrocephalus Luhe, 1899 from *Ophiocephalus striatus* in Bengal, India. *Senga pcynomera* Woodland, 1924 as *Bothriocephalus pcynomera* from *Ophiocephalus marulius* at Allahabad, India. *Senga lucknowensis,* Johri, 1956 from *Mastacembelus armatus* in India. Fernando and Furtado, 1963 recorded *Senga malayana* from *Channa striata*, *Senga parva* and *Senga filiformis* from *Channa micropeltes* at Malacca. Rama Devi and Hanumanh Rao, 1966 reported the plerocercoid of *Senga* Spp. from *Panchax panchax*. Tadros, 1968 synomised the genus *Senga* with the genus *Polyonchobothrium* and proposed new combinations for the species. Furtado and Chauhan, 1971 reported *Senga pahangensis* from *Channa micropeltes* at Tesak Bera. Shinde, 1972 redescribed *Senga besnardi* from *Ophiocephalus gachua* in India. Rama Devi and Rao, 1973 reported another species of *Senga visakhapatanamensis* India. Rama Devi (1976) described the life cycle of *Senga visakhapatnamensis* from *Ophiocephalus punctatus* in a lake at Kondakaria, Andhra Pradesh, India. But they do not agree with Tadors statements. Wardle, McLeod and Radinovsky, 1974 put *Senga* as a distinct genus in the family Ptychobothridae. Deshmukh, 1980 reported *Senga khami* from *Ophicephalus marulius*, a fresh water fish from Kham River at Aurangabad. Jadhav and Shinde, 1980 reported *Senga godavari* from *Mastacembelus armatus* at Nanded, Maharashtra India. One more species *Senga aurangabadensis* was added by Jadhav and Shinde, 1980 from *Mastacembelus armatus* at Aurangabad, Maharashtra India. A new addition made by Kadam et al., 1981 as *Senga paithanensis* from host *Mastacembelus armatus*. Majid et al., 1984 added *Senga raoi* and *Senga jagannathae* from *Channa punctatus*. Two more new species erected by Jadhav et al., 1991 as *Senga maharashtrii* and *Senga gachuae* from the intestine of *Mastacembelus armatus*. Monzer Hasnain, 1992 added *Senga chauhani* from *Channa punctatus*. Tat and Jadhav, 1997 added *Senga mohekarae* from the intestine of the *Mastacembelus armatus*, at Parli, Dist. Beed, Maharashtra, India. Patil and Jadhav added *Senga tappi* from *Mastacembelus armatus* in 2003. Jadhav, 2005 studied on genus *Senga* from freshwater fishes from Maharashtra state, India. Recently Pande et al., 2006 added two new species i.e. *Senga ayodhensis* from *Amphinuous cuchia* and *Senga baghui* from *Rita rita*.

Materials and Methods

A total of Eighty Three samples of four fish species collected with hoop net fyke net, two-man seines, and gill net namely, *Wallago attu* (n=18), *Clarias batrachus* (n=21), *Mastacembelus armatus* (n=26), *Heteropneustes fossilis* (n=18), and were collected in December to January 2010 from the different localities of Baramati Tehsil of Pune District Maharashtra State. Most of the fishes belong to small and medium size. Weight and length was measured after collection of

Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Forty Four species of the cestode parasites was collected from the intestine of *Mastacembelus armatus* (Lacepede, 1800) during the work.

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996)

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observations

Forty Four species of the collected cestode parasites from *Mastacembelus armatus* (Lecepede, 1800) at Baramati during the period of December 2008 to January 2009.

As per the observations we made we found that, all these tapeworms were long, consisting of scolex, immature, mature and gravid proglottids. The scolex is pear shaped, tapering anteriorly and broad posteriorly and measures about 0.631 (0.578-685mm) in length and 0.418mm (0.201-0.614mm) in breadth.

The scolex having pair of sessile bothria, which extends to posterior end of the scolex and measures 0.682mm (0.648-0.716mm) in length and 0.065mm (0.046-0.085mm) in breadth. The anterior end of the scolex terminates in a rostellum, which is oval to rounded in shape and measures about 0.028mm (0.18-0.038mm) in length and 0.068mm (0.046-0.086mm) in breadth. The rosetellum is armed with 29-33 hooks, which are arranged in two semicircle unequal length i.e. short and long .The long hooks measures 0.081mm(0.075-0.088mm) in length and 0.007mm(0.003-0.011mm) in breadth, while the short hooks measures about 0.070mm(0.007-0.077mm) in length and 0.008mm(0.004-0.012mm) in breadth. The neck is absent. The mature proglottids are about 5-6 times broader than long, measures about 0.334mm (0.294-0.367mm) in length and 1.616mm (1.604-1.629mm) in breadth. The testes are small, oval in shape, 170-200 in number, scattered throughout the segment and measures about 0.022mm (0.017-0.027mm) in length and 0.017mm (0.012-0.022mm) in breadth. The cirrus pouch is oval in shape, pre-ovarian in position, situated in the centre of the segment and measures about 0.063mm (0.056-0.070mm) in length and 0.020mm (0.0013-0.028mm) in breadth. The cirrus is short, thin, and present within the cirrus pouch and measures 0.044mm (0.036-0.051mm) in length and 0.006mm (0.002-0.012mm) in breadth. The vas deferens is short, thin, straight tube and measures 0.017mm (0.012-0.022mm) in length and 0.007mm (0.003-0.0011mm) in breadth. The vagina and cirrus pouch open a common pore known as genital pore, which is small in size, oval in shape and measures 0.013mm (0.10 - 0.016mm) in length and 0.08 (0.04 - 0.013mm)in breadth.

The vagina is a thin tube, curved, arises from the genital pore, runs posteriorly and forms receptaculum seminis and measures 0.066mm (0.059-0.072mm) in length and 0.007(0.005-0.015mm) in breadth. The receptaculum seminis is straight tube open into ootype and measures about 0.022 (0.020 - 0.026mm) in length and 0.015 (0.010 - 0.021mm) in breadth, which is oval, medium in size, present between the ovarian lobes and measures about 0.051 in diameter. From the ootype ovarian lobes start. The ovary is large, distinctly bilobed, transversely placed at posterior margin of the proglottids and measures 0.493mm (0.458-0.530mm) in length and 0.058 (0.038-0.080mm) in breadth. The vitellaria are granular, on each lateral side from anterior to posterior margin of the proglottids. The uterus is saccular, filled with eggs and measures about 0.143mm (0.104-0.181mm) in length and 0.340mm (0.216-0.464mm) in breadth. Eggs are elongated, tapering at both ends and measures 0.038mm (0.036-0.041mm) in length and 0.014mm (0.011-0.018mm) in breadth. The uterine pore is rounded, to words anterior region of the Proglottids and measures 0.026mm in diameter.

Result and Discussion

The genus *Senga* was established by Dollfus, 1934 with the type species *Senga besnardi* from *Betta splendens*. The present worm comes closer to all the known species of the genus *Senga* Dollfus, 1934 in general topography of organs but differs due to some characters from following species.

The present tape worm differs from *Senga besnardi* Dollfus, 1934 in the shape of scolex which is triangular, hooks 50 in numbers, testes 160-175 in numbers, ovary compact and reported from *Betta splendens* in France. The present cestode differs from *Senga ophiocephalina* Tseng,1933 in having hooks 47-50 in numbers, testes 50-55 in numbers, ovary bilobed but equatorial in position, vitellaria lobate and reported from *Philocephalus argua* in China.

The present tapeworm differs from *Senga pcynomera* Woodland, 1924 in having scolex elongated, hooks 68 in numbers, mature segments are indistinct, ovary discontinuous into two groups and reported from *Philocephalus marulius* in India.

The present parasites differs from *Senga lucknowensis* Johri,1956 in having hooks 36-48 in numbers, ovary post equatorial, vitellaria lobulate and discontinue in two groups.

The present cestode differs from *Senga malayana* Furnando and Furtado, 1964 in having scolex circular, hooks 60 in numbers, ovary slightly bilobed, post equatorial, vitellaria lobate, discontinuous in two groups and reported from *Channa striata*, in Malacca.

The present tapeworm differs from *Senga parva* Furnando and Furtado, 1964 in having hooks 38-40 in numbers, testes 100 in numbers and reported from *Channa micropeltis*, in Malacca.

The present cestode differs from *Senga pahangensis* Furtado et al., 1971 in having triangular scolex, hooks 52 in numbers, neck short, segmentation clear, testes laterally situated in the proglottids, vitellaria lobulated and reported from *Channa micropeltis*, in Tasek, Bera .

The present tapeworm differs from *Senga visakhapattanamensis* Rama Devi et al., 1973 in having circular scolex, hooks 46-52 in numbers, testes 50-55 in number, vitellaria lobulated and reported from *Ophiocephalus punctatus*, in India.

The present worm differs from *Senga khami* Deshmukh and Shinde,1980 having scolex rectangular, oval, shallow bothria, hooks 55-57 in numbers, short neck, testes rounded, 155 in numbers and arranged in two fields, cirrus pouch is elongated, vitellaria follicular and reported from *Ophiocephalus marulius*, in India.

The present cestode differs from *Senga aurangabadensis* Jadhav et al., 1980 in having oval scolex, hooks 50-52 in numbers; in two half rows, overlapping on each other, mature segment longer than broad, testes 240-260 in numbers and vitellaria follicular. The present tapeworm differs from *Senga godavarii* Shinde et al., 1980 in having hooks 40-42 in numbers, arranged in two half rows, testes rounded, 220-230 in numbers, cirrus pouch is oval, situated in anterior half of the segment and vitellaria follicular.

