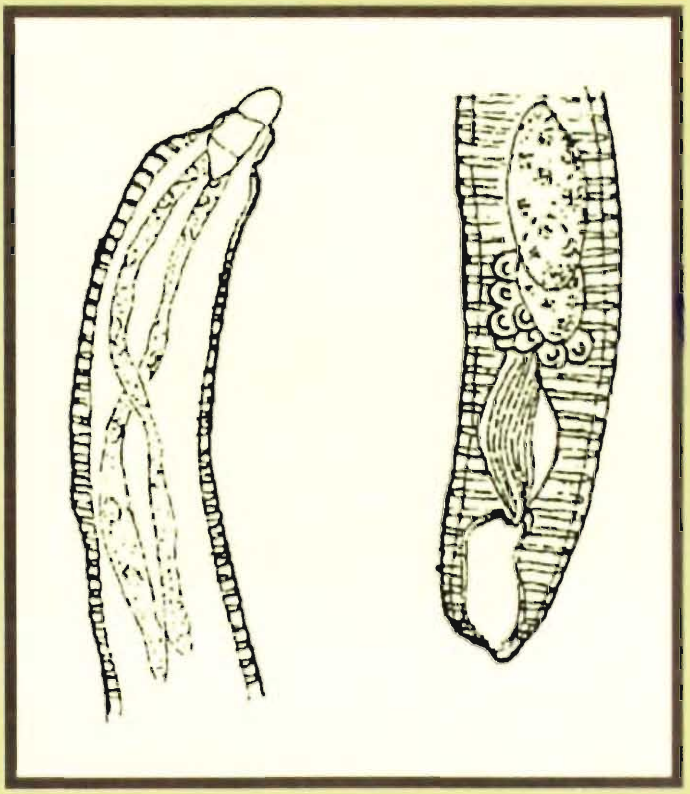
Fauna of India



ACANTHOCEPHALA

K. VANAMALA NAIDU

This book, Fauna of India : Acanthocephala by the present author is an attempt to put together all the information available in literature of Acanthocephala. Out of 1250 species known from all over the world, this work deals with 348 species of these parasites occurring in the Indian subcontinent. These 348 species belonging to 65 genera, 18 families, 8 orders, 3 classes of which description and figures are provided for 339 species. The present volume will certainly help the future workers in this field.

FAUNA OF INDIA
AND
THE ADJACENT COUNTRIES

ACANTHOCEPHALA

K. VANAMALA NAIDU

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FOREWORD

As per the objectives of the Zoological Survey of India, several group of animals were included in the earlier volumes of Fauna of India Series.

The present work by Late Dr. K. Vanamala Naidu deals with the Phylum Acanthocephala which infects the human being who eat raw and improperly cooked meat. The author made an attempt to record as many as 348 species belonging to 65 genera, 18 families, 8 orders and 3 classes. The present volume will certainly help the taxonomic researchers on Acanthocephala

December, 2011

Dr. K. Venkataraman
Director
Zoological Survey of India

FOREWORD

The present century is witnessing a perceptible decline in research in the field of Taxonomy all over the world and this has been the cause of much concern to scientists. The reasons for the crisis are many, the major one being the difficulties in getting access to the literature which is making the taxonomy research strenuous and unattractive to the youth. In particular helminth taxonomy has received lot of significance and India has produced many eminent helminth taxonomists not to speak of the number of publications dealing with descriptions of new taxa. Literature as is known is scattered and some of it published in remote journals is not readily accessible. Indeed as one working on Digenean fauna of marine fishes, personally I found it to be frustrating to get the relevant literature. To simplify the task of identification of taxa, importance should be given for publication of monographs, checklists and reviews and creation of databases on different taxa. In this context publication of this volume on Acanthocephalan fauna of India and adjacent countries is most desirable and a welcome step.

Late Sri Vanamala Naidu had conceived the idea of preparing the account on Acanthocephalan fauna and finally bringing out an excellent text. I am sure it is the combination of several years of hard work, dedication and most important the commitment that culminated in this publication. The hazards of compiling all the information to bring out a volume of this kind are well known. Sri Vanamala Naidu who wrote at the age of 85, had proved that age is not a factor for undertaking any academic work. He had put his whole mind on this work and saw that his dream is fulfilled.

I am extremely pleased and feel honoured that I have been given the opportunity to write foreword for this volume. The volume runs to over 640 pages. It is a comprehensive account compiling all the acanthocephalan species recorded from different groups of vertebrates – fishes to mammals from the Indian and adjacent regions. The author strove hard to maintain high quality through out. The text is so carefully planned and succinctly written that using this book any acanthocephalan could be identified easily up to species level with full accuracy.

Academicians, research scholars and students will find a wealth of information in this massive volume. As far as I know, this is the very first comprehensive account dealing with Acanthocephalan fauna of Indian region. Yamaguti's series on 'Systema Helminthum' published nearly half a century ago are still referred by helminth taxonomists all over the world. So also I am of the opinion, this publication will be useful to generations of researchers working on acanthocephalan taxonomy.

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PREFACE

Hitherto, there is no publication on the Acanthocephala in the Fauna of India series. To fill the void, the present author has made an earnest effort to put together all the information available in literature on the Acanthocephala. Of over 1250 species of Acanthocephala known all over the world, this work deals with 348 species of these parasites occurring in the Indian subcontinent.

Shipley (1904) was the first to record two acanthocephalan parasites, *Porrorchis rotundatus* (von Linstow, 1897) and *Macracanthorhynchus hirudinaceus* (Pallas, 1781) from Sri Lanka (Ceylon). Chandler (1925) reported single new species. Thapar (1927, 1931), Van Cleave (1928); Bhalerao (1929, 1931, 1935, 1937); Datta (1927, 1928, 1933, 1936, 1937, 1940, 1947, 1952, 1953a, b); Datta & Poddar (1935); Poddar (1937a, b, 1938, 1941); Kaw (1941, 1951); Gupta, P. V. (1950); Das (1950a, b, 1952 a, b, c, d, 1954, 1957 a, b); Sarkar (1953, 1956); Datta & Soota (1954, 1958a, b,1962, 1963); Soota (1956); Pal (1963a, b); Agarwal (1958), Tripathi (1959); Gupta, N. K. & Jain (1963, 1973, 1975, 1977, 1979 a, b, 1980 a, b, 1982, 1983, 1985), Gupta, N. K. & Lata (1963, 1968a, b, 1969); Sahay, Sinha & Narayanan (1967), Rai (1967, 1971); Fotedar (1968, 1970); Gupta, N. K. & Kajaji (1969); Sahay & Sinha (1969, 1971); Sahay, Sinha & Ghosh (1971), Srivastava & Pande (1971); Soota & Kansal (1970, 1972); Fotedar, Duda & Raina (1972); Fotedar & Dhar, (1973, 1974, 1977a, b); Gupta, N.K. & Gupta, K. (1971, 1972a, b, c), George & Nadakal (1973, 1978a, b, 1984, 1987b), Rengaraju & Das (1975, 1977, 1979, 1980, 1981); Gupta, R. C. Gupta, S. P. (1975a, b), Gupta, P.D. (1976); Gupta, S. P. & Gupta, R. C. (1977, 1979); Gupta, S. P. & Verma (1977, 1981, ?1986); Gupta, P. C. & Kumari (1978, 1988), Gupta, N. K. (1979, 1971 a, b),] Gupta, P.D. & Ghosh (1979); Jain & Gupta, N.K. (1979, 1980, 1981a, b, c, 1984); Gupta, S. P. & Naqvi (1980, 1981, 1984 a, b, 1992); Gupta, V. & Fatma (1980, 1981, 1983, 1984, 1985, 1986, 1989 a, b); Chandra, Rao & Shyamasundari ((1982 a, b, 1984, 1985, 1986, 1988); Gupta, P.C. & Kumar (1978, 1988 a, b, 1986); Chandra (1984); Duggal & Kaur, (1986a, b), Duggal, Solomon & Ambardar (1987); Chowhan, Gupta, N.K. & Khera (1987a, b, 1988); Singh, Agarwal & Lakshmi (1988), Chowhan & Khera (1988,1991), Gupta, V. & Sinha (1989, 1990, 1991 a, b, 1993), Nadakal, John & Jacob (1990), Hemkar & Ranapurkar (1991); Kumar (1992 a, b, c, d); Murugesh (1994); Koul, Raina, Bambroo & Koul (1991), Koul & Raina (!999), Arthur, Regidor & Albert (1995), Saxena (2004 a, b) reported good known number of species and number of new species and some new genera from India.

Shipley (1904), Fernandes & Furtudo (1963); Cruz & Mills (1970) and Cruz & Ching (1975) reported some already known, new species, and a new genus from Sri Lanka.

Subramanian (1927 a, b, c. 1937 a, b) added some known, new species, and a new genus from Burma.

Bilqees (1970, 1971, 1972, 1972/73, 1976); Khan & Bilqees (1984, 1985a, b, 1986, 1987, 1989, 1990, 1994, 1998); Khan, Bilqees, Noor-un-Nissa, Gazi & Ata-ur-Rahim (1999); Khan, Gazi & Bilqees (1999); Khan, Khatoon & Bilqees (2002); Khan, Khatoon & Bilqees ((2002) added some known and a number of new species and a few new genera from Pakistan.

Barus & Tenora (1976) one new species from Afghanistan.

The works of all the above researchers have resulted in reporting 348 species of the acanthocephalan parasites from this subcontinent.

To a large extent, many problems posed by the literature for the acanthocephalan parasites is due to the difficulty that the researchers in accessing the literature. In many cases they have relied heavily on Yamaguti (1963) volume on Systema Helminthum on Acanthocephala for species identification. New species often been established based on inadequate and inaccurate description and/or insufficient material of small number of specimens, or in dioceious species, specimens on only one sex, often without critical comparison with previously described species.

The introduction includes the historical account of the Acanthocephala, Anatomical section deals with External features, Functional morphology, Tegument organization, Lacunar system, Nervous system, Excretory system, Reproductive system and Physiology section with the feeding and nutrition of the group. Classification deals with the latest trends in classification. Lastly Systematic section provides the Keys to Classes, to Orders, to families, to Indian genera, to Indian species. For each species, references are cited with the author who first described the species, genus, family, class, followed by the investigators of India, Pakistan, Burma and Sri Lanka. Diagnoses are given to genera, family, order, class, and description of each species contain the length and width, colour, if any, of the parasite, shape and divisions of the body, shape of proboscis and its armature, proboscis receptacle and position of ganglion, neck where ever present, trunk with or without armature, shape and size of lemnisci and testes, number of cement glands, their reservoir and ducts, seminal vesicle, Saefftigen's pouch, copulatory bursa of male, ovary or ovarian balls and eggs, uterine bell, uterus, vagina, its sphincters, position of gonopore of female, host of the adult parasite, location of the parasite in host, locality in Indian subcontinent from which the host was collected are provided.

The new classification of Acanthocephala given by Amin (1985) is followed in this work. Nomenclature is updated as per Golvan (1994) and latest valid names of genera and species are given in this work.

Diagnoses of class, order, family, genera are after Yamaguti (1963), Schmidt, Species descriptions are after the author who first described and redescriptions by other authors. For each genus the number of species known in the world is listed as per Golvan (1994) and additions are made from the species described after 1994.

The anatomy of the typical acnthocephalan male and female (Fig. 4: A, B)) showing various organs, and diagrams of male and female genital organs (Fig. 4: C, D) showing various parts are also given, which form the guide to the organs in the figures accompanying the descriptions of species. As such the various organs in the figures are not labeled.

In the revision of Genus *Neoechinorgynchus* Stiles & Hassall. 1905 Amin (2002) invalidated a large number of species on the basis of incomplete description, if that yardstick is adopted nearly half the number of species presented in this work has to be invalidated.

This work lists 348 species of Acanthocephala reported from this subcontinent, belonging to 65 genera, 18 families, 8 orders, 3 classes, of which descriptions and figures are provided for 339 species, and for rest of 9 species descriptions and figures, could not be given for want of literature.

Acanthocephalan infection of humans is very rare. Those who eat raw and improperly cooked meat and raw insects are infected by larvae of Acanthocephala Schmidt (1971) reported some of the infections in man. First report of thorny-headed worm *Macracanthorhynchus hirudinaceus* was from a child in Paraguay reported by Lambl (1859). Goeza (1921) recorded eggs of *M. hirudinaceus* in two of 1,236 human stools. *Moniliformis moniliformis* a parasite of rats and cockroaches, was reported from man Italy, Sudan and British Honduras by Faust and Russel (1957). Beck (1959) reported it from a patient in Florida, U, S. A. Calandruccio voluntarily infected himself with *M. moniliformis* and the symptoms displayed by him were reported by Grassi and Calandruccio (1958). Kuntz reported acanthocephalan eggs possibly those of *M. moniliformis* from stools if two children in Dacca, Bangladesh. An interesting discovery of acanthocephalan eggs in human coprolites obtained from archeological excavations in Dunger, Uatah, U. S. A. by Moore, Fry and Englert (1969). Radioactive dating placed the samples at 1800 B. C. The authors suggested that the parasite may be *Moniliformis clarki* which is common in the cave. *Acanthocephala rauschiis reported* from the peritoneum of an Eskimo in Alaska by Golvan (1969). Male *Pseudacanthocephalus bufonis* was reported from the small intestine of Indonesian man, and. juvenile of *Corynosoma strumosum* found in the stool of an Eskimo at Chevac in Alaska is reported by Schmidt (1071). There is no report of acantocephalan infection of man from the Indian subcontinent.

Author

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INTRODUCTION

The Acanthocephala or thorny-headed worms constitute a distinct phylum of the animal kingdom. They number over 1000 species all over the world. They are total parasites attaining sexual maturity in the digestive tract of a vertebrate host. They have an elongated bilaterally symmetrical flattened body. In life body is slightly translucent or milky white, though sometimes the worms pick distinctive colour from the material of the lumen of the host's intestine. They are total parasites without any trace of the digestive system in any part of their life cycle. The attachment to the tissues of the host's intestine is by the highly modified hooks covered in anterior proboscis, which is the primary organ of attachment. The neck and trunk may become secondarily modified accessory organs of attachment. The external appendages and specialized sensory organs are totally absent. The body of both male and female is a cylindrical pouch for containing the internal organs, the reproductive organs etc.

The body is divisible into three morphological subdivisions, the proboscis, neck and trunk. The proboscis is the primary organ of attachment of the adult worm to the wall of the intestine of vertebrate definitive host. The neck lies immediately behind the proboscis and serves as transition from the proboscis to the trunk. The proboscis is provided with a number of sharp pointed backwardly directed hooks. It is capable of introversion within an internal sac, the proboscis receptacle, when all the hooks are withdrawn into the interior of the front part of the body with the tips of all hooks directed anteriorly in the central cavity formed by the introverted proboscis.

The trunk wall is simple in construction, bounded externally by a thin non-cellular cuticle, below which lies relatively thick fibrous hypoderm or subcuticula composed of several distinct layers, the number varying in different groups of the phylum. The syncytial subcuticula contains a series of inter-communicating spaces called lacunar system. This lacunar system commonly consists of two main longitudinal channels, either dorsal and ventral or lateral, in some instances only the dorsal channel is present. Smaller vessels, either as irregular mesh-work or in fairly regular transverse vessels, communicate with the longitudinal channels and ramify through all parts of the body wall. The lacunar system is not provided with epithelial lining. Pseudosegmentation in observed in some species, where the lateral lacunae and body wall musculature provide the pattern for the constriction which divide the trunk by repeated transverse folds. These folds are confined to the body wall and do not affect the arrangement of the internal organs. The subcuticula contains the nuclei in pattern of arrangement and numbers that are distinctive of the various orders of the phylum. The inner surfaces of the subcuticula is lined by the trunk musculature which consists of two syncytial fibrous layers, an external layer of circular fibres and internal layer of longitudinal fibres, forming the lining of the pseudocoel.

The pseudocoel of the trunk holds all the internal organs, the proboscis receptacle, musculature for retracting the proboscis, neck and the lemnisci in the anterior part of

trunk, and the reproductive organs in the posterior part of the trunk, enclosed in an axial ligament sac members of one order modified protonephridia are associated with the reproductive canals, but in most others specialized excretory organs are absent.

The proboscis receptacle is usually attached at the posterior end of proboscis, although in some genera it joins the inner surface of the proboscis wall some distance anteriorly. Muscles known as invertors of the proboscis are inserted on the inside of the anterior tip of the proboscis and extend through the length of the proboscis and its receptacle. The brain, or the chief ganglion of the ventral nervous system, is a small mass of nervous tissue located within the cavity of the proboscis receptacle, from which delicate main trunks, but two of them the retinacula, have muscle fibres associated with them and pass through the wall of the receptacle to inervate the body wall. Genital ganglion is small associated with the copulatory apparatus of the male, situated near the posterior end of the trunk. At the posterior end of the receptacle, or in some cases through the cleft in the ventral wall of the receptacle, the invertor muscles leave the receptacle and pass into the body cavity, where they continue for some distance, one attach itself to dorsal wall and the other to the ventral wall of the trunk. The contraction of the anterior part of these longitudinal fibres introvert the anterior tip of the proboscis while contraction of the posterior part of the same fibres withdraws the entire receptacle more deeply within the body cavity. A sheet of muscles attached to the neck causes the neck to be tucked in and folded around the base of the proboscis when contracted. The neck retractors are intimately associated with the pair of long, tubular or flat, ribbon-shaped, or short, broadly flattened organs, the lemnisci. Lemnisci are outgrowths of the subcuticula of the neck, extending backwards in the body cavity.

The reproductive system of male consists of a pair of testes, and specialized cement glands of various cytological constitution in different classes of the phylum. Both testes and cement glands discharge their secretions through their ducts through the penis which is surrounded by the bell-shaped copulatory bursa. Bursa is normally lies introverted in posterior part of the trunk, but during copulation it is extruded and applied to the posterior tip of the female worm, where it is held securely in position by the secretion of the cement glands, which forms the hardened resistant copulatory cap, which is an internal cast of the bursa that remains attached to the genital pore of the female for sometime.

The reproductive system of the female is peculiar in that the ovary fragments into a large number of free-floating ovarian balls. As the ova leave the ovarian balls fertilisation takes place. The fertilized eggs acquire a series of external membranes. Once the ova are all fertilised the individual female is at the end of the reproductive cycle, since additional eggs cannot be produced. The fertilised eggs are retained in the body of the female until they are fully embryonated. The persistent part of female reproductive system consists of uterine bell, uterus and vagina. The uterine bell opens into the body cavity or into one of the pair of ligament sacs holding the embryonated eggs. Uterine bell with its guard cells, the selective apparatus, opens into the uterus, this in turn opens into the vagina with a muscular sphincter. The immature eggs directed into the uterine bell by the contractions

of the bell, are by-passed through special openings in the walls of the selective apparatus and returned to the body cavity or the ligament sac. Fully embryonated eggs are passed down the uterus and are eliminated through the vaginal sphincter to the outside.

All Acanthocephala are completely dependant upon the parasitic mode of existence that there is no single exception to this rule which states that no member of the phylum exists in nature as a free living organism even for a short duration. The hard-shelled eggs never hatches normally as an acanthor until it is swallowed by a suitable arthropod which, so far as is known, is always the first intermediate host. Within the arthropod the acanthor undergoes metamorphosis to a more advanced sereis of stages known as acanthella, in which rudiments of the organs of the adult make their appearance. The juvenile worm, with all its organs blocked out, becomes encysted as an infective larva or cystacanth either in an arthropod or in some other intermediate host.

In the least complicated life cycle, the final vertebrate host invariably acquires its burden of larval Acanthocephala by eating the infected arthropod hosts. The life cycle may be prolonged and complicated by the introduction of one or more additional intermediate hosts between first intermediate host and final vertebrate definitive host. The second, and sometimes a third intermediate host may be any suitable invertebrate or vertebrate in which the infective acanthocephalan larva can become established in a visceral cyst (cystacanth). The newly acquired host must feed on the earlier intermediate host and in turn must serve as a food element for a later intermediate host or for the definitive host. There is no means, other than through food chains, for the parasite to gain entrance into each successive host. Hence the habitat and feeding habits of each species of the vertebrate largely determine the susceptibility of that species to the acanthocephalan infection and at the same time these factors control the intensity of the individual infection of any host.

Although the phylum Acanthocephala is world wide in its geographical distribution, but its genera and species are not of uniform distribution as certain species are practically cosmopolitan while others genera and species are rigidly confined to a limited area. The limitation is never the direct effect of the external physical environment on the parasite. The external physical surroundings may directly restrict the distribution of one or more of the essential hosts of the acanthocephalan. The physiological adaptation between the parasite and the host, whose body provides the environment of the worm often furnishes obstacles to the worm becoming safely established in any animal other than its natural hosts. Although host specificity is fairly well established for some species of Acanthocephala, other species have relatively wide range of host tolerance, but never does the same species occur as normal adult in both cold blooded and warm-blooded definitive hosts. In a few instances where this rule seems to be violated there is evidence that one of the hosts is the result of occidental infection and that parasites are unable to reach full sexual maturity in it.

Majority of the acanthocephalans are parasitic in the fishes than in any other vertebrates. This has led to belief that they were parasites of fishes before the other fish eating vertebrate groups were parasitised. Many highly specialized species occur chiefly in birds and mammals but some of the more generalized families have become secondarily established

in birds and mammals. This may be explained by the fact that some birds and mammals have become closely associated ecologically, with the lower vertebrates in the aquatic habitat. The largest number of species the vertebrate hosts are the fishes followed by birds, mammals, amphibians and reptiles. The evolution that has taken place or subfamily to limit the host relations, there is no sharp discrimination between parasites of birds and mammals. Among the Paleacanthocephala, the subfamily has the genera *Polymorphus*, *Arhythmorhynchus* and *Filicollis* which normally occur exclusively in birds, the genus *Bolbosoma* in the mammals only and the genus *Corynosoma* which has some species normally found in mammals only and others which are rigidly restricted to birds. Likewise within the Archiacanthocephala a corresponding diversification of host relations is reflected within the family Gigantorhynchidae wherein the genus *Gigantorhynchus* is strictly a mammalian parasite while the species of *Mediorhynchus* invariably occurs in birds.

HISTORICAL ACCOUNT

The first recognized account of an acanthocephalan worm was described by Redi (1684) as worm with head having proboscis armed with hooks from the intestine of an eel. Later von Leewenhoek (1695) described and illustrated the two kinds ofacanthocephalans from the intestine of an eel. Leewenhoek's first record included a drawing of a proboscis which was regarded by Meyer (1932) as that of *Acanthocephalus anguillae* and by Lühe (1904) as *Acanthocephalus lucii.* Formal binominal names were not used by Leewenhoek and earlier observers of the acanthocephalans, although binominal names were included in the work of Le Clerc (1715) before the tenth edition of Linnaeus' Syatema Naturae. The existence of distinct genera and species of Acanthocephala was not recognized until the thirteenth edition of Systema Naturae edited by Gmelin between 1788 and 1793, when the generic name *Echynorhynchus,* appeared. This name was first proposed in 1766 by Zoega & Müller (in Müller (1766) for a form (from a fish) similar to the one previously described by Koelreuther (1771) as Acanthocephalus. In fact, Koelreuther was probably the first worker to realize that the Acanthocephala were a distinct group of helminthes which he named 'Acanthocephali' During this period Pallas in 1760, 1766, 1781, described parasitic worms under various names from fish, frogs and mammals, which proved to be Acanthocephala. Pallas was also the first to describe the highly pathogenic parasite of pigs as *Taenia hirudinacea*, which were later recognizes as *Macracantorhynchus hirudinaceus.* He was also the first to draw attention to the distinguishing organs, the lemnisci of the Acanthocephala. While studying the worm parasites of fish, Koelreuther (1771) was the first to establish the specific organization of Acanthocephala. He described their morphology and gave the generic name *Acanthocephalus,* which proved to besuitable that it was accepted as the name to the entire class of worms.

Müller (1776) also described Acanthocephala from the intestine of fish, an apparently unaware of the works of Koelreuther, gave them the generic name *Echinorhynchus.* By the end of 18th and beginning of 19th century saw intense study of parasitic worms including Acanthocephala. Many new species of Acanthocephala in the works of Goeze (1788), Zeder

(1800), Schrank (1782), Tilsius (1810), and in particular Rudolphi (1793-1819) were described and attempts were made to systematiże them. Bremser (1811) in his monograph indicated the existence of 52 species of Acanthocephala which included 31 species he described for the first time. These "new" species cannot be regarded as true species, as Bremser classified each worm found in different host species. It later turned out except two species to be true species and all others turned out to be synonyms. But importance should be given to the fact that Bremser indicated 122 species of vertebrates hosts of Acanthocephala. Zeder (1803) gave these worms the common name 'Hakenwurmer' (hooked worms).

Randolphi (1802, 1809) renamed them the 'Acanthocephala' (Greek: Akantho=spiny, kephala=head) and visualized the taxon having ordinal rank with single genus *Echinorhynchus*. Apparently accepting Linnaeus allocation of the Vermes as a class. Rudolphi regarded the 'Vermes acanthocephala' as an order coordinate with 'Vermes trematoda', 'Vermes cestoda' and 'Vermes nematoda,' but did not discuss the phylogenetic relationships. He divided the genus into two according to the presence or absence of body armature, and each of these he subdivided into smaller units on the basis of presence or absence of neck, etc. He regarded the shape of the proboscis as the main character for species determination. In 1819, in a comprehensive report on these worms, Rudolphi cited 53 true species with 52 synonyms of Acanthocephala.

First monograph on Acanthocephala was written by Westrumb (1821), inwhich he described their anatomy and to some extent their physiology. He also carried out an analysis of species and established a taxonomy of these helminthes. He also regarded as basic taxonomic characters the body armature, shape and arnature of proboscis, neck length, body size, shape and colour of body and considered the armature of proboscis to be the principal character. He was the first person to count the hooks on the proboscis according to numbers of transverse rows of them. In the taxonomic section of the monograph, he described 66 species of Acanthocephala with 24 synonyms. In the anatomical section, he described the musculature of proboscis receptacle, the lacunar system in the lemnisci (although he called these lacunae vessels), and the body wall of *Macracanthorhynchus hirudinaceus*, and the reproductive system of this helminth. He also expressed an opinion concerning the mechanism by which food entered the body of the parasite through a special opening at the top of proboscis, and from there through the neck and lemnisci into body, which assumption was later shown to be mistaken.

Following Westrumb's system, Diesing (1851) in his "A system of Helminths" described 88 species of Acanthocephala and 25 insufficiently studied representatives .He placed Acanthocephala together with Gregarinida in the Aprocta which he placed with the Sipunculidea. Giebel (1877) in his taxonomy of the species followed Westrumb's system and referred Acanthocephala to Protozoa. Such ideas on the systematic position of Acanthocephala were an indication of how simply the organization of these worms was treated and how different it was to understand such changes in their organization as they understood in connection with narrow specialization to parasitism in the organization of various animals.

Most early taxonomic desceiptions lacked the morphological details necessary to recognize the species from the original descriptions; host and locality information furnished the principal basis for recognition. Lühe's (1904-1905) critical reviews of early specific descriptions was an important contribution to the acanthocephalan taxonomy. Later studies were greatly aided by the foundation laid by Coquet (1824) who described lateral tubes (lacunae) of Acanthocephala and noted that ligament cavity was filled with a gelatinous mass, which Meyer (1928) established, was the product of degeneration of the primary ovaries.

Bulow (1836) described the anatomy of *Corynosoma* and established the presence of complxly arranged uterine bell, by means of which, the eggs of parasite pass out through the posterior gonopore. In this Bulow corrected the errors of previous investigators, who believed that the eggs left the body of the parasite through the opening at the top of proboscis.

Siebold (1836-1848) established the spermatozoids in *Acanthocephala lucii* and the presence of nerve ganglion in proboscis receptacle. Henle (1840) proved the existence of a special genital ganglion in *Pomphorhynchus laevis*, although he mistook this ganglion for the central nervous system.

At the end of 19th century Fredchenko made many collections of helminthes including Acanthocephala, during his expeditions to Central Asia. These collections were identified by von Linstow and the results were published in a number of his works (1883-1908). He also published the results of the study of helminthological collections from other parts of the world, viz., from Atlantic Islands of South Georgia (1890), Bismark Archpelago (1897), Madagascar (1897), South Africa (1901), Java (1908) etc. Kostylew (1925 etc.,) found that many of the identificatons of Linstow to be erroneous.

Wegener (1858) reported the presence of spines in the larvae of some acanthocephalans and their motility in the eggs, and also indicated that the larva has a mouth at its anterior end, which, however, was wrong. Weinland (1856) compared the lemnisci of the acanthocephalans with the intestine of trematodes, which was also a mistake.

Pagenstecher (1859, 1863) gave accurate descriptions with good figures of the genital glands in early stages of female Acanthocephala and of excretory genital ducts of *Pomphorhynchus laevis*. He also opined on the function of particular parts of uterine bell. He considered that the eggs were formed on the inner wall of genital ligament sac and the ligament served only as a casing for the testes.

After performing a number of anatomical-histological investigations on *Macracanthorhynchus hirudinaceus*, Schneider (1868) reported the histological structure of the body wall and certain organs.

Yarzhinski (1868-1870) investigated the structure of the nervous system of 18 species of Acanthocephala and described the structure and position of proboscis receptacle of the cephalic ganglion and the nerves proceeding from it. He also investigated the histological structure of nervous system and determined the shape of nerve cells of the parasite. His work was unknown for a long time.

Zalinski (1870) described the anatomy and development of germ cells in *Acanthocephalus lucii* and also gave detailed description of the structure of body wall and provided excellent illustrations of transverse section of the body of parasite. He also described the hypoderm with the lacunae passing inside it, and also noted that lacunae lacked walls of their own and therefore cannot be called vessels, although their physiological function consists of the movement of liquid through the body. He was also responsible for establishing that the body of Acanthocephala is divisible into two regions, which correspond to the praesoma and metasoma as they are understood today. He indicated that lemnisci were projections of the hypoderm of praesoma and described the muscles which cause contraction of lemnisci, the shape and structure of muscle fibres and cells, and also the central nerve ganglion, together with the nerves emerging from it, in the species of Acanthocephala. Zainski also described the spermatogenesis and oogenesis of Acanthocephala. Kaiser (1893) described the structure of same species, duplicating the work of Zalinski (1870).

The anatomy of Acanthocephala was the subject of several works by Linstow (1872), Andres (1878), Baltzer (1880), Saefftigen (1884), Knupffer (1888), and others. Saefftigen found the absence of genital ganglion in the female parasite and that formation of secretion of cement glands takes place by means of degeneration of changed cells. Additional information towards the understanding of uterine bell was added by Andres (1878).

Leuckart (1862, 1873, 1876), Graeff (1864), and Schneider (1871) undertook the investigations into the development cycle of Acanthocephala and established the phenomenon of change of hosts in Acanthocephala and paved the way for correct approach to understanding the mechanics of infection by these animals and by other parasites.

Hamann perceived diversity within the previously accepted uniformity in structure and was the first to propose the division of the old genus *Echinorhynchus* Müller, 1776 based on consistent differences in the construction of the proboscis and its receptacle, and the structure of the body wall into three genera *Echinorhynchus, Neorhynchus* and *Gigantorhynchus* and placed them in families Neorhynchidae and Gigantorhynchidae, and changed the diagnosis of Echinorhynchidae. Echinorhynchidae, Gigantorhynchidae and Neorhynchidae formed the conceptual basis on which more recent classification of the Acanthocephala was founded. The three major subdivisions, first regarded as orders by Meyer (1931b) and Van Cleave (1936), are essentially elevated families of Hamann.

Uncertainity about the position of the Acanthocephala among the animal phyla was not easily resolved. Leuckart (1848) postulated that the common lines of descent ran between the cestodes and Acanthocephala and considered them as the two orders of his class Anenteraeti. Voigt (1851) suggested Nemathelmia, in which he grouped the gregarines, nematodes, acathocephalans and gordiacians, was altered to Nemathelminthes by Gagenbaur (1859). Hamann drew attention to certain similarities between acanthocephalan and cestode embryos. Cholodkovsky (1897) was the first to suggest a close relationship between the embryos of Cestoda and Acanthocephala and this view was supported by Skrjabin & Ahults (1931), Petrotschenko (1952) and Van Cleave (1941b). But Meyer (1932,

1933) assembled the Rotifera, Gastrotricha, Kinorhyncha, Pripuloidea, Acanthocephala, Nematomorpha and Nematoda into the Aschelminthes.Van Cleave (1941b, 1948) concluded that the Acanthocephala had much more in common with Cestoda and Nematoda and proposed recognition of the Acanthocephala as an independent phylum.

Since Hamann's contribution (1891a, 1892, 1895) the systematics of the Acanthocephala was evolving steadily. Basing on the study of collections of Acanthocephala and literary material, Lühe (1911) radically revised their taxonomy, established several new genera and recognised the shape and armature of the proboscis, shape and armature of the body, structure of the proboscis receptacle, position of the cerebral ganglion, arrangement of the testes, shape and number of the cement glands, shape and size of the eggs, size of the lemnisci, and distribution of lacunar canals and the nuclei in the body wall, as taxonomic characteristics. Southwell & Macfie (1925) considered the Acanthocephala to be an order with three suborders in the phylum Nemathelminthes. Each suborder was essentially one of Hamann's (1892) families. They recognized the importance of the proboscis receptacle, cement glands and subcuticular nuclei, but did not always apply these characters critically at the family and suborder levels. Their three suborders were later elevated by Faust (1919) to ordinal rank with new names proposed for each.

Marval (1905) published a monograph specially devoted to the Acanthocephala of birds, but he committed serious errors in the differentiation of species and thus brought confusion to the taxonomy of these parasites.

A great contribution to the knowledge of Acanthocephala and the elaboration of their taxonomy was made by Lühe (1911), Kostylew (1912, 1916), and a series of subsequent works, Skrjabin (1913).

Kostylew (1912) in his large work described in detail the anatomy of several species of Acanthocephala, viz., *Centrorhynchus aluconis*, *C. lancea*, *Mediorhynchus micracanthus*, *Acanthocephalus anguillae*, *Empodius taeniatus*, and illustrated these descriptions with 23 figures. Later Kostylew (1916) compiled a catalogue of species of Acanthocephala occurring in U.S.S.R., in which he gave descriptions of about 25 species, diagnoses of genera, and keys to species. Skrjabin (1913) described Acanthocephala of aquatic and palustrine birds of Kazakhstan, describing three new species, *Polymorphus magnus*, *P. corynoides* and *Mediorhynchus empodius.*

Bullock (1969) expanded the characterization of the Meyer-Van Cleave concept of taxa, Eoacanthocephala, Paleacanthocephala and Archiacanthocephala to include such features as the body size, the host habitat, the distribution of the main longitudinal channels of the lacunar system, number of cement glands, embryonic membranes, acanthor spination, presence or absence of protonephridia, trunk spination, and nature of intermediate hosts. This arrangement is now widely accepted.

The works of Lühe, Kostylew and Skrjabin laid the foundation for a taxonomy of Acanthocephala. In a series of works on these parasites Kostylew described several new genera and species, explaining their fauna in various animals in many regions of the

U.S.S.R. Beginning in 1913, Van Cleave in numerous works, described many new forms of these helminthes, expressed opinions on the principles of their taxonomy, and in this connection solved a number of principal problems, viz., the distribution of hooks on the proboscis and the method of counting them (1930), establishment of new order of Acanthocephala (1936), naming of the larval stages of these parasites (1937) etc.

Travassos from 1921-1926, added a number of new species of Acanthocephala from Brazil, and produced a scheme of taxonomy which included four families, Neoechinorhynchidae with six genera in two subfamilies, Neoecinorhynchinae and Quadrigyrinae; Echinorhynchidea with 12 genera in two subfamilies, Echinorhynchinae and Centrorhynchinae; Rhadinorhynchidae with six genera; and Gigantorhynchidea with 11 genera in three subfamilies, Gigantorhynchinae, Moniliforminae and Prosthenorchinae. His system was based on insufficiently constant characters, resulting in the misplacement of certain genera. A year later Thapar (1927) proposed another scheme which included three orders, Echinorhynchidea with 15 genera in two families, Echinorhynchidae and Oligacanthorhynchidae; Acanthogyridea with 15 genera in two families, Acanthogyridae and Gigantorhynchidae; and Apororhynchidea with single genus in one family, Apororhynchidae. This scheme was not generally accepted because it misinterpreted trunk spination and was still open to some of the objections to Travassos (1926) classification. Like Thapar, Witenberg (1933a, b) recognized three orders, two of which he accredited to Southwell & Macfie while accepting the third from Thapar. Meyer (1931b, 1932, 1933) proposed a scheme in which the Acanthocephala were regarded as a class of the Aschelminthes and were divided into two orders, Paleacanthocephala and Archiacanthocephala, on the basis of morphology and ontogeny. Meyer attached importance not only to the lacunar system, the presence or absence of protonephridia, the arrangement of proboscis hooks, and the nature of female ligament sacs, but also to those features which now described as epizootiology. He considered the position of the main longitudinal channels of the lacunar system to be of prime importance; the Archiacanthocephala having either dorsal and ventral or dorsal channel and the Paleacanthocephala having a pair of lateral channels. In 1932, Meyer divided the 12 families and 58 genera that had been reported up to that time into two new orders.

Meyer's system required exceptions to accommodate some genera and families. Van Cleave (1936) removed some of the inconsistencies in Meyer's system by the establishment of a third order, the Eoacanthocephala, on the basis of giant subcuticular nuclei, a single syncytial cement gland and a single-walled proboscis receptacle. Van Cleave further divided the phylum into two classes and four orders, Class Metacanthocephala with orders Paleacanthocephala and Archiacanthocephala, and class Eoacanthocephala with orders Gyracanthocephala and Neoacanthocephala.

Petrotschenko in his publications from 1949-1959, added a number of new species from Russia, elucidated phylogenetic connection of Acanthocephala with other groups of invertebrates and provided a monograph on the Acanthocephala of domestic and wild animals. Petrotschenko (1956) devised a system based on acanthot spination in which the

Acanthocephala are divided into three subclasses, Neoechinorhynchinea, Echinorhynchinea and Gigantorhynchinea. Like Meyer (1933) and Van Cleave (1941 b), Petrotschenko regarded the Neoechinorhynchinea as the most primitive group; he based this view on the absence of acanthor spines, the small proboscis, with few hooks, the single-walled proboscis receptacle, the syncytial cement gland, the giant subcuticular nuclei and more primitive intermediate hosts.

Golvan (1959a, 1960, 1961, 1962, 1969) drew attention to the Meyer-Van Cleave system of classification, considered Paleacanthocephala, Archiacanthocephala and Eoacanthocephala as classes. He has placed too much importance on the number of cement glands and for inconsistent use of trunk spination in his classification. Yamaguti (1963) divided the Acanthocephala into four orders, Neoechinorhynchidea, Echinorhynchidea, Gigantorhynchidea, which are essentially Petrotschenko's subclasses, and the new order Apororhynchudea. The first three orders roughly correspond to the Paleacanthocephala, Archiacanthocephala and Eoacanthoicephala of the Meyer-Van Cleave system of classification.

Bullock (1969) expanded the characterization of the Meyer-Van Cleave concept of taxa, Eoacanthocephala, Paleacanthocephala and Archiacanthocephala to include such features as the body size, the host habitat, the distribution of the main longitudinal channels of the lacunar system, number of cement glands, embryonic membranes, acanthor spination, presence or absence of protonephridia, trunk spination, and nature of intermediate hosts. This arrangement is now widely accepted.

ANATOMICAL SECTION

External features : Acanthocephala are usually white to cream in colour, occasionally slight yellow to orange, with cylindrical or slightly flattened body. Worms of most species are not more than 10 mm long, but some may reach a length of 700 mm. Smallest forms are the representatives of family Neoechinorhynchidae and largest forms are from families Gigantorhynchidae and Oligacanthorhynchidae. Externally they have several prominent distinguishing characters: an invaginable and retractile proboscis with rows of recurved hooks, body wall folds and, posteriorly a copulatory bursa in male and gonopore in female. Externally proboscis has radial symmetry, with ists hooks arranged in longitudinal rows or in spiral rows (Van Cleave, 1961). Hooks with roots and spines without roots may be present on any part of trunk surface. Proboscis is connected to trunk by a short neck.

Functionally body is divisible into two major regions, praesoma comprising of proboscis, proboscis receptacle, ganglion, neck and lemnisci and various muscles, and metasoma comprising of trunk its body wall enclosing the body cavity, the pseudocoel containing ligament sacs, sex organs, excretory organs when present, genital ganglia in the male. Shape of proboscis, a characteristic feature of particular species of Acanthocephala and the higher systematic categories, is circular or spherical, oval, ovoid, cylindrical, or conical with various modifications and transitions. The size of proboscis is more or less constant

for a particular species, and proboscis shape, is of great taxonomic significance. Proboscis is responsible for attachment of the worm to intestinal mucosa of host. Except for a small area of neck in some species, the body wall covers the outer surface of entire worm. Pervading the entire body wall is a set of channels of lacunar system, which is organized differently in three classes of Acanthocephala.

FUNCTIONAL MORPHOLOGY

Hooks and spines : Hooks are an important taxonomic character for these worms, but their chemical composition and ultra structure are not well established. (development of hooks has been described by De Giusti (1949a) for *Leptorhynchus thecatus*, by Harms (1965a) for *Octospinifer macilentus* and by Cable & Dill (1967) for *Pallisentis fractus*. The pattern of arrangement of hooks were reviewed by Van Cleave (1941a), Van Cleave & Bullock (1950) noted that in representative species of a number of genera (*Echinorhynchus*, *Leptorhynchus*, *Acanthocephalus*), where the cystacanth has a proboscis with hooks that were fully developed, whereas in others, such as *Filicollis* and *Polymorphus*, the proboscis underwent considerable morphological modifications, though not in number and arrangement of the hooks. Some differences in hook number may occur between sexes, as in *Echinorhynchus gadi*, where the female has slightly more hooks. Larger hooks are not always at or near the apex. In Paleacanthocephala the largest hooks are near middle of proboscis. In *Telosentis tenuicornis* and *Arhythmorhynchus trichocephalus* the hooks of ventral surface are larger than those of dorsal surface. In Archiacanthocephala and Eoacanthocephala, largest hooks are at or near anterior end of proboscis. Hoffman & Bullock (1975) used meristogram analysis of morphological variants in hook pattern to separate species of *Echinorhynchus* and Huffman & Nickol (1979) for *Pomphorhynchus*.

Van Cleave & Bullock (1950) reviewed by trunk spines. Spines differ from hooks in the absence of hollow core and by originating from tegumental 'felt layer' rather than from basement membrane. Van Cleave & Bullock (1950) described wide variation in form, structure, location and pattern of the trunk spines which they believe to be secondary holdfast structures. Worms with trunk spines acquire them during their development in intermediate host.

(Hooks of *Macracanthorhynchus hirudinaceus* have greater curvature with a small goove that extend about half of exposed part of blade. Base of the goove leads to a tube like opening may have secretory activity. *Leptorhynchus thecatus* and a species of *Neoechinorhynchus* have no such groove. Anantaraman & Ravindranath (1973) reported that hooks of cystacanth of *Moniliformis moniliformis* were devoid of lipids, and mucopolysacchrides and proteins, but contained polysaccharides similar to chitin and the hook rigidity was due to O-glycoside link between phenolic acid and a polysaccharide which contained a hexasomine other than glucosomine. These different from those of Crompton (1963) who obtained a positive Millon reaction and positive ninhydrin-Schiff reaction for protein with *Polymorphus minutus*. He also suggested the base of hollow hooks had reducing properties and some alkaline phosphatase activity. On examining the

development of hooks in *M. moniliformis* Hutton & Oetinger (1980) determined that hook primordial did not originate from hypodermal basement membrane, as suggested by Hammond (1967) but may arise from a connective tissue layer between hypodemnis and muscle layers of body wall. While examining larvae at the same stage of development, also observed ultrastructural similarities between the layer of the proboscis wall from which hooks arise and circular muscles of the trunk wall (Hutton & Oetinfer, 1980).

Proboscis receptacle is a cylindrical muscular sac, open at anterior end and half-closed at posterior end. At the anterior open end it is attached to the proboscis wall, its cavity corresponds to the cavity of proboscis. Posterior end of receptacle hangs freely in the body cavity or pseudocoel. The point of attachment of receptacle to proboscis, its structure etc., are of great significance in the taxonomy and characterization of entire systematic groups of Acanthocephala. In most species receptacle is attached to base of proboscis, but in some groups, such as the family Centrorhynchidae, genus *Mediorhynchus*, it is attached inside the proboscis. The wall of proboscis receptacle is formed of muscle fibers arranged circularly or diagonally in one or two layers and variously developed in different groups. The receptacle wall is single layered in Neoechinorhynchida and order Oligacanthorhynchida. In subclass Echinorhynchida the receptacle wall is two layered. The size of proboscis receptacle varies, depending to some extent on that of the proboscis. In *Apororhynchus* receptacle is not developed, in the female of *Filicollis* it is extremely narrow. The cavity of receptacle contains the element of central nervous system, the cephalic or proboscis ganglion, from which emerge nerve fibers, which pass through wall of receptacle into body cavity and then into body wall. The position of ganglion in receptacle (at base, in the middle, or in anterior half) is characteristic for certain genera and even subfamilies and is therefore a determining character. Retractor muscles of proboscis pass through the cavity of proboscis receptacle, these retractors are attached at one end to the anterior and lateral walls of the proboscis, at the other end, after leaving the receptacle through posterior wall, they are attached to the body wall of the parasite. By means of these muscles proboscis can be retracted into the cavity of receptacle. Retraction of proboscis begins at the anterior end and proceeds like the turning inside out of a finger of a glove, the retracted proboscis lies in the cavity of receptacle with its hooks grouped along the middle line.

Neck : It is located between proboscis and trunk and is always unarmed. Its border with proboscis is not distinct and is determined at the point of emergence of last hooks of proboscis, its posterior border is well marked by a slight contraction which separates it from trunk. The shape and measurement of neck vary among different Acanthocephala. In most of them it forms a truncated cone, but in some species it is considerably elongated (females of *Filicollis anatis*, *Pomphorhynchus laevis* etc.). In order to get an idea of its shape it is essential to measure the width at its upper and lower end.

In the neck region the special organs, the paired lemnisci are formed by the invagination of the hypodermis of the neck wall into the body cavity. They lie along the sides of the proboscis receptacle in the form of two strips or bands. Sometimes the lemnisci are twisted,

and in some forms they split at their distal end. They have many lacunae, of which two lateral are well developed. The lacunae of lemnisci communicate with those of neck and not with those of trunk. Their function is in retraction and eversion of proboscis according to the admission of fluid into the lacunae or its expulsion from the, (Hamann, 1891, Kostylew, 1912).

Trunk : It is musculo-cutaneous sac, the cavity of which encloses the internal organs of the parasite. Its body wall or tegument is organized into three distinct sections, an outer tegument, a middle group of circular muscles and an inner group of longitudinal muscles.

TEGUMENT OR BODY WALL ORGANIZATION

Tegument or body wall of Acanthocephala is organized into three distinct sections, an outer tegument, a middle group of circular muscles and an inner group of longitudinal muscles. Channels of lacunar system run throughout these three sections. The tegument or body wall of acanthocephalans has trophic, metabolic, protective and supporting functions. Structure of the tegument appeared with light microscopy as a double-layered cuticle, overlying a double-layered hypodermis, The outermost layer of cuticle is thin and apparently structureless. Beneath this, the second layer, also thin, had fine striations perpendicular to the surface. Outer part of hypodermis contained a complex system of fine, interwoven fibers, which appeared felt-like layers. The inner part of hypodermis contained fibers oriented perpendicular to the surface, its elements inserted into base membrane layer proximally and the felt layer distally.

Electron microscopic studies of body wall significantly changed the interpretation of tegument organization, with result many terms applied earlier to body wall structures are no longer appropriate. Tegument is preferred over such terms as 'cuticle' 'epidermis' and 'dermis' for outer syncytial layer of acanthocephalan body wall, as the term is advantageous in that it does not bear the connotation of non-living and does not imply a cellular structure.

The most external layer of body wall is a very thin electron-dense surface coat of fine filamentous nature. The terms epicuticle (Crompton & Lee, 1965) and layer I (Nicholas & Mercer, 1965) have been used, but more recently Beermann, Arai & Costerto (1974) and others have justifiably advocated the use of glycocalyx for this layer. (Wright & Lumsden (1968) identified acid mucopolysacchrides in the glycocalyx of *Moniliformis moniliformis* and Rothman & Eldere (1970) concluded that the PAS-positive reaction observed in its tegument was due to a keratin sulfate-like substance).

Beneath the glycocalyx, the plasma membrane of *Pomphorhynchus laevis* is a typical bilayer, but with numerous infoldings (of 15 nm diameter, apparently 200 nm apart). The openings of these infoldings were described as pores by Hammond (1968a) using scanning electrom microscope. These openings and the glycocalyx material which lines them may act as a molecular sieve system to exclude particle (of 8.5 nm or larger (Byram & Fisher, 1973)).

Tegument has been referred to as the cuticle and hypodermis in early microscope studies, however, electron microscopy has elucidated three layers. Together they form a thick layer of fibrous syncytial constuction that presumably corresponds to an epithelium. The three fibrous strata are an outer striped layer, a middle somewhat thicker feltwork of layer of fibers running in different directions and an inner layer of radial fibers. The inner layer is thickest and is regarded by many as the epidermis proper while outer striped and felt layers are assigned to cuticle. There are no indications of cell division and the entire tegument forms a syncytium. Collegen is the main extracellular fibrous protein found in the tegument and that its function of *Macacanthorhynchus hirudinaceus* is different from the cuticular collegen of other worms.

The striped layer has been interpreted through electron microscopy to be that area of the tegument adjacent to the plasma membrane and pierced by numerous canals or crypts. The crypts have been calculated to give a 20-60 fold increase in surface area. The material contained within them is continuos with material of low relative molecular mass external to the gycocalyx. These crypts may serve as pinocytic invaginations and acid hydrolase activity has been found in them. In addition to pinocytotic activity, the discovery of acid phosphate activity, alkaline phosphatase activity has established the presence of functional lysosomes and mitochondria in this layer.

The middle layer of tegument, the feltwork layer, called the fibre layer by Lange (1970) in *Echinorhynchus gadi*, was found to contain large concentrations of glycogen. In this layer, the endoplasmic reticulum consists of an irregular tubular array of smooth membrane which become progressively more loosely arranged in the deeper layer. Inevetably many of the tubules appear as vacuoles depending upon the plane of section and small roughly spherical mitochondria with a few cristae are scattered throughout. A skeletal function is attributed to both the striped and feltwork layers and consider that fibres of feltwork layer support the trunk spines.

The feltwork layer grades imperceptibly into radial layer in which electron-dense strands may be visible. In this layer, the strands appear to be formed between parallel membranes of endoplasmic reticulum. The radial layer has been implicated as the main metabolic center of the acanthocephalan body. As this conclusion has been supported by the detection of many mitochondria within this layer. In addition, the inner radial layer contains nuclei and lacunar channels.

In Acanthocephala, the number of nuclei has been reported to be approximately constant for each species, at least in early stages and in many families throughout life. The nuclei of tegument are few in number and more or less fixed in position, being regularly associated with the main channels of the lacunar system. In Neoechinorhynchidae, there are nearly always six nuclei in the tegument, five along the main dorsal lacuna and one ventral along the anterior part of the ventral lacuna. In worms of other families that retain the larval condition of the nuclei, there are up to 20 nuclei in the tegument. This forms range from oval to rosette, or they may be amoeboid, highly branched and of relatively large size; some are more than 2 mm in length. In some families of Acanthocephala, such as

Polymorphidae and Echinorhynchidae, the larval nuclei fragment during later development so that the tegument is provided with a large number of small nuclei.

LACUNAR SYSTEM

In those genera such as *Centrorhynchus* where the lacunar system has been described as a network and without a regular pattern, there is usually a pair of main channels that traverse the body length with numerous connections to the remainder. In the Acanthocephala directional-flow circulatory system is absent but possess instead a loose network of tube-like cavities without linings or pumps, these cavities are the channels of the lacunar system which interconnect, forming a definite pattern in some species. In Archiacanthocephala and Eoacanthocephala, the large channels are located dorsally and ventrally in the tegument, although ventral channel is occasionally missing (Meyer, 1933). In Paleacanthocephala, the main channels are placed laterally.

It is generally accepted that the lacunar system of the trunk wall is distinct from that of praesoma, the latter presumably having no connection with the channels of former. The worm surface has numerous infoldings with direct openings to the 'hypodermis' interior, which in turn, provides access to the lacunar system. In *Macracanthorhynchus hirudinaceus* exists rete system consisting of a series of thin walled tubes the entire medial surface of longitudinal muscles. In *Oligacanthorhynchus tortuosa* it is located between the longitudinal and circular muscles. There is no connection between the rete system and lacunar system in both the species.

A pair of median longitudinal channels is located adjacent to the circular muscle and connected to the circular lacunar channels called primary ring canals. The primary ring canals are connected to the median longitudinal channels by regularly spaced transverse medio-lateral connection termed radial canals. These small tubular connections pass between the circular and longitudinal muscles and are easily overlooked in fixed tissue. The lacunar fluid passes through either dorsal or ventral lacunar channel to radial canals and finally into main longitudinal channel.

Muscles : Proboscis receptacle consists of one or two muscle layers enclosed in a thin sheath. Species belonging to Paleacanthocephala have a double-walled receptacle, whereas those of Eoacanthocephala and Archiacanthocephala have a single-walled receptacle. In *Oligacanthorhynchus* the muscular wall of receptacle do not insert on the inside of the proboscis but was attached near the inner apex. The muscles associated with the outside surface of the receptacle in most archiacanthocephalans may be homologous with the outer muscle layer of the receptacle of Paleacanthocephalans. In *Neoechinorhynchus emydis* Van Cleave & Bullock (1950) named the inverters of the proboscis for muscles originating at its tip and extending through its length into the receptacle. These muscles continue through the muscular wall of the receptacle to become the receptacle retractors which are inserted into the trunk body wall.

Body wall muscles : Organisation of muscular layers of the body wall in most acanthocephalan species consists of an inner longitudinal and an outer circular layer enclosed

by the tegument. There are considerable variation in their attachment and internal distribution. The acanthocephalam musculature is tubular with intimate connection in the circulation of lacunar fluid. As the muscles are arranged in an anastomosing network of tubes, they effectively provide for their own nourishment and waste removal. The contractions of circular muscles forces lacunar fluid into longitudinal muscle system and the contraction of longitudinal muscles tend to force lacunar fluid into the circular muscle system

NERVOUS SYSTEM

The central or cephalic nerve ganglion (Fig. 1 A. B, C. g, 2 a. 7) lies inside the proboscis receptacle, not far from the point of attachment of the proboscis retractor muscles, but the position of ganglion varies in different species, and it also varies according to how the proboscis retracts and protractors protrude. The ganglion is covered with a very thin transparent membrane with processes by means of which it is attached to the surrounding muscles. Its shape and size varies in different species.

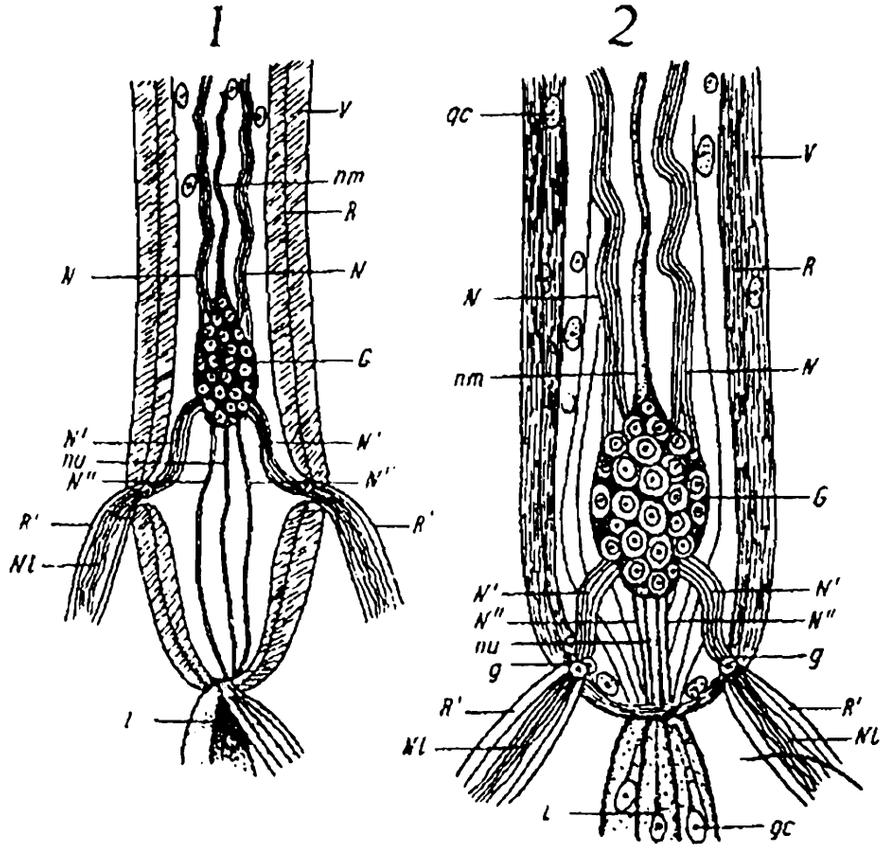


Fig. 1. Nervous system of Acanthocephala. A. *Pseudochinorhyncus clavula,* B. *Acanthocephalus lucii,* G. Cephalic ganglion. g. Lateral ganglion, gc. Ganglionic cells in muscles. L. Ligament, m. Rootlets of anterior lateral nerves, n. Lateral nerve branches, N. Anterior nerve bundles. N' Posterior lateral nerves. N" Posterior dorsolateral nerve. NI. Posterolateral nerve, Nu. Posteromedian, nm. Anterior median nerve inner layer. R. Inner layer of proboscis receptacle, R' Retinacula. V. Outer layer of proboscis receptacle. (after Yarzhinskii, 1868)

Peripheral nervous system from Cerebral ganglion :

In *Oligacanthorhynchusmicrocephala* and *Macracanthorhynchus hirudinaceus* a six major nerves leave the cerebraganglion: the anterior proboscis nerve (Fig. 2a. 2), the apical sensory nerve (Fig. 2a. 1), theanterior ventral nerve (=lateral anterior nerve) of proboscis receptacle (Fig. 2a. 3, 5), theanterior lateral nerve (Fig. 2a. 4), the lateral medialnerve and the lateral posterior nerve. The anterior proboscis nerve and apical sensory nerve leave the ganglion together, giving the impression of five rather than six nerves.

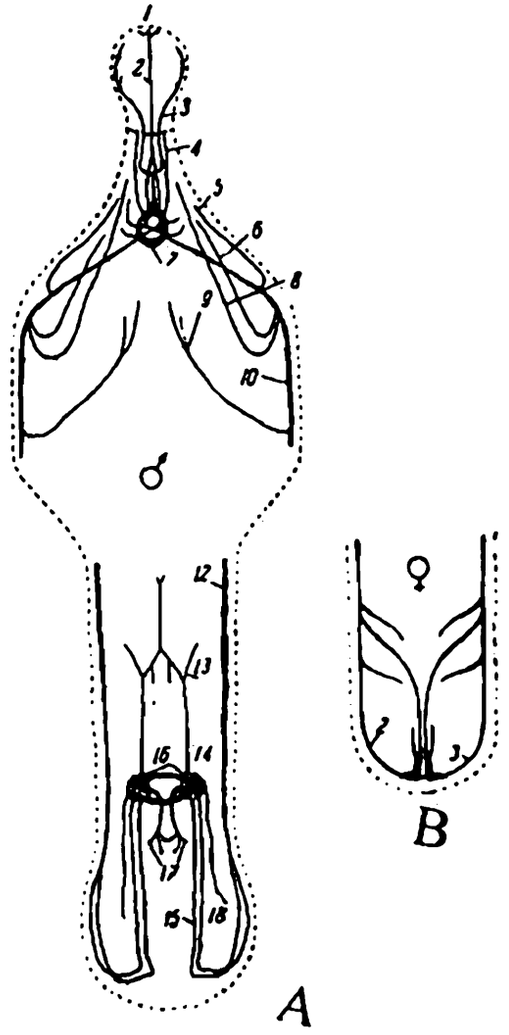


Fig. 2. Nervous system of *Macracanthocephalus hirudinaceus*. A. Male. 1. Nerve cell of papilla. 2. Anterior medial nerve. 3 and 5. Ventral anterior nerves. 4. Lateral anterior nerve of proboscis sheath, 6, 8, 9, 10, 12. Posterior lateral nerves of body musculature. 7. Cephalic ganglion, 16. Paired genital ganglion with outgoing nerves, 13, 14, 15, 17, 18. B. Posterior part of female nervous system. 1. Ventral nerve, 2 & 3. dorsal nerves (After Kaiser, 1893, Brandes, 1899, from Meyer, 1933).

The anterior lateral nerve consists of two pairs of neurites that together leave the anterior surface of the ganglion. The paired anterior ventral nerves, each of which consists of a bundle of seven processes, leave the ganglion anterior to the anterior lateral nerves and extend to the lateral sensory organs. The paired lateral median nerves leave the

ganglion along its midlateral margin and extend posteriorly before doubling back to run anteriorly. Each lateral medial nerve consists of two processes. Each of the paired lateral posterior nerves consists of approximately 22 processes. This pair of nerves leave the ganglion from the dorsal surface along the retinacular muscle while passing through the pseudocoel.

Little is known about the nerve endings, and in *Polymorphus phippsi* they are seen as circular plates, 7-18 μm in diameter, and are particularly clear in the retractor muscle of the proboscis and the longitudinal muscles of the body wall. In *Pseudoechinorhynchus clavula*, and *Acanthocephalus lucii* the cerebral ganglion (Fig. 1A, B, C. g) is located in probocis receptacle, from which number of nerves emerge. From its antero-lateral margins anterior nerve bundles (Fig. 1A, B, C. N) and from mid-anterior region a median nerve (Fig. 1A, B, C, nm) run forward. From its postero-lateral margin emerge two postero-lateral nerves (Fig. 1A, B. C. N') and from its middle single posterior median nerve (Fig. 1A, B, C. nu) and two posterior dorso-lateral nerves (Fig. 1B, C. N") run backwards. Behind the cerebral ganglion two lateral ganlia (Fig. 1B. G) are located, from which retinacula (Fig. 1 A, B, R') emerge and become pposterior lateral nerves and run backwards.

Genital ganglion : In all male worms the genital ganglia are located posteriorly and consist of two lateral cell accumulations connected by a small dorsal and a large ventral commissures (Fig. 2a. 16). In *Polymorphus phippsi* the genital ganglia is horse-shoe-shaped and are linked by a ventral commissure with five or six nerve fibres and dorsal commissure with three or four nerve fibres. Both the commissures of *P. phippsi* originate from the symmetrical ends. In *Oligacanthorhynchus microcephali* the genital ganglion is connected by dorsal commissure with eight fibres and the ventral commissure with 15 fibres. These nerve fibres enervate the male reproductive system. In *Macracanthorhynchus hirudinaceus* the ganglia are located below the insertion of bursal depressor and near the ejaculatory duct musculature and Saefftigen's pouch. This position enables the dorsal commissure to pass medially to the ejaculatory duct musculature and Saefftigen's pouch and externally to thick bursal musculature. The nerves originating from each genital ganglion consists of (1) the anterior depressor nerve which originates from the ventral lateral margin and procceds anteriorly to the origin of the bursal depressor muscle; (2) the penis nerve which originates from the ventral lateral margins and enervates receptors in the penis tip (Fig. 2 a. 17); (3) the inner and outer bursal nerves from the posterior margin which extend to receptors in the ventral surface of the bursal muscle; (4) the protrusor nerve originating from the posterior margin of the bursal depressor muscle; (5) the lateral bursal nerve originating from the posterior lateral margin and extending to the receptors on the outer surface of the bursal muscle; (6) the core nerve from the ventral lateral surface and extending medially to the ejaculatory duct and servicing muscles in this region; (7) the posterior depressor nerve running to the protrusor muscle.

Bursal ganglion : It is a small ganglion with four large club-shaped cells arranged in two pairs along the medial surface of the dorsal longitudinal muscles and near pseudocoel, located medially to dorsal lacunar channel about 1 mm from postertor end of

the worm with an invaginated bursa in *Monilifoemis monilifomis.* Each cell is bipolar, providing neuritis to the bursal muscles and longitudinal body wall muscles.

In female *Macracanthus hirudinaceus* the genital ganglia consists of a ventral nerve (Fig. 2b. 1) and two dorsal nerves (Fig. 2b. 2, 3) supplying the uterus and vagina.

Sensory receptor system : In acanthocephala the organization and functioning of the sensory receptor system is poorly known. It is suggested that the sense receptors are either tactile, chemical, glandular or vestiges of a digestive system. The apical organ varies in form from a papilla to a depression surrounded by a small elevated rim devoid of surface extension. The core of this organ is formed from a combination of apical sensory nerves and a supporting cell duct in *Macracanthorhynchus hirudinaceus.* All these structures are enclosed by a large binucleate cone-shaped cell. In *Neoechinorhynchus emydis* Van Cleave and Bullock (1950) noticed the apical organ divided into two regions; the anterior with three nuclei. The apical organ of *Corynosoma hammani* is pyriform with two large nuclei. *Gigantorhynchus echinodiscus* has two apical papillae with separate openings to the outside and *Oligacanthorhynchus thunbi* has a single apical papilla. Each of the two papillae of *G. echinodiscus* contain a series of parallel branched endings of the median nerve. The same design occurs in *Moniliformis moniliformis.*

The lateral organs are sensory receptors occur in pairs opposite each other on the neck of the proboscis of some species. These organs are small depressions surrounded by a slightly elevated ring of tegument, at the center of which lie the termini of neuritis from separate cerebral ganglion cells.

In male worms receptors associated with the reproductive system are well known. In *Macracanthorhynchus hirudinaceus,* the lateral bursal nerves from each of the paired genital ganglia extend over the outer surface of the bursa musculature to the anterior margin of the bursal sac, where upon each of the nerves enters the musculature and terminates in a pair of uniquely designed finger-like receptors located on the inside of the posterior margin of the bursa. The inner and outer bursal nerves are also associated with receptors located on the ventral surface of the bursal muscles near its posterior margin. These pear-shaped receptors are highly vacuolated and individually innervated. Both these types are not exposed to the outside, but each is covered by a layer of tegument from the lining of the bursal lumen.

Sensory support cell : In *Macracanthorhynchus hirudinaceus* multinucleate support cell was described by Miller & Dunagan, 1983). A similar cell was described from *Bolbosoma turbanella* by Harada (1931), who found two cells joined along their posterior margins and located between the dorsal proboscis retractors and proboscis receptacle. A cell extension from each anterior margin went to the lateral sensory organ on the same side. In contrast the support cell in *M. hirudinaceus* has a cap on the midventral longitudinal receptacle which is ventral and anterior to the cerebral ganglion. Two posterior processes that follow the ventral receptacle retractor muscles through the receptacle. Once inside receptacle wall, they turn anteriorly and fuse into a tube-like duct that extends to the apical organ. Proboscis

receptacle muscles enclose this duct throughout the proboscis. The two anterior sensory support cell processes move laterally over the outside surface of the proboscis receptacle until they turn anteriorly and terminate in the lateral sensory organs.

EXCRETORY SYSTEM

The excretion in Acanthocephala is carried out by protonephridia, consisting of flame cells. The flame cells are divided into two types, dendritic type of *Oligacanthocephala microcephala* (Golvan, 1959b), and sac type of *O. taenioides* (Meyer, 1931c). The dendritic type consists of a central canal from which numerous smaller canals arise and end in blind pouches containing cilia. The sac type consists of a bladder-like receptacle into which flame cells open directly. In either case the excretory canals eventually join the vas deferens in male and uterus in female.

In the dendritic type of exvretory system (Fig, 3A) in *Oligacanthorhynchus microcephala,* where in male worm has the cauliflower-like protonephridia (Fig. 3A. PRN) symmetrically located on the dorso-median line of the anterior rim of the ejaculatory duct constrictor muscle (Kilian, 1932). In *O. microcephala* each protonephridium consists of 500-600 flame cells (Fig. 3A. FC), of 29-45 μm long, 15-20 μm wide containing 10-20 cilia. The excretory products are collected in to excretory bladder (Fig. 3A. EXB), from there they are carried by excretory canal (Fig. 3A. EXC). The excretory canal is joined by (Fig. 3A. VD) and cement duct (Fig. 3A. CED) to form the urinogenital canal (Fig. 3A. UGC). The dendritic arrangement of flame cells involves three orders of branching. Together the protonephridia empty through the urinogenital canal its muscular terminus is ejaculatory duct. The excretory canal is lined by cilia throughout its length except its anterior terminus. Only difference between male female systems occurs in the number and type of ducts associated with the excretory canal (Fig. 3 A. UGC). In males the excretory canal (Fig. 3A. EXC) joins the vas deference, forming the urinogenital canal. In females ciliated excretory canal joins the oviduct to form a short urinogenital canal (Fig. 3B. UGC) which discharges into the uterus (Fig. 3B. U) either terminally or subtereminally, depending on the species.

The sac or capsular type (Fig. 3B) of the excretory system is seen in *O. taenioides* (Meyer, 1931c) and *O. thumbi* (Haffner 1942 a, c). The major difference between the sac and dendritic types is in the organistion. Most descriptions of Acanthocephala do not contain comments on the presence or absence of pprotonephridia. Meyer found the protonephridia in worms of following genera : *Oncicola, Oligacanthorhynchus, Nephridiorhynchus, Prosthenorchis, Pachysentis,* and *Macracanthorhynchus.* Schmidt (1972b) rearranged the taxonomy of the class Archiacanthocephala and partly based his classification on the presence or absence of protonephridia. According to him, this class has three orders, Oligacanthorgynchida posses protonephridia.

In capsular type of excretory system protonephridia (Fig. 3B. PRN) consist of number of flame bulbs (Fig. 3B. FB), their excretory producs are carried by nephridial canal

(Fig. 3B. NC) and emptied into excretory bulb (Fig. 3B. EXB), from there they are carried by excretory canal (Fig. 3B. EXC), which is joined by oviduct and common duct (Fig. 3B. OVD. And CO) to form the urinogenital canal (Fig. 3B. UGC), which enters the uterus (Fig. 3B. U).

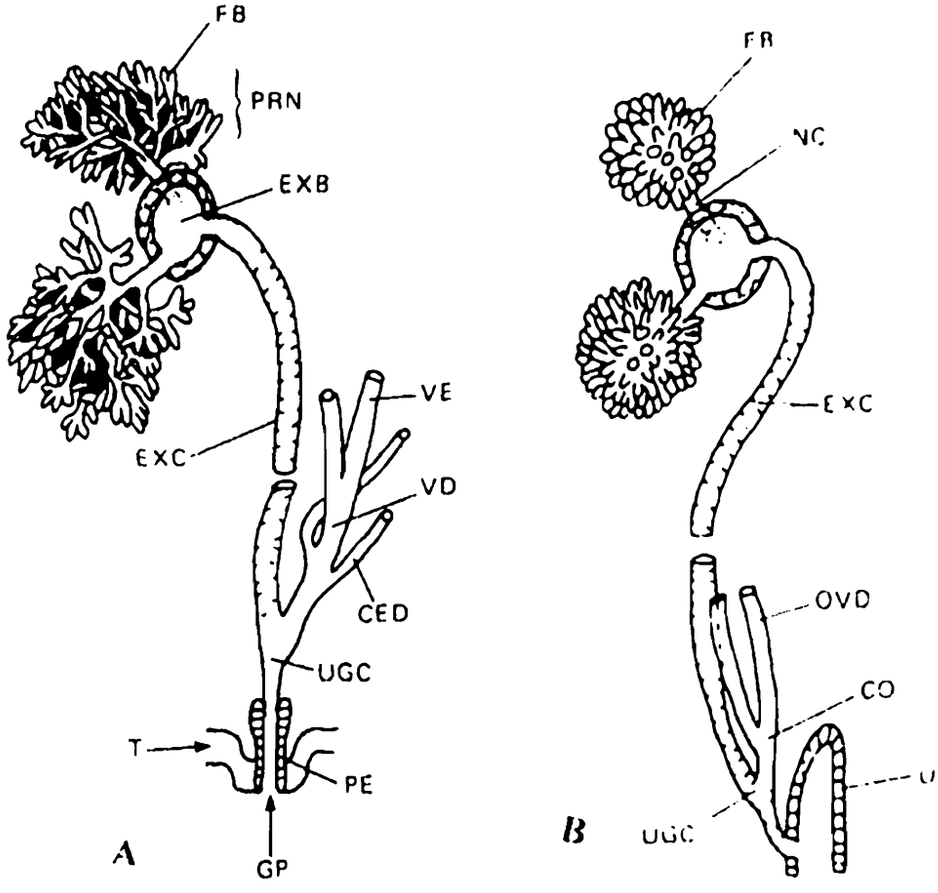


Fig. 3. A. Diagramatic representation of dentritic type of excretory system of male *Oliacanthorhynchus taenides*. CD. Cement duct, EB. Excretory bladder, EC. Excretory canal, FB. Flame bulb. GP. Gonopore, PE. Penis, PN. Protonephridia, T. Tegument, V.D. Vas deferens. VE. Vas efferens. (after Miller & Dunagan, 1985). B. Diagramatic representation of capsular type of excretory system of female *Oligacanthorhynchus taenioides*. CO. Common oviduct. EC. Excretory canal, FB. Flame bulb. NC. Nephridial canal, OD. Oviduct, U. Uterus. UC. Urino-genital canal. (After Miller & Dunagan, 1985)

The function of the protonephridia (Fig. 3B. PRN), although not investigated, might include osmoregulation, detoxificaztion and excretion. It is generally recognized that aquatic invertebrates eliminate nitrogen as ammonia, and aacanthocephalan may also do the same. Because most acanthocephalans apparently lack a protonephridial system, it is usually assumed that the tegument is involved in the exchange of ions, water and metabolic wastes. Parshad & Guraya (1977b) concluded that, in the absence of excretory organs, *Sphaerirostris pinguis* eliminated wastes products through the body wall and did not regulate its osmotic pressure.

REPRODUCTIVE SYSTEM

Male reproductive system : It consists of two testes, vasa efferentia, vasdeferens, seminal vesicle, cement glands, cement reservoir, Saefftigen's pouch, pyriform glands, copulatory bursa and penis. In some species variations in these components may occur. The testes (Fig. 4C. Ta, Tp) are spherical or ovoid, usually arranged in tandem, are suspended in the anterior, middle or posterior part of the body cavity by the ligament strand, enclosed by the ligament sac and attached to its ventral wall. The dorsal and ventral ligament sacs arise early in the development from the base of the proboscis receptacle to merge with genital sheath musculature. Rarely single testis is found in the male, which is larger than the testes of others. The vas efferentia (Fig. 4C. VD) extend posteriorly for a short distance from the testes before uniting to form vas deferens. In some species a vas efferens or vas deferens is enlarged to form a seminal vesicle (Fig. 4C. SV) for storage of sperms. Within the genital sheath posteriorly the vas deferens merges with either a single duct or multiple ducts from the cement glands to form the common genital canal. Slightly posteriorly the common genital canal may fuse with the ciliated excretory canal, when present, to form the urinogental canal.

Directly adjoining the testes are the cement glands (Fig. 4C. CG), their number and shape are characteristic for certain groups of Acanthocephala and is of great importance in their taxonomy. Three basic types of cement glands are recognized in Acanthocephala by Van Cleave (1949). The cement gland complex, attached to ligament strand, consists of a single syncytial gland in the Eoacanthocephala, or as many as eight elongate, tubular or flask-shaped glands in Archiacanthocephala and Paleacanthocephala. Cement gland ducts (Fig. 4C. CD) arise from the glands and run posteriorly towards the penis. Sometimes these ducts fuse and in some species they enlarge and serve as cement reservoirs. A separate cement reservoir occurs in Eoacanthocephala.

The cement glands secretions are assumed to contribute to the formation of the hard copulatory caps which are often observed around the gonopore of the female and sometimes in the males. The penis (Fig. 4C. PE) is sharp cone-shaped, which projects into the lumen of copulatory bursa. Its lumen becomes continuous with the ciliated urinogenital canal which merges with the descending unciliated seminal duct. Surrounding the penis canal is the urinogenital syncytium with a layer muscles to its exterior.

The muscular Saefftigen's pouch, (Fig. 4C. SP) the eversible campanulate bursa and the penis form the copulatory structure. Bursa (Fig. 4C. B) is equipped with complex musculature. With the aid of these muscles, bursa spreads over the posterior end of the female, followed by attachment as the edge of the bursal musculature contracts. Then the gonopore region of the female pulled into the body of the male, constricted and in effect separated from the rest of the trunk of the female. After the copulation the contents of cement glands is ejected into the gonopore of the female forming a dark brown plug which tightly seals the eggs.