The worm differs from *Senga paithanensis* Kadam et al.,1981 which shows prominent, large, triangular scolex, hooks 54 in numbers, neck present, testes oval to rounded, 130-135 in numbers, arranged in two lateral groups, vagina posterior to cirrus pouch and vitellaria follicular. It is also differs from *Senga raoi* Majid and Shinde,1984 in having hooks 46 in numbers, testes 65-170 in numbers, vagina posterior to cirrus pouch and reported from *Channa punctatus*, in India. It differs from *Senga jagannathae* Majid and Shinde, 1984 in having hooks 44 in numbers, testes 240 - 250 in numbers, ovary compact, and vagina anterior to cirrus pouch and reported from *Channa punctatus*, in India. *Senga gachuae* Jadhav et al.,1991 in having hooks 22-25 in numbers, neck present, testes 60-70 in numbers, vitellaria follicular and reported from *Channa gachua*, in India. The present cestode differs from *Senga maharashtrii* Jadhav et al., 1991 which shows muscular scolex, hooks 45-46 in numbers, large, arranged in two half crowns, testes oval 80-90 in numbers and vitellaria follicular. *Senga chauhani* Monzer Hasnain,1992 in having scolex oval, hooks 40-44 in numbers and testes 200-210 in numbers, vitellaria non lobate and reported from *Channa punctatus*, in India. The present cestode differs from *Senga mohekarae*, Tat and Jadhav, 1997 which shows elongated scolex, hooks 151 in numbers, neck short and broad, testes 300-310 in numbers and vitellaria follicular. The present parasite differs from *Senga armatusae* Hiware, 1999 in having scolex triangular, hooks 32-40 in numbers, vagina anterior to cirrus pouch and vitellaria follicular.

The present tapeworm differs from *Senga tappi* Patil et al., 2003 which is having triangular scolex, hooks 42-44 in numbers, neck is very short and squarish, testes 285-295 in numbers, small, rounded, distributed in 2 fields, vagina anterior to cirrus pouch and vitellaria follicular. The present parasite differs from *Senga ayodhensis* Pande et al., 2006 in having conical scolex, hooks 29 in numbers, testes numerous, vitellaria follicular and reported from *Amphinuous cuchia*, in India. The present cestode differs from *Senga baughi* Pande et al., 2006 in having hooks 28 in numbers, neck present, testes 40-50 in numbers, ovary compact, vitellaria follicular and reported from *Rita rita*, in India.

It is differs from *Senga govindae* sp. nov. in having scolex conical, hooks 40-44 in numbers and testes 200-225 in numbers In above aforesaid discussion on the present parasite deserves the status of a new species and named *Senga govindae* sp. nov. after the name of Prof. G.B. Shinde contribute to the study of Helminthology in India.

Taxonomic Summary

Genus	- *Senga* Dollfus, 1934
Species	- *Senga govindae* sp. nov. (Plate 4)
Type host	- *Mastacembelus armatus* (Lecepede, 1800)
Habitat (Site)	- Intestine
Type locality	- Baramati, Maharashtra
Date of collection	- December 2008 to January 2009.
Etymology	- Named after Prof. G.B. Shinde contribute to the study of Helminthology in India.

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Cotyloda	Wardle, McLeod and Radinovsky, 1974.
Caryophyllidea	Benden in Olsson, 1893.
Lytocestidae	Wardle and McLeod, 1952. (Sub family Lytocestinae, Hunter 1927)
Lytocestus	Cohn, 1908.

On a new species of *Lytocestus* (Cohn, 1908) from a fresh water Fish *Heteropneustes fossilis* (Bloch, 1794) at Baramati region of Pune District.

Lytocestus niraensis sp. nov. (Plate 5)

Introduction

The genus *Lytocestus* was erected for the cestodes from the siluroid host, *Clarias fuscus,* from Hongkong. The 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 *Lytocestus adherens* Cohn, 1908, several species have been added to date. This genus was first confirmed by Woodland in 1923 and 1924 by including two more species in addition to the type species i.e. *Lytocestus filiformes*, in *Mormynus caschive* (in 1923) and *Lytocestus chalmersius*, (in 1924) later on, *Lytocestus cunningtoni* (Fuhrmann and Baer, 1925) and *Lytocestus indicus* Moghe, (1925:a) (Syn. *Caryophyllaeces indicus*) was recorded from *Clarias batrachus* in India (1925:b). Record of same species was also reported from *Clarias magur* by Mehra, 1930 and in India. Hunter, 1927 placed the genus in sub-family Lytocestinae and retained three species i.e. *Lytocestus adhaerens*, *Lytocestus filiformis* and *Lytocestus indicus.* He put the species *Lytocestus cunningtoni* and *Lytocestus chalmersius* in the genus *Monobothrioides*. Wardle and McLeod, 1952 followed Hunter's classification but raised the status of Lytocestinae from Sub family to family. Furtado, 1963 *Lytocestus parvulus* from a Malayan cat fish. Wardle, McLeod and Radinovsky, 1974 suggested a new system of classification of cestodes, which used the term Cotyloda as a class and order Caryophyllidea is kept in this class. Subsequent work of Gupta, 1961 adhered to these changes. Mackiewiez, 1962 included the species *Lytocestus javanicus* (Bovien, 1926). Furtado, 1963 and Lynsdale, 1950 considered *Lytocestus alestesi* as Syn. of *Lytocestus barmanicus,* But Mackiewiez J.S. 1962 after examination of original material *Lytocestus alestesi (*Lynsdale, 1956) concluded that it should be considered as *Lytocestus filiformis* (Woodland, 1923). Rama Devi, 1973 described *Lytocestus longicollis* from *Clarias batrachus* in India. Singh, 1975 added *Lytocestus fossilis.*

Later on Shinde, 1988 erected *Lytocestus marathwadensis* from C*larias batrachus* from India. Jadhav and Gavhane, 1991 added two species to this genus i.e. *Lytocestus alii* and *Lytocestus clariasae* from *Clarias batrachus*. *Lytocestus naldurgensis* erected by Kadam et al., 1998 in *Clarias batrachus. Lytocestus teranaensis* was erected in 1999 by Shinde from *Wallago attu*. Jadhav et al., 2002 added *Lytocestus govindae* from *Clarias batrachus*. Tandom et al., 2005 erected four new species *Lytocestus clariae, Lytocestus allenuateus, Lytocestus assamensis* in *Clarias batrachus* and *Lytocestus heteropneustii* in *Heteropneusteus fossils*. Lastly Poonam, 2007 added *Lytocestus mujumdari* from *Clarias batrachus.*

Materials and Methods

A total of Ninety Five samples of five fish species collected with hoop net, two-man seines, fyke net and gill net namely, *Clarias batrachus* (n=20), *Heteropneustes fossilis* (n=22), *Tilapia mossambica* (n=28), *Mastacembelus armatus* (n=5) and *Wallago attu* (n=20) were collected during October 2009 to January 2010 from the Nira river of Baramati region. An attempt was made to collect nearly an equal number of fishes of which most were of the small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Twenty three species of the cestode parasites was collected from the intestine of the fresh water catfish *Heteropneustes fossilis* (Bloch, 1794).

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996)

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observation

The total of Twenty Three (23) mature specimens of the collected cestode parasites from *Heteropneustes fossilis* (Bloch, 1794) ***Lytocestus niraensis*** sp. nov. are long, single segmented, and tapering at both the ends Parasites are measures about 30mm (29-32mm) in length and 2.5mm (1.5-3.5) in width. The head is long, well marked off from the body and measures 3.5mm (2.9-3.9mm) in length and 2.0mm (1.0-3.0mm) in width. The testes are rounded, 425-500 in number, pre-ovarian, placed centrally, evenly distributed and measures 0.102mm (0.087-0.124mm) in length and 0.145mm (0.135-0.155mm) in width. The cirrus pouch is large, oval, pre-ovarian, transversely placed and measures 0.696mm (0.650-0.712mm) in length and 0.312mm (0.180-0.410mm) in width. The cirrus is thin, straight and measures about 0.635mm (0.602-0.670mm) in length and 0.032mm (0.015-0.050mm) in width. The vas deferens is short, thin and measures about 0.130mm (0.120-0.155mm) in length and 0.040mm (0.033-0.051mm) in width. Vagina and cirrus pouch open a common pore known as genital pore, which is small, oval and measures about 0.068mm (0.050 -0.086mm) in length and 0.042mm (0.033-0.051mm) in width.

The vagina is thin tube, long, starts from genital pore and runs posteriorly to the cirrus pouch, forms receptaculum seminis and measures about 2.255mm(2.100-2.407mm) in length and 0.050mm(0.032-0.068mm) in width. The receptaculum seminis is thin tube, it open into the ootype and measures about 1.095 (1.068-1.122) in length and 0.070mm (0.052-0.088mm) in width. The ootype is rounded to oval and measures about 0.105 in diameter. From the ootype ovarian lobes start. The ovary is bilobed, 'H' shaped, situated near the posterior region of the worm and measures 1.719mm (1.585-1.853mm) in length and 1.012mm (0.959-1.066mm) in width.

The uterus is saccular, filled with numerous eggs and measures about 0.070 (0.052-0.088mm) in length and 0.040mm (0.030-0.048) in width. The eggs are non-operculated, oval in shape and measures 0.068mm in diameter. The vitellaria are follicular and arranged in 2 rows.