Female reproductive system : It consists of ovaries from which ovarian balls develop to produce oocytes and later eggs (= shelled acanthors), ligament sacs, if they persist,

contain the developing eggs and an efferent duct system with the uterine bell, uterus and vagina. Ligament (Fig. 4C. L) sacs are hollow tubes associated with the reproductive system in the pseudocoel, extending from the proboscis receptacle to the uterine bell. In Archiacanthocephala and Eoacanthocephala they are paired, one dorsal and one ventral with each in contact with the other. In Paleacanthocephala the single ligament sac ruptures early in sexual development. In Eoacanthocephala the ligament sacs fail to persist. In Archiacanthocephala the two sacs fuse to form a single sac anteriorly, posteriorly the dorsal ligament sac terminates in the uterine bell (Fig. 4 D. UB). The ventral ligament sac ends near the genital sphincter and is attached to the uterine bell through the ventral opening of the bell complex. The openings between two ligament sacs permit the circulation of the eggs from the ventral sac to the larger dorsal sac and through the uterine bell, a process which facilitates the retention of immature eggs.

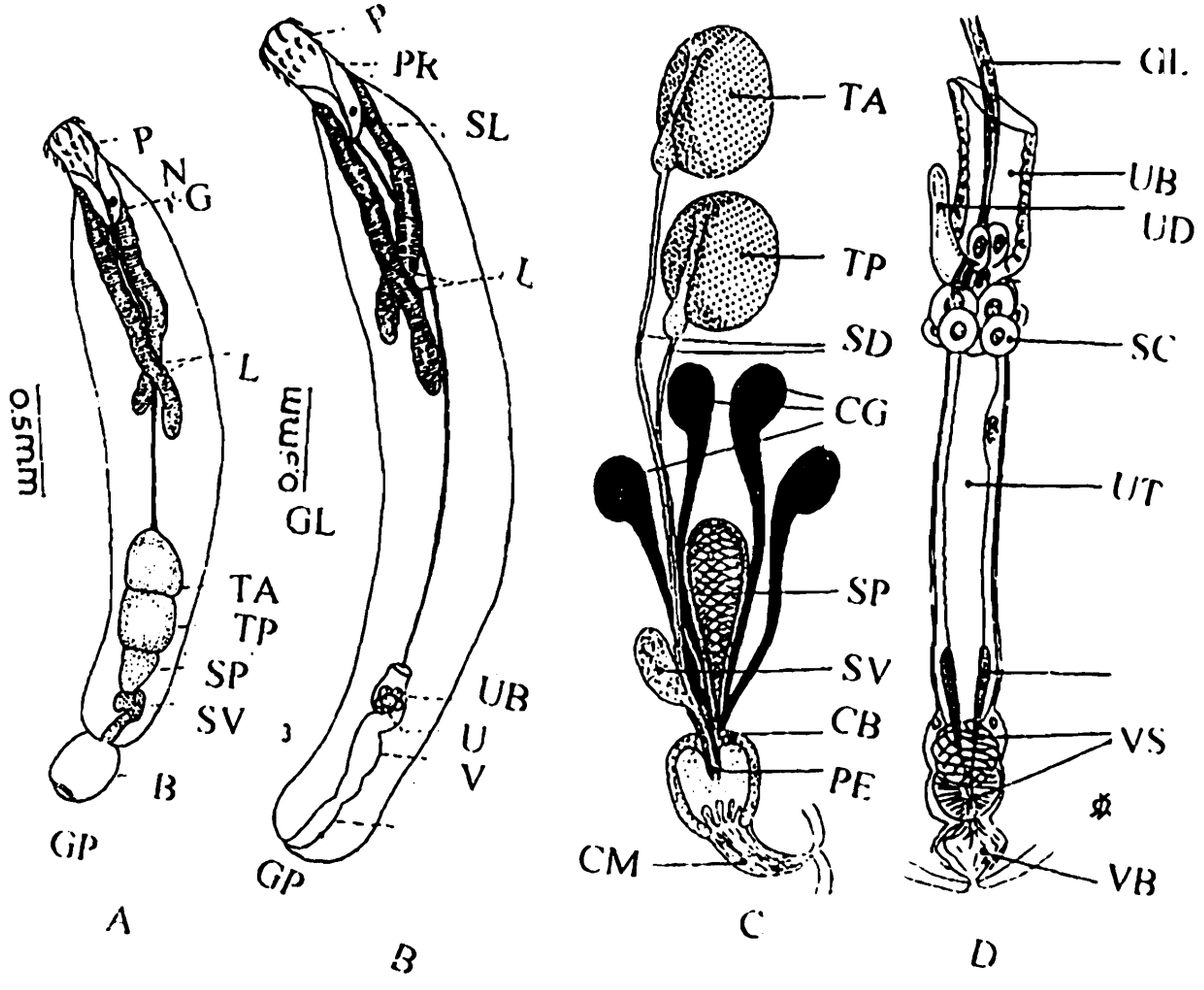


Fig. 4. Typical acanthocephalan (A) male, (B) female, (C) male genital organs and (D) female genital organs. B : Bursa, BD : Bursal diverticulum, CB : Copulatory bursa, CG : Cement gland, CR : Cement reservoir, G : Ganglion, GL : Genital ligament, GP : Gonopore, L : Lemniscus, N : Neck, P : Proboscis, PE : Penis, PH : Proboscis hook, PR : Proboscis receptacle, SC : Selector cells. SD : Sperm duct. SL : Suspensory ligament, SP : Saefftengen's pouch. SV : Seminal vesicle. TA : Anterior testis, TP : Posterior testis, U : Uterus, UB : Uterine bell, V : Vagina, VA : Ventral aperture of uterine bell, VB : Vaginal bulb and vulva, VE : Vas efferens. VS : Vaginal sphincter.

The complex efferent duct system begins with the anterior opening of the bell wall and ends in the gonopore. It is divided into three regions: (1) uterine bell, (2) uterus, and (3) vagina. The eggs move from the anterior bell chamber into the selector apparatus. (Fig. 4 D. SC). The eggs move from the anterior bell chamber into a selector apparatus, which consists of two lateral pockets, two median wall cells and two duct cells around the tube of the uterine duct. A duct from the anterior bell chamber leads into the egg sorting or selector apparatus. The eggs are free to move into and out of each pocket whose walls consist mostly of circular muscle. Each of the channels formed by the median wall cells leads posteriorly to a duct formed by the uterine duct cells. These two paired uterine ducts empty into the uterus.

The movement of eggs can occur in three ways, (1) into the uterus, (2) return through the ventral bell opening; or (3) enter lateral pocket and then either route (1) or (2). Four muscular events are responsible for the movement of eggs from the anterior chamber of the bell through the selector apparatus. These events are aided by the flow of fluid followed by muscular activity. The sequence of events takes place in the bell wall peristalsis, bell flexion and extension, lateral pocket contraction and uterine duct peristalsis. Muscular activity of the bell forces eggs into either of the two channels formed between the lateral surface of each median wall cell and adjacent lappets of the uterine duct cells. The ejection of immature egg would occur during bell flexion. The entrance of eggs to the uterus (Fig. 4D. UT) is guarded by the selector apparatus anteriorly and by a vaginal sphincter posteriorly. In *Moniliformis moniliformis* the uterus is joined to the vagina (Fig. 4D. V) at an angle of 45 degrees ventrally, the latter consisting of a narrow lumen enclosed by an inner dumbbell-shaped syncytium, a middle smooth muscle layer organized as a sphincter (Fig. 4D B. VS),and an outer layer an extension of the muscle layer of uterine wall. In *Neoechinorhynchus buttnerae* the vagina is peculiarly coiled, and in *N. johnii* it is unusually modified. Specialised cells, presumed to be glandular, occur in association with the vagina, Verma & Datta, 1929; Poddar, 1938, stated that the two nucleated, club-shaped glands lie outside the vaginal wall and communicate with the vagina by a common pore close to its external opening. They thought that these glands probably secreted a fluid to lubricate the genital opening.

In most species the gonopore (Fig. 4D. GP) is subterminal and eggs reach its opening by moving in single file through the vagina. The position of gonopore varies in different species. In *Moniliformis moniliformis* the vaginal sphincter regulates the opening of the gonopore. Gonopore is blocked by a copulatory cap after insemination, which must be lost before egg release can begin.

The mature eggs of the Acanthocephala contain the embryonic larva surrounded by several egg membranes. The eggs and embryonic larvae differ in structure among different groups of the Acanthocephala.

PHYSIOLOGY

Feeding and Nutrition : As a result of parasitic mode of life, total lack of digestive system and associated glands in the phylum Acanthocephala is unique in the animal kingdom. These animals absorb the already digested food in liquid form from the lumen of the intestine of the host through their tegument of the trunk. Striped layer of the acanthocephalan tegument represents some sort of permanent structure, oriented perpendicular to the helminth surface, which provides conduits for the nutrient absorption through the 'cuticle' In transitional electron microscope images, these conduits appear as regularly arrayed bag-like invaginations of the adult *Moniliformis moniliformis* surface as crypts, whose apices narrow into slender necks through which the lumina communicate with the external environment. The crypts occur as labyrinthine cavities whose membranous lining is extensively evaginated to form microvillar projections in the acanthors and these cavities may give an impression of vesicular structures in the developing acanthellae and cystacanths.

BIOGEOGRAPHY

Of the 322 species of Acanthocephala listed in this work, 247 species i. e 77% are known only from the Indian subcobtinent, of this 186 species are known only from type localities. Remaining 61 species are reported more than once from different parts of the subcontinent. Of the 322 species only 9 species are cosmopolitan. The remaining 66 species are of restricted distribution reported from different parts of world. The 247 species are indigenous to the Indian subcontinent.

Some genera with all their species are only known from this region. Genus *Dispiron* Bilqees, 1970 with all three species is known only from Pakistan. Genus *Cleaveius* Subramanian, 1927 with all its 12 species is known only from India and Pakistan. Genera *Bullockrhynchus* Chandra, Rao and Shyamasundari, 985, *Goacanthus* Gupta, N. K. Jain, 1980, *Neogorgorhynchoides* Gupta, V. and Fatma, 1987, *Acanthogyrus* Thapar, 1927, *Paraechinorhynchus* Bilqees and Khan, 1983 and *Zeylanechinorhynchus* Fernando and Furtudo, 1963 each with single species are known only in this subcontinent. Genus *Indorhynchus* Golvan, 1969 with its two species and Genus *Raosentis* Datta, 1947 with its four species are known only from India. These eleven genera are indigenous to this subcontinent.

PHYLOGENY

Acanthocephala do not show any close relationship with any kown existing groups of animals, unlike other parasitic helminthes groups which have a clear ancestors. Presence of pseudocoel, cuticular texture in Acanthocephala show close relationship with Nematoda and Nematomorpha. Presence of ligament sac as rudiment of intestine and cilia in the excretory system, this group shows affinity towards Rotifera. Body wall, excretory system, nervous system, embryonic development of Acanthocephala are similar to those of

Turbellaria. Hence it is believed to have derived from Turbellaria. Petrotschenko (1956) claimed that this group has originated from lower group of Rhabdocoela or Acoela of Turbellaria. Golvan suggested a hypothetical ancestor Protacanthocephala. Scientists in different countries are trying to establish the relationship of Acanthocephala, but at present this wholly parasitic group has gained independent status of a phylum.

CLASSIFICATION

Amin (1989) added a new classPolyacanthocephala Amin, 1989, with single order Polyacanthovephalida Amin, 1989 to the existing three classes Archacanthocephala, Palaeacanthocephala and Eoacanthocephala,

Phylum Acanthocephala (Rudolphi, 1898) Skrajbin & Schultz, 1921.

1. Class Archiacanthocephala Meyer, 1931.
    1. Order Apororhynchidea Thapar, 1927.
        1. Family Apororhynchidae Shipley, 1899.
    2. Order Oligacanthorhynchida Petrotschenko, 1956.
        2. Family Oligacanthorgybchidae Southwell & Mecfie, 1925.
    3. Order Gigantorhynchida Southwell & Macfie, 1925.
        3. Family Gigantorhynchidae Hamann, 1892.
    4. Order Moniliformida Schmidt, 1972.
        4. Family Moniliformidae Van Cleave, 1924.
2. Class Palaeacanthocephala Meyer, 1931.
    4. Order Echinorhynchida Southwell & Macfie, 1925.
        6. Family Fessisentidae Van Cleave, 1931.
        7. Family Hypoechinorhynchidae Golvan, 1960.
        9. Family Diplosentidae Tubangui & Masilungan, 1937.
            1. Subfamily Diplosentinae Tubangui & Masilungan, 1937.
            2. Subfamily Allorhadinorhynchinae ——
        10. Family Heteracanthocephalidae Petrotschenko, 1956,
            3. Subfamily Aspersentinae Golvan, 1960.
            4. Subfamily Heteracanthocephalinae Petrotschenko, 1956.
        11. Family Arhythmacanthidae Yamaguti, 1935.
            5. Subfamily Arhythmacanthinae Yamaguti, 1935.
            6. Subfamily Neoacanthocephaloidinae ——
            7. Subfamily Paracanthocephaloidinae Golvan, 1969.

12. Family Echinorhynchidae Cobbold, 1876.
    7. Subfamily Echinorhynchinae Cobbold, 1876.
    8. Subfamily Yamagutisentinae Golvan, 1969.
    9. Subfamily Circinatechinorhyninae Bhattacharya, 2007.
13. Family Cavisomidae Meyer, 1932.
14. Family Illiosentidae Golvan, 1960,
15. Family Rhadinorhynchidae Travassos, 1923.
    10. Subfamily Rhadinorhynchinae Luhe, 1911.
    11. Subfamily Serrasentinae Petrotschenko, 1956.
    12. Subfamily Serrasentoidinae Parikhin, 1982.
    13. Sufamily Golvanacthinae Van Cleave, —-
    14. Subfamily Gorgorhynchinae Van Cleave & Lincicome, 1940.

6. Order Polymorphida Golvan, 1956.
    15. Family Polymorphidae Meyer, 1931.
    16. Family Centrorhynchidae Van Cleave, 1916.
    17. Family Plagiorhynchidae Meyer, 1931.
        18. Subfamily Plagiorhynchinae Meyer, 1931.
        19 Subfamily Porrorchinae Golvan, 1956.
        18. Subfamily Sphaerechinorhynchinae Golvan, 1960.

3. Class Eoacanthocephala Van Cleave, 1936.
    7. Order Gyracanthoceplala Van Cleave, 1936.
        20. Family Quadrigyridae Van Cleave, 1920.
            21. Subfamily Quadrigyrinae Van Cleave, 1920.
            22. Subfamily Pallisentinae Van Cleave, 1285.
    8. Order Neoechinorhynchida Southwell & Macfie, 1925.
        23. Family Telosentidae Van Cleave, 1936.
        24. Family Dendronueatidae——
        25. Family Neoechinorhynchidae Van Cleave, 1919,
            26. Subfamily Eocollinae Petrotschenko, 1956.
            27. Subfamily Gracilisentinae Petrotschenko, 1956.
            28. Subfamily Neoechinorhynchinae Travassos, 1926.
            29. Subfamily Atactorhynchinae Petrotschenko, 1956.

4. Class Polyacanthocephala Amin, 1989.
    9. Order Polyacanthocephalida Amin, 1989.
        30. Famiily Polyacanthocephalidae Amin, 1989.

SYSTEMATIC ACCOUNT

Amin (1995) has included a fourth class Pokycanthocephala Amin, 1989) with single order Polycanthocephalidae Amin, 1989 to already existing three class Archiacanthdicephala Meyer, 1931, Paleacanthocephala Meyer, 1031 and Eoacanthocephala Van Cleavd, 1948 to Phylum Acanthocephala.

The slightly modified Meyetr-Van Cleave classification of Acanthocephala Bullock (1969) as presented by Amin, (1985, 1989) is followed in present work.

Several workers have p[roposed classificarion of Acanthocephala from time to time in 20 th centuey. Travassos (1926) divided Acanthocephala into four families and 32 genera. Thapar (1926) divides Acanthocephala iinto three orders, five families and 32 genera. Meyer (1933) divided Acanthocephala into three orders, twelve families and 30 genera. Petrotschenko divided into three subclasses with 19 families and 19 genera. Yamaguti divided phylum Acanthocephala into four orders. 23 familes. 21 subfamilies with 93 genera.

Phylum Acanthocephala (Rudolphi) Skrjabin an Schutzel 1921

1925. *Nemathelminhes* Southwell & Macfie, : 147.

1956. *Acanthocephales* Petrotschenko, : 181.

Diagnosis : Parasitic worms with bilateral symmetry. Body in live specimens generally flat, becoming cylindrical sfter fixation. Body surface covered with with cuticle. Musculo-cutaneous sac consists of system of longitydinal and circular muscles. Berween cuticle and muscular layers lies a strong hypoderm with lacunar system with two lateral main dorsal and ventral or lateral longitudinal channels and a network of small transverse anastomising canals. Giant amoeboid nucleu in hypoderm present. Alimentaru system (mouth, intestine and anus) absent. Feeding osmatic. Extensive primary body cavity containing highly developed reproductive system and its products. Blood vascular system absent. Excretory system protonephridial type present, but in many forms completely absent. Nervous system biradially or bilaterally symmetrical, consisting of cephaliv (proboscis) ganglion. Anterior part of body transformed into a proboscis generally armed with chitinous hooks. All presently known species are specialized endoparasites. Dioecious. Reproductive system with well developed male and female genital organs. Fertilisation intermal. Cleavage of fertilized egg in initial phases resembles spiral type but then becomes irregular ans asychronomous. Embryonic development results in transformation of an oval embryonic larva consisting of an outer ectodermal and innerv mesodermal layer. Three types distinguished by type of surface covering, anechinate, hemiechinate and holoechinate corresponding to three classes of acanthocephalan. Larva enclosed in multilayered shell, egg membranes. Development proceeds with obligatory participation of intermediate hosts, which may be mollusca, crustaceans or insects. Definitibe hosts are all classes if vertebrates. Phylum consista of three classes and comprise more 1000 species.

Key to classes of phylum ACANTHOCEPALA

– Cement gland of male single, syncytial with specialized cement reservoir proboscis receptacle single-walled sac; lacunar system with main dorsal and ventral channels; with specialized excretory organs. Normal definitive hosts always cold-blooded vertebrates ..... Class EOACANTHOCEPHALA

– Males with 8 separate cement glands; lacunar system with dorsal and ventral main channels, often with specialized excretory organs; ligament sacs of female dorsal and ventral persistent, adults parasitic in warm-blooded vertebrate ..... as ARCHIACANTHOCEPHALA

– Males with less than 8 but more than 1 cement glands; lacunar system usually with lateral main channels; never with special excretory organs; ligament sacs of female usually ruptured so that eggs develop in body cavity; adults parasitic in all groups of vertebrate ..... Class PALEACANTHOCEPHALA

A. Class ARCHIACANTHOCEPHALA Meyer, 1931

Archiacanthocephala Meyer, 1931c : 110, 1932 : 166-169; Petrotschenko, 1956 : 181; Yamaguti, 1963 : 1.

Diagnosis : Mostly large worms, in terrestrial hosts. Lacunar system with dorsal andn ventral or dorsal main channels. Proboscis with spirally arranged hooks with ventral hooks not larger than dorsal. Proboscis receptacle with ventral cleft except in *Moniliformis*, with one circular muscle layer. Trunk without spines. Hypodermic nuclei few and highly modified and elongate. Ligament sacs dorsal and ventral and persistent. Protonephridia present or absent. Cement glands usually 8, separate. Embryonic membranes heavy and outer sculptured. Adults parasitize warm-blooded vertebrates.

Includes four orders, Apororhynchida Thapar, 1927, Gigantorhynchida Southwell & Macfie, 1925, Moniliformida Schmidt, 1972 and Oligacanthorhynchida Petrotschenko, 1956, all occur in this subcontinent.

Key to orders of class ARCHIACANTHOCEPHALA

1. Proboscis subspherical; protonephridial organs present ..... OLIGACANTHORHYNCHIDA

– Proboscis not subspherical; protonephridial organs absent 2

2. Proboscis bulbous ..... APORORHYNCHIDA

– Proboscis not bulbous 3

3. Proboscis a truncate cone ..... GIGANTORHYNCHIDA

– Proboscis cylindrical ..... MONILIFORMIDA

1. Order APORORHYNCHIDA Thapar, 1927

Apororhynchidea Thapar, 1927 : 116; Meyer, 1933 : 176-177; Petrotschenko, 1958 : 269; Yamaguti, 1963 : 13-14.

Diagnosis : (Yamaguti, 1963) Acanthocephala. Small subconical forms. Proboscis bulbus with infolded anterior wall, incapable of withdrawing into body. Body covered with numerous fine spines instead of hooks. Trunk divided by a constriction, producing anteriorly a collar for reception of base of proboscis. Lacunar system with main dorsal and ventral longitudinal channels. Hypodermic nuclei large, numerous. Protonephridia absent. Proboscis receptacle absent. Lemnisci long with many giant nuclei. Ligament sac persistent. Cement glands 8, rather compact. Ova with three membranous shells. Parasites of birds.

Type family : Apororhynchidae Shipley, 1899 emended Yamaguti, 1963.

Includes only one family Apororhynchidae Shipley. 1899 which occurs in this subcontinent.

1. Family APORORHYNCHIDAE Shipley, 1899

Apororhynchidae Shipley, 1899 : ——; Southwell & Mafie, 1925 : 151; Meyer, 1932 : 176; Petrotschenko, 1958 : 269; Yamaguti, 1963: 14; Bhattacharya, 2007 : 14.

Diagnosis : Apororhynchida. Body plump, with maximum width at level of proboscis or collar. Hypdermic nuclei large, amoeboid, 28-31. Lacunar system consists of a dorsal and ventral main channels and transverse anastomoses. Proboscis globular, its hooks reduced spines which are deeply set without reaching surface, or completely lacking. Proboscis receptacle absent. Ganglion large and embedded in loose mesh of tissue just beneath anterior wall of proboscis. Lemnisci very long, digitiform or tubular, with central canal and 7-11 giant nuclei. Protonephridia absent. Testes diagonal at or near midtrunk. Cement glands 8, pyriform. Ova oval or elliptical, not fusiform, with three membranes. Parasites of birds.

Type genus : *Apororhynchus* Shipley, 1899.

Includes only one genus *Apororhynchus* Shipley, 1899, which occurs in this subcontinent.

1. Genus ***Apororhynchus*** Shipley, 1899

Apororhynchus Shipley, 1899a : 361; Southwell& Macfie, 1925 : 151-152; Meyer, 1932 : 176-177; Petrotschenko, 1958 : 269-270; Yamaguti, 1963 : 14; Anantaraman, M. & Anantaraman, S., 1970 : 2; Bhattacharya, 2007 : 14.

Diagnosis : Apororhynchidae. Proboscis globular, its hooks reduced to spines, deeply set without reaching surface or completely lacking. Proboscis receptacle absent. Ganglion large imbedded in loose mesh of tissue just below anterior wall proboscis. Trunk plump with maximum width at level of proboscis or collar. Hypodermic nuclei large, amoeboid,

28-31. Lacunar system with dorsal and ventral main longitudinal channels and transverse anastomoses. Lemnisci very long, digitiform or tubular with central canal and 9-11 giant nuclei. Protonephridia absent. Testes diagonal at or near midtrunk. Cement glands 8, pyriform. Ova oval or elliptical, not fusiform, with three membranes. Parasites of birds.

Type species : *Apororhynchus hemignathi* (Shipley, 1896) Shipley, 1899.

Includes 7 species *Apororhynchus bivolucrus* Das, 1952, *A. chauhani* Sen, 1975, *A aculeatus* Meyer, 1931, *A. amphistomi* Byrd & Denton, 1949, *A. hemignathi* (Shipley, 1896) Shipley, 1899, *A. paulonucleatus* Khokhlova & Tsimbalyuk, 1966 and *A. silesiacus* Okulewicz & Maruszewski, 1980, of which first two occur in India.

Key to Indian species of genus *Apororhynchus*

- Proboscis with numerous minute hooks..... *Apororhynchus chauhani*
- Proboscis withot hooks ..... *Apororhynchus bivolucus*

1. ***Apororhynchus bivolucrus*** Das, 1952
(Fig. 5)

Apororhynchus bivolucrus Das, 1952a : 43-49, Textfig.1-3; Yamaguti, 1963 : 15; Anantaraman, M. & Anantaraman, S., 1970 : 2; Gupta, P. D. & Ghosh, 1979 : 312; Golvan, 1994 : 139.

Type locality : Amarouti, Maharastra, India.

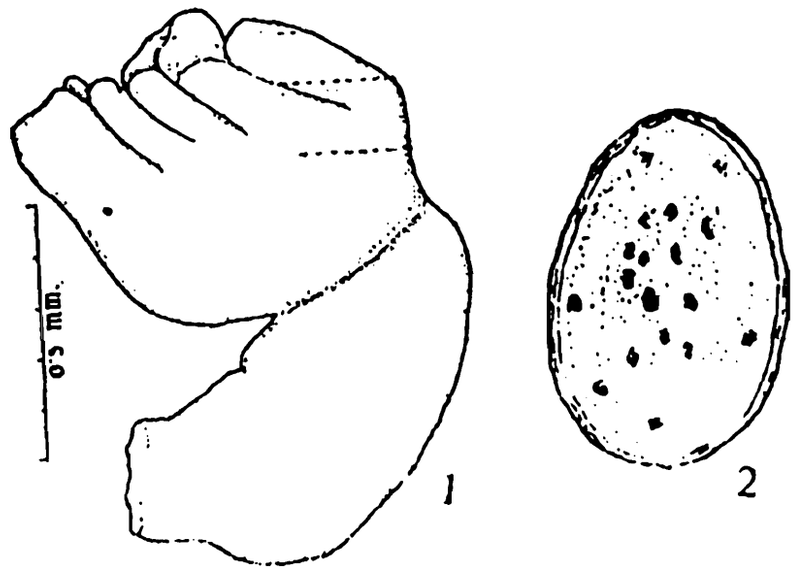


Fig. 5. *Apororhynchus bivolucrus*, Das, 1952. 1. Entire worm, 2. Mature ovum (all after Das, 1952).

Description : Worms dark brown in life, cylindrical and rounded in cross section, curved on dorsal surface, 1.40 × 0.70 mm. Proboscis 0.53 × 0.70 mm, devoid of hooks and spines, divided into two involucres and inner cone-like proboscis by means of deep cleavages and outer involucre forms a complete cup. Anterior end of cup divided into clefts. One

such cleft carries on it a muscle mass. Dorsally outer involucre, much thinner than on ventral surface, thickness 0.05 mm on dorsal and 0.18 mm in on ventral aspect. Inner involucre with uniform thickness, 0.08 mm but incomplete on ventral surface, with its rim cleaved and whole of it protrudes beyond outer involucre, protrusion being 0.06 mm on dorsal surface. Inner involucre encloses within it a solid cone-like inner proboscis 0.45 × 0.30 mm, it is solid mass of muscles situated half way between apex and base. Similar space between inner involucre and proboscis exists, measures 0.30 × 0.01 mm. Involucres and proboscis joined together at base. On ventral surface of cleft of inner involucre lies a horse-shoe-shaped muscle near constriction, measures 0.40 × 0.26 mm, occurring in 5 sections of 0.020 mm thickness each. Muscle situated at base of proboscis base between outer involucre and inner cone regulate size of cleft. This mechanism seems to provide an adhesive organ in absence of hooks, allowing contents of intestine of host to pass around clefts between involucres and inner cone to provide a large absorptive surface. At tip of ventral wall of outer involucre of proboscis, where a small part is bifid, a similar but small muscle mass exists and helps portion of bifid wall to work like a pincer. Just below this muscle is a spherical hollow cellular structure, its lumen leading into a cellular duct ending blindly, of unknown function. Saccular trunk markedly convex dorsally, and narrower than proboscis, with faint annulations on outer surface in life. Trunk wall with giant nuclei, 0.09 × 0.05 mm. Lemnisci 2, elongated fibrous arise from base of proboscis on ventral surface and extend more than half length of trunk, each 0.40 × 0.017 mm, lying 0.080-0.10 mm apart from each other, Ovary spherical 0.13 mm in diameter, lies at anterior end of genital sac, giving rise directly to ovoid eggs, 0.10 × 0.06 × 0.04 mm with 3 concentric membranes. Uterus elongated, 0.30 × 0.10 mm. Vagina canal with vaginal gland and horse-shoe-shaped muscle.Vagina opens out through vulva, inclined and located in center of cup-like depression at posterior end of trunk.

Host : White scavenger vulture *Neophron percuopterus* (Linnaeus).

Location : Intestine.

Locality : Amraoti (Maharastra).

Distribution : Known only from type locality.

Note : Yamaguti considered this species as strigis trmatode, but Amin consideres it as an acanthocephalan.

2. ***Apororhynchus chauhani*** Sen, 1975
(Fig. 6)

Apororhynchus chauhani Sen, 1975 : 211-213, Textfig. 1A, B; Golvan, 1994 : 132; Bhattacharya, 2007 : 15, Pl. 3, Fig. 1 a, b.

Type locality : Srisailam, Andhra Pradesh, India.

Description : Female 4.7 × 1.7 mm, small, plump with maximum width in proboscis region, divided by a constriction forming a collar. Extroverted proboscis semilunar with

convex anterior margin, wider than long, 1.11 × 1.68 mm, armed with numerous finger shaped hooks, embedded in proboscis wall and slightly protruding, more numerous in posterior part. Five rows of minute anteriorly directed hooks at posterior region of proboscis and about three rows of slightly larger hooks just in front of collar. Proboscis receptacle slightly larger in size than proboscis with nerve ganglion embedded near its anterior end. Lacunar system with dorsal and ventral main longitudinal channels and transverse anastomoses. Hypodermic nuclei large and amoeboid. Lemnisci very long, unequal, tubular extending from posterior margin of proboscis to uterine bell with central canal. Uterine bell 0.38 × 0.15 mm with six guard cells. Uterus and vagina together, 0.45 mm long. Ovary broken up into large number rounded or ovoid ovarian balls filling body cavity, each 0.07 × 0.17 mm. Eggs not fully formed 0.03-0.04 × 0.01-0.02 mm. Male not known.

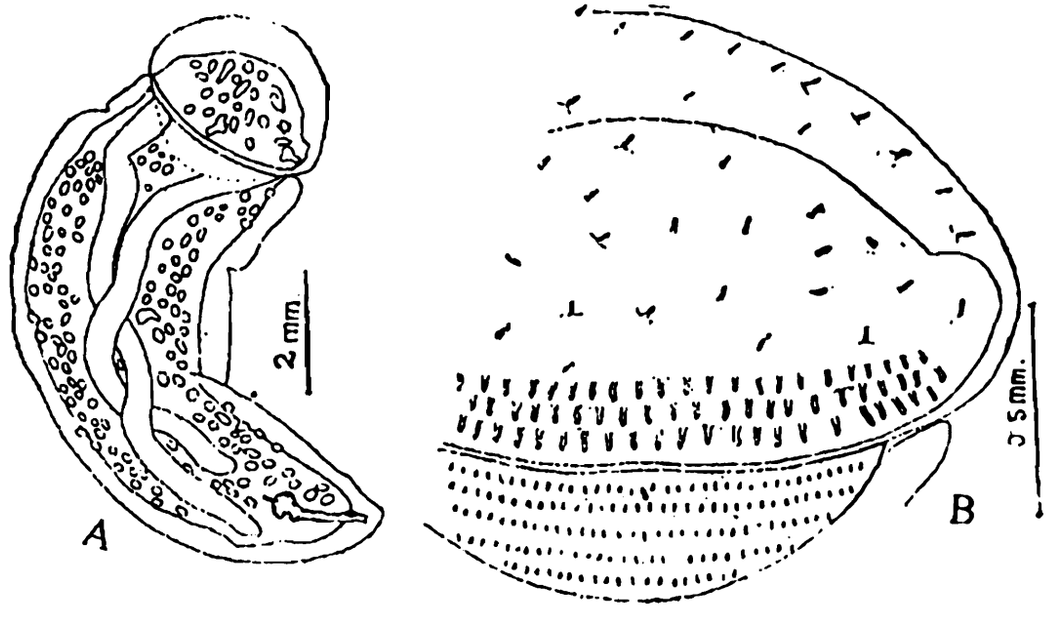


Fig. 6. *Apororhynchus chauhani* Sen, 1975. 1. Male, 2. Proboscis enlarged (after Sen, 1975).

Host : *Athene brama* (Temminick).

Location : Intestine.

Locality : Srisilam in Kurnool district (Andhra Pradesh).

Distribution : Known only from type locality.

2. Order GIGANTORHYNCHIDA Southwell & Macfie, 1925

Gigantorhynchidea Southwell & Macfie, 1925 : 152;
Gigantorhynchida Petrtschenko, 1958 : 146; Yamaguti, 1963 : 113.

Diagnosis : Acanthocephala. Proboscis invaginable, bipartite or not, with small or large number of hooks.Proboscis receptacle single- or double-walled, inserted at base of

proboscis or anterior to it. Trunk of medium to large size, spinose or aspinose. Protonephridia present or absent. Cement glands divided into three or more compact or tubular lobes. Eggs oval to elliptical, withoutpolar prolongations of middle shell. Embryo with hooks at either end and numerous spines elsewhere. Parasites as adults in terrestrial vertebrates, as larva in insects.

Includes single family Gigantorhynchidae Hamann 1892.

2. Family GIGANTORHYNCHIDAE Hamann, 1892

Gigantorhynchidae Hamann, 1892: 195-197;

Gigantorhynchinae Travassos, 1915 : 3; 1915b : 137; Thapar, 1927 : 117;

Leiperacanthidae Bhalerao, 1937 : 202;

Gigantorhynchinae Southwell & Macfie, 1925 : 152;

Gigantorhynchidae Petrotschenko, 1958 : 196; Yamaguti, 1963 : 113; Bhattacharya, 2007 : 17.

Diagnosis : Gigantorhynchida. Proboscis bipartite, anterior part with large hooks, posterior part with smaller rootless hooks or spines. Proboscis receptacle elongate or plump inserted at base of anterior part of proboscis. Trunk of medium to large size, with or without pseudo-segmentation. Lemnisci long or short, slender. Protonephridia absent. Testes in anterior, middle or posterior part of trunk. Cement glands 6-8, compact. Eggs oval, with concentric membranous shells. Parasites of birds and mammals.

Type genus : *Gigantorhynchus* Hamann, 1892.

Includes three genera *Mediorhynchus* Van Cleave, 1916, *Gigantorhynchus* Hamann, 1872 emend Yamaguti, 1963, of which first genus occurs in this subcontinent.

2. Genus ***Mediorhynchus*** Van Cleave, 1916

Mediorhynchus Van Cleave, 1916b : 221-232;

Micracanthorhynchus Travassos, 1917 : 60;

Mediorhynchus Southwell & Macfie, 1925 : 165;

Empodium Southwell & Macfie, 1925 : 163;

Mediorhynchus Meyer, 1933 : 183;

Leiperacanthus Bhaterao, 1937 : 202;

Mediorhynchus Van Cleave, 1947b : 297; Petrotshenko, 1958 : 252-254;

Empodius Petrotschenko, 1958 : 248; Golvan, 1994 : 161.

Mediorhynchus Bhattacharya, 2007 : 17.

Diagnosis : Gigantorhynchidae. Proboscis with hooks in spiral and longitudinal rows, posterior part often conical, slightly wider than anterior part, and may be folded transversely. Proboscis receptacle saccate to claviform, single-walled. Trunk of medium size, usually without pseudosegmentation. Lemnisci long, slender. Testes in middle or posterior pary of trunk. Cement glands 6-8 ovoid. Eggs oval with concentric membranous shells. Paraites of birds.

Type species : *Mediorhynchus papillosum* Van Cleave, 1916.

Includes fifty seven species, 1. *Mediorhynchus armenicus* Petrotschenko, 1957, 2. *M. cambellensis* Soota, Srivastava & Ghosh, 1969, 3. *M. channapettae* George & Nadakal, 1984, 4. *M. colini* (Webster, 1948) Schmidt & Kuntz, 1977, 5. *M. fatimae* Khan, Bilqees & Muti-ur-Rahman, 2004, 6. *M. gallinarum* (Bhalerao, 1937) Van Cleave, 1947, 7. *M. garruli* Yamaguti, 1939, 8, *M. grandis* Van Cleave, 1916, 9. *M. indicus* George, Nadakal, Vijayakumar & Rajendran, 1981, 10. *M. mariae* George & Nadakal, 1981, 11.*M. micracanthus* (Rudolphi, 1819) Meyer, a1932, 12. *M. nickoli* Khan, Bilqees & Mati-ur-Rehman, 2004, 13. *M. orientalis* Belopolskya, 1953, 14. *M. pandei* Bhattacharya, 2007. 15. *M. passerus* Das, 1951, 16. *M. peckeri* Bhattacharyam 1999, 17. *M.quilonensis* Bhattacharya, 2007,18.*M. rajasthanensis* Gupta, P. D., 1976, 19. *M. robustus* Van Cleave, 1918, 20. *M. taeniatus* (Linstow, 1901) Dollfus, 1936, 21. *M. thrushi* Bgattacharya, 2000, 22. *A. alecturae* (Johnston & Edmonds, 1947) Golvan, 1962, 23. *M. bakeri* Byrd & Kellog, 1971, 24. *M. centurorum* Nickol, 1969, 25. *M. conirostris* Ward, 1966, 28. *M. corcoracis* Johnston & Edmonds, 1951, 29. *M. edmondsi* Schmidt & Kuntz, 1977, 29. *M. emberiszae* (Rudolphi, 1819) Travassos, 1924, 22. *M. empodius* (Skrjabin,1913) Van Cleave, 1924, *M.* 23. *M. fasciatus* (Westrumb, 1821) Meyer, 1932, 30. *M. giganteus* Meyer, 1931, 31. *M. kuntzi* Ward, 1960, 32. *M lagodekhiensis* Kurachvilli, 1955, 33. *M. leptis* Ward, 1966, 34. *M. lophurae* Wang Pu Qin, 1966, 35. *M. mattei* Marchand & Vassillades, 1982, 36. *M. meiringi* Bisseru, 1960, 37. *M. mirabilis* (de Marval, 1905) Travassos, 1925, 38. *M. murtensis* Lundstrom, 1942, 39. *M. numidae* (Baer, 1925) Golvan, 1962, 40. *M. oswaldocruzi* Travassos, 1923,41. *M. otidis* (Miescher, 1841 in de Marval, 1904) Van Cleave, 1947, 42. *M. papillosus* Van Cleave, 1916,43. *M. pauciuncinatus* Dollfus 1959, 4. *M. petrotschenkoi* Gvuzdev & Soboleca, 1966, 45. *M. pintoi* Travassos, 1923, 46. *M. radensis* Diaz-Cosin 1971, 47. *M. segmentatus* (de Marval, 1902) Dollfus, 1936, 48. *M. selengensis* Harris, 1973, 49. *M. sipocotensis* Tubangui, 1935, 50. *M. tanagrae* (Rudolphi, 1819) Travassos, 1921, 51. *M. tenius* Meyer, 1931, 52. *M. textori* Barus, Sixl & Majumdar, 1978, 53. *M. turnixena* (Tubangui, 1933) Golvan, 1962, 54. *M. vaginatus* (Diesing, 1851) Meyer, 1932, 55. *M. vancleavei* (Lundstrom, 1942) Golvan, 1962, 56. *M. wardi* Schmidt & Canaris, 1967 and 57. *M. zosteropis* (Porta, 1913) Meyer, 1932, of which first twenty one species occur in Indian subcontinent.