Result and Discussion

Cohn established the genus *Lytocestus* in 1908 with its type species *Lytocestus adhaerens* from *Clarias fuscus* at Hong-Kong. The present cestode parasites collected from *Heteropneustes fossilis* (Bloch, 1794) are closer to all the known species of the genus *Lytocestus* Cohn, 1908 in general topography of organs but differs from *Lytocestus adhaerens* Cohn, 1908 in having head undifferentiated from body, cirrus pouch strongly muscular and uterus looped; from *Lytocestus filiformis* Woodland, 1923 in having testes numerous, large, scattered in central medulla, ovary bilobed, small, containing 6-11 large follicles, cirrus pouch small and uterus tubular; from *Lytocestus indicus* Moghe, 1925 in *Clarias batrachus* in having head short, bluntly rounded and testes 230-270 in numbers; from *Lytocestus biramanicus* Lynsdale, 1956, in having testes medullary, extend up to genital pore, ovary wing like, with numerous follicles and uterus consist of number of loose cells, from *Lytocestus alestus* Lynsdale, 1956 in having testes more or less spherical, numerous and uterus short; from *Lytocestus longicollis* Ramadevi, 1973 in having the testes 104 to105 in number, arranged in two rows, ovary bilobed and vas deferens convoluted tube; from *Lytocestus fossilis* Singh, 1975 in having head stumpy, testes numerous, ovary bilobed, receptaculum seminis absent and uterus compactly coiled tube; from *Lytocestus marathwadensis* Shinde and Phad, 1988 in having testes numerous, arranged in 2 or 3 rows in central medulla, receptaculum seminis absent and vitellaria small and oval, single row on lateral side; from *Lytocestus alii* Jadhav and Gavhane, 1991 in having head bluntly rounded, testes 460-480 in numbers, cirrus pouch small, oval, ovary butterfly shaped and uterus convoluted tube; from *Lytocestus clariasae* Jadhav and Gavhane, 1991 in having head bluntly rounded, testes 700-750 in numbers and cirrus pouch medium; from *Lytocestus naldurgensis* Kadam et al., 1998 inhaving head conical, blunt, cirrus pouch small and ovary butterfly shaped; from *Lytocestus teranaensis* Kolpuke and Shinde, 1999 in having head conical, blunt, testes 1200-1500 in numbers, cirrus pouch small, transversely placed, ovary bilobed, large, each lobe triangular and vitellaria follicular, smaller, in 4-5 rows; from *Lytocestus chalisgaonesis* Kalse and Shinde, 1999 in having head bluntly rounded, testes 1500-1600 in numbers, ovary bilobed, each lobe triangular and vitellaria granular; from *Lytocestus govindae* Patil and Jadhav, 2002 in having head long, well marked off from body, testes numerous, 1425-1475 in numbers, pre-ovarian, evenly distributed, cirrus pouch small, ovary butterfly shaped and vitellaria granular; from *Lytocestus batrachusae* Pawar et. al., 2004 in having head spatulate, testes medium, 3800-4000 in numbers, ovary butterfly shaped and vitellaria small, oval arranged in two rows; from *Lytocestus shindei*, Jadhav et al., 2004 in having testes 350-360 in numbers, cirrus pouch small, ovary butterfly shaped and vitellaria granular; from *Lytocestus nagapurensis* Shinde et. al., 2004 in having head spatulate, bluntly rounded, testes 1100-1150 in numbers and vitellaria granular; from *Lytocestus clariae* Tandon, 2005 in having head unarmed and testes oval, 270-495 in numbers; from *Lytocestus attenuatus* Tandon et al., 2005 in having head unarmed, testes 195-398 in numbers, ovary inverted 'A' shaped and uterus glandular; from *Lytocestus assamensis* Tandon et al., 2005 in having head unarmed, testes 266-565 in numbers, ovary inverted 'A' shaped and uterus glandular; from *Lytocestus heteropneustii* Tandon et al., 2005 in having head smooth, conical, testes ovoid, 235-340 in numbers and uterus glandular and from *Lytocestus mujumdari* Poonam, 2007 in having testes numerous, ovary bilobed and uterus saccular.

The present worm differs from the *Lytocestus follicularae*, Bhure, 2008 in having Head is differentiated, smooth, unarmed, testes large 400-500 in number. Cirrus pouch is oval, ovary is Bilobed, 'H' shaped. Uterus is saccular and vitellaria are follicular, in 2-3 rows.

The present parasite differs from the *Lytocestus osmanabadensis*, Bhure, 2008 in having body is elongated, and head is blunt, unarmed, testes large 300-350 in number. Cirrus pouch is small, oval and transversely placed, ovary is Bilobed, 'V' shaped. Uterus is saccular and vitellaria are follicular, in 2-3 rows.

In above aforesaid discussion on the present parasite deserves status of a new species and named *Lytocestus niraensis* sp. nov. after the name of river Nira which passes through Baramati Tehsil.

Taxonomic Summary

Genus	- *Lytocestus* Cohn, 1908
Species	- *Lytocestus niraensis* sp. nov. (Plate 5)
Type host	- *Heteropneustes fossilis* (Bloch, 1794)
Habitat (Site)	- Intestine
Type locality	- Nira river, Baramati, Maharashtra
Date of collection	- December 2009 to January 2010.
Etymology	- Named after the name of River from Baramati region.

Cotyloda Wardle, McLeod and Radinovsky, 1974.
Caryophyllidea Benden in Olsson, 1893.
Lytocestidae Wardle and McLeod, 1952. (Sub family Lytocestinae, Hunter 1927)
Lytocestus Cohn, 1908.

On a new species of *Lytocestus (Cohn, 1908)* from a fresh water cat fish *Clarias batrachus* (Linneus, 1758) at Baramati region of Pune District.

Lytocestus baramatiensis sp. nov. (Plate 6)

Introduction

The genus *Lytocestus* was erected for the cestodes from the siluroid host, *Clarias fuscus,* from Hongkong. The 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 *Lytocestus adherens* Cohn, 1908, several species have been added to date. This genus was first confirmed by Woodland in 1923 and 1924 by including two more species in addition to the type species i.e. *Lytocestus filiformes*, in *Mormynus caschive* (in 1923) and *Lytocestus chalmersius*, (in 1924) later on, *Lytocestus cunningtoni* (Fuhrmann and Baer, 1925) and *Lytocestus indicus* Moghe, (1925:a) (Syn. *Caryophyllaeces indicus*) was recorded from *Clarias batrachus* in India (1925:b). Record of same species was also reported from *Clarias magur* by Mehra, 1930 and in India. Hunter, 1927 placed the genus in sub-family Lytocestinae and retained three species i.e. *Lytocestus adhaerens*, *Lytocestus filiformis* and *Lytocestus indicus.* He put the species *Lytocestus cunningtoni* and *Lytocestus chalmersius* in the genus *Monobothrioides*. Wardle and McLeod, 1952 followed Hunter's classification but raised the status of Lytocestinae from Sub family to family. Furtado, 1963 *Lytocestus parvulus* from a Malayan cat fish. Wardle, McLeod and Radinovsky, 1974 suggested a new system of classification of cestodes, which used the term Cotyloda as a class and order Caryophyllidea is kept in this class. Subsequent work of Gupta, 1961 adhered to these changes. Mackiewiez, 1972 included the species *Lytocestus javanicus* (Bovien, 1926). Furtado, 1963 and Lynsdale, 1950 considered *Lytocestus alestesi* as Syn. of *Lytocestus barmanicus,* But Mackiewiez J.S. 1962 after examination of original material *Lytocestus alestesi (*Lynsdale, 1956) concluded that it should be considered as *Lytocestus filiformis* (Woodland, 1923). Rama Devi, 1973 described *Lytocestus longicollis* from *Clarias batrachus* in India.

Later on Shinde, 1988 erected *Lytocestus marathwadensis* from C*larias batrachus* from India. Jadhav and Gavhane, 1991 added two species to this genus i.e. *Lytocestus alii* and *Lytocestus clariasae* from *Clarias batrachus. Lytocestus naldurgensis* erected by Kadam et al., 1998 in *Clarias batrachus. Lytocestus teranaensis* was erected in 1999 by Shinde from *Wallago attu*. Jadhav et al., 2002 added *Lytocestus govindae* from *Clarias batrachus*. Tandom et al., 2005 erected four new species *Lytocestus clariae, Lytocestus allenuateus*, *Lytocestus assamensis* in *Clarias batrachus* and *Lytocestus heteropneustii* in *Heteropneusteus fossils*. Lastly Poonam, 2007 added *Lytocestus mujumdari* from *Clarias batrachus.*

Materials and Methods

A total of One Hundred and Fifteen samples of four fish species collected with hoop net, two-man seines, fyke net and gill net namely, *Clarias batrachus* (n=30), *Heteropneustes fossilis* (n=25), *Tilapia mossambica* (n=35) and *Wallago attu* (n=25) were collected in October, 2009 to January 2010, from the different sources and regions of the Baramati Tehsil. An attempt was made to collect nearly an equal size of fishes of which most them were small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Thirty Six (36) species of the cestode parasites was collected from the intestine of the fresh water catfish *Clarias batrachus* (Linneus, 1758).

The examinations were made with a binocular stereoscopic microscope. When possible, helminths were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996)

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

The total of Thirty Six (36) mature specimens of the collected cestode parasites from *Clarias batrachus* (Linneus, 1758) *Lytocestus baramatiensis* sp. nov. are long, elongated, and single segmented; tapering at both ends and measures about 32mm (31-33mm) in length and 2.6mm (1.7-3.2mm) in width. The head is long, measures about 2.2mm (1.7-2.7mm) in length and 1.3mm (1.0-2.2mm) in width. The testes are large, oval to round, having testicular follicles, 300-340 in number, pre-ovarian, scattered in central medulla and measures about 0.130mm (0.080-0.160mm) in length and 0.177mm (0.143-0.212mm) in width. The cirrus pouch is large, elongated, pre-ovarian, transversely placed and measures 0.658mm (0.605-0.712mm) in length and 0.310mm (0.176-0.444mm) in width. The cirrus is thin, straight within cirrus pouch and measures about 0.649mm (0.605-0.694mm) in length and 0.033mm (0.015-0.051mm) in width. The vas deferens is thin, short tube and measures 0.165mm (0.138-0.192mm) in length and 0.051mm (0.033-0.069mm) in width. The vagina and cirrus pouch open a common pore known as genital pore, which is small, oval and measures 0.096mm (0.069 -0.123mm) in length and 0.053mm (0.035-0.071mm) in width.

The vagina is long, thin tube, starts from genital pore and runs posterior to cirrus pouch, forms receptaculum seminis and measures 2.408mm (2.373-2.444mm) in length and 0.042mm (0.032-0.052mm) in width. The receptaculum seminis is thin tube, it open into the ootype and measures 0.926mm (0.908-0.944mm) in length and 0.060mm (0.051-0.069mm) in width. The ootype is small, rounded and measures 0.087mm in diameter. From the ootype ovarian lobes start. The ovary is bilobed, 'V' shaped, situated near the posterior region of the worm and measures 2.319 (1.961-2.675mm) in length and 0.336mm (0.263-0.407mm) in width.

The uterus is saccular, diverticular, filled with numerous eggs and measures 2.608mm (2.509-2.705mm) in length and 0.683mm (0.353-1.013) in width. The eggs are non-operculated, oval in shape and measures 0.069 in diameter. The vitellaria are follicular, arranged in two rows.

Result and Discussion

Cohn established the genus Lytocestus in 1908 with its type species *Lytocestus adhaerens* from *Clarias fuscus* at Hong-Kong. The present worm collected from *Clarias batrachus* closer to all the known species of the genus *Lytocestus* Cohn, 1908 in general topography of organs, but differs due to having head undifferentiated from body, cirrus pouch strongly muscular, ovary bilobed, uterus looped, and vitellaria are granular. This worm differs from *Lytocestus filiformis*

Woodland, 1923 in having testes numerous, large, rounded, in central medulla, ovary bilobed, containing 6-11 large follicles, cirrus pouch small, uterus convoluted, tubular, pre-ovarian and reported from *Mormyrus caschive*, in Sudan. It is differs from *Lytocestus indicus* Moghe, 1925 in having head bluntly rounded, testes 230-270 in numbers, cirrus pouch small, ovary with numerous follicles and uterus is thick. This cestode differs from *Lytocestus biramanicus* Lynsdale, 1956, in having testes medullary, extend up to genital pores, ovary wing like, with numerous follicles, cirrus pouch medullary in position, uterus consist of number of loose cells and reported from *Clarias batrachus,* in Burma. This tapeworm differs from *Lytocestus alestei,* Lynsdale, 1956 in having testes more or less spherical, ovary bilobed, and cirrus pouch small, oval in medullary region, uterus short, vitellaria extend from short distance behind most anterior and reported from *Alestes nurse*, in Sudan.

This worm is differs from *Lytocestus longicollis* Rama Devi P, 1973 in having head long, testes 105 to 140 in numbers, arranged in two layers, ovary 'H' shaped, corticular with closely packed follicles, cirrus pouch small, oval, vas deferens much convoluted and vitellaria corticular, rounded, in 1-2 rows on each lateral side, extending to anterior tip of ovary. The present cestode differs from *Lytocestus fossilis* Singh, 1975 in having head stumpy, testes numerous, cirrus pouch oval, ovary follicular, 'H' shaped, uterus compactly coiled and vitellaria granular, post ovarian. The present parasite differs from *Lytocestus marathwadensis* Shinde and Phad, 1988 in having head stumpy, testes oval, arranged in 2 or 3 rows, in central medulla, ovary 'H' shaped, uterus saccular and vitellaria small, oval, in a single row on lateral side.

The present cestode differs from *Lytocestus alii,* Jadhav and Gavhane, 1991 in having head bluntly rounded, testes 460-480 in numbers, cirrus pouch small, oval, ovary bilobed, and butterfly shaped, uterus convoluted tube and vitellaria follicular, corticular, in 5-6 rows.

The present parasite differs from *Lytocestus clariasae* Jadhav and Gavhane, 1991 in having head bluntly rounded, testes 700-750 in numbers, small, oval, cirrus pouch medium, ovary bilobed, like bunch of grapes and vitellaria follicular, arranged in 5-6 rows.

The present form differs from *Lytocestus naldurgensis* Kadam *et* al., 1998 in having head long, conical, blunt, spatulate, testes 500-600 in numbers, scattered in medullary region, cirrus pouch small, oval, vertical, obliquely placed, ovary bilobed, butterfly shaped, uterus wide, convoluted tube, vitellaria follicular, arranged in 3-4 in rows. The present parasite differs from *Lytocestus teranaensis* Kolpuke and Shinde, 1999 in having head conical, long, bluntly rounded, testes numerous, rounded, 1200-1500 in numbers, pre-ovarian, ovary bilobed, each lobe triangular, uterus convoluted tube, vitellaria follicular, smaller, oval, arranged in 4-5 rows and reported from *Wallago attu,* in India. The present form differs from *Lytocestus chalisgaonesis* Kalse and Shinde, 1999 in having head bluntly rounded, marked off from body, testes 1500-1600 in numbers, cirrus pouch elongated, pre-ovarian, ovary bilobed, each lobe triangular, uterus convoluted tube and vitellaria granular, corticular in position.

The present cestode differs from *Lytocestus govindae*, Patil and Jadhav, 2002 in having head long, testes numerous, 1425-1475 in numbers, pre-ovarian, evenly distributed, scattered in single field, cirrus pouch small, oval, obliquely placed, ovary bilobed, butterfly shaped, receptaculum seminis coiled, uterus wide, convoluted tube and vitellaria granular, corticular in position. The present worm differs from *Lytocestus batrachusae* Pawar *et* al., 2004 in having head spatulate, testes 3800-4000 in numbers, rounded, pre-ovarian, scattered centrally, ovary bilobed, butterfly shaped, uterus convoluted tube, transversely placed and vitellaria small, oval, arranged in two rows.

The present worm differs from *Lytocestus shindei* Jadhav et al., 2004 in having head long, testes 350-360 in numbers, cirrus pouch small, oval, pre-ovarian, obliquely placed, ovary butterfly shaped, uterus convoluted tube and vitellaria granular. The present parasite differs from *Lytocestus nagapurensis* Shinde et al., 2004 in having head spatulate, bluntly rounded, testes numerous, 1100-1150 in numbers, oval, scattered all over the segment, cirrus pouch medium, medullary, pre-ovarian, ovary 'H' shaped with numerous oval follicles, uterus convoluted tube and vitellaria granular. The present worm differs from *Lytocestus clariae* Tandon, 2005. in having head undifferentiated from body, testes 270-495 in numbers, oval, cirrus pouch compact, ovary 'H' shaped and uterus glandular.

The present parasite differs from *Lytocestus attenuatus* Tandon et al., 2005 in having head undifferentiated from body, testes 155-398 in numbers, cirrus pouch medullary, ovary inverted 'A' shaped and uterus glandular. The worm differs from *Lytocestus assamensis* Tandon et al., 2005 in having head undifferentiated from body, testes 266-565 in numbers, cirrus pouch prominent, ovary inverted 'A' shaped and uterus glandular. The present parasite differs from *Lytocestus heteropneustii* Tandon et al., 2005 in having head undifferentiated from body, testes 235-340 in numbers, ovary bilobed, and uterus glandular and reported from *Heteropneustes fossilis*, in India. The present worm differs from *Lytocestus mujumdari* Poonam, 2007 in having head undifferentiated from body, testes numerous, ovary large, bilobed, 'H' shaped and uterus saccular. The present parasite differs from *Lytocestus follicularae* in having head undifferentiated from body, testes 400-500 in numbers, oval, large, cirrus pouch oval, ovary bilobed, 'H' shaped, uterus saccular and vitellaria follicular, arranged in 2-3 rows.

The present parasite differs from the *Lytocestus osmanabadensis*, Bhure, 2008 in having body is elongated, head is blunt, unarmed, and testes are large 300-350 in number. Cirrus pouch is small, oval and transversely placed, ovary is Bilobed, 'V' shaped. Uterus is saccular and vitellaria are follicular, in 2-3 rows.

The present parasite also differs from the *Lytocestus niraensis* sp.nov. having body is long, head is long, well marked off from the body, unarmed, testes large 425-500 in number. Cirrus pouch is large, oval, transversely placed, ovary is Bilobed, 'H' shaped. Uterus is saccular and vitellaria are follicular, in 2-3 rows.

In above aforesaid discussion on the present parasite deserves status of a new species and named *Lytocestus baramatiensis* sp.nov.

Taxonomic Summary

Genus	- *Lytocestus* Cohn, 1908
Species	- *Lytocestus baramatiensis* sp. nov. (Plate 6)
Type host	- *Clarias batrachus* (Linneus, 1758)
Habitat (Site)	- Intestine
Type locality	- Nira river, Baramati, Maharashtra
Date of collection	- December 2009 to January 2010.
Etymology	- Named after the name of River from Baramati region.

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Eucestoda	Wardle, McLeod and Radinovsky, 1974.
Proteocephalidea	Mola, 1928.
Proteocephalidae	La Rue, 1911.
Silurotaenia	Nybelin, 1942.

On a new species of *Lytocestus* (Cohn, 1908) from a Fresh Water Fish *Mystus seenghala* (Sykes, 1839) at Baramati region of Pune District.