Key to Indian species of genus *Mediorhynchus*

1. Anterior proboscis with 12 spiral rows of 7 hooks each, posterior proboscis with 40 longitudinal rows of 3 hooks each ..... *Mediorgynchus colini*

– Proboscis with only spiral rows of hooks .....

2. Proboscis with longitudinal rows of hooks 5

– Proboscis with 12 spiral rows of 4 jooks each in male, 30 spiral rows of 14-15 hooks each in female ..... *Mediohgynchus rajasthanensis*

– Proboscis divided into anterior and posterior parts with different number of hooks 3

– Anterior proboscis with 6 spiral rows of 5 hooks each, posterior proboscis with 12 spiral rows of 16 hooks each ..... *Mediorhynchus taeniatus*

– Anterior and posterior proboscis with more than 6 and 12 spiral rows 4

4. Anterior proboscis with 7 spiral rows of 7-8 hooks each, posterior proboscis with numerous rows of hooks ..... *Mediorhynchus cambellensis*

– Anterior proboscis with 7 diagonal spiral rows of 5-6 hooks each, posterior proboscis prpboscis with 7 spiral rows of 2-3 hooks each..... *Mediorhynchus passerus*

– Anterior proboscis with 9 spiral rows of 9 hooks each, posterior proboscis with 10 spural rows of 5-6 hooks each ..... *Mediorhynchus micracanthus*

5. Entire proboscis with same number of hooks 6

– Antereior and posterior proboscis with different number of rows of longitudinal rows of hooks 10

6. Proboscis with 14-17 longitudina,l rows of 8-10 hooks each .... *Mediorhynchus indicus*

– Proboscis with 19 longitudinal rows of 5 hooks each ... *Mediorhynchus gallinarum*

– Proboscis with more than 18 rows of hooks 7

7. Proboscis with 16 longitudinal rows of 8 hooks each ..... *Mediorhynchus pandei*

– Proboscis with 18 or more longitudinal rows of hooks each 8

8. Proboscis with 18-24 longitudinal rows of 10-14 hooks each .... *Mediorhynchus mariae*

– Proboscis with 20 longitudinal rows of 4 hooks each.... *Mediorhynchus quilonensis*

– Proboscis with 20 or more longitudinal rows of hooks 9

9. Proboscis with 20-30 longitudinal rows of 4-5 hooks each..... ..... *Mediorhynchus robustus*

– Proboscis with 30-32 longitudinal rows of 4-5 hooks each .... *Mediorhynchus garruli*

10. Anterior proboscis with with 10 longirtdinal rows of 7-8 hooks each, posterior proboscis with 7 longitudinal rows of 608 hooks each ..... *Mediorhynchus nickoli*

– Anterior proboscis with 10-12 longitudinal rows of 6-8 hooks eaxh, posterior proboscis with 10-12 longitudinal rows of 7-8 hooks each .....*Mdiorhynchus fayimae*

– Anterior proboscis with 10-12 longitudinal rows of 7 hooks each, posterior proboscis with 10-12 longitudinal rows of 5-6 hooks each ..... *Mediorhynchus armenicus*

– Abterior and posterior proboscis with more than 12 longitudinal rows of hooks 11

11. Anterior proboscis with 14 longitudinal rows of 6 hooks eaxh, posterior proboscis with 14 longitudinal rows of 4 hooks each ..... *Mediohgynchus peckeri*

– Anterior proboscis with 14-16 longitudinal rows of 4 hooks each, posterior proboscis with 18 longirudinal rows of 7 hooks each ..... *Mediorhynchus grandis*

– Anterior and posterior proboscis with 16 or more longitudinal rows of 7 hooks each 12

12. Anterior proboscis with 16 longitudinal rows of 5 hooks each, posterior proboscis with 18 longitudinal rows of 5 hooks eaxh ..... *Mediorhynchus thrushi.*

Anterior proboscis with 16-25 longitudinal rows of 7-12 hooks each, posterior proboscis with 40-45 lonitudinal rows of 8-14 hooks each ..... *Mediorhynchus channapettae*

– Anterior proboscis with 20-22 longitudinal rows of 4-7 hooks each, posterioe proboscis with 32-50 hooks each ..... *Mediorhynchus orientalis*

3. ***Mediorhynchus aremenicus*** Petrotschrnko, 1958
(Fig. 7)

Mediorhynchus aremenicus Petrotschnnko, 1958 : 253-268; Gupta, N.K. & Lata, 1968 : 253-268; Bhattacharya, 1999 : 371; 2000 : 152155; 2007 : 19, Pl. 2, Fig. 2 a, b. : 11-458; Gupta, N.K. & Lata, 1968; Bhattacharya, 2007: 19, Pl. 3, Fig. 2 a, b.

Type locality : Central Asia.

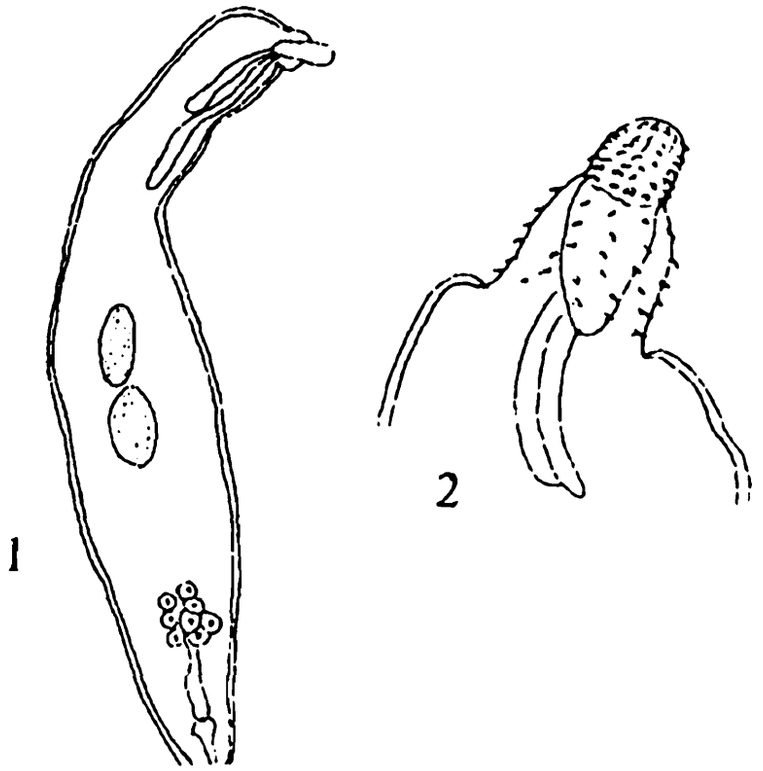


Fig. 7. *Mediorhynchus armenicus* Petrochenko, 1958. 1. Female, 2. Proboscis enlarged (after Bhattacharya, 1997).

Description : Male 9-16 × 2.21-2.93 with pseudosegmentation. Proboscis cylindrical, divided into two parts, anterior proboscis 0.56-0.63 × 0.52-0.59 mm. at base, with 10-12 lomgitudinal roes of 7 hooks each, hooks 0.04 mm long, posterior proboscis wider with 10-12 longitudinal rows of 5-6 hooks each, hooks 0.03 mm long. Proboscis receptacle 0.49-0/77 × 0.24-0.43 mm. Lemnisci about half as long as receptacle. Testes in ovoid, in tandem, postequatorial, anterior 1.30-1.39 × 0.78-0/95 mm, posterior 1.29-2.17 × 0.81-0.94 mm. Cement glands eight.

Host : *Garrulax moniligers*; Picus flavinucha;

Location : Intestine;

Locality : Punjab; Garo Hills (Meghalaya).

Distribution : Central Asia.

4. ***Mediorhynchus cambellensis*** Soota, Srivastava & Ghosh, 1969 (Fig. 8)

Mediorhynchus cambellensis Soota, Srivastava & Ghosh, 1969 : 504; 1971 : 24-25, Textfig. 3 a, b, 4; Gupta, N.K. & Jain, 1973 : ?24-25, Fig. 3, 4; Gupta, P.D. & Ghosh, 1979 : 314; Golvan, 1994 : 162; Bhattacharya, 2007 : 10-20, Pl. 3. Fig. 3 a-c.

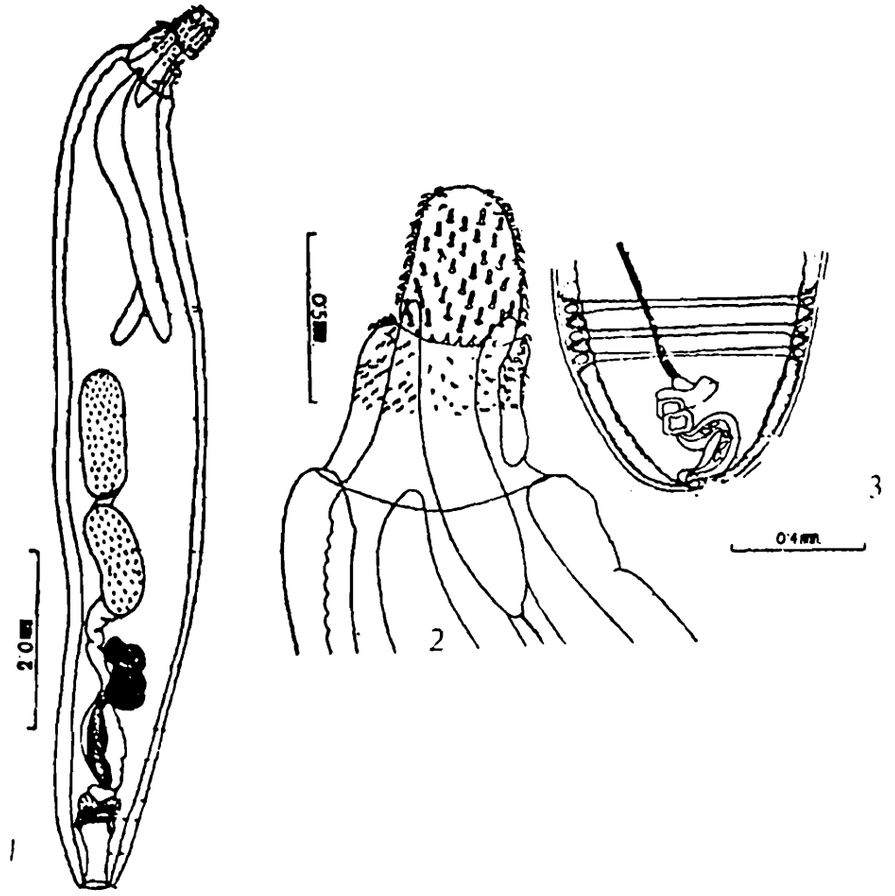


Fig. 8. *Mediorhynchus cambellensis* Soota, Srivastava & Ghosh, 1969. 1. Male, 2. Anterior part of worm, 3. Posterior part of female. (after Soota, Srivastava & Ghosh, 1969).

Type locality : Campbrll Bay, Car Nicobar, Andaman and Nicobar Islands, India.

Description : Male 9.13 × 1.2 mm. Female 13-16 × 2.0 mm. Proboscis short, club-shaped about 0.83 mm long, proximal part conical, distal part truncated, with anterior hooks in 7 spiral rows of 7-9 larger hooks each, posterior too numerous and small to be counted. Proboscis receptacle 0.66 mm long in male; in female 1.0 mm long. Trunk elongate, robust. Lemnisci almost equal, 3.15 × 0.25 mm, extending upto third of body. Testes almost equal, 1.2 × 0.44 mm. Cement glands 4 pairs, not clearly discernible. Female genital tract recumbent and deltoid. Eggs 0.055 × 0.033 mm. Gonopore subterminal.

Host : Oriole Fly catcher.

Location : Intestine.

Locality : Campbell Bay, Great Nicobar (Andaman & Nicobar Islands).

Distribution : Known only from India.

Note : Not valid as per Schmidt & Kuntz, 1977.

5. ***Mediorhynchus channapettae*** George & Nadakal, 1984 (Fig. 9)

Mediorhynchus channapettae George & Nadakal, 1984 : 99-101, Fig. 2 a-d; Golvan, 1994 : 162; Bhattacharya, 2007 : 20, Pl. 3, Fig. 4 a-c.

Type locality : Channapetta, Kerala, India.

Description : Male 6-12 × 0.5 mm; female 8-20 × 1.35-3.0 mm. Proboscis ovoid or cone-shaped, 0.4-0.45 × 0.30-0.625 mm in male; in female 0.60-0.62 × 0.37-0.81 mm. divided into anterior narrow and posterior wide parts, former with 16-25 longitudinal rows of 7-12 hooks each and latter with 40-45 longitudinal rows of 8-14 hooks each. Roots directed backwards with circular and elongated discs. Anterior hooks 0.025-0.030 × 0.008-0.010 mm, middle 0.050-0.058 × 0.010-0.016 mm and posterior 0.025-0.030 × 0.006-0.010 mm. Spines with cuticular papillae around their bases. Neck indistinct. Proboscis receptacle claviform, single-walled 0.56-0.60 × 0.20-0.25 mm in male; in female 0.60-0.62 × 0.20-0.30 mm, with ganglion embedded in middle of receptacle. Trunk plump, nearly cylindrical, pseudo-segmented, aspinose and swollen anteriorly. Lemnisci unequal, flat, wide anteriorly and narrow posteriorly, extend beyond receptacle, in male 1.7-1.9 × 0.2-0.25 mm, in female 2.2-2.5 × 0.2-0.22 mm. Testes post-equatorial, in tandem, equal and ovoid, 1.6-1.7 × 0.8-0.85 mm. Cement glands 8, pyriform or spheroidal, equal, lying away from posterior testis in two groups of 4 glands on either side. Cement reservoir 0.27-0.40mx 0.40-0.46 mm. Everted bursa not observed. Uterine bell 0.25-0.27 × 0.12-0.15 mm, post-equatorial. Uterus tubular, long, 0.30-0.32 × 0.07-0.12 mm. Vagina 0.18-0.20 × 0.04-0.06 mm. Eggs oval 0.06-0.08 × 0.04-0.05 mm with 3 shells. Embryos 0.04-0.05 × 0.035-0.040 mm, with larval hooks and central nuclear mass. Outer egg shell not sculptured and middle shell without polar prolongations. Gonopore terminal.

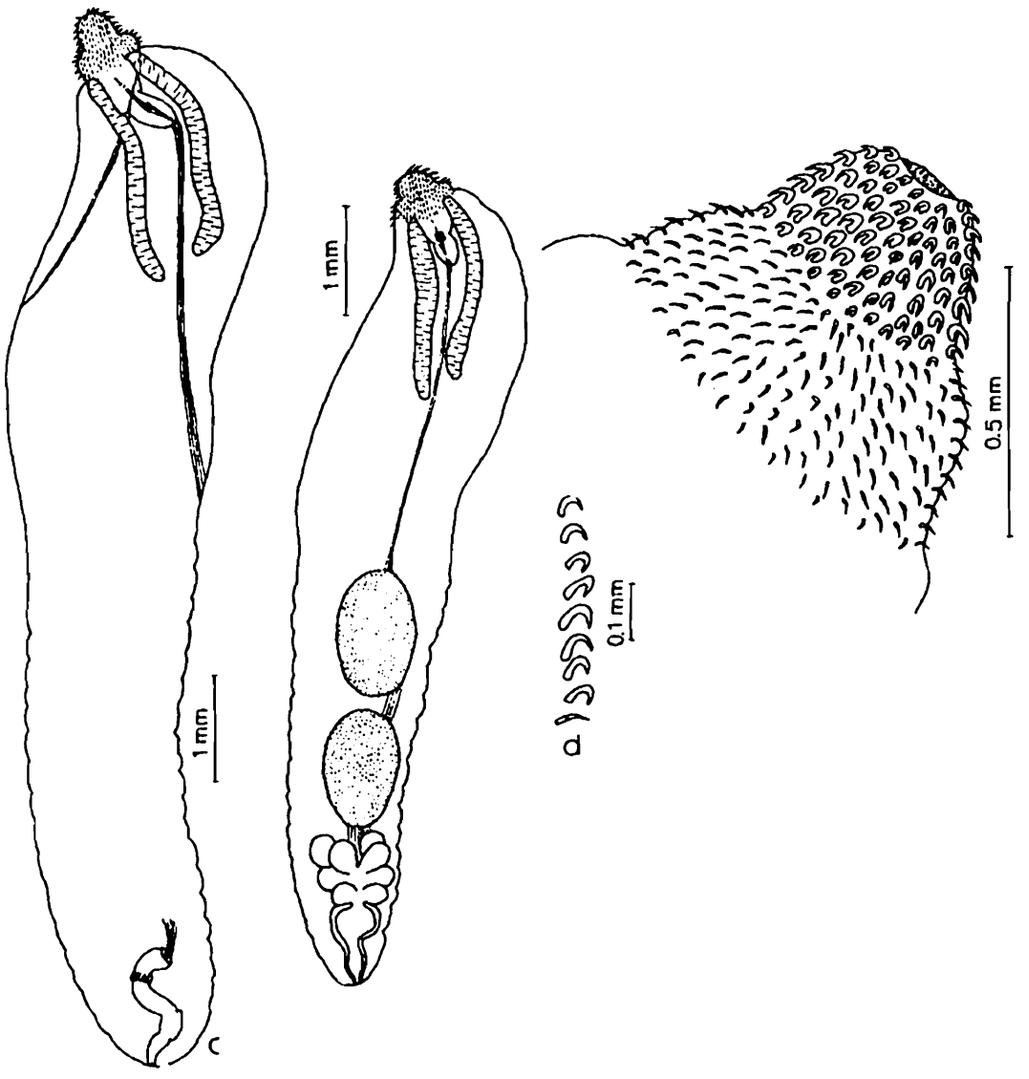


Fig. 9. *Mediorhynchus channapettae* George & Nadakal, 1984. 1. Female, 2. Male, 3. Proboscis, enlarged, 4. Row of proboscis hooks enlarged (after George & Nadakal, 1984).

Host : *Dinopium bengalense* (Linnaeus).

Location : Small intestine.

Locality : Channapettae (Kerala); Punjab.

Distribution : Known only from Indian subcontinent.

6. ***Meridorhynchus colini*** (Webster, 1948) Schmidt & Kuntz, 1977 (Fig. 10)

Meridorhynchus colini Webster, 1948 : 84-86; Gupta, N. K. & Lata, 1968 : 253-268; Bhattacharya, 2007 : 20, Pl. 3, Fig. 5 a, b.

Type Locality : Texas, U. S. A.

Description : Female 24-31 × 0.6-1.0 mm. Proboscis conical, 0.292 × 0.388 mm, anterior proboscis with 12 spiral rows of 7 hooks each, posterior proboscis with 10 longitudinal rows of 3 hooks each, hooks 0.03-0.05 mm long. Proboscis receptacle 1.08-1.25 × 0.274 mm with central ganglion. Lemnisci twice as long as receptacle, 3.48-3.56 mm long with 8-9 nucleus each. Eggs 0.029-0.036 × 0.018-0.021 mm.

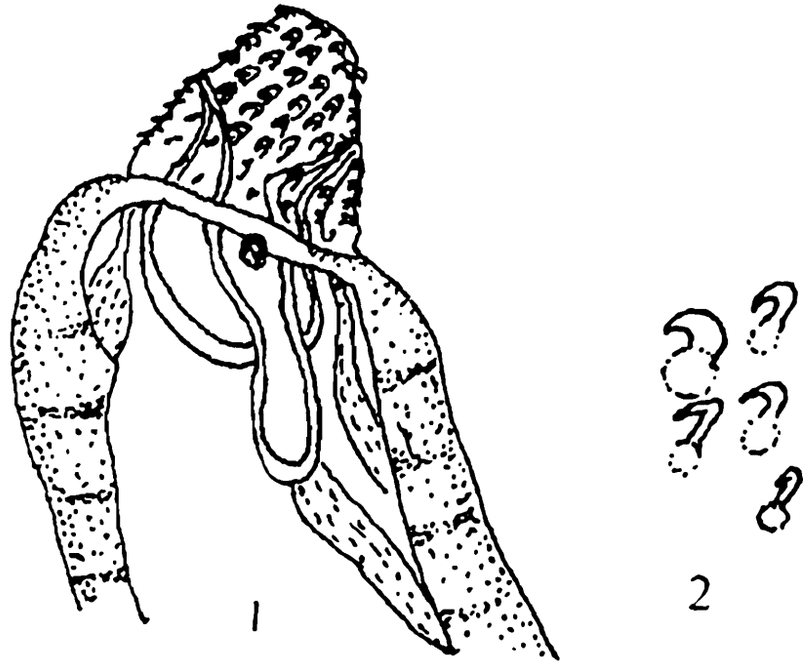


Fig. 10. *Mediorhynchus colini* (Webster, 1948) Schmidt & Kuntz, 1977, 1. Proboscis, 2. Proboscis hooks. (after Bhattacharya, 1997).

Host : *Colinus virginiatus.*

Location : Intestine.

Locality : Punjab.

Distribution : Texas, U.S.A.

7. ***Mediorhynchus fatimae*** Khan, Bilqees & Muti-ur-Rahman, 2004 (Fig. 11)

Mediorhynchus fatimae Khan, Bilqees & Muti-ur-Rahman, 2004 : 139-140, Fig 1 A-E; Golvan, 1994: 162.

Type locality : Karachi, Sindh, Pakistan.

Description : Male 22.6-22.8 mm long, 1.04-1.52 maximum width; female 34.16-43.56 × 1.2-1.6 mm. Proboscis truncate divided into two parts, 0.64-0.92 × 0.32-0.41 mm in male; in female 0.48-0.72 × 0.30-0.32 mm, with10-12 rows of 6-8 hooks each. Hooks 0.043-0.045 × 0.0057-0.0083 mm. Teloboscis armed with 10 rows of 7-8 spines each,

0.022-0.043 × 0.0038-0.0045 mm. Neck small, short, 0.02-0.08 × 0.44-0.62 mm at base in male, in female 0.2-0.4 × 0.24-0.28 mm. Proboscis receptacle, 1.20-1.32 × 0.24-0.32 mm in male; in female 1.04-1.44 × 0.20-0.24 mm. Trunk elongate with slight pseudo-segmentation. Lacunar system with main longitudinal channels and transverse anastomoses. Lemnisci 2.12-2.24 × 0.24-0.36 mm in male; in female 2.12-2.40 × 0.16-0.44 mm. Anterior testis 0.76-0.86 × 0.26-0.28 mm, posterior 0.80-0.84 × 0.36 mm.

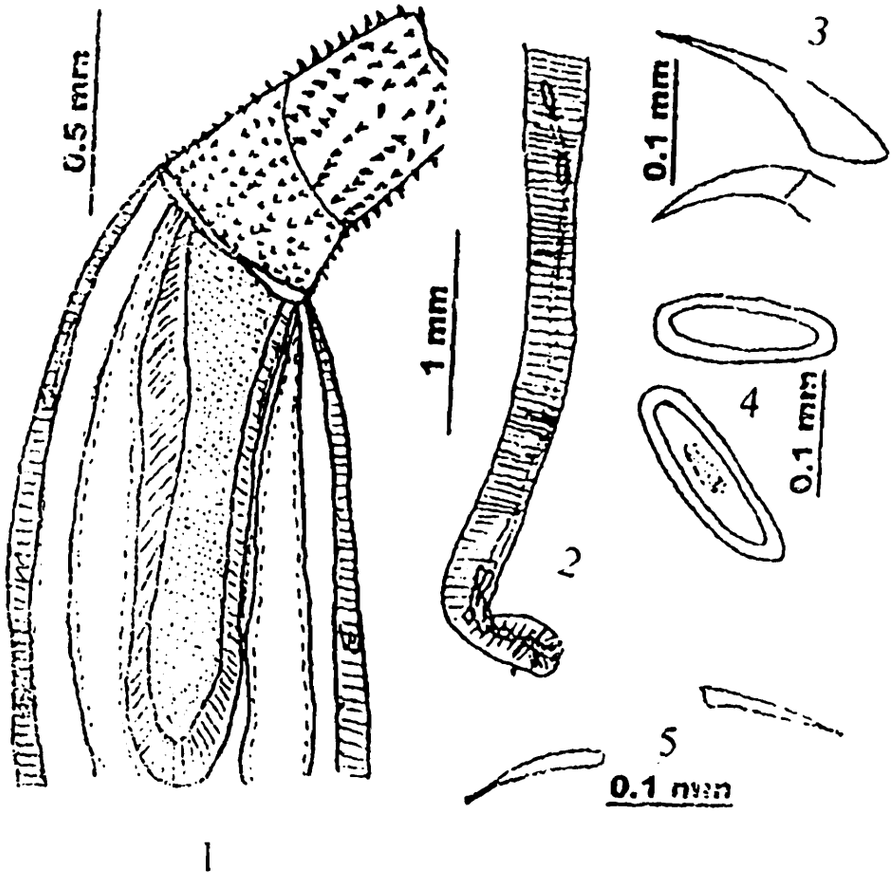


Fig. 11. *Mediorhynchus fatimae* Khan, Bilqees & Muti-ur-Rehman. 2004. 1. Anterior part of worm. 2. Posterior part of male. 3. Proboscis hooks enlarged. 4. Eggs enlarged, 5. Trunk spines enlarged (after Khan *et al.*, 2004).

Distance between lemnisci and anterior testis 2.60-4.10 mm. Distance between testes 0.8-1.04 mm. Cement glands 8, lying posterior to testes. Bursa 2.72 × 0.72 mm. Ovarian balls 1.0-1.04 × 0.5-1.0 mm. Uterine bell 2.2-2.6 × 0.16-0.20 mm. Eggs elongate 0.041-0.045 × 0.015-0.018 mm, without polar prolongation of middle shell.

Host : Eagle, *Butastur teesa* Franklin.

Location : Intestine.

Locality : Karachi, Sindh, Pakistan.

Distribution : Known only from type locality.

8. ***Mediorhynchus gallinarum*** (Bhalerao, 1937) Van Cleave, 1947 (Fig. 12)

Leiperacanthus gallinarum Bhalerao, 1937 : 199-203; Fig. 1-4;

Mediorhynchus gallinarum Van Cleave, 1947a : 55-58;

Empodius gallinarum, Petrotschenko, 1958 : 258;

Empodium sp. Alwar & Lalitha, 1961 : 142;

Mediorhynchus gallinarum Yamaguti, 1963 : 117; Nath & Pande, 1963 : 31-34, Fig. 1-4;

Mediorhynchus (*Leiperacanthus*) *gallinarum* Anantaraman, M. & Anantaraman, S., 1970 : 7;

Mediorhynchus gallinarum, Srivastava, 1971 : 92; Joshi, Sharma & Shah, 1978 : 1020; Golvan, 1994 : 162.; Bhattacharya, 2005 : 123-157; 2007 : 21, 23, Pl. 4, Fig. 7 a, b.

Type Locality : Mhow, Madhya Pradesh, India.

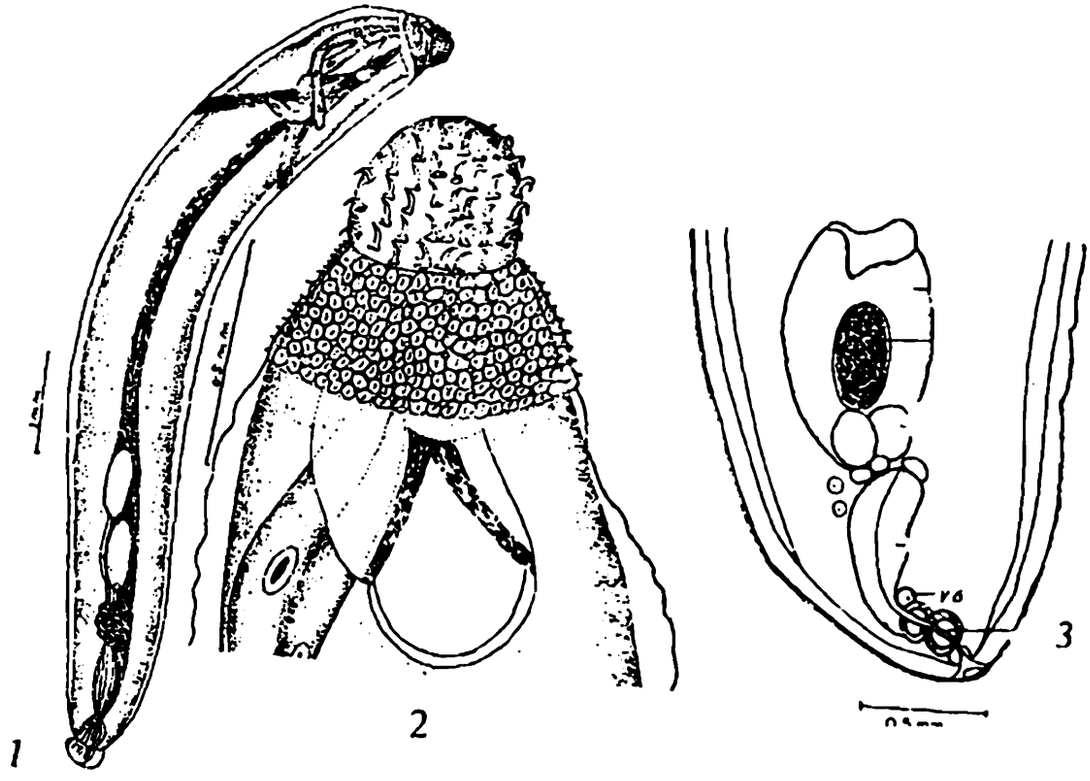


Fig. 12. *Mediorhynchus gallinarum* (Bhalerao, 1937) Van Cleave, 1947. 1. Male, 2. Anterior part of worm. 3. Posterior part of male. (1 after Bhalerao, 1937, 2, 3 from Van Cleave, 1947).

Description : Male 8.2-11.3 × 1.2-1.5 mm. Females 16-40 × 1.16-2.0 mm. Proboscis divisible into proximal subglobular part, 0.27-0.35 × 0.36-0.38 mm and posterior part nearly rectangular, 0.20-0.32 × 0.72-0.76 mm, in female proximal part, 0.30-0.34 × 0.37-0.45 mm, distal part 0.3-0.45 × 0.37-0.45 mm, with 18 longitudinal rows of 5 hooks each in both sexes. Hooks distally with a granular disc but proximal end sharply curved and gradually diminishes posteriorly. Proboscis receptacle bent to one side, 0.75-0.81 × 0.30-0.32 mm, with paraproboscoidal sacs. Lemnisci 1.35-1.72 mm long. Testes elongated, lie

one behind other, in posterior third of trunk, 0.75-0.855 × 0.30-0.34 mm. Two vasa efferentia unite about middle of cement glands, forming vas deferens, running along its sides, enlarge posteriorly into seminal vesicle, which opens finally at bursa. Cement gland 0.40-0.48 × 0.33-0.35 mm with 8 nucleated cells nearly equal and their ducts open into a cup-shaped bursa with complicated structure, 0.155-0.168 × 0.34-0.38 mm.

Host : *Gallus gallus domesticus*. Domestic poultry and ducks.

Location : Intestine.

Locality : Kurnool (Andhra Pradesh); Mhow (Madhya Pradesh); Mukteswar, Mathura (Uttar Pradesh).

Distribution : Cosmopolitan.

9. ***Mediorhynchus garruli*** Yamaguti, 1939
(Fig. 13)

Mediorhynchus garruuli Yamaguti, 1939 : 348-349, Pl. 48, Fig. 39,40, Pl. 49, Fig. 51. 52; Bhattacharya, 2000 : 152; 2007 : 20-21, Pl. 4, Fig. 6 a, b.

Type Locality : Japan.

Description : Male 20-47 × 0.8-1.3 mm ; female 55-65 × 1.8 mm. Proboscis truncate, conical, 0.27-0.3 × 0.2-0.25 mm, in male and in female 0.4 × 0.32 mm, its hooks with small sharp blade and a large plump root ensheathed in cuticular fold, arranged in 22-24 alternating longitudinal rows of about 5 hooks each, subapical hooks slightly larger than apical hooks, up to 0.036 mm from tip of blade to height of curve. Proboscis receptacle

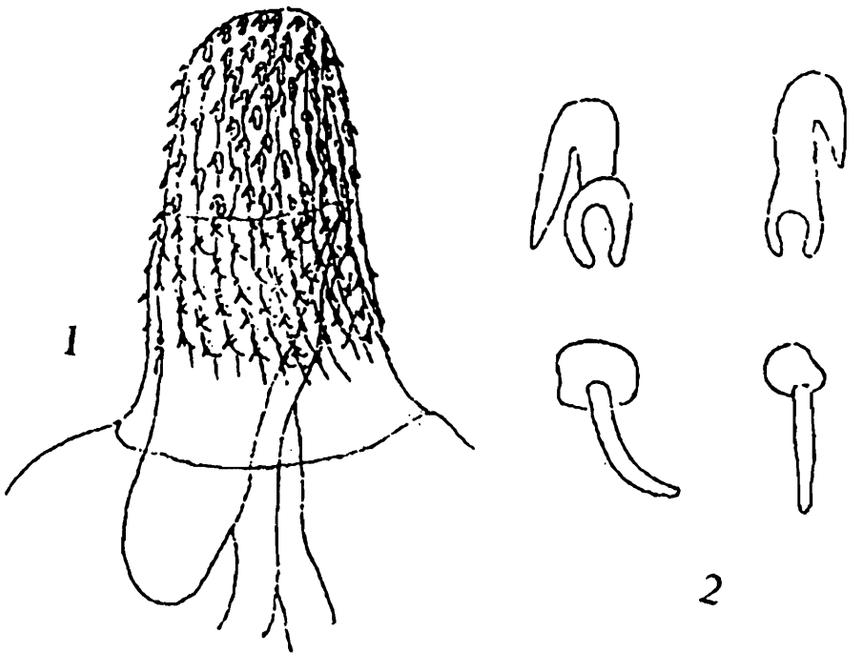


Fig. 13. *Mediorhynchus garruli* Yamaguti, 1939. 1. Proboscis enlarged, 2. Proboscis hooks (After Bhattacharya, 1997).

0.7-1.1 × 0.15-0.25 mm in male and in female up to 1.4 × 0.35 mm, divided into two unequal parts, anterior slightly longer and wider than posterior part and enclosed in thick capsule of fine longitudinal muscles., and posterior part projects freely into wide sheath loke ligament functioning as genital sheath posteriorly. Ganglion lies dorsally behind middle of anterior part of receptacle, paired retinacula penetrate this part a little behind ganglion. Neck truncate, conical, 0.37-0.4 × 0.35-0.58 mm, armed in anterior half with simple spines arranged in 28-30 longitudinal rows of 4-5 each, whose basal part embedded in papilliform cuticular folds. Trunk smooth, pseudosegmented, entire length. Lemnisci 1.75-2.4 × 0.14-0.15 mm in male and in female 5.2 × 0.35 mm. Testes elliptical, in tandem, in posterior thirf of trunk, 1.2-1.7 × 0.4-0.8 mm. Cement glands 8, forming a mass 1.1-1.3 × 0.45-0.65 mm. behind posterior testis. Seminal vesicle 0.8-1.4 mm in diameter. Saefftigen's pouch 0.25-0.35 mm in diameter. Uterus and vagina ibscured by eggs. Eggsoval to elliptical, 0.066-0.72 × 0.040-0.042 mm, embryo 0.048-0.051 × 0.026-0.027 mm.

Host : *Garrulus glandaris japonicus* (Woodpecker).

Location : Intestine.

Locality : Tripura.

Distribution : Japan.

Note : Indian specimens of this species are much smaller than Japanese specimens.

10. ***Mediorhynchus grandis*** Van Cleave, 1916

Mediorhynchus grandis Van Cleave, 1916 : 221-232; Bhattacharya, 1999 : 370-371, 2007:21.

Type localiry : U.S.A.

Description : Male 8 × 0.75 mm; Female 12.25 × 0.75 mm. Proboscis cylindrical, 0.62 × 0. 57 mm, anterior proboscis with 16 longitudinal rows of 4 hooks each, posterior proboscis with 18 longitudinal rows of 7 hooks each. Point of hooks 0.016 mm long and root 0.04 mm l.long. Proboscis receptacle single-walled with central ganglion. 0.624 × 0/ 3 mm. Eggs 0.045 × 0.025 mm.

Host : *Vanellus* sp.

Location : Intestine.

Locality : Garo Hills (Meghsalaya).

Distribution : U.S.A.

11. ***Mediorhynchus indicus*** **George,** Nadakal, Vijayakumar & Rajendran, 1981 (Fig. 14)

Mediorhynchus indicus George, Nadakal, Vijayakumar & Rajendran, 1981 : 301-303; George & Nadakal, 1981c : 303-304; Golvan, 1994 : 162.

Type locality : Trivandrum, Kerala, India.

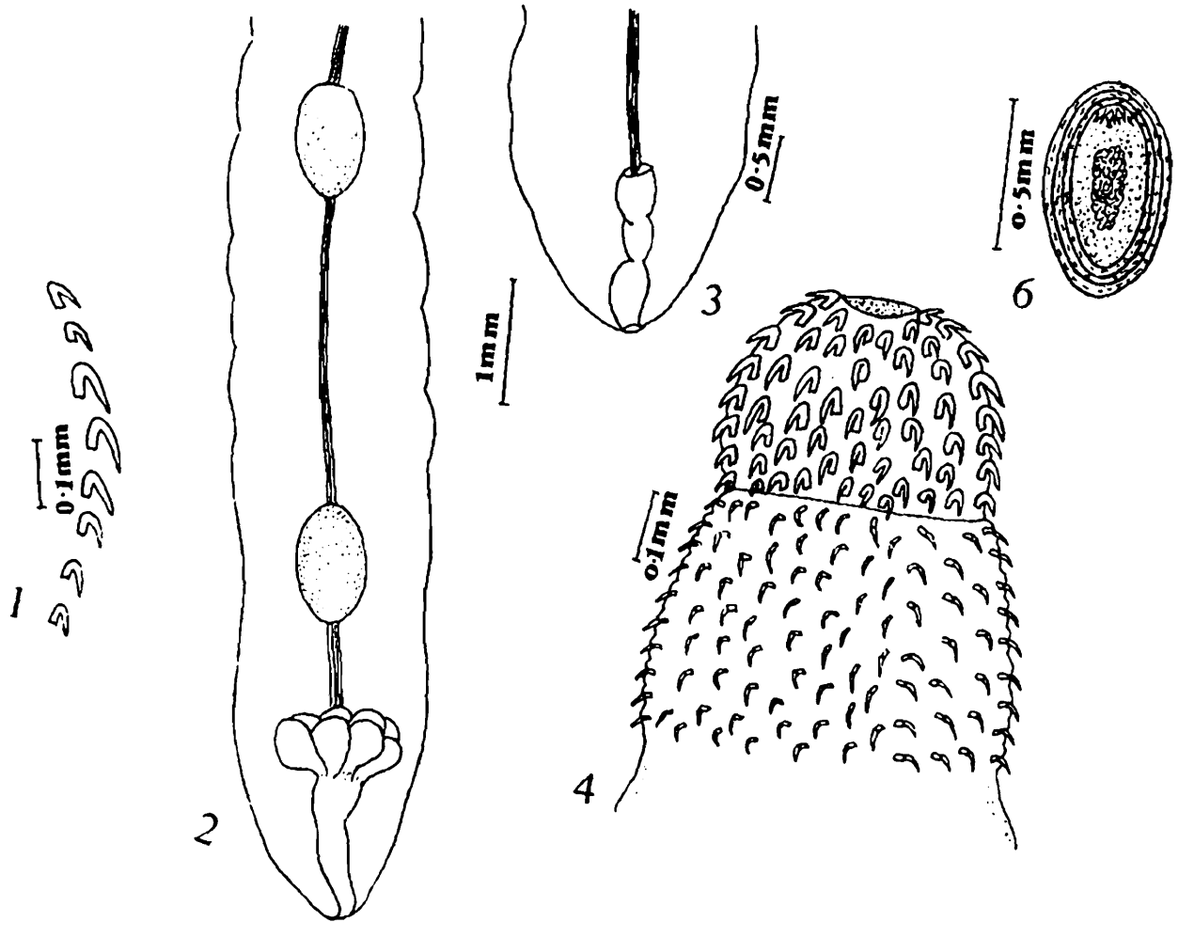


Fig. 14. *Mediorhynchus indicus* George, Nadakal, Vijayakumar & Rajendran, 1981. 1. Row of proboscis hooks enlarged, 2. Posterior part of male, 3. Posterior part of female, 4. Proboscis enlarged, 5. Ovum enlarged. (after George, Nadakal, Vijayakumar & Rajendra, 1981).

Description : Worms colourless. Male 1.2-1.8 × 0.14-0.15 mm; female 2.0-2.5 × 0.2-0.25 mm. Proboscis conical, truncate and divided into two parts, anterior part with hooks and posterior part with spines, 0.45-0.48 × 0.41-0.43 mm in male; in female 0.62-0.64 × 0.35-0.45 mm, with 14-17 longitudinal rows of 8-10 hooks each in both sexes. Hooks of first two rows and last four rows with 0.032-0.040 mm long. Third and fourth hooks of each row 0.045-0.052 mm long. Spines similar in size with cuticular papillae. Hook roots elongate, 0.030-0.042 mm long. Neck indistinct in both sexes. Proboscis receptacle claviform and anterior part double-walled, inner wall thick, 1.3-1.4 × 0.321-0.334 mm in male; in female 1.3-1.35 × 0.324-0.360 mm, with ganglion located in its middle. Trunk cylindrical, aspinose, pseudo-segmented, narrowing posteriorly. Lacunar system with main longitudinal channels and lateral branches. Lemnisci 2, equal, posterior part flexed and extended beyond receptacle, 4.50-4.56 × 0.43-0.462 mm in male; in female 4.48-4.52 × 0.45-0.47 mm. Testes equal, ovoid, post-equatorial, in tandem, 0.83-0.915 × 0.54-0.67 mm, and separated from each other and from cement gland group. Cement glands 8, ovoid, equal, grouped together, 0.320-0.334 × 0.27-0.30 mm. Common genital duct 0.65-0.70 × 0.25-0.38 mm, open into ejaculatory duct. Bursa not observed. Uterine bell 0.32-

0.34 × 0.31-0.325 mm. Uterus 0.24-0.25 × 0.20-0.32 mm. Vagina 0.48-0.51 × 0.42-0.44 mm. Eggs 0.072-0.076 × 0.040-0.046 mm, with three shells, without polar prolongations. Embryo armed with central nuclear mass and 6 hooks Gonopore terminal.

Host : *Gallus gallus demesticus.*

Location : Ileo-caecal junction.

Locality : Trivandrum, Kerala.

Distribution : Known only from type locality.

12. ***Mediorhynchus mariae*** George & Nagakal, 1984 (Fig. 15)

Mediorhynchus mariae George & Nadakal, 1984: 98-101, Fig. 1 a-d; Golvan, 1994: 162; Bhattacharya, 2007 : 23, P;. 4, Fig. 8 a-e.

Type locality : Channapetta, Kerala, India.

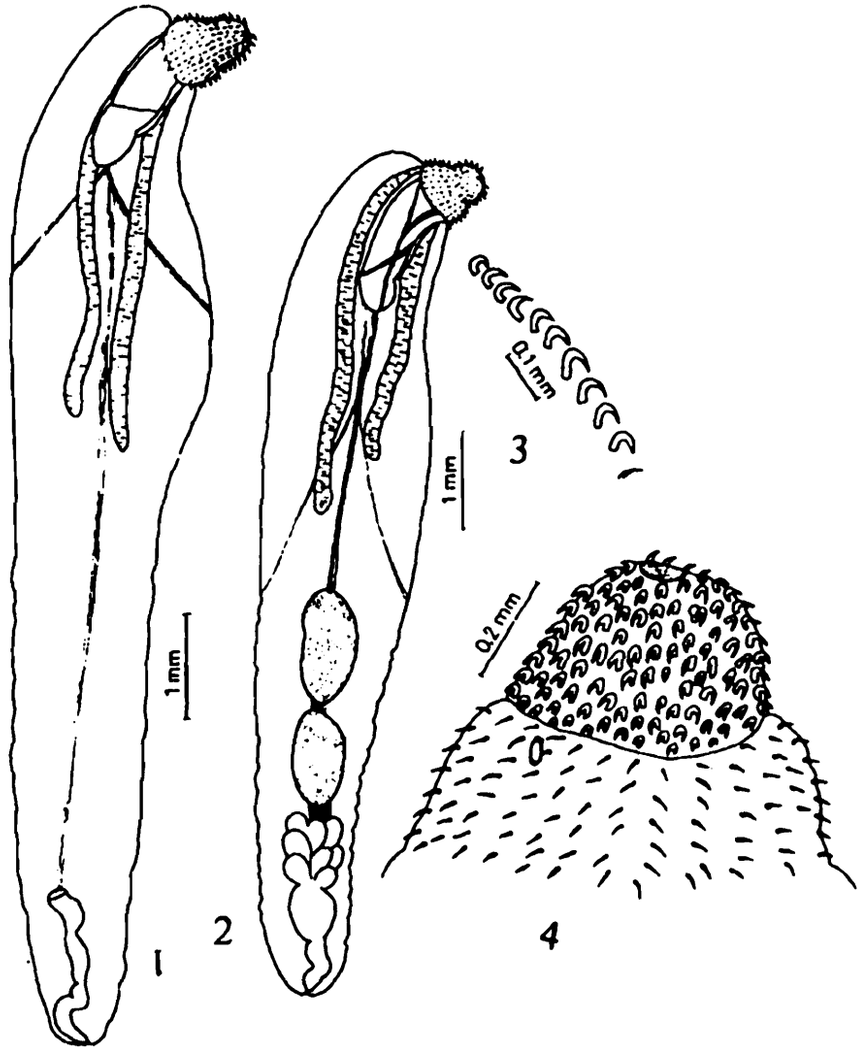


Fig. 15. *Mediorhynchus mariae* George & Nadakal, 1984. 1. Female, 2. Male, 3. Row of proboscis enlarged, 4. Proboscis enlarged (after George & Nadakal, 1984).

Description : Male 6.15 × 1.0-1.5 mm. Female 6.35 × 1.5-2.0 mm. Proboscis globular or cone-shaped armed with 18-24 longitudinal rows of 10-14 spines each, similar in both sexes. Anterior hooks 0.036-0.040 × 0.008-0.014 mm, middle hooks 0.058-0.064 × 0.010-0.015 mm, and posterior hooks 0.040-0.046 × 0.008-0.012 mm. Root of hooks 0.035-0.040 mm long. Teloboscis 0.27-0.45 × 0.50-0.91 mm in male, in female 0.32-0.50 × 0.60-0.92 mm. with 20-25 longitudinal rows of 7-10 spines each, 0.65-0.76 × 0.40-0.65 mm in male; in female 0.7-1.0 × 0.4-0.7 mm. Proboscis receptacle long, cylindrical and bipartite, anterior part double-walled and posterior part single-walled, 1.0-1.15 × 0.4-0.55 mm in male; in female 1.5-1.6 × 0.3-0.4 mm. Lacunar system with dorsal channel and transverse vessels. Trunk cylindrical, slightly swollen in middle on one side and tapering at posterior end, aspinose, pseudo-segmentation distinct at posterior part in both sexes. Hypodermal nuclei small and numerous. Lemnisci subequal, long and wide anteriorly, extending beyond receptacle, 3.0-3.5 × 0.15-0.22 mm and 2.8-3.31 × 0.15-0.16 mm in male; in female 3-4 × 0.17-0.22 mm and 3.5-4.1 × 0.16-0.20 mm. Testes subequal, ovoid, in tandem post-equatorial, anterior 1.12-1.15 × 0.4-0.45 mm, posterior 1.0-1.17 × 0.4-0.45 mm, remain apart from each other. Cement glands 8, rounded or spherical lie just behind posterior testis. Cement ducts open into a reservoir, which extends as ejaculatory duct in muscular bursal cap. Everted bursa not observed. Uterine bell 0.40-0.45 × 0.20-0.22 mm. Uterus 0.60-0.95 × 0.10-0.18 mm. Vagina 0.20-0.226 × 0.10-0.12 mm. Eggs 0.06-0.07 × 0.034-0.045 mm; embryos 0.040-0.05 × 0.015-0.20 mm. Uterine bell equatorial or post equatorial, attached to ligament sac. Uterus long. Eggs oval with three shells. Embryos with central nuclear mass and larval rostellar hooks. Gonopore subterminal.

Host : *Acridotheres tristis* (Linnaeus).

Location : Posterior part of small intestine.

Locality : Channapetta and Bethany hills, Kerala.

Distribution : Known only from type locality.

13. ***Mediorhynchus micracanthus*** (Rudolphi, 1819) Meyer, 1932 (Fig. 16)

Mediorhynchus micracanthus (Rudolphi, 1819) Meyer, 1932:

Mediorhynchus sp. Das, 1954a : 212;

Mediorhynchus micracanthus (Rudolphi), Petrotschenko, 1958 : 262-264, Fig. 136; Yamaguti, 1963: 117, Pl. 50, Fig. 507-510;

Diagnosis : Male about 20 × 0.86 mm, female 20 × 0.75 mm. Proboscis conical, 0.63 mm long, 0.22 mm wide at anterior end and 0.39 mm wide at posterior end, divided into two conical parts, anterior 0.3 mm long, 0.25 mm at base, posterior 0.12 mm long, 0.36 mm at base. Anterior part with 9 spiral rows of 9 large hooks each of 0.37 mm long. Roots with claviform widening at posterior end. Mucros about 0.026 mm long, roots about 0.029 mm long, slightly thicker than mucros. Posterior conical part covered with 10 spiral rows of 5-6 spines. Neck 0.175 mm long, with sensory papillae. Proboscis receptacle 0.65

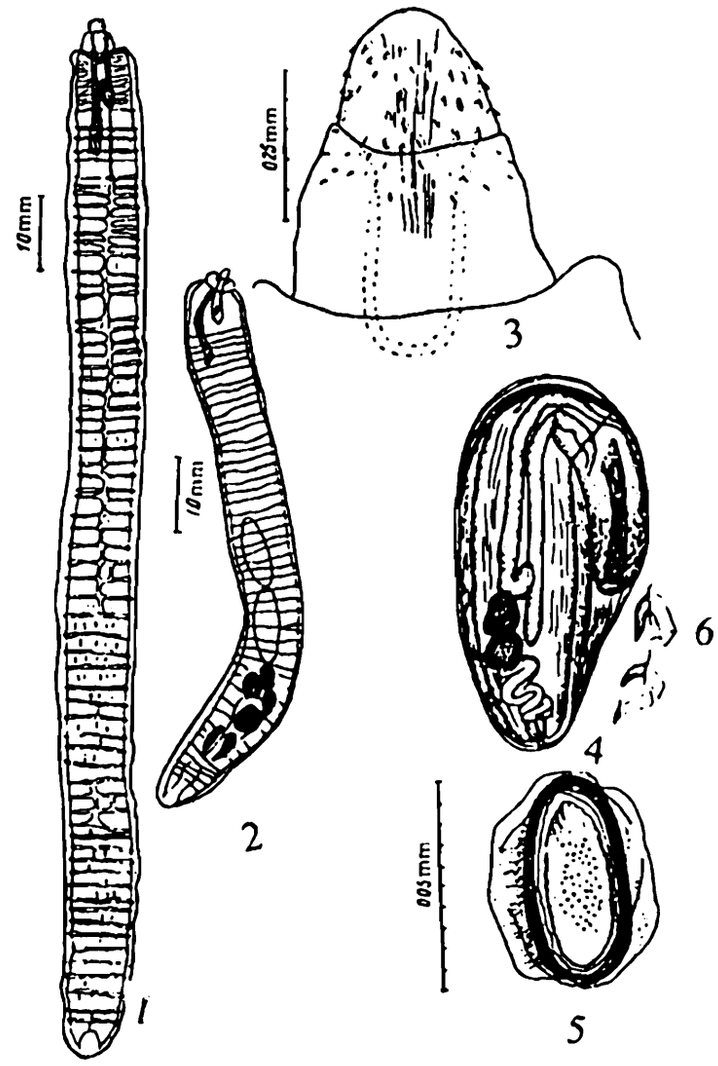


Fig. 16. *Mediorhynchus micracanthus* (Rudolphi, 1819) Meyer, 1932. 1. Female, 2. Male, 3. Proboscis and neck enlarged, 4. Acanthella, 5. Ovum enlarged, 6. Proboscis hooks enlarged (after Rhzhikov, & Dizier, 1954).

mm long with ganglion anterior to middle. Lemnisci equal, flagelliform, about 2.9-3.2 × 0.26 mm. Testes elongate-oval, 2.1 mm long, one behind other about midtrunk. Cement glands 4 parts in posterior part of trunk, 0.4-0.5 mm long. Protonephridia absent. Eggs oval, 0.05 mm wide.

Host : *Charadrius dubius curonicus.*

Location : Intestine.

Locality : India.

Distribution : Europe; Brazil.

14. ***Mediorhynchus nickoli*** Khan, Bilqees & Mati-ur-Rehman, 2004

Mediorhynchus nickoli Khan, Bilqees & Mati-ur-Rehman, 2004: 140-141, Fig. 2 A-F; Golvan, 1994: 162.

Type locality : Karachi, Sindh, Pakistan.

Description : Male 10.8-15.2 × 1.04-1.44 mm; female15.6-22.0 × 1.20-1.60 mm. Proboscis truncate, 0.52-0.60 × 0.40-0.42 mm in male; in female 0.52-1.00 × 0.40-1.00 mm, with 10 longitudinal rows of 7-8 hooks each in both sexes. Proboscis hooks 0.055-0.057 × 0.01-0.015 mm. Teloboscis with 7 rows of 6-8 spines each, measuring 0.027-0.028 × 0.0076-0.011 mm. Neck small, 0.016-0.040 × 0.020-0.036 mm in male; in female 0.20-0.28 × 0.16-0.40 mm. Proboscis receptacle 0.35-1.6 × 0.28-0.40 mm in male; in female 1.40-1.86 × 0.36-0.38 mm with ganglion in anterior third of receptacle. Trunk elongate with slight pseudo-segmentation. Lemnisci long, 0.64-0.88 × 0.40-0.72 mm in male; in female 2.58-2.80 × 0.34-0.40 mm. Anterior testis 0.88-1.20 × 0.40-0.64 mm, posterior 0.64-1.12 × 0.64-0.72 mm. Cement glands 8, its reservoir small, 1.84 × 0.16-0.18 mm. Saefftigen's pouch 0.48 × 0.16 mm. Bursa 1.12-1.40 × 0.36-0.72 mm. Mature eggs 0.046-0.051 × 0.0076-0.015 mm.

Host : Kite, *Milvus migrans migrans* Boddart.

Location : Intestine.

Locality : Karachi, Sindh (Pakistan).

Distribution : Known only from type localty.

15. ***Mediorhynchus orientalis*** Belopolskaya, 1953
(Fig. 17)

Mediorhynchus orientalis Belopolskaya, 1953 : 45-65; Petrotschenko, 1958: 265-266, Fig. 138; Yamaguti, 1963 : 118, Pl. 50, Fig. 515, 516;

Mediorhynchus bullocki Gupta, N. K. & Jain, 1973a : 321-324, Fig. 1-6;

Mediorhynchus orientalis; Schmidt & Kuntz, 1977a : 502-504, Fig. 4-7;

Golvan, 1994 : 162; Bhattacharya, 1999 : 369-370. 2007 : 28-30, Pl. 6 & 7 Fig. 16 a-f.

Type Locality : Central Asia.

Description : Male 8.0-11.5 × 1.0-1.2 mm, female 11.0-34.0 × 1.3-2.0 mm. Proboscis conical, truncate, 0.50-0.60 × 0.20-0.21 mm in male; in female 0.50-0.90 × 0.20-0.24 mm, with armature similar in both sexes, in 16-24 (usually 20-22) nearly longitudinal rows of 4-7 hooks each. Anterior 2 or 3 hooks 0.034-0.042 mm long, middle 2 or 3 hooks 0.034-0.042 mm long, posterior 1 or 2 hooks 0.030-0.044 mm long. Rootless spines at base of proboscis in 32-50 longitudinal rows of 3-6 spines each, spines 0.024-0.040 mm long. Neck 0.16-0.24 × 0.50-0.53 mm at base in male; in female 0.21-0.24 × 0.53-0.60 mm at base. Proboscis receptacle 0.85-0.92 × 0.225-0.24 mm in male; in female 0.92-1.48 mm wide at level of ganglion. Trunk elongate, without pseudo-segmentation. Lacunar system with main longitudinal channels and transverse anastomoses. Lemnisci long, slender, usually slightly subequal in length, 1.7-3.2 mm long usually not reaching level of anterior testis in male; in female 2.1-3.22 mm long. Testes oval, one behind other in second half of trunk, anterior 1.1-1.2 × 0.50-0.64 mm, posterior 1.03-1.15 × 0.50-0.65

mm. Cement glands 8. orbicular. Uterine bell 0.80-0.92 mm from gonopore. Eggs 0.05-0.056 × 0.022-0.028 mm, its outer membrane sculptured, middle membrane without polar prolongations. Gonopore terminal in both sexes.

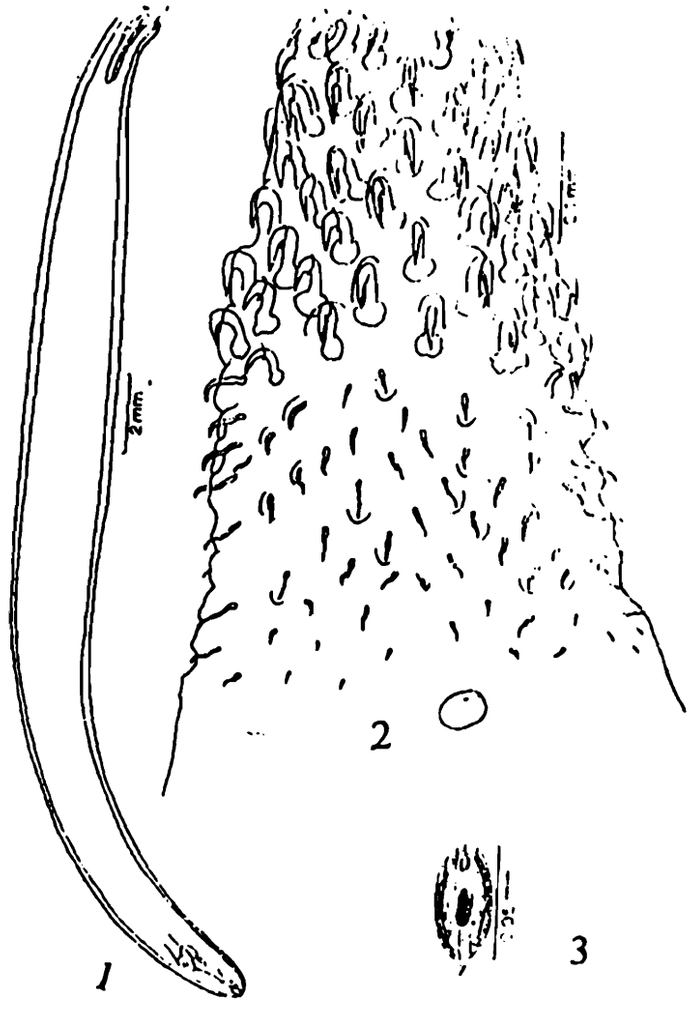


Fig. 17. *Mediorhynchus orientalis* Belopolskaya, 1953. 1. Female, 2. Proboscis enlarged, 3. Ovum (after Yamaguti, 1963).

Host : *Acridotheris tristis* (Linnaeus); *Centropus* sp.; Sphaexhochila lumei.

Location : Small intestine.

Locality : Chandigarh; Tripura; Meghalaya.

Distribution : Russia; Hawaii; Taiwan; Pescadores Islands; Borneo; Primorski Krai.

16. ***Mediorhynchus pandei*** Bhattacharya, 2007
(Fig. 18)

Mediorhynchus pandei Bhattacharya, 2007 : 23-24, Pl. 5, Fig. 10 a, b.

Type Locality : Uttar Pradesh, India.

Description : Worms long, cylindrical, slender, 51.625-58.5 × 0.90-0.975 mm. Proboscis truncated, divided into two parts, 0.625-0.675 × 0.4-0.45 mm with 16 longitudinal rows of 8 hooks each. Points hooks small, 0.01-0.014 mm long, roots 0.02 mm long. Proboscis receptacle single-walled with central ganglion. Trunk cylindrical. Lemnisci slightly unequal, 1.45-4.55 mm long, twice as long as receptacle. Gonopore terminal. Eggs 0.055-0.060 × 0.035-0.049 mm, outer shell membrane square case.

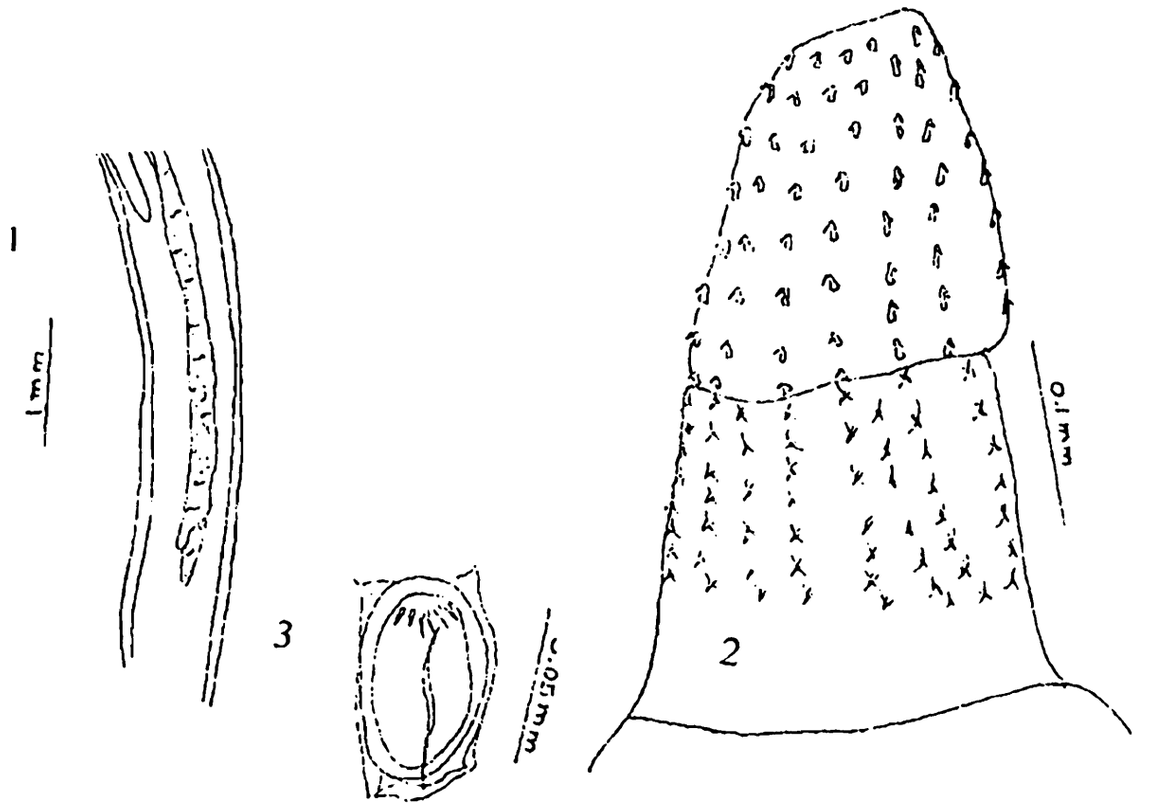


Fig. 18. *Mediorhynchus pandei* Bhattacharya, 2007. 1. Anterior part of worm. 2. Proboscis enlarged, 3. Ovum enlarged (after Bhattacharya, 1997).

Host : *Metopidius indicus.*

Location : Intestine.

Locality : Uttar Pradesh.

Distribution : Known only from type locality.

17. ***Mediorhynchus passerus*** Das, 1951
(Fig. 19)

Mediorhynchus passerus Das, 1951a : 212; 1952 : 55-61, Textfig. 1-4;

Mediorhynchus sp. Das, 1952a : 212.

Mediorhynchus passerus Anantaraman, M. & Anantaraman, S., 1970: 7; Schmidt & Kuntz, 1977a: 505; Gupta, P. D. & Ghosh. 1979: 314; Golvan, 1994: 162; Bhattacharya, 2007: 24, 26 Pl. 4, Fig 91-f.

Type locality : Amroati, Maharastra, India.

Diagnosis : Male 5.6 × 0.6 mm; female 16.4 mm long, 1.0 mm wide at midbody and at narrow posterior part 0.50 mm wide. Proboscis 0.36 × 0.23 mm, with 7 diagonal spiral rows of 5-6 hooks each on distal segment and with 7 spiral rows with 2-3 hooks each in proximal segment. Hooks of distal segment vary much in size and shape from those in

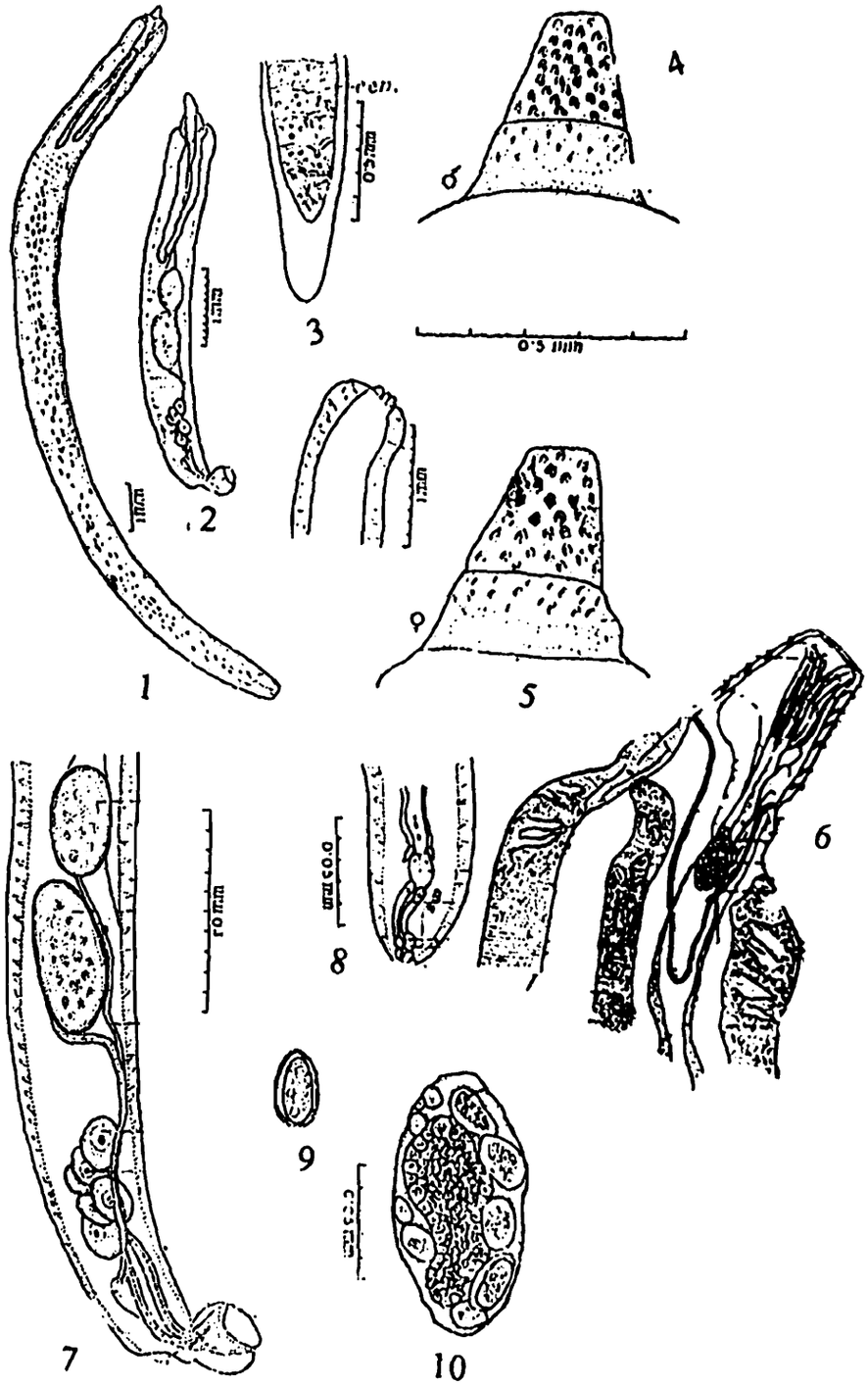


Fig. 19. *Mediorhynchus passerus* Das, 1951. 1. Female, 2. Male, 3. Slice of trunk wall, 4. Proboscis of male enlarged, 5. Proboscis of female enlarged, 6. Sagittal section of anterior part of worm, 7. Posterior part of male, 8. Posterior part of female, 9. Egg, 10. Egg mass. (after Das, 1951).

proximal segment. Hooks of distal segment with large ensheathed roots 0.019-0.030 mm long, and rounded bases, and protruding part of hooks 0.010-0.020 mm long, hooks on proximal segment completely embedded, 0.014-0.018 mm long. Proboscis receptacle single-walled, 0.46 × 0.13 mm with ganglion at its middle. Trunk cylindrical of uniform thickness except at posterior end where it tapers. Lacunar system with a main dorsal longitudinal channel and circular canals at regular intervals. Hypodermal giant nuclei 0.02 × 0.01 mm present. Lemnisci long, digitiform, 2.6 × 0.08-1.7 mm, with giant nuclei 0.08 × 0.03 mm lie in linear order throughout lemnisci. Testes oval, one behind other, anterior smaller 0.56 × 0.31 mm; posterior 0.8 × 0.33 mm from which emerge vasa efferentia and form vas deferens, runs by side of cement gland, and enlarges into a seminal vesicle and opens into penis attached to everted bursa. Cement glands 6, each measure 0.28 × 0.10 mm, with single nucleus in each. Cement ducts form two groups open into bursa. Bursa cup-shaped 0.40 mm wide with opening of 0.25 mm wide. Uterine bell spherical, 0.15 × 0.10 mm, lies behind egg masses. Uterus elongated 0.2 × 0.06 mm with narrow lumen with two nuclei placed anteriorly. Vagina narrow 0.12 mm long, guarded by antereior and posterior sphincter muscles, terminally opening by vulva. Embryo oval 0.03 × 0.02 mm with concentric membranes.

Host : House sparrow, *Passer domesticus indicus*; Wood pecker.

Location : Inteatine.

Locality : Amraoti (Maharastra).

Distribution : Known only from type locality.

18. ***Mediorhynchus peckeri*** Bhattacharya, 1999
(Fig. 20)

Mediorhynchus poeckeri Bhattacharya, 1999: 368-369, Pl. 3; 2007 : 24, 26, Pl. 5, Fig. 11 a-d.

Type locality : Meghalaya, India.

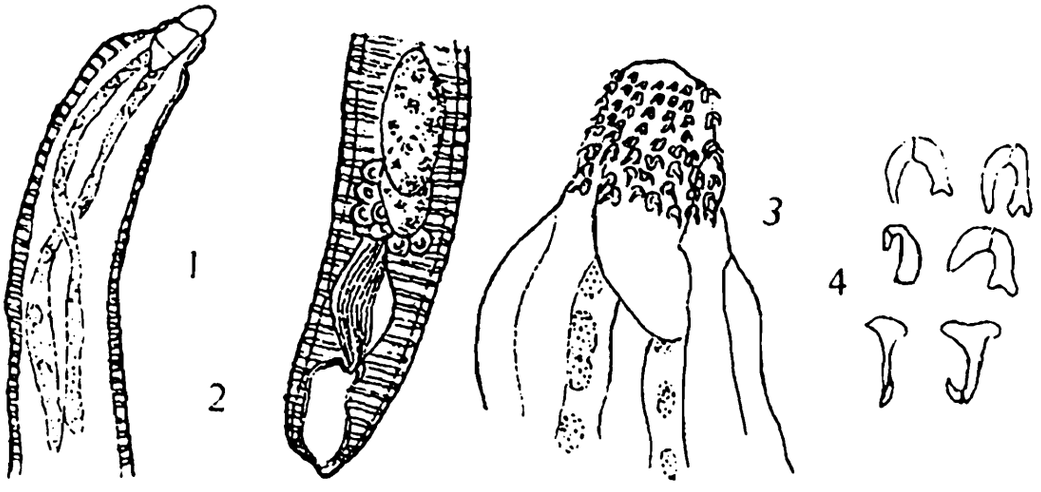


Fig. 20. *Mediorhynchus peckeri* Bhattacharya, 1999. 1. Anterior part of male, 2. Posterior part of male, 3. Proboscis enlarged, 4. Proboscis Hooks (after Bhattacharya, 1999).

Description : Male 22.25 × 1.125 mm. Proboscis conical, 0.75 × 0.45 mm with 14 longitudinal rows of 4 hooks each, in both anterior and posterior parts. Points of anterior hooks 20-0.936 mm, roots 0.03-0.044 mm long, and in posterior hooks 0.03 mm long. Fourth hook in each row largest with 0.068 mm long point and root together. Proboscis receptacle 0.675 × 0.275 mm longer than receptacle. Trunk cylindrical. Lemnisci several times longer than receptacle, with number of nuclei. Unequal, 4.5 × 0.125 mm and 4.75 × 0.125 mm, one lemniscus with 6-7 nuclei, other with 4 nuclei. Testes ovoid, in tandem, 1.25 × 0.625 mm, Cement glandseight spherical. Gonopore teeminal.

Host : Woodpecker.

Location : Intestine.

Locality : Meghalaya.

Distribution : Known omly from type locality.

19. ***Mediorhynchus quilonensis*** Bhattacharya, 2007
(Fig. 21)

Mediorhynchus quilonensis Bhattacharya, 2007 : 28-29, Pl. 5, Fig. 12 a-g.

Type locality : Quilon, Kerala, India.

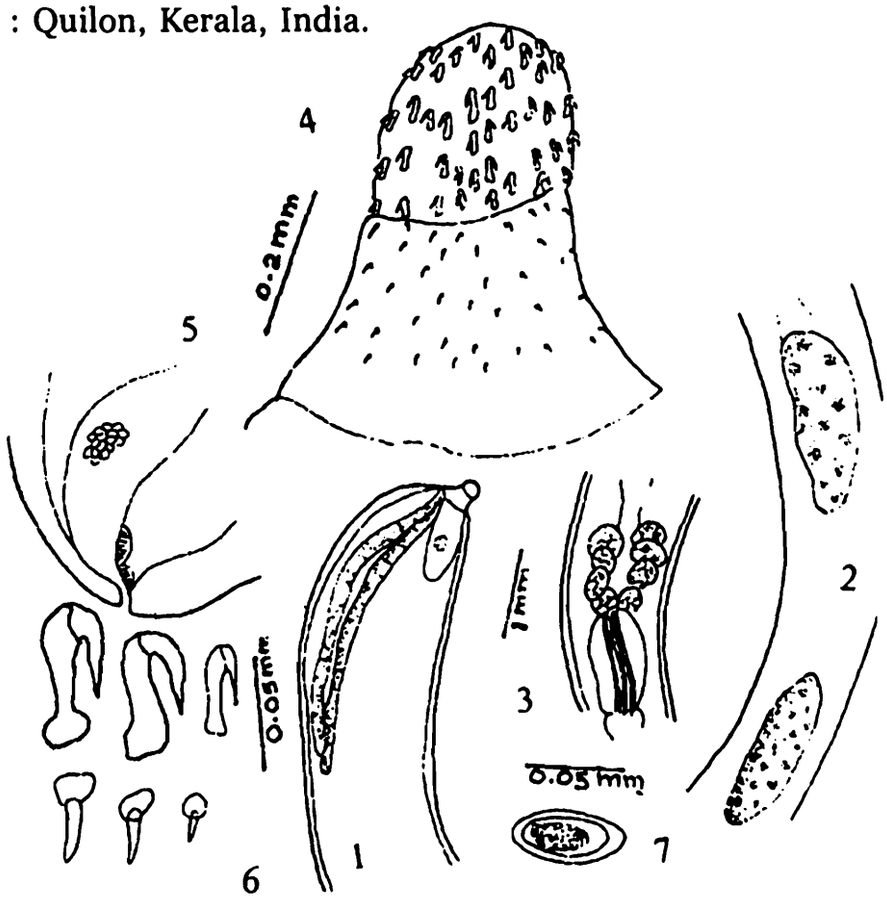


Fig. 21. *Mediorhynchus quilonensis* Bhattacharya, 2007. Anterior part of male, 2. Mid trunk, 3. Posterior part of male, 4. Proboscis enlarged, 5. Posterior part of female, 6. Proboscis hooks, 7. Ovum (After Bhattacharya, 2007).