Silurotaenia karhawagajensis sp. nov. (Plate 7)

INTRODUCTION

The genus *Silurotaenia* was erected by Nybelin, 1942 as *Silurotaenia siluri* from *Siluris glanis*. Shinde, Deshmukh and Chincholikar, 1975 described *Silurotaenia nybelin* from *Pseudeutropius taakree*. In 1983 Shinde, added four new species to this genus i.e. *Silurotaenia macroni*, *Silurotaenia seenghala* from *Macrones seenghala* and *Silurotaenia barbusi, Silurotaenia ticto* from *Barbus ticto*. In 1989, Deshmukh and Shinde added *Silurotaenia behairvnathi*, new species to this genus. Later on Jadhav and Gavhane, 1991 added one more new species to this genus, i.e. *Silurotaenia shastri* from *Mystus seenghala.*

Materials and Methods

A total of One Hundred and Fifteen samples of Six fish species collected with hoop net, two-man seines, fyke net and gill net namely, *Clarias batrachus* (n=15), *Heteropneustes fossilis* (n=25), *Tilapia mossambica* (n=15), *Mastacembelus armatus* (n=20), *Mystus seenghala* (n=25) and *Wallago attu* (n=15) were collected in December 2009 to January 2010 from the different sources of the Baramati region. An attempt was made to collect nearly an equal number of fishes of which most were of the small and medium size. Weight and length was measured after collection of Fishes. The fishes were killed immediately before examination, since it was found that the small cestode parasites rapidly disintegrated after the death of the fish. Thirty Three species of the cestode parasites was collected from the intestine of the fresh water catfish *Mystus seenghala* (Sykes, 1839).

The examinations were made with a binocular stereoscopic microscope. When possible, cestode parasites were removed from the host and identified while in the living state. Weight and length was measured after collection of parasites. Common necropsy and parasitological techniques were used to isolate the parasites. Parasites were preserved in 4% formalin. Worms were cleared in lactophenol before identification using standard keys (Khalil, 1991, Parpena, 1996).

The mean intensity was determined by dividing the total number of collected parasites by the number of infected fish samples, while abundance was calculated by dividing the total number of collected parasites by the number of (infected and uninfected) fish samples. The dominance of a parasite species was calculated as N/N sum (where N=abundance of a parasite species and N sum = sum of the abundance of all parasite species found). All measurements are in millimeters (mm).

Observation

Twenty five specimens of cestode parasites were collected from the intestine of freshwater fish *Mystus seenghala* (Sykes, 1839) at Baramati Region of Pune districts of Maharashtra, India during the period of December 2009 to January 2010

All the cestodes are long, consisting of scolex, immature, mature and gravid proglottids and measures 40-45 mm in length and 1-5 mm in width. Scolex is well developed, distinct longer than broad, pear shaped and measures about 0.277mm (0.240-0.313mm) in length and 0.264mm (0.231-0.298mm) in breadth. The scolex bears pair of suckers, one pair on each side of scolex, overlapping with each other, oval to rounded and measures 0.078mm (0.070-0.085mm) in length and 0.063mm (0.051-0.075mm) in breadth. The rosetellum is medium, oval and measures 0.124mm (0.085-0.163mm) in length and 0.211mm (0.177-0.245mm) in breadth. Rounded rostellum is present at the anterior extremity of the scolex. Rostellum is surrounded by number of hooks, which are arranged in circle, 'V' shaped, and measures 0.017mm (0.012-0.022mm) in length and 0.008mm (0.003-0.013mm) in breadth. Neck is absent.

Mature proglottids are broader than long and measures 0.956mm (0.882-1.01mm) in length and 1.755mm (1.719-1.76mm) in breadth. The testes are small, rounded, evenly distributed all over the proglottid, 122-128 in numbers, pre-ovarian and measures 0.0022mm (0.012-0.031mm) in length and 0.021mm (0.012-0.027mm) in breadth. The cirrus pouch is oval, transversely placed and measures 0.267mm (0.250-0.284mm) in length and 0.104mm (0.085-0.124mm) in breadth. The cirrus is thin tube, within the cirrus pouch and measures 0.232mm (0.218-0.248mm) in length and 0.011mm (0.007-0.012mm) in breadth. The vas deferens is a thin tube, slightly curved, runs obliquely up to testicular field and measures 0.130mm (0.120-0.139mm) in length and 0.011mm (0.008-0.012mm) in breadth.

The vagina is thin tube, arises from posterior side of the cirrus pouch, forms receptaculum seminis and measures 0.680mm (0.672-0.694mm) in length and 0.011mm (0.008-0.013mm) in breadth. The receptaculum seminis is thin, runs transversely towards the posterior side, reaches to ootype and measures 0.432mm (0.425-0.439mm) in length and 0.022mm (0.012-0.031mm) in breadth. Vagina and cirrus pouch open through the common genital pore which is oval, marginal, irregularly alternate and measures 0.056mm (0.051-0.061mm) in length and 0.013mm (0.008-0.019mm) in breadth. The ootype is small, oval in shape and measures 0.095mm in diameter. From the ootype ovarian lobes start. The ovary is large, bilobed, located at the posterior side of the segment and measures 1.375mm (1.34-1.40mm) in length and 0.160mm (0.110-0.214mm) in breadth. The excretory canals are long tube, running across the proglottid longitudinally on both sides of the proglottid and measures 0.914mm (0.894-0.932mm) in length and 0.014mm (0.012-0.017mm) in breadth. The vitellaria are granular, arranged on either side of the proglottid, pre-ovarian, except the cirrus pouch.

Result and Discussion

The genus *Silurotaenia* was established by Nybelin, 1942 with its type species *Silurotaenia siluri.* The present cestode are comes closer to all the known species of the genus *Silurotaenia* Nybelin, 1942 in general topography of organs but differs due to some characters from following species.

The present tapeworm differs from *Silurotaenia siluri* Nybelin, 1942 in having mature proglottids almost squarish, testes 220-230 in numbers, cirrus pouch oval, genital pores just anterior to the middle of the segment, vitellaria follicular, 3-4 in rows and reported from *Siluris glanis,* in Europe. The present cestode also differs from *Silurotaenia nybelini* Shinde et al., 1975 in having scolex bluntly pointed at anterior end, mature proglottids longer than broad, testes 130-140 in numbers, genital pore placed one third from the anterior margin of the segment and reported from *Pseudeutropius taakree*, in India.

The present worm differs from *Silurotaenia macroni* Shinde et al., 1984 in having scolex long and large, mature proglottids almost squarish, testes 68 in numbers, genital pore placed in the middle position of the proglottids and reported from *Macronus seenghala*, in India. The present parasite differs from *Silurotaenia seenghala* Shinde et al., 1984 in having scolex long with deep constriction on both the sides, testes 370-390 in numbers, cirrus pouch sacular, elongated, genital pore placed one third from the anterior margin of the proglottids, vitellaria follicular and reported from *Macronus seenghala*, in India.

The present form differs from *Silurotaenia barbusi* Shinde et al., 1984 in having scolex large, mature proglottids longer than broad, testes 135-140 in numbers, cirrus pouch cylindrical and reported from *Barbus ticto*, in India.

The present cestode differs from *Silurotaenia ticto* Shinde et al., 1984 in having scolex broader at the base and tapering anteriorly, testes 575-590 in numbers, cirrus pouch large, saccular, spinose, genital pore just anterior to the middle of the segment and reported from *Barbus ticto*, in India.

The present parasite differs from *Silurotaenia behairvnathi* Deshmukh et al., 1989 in having scolex distinct, longer than broad, mature proglottids almost squarish, testes 250-260 in numbers, spherical, cirrus pouch oval, genital pore at one fourth of the proglottids and reported from *Mastacembelus armatus*, in India.

The present parasite differs from *Silurotaenia shastri* Gavhane et al., 1991 in having scolex vessel shaped, small, testes 72-78 in numbers, oval to rounded, cirrus pouch oval, narrow anteriorly and broad posteriorly, genital pore small, rounded and reported from *Macronus seenghala*, in India.

The present worm differs from *Silurotaenia raoii* Sp.Nov Bhure, et al., 2008, in having scolex Small, pear shaped, covered by spines, mature proglottids Broader than long, testes large, 125-130 in numbers, genital pore marginal, and reported from *Mystus seenghala*, in India.

From the above discussion the present parasite deserves the status of a new species and named ***Silurotaenia karhawagajensis*** sp. nov. proposed in the name of host locality.

Taxonomic Summary

Genus	- *Silurotaenia* Nybelin, 1942
Species	- *Silurotaenia karhawagajensis* sp. nov. (Plate 7)
Type host	- *Mystus seenghala* (Sykes, 1839)
Habitat (Site)	- Intestine
Type locality	- Karhawagaj, Baramati Maharashtra
Month of collection	- December 2009 to January 2010.
Etymology	- Named in locality of Host

Morphometric measurement (in mm) and some characters of known species of collected cestode parasites are given in comparative chart (Table 1 to 4)

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Part B
Diversity of Cestode Parasites

Diversity of Cestode parasites from Freshwater Fishes

Biodiversity provides the basic biotic resource that sustains the human race. This includes diversity within species, between species and of ecosystem; Biodiversity is the most significant national asset and constitutes an enduring resource for supporting the continued existence of human societies. Biodiversity is not merely a natural resource; it is an embodiment of cultural diversity and the diverse knowledge traditions of different communities across the world.

Ecological diversity is the intricate network of different species present in local ecosystem and the dynamic interplay between them. An ecosystem consists of organism from many different species living together in a region that are connected by the flow of energy, nutrient and matter that occurs as the organisms of different species interact with one another.