Description : Worms cylindrical, male 33-36 × 1.375-1.40 mm; female very long, 60-68 × 2.0-2.15 mm. Proboscis conical 0.55-0.62 × 0.425-0.45 mm with 22 longitudinal rows of 4 hooks each. Roots longer than points , eoots 0.045-0.055 mm long, points 0.04-0.046 mm long, posterior hooks 0.03-0.032 mm long in male. In female probosxis cinical, 0.58-/0.65 × 0.45-0.0425 mm with 20 longitudinal rows of 4 hooks each in both anterior and posterior parts,, points 0.042-0.045 mm long, roots 0.05-0.055 mm long in anterior part and in posterior part hooks 0.03-0.034 mm long. Proboscis receptacle single-walled 0.85-0.88 × 0.3-0.35 mm, with central ganglion.Trunk cylindrical Lemnisci equal, 3.25-0.336 mm and 3.2-3.5 mm long. With nuclei. Testes postequatorial, oval, in tandem, anterioe 2.00-2.125 × 0.624-0.676 mm, posterior 2.125-2.175 × 0.7009,75 mm. Cement glands eight, pyriform, in two lines.

Host : *Vanellus malabaricus.*

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

20. ***Mediorhynchus rajasthanensis*** Gupta, P.D. 1976
(Fig. 22)

Mediorhynchus rajasthanensis Gupta, P.D., 1976 : 182-183; Fig. 1-5; Golvan, 1994 : 162; Bhattacharya, 2007 : 27, Pl. 6, Fig 13 a-e.

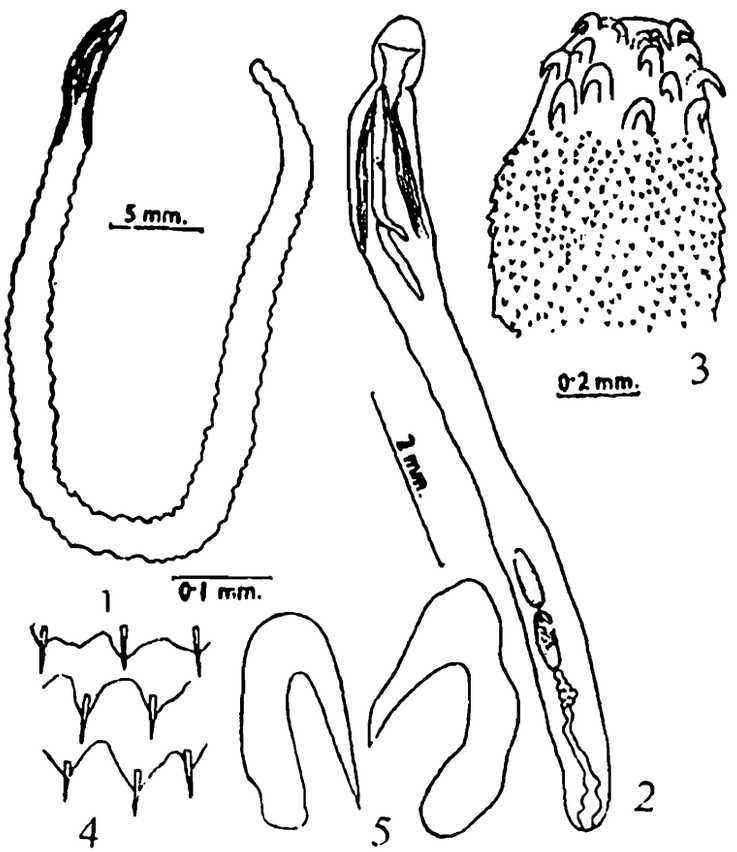


Fig. 22. *Mediorhynchus rajasthanensis* Gupta, P.D. 1961. 1. Outline of worm, 2. Male, 3. Proboscis and neck enlarged, 4. Trunk spines enlarged (after Gupta, P.D. 1961).

Type Locality : Pokharam in Jaisalmer district, Rajasthan, India.

Description : Male 9.44 × 0.83 mm; female 60-75 × 2.0-3.5 mm. Proboscis 0.96 × 0.54 mm, with 12 spiral rows of 4 hooks each, hooks 0.10-0.12 × 0.016-0.020 mm in male and in female 30 spiral rows of 14-15 spines each, hooks 0.02 mm long. Proboscis receptacle double-walled, muscular sac, 0.756-11.08 × 0.396-0.468 mm, with spherical ganglion, of 0.18 mm wide, situated towards its base. Trunk slightly swollen in anterior part without external pseudo-segmentation in males, in female shows prominent external pseudo-segmentation, attaining maximum width slightly behind midbody. Lemnisci a pair, unequal, 1.98-2.84 × 0.144 mm, each with 7 nuclei. Testes elliptical in posterior third of body length, anterior 0.684 × 0.216 mm, posterior 0.648 × 0.216 mm. Cement glands 8, located behind posterior testis. Seminal vesicle 0.648 × 0.126 mm. Right side of muscular cap of bursa longer than left side. Bursa 0.306 × 0.18 mm, maximum width at its anterior end. Eggs 0.062-0.081 × 0.031-0.05 mm.

Host : Great Indian bustard, *Choriotis nigriceps* (Vigors).

Location : Intestine.

Locality : Pokaram in Jaisalmer district (Rajathan).

Distribution : Known only from type locality.

21. ***Mediorhynchus robustus*** Van Cleave, 1916

Mediorhynchus robustus Van Cleave, 1916 167-174; Bhattacharya, 2005 : 122-157; 2007: 30.

Type Locality : U.S.A.

Description : Male 7-10.62 × 0.6440.664 mm, female 16 mm long. Proboscis 0.644-0.913 × 0.332-0.664 mm, with 29-30 longitudinal rows of 4-5 hooks each; points of anterior hooks 0.024 mm long, roots 0.04-.045 mm long; posterior hooks 0.015-0.9375 mm long. Proboscis receptacle single-walled, 0.913-0.99 × 0.166-0.249bmm. Lemnisci 2.90-3.486 mm long. Gonopore terminal. Eggs 0.038 × 0.016 mm.

Host : Drongo and Racket tailed frongo.

Location : Intestine.

Location : Kurnool (Andhra Pradesh).

Distribution : Known only from type localty.

22. ***Mediorhynchus taeniatus*** (Linstow, 1901) Dollfus, 1936 (Fig. 23)

Empodius taeniatum Linstow, 1901 : 271-295; Petrotschenko, 1958 : 247-248, Fig. 126; Yamaguti, 1963 : 118, Pl. 51, Fig. 523-525;

Mediorhynchus taeniatus Srivastava, 1994: 40-42; Srinivasarao & Balamani, 1994: 27-30; Rao, B. S. 1994: 81-84; Golvan, 1994: 162; Balamani & Rao, 1995: 447-451; Bhattacharya, 2005: 122-157; 2007: 27.

Description : Worms white when young and mature form greenish to brown. Male and female 90-115 × 2.5-3.0 mm .Proboscis erect, cylindrical, 0.86 × 0.4 mm, anterior part with 6 spiral row of 5 hooks each, roots directed posteriad; posterior part with 12 spiral rows of 16 spines each. Proboscis receptacle attached to border of anterior and posterior parts of proboscis, with triangular ganglion at its middle. Trunk with maximum width at midbody and tapering to both ends, distinct pseudo-segmentation, flattened at sides. Annulation absent in anterior part of trunk. Lacunar system with one median dorsal channel from which annular canals branch out ventrally Lemnisci nearly cylindrical, with about 5 nuclei, slightly wider towards both ends, slightly longer than receptacle..Testes elongate-oval, 3 mm long about 20 mm from posterior end. Eggs 0.1 × 0.04 mm, with compact granular yellowish membrane.

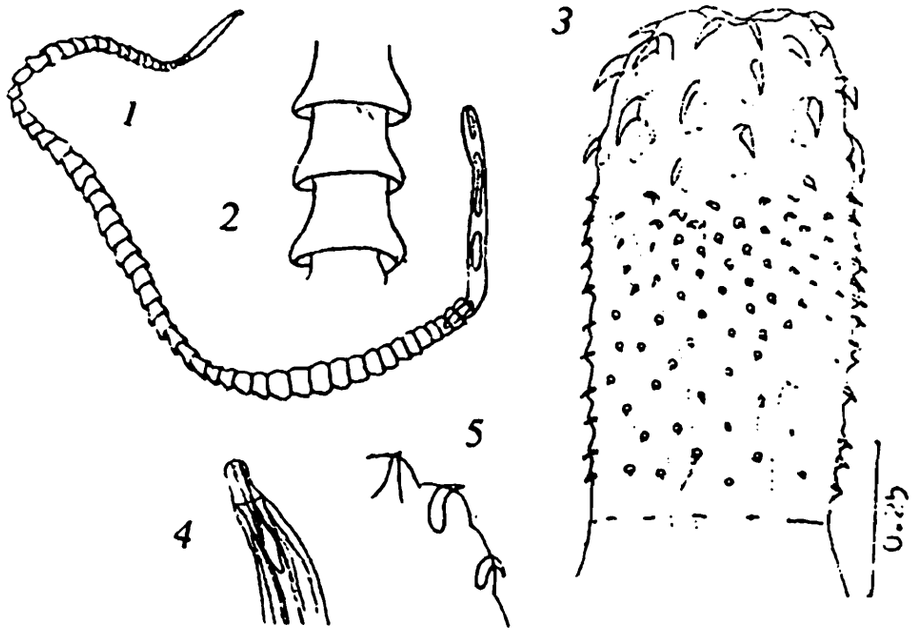


Fig. 23. *Mediorhynchus taeniatus* (von Linstow, 1901) Dollfus, 1935. 1. Male, 2. Pseudosegments, 3. Proboscis enlarged, 4. Anterior part of worm, 5. Trunk spines enlarged.

Host : *Turnix suscitator tajoori*

Location : Intestine.

Locality : Nalgonda (Andhra Pradesh).

Distribution : Palaearctic region, Ural and Egypt.

23. ***Mediorhynchus thrushi*** Battacharya, 2000
(Fig. 24)

Mediorhynchus thrushi Battacharya, 2000 : 151-152, Fig. 5a-c, 6a, b; 2007 : 28, Pl. 6, Fig. 15a-e.

Description : Male plumpy, .48-5.25 × 1.42-1.5 mm. Proboscis 0.48-0.55 × 0.645 mm with 16 longitudinal rows of 5 hooks each anteriorly, posyerior proboscis with 18

longitudinal rows of 5 hooks each; points of hooks 0.041-0,055 mm long, roots 0.043-0.058 mm long; posterior hooks 0.026 mm long. Proboscis receptacle single-walled, saccular, 0.45-0.70 × 0.25-0.28 mm. Anterior trunk with longitudinal rows of spines. Lacunar system with rwo lateral lonhitudinal channels with transcerse anastomoses. Lemnisci slrnder, equal, much lomger than receptacle with 4 nuclei each. Testes ovoid, contiguous , 0.98-1.0 × 0.50-0.55 mm and 1.00-1.15 × 0.55-0.58 mm. Cement glands six in pairs. Seminal vesicle 0.38 mm in diameter. Bursa not protruded. Gonopore teeminal.

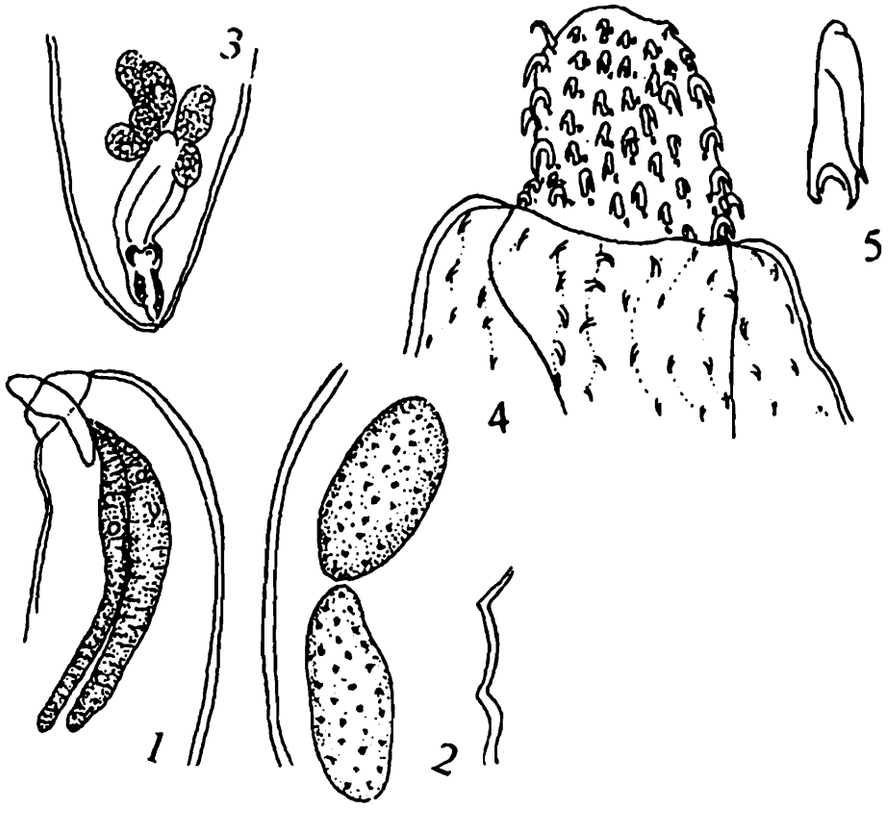


Fig. 24. *Mediorhynchus thrushi* Bhatacharya, 2000. 1. Anterior part of male, 2. Midtrunk of male, 3. Posterior part of male 4. Proboscis enlarged, 5. Proboscis hooks enlarged (after Bhattacharya, 2000).

Host : Garrulus maniligers.

Location : Intestine.

Locality : Paratia (Tripura).

Distribution : Known only from gttype locality.

3. Order MONILIFORMIDA Schmidt, 1972

Moniliformida Schmidt, 1972 : 292; Bhattacharya, 2007 : 38.

Diagnosis : Proboscis cylindrical with long, approximately straight longitudinal rows of hooks. sensory papillae absent. Proboscis receptacle double-walled, outer wall with

muscle fibers arranged spirally, ganglion near its posterior end. Retractor muscles of proboscis pierce posterior end of receptacle. Trunk medium sized to long usually with pseudo-segmentation of wall. Lemnisci long, flat, ends not bound to body wall, with few giant nuclei. Testes in tandem, near posterior end of trunk. Cement glands 8, compact, with single giant nucleus. Protonephridial organs absent. Eggs oval with sculptured outer membrane. Parasites of birds and mammals. Cosmopolitan.

Type and only family : Moniliformidae Van Cleave, 1924.

Includes only one family Moniformidae Van Cleave, 1924, with one genus occurs in this subcontinent.

3. Family MONILIFORMIDAE Van Cleave, 1924

Moniliformidae Van Cleave, 1924: 30; Southwell & Macfie, 1925: 170-171; Van Cleave, 1953: 30; Petrotschenko, 1958: 273-274; Yamaguti, 1963: 129; Bhattacharya, 2007 : 38.

Diagnosis : Moniliformida. Proboscis claviform or flask-shaped, with numerous small hooks in longitudinal rows or somewhat irregular, or spiral rows, each hook with backwardly directed root. Proboscis receptacle comparatively short, double-walled, with ganglion near or at its base, outer wall with spiral muscles. Trunk long, often with external pseudosegmentation. Lacunar system with dorsal and ventral or only dorsal main channels and transverse anastomoses. Protonephridia absent. Lemnisci filiform, long. Testes in tandem in posterior part of trunk. Cement glands 6(?)- 8, compact, may or may not lie well apart from posterior testis. Eggs comparatively large, with concentric membranes but without strong shell. Parasites of mammals, occasionally birds.

Type genus : *Moniliformis* Travassos, 1915.

This family includes two genera *Moniliformis* Travassos, 1915 and *Promoniliformis* Dollfus and Golvan, 1963, of which first genus occurs in Indian subcontinent.

3. Genus ***Moniliformis*** Travassos, 1915

Moniliformis Travassos, 1915a : 137;

Moniliformis Southwell & Macfie, 1925 : 171; Meyer, 1932: 221-222; Van Cleave, 1953 : 123-127; Petrotschenko, 1958 : 273-274; Yamaguti, 1963 : 130; Golvan, 1994: 164l Bhattacharya, 2007 : 38.

Diagnosis : Moniliformidae. Proboscis claviform or flask-shaped, with numerous small hooks in longitudinal or somewhat irregular, or spiral rows, each hook with back-wardly directed root. Many of the root notched or slightly bifid posteriorly. Often with a single small, flat, rounded sensory papilla on external surface of proboscis immediately posterior to level of wide hooks. Proboscis receptacle comparatively short, double-walled, with ganglion near or at its base, its outer wall consists of spiral muscles. Trunk large, elongate, usually with conspicuous pseudo-segmentation involving only its wall. Lacunar system with median dorsal and ventral or only dorsal main channel and transverse anastomoses.

Lemnisci filiform, long. Testes in tandem in posterior part of trunk. Cement glands 6 (?) –8, compact, may or may not be well apart from posterior testis. Eggs comparatively large, with concentric membranes but without strong shell. Parasites of mammals, occasionally of birds.

Type species : *Moniliformis moniliformis* (Bremser, 1811) Travassos, 1915.

Includes 15 species 1. *Moniliformis clarki* (Ward, 1917) Chandler, 1921, 2. *M. dubius* Meyer, 1932, 3. *M. kalahariensis* Meyer, 1931, 4. *M. moniliformis* (Bremser, 1811) Travassos, 1915, 5. *M. spiralis* Subramanian, 1927, 6. *M. acomysi* Ward & Nelson, 1967, 7. *M. aegypticus* Meyer, 1932, 8. *M. cestodiformis* (Linstow, 1904) Travassos, 1917, 9. *M. convolutes* Meyer, 1932, 10. M. *echinosorexi* Deveaux, Schmidt & Krishnasamy, 1988, 11. *M. gracilis* (Rudolphi, 1819) Meyer, 1931, 12. *M. marionis* Golvan & Theodorides, 1960, 13. *M. monoechinus* (Linstow, 1902) Petrotschenko, 1958, 14. *M. siciliensis* Meyer, 1932, 15. *M. tarsi* Devaux, Schmidt & Krishnasamy, 1988, of which first five species occur in Indian subcontinent.

Key to Indian species of genus *Moniliformis*

1. Proboscis 0.3-0.3.5 mm long with 12-16 longitudinal rows with 6-8 hooks each ..... *Moniliformis clarki*

– Proboscis larger or smaller than 0.3.5 mm long, proboscis hooks more than 8 hooks in each row 2

2. Proboscis 0.85 mm long, with 9-10 hooks in each row ..... *Moniliformis kalahariensis*

– Proboscis smaller than 0.85 mm long with more hooks than above 3

3. Proboscis 0.42-0.52 mm long with 11-14 rows of 9-14 hooks each ..... *Moniliformis monoliformis*

– Proboscis larger or smaller than above; with more or less number of hooks in each row 4

4. Proboscis 0.26-0.45 mm long with 12-14 rows of 12-14 small hooks each ..... *Moniliformis spiralis.*

– Proboscis 0.55-0.64 mm long with 12 rows of 10-11 hooks each ..... *Moniliformis dubius*

24. ***Moniliformis clarki*** (Ward, 1917) Chandler, 1921
(Fig. 25)

Harmorhynchus clarki Ward, 1917: 141;

Moniliformis clarki t, 1958: 279, Fig. 143a; Yamaguti, 1963: 131, Pl. 58, Fig. 600; Sen & Chauhan, 1973: 39-40; Amin, 1985: 34; Golvan, 1994: 164; Bhattacharya, 2007: 60, Pl. 8, Fig. 22a.

Description : Male 36-40 x1.25-1.41 mm. Females 62-81 x1.37 mm. Proboscis claviform, 0.35-0.42 × 0.13-0.17 mm in males, in females 0.32-0.47 × 0.17-0.18 mm, with 13 spiral rows of 6 back-wardly directed hooks each. Each hook cresecentic in form, without sharp differentiation between thorn and root, hooks 0.02-0.03 mm long. Proboscis receptacle long, double-walled, with ganglion situated near its base, 0.36-0.43 × 0.17-0.18 mm in males, in females 0.57-0.63 × 0.27-0.34 mm. Trunk large, cylindrical, long, with pseudo-segmentation of its wall. Lacunar system with dorsal and ventral channels and transverse anastomoses. Lemnisci short, slender extending slightly beyond receptacle, 8-13 × 0.066-

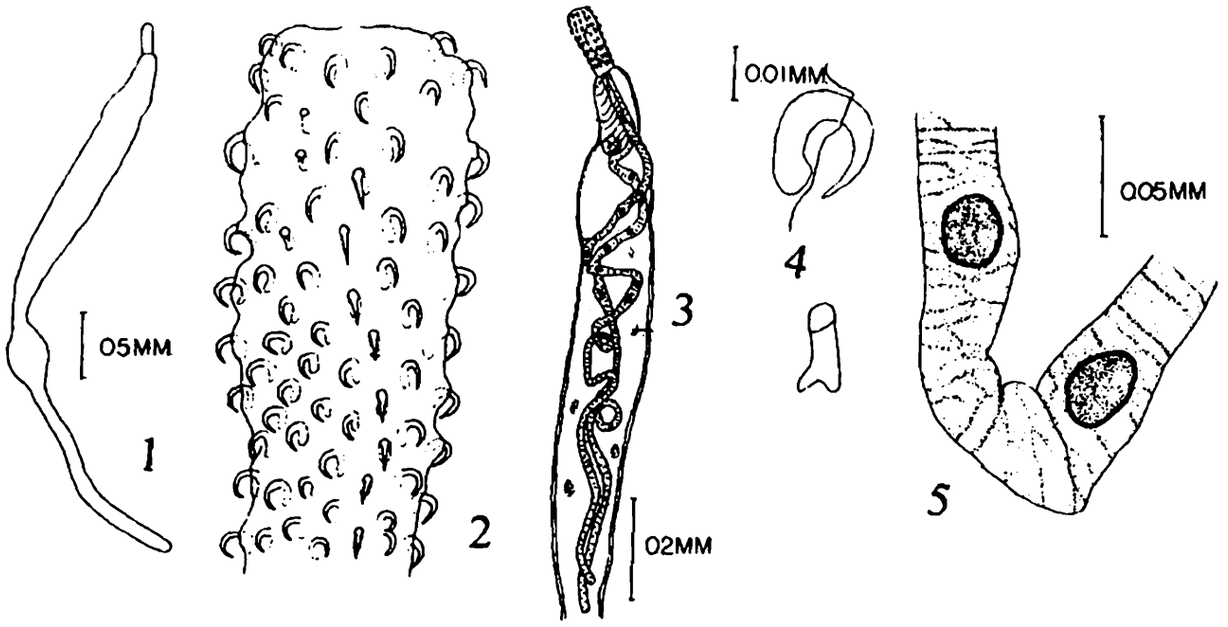


Fig. 25. *Moniliformis clarki* (Ward, 1917) Chandler, 1921. 1. Outline of worm, 2. Proboscis enlarged, 3. Anterior part of female, 4. Profile view of proboscis hook, 5. Part of lemniscus (after Halloway & Burton, 1964).

0.10 mm, with many nuclei. Testes in tandem, located at widest part of trunk near posterior end, almost contiguous or very near each other, elongate, oval or bean shaped, anterior 2.21-3.03 × 0.81-0.85 mm, posterior 2.84-3.03 × 0.85-0.91 mm. Cement glands 6-8, compact, often superimposing each other, entire gland 0.92-1.54 × 0.53-0.87 mm. Seminal vesicle 0.57-0.81 mm long. Bursa not protruded and gonopore subterminal. Uterine bell 0.39-0.50 × 0.18-0.21 mm, containing 8 guard cells. Uterus with vagina, 0.43-0.56 mm long. Eggs elliptical, 0.06-0.07 × 0.03 mm, with embryos.

Host : *Rattus rattus* Linnaeus.

Location : Intestine.

Locality : Goa.

Distribution : North America.

Note : Chandler (1947) reports length 400 mm, proboscis 0.286-0.42 × 0.11-0.14 mm,

hook number 95-108, hook size 0.016-0.021 mm, proboscis receptacle 0.67-0.84 mm long, lemnisci 8-13 × 0.066-0.10 mm, eggs 0.066-0.070 mm long, which are much larger than the Indian specimens.

25. ***Moniliformis dubius*** Meyer, 1932
(Fig. 26)

Moniliformis dubius Meyer, 1932: 232, Fig. 246; Petrotschenko, 1958: 280-282, Fig. 143b, 144, 144a; Yamaguti, 1963: 131, Pl. 59, Fig. 601; Amin, 1985: 33; Suseela, 1991: 81-84; Suseela & Narayanarao, 1992: 39-42; Golvan, 1994: 164; Bhattacharya, 2007: 60-61.

Diagnosis : Male 30-145 mm long and female 140-270 mm long, 3.2 mm wide, posterior end 10-20 mm long, smooth. Proboscis cylindrical, 0.55-0.64 × 0.19-0.24 mm, with 12 longitudinal rows of 10-11 hooks each. Hooks 0.02-0.026 mm long. Proboscis receptacle 0.91-1.20 mm long. Trunk markedly annular, especially in female. Lemnisci about 4.0-7.5 × 0.15-0.17 mm. Testes about 2 mm long. Cement gland 6. Eggs 0.112-0.125 × 0.056-0.060 mm and 0.09-0.118 × 0.04-0.054 mm wide.

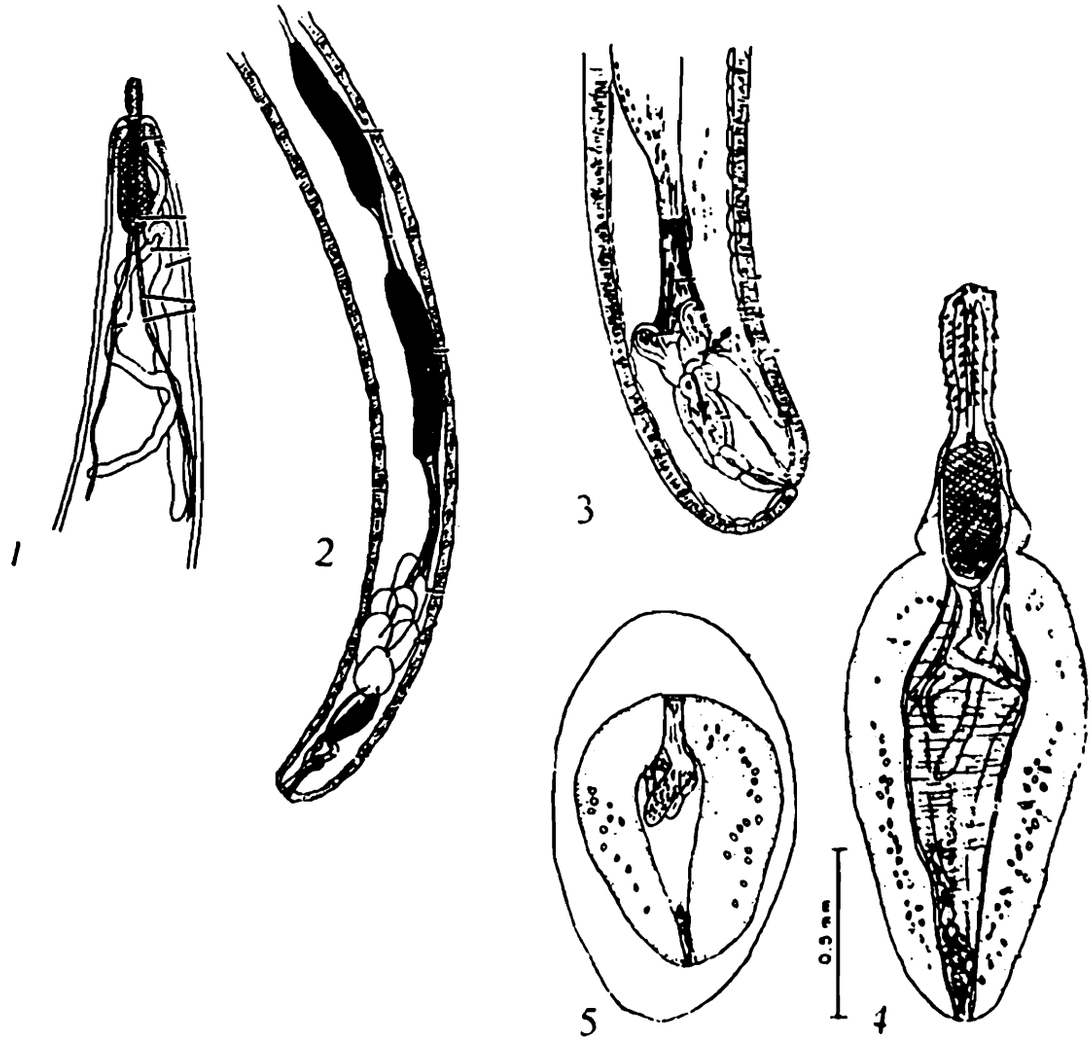


Fig. 26. *Moniliformis dubius* Meyer, 1932. 1. Anterior part of worm, 2. Posterior part of male, 3. Posterior part of female. 4. Preacanthella, 5. Encysted acanthella, (after Halloway & Burton, 1964).

Host : *Bandocoota bengalensis; Rattus ratus rufescens.*

Location : Inteatine.

Locality : Hyderabad, Kakinada (Andhra Pradesh).

Distribution : Japan, Formosa; Texas.

26. ***Moniliformis kalahariensis*** Meyer, 1931
(Fig. 27)

Moniliformis kalahariensis Meyer, 1931c : 58-108; 1932 : 232, Fig. 251-254; Petrotschenko, 1958 : 285-286, Fig. 146; Yamaguti, 1963 : 132, Pl. 58, Fig. 598, 599; Anantaraman, M. & Anantaraman, S., 1970 : 7; Amin, 1985 : 33; Golvan, 1994: 164.

Diagnosis : Parasite 140-150 mm long, 2.5 mm wide at midtrunk, 0.75 mm wide anteriorly, 1.25 mm wide posteriorly. Proboscis nearly cylindrical, widening slightly

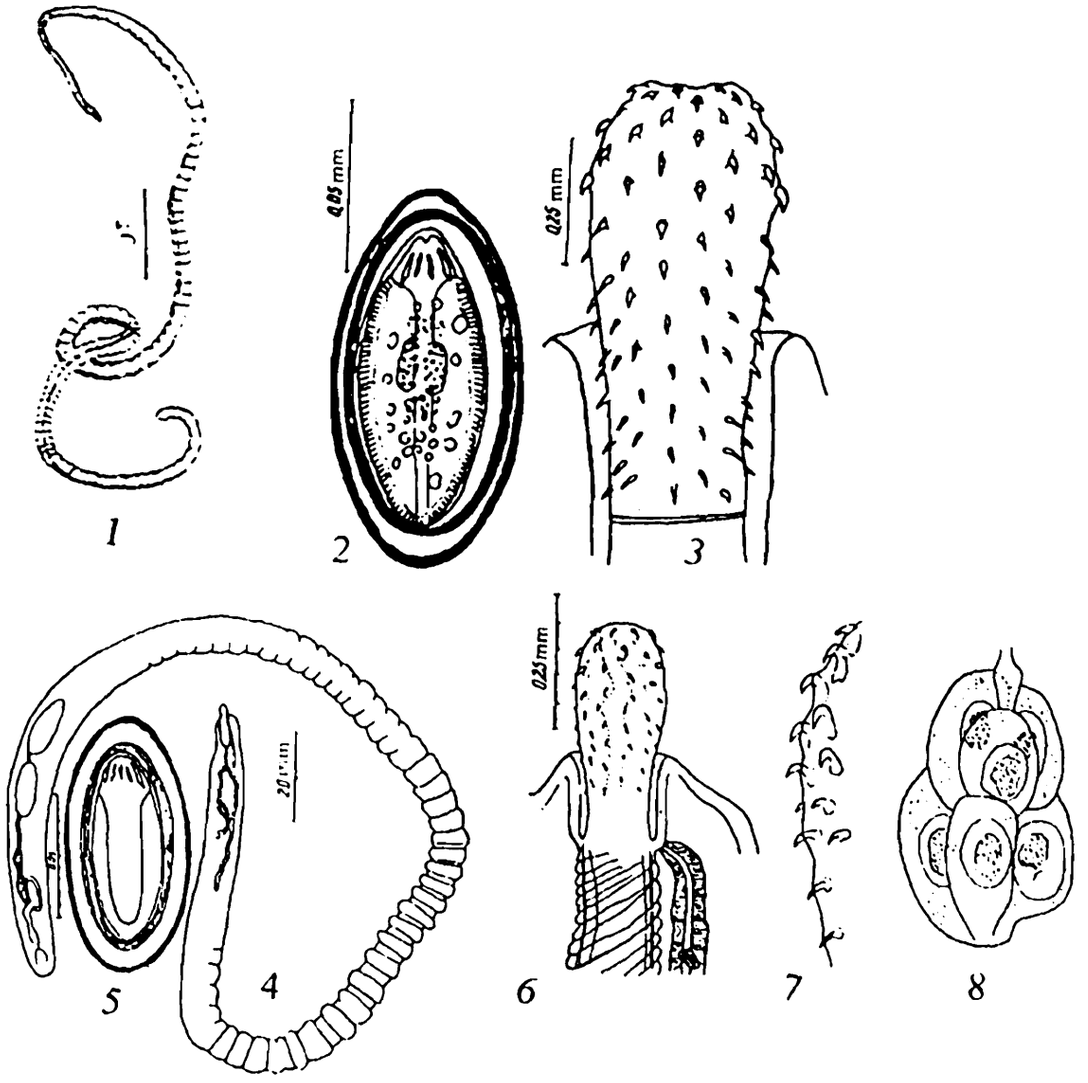


Fig. 27. *Moniliformis kalahariensis* Meyer, 1931. 1. Entire worm, 2. Ovum enlarged, 3. Proboscis enlarged, 4. Male, 5. Ovum enlarged, 6. Anterior part of worm, 7. Row of proboscis hooks enlarged, 8. Eggs with embryos.

anteriorly, 0.85 mm long, 0.4 mm wide anteriorly and 0.26 mm wide at base, with 14 longitudinal rows of 9-10 hooks each. First 4 hooks blunt, increasing in length up to middle of proboscis, after which length decreases as they become thinner. Trunk long, cylindrical, faintly annular but not taeniate. Lacunar system with unusually sharply protruding median longitudinal channels. Testes oval about 5 mm long, in posterior end of trunk. Cement glands 6, arranged in pairs. Eggs 0.11 mm long, 0.057 mm wide.

Host : Juvenile in *Phyllodromia germanica.*

Location : Intestine.

Locality : Mumbai (Maharastra).

Distribution : Sputh west Africa.

27. ***Monoliformis moniliformis*** (Bremser, 1811) Travassos, 1915 (Fig. 28)

Echinorhynchus moniliformis Bremser, 1811: 1-31.

Moniliformis moniliformis, Subramanian, 1927b: 646; Meyer, 1932: 223-224, Fig. 238-242; Bhalerao, 1935 : 323; Chatterji, 1940 : 62; Maplestone & Bhaduri, 1941 : 202; Sita, 1949: 216-218; Fig. 1, 2; Petrotschenko, 1958: 275-276, Fig. 141; Alwar & Lalitha, 1961 : 148; Yamaguti, 1963 : 130, Pl. 58, Fig. 595-597; Anantataman, M. & Anantaraman, S., 1970 : 7; Anantaraman, S. & Ravindran, 1973 : 214-230; Amin, 1985: 33; Najib, 1986: 4; 1990 : 1,4-6; Hemankar & Renapurkar, 1991: 134-137, Fig. 1 a-e; Najib, 1991 : 79-85; George & Nadakal, 1992 : 287; Golvan, 1994 : 164; Thakur, 1996: 111-115; Bhattacharya, 2007 : 59, Pl. 7-8, Fig. 22 a-d.

Description : Worms creamy white or yellowish. Males 77 × 1.66 mm, females reach 140 × 1.24 mm. Proboscis cylindrical to club-shaped, 0.50-0.64 × 0.19-0.24 mm, with 11-14 longitudinal rows of 9-14 crescentic hooks each (usually 10 rows of 10-11 hooks each). Largest hooks 0.02-0.034 mm long in males and 0.031 mm long in females, decreasing

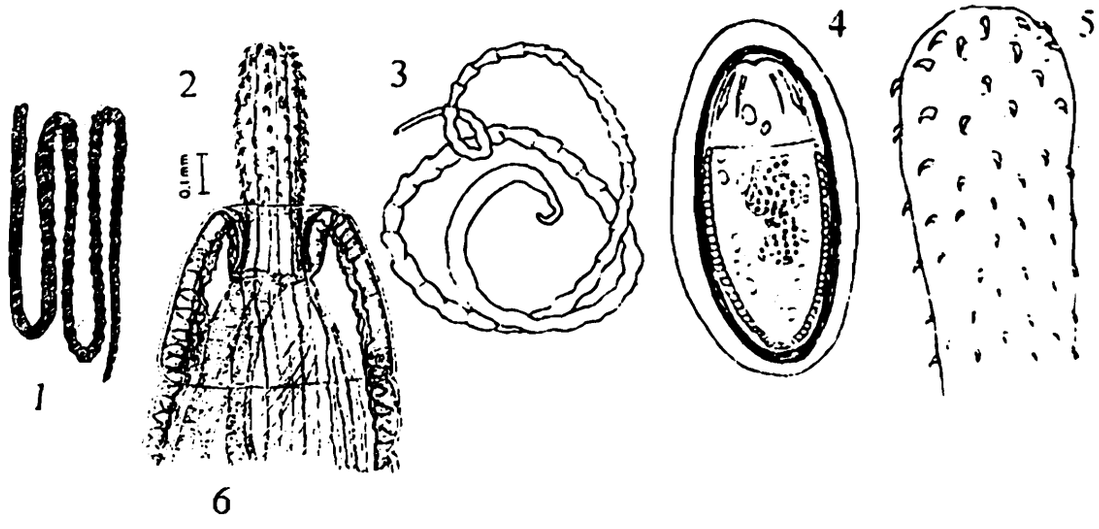


Fig. 28. *Moniliformis moniliformis* (Bremser, 1811) Travasson, 1915. 1. Entire worm, 2. Anterior part of worm with partly extruded proboscis, 3. Male, 4. Ovum enlarged, 5. Proboscis enlarged (1,2, after Van Cleave, 1953, 3,4,5 after Yamaguti, 1963).

in size posteriorly. Proboscis receptacle double-walled, 0.89-1.07 × 0.27-0.28 mm. Trunk cylindrical and attenuated to both ends, with external pseudo-segmentation of its wall. Lemnisci filiform, 4.0-7.5 × 0.15-0.17 mm. Testes long, elliptical, in tandem in posterior unannulated region of trunk, 2.2-3.0 × 0.5-0.8 mm. Cement glands 8, pyriform to oval, 0.6-1.26 × 0.4-0.6 mm. Eggs elliptical, large, 0.11-0.12 × 0.045-0.06 mm, with three membranes. Outer one smooth or wrinkled..Embryos with concentric membranes, 0.084-0.10 × 0.034-0.047 mm.