Parasitic diversity refers to variety and variability of different species of parasitic taxa. Parasitic diversity includes specially helminth and protozoan diversity. Helminth parasite includes cestode, trematode and nematode parasites. The study of helminthic diversity is very important in medical point of view because parasites cause some diseases to animals and humans health.

Variation is the law of nature. It occurs everywhere and moment. The variation takes place at micro levels at short space and small time period, but these becomes apparent only over a large space and big time gap. The variety and variability of organisms and ecosystems is referred to as biological diversity or biodiversity. The biological variations initiate at the micro level and become apparent at species level.

Biodiversity refers to the variety of life forms; the different plants, animals and microorganisms, the genes they contain and the ecosystem they form. This living wealth is the product of millions of years of evolutionary history. Biodiversity is usually considered at three different levels i. e. genetic diversity, species diversity and ecosystem diversity. Biodiversity in a crude way is referred to listing of species, their number and status in particular region.

The biodiversity ACT of India, which come into force from January, 2005, takes care of biosafety issues of indigenous species and GM species, but there are many lacunae in this ACT. The major attention is focused on plant species if agricultural importance, but there is little concern about other wild terrestrial and aquatic species for their safety. In the absence proper inventory of microorganisms and parasites, the law can not help to protect domestic indigenous animal species, including dying races of human species in India.

Various factors are responsible for determination of biodiversity of parasites in nature i.e. varied climate of the area, introducing new species in a particular area, habitat loss, industrialization, pollution and availability of particular host.

Zoogeographical distribution of any organism is the representation if its adjustment and adaptation to the particular surrounding, there all its biological demands are met and the organism enjoys its surrounding for the continuation of its generations. Geographical distribution is the functionally preferred area of activity by the organism on survey of literature it was found that the parasites enjoys some restricted range on a earth, Thus, an attempt is being made to study the geographical distribution of helminth parasites from freshwater fishes of Baramati region of Pune District of Maharashtra state, India.

Results and Discussion

The occurrences of cestode parasites in relation with its host species of different carnivorous fishes from Baramati region of Pune District, from January 2008 to to June 2010 are as follows.

Circumoncobothrium sindhuensis sp. nov. and ***Circumoncobothrium puneensis*** collected from the fresh water fish ***Mastacembelus armatus*** (Lecepede, 1800) are recorded from Baramati Tehsil of Pune district. (Plate 1 and 2)

Senga jadhavensis sp. nov. and ***Senga govindae*** sp. nov. collected from the fresh water fish ***Mastacembelus armatus*** (Lecepede, 1800) are recorded from Baramati Tehsil of Pune district 2010. (Plate 3 and 4)

Lytocestus niraensis sp. nov. and ***Lytocestus baramatiensis*** sp. nov. from the fresh water carnivorous fishes ***Heteropneustes fossilis*** (Bloch, 1794) and ***Clarias batrachus*** (Linneus, 1758) are recorded from Baramati Tehsil of Pune district. (Plate 5 and 6)

Silurotaenia karhawagajensis sp. nov. is recorded from the fresh water fish ***Mystus seenghala*** (Sykes, 1839) at Baramati Region of Pune districts of Maharashtra, India. (Plate 7)

Discussion

The cestode parasites of freshwater carnivorous fishes include four genera from class Cestoda. All these species are occurred various places of Baramati Tehsil, from Pune district of Maharashtra state during means distribution range are wide except some species.

All these species are differs from each other in general topography of taxonomy. The parasites belonging to the class Cestoda are highly diversified i. e. Seven (07) different species recorded from present investigations.

Kenndy C.R. (1978) explained the ecological factors i.e. distribution and environment of host, the diet and mode of feeding of host and parasites are influence the parasitic development.

Baramati is the region where, below average rainfall is occurred. The water becomes warm which is suitable for the growing of Zooplankton, some aquatic invertebrates i.e. mollusks and crustacean, these aquatic animals as a food of freshwater fishes as well as the intermediate host of many parasites. The maximum infections are occurred in the host Mastacembelus armatus. (Table A, B, C and D)

The infections are host-specific because the morphological, physiological and ecological factors affect the host specificity. The morphological factors are those which like a parasite with its host at the site of attachment. The ecological factors are such as, distribution and environment of the host, the diet and mode of feeding. These adaptations often provide important role for limiting a parasite to a particular host species, particular season. (Table A, B, C and D)

This type of results indicates the morphological, physiological and ecological factors affecting the distribution and diversity of parasites.

Reading

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Part C
Histopathology

Histopathology

Introduction

Interest in the study of host-parasite relationships has declined sharply with the development of anti-helminthic, antibiotic and chemotherapeutic treatment of parasitic diseases. The study of the interactions of potential hosts and potential parasites remains one of most interesting and important aspects of the natural sciences. It is indeed doubtful whether investigations of host-parasite interrelationships are less pertinent today from the perspective of human health.

The term 'host-parasite relationship' correctly designates an intimate interaction, or stage of interaction, between two or more distinct organisms, in which the one benefits while causing damage to the others. The study of parasites and parasitism is without an end. One could go on and on like this as the various aspects are not only important but quite interesting too. What about the host-parasite and parasite-parasite relationship as also the relationship between the definitive and intermediate hosts of the parasites.

In fishes, the mechanism of parasites establishment varied from species to species and it also depend on the stage of parasite, host tissue and environmental conditions. The physiological conditions in a gut of particular host (fishes) with regard to pH or other physiological characters may provide favourable or unfavourable site for metabolism of particular species. The nature of diet of the host have profound effect the growth of the helminth parasites, may be lacking in nutritional factor, essential for the development of parasites.

Helminths live in a hazardous environment where the parasitic movement towards gut and passage of food make the possession of an efficient form of attachment is a prerequisite for survival. Taxonomic studies reveals that the hold fast organ is beautifully developed and adapted which are help them to attach the mucosa of specific hosts where as there are other species which are having weakly developed scolex. They do not prove to reside in any particular host intestine but have a wide host spectrum; there is increasing evidence in the genus *Echinococcus* at least that such strain occur in different hosts.

Parasites when make contact with a host at cellular level, the host reacts bringing into cellular and serological reaction, which is an inflammatory reaction. It is thought that the host is able to distinguish between self and non-self material, it is not clear as to how these recognition is carried out at molecular level. Recognition must occur on or near the surface of the susceptible cells and probably it may require contact between the material and the recognizing cells. Sprent, 1963 has given an excellent account about it the onset of inflammation is characterised by local dilation of the capillaries (vasodilatation). The host-parasites relationships in case of helminth parasites result into large scale damage at the site of attachment.

As a subject of fundamental scientific interest, the area of host-parasite relationships has to be even more important with the rapid accumulation of information on the molecular bases of biological phenomena. The knowledge has been gained in the past 50 years on the chemical and physical processes which underlie and explain the structure and function of cells, tissues and organisms remains truncated, without a partial development of understanding of the interaction of these biological compartments with each other. The interrelationships of potential hosts and parasites today after in many instances the technically most feasible and conceptually most attractive possibilities and no approach to the study of the phylogeny of species or the ontogeny of individuals can ignore host-parasite biology. It goes without saying that the field remains as pertinent today as it was in the past to the student of the cultural and economic history of human communities.

The host parasite relationship has studied by Nadakal et al., 1974 in *Raillietina, Amoebotaenia indiana* by Mitra and Shinde, 1980; *Hymenolepis nana* by Bailey, 1951; Niyogi and Agrawal, 1989 studied the intestinal pathology of fresh water fishes.

A successful parasite usually does not cause death to the host must cause diseases and the same time produce a low degree immunity so that the host become susceptible to the same infection over and over again. The researchers not yet area of host-parasite relationships will become more aware of the special approaches, difficulties and challenges which characterize this field.

Material and Methods

For the histopathological study, different types of freshwater fishes were dissected to observe the rate of infection. Some fishes were found to be infected and some normal. Both infected and normal hosts intestine were dissected and fixed in Bouin's fluid to study histopathological changes. The fixative inhibits the post mortem changes of the tissues. Then tissues were washed, dehydrated through alcoholic grades, cleared in xylene and embedded in paraffin wax (58-62°C).

The blocks were cut at 7μ and slides were stained in Eosin Haematoxylin double staining method. Best slides or sections were selected and observed under the microscope for histopathological study.

Results and Discussions

Parasitism of cestodes with their respective hosts is shown in the histopathological studies. This study is carried out with micro-technique where the sections were cut at 7μ on a rotary microtome and stained with Haematoxylene & Eosin stain.

Healthy intestine shown, healthy villi and all layers are clearly observed, where as infected intestine has been observed that the worm attached to the mucosal layer of intestine and slowly invades to the deeper layers of the host tissue. (Plate 8 to 11)

Conclusion

From above discussion it can be concluded that helminth parasites like *Senga madhavii Sp.Nov.*, *Silurotaenia raoii* Sp.Nov., are finds the nutritive material from the intestine of hosts *Mastacembelus armatus*, *Mystus seenghala*, *Channa gachua* and *Wallago attu*, which is essential for their nourishment and growth.

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Part D
Population Dynamics
&
Seasonal Variations

Population Dynamics of Cestode Parasites from Different Carnivorous Fishes

Parasitology is one of the vast and highly advanced branches of Zoology. Parasitism is undoubtedly an ecological relationship between two different populations. Noble and Noble, 1976 stated that parasitism is an association of two organisms of different species, in which one is benefited and other harmed. The organism, which is benefited, is the parasite and that which suffers, is the host.

Fish parasitic populations are known to differ, due to variation in the environment and host population (Dogiel, 1961; Wisniewski, 1958 and Kennedy, 1978). For most of the fish parasites it is difficult to know, whether differences such as the presence or absence of parasites prevalence, intensity, density and index of infections, are due to the environmental factors or due to differences in host species, composition and their density (Koskivara et. al., 1991)

Helminths are members of complex biota, an understanding of population structure and behavior has resulted in the emergence of population dynamics and community structure as major branches of animal Helminthology. Helminths are common parasites of fishes. Usually they are present in large numbers and have high species diversity.

Most of the valuable information's are also available in the field of population dynamics of helminth parasites of vertebrates from various countries like Austria, Bulgaria, France, Germany, Japan, U.K. and Russia. Among the authors, Cole, 1954; Dobson, 1961 & 1965; Dogiel et al., 1954; Johnson, 1964; Anderson, 1974; Kenddey, 1975 and Moller et al., 1995 have contributed largely to this aspect of study in the population dynamics of helminth parasites of vertebrates.

In India many workers did the study of population dynamics of helminth parasites from vertebrates. Population investigation can provide data for the predication of integrated methods to achieve the regulation of numbers of harmful parasites, because it has been stated that a single method of control or coordinated activities are of little value, since they ameliorate the infection (Kennedy, 1975,1978).

Seasonal fluctuations, locality, age, size and sex of the host also determine the parasitic community diversity and burden. Dogiel et al., 1961 stated that seasonal environmental changes of water such as temperature, pH and conductivity affect the occurrence of parasites of an aquatic host.

In the present study except the *Lytocestus spp*. the incidences are high during the period of summer seasons. Feeding activity of the host also be one of the reasons for the seasonal fluctuation of infections according to Pennuyuick(1971 a, b) the fishes were infected with large number of parasites in late winter to end of summer months, because the environmental conditions are favourable in such months. The waters are warm but not cold at that time the Zooplankton fauna may be rich, this probably corresponds to the peak in the feeding activity of the fish together with the richness in the intermediate host fauna may be the crustaceans, smaller mollusks and fish resulting in high infections. Thus the temperature and seasons play an important role in the recruitment of parasitic fauna.

Conclusion

After the analysis of data the present study can be concluded that the high infection of helminth parasites (incidence, intensity, density and index of infection) are occurred in summer seasons followed by winter where as low in monsoon season except *Lytocestus spp*. This type of results indicated that environmental factors and feeding habitat are influencing the seasonality of parasitic infection either directly or indirectly.

In the present study author try to illustrate population dynamics of some cestode parasites collected from some carnivorous fishes of Baramati Tehsil, Pune district of Maharashtra State during the study from January 2008 to July 2010 by using Table A,B,C and D.

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Noble, E. R., and G. A. Noble. (1982). *Parasitology, the biology of animal parasites*. Lea & Febiger, Philadelphia.

Polyanski (eds.). Oliver & Boyd, Edinburgh, U.K., p. 1–47.

Wisniewski WL (1958). Characterization of the parasitofauna of an eutrophic lake. *Acta Parasitol Pol* 1958 , 6**:**1-64.

Genus - *Circumoncobothrium* Shinde, 1968
Species - *Circumoncobothrium sindhuensis* sp. nov.
Type host - *Mastacembelus armatus* (Lecepede, 1800)

Genus - *Circumoncobothrium* Shinde, 1968
Species - *Circumoncobothrium puneensis* sp. nov.
Type host - *Mastacembelus armatus* (Lecepede, 1800)

Genus - *Senga* Dollfus, 1934
Species - *Senga jadhavensis* sp. nov.
Type host - *Mastacembelus armatus* (Lecepede, 1800)

Genus - *Senga* Dollfus, 1934
Species - *Senga govindae* sp. nov.
Type host - *Mastacembelus armatus* (Lecepede, 1800)

Genus - *Lytocestus* Cohn, 1908
Species - *Lytocestus niraensis* sp. nov.
Type host - *Heteropneustes fossilis* (Bloch, 1794)

Genus - *Lytocestus* Cohn, 1908
Species - *Lytocestus baramatiensis* sp. nov.
Type host - *Clarias batrachus* (Linneus, 1758)

Genus - *Silurotaenia* Nybelin, 1942
Species - *Silurotaenia karhawagajensis* sp. nov.
Type host - *Mystus seenghala* (Sykes, 1839)

Systematic List of Hosts

Host

Super Class	Pisces
Class	Telestomi
Sub-class	Actinopterygii
Order	Siluriformes
Family	Siluridae
Genus	*Wallago*
Species	***Wallago attu*** **(**Bleeker, 1851)

Super Class	Pisces
Class	Telestomi
Super order	Actinopterygii
Order	Mastacembeliformes
Family	Mastacembelidae
Genus	*Mastacembelus*
Species	***Mastacembelus armatus*** (Lacepede, 1800)

Super Class	Pisces.
Class	Telestomi
Super order	Siluriformes
Order	Siluriformes
Family	Siluridae
Genus	*Clarias*
Species	***Clarias batrachus*** (Linnaeus, 1758)

Sub-class	Pisces
Class	Telestomi
Super order	Actinopterygii
Order	Siluriformes
Family	Siluridae
Genus	*Mystus*
Species	***Mystus seenghala*** (Sykes, 1839)

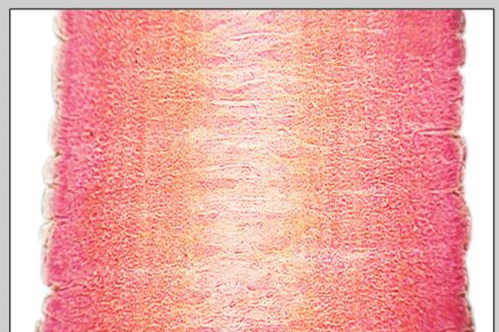
Series	Pisces
Class	Teleostomi
Subclass	Actinopterygii
Order	Cypriniformes
Genus	***Heteropneustes foosilis*** (Bloch, 1794)