Host : House rat, *Rattus rattus* Linnaeus, *Rattus rattus rufescens*, *Ratus norvegicus*, *Bandicota bengalensis*, *Suncus caeruleus*, Albino rat; Cat. Juvenile in *Periplaneta americana*.

Location : Small intestine;

Locality : Mumbai (Maharastra); Burma;

Distribution : Cosmopolitan.

28. ***Moniliformis spiralis*** Subramanian, 1927
(Fig. 29)

Moniliformis spiralis Subramanian, 1927b: 646-648, Fig. 1, 2; Meyer, 1932 : 232-233; Petrotschenko, 1958: 288; Yamaguti, 1963 : 132; Sen & Chauhan, 1972 : 40-41; Amin, 1985 : 33; Golvan, 1994: 164; Bhattacharya, 2007 : 539-60, Pl. 35, Fig. 195 1-c.

Type locality : Rangoon, Burma.

Description : Male 16.94 mm long, 0.56 mm in maximum width; female 40 × 0.91 mm. Proboscis claviform, 0.43 × 0.11 mm in male; in female 0.35-0.47 × 0.17-0.18 mm, with

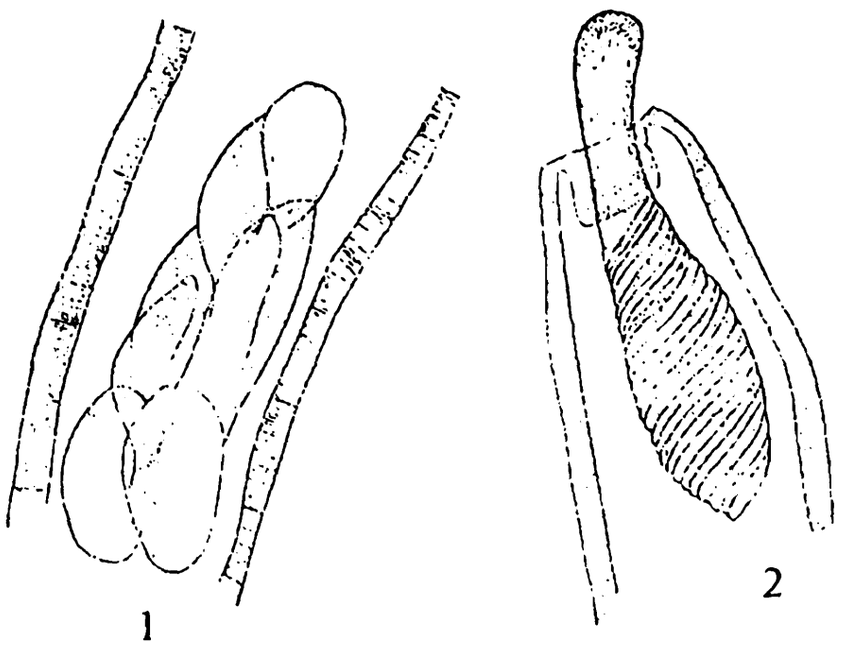


Fig. 29. *Moniliformis spiralis* Subramanian, 1927. Part of male trunk with cement glands, 2. Anterior end of worm (after Subramanian, 1927).

12-14 longitudinal rows of 12-14 small hooks each with back-wardly directed roots. Hooks measure 0.04 mm long. Proboscis receptacle moderately long, double-walled, 0.64-0.85 × 0.24-0.30 mm in male, in female 0.98 × 0.31 mm, with ganglion near its base. Trunk cylindrical, long with pseudo-segmentation of its wall. Lacunar system with dorsal and ventral main longitudinal channels and transverse anastomoses. Lemnisci short, cylindrical, slightly unequal in length, extending slightly beyond receptacle, 0.81 × 0.25 mm, longer 0.83 × 0.28 mm. Testes spindle-shaped, in tandem, nearly contiguous, anterior 0.81 × 0.25 mm, posterior 0.85 × 0.28 mm. Cement glands 6-8, compact, often superimposing, entire mass 0.53 × 0.21 mm. Seminal vesicle 0.45 mm long. Bursa slightly protruded. Gonopore terminal. Uterine bell 0.91 × 0.48 mm with 4 guard cells. Uterus together with vagina 0.60 mm long. Eggs 0.06 × 0.03 mm.

Host : *Nesokia bengalensis*; *Rattus rattus* Linnaeus, *Bandicoota* sp;

Location : Intestine.

Locality : Goa; Kolkata (West Bengal); Shillong (Assam); Mellibazar (Sikkim); Rangoon (Burma).

Distribution : Known only from Indian subcontinent.

4. Order OLIGACANTHORHYNCHIDA Petrotschenko, 1956

Oligacanthorhynchida Petrotschenko, 1958 : 272-273;

SOligacanthorhynchidae Yamaguti, 1963 : 133.

Diagnosis : Gigantorhynchida. Proboscis subcylindrical, with short, approximately straight longitudinal rows of few hooks each. All except basal hooks with anterior blade and strong root. Sensory papillae present on apex of proboscis and each side of neck. Proboscis receptacle with thick muscular wall and without outer wall, with ganglion on its ventral inner surface. Proboscis retractor muscle pierces dorsal wall of receptacle. Trunk medium-sized to very long. Lemnisci flat, long, distal ends not attached to body wall, with a few giant nuclei. Testes elongate, in tandem. Cement glands 8, compact, usually each with single giant nucleus. Protonephridia present in both sexes, near anterior cement glands in males, on uterine bell in females. Eggs oval, with sculptured or punctate thin outer membrane, and thick middle membrane. Larvae in insects, especially in ground beetles, occasionally in snakes. Parasites of birds and mammals.

Includes one family, Oligacanthorhynchidae Southwell & MacFie, 1925, which occurs in this subcontinent.

4. Family OLIGACANTHORHYNCHIDAE Southwell & Macfie, 1925

Oligacanthorhynchidae Southwell & Macfie, 1925 : 153; Thapar, 1927: 116; Van Cleave, 1953 : 29-30; Petrotschenko, 1958, 290; Yamaguti, 1963 : 133; Schmidt, 1972 : 292; Bhattacharya, 2007 : 30-31.

Diagnosis : Gigantorhynchida. Proboscis subcylindrical, with short, approximately straight longitudinal rows of few hooks each. All except basal hooks with anterior blade and strong root. Sensory papillae present on apex of proboscis and each side of neck. Proboscis receptacle with thick muscular wall and without outer wall, with ganglion on its ventral inner surface. Proboscis retractor muscle pierces dorsal wall of receptacle. Trunk medium-sized to very long. Lemnisci flat, long, distal ends not attached to body wall, with a few giant nuclei. Testes elongate, in tandem. Cement glands 8, compact, usually each with single giant nucleus. Protonephridial organs present in both sexes, near anterior cement glands in males, on uterine bell in females. Eggs oval, with sculptured or punctate thin outer membrane, and thick middle membrane. Larvae in insects, especially in ground beetles, occasionally in snakes. Parasites of birds and mammals.

Type genus : *Oligacanthorhynchus* Travassos, 1915.

This family includes ten genera, 1. *Macracanthorhynchus* Travassos, 1917, 2. *Echinopardalis* Travassos, 1918, 3. *Nephridiacanthus* Meyer, 1931,4. *Oligacanthorhynchus* Travassos, 1915, 5. *Prosthenorchis* Travassos, 1915, 6. *Multisentis* Smales Lesley, 1997, 7. *Neoncicola* Schmidt, 1972,7, 8. *Oncicola* Travassos, 1916, 9. *Pachysentis* Meyer, 1931 and 10. *Tchadorhynchus* Troncy, 1970, of which first four genera occur in this subcontinent.

Key to genera of family OLIGACANTHORHYNCHIDAE

1. Anterior end of trunk with conspicuous, festooned collar ..... *Prosthenorchis*
– Anterior end of trunk without such collar 2
2. Proboscis with 36 hooks 3
– Proboscis with more than 36 hooks 4
– Testes both post-equatorial, anterior trunk narrower than posterior trunk ..... *Oligacanthorhynus*
– At least one testis pre-equatorial, anterior trunk wider than posterior trunk 5
4. Trunk very long, females over 100 mm long ..... *Macracanthorhynchus*
– Trunk short to medium long ..... *Nephridiorhynchus*

4. Genus ***Macracanthorhynchus*** Travassos, 1917

Macracanthorhynchus Travassos, 1917b : 20; Southwell & Mafie, 1925 : 153; Meyer, 1932 : 212; Petrotschenko, 1958: 298; Yamaguti, 1963 : 140; Schmidt, 1972 : 293; Amin, 1985 : 34; Golvan, 1994 : 161; Bhattacharya, 2007 : 36.

Diagnosis : Proboscis subsphercal, with 12 longitudinal, approximately straight, regular alternating rows of 3 hooks each. Hooks with large blade and powerful roots, except in basal spines. Tip of hooks without barbs. Proboscis receptacle inserted in side of proboscis anterior to its base. Protonephridia present on each side at anterior end of uterine bell or

ejaculatory duct, with number of dendrite branches ending in baskets. Trunk large to very large, usually with transverse wrinkles, anterior end much wider than posterior end, ventrally curved. Lacunar system with two median longitudinal main channels and circular anastomoses. Lemnisci belt-like, short, with few giant nuclei. Testes elongate, pre-equatorial. Cement glands 8, compacteach with single giant nucleus. Eggs with sculptured outer shell. Parasites of pigs and Carnivora. Cosmopolitan.

Type species : *Macracanthorhynchus hirudinaceus* (Pallas, 1776) Travassos, 1917.

Includes four species, *Macranthorhynchus catulinus* Kostylew, 1927, *M. hirudinaceus* (Pallas, 1776) Travassos, 1917, *M.* (?) *erinacei* Dollfus, 1954 and *M. ingens* (Linstow, 1879) Meyer, 1932, of which first two occur in this subcontinent.

Key to Indian species of genus *Macracanthorhynchus*

- Proboscis less than 1 mm long, mucros of largest hooks less than 0.3 mm long, parasitising mainly carnivores ..... *Macracanthorhynchus catulinus*
- Parasitizing mainly cornivores ..... *Macracanthorhynchus catulinus*
- Proboscis 1 mm or more long, mucros of largest hooks much larger than 0.3 mm long ..... *Macracanthorhynchus hirudinaceus*

29. ***Macranthorhynchus catulinus*** Kostylew, 1927
(Fig. 30)

Macranthorhynchus catulinus Kostylew, 1927 : 494-503; Meyer, 1932 : 216-217, Fig. 235; Petrotschenko, 1958 : 314-316, Fig. 155; Barus, Kullman & Tenora, 1970 : 263-276; Barus & Tenora, 1976 : 348-349, Yamaguti, 1963 : 141, Pl. 62, Fig. 641-644; Amin, 1985: 34; Golvan, 1994 : 161.

Type Locality : Turkestan, Central Asia.

Description : Male 45-65 mm long, female 125 mm long, 5-6 mm wide. Proboscis nearly orbicular, 0.53 mm long, 0.47-0.53 mm wide anteriorly, 0.42-0.52 mm wide posteriorly, with 6 spiral rows of 36 hooks each. Most anterior hooks largest, with anterior and posterior root processes, roots of rest of hooks disk like. In 5 females hooks measured: mucro of I hook 0.200-0.242 mm long, II hook 0.220 mm, of III hook 0.186 mm, of IV hook 0.132 mm and of V and VI hooks 0.053 mm long. Proboscis receptacle 2 mm long, attached at apex of proboscis. Trunk long, ventrally curved, maximum width in anterior third. Lemnisci band-shaped, flat, with numerous giant cells and one large central canal. Testes in anterior half of body, nearly cylindrical, 6.6 × 0.66 mm, lying one behind other. Cement glands 8, in pairs but not symmetrical. Protonephridia present in female. Eggs 0.092-0.105 mm long, 0.0462 mm wide, with thick membranes.

Host : *Herpestes* sp.

Location : Inteatine.

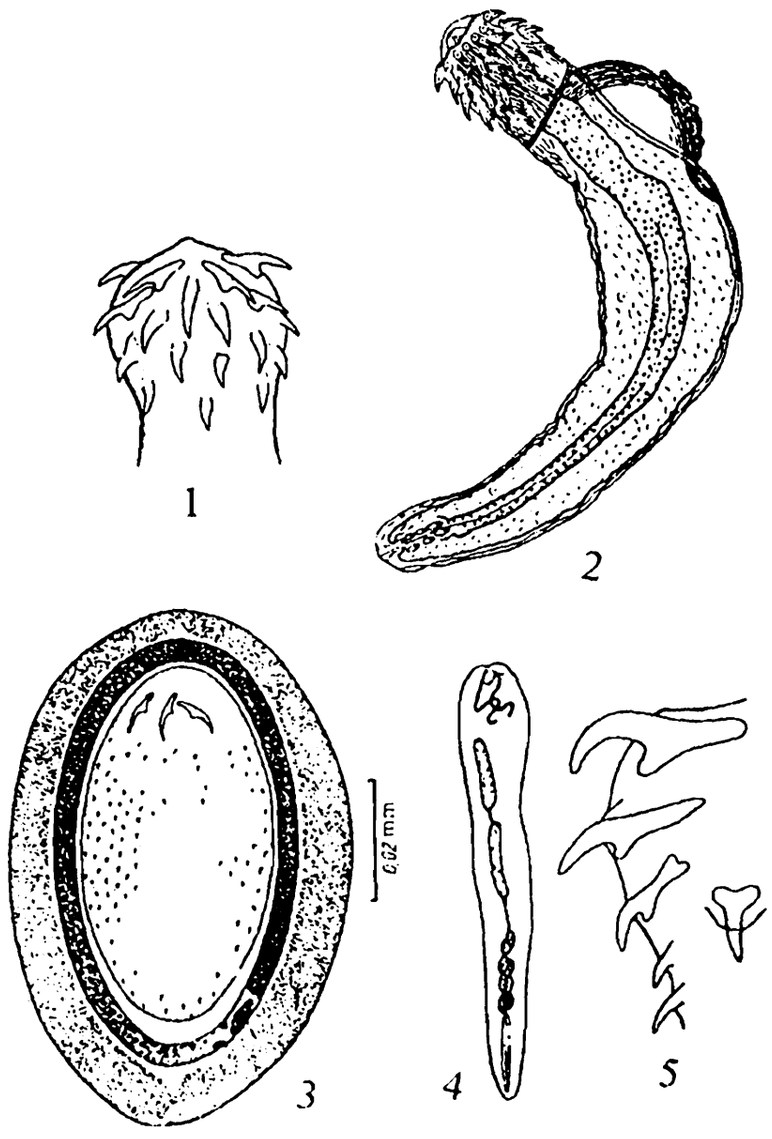


Fig. 30. *Macracanthorhynchus catulinus* Kostylew, 1927. 1. Proboscis enlarged, 2. Juvenile female, 3. Ovum enlarged, 4. Male, 5. Proboscis enlarged (after Rhzhikov & Dizer, 1954).

Locality : Jalalabad, Nimla (Afghanistan);

Distribution : Russia; Buriat, Turkestan, Central Asia.

30. ***Macranthorhynchus hirudinaceus*** (Pallas, 1781) Travassos, 1917 (Fig. 31)

Gigantorhynchus gigas Shipley, 1904: 54;

Macranthorhynchus hirudinaceus (Pallas) Travassos, 1917b : 5-62 ; Maplestone, 1930 : 78; Meyer, 1932 : 212-215, Fig. 232-234; Chatterji, 1940: 62; Petrotschenko, 1958: 299-305, Fig. 151-154; Alwar & Lata, 1961 : 147; Ahluwalia, 1959 : 361;1962: 361; Yamaguti, 1963 : 141, Pl. 61, Fig. 630-632; Anantaraman, M. & Anantaraman, S., 1970: 7; Gogai & Lahkar, 1975: 33-36; Amin, 1985 : 34; Golvan, 1994 : 161.; Bhattacharya, 2003 : 87-91; 2007 : 37, Pl. 17, Fig. 95 a-c.

Description : Females attaining 650 × 7-8 mm, males 50-90 × 6-8 mm. Proboscis globular about 0.6-1.0x 0.50-0.92 mm, with 6 spiral rows of 6 hooks each. Largest hooks 0.32 mm long, smaller in basal circle 0.26 mm from tip of thorn to anterior end of anterior root. Trunk very large, in living worm in normal habitat, flat but becomes turgid in water or preservative. In both sexes trunk tapers gradually from region immediately posterior to praesoma to a considerably smaller size near posterior end, and old fully grown females commonly show shallow, irregular transverse wrinkles; males lacking transverse wrinkles. Both sexes usually with slight ventral bending of both ends, some females showing tendency towards coiling. Lemnisci flat, ribbon-like, 0.20-0.35 mm long, widened posteriorly, each with 6 giant nuclei (occasionally 5 or 7). Testes in front half of body. Cement glands 8, often in pairs as an elongated series. Protonephridia associated with genital tract in both sexes. Mature embryos in gravid females 0.092-010 × 0.05-0.05 mm.

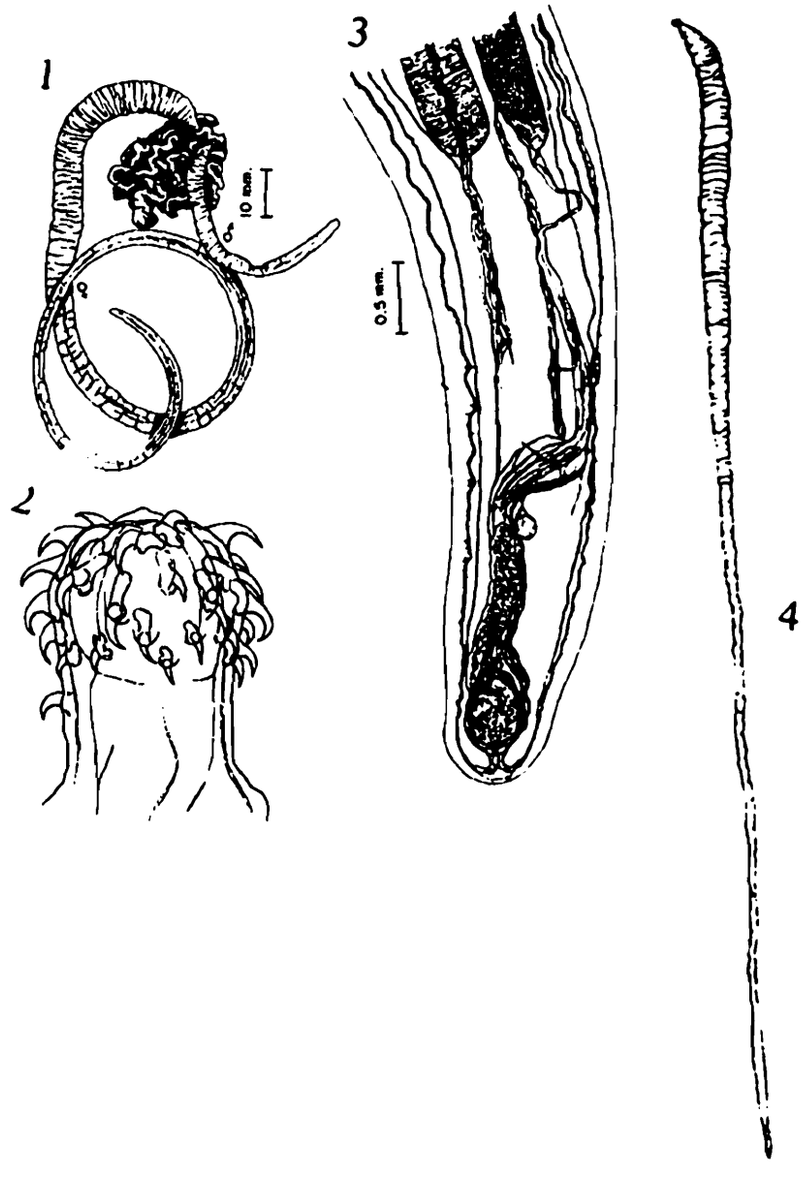


Fig. 31. *Macracanthorhynchus hirudinaceus* (Pallas, 1781) Travassos, 1917. 1. Male and female with proboscis implanted in intestinal wall of host, 2. Proboscis enlarged, 3. Posterior part of male. (1, 2, 3 after Van Cleave, 4 after Yamaguti, 1963).

Host : Pigs, *Sus scrofa domesticus, Sus scrofa cristatus,* Wild pig.

Location : Intestine.

Locality : Delhi; Western Uttar Pradesh; West Bengal, Raimona in Golpara district(Assam); Burma; Batuluoya (Sri Lanka).

Distribution : Cosmopolitan.

5. Genus ***Nephridiacanthus*** Meyer, 1931

Nephridiacanthus Meyer, 1931c: 53-108; 1933 : 199-200;

Nephridiorhynchus Meyer, 1932: 198; Petrotschenko, 1958: 321; Yamaguti, 1963: 137; Schmidt, 1972 : 293; Golvan, 1994: 167; Bhattacharya, 2007 : 33.

Diagnosis : Oligacanthorhynchidae. Proboscis subspherical with regularly alternating, approximately longitudinal rows of 4 hooks each. Hooks with large, complex blade, points barbed and roots, except for basal spines. Trunk slender, long, anterior end narrower than posterior end, commonly fixed with numerous transverse wrinkles. Testes in tandem, post-equatorial. Cement glands 8, compact, each with single giant nucleus. Eggs with sculptured outer membrane. Parasites of hedgehogs and pangolins. Europe, Africa, Asia Minor and Palawan.

Type species : *Nephridiacanthus kamerunensis* Meyer, 1931.

Includes nine species, 1. *Nephriorhynchus oreinus* Fotedar, 1968, 2. *N. thapari* Sen & Chauhan, 1972, 3. *N. gerberi* Baer, 1959, 4. *N. kamerunensis* Meyer, 1931, 5. *N. longissimus* Golvan, 1962, 6. *N. major* (Brenser, 1811) in Westrumb, 1821, 7. *N. manisensis* Meyer, 1931, 8. *N. maroccanus* Dollfus, 1951 and 9. *N. palawanensis* (Tubangui & Masilungan, 1938) Golvan, 1962, of which first two species occur in India.

31. ***Nephridiacanthus oreinus*** (Fotedar, 1968) Golvan, 1994

Nephridiorhynchus oreinus Fotedar, 1968 : 147-152; Gupta, V. & Sinha, 1990: 45;

Nephridiacanthus oreinus (Fotedar, 1968) Golvan, 1994 : 167.

Type locality : Jammu and Kashmir, India.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Oreinus sinuatus* Haeckel.

Location : Inteatine.

Locality : Jammu & Kashmir.

Distribution : Known only from India.

32. ***Nephridiacanthus thapari*** (Sen & Chauhan, 1972) Golvan, 1994 (Fig. 32)

Nephridiorhynchus thapari Sen & Chauhan, 1972 : 42-43, Textfig. 2 A, B;

Nephridiacanthus thapari (Sen & Chauhan, 1972) Golvan, 1994: 167; Bhattacharya, 2007: 33-34, Pl. 7, Fig. 19 a, b.

Type locality : Allahabad, Uttar Pradesh, India.

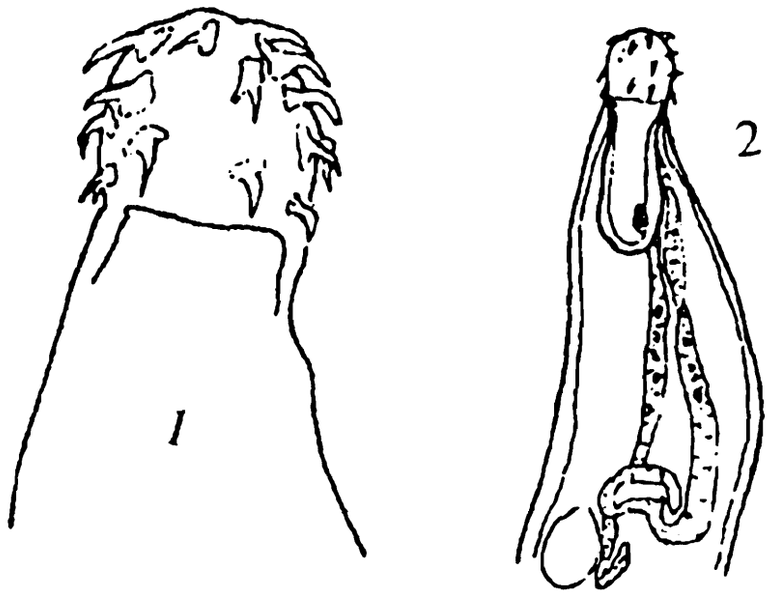


Fig. 32. *Nephridiacanthus thapari* (Sen & Chauhan, 1972) Golvan, 1994. 1. Proboscis enlarged, 2. Anterior part of male (after Sen & Chauhan, 1972).

Description : Male 8-10 × 1.54 mm. Proboscis short, round in front, 0.57 × 0.54 mm, with 6 spiral rows of 8 hooks each, barbed in 2-5 rows and not barbed in 1 and 6 rows. Hooks measure 0.11-0.13 mm long. Neck short with short papilla on each side. Proboscis receptacle with inner wall inserted into it, 1.92 × 0.52 mm. Lacunar system with dorsal and ventral main longitudinal channels and transverse anastomoses. Trunk slightly flattened from side to side, wider anteriorly, narrower posteriorly. Lemnisci long, filiform, with central canal, extending almost to anterior third of trunk with 13 nuclei. Testes almost equal, in midtrunk, oblique, oval, anterior 0.56 × 0.28 mm, posterior 0.49 × 0.28 mm. Cement glands 4, cylindrical, at a distance from posterior end of trunk, entire cement gland mass 0.56 × 0.21 mm. Seminal vesicle 0.77 mm long. Bursa protruded and gonopore subterminal. Female not known.

Host : *Herpestes* sp.

Location : Intestine.

Locality : Allahabad (Uttar Pradesh);

Distribution : Known only from type locality.

6. Genus ***Oligacanthorhynchus*** Travassos, 1915

Oligacanthorhynchus Travassos, 1915a : 137;

Hananniella Travassos, 1915a : 137;

Oligacanthorhynchus Southwell & Macfie, 1925: 154; Meyer, 1933: 194;

Hammaniella Van Cleave, 1953 : 112-113;

Oligacanthorhynchus Petrotschenko, 1958: 291;

Hammaniella Yamaguti, 1963 : 134;

Oligacanthorhynchus Yamaguti, 1963 : 134; Schmidt, 1972 : 293; Golvan, 1994 : 168.

Diagnosis : Proboscis subspherical with 12 regularly alternating, approximately longitudinal rows of 3 hooks each. Hooks with large, anterior blade and strong root, except for basal spines, points commonly barbed. Sensory papillae present on apex of proboscis. Proboscis receptacle with a thick muscular wall and without outer wall, with ganglion on ventral inner surface of receptacle. Trunk long, slender, anterior end narrower than posterior end, usually fixed with numerous transverse wrinkles. Lacunar system with two main median channels and numerous longitudinal and circular anastomoses. Lemnisci long, flat, distal end not bound to body wall, with few giant nuclei and central canal. Testes in tandem, post-equatorial. Cement glands 8, compact, each with single giant nucleus or rarely with nuclear fragments. Eggs usually with sculptured outer shell. Parasites of birds and mammals, juveniles commonly found encysted in reptiles. Asia; Europe, Africa; North and South America.

Type species : *Oligacanthorhynchus spira* (Diesing, 1851) Travassos, 1915.

Includes twenty species, 1. *Oligacanthorhynchus cati* (Gupta, N. K. & Lata) Schmidt, 1972, 2. *O. indicus* Rengaraju& Das, 1981, 3. *O. shillongensis* (Sen & Gupta, 1972) Amin, 1985, 4.,*O. citilli* (Rudolphi, 1806) Kostylevw & Zmeeve, 1939, 5. *O. erinasi* (Rudolphi, 1793) Meyer, 1932, 6. *O. hamatus* (Linstow, 1897) Schmidt, 1972, 7. *O. iheringi* Travassos, 1917, 8. *O. kamtschticus* Khokhlova, 1966, 9. *O. lagenaeformis* (Westrmb, 1821) Travassos, 1917, 10. *O. lamasi* (de Preitas & Costa, 1964) Amato, Nickol & Froes, 1979, 11. *O. lerouxi* (Bisserus, 1956) Schmidt, 1972, 12. *O. major* (Machado Filho, 1963) Schmidt, 1972, 13. *O. manifestus* (Leidy, 1851) Travassos, 1917, 14. O. *mariemily* (Tadeis, 1969) Amin, 1985; 15. *O. minor* Machado Filho, 1964, 16. *O. oligacanthus* (Rudolphi, 1819) Mryer, 1932, 17. *O. oti* Machado Filho , 1964, 18. *O. ricinoides* (Rudolphi, 1808) Travassos 1915, 19. *O. spira* (Diesing, 1851) Travassos, 1915, and 20. *O. taenioides* (Diesing, 1851) Travassos, 1915, of which first three species occur in Indian subcontinent.

Key to Indian species of genus *Oligacanthorhynchus*

1. Proboscis with 10 longitudinal rows of 2-3 hooks each ..... *Oligacanthorhynchus cati*

– Proboscis with less than 10 rows of hooks 2

2. Proboscis with 6 spiral rows of 6 hooks each 3

– Proboscis with 3 spiral rows of hooks 4

3. Worms large 100-120 mm long ..... *Oligacanthorhynchus shillongensis*

Worms small about 6 mm long ——————————*Oligacanthorhynchus indicus*

33. ***Oligacanthorhynchus cati*** (Gupta, N. K. & Lata, 1968) Schmist, 1972 (Fig. 33)

Hamanniella cati Gupta, N. K. & Lata, 1968 : 254-256, Fig. 1, 2;
Oligacanthorhynchus cati, Schmidt, 1972 : 293; Golvan, 1994 : 168.

Type locality : Chandigarh, North India.

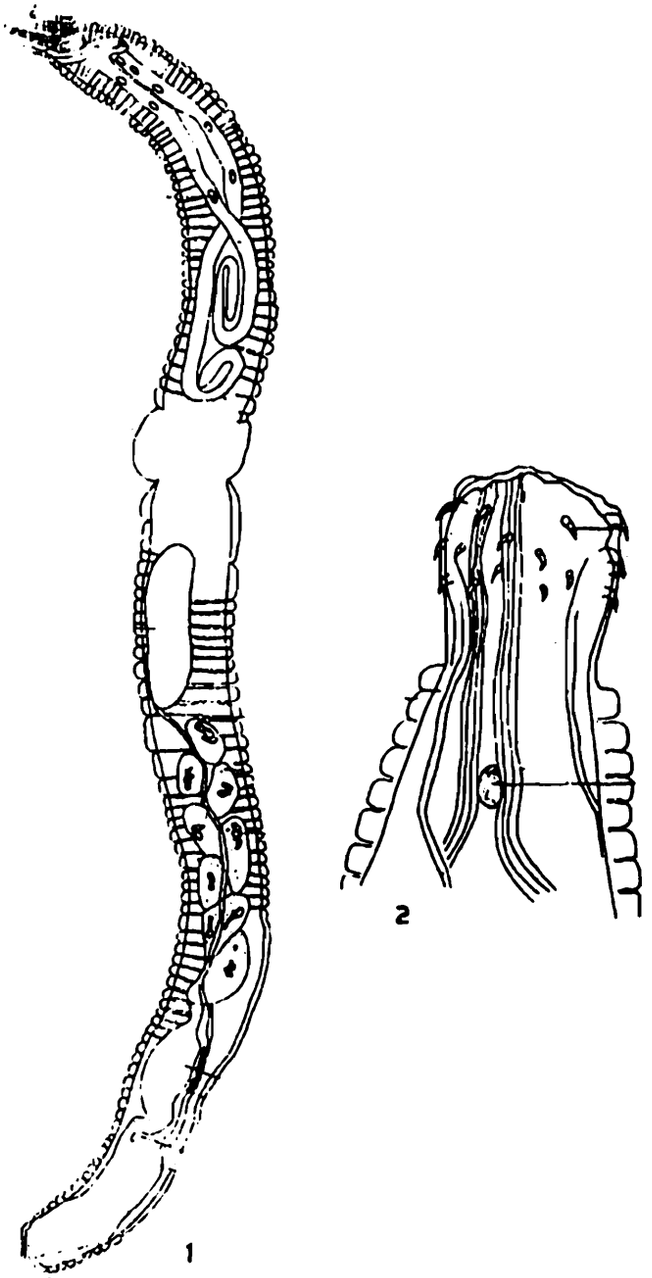


Fig. 33. *Oligacanthorhynchus cati* (Gupta, N.K. & Lata, 1967) Schmidt, 1972. 1. Male, 2. Proboscis enlarged (after Gupta N.K & Lata 1967).

Description : Males 29.0-29.3 × 1.8-1.9 mm. Proboscis short, globular 0.30-0.64 × 0.49-0.54 mm, with 10 longitudinal rows of 2-3 hooks each. Marginal hooks large, 0.084 × 0.028 mm. Proboscis receptacle plump, attenuated posteriorly, single-walled, 1.23-1.47 × 0.25-0.44 mm, with thick muscular wall and supplied with a set of retractor muscles which extend anteriorly upto anterior part of proboscis. Ganglion situated at a short distance from base of receptacle. Trunk long cylindrical, aspinose, with distinct annulations. Lacunar system not well developed. Lemnisci paired, long, tubular, convoluted, band-like emerging from rear of proboscis and hang freely in trunk pseudocoel, 0.23-0.28 mm wide, with 4 to 5 oval-shaped nuclei. Testes paired, elongated cylindrical, in midtrunk, anterior testis 3.2-3.5 × 0.77-0.84 mm. Cement glands 4 pairs. Genital sheath 2.54-3.05 × 0.98-0.99 mm. Penis small, 0.35 × 0.098 mm. Bursa inverted, 3.62-4.41 × 0.98 mm. Female not known.

Host : *Felis domesticus.*

Location : Intestine.

Locality : Chandigarh, India.

Distribution : Known only from type locality.

34. ***Oligacanthorhynchus indicus*** Rengaraju& Das, 1981
(Fig. 34)

Oligacanthorhynchus indicus Rengaraju & Das, 1981 : 37-39, Textfig. 1 A-D.

Type locality : Amaroti, Maharastra, India.

Description : Female juvenile 5.75 mm long, narrower anteriorly, 0.95 mm wide, wide posteriorly 1.6 mm wide, with wrinkled surface. Proboscis globular, 0.80 × 0.79 mm, with

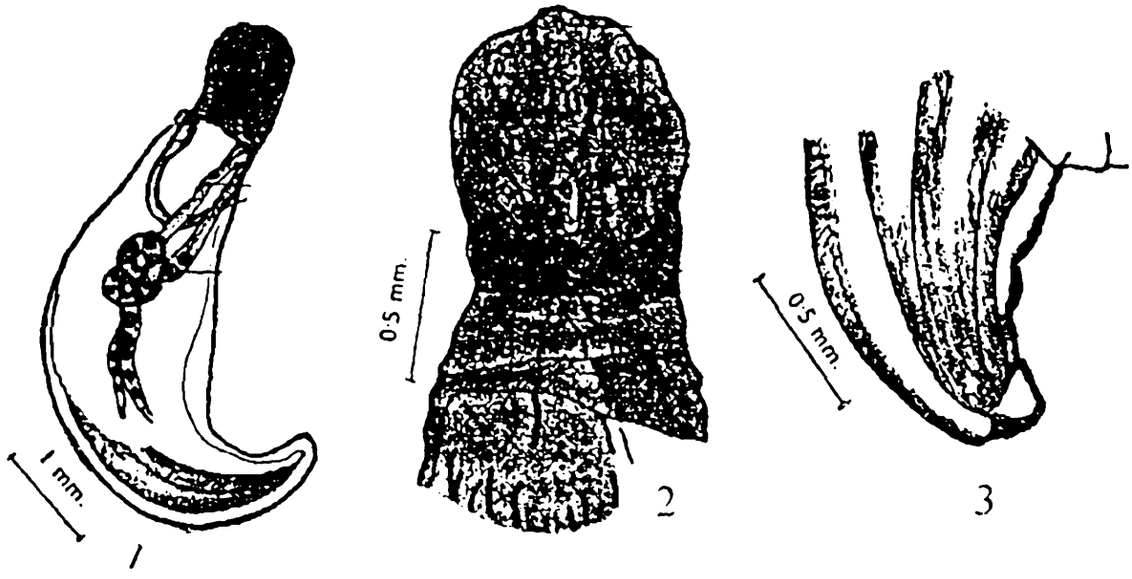


Fig. 34. *Oligacanthorhynchus indicus* Rengaraju & Das, 1981. 1. Male, 2. Proboscis enlarged, 3. Posterior end of female (after Rengaraju & Das, 1981).

3 spiral rows of 6-8 subequal hooks each. Hooks with anterior manubria and powerful roots, roots of anterior hooks larger than those of posterior hooks. Largest root with manubrium 0.55 × 0.18 mm. Nonspinose region of proboscis 0.25 × 0.45 mm long. Proboscis receptacle 1.0 × 0.75 mm, with thick muscular wall. Lemnisci filiform, looped, tapering posteriorly, each about 5.1 mm long, with a few giant nuclei, each nucleus about 0.1 mm in diameter. Male not known.

Host : *Ptyas mucosus* (Linnaeus).

Location : Mesentery cysts.

Locality : Amroati (Maharastra).

Distribution : Known only from type locality.

Note : Not recognised by Golvan, 1994.

35. ***Oligacathorhynchus shillongensis*** (Sen & Chauhan, 1972) Amin, 1985 (Fig. 35)

Nephridiacanthus shillongensis Sen & Chouhan, 1973 : 41-43, Textfig. 2 A, B; *Oligacathorhynchus shillongensis* (Sen & Chauhan) Amin, 1985 : 37; Golvan, 1994 : 168.

Nephridiacanthus shillongensis Bhattacharya, 2007 : 394, Pl. 7, Fig. 20 a, b.