PLATE - 1

***Circumoncobothrium sindhuensis* sp. nov.**

Scolex

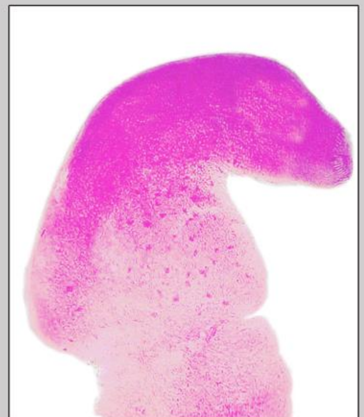
Rostellum with Hooks



Mature Proglottid

PLATE - 2

Circumoncobothrium puneensis **sp. nov.**



Scolex

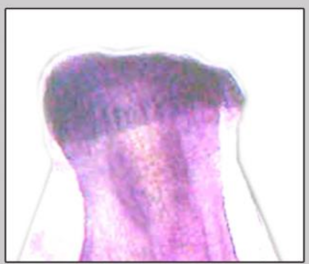
Rostellum with Hooks

Mature Proglottid

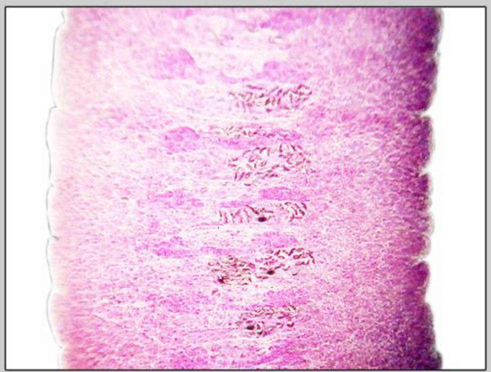
PLATE - 3

***Senga jadhavensis* sp. nov.**

Scolex



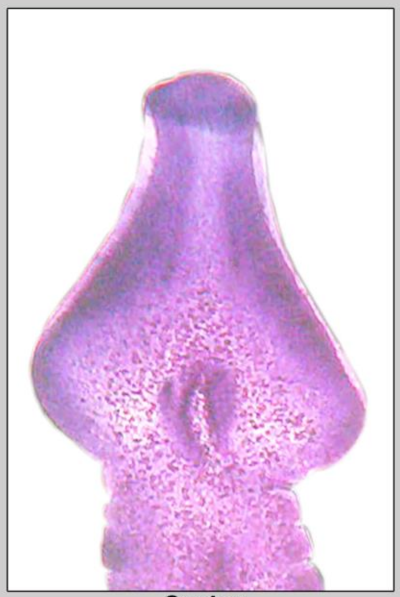
Rostellum with Hooks



Mature Proglottid

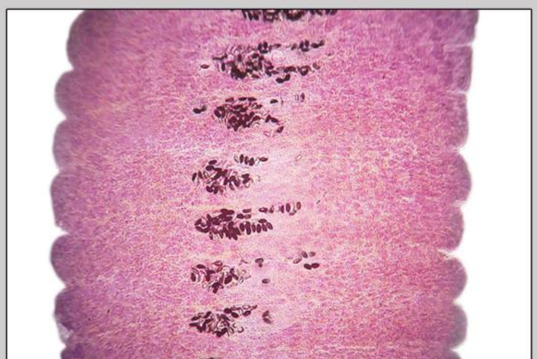
PLATE - 4

***Senga govindae* sp. nov.**



Scolex

Rostellum with Hooks

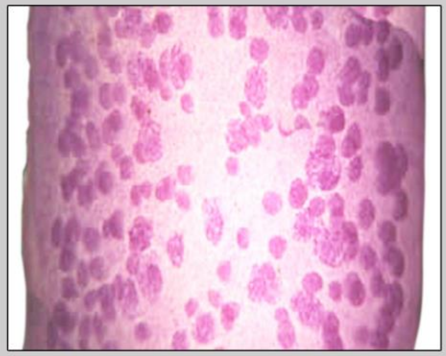


Mature Proglottid

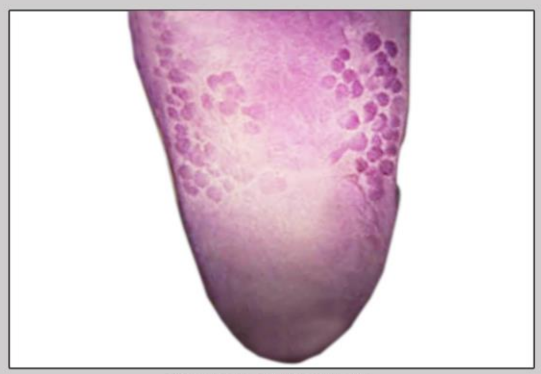
PLATE - 5

***Lytocestus niraensis* sp. nov.**

Anterior portion



Middle Portion

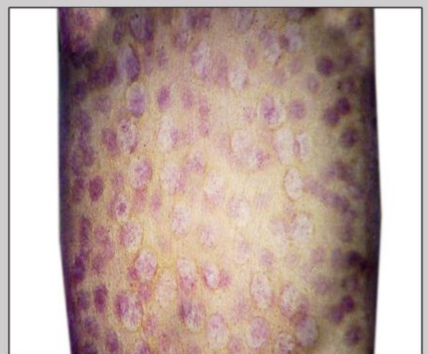


Posterior Portion

PLATE - 6

***Lytocestus baramatiensis* sp. nov.**

Anterior portion



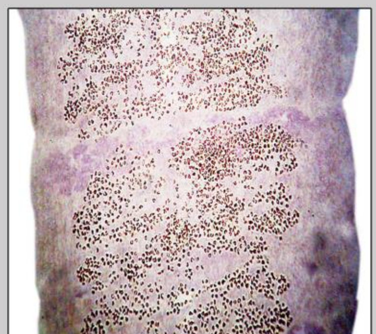
Middle Portion

Posterior Portion

PLATE - 7

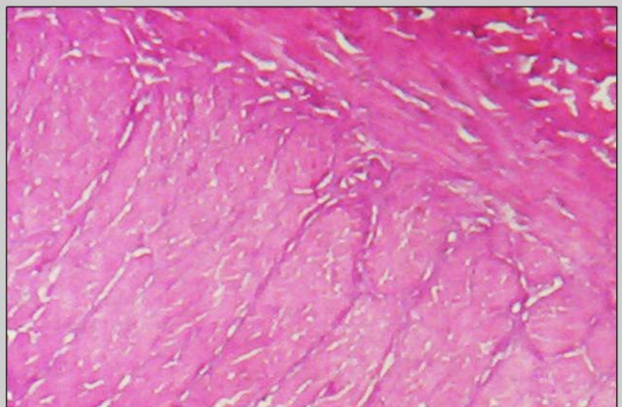
***Silurotaenia karhawagajensis* sp. nov.**

Scolex

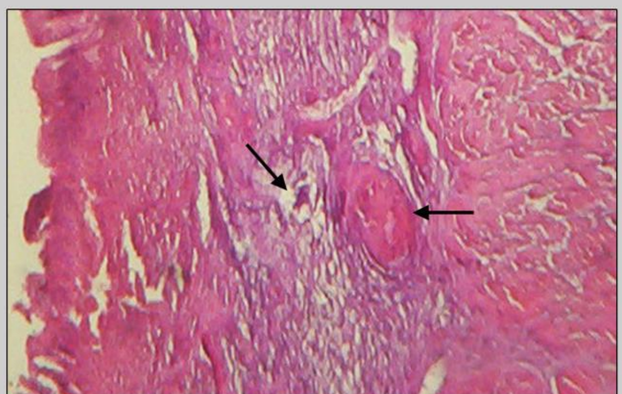


Mature Proglottids

PLATE - 8

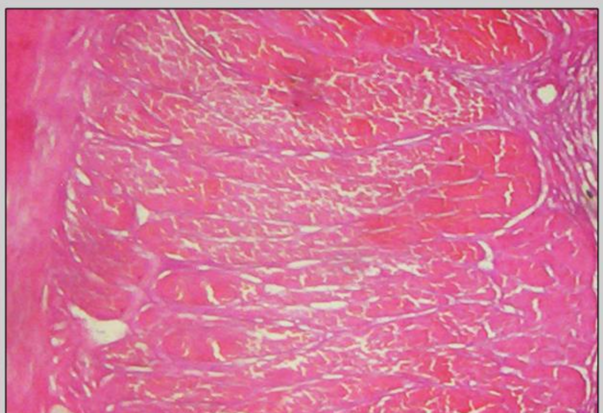


a) T.S. of normal intestine of ***Mastacembelus armatus***

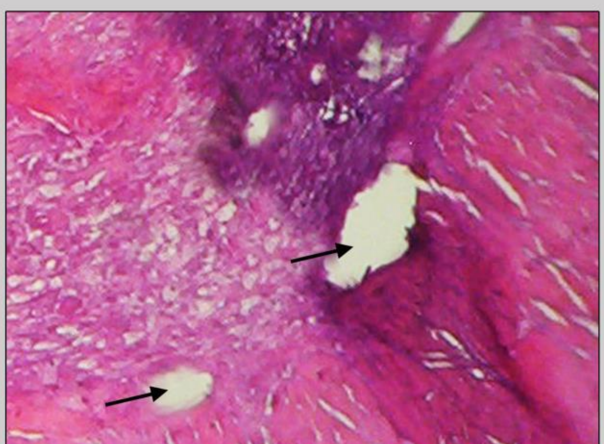


b) T.S. of infected intestine of ***Mastacembelus armatus***

PLATE - 9

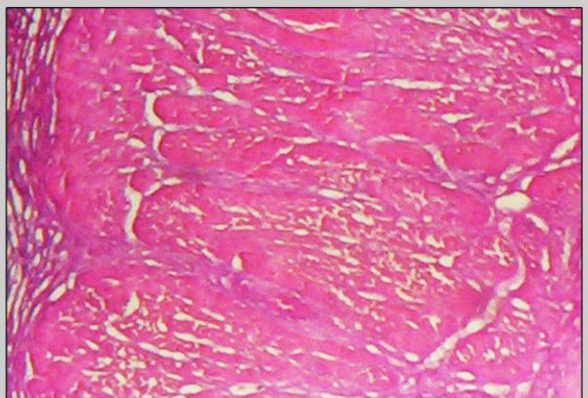


a) T.S. of normal intestine of *Claris batrachus*

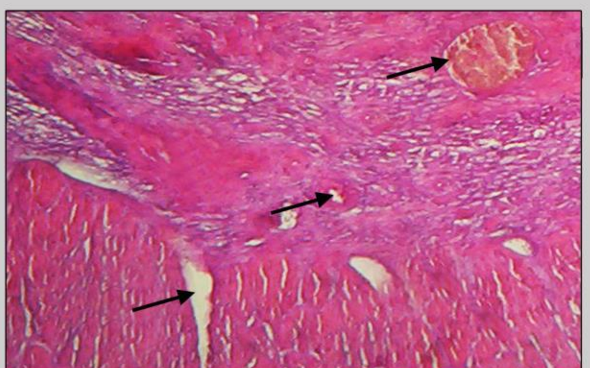


b) T.S. of infected intestine of *Claris batrachus*

PLATE - 10

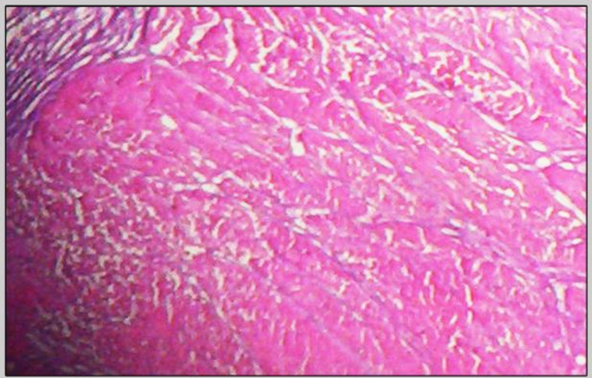


a) T.S. of normal intestine of *Mystus seenghala*

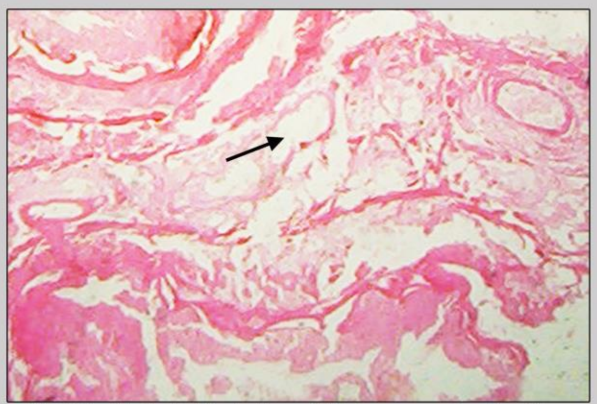


b) T.S. of infected intestine of *Mystus seenghala*

PLATE - 11



a) T.S. of normal intestine of ***Heteropneustus fossillis***



b) T.S. of infected intestine of ***Heteropneustus fossillis***

PLATE - 12

Wallago attu

Mastacembelus armatus

Clarias batrachus

PLATE - 13

Mystus seenghala

Heteropneusteus fossilis