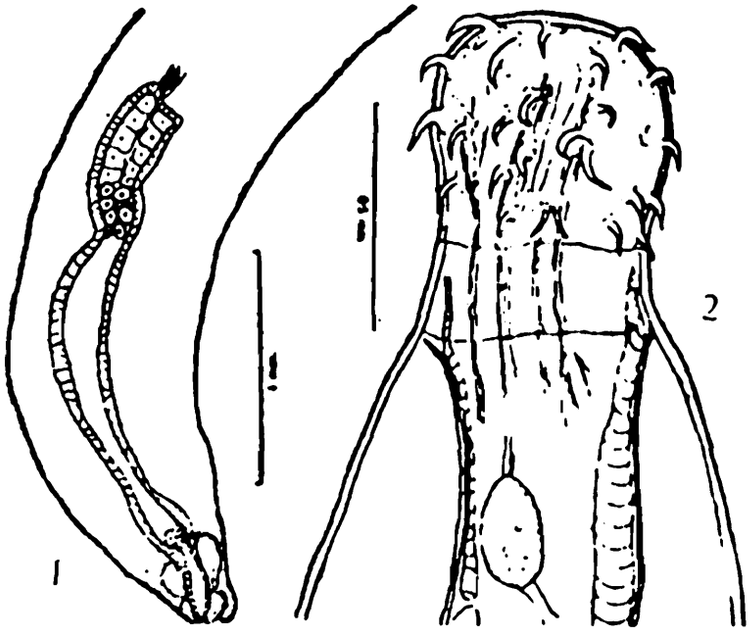


Fig. 35. *Oligacanthorhynchus shillongensis* Sen & Chauhan, 1972) Amin, 1985. 1. Posterior part of female, 2. Anterior part of worm (after Sen & Chauhan, 1972).

Type locality : Shillong, Meghalaya, India.

Description : Female 100-120 mm long, 1.51 in maximum width. Proboscis globular, round antereiorly, 0.52 × 0.52 mm, with 6 spiral rows of 6 hooks each. Hooks measure 0.08-0.10 mm long. Neck short, 0.25 mm long. Proboscis receptacle plump, saccular,

plump, 0.98 × 0.48 mm, with ganglion at its middle. Trunk long, cylindrical, flattened from side to side and showing transverse annulations of almost same width. Lacunar system with dorsal and ventral longitudinal channels and reticular anastomoses. Lemnisci long, filiform, with convoluted central canal, occupying about 1/5 of trunk length wider at places with 6 nuclei. Uterine bell 1.15 × 0.24 mm with 6 guard cells. Uterus along with vagina measure 1.96 mm long. Gonopore oblique and subterminal. Eggs oval, 0.06 × 0.03-0.04 mm. Male not known.

Host : *Manis pentadactyla aurita* Hodgson.

Location : Inteatine.

Locality : Shillong (Meghalaya).

Distribution : Known only from type locality.

7. Genus ***Echinopardalis*** Travassos, 1918

Pardalis Travassos, 1917 : 21;

Echinopardalis Travassos, 1920 : 10; Meyer, 1932 : 247; Pujatti, 1951a : 120; Van Cleave, 1953 : 121-123; Petrotschenko, 1958 : 352; Yamaguti, 1963 : 145; Golvan, 1994 : 145.; Bhattacharya, 2007 : 34.

Diagnosis : Gigantorhynchida, Oligacanthorhynchidae. Proboscis orbicular, with 36 hooks in spiral rows. Trunk elongate. A small process at postereior end dorsal to female gonopore present in sexually mature forms. Lemnisci nearly cylindrical, long, extending to testes. Lacunar system slightly developed with amaeboiform giant nuclei present in region of main canals. Testes oval to elongate, in anterior half of trunk. Cement glands 8 in pairs. Protonephridia present. Eggs oval, with concentric membranes and without compact external shell. Parasites of cornivora.

Type species : *Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1917.

Includes five species, 1. *Echinopardalis bangalorensis* Pujatti, 1951,2. *E. pardalis* (Westrumb, 1821) Travassos, 1918, 3. *E. atrata* Meyer, 1931, 4. *E. dcerescens* Meyer, 1931, 5. *E. lerouxi* Bisseru, 1956, *E. macrurae* Meyer, 1931, of which firs two species occur in India.

Key to Indian species of *Echinopardalis*

- Worms small, 15-17 mm long, proboscis with 6 spiral rows of 6 hooks each .... *Echinopardalis bangalorensis*
- Worms large, 30-37 mm long, proboscis with 6 spiral rows of 5 hooks each ....*Echinopardalis pardalis*

36. ***Echinopardalis bangalorensis*** Pujatti, 1951

Echinopardalis bangalorensis Pujatti, 1951c : 1-6; 1951b : 251-255; Petrotschenko, 1958 : 354-355; Yamaguti, 1963 : 146; Anantaraman, M. & Anantaraman, S., 1970 : 8;

Oligacatnorhynchus bangalorensis (Pujatti), Schmidt, 1972 : 293; Golvan, 1994 :145; Bhattacharya, 2007 : 35.

Type locality : Bangalore, Karnataka, India.

Description : (after Pujatti, 1951) Male 15.0-16.5 × 1.0-1.5 mm. Proboscis hemispherical, 0.43 × 0.525 mm with 6 spiral rows of 6 hooks each. Mucro of I hook 0.21 mm long, of II hook 0.24 mm long, of III hook 0.182 mm long, of IV hook 0.10-0.11 mm long, of V hook 0.074-0.084 mm long, of VI hook 0.07-0.08 mm long. Proboscis receptacle 1.0-1.2 mm long. Trunk cylindrical. Lemnisci cylindrical, 0.156 mm long. Testes ellipsoidal, 1.05 × 0.32 mm. Cement glands 8, extending along body for 2.5 mm. Protonephridia near cement glands in male, in female near uterine bell. Uterine bell 1.5-2.0 mm long. Uterus leads into vagina, which opens subterminally. Eggs oval.

Host : *Bufo melanostictus* (Schneider).

Location : Inteatine.

Locality : Bangalore (Karnataka); Western India.

Distribution : Known only from India.

37. ***Echinopardalis pardalis*** (Westrumb, 1821) Travassos, 1918 (Fig. 36)

Echinorhynchus pardalis Westrumb, 1821 : 1-85;

Prosthenorchis pardalis Southwell & Macfie, 1925: 156-158;

Echinopardalis pardalis (Westrumb), Meyer, 1933: 247-248; Fig. 273-275; Petrotschenko, 1958: 353, Fig. 176; Yamaguti, 1963: 146, Pl. 68, Fig. 699-701;

Oligacatnorhynchus pardalis Gupta, N. K. & Lata, 1968c: 395-403, Fig. 1-19; Schmidt, 1972: 293; Golvan, 1994: 145.; Bhattacharya, 2007: 35, Pl. 7, Fig. 21 a-c.

Type locality : Brazil, South America.

Description : Male 30.38-37.66 × 1.69-2.0 mm; female 42.3-42.4 × 2.15-2.32 mm. Proboscis short, globular, 0.50-0.86 × 0.33-0.46 mm, with 10 longitudinal rows of 3 hooks each, equivalent to 6 spiral rows of 5 hooks each. Hooks 0.042-0.047 × 0.014 mm, with well developed roots, with blades truncated obliquely. Proboscis receptacle cylindrical, single-walled, inserted at base of proboscis 1.66-1.67 × 0.22-0.50 mm, with ganglion located inside post-equatorial lying close to its wall, from which a pair of nerves emerge. Neck retractors and compressors of lemnisi are also present. Neck retractors enclose lemnisci and terminate on muscular wall of trunk. Trunk long, cylindrical with superficial annulation, spinose. Lacunar system with two main longitudinal channels and smaller canals. Hypodermal nuclei large number, of various shapes. Lemnisci paired, tubular, very long, convoluted organs occupying one third of body, 0.19-0.29 mm wide, each with 3-4 giant ovoid nuclei, each nucleus 0.28 × 0.14 mm, richly supplied by vessels of lacunar system. Protonephridia open at anterior part of uterine bell. Testes paired, elongate ovoid, contiguous. Uterine bell 0.56 × 0.19 mm, leads into uterus. Uterus long, tubular, 0.99 ×

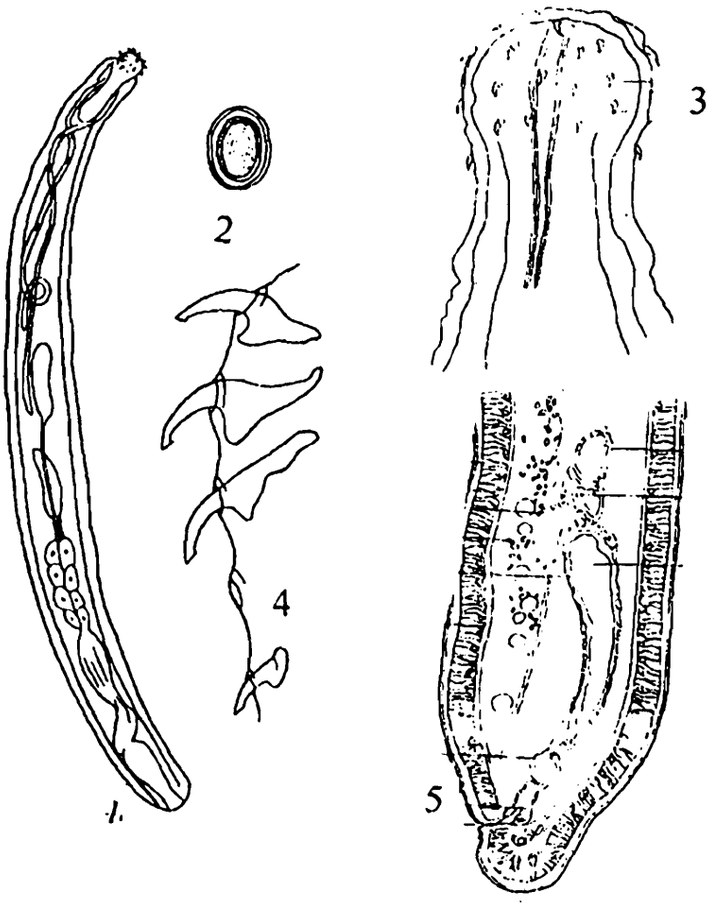


Fig. 36. *Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1918. 1. Male, 2. Ovum enlarged, 3. Proboscis enlarged, 4. Proboscis hooks enlarged, 5. Posterior part of female (after Yamaguti, 1963).

0.12 mm. Vagina 0.36 × 0.12 mm with a pair of vaginal sphincters and opens to outside by female gonopore. Eggs small, ovoidal, 0.05-0.056 × 0.034-0.038 mm, occupy whole of body cavity. Ovarian balls also present.

Host : *Felis domesticus.*

Location : Intestine.

Locality : Chandigarh.

Distribution : Brazil

8. Genus ***Prosthenorchis*** Travassos, 1915

Echinorhynchus Zoega in Muller, 1788 : 214, 215, (part).

Gigantorhynchus Hamann, 1892 : 196, (part);

Prosthenorchis Travassos, 1915a : 137; 1917 : 186, 1924: 366; Southwell & Macfie, 1925 : 175; Meyer, 1932 : 206; Dollfus, 1938: 387-389; Petrotschenko, 1958 : 326; Yamaguti, 1963 : 142-143; Schmidt, 1972 : 293; Golvan, 1994 : 174; Bhattacharya, 2007 : 37-38.

Description : Oligacanthorhynchidae. Proboscis subspherical, with 12 regularly alternating, approximately longitudinal rows of 3 hooks each. Hooks with large, complex blades and roots except for basal hooks. Collar conspicuous and festooned. Trunk moderately long, slender, not swollen near anterior end. Conspicuous festooned collar on anterior end of trunk. Testes in tandem, anterior about equilateral. Cement glands 8, compact, each with single giant nucleus. Eggs with sculptured outer membrane. Parasites of primates. Southern America and primate colonies throughout world, and Felidae in Africa.

Type species : *Prosthenorchis elegans* (Diesing, 1851) Travassos, 1915.

Included five species, 1. *Prosthrnorchis lemuri* Machado Filho, 1950, 2. *P. elegans* (Diesing, 1851) Travassos, 1915, 3. *P. fraterna* (Baer, 1959) Schmidt, 1972, 4. *P. pachyacanthus* (Sonsino, 1889) Travassos, 1917 and 5. *P. sinicus* Hu, 1990, of which first species occurs in India.

38. ***Prosthenorchis lemuri*** Machao-Filho, 1950
(Fig. 37)

Prosthonorchis lemuri Machao-Filho, 1950 : 535-537, Fig. 85-92; Yamaguti, 1963 : 144, Pl. 67, Fig. 689-691; Patnaik & Acharjyo, 1970 : 729; Golvan, 1994: 174.

Type locality : Paris, France.

Description : Female 45 × 3 mm, Proboscis subspherical with 6 longitudinal rows of 7 hooks each, placed obliquely. Sensory papilla 0.125 × 0.105 mm at base of proboscis. Collar

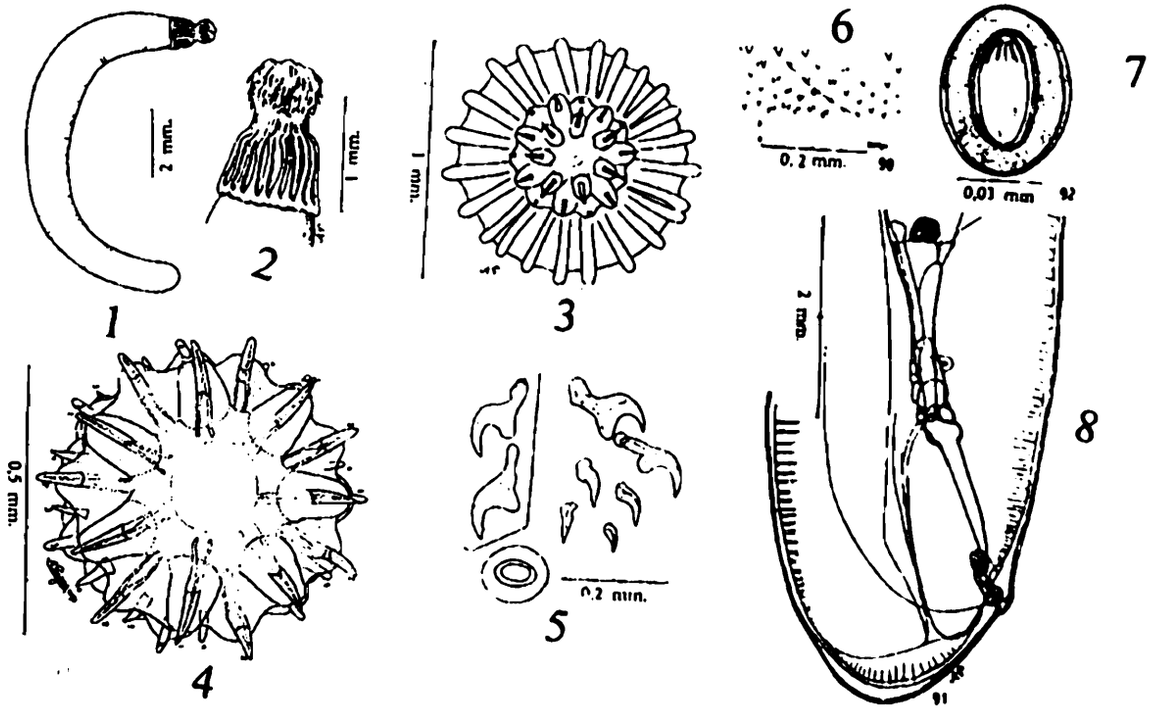


Fig. 37. *Prosthenorchis lemuri* Machado-Filho, 1950. 1. Female, 2. Proboscis enlarged and neck enlarged, 3.4. End view of Proboscis, 5. Proboscis hooks enlarged, 6. Trunk spines, 7. Egg enlarged (from Machado-Fitho, 1950).

conspicuous and festooned with 20-25 longitudinal rows of spines. Proboscis receptacle single-walled. Trunk long, cylindrical with pseudo-sementation and hind end bluntly rounded. Lemnisci 17.4 × 7.5 mm in male; in female 17.5 × 7.0 mm. Testes in tandem, in midtrunk region. Cement glands 8, compact each with a nucleus. Eggs 0.060 × 0.042 mm with outer shell sculptured with granules and reticulations. Vulva postero-dorsal.

Host : *Nycticebus coucana.*

Location : Intestine.

Locality : Baranga Zoo (Orissa).

Distribution : Cosmopolitan.

B. Class PALEACANTHOCEPHALA Meyer, 1931

Paleacanthocephala Meyer, 1931c53-108; Van Cleave, 1953 : 25; Petrotschenko, 1956 : 253; Golvan & Houin, 1963: 808; Golvan, 1969 : 11-12.

Diagnosis : Small to large worms parasites of aquatic vertebrates. Proboscis with radially arranged hooks, ventral hooks often larger than dorsal hooks. Proboscis receptacle double-walled closed muscular sac. Trunk with or without spines. Lacunar system with generally lateral main channels. Hypodermic nuclei numerous amitotic fragments or few highly branched. Ligament sacs ruptured. Protonephridia absent. Cement glands multiple, 6 or less. Embryonic membranes thin.

Includes two orders, Echinorhynchida Southwell & Macfie, 1925, and Polymorphida Petrotschenko, 1956, both of which occur in this subcontinent.

Key to orders of class Paleacanthocephala

– Ova with polar prolongations of middle shell; embryos with hooks at either end. Parasites of fishes and amphibia ..... ECHINORHYNCHIDA

– Ova with protrusions of middle membrane at poles, embryos hemiechinate. Parasites of birds and mammals, rarely in reptiles ..... Polymorphida

5. Order ECHINORHYNCHIDA Southwell & Macfie, 1925

Echinorhynchidea Southwell & Macfie, 1925 : 158; Petrotschenko, 1956 : 254; Yamaguti, 1963 : 36; Golvan & Houin, 1963 : 809; 1964 : 536-537; Bhattacharya, 2007 : 85.

Diagnosis : Proboscis invaginable, provided with small or large number of hooks. Proboscis receptacle double-walled, inserted at base of proboscis. Trunk usually small, spinose or aspinose. Lacunar system with main lateral longitudinal channels. Hypodermal nuclei usually small, numerous. Protonephridia absent. Cement gland divided into 2 or more lobes, moniliform, round, pear-shaped, or elongate-cylindrucal. Ova usually with polar prolongation of middle shell. Embryo with hooks at each end.

Includes thirteen families 1. Arhythmacanthidae Yamaguti, 1935, 2. Cavisomidae Meyer, 1931, 3. Diplosentidae Tubangui & Masilungan, 1937, 4. Echinorhynchidae Cobbold, 1876, 5. Heteracanthocephalidae Petrochenko, 1956, 6. Hypoechinorhynchidae Golvan, 1980, 7. Illiosentidae Golvan, 1960, 8. Micranthorhynchidae Yamaguti, 1963. 9. Plagiorhyncidae Golvan, 1969, 10. Polymorphidae Meyer, 1931, 11. Pomphorhynchidae Yamaguti, 1939, 12.Rhadinorhynchidae Travassos, 1925, 13. Fessisentidae Van Cleave, 1931, of which first twelve families occur in this subcontinent.

Key to Indian families of order ECHINORHYNCHIDA

1. Neck very long, cylindrical or spirally twisted, with or without bulbous swelling; ... . POMPHORHYNCHIDAE
– Neck short, if at all, never cylindrical or spirally twisted, without bulbous swelling 2
2. Cement glands 2 ..... DIPLOSENTIDAE
– Cement glands more than 2 3
3. Cement glands 4 ..... CAVISOMIDAE
– Cement glands 4-6 ..... RHADINORHYNCHIDAE
– Cement glands 6 or more 4
4. Cement glands 8 ..... ILLIOSENTIDAE
– Cement glands 6-8 ..... ECHINORHYNCHIDAE
– Cement glands 6 5
5. Ventral proboscis hooks much larger than dorsal hooks .... HETERANTHOCEPHALIDAE
– Proboscis hooks not as above 6
6. Trunk spinose anteriorly ..... ARHYTHMACANTHIDAE
– Trunk aspinose ..... HYPOECHINORHYNCHIDAE

5. Family ARHYTHMACANTHIDAE Yamaguti, 1935

Arhythmacantuidae Yamaguti, 1935 : 272; Petrotschenko, 1956 : 355; Yamaguti, 1963 : 59; Golvan, 1969 : 163;

Arhythmacanthinae Amin, 1985 : 39; Bhattacharya, 2007 : 105.

Diagnosis : Palaeacanthocephala, Echinorhynchida. Proboscis short, cylindrical or pyriform, with different types of hooks, of which subapicals larger than basal hooks or with nearly uniform hooks, ventral hooks may be larger than dorsals. Neck short. Proboscis receptacle double-walled, with basal ganglion. Trunk small, to medium size, covered with spines on its anterior part. Hypodermal nuclei numerous and scattered. Lemnici digitiform, longer than receptacle. Testes spherical usually contiguous. Cement glands 6, usually

compact, may be pyriform or more elongate. Saefftigen's pouch large. Eggs with polar prolongations of middle shell. Gonopore terminal in both sexes. Adults parasitic in marine fishes.

Type genus : *Arhythmacanthus* Yamaguti, 1935.

This family consists of three subfamilies : 1. Arhythmacanthinae Yamaguti, 1935, 2. Paracanthocephaloidinae Golvan, 1960, and 3. Neoacanthocephaloidinae Golvan, 1960, of which first two subfamilies occur in this subcontinent.

Key to Indian subfamilies of family ARHYTHMACANTHIDAE

- Proboscis with 3 kinds of hooks, apicals minute, rootless, subapicals large with roots and basals minute, rootless; hypodermal nuclei few ..... ARHYTHMACANTHINAE
- Proboscis with 2 kinds of hooks, apicals with well developed roots, and basals with poorly developed roots; hypodermal nuclei numerous .... PARACANTHOCEPHALOIDINAE

Subfamily ARHYTHMACANTHINAE

This subfamily consists of four genera, 1. *Arhythmacanthus* Yamaguti, 1935, and 2. *Gorgorhynchoides* Cable & Linderoth, 1963, 34. *Heterosentis* Van Cleave, 1931, 4. *Spinacanthus* Munoz & Nascimento, 2002, of which one occur in this subcontinent.

9. Genus ***Arhythmacanthus*** Yamaguti, 1935

Arhythmacanthus Yamaguti, 1935 : 247-259; Bhattacharya, 2007 : 107.

Diagnosis : Arhythmacanthidae, Arhythmacanthinae. Trunk fusiform with very thick hypodermis and few giant muscle cells on its inner surface at level of posterior ends of lemnisci. Anterior half or third with circular rows of close-set spines sheathed in scale-like cuticular folds. Proboscis short, globular, hooks divided into three groups, apical, sub-apical and basal; apical hooks 18 minute, rootless, in radial rows; sub-apical hooks large, strongly recurved with slender blade and simple, backwardly directed roots, arranged in 2 alternate rows of 7 each; basal hooks minute, rootless, in 14 longitudinal rows of 3 each. Neck short, unarmed. Proboscis receptacle plump, double-walled with basal ganglion. Lemnisci 2, occasionally 4, digitiform, longer than proboscis receptacle. Testes contiguous, post-equatorial. Cement glands 6-8, pyriform, close together. Eggs unknown. Parasites of marine fishes.

Type species : *Arhythmacanthus fusiformis* Yamaguti, 1935.

This genus includes *six species Arhythmacanthus septacanthus* (Sita, 1949) Amin, 1985, 2. A. *thapari* Gupta, V. & Fatma, 1980, 34. A. *zdzitewicekii* Kumar, 1992, 4. *A. fusiformis* Yamaguti, 1935,56. A. *orerstreeti* Schmidt & Paperna, 1978, 6. *A. Paraplagusiiarum* Nickol, 1972, of which first three occur in this subcontinent.

Key to Indian species of genus *Arhythmacanthus*

1. Proboscis hooks in 10-12 longitudinal rows of 7-8 hooks each ..... *Arhythmacanthus thapari*

– Proboscis hooks in 3 groups, apicals, subapicals and basals 3

2. Apical hooks in 3 rows of 6 hooks each, subapicals in 3 rows of 6 hooks each, ... *Arhythmacanthus setacanthus*

– Apical hooks in radial rows of 12 hooks each, subapicals in 14 longitudinal rowsof hooks each ..... *Arhythmacanthus zdzitowiekii*

39. ***Arhythmacanthus septacanthus*** (Sita, 1949) Amin, 1985 (Fig. 38)

Heterosentis sp. Sita, 1949 : 175-177;

Arhythmacanthus septacanthus Sita in Golvan, 1969 : 175-177, Fig. 127 A, B;

Arhythmacanthus (*Heterosentis*) sp. Anantaraman, M. & Anantaraman, S., 1970 : 4;

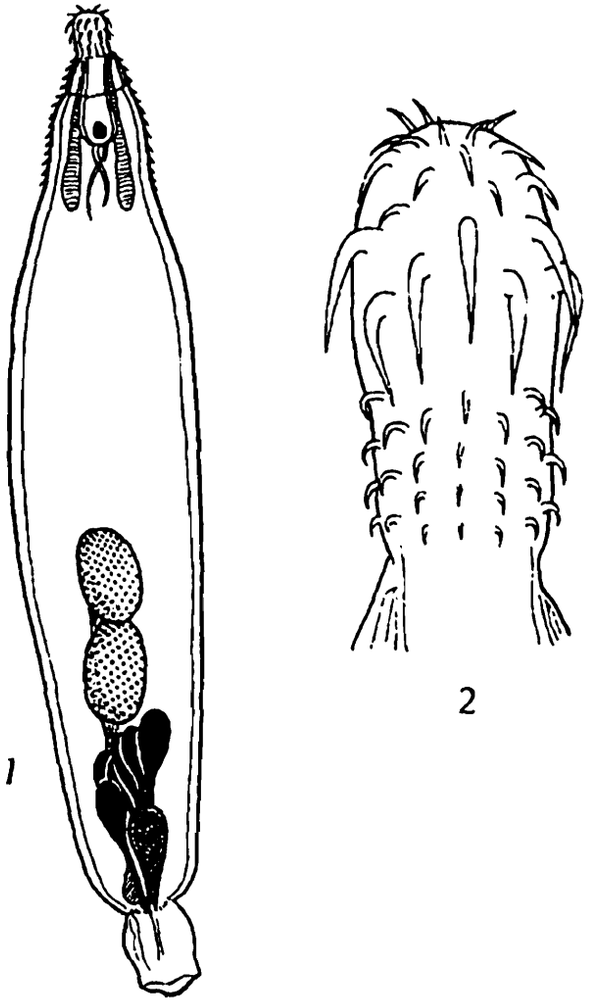


Fig. 38. *Arhythmacanthus septacanthus* (Sita, 1949) Amin, 1985. 1. Male, 2. Proboscis enlarged (after Golvan, 1969).

Heterosentis septacanthus (Sita in Golvan, 1969) Amin, 1985: 39;

Arhythmacanthus septacanthus Golvan, 1994: 139; Bhattacharya, 2007: 107-108, Pl. 18, Fig. 100 1,b

Type locality : Pulicut lake, Andhra Pradesh, India.

Description : Worms fusiform, anterior trunk spinose. Proboscis club-shaped, 0.216 × 0.124 mm, with three types of hooks. Apical hooks small in 3 rows of 6 hooks each, next large hooks in 3 rows of 6 hooks each, following which hooks are small in 6 rows of 6 each. Hooks in each row 0.036, 0.060, 0.056 and 0.016 mm long respectively. Neck and trunk with 13 or 14 spines each. Proboscis receptacle double-walled 0.495 × 0.12 mm, with ganglion near its base. Trunk fusiform, widest in middle, spinose in anterior part. Lemnisci subequal, 0.345 × 0.03 mm. Testes ovoid, one behind other, attached to ligament, 0.255 × 0.03 mm and 0.27 × 0.16 mm. Cement glands 6, pyriform, 0.12 ×,0.09 mm. Seminal vesicle pyriform. Saefftigen's pouch 0.255 × 0.105 mm wide. Bursa copulatrix 0.36 × 0.255 mm. Uterus and vagina long, later with sphincters. Embryophore 0.032 × 0.004 mm.

Host : *Plotossus caninus* Hamilton-Buchanan.

Location : Intestine.

Locality : Pulicut lake (Andhra Pradesh).

Distribution : China.

40. ***Arhythmacanthus thapari*** Gupta, V. & Fatima, 1980 (Fig. 39)

Arhyhmacanthus thapari Gupta, V. & Fatma, 1980 : 50-53, Pl. 3, Fig. 1-4; Gupta, V. & Sinha, 1990b : 54; Golvan, 1994 : 139; Bhattacharya, 2007 : 108, Pl. 18, Fig. 101 a-d.

Type locality : Mandapam, Tamil Nadu, India.

Description : Male 1.24-1.52 × 0.16-0.30 mm. Proboscis globular, short, 0.15-0.18 × 0.072-0.085 mm, with 10-12 longitudinal rows of 7-8 hooks each. Proboscis hooks of three types, apical hooks of each longitudinal row thin, intermediate in length, not greatly recurved with much reduced root or rootless, 0.015-0.016 mm long; subapical hooks larger and strongly recurved with large prominent roots, 0.025-0.030 mm long; basal hooks 4-5 smallest, greatly recurved and closely spaced, 0.01-0.11 mm long, gradually decreasing in size towards base. Neck short, 0.01-0.015 × 0.07-0.085 mm, unarmed. Proboscis receptacle 0.30-0.35 × 0.2-0.5 mm, double-walled with ganglion at its base, its posterior wall with 2 large nuclei in outer wall and 4-5 in inner wall. Trunk short, fusiform, spines 6-8 circular rows evenly distributed from neck upto 0.30-0.40 mm from anterior trunk. Lemnisci subequal, smaller than receptacle, shorter lemniscus 0.105-0.110 × 0.02-0.025 mm, longer 0.145-0.18 × 0.02-0.033 mm. Testes contiguous, in tandem, elliptical in midtrunk, anterior 0.10-0.18 × 0.08-0.15 mm posterior testis 0.10-0.16 × 0.12-0.13 mm. Cement glands 6, pyriform, forming a cluster anterior to bursa, extending up to posterior testis, 0.050-0.065 × 0.030-0.035 mm arranged in two groups of 3 glands each.

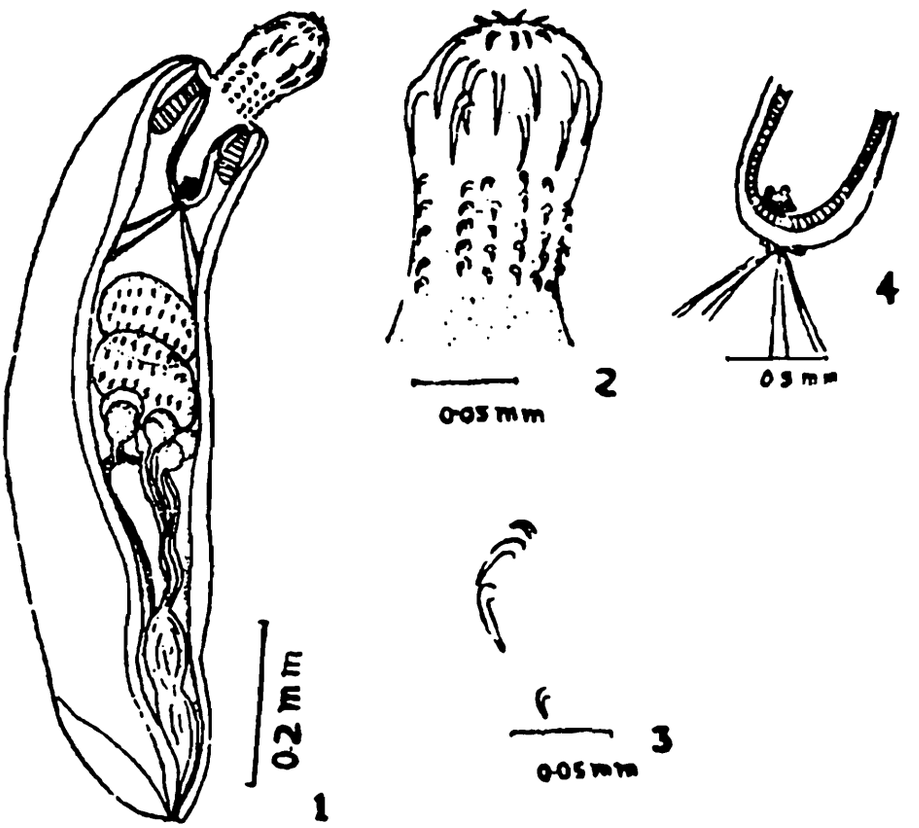


Fig. 39. *Arhythmacanthus thapari* Gupta & Fatima (1979) Amin, 1985. 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged, 4. Posterior end of proboscis receptacle (after Gupta, V & Fatima, 1979).

Cement ducts from each pair open into bursa on one side of Saefftogen's pouch. Seminal vesicle elongated 0.065-0.07 × 0.03-0.04 mm Saefftigen's pouch pyriform, 0.16-0.18 × 0.06-0.08 mm. Bursa muscular with rays, 0.22-0.28 × 0.06-0.08 mm opening outside through terminal pore.

Host : *Elops saurus* (Linnaeus).

Location : Intestine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

41. ***Arhythmacanthus zdzitowieckii*** Kumar, 1992
(Fig. 40)

Arhythmacanthus zdzitewicekii Kumar, 1992b: 143-144, Fig. 1 A-D; Bhattacharya, 2007: 108.

Type locality : Chilka Lake, Oriss, India.

Description : Male 1.49-3.33 × 0.36-0.80 mm, female 3.27-3.97 × 0.95-1.15 mm. Proboscis ovoidal, 0.12-0.25 × 0.07-0.18 mm in male; in female 0.24-0.29 × 0.15-0.19 mm, with 3 types of hooks, apical, subapical and basal. Apical hooks rootless, in radial row

of 12 hooks, 0.015-0.042 mm long in male, in female 0.032-0.049 mm long; subapical hooks large with root, in 14 longitudinal rows of 2 hooks each, 0.025-0.06 mm long in male, in female 0.039-0.078 mm long; basal hooks, rootless in 14 longitudinal rows of 3 or 4 hooks each, 0.011-0.02 mm long in male, in female 0.019-0.029 mm long. Neck very short. Proboscis receptacle claviform, double-walled with ganglion at its base, 0.24-0.40 × 0.10-0.18 mm in male, in female 0.48-0.63 × 0.20-0.27 mm. Trunk small, fusiform, spinose anteriorly, attenuated posteriorly. Trunk spines minute, closely set, anteriorly directed, 0.009-0.01 mm long in male, in female 0.01-0.012 mm. Hypodermal nuclei small, numerous. Lemnisci two, unequal, uninucleate, longer than receptacle, smaller lemniscus 0.28-0.40 mm and larger 0.35-0.58 mm long in male; in female smaller lemniscus 0.36-0.65 mm long, larger 0.50-0.75 mm long. Testes 2, oval or elongate,

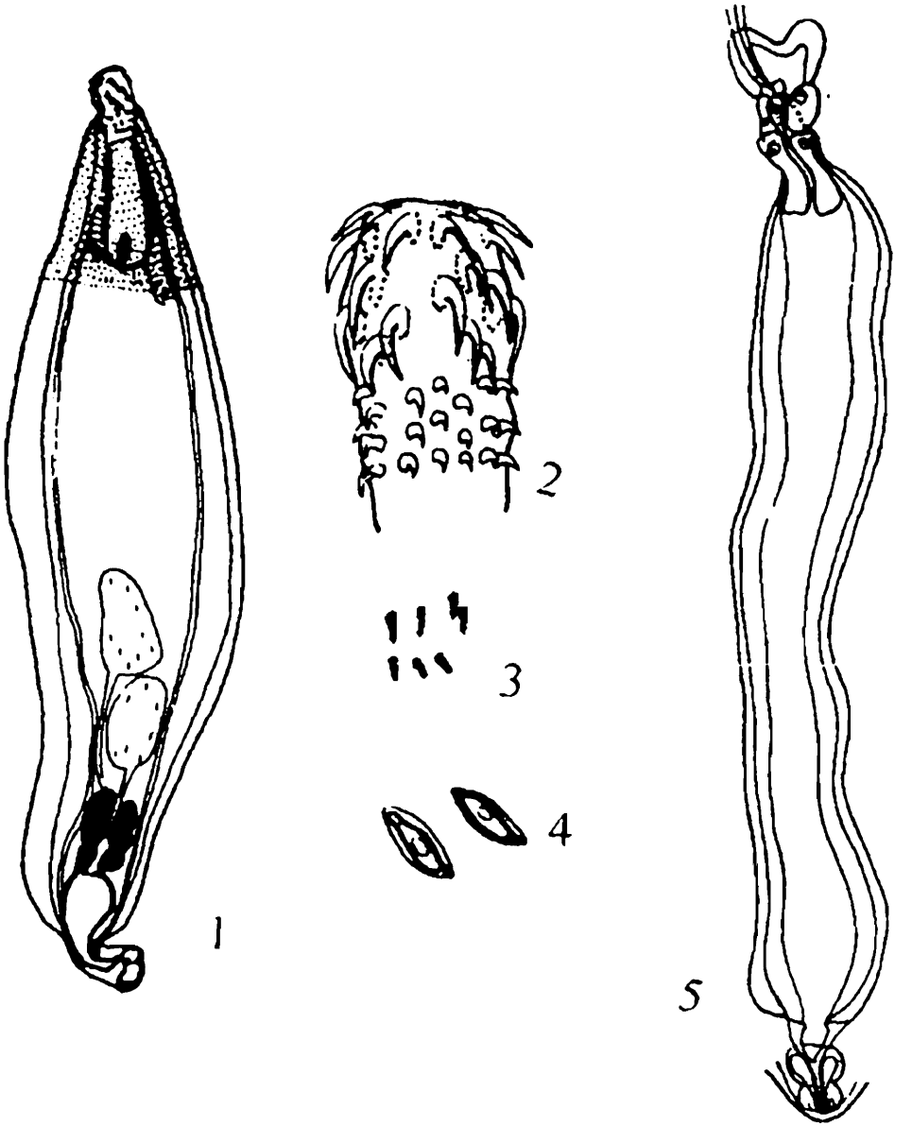


Fig. 40. *Arhythmacanthus zdritowiekii* (Kumar, 1992). 1. Male ventral view, 2. Proboscis of enlarged, 3. Trunk spines of enlarged, 4. Eggs enlarged, 5. Female genitalia, ventral view enlarged (after Kumar, 1992).

umequal, in tandem, contiguous or separate, post-equatorial or in midtrunk, anterior testis smaller, 0.16-0.40 × 0.13-0,21 mm, posterior 0.17-0.33 × 0.14-0.18 mm, Cement glands 6, pyriform, in 2 pairs of 3 each. Saefftigen's pouch spindle-shaped, 0.23-0.35 × 0.07-0.18 mm. Seminal vesicle club-shaped, 0.08-0.10 × 0.049-0.05 mm. Bursa globular, 0.06-0.19 × 0.07-0.08 mm. Uterine bell 0.18-0.20 × 0.08-0.09 mm, guarded by selective cells. Uterus tubular, 0.96-0.98 × 0.15-0.19 mm. Vagina 0.08-0.10 × 0.01-0.11 mm, guarded by two muscles sphincters. Vaginal glands 4, lying at bases of genital pore. Eggs 0.050-0.052 ×,0.019-0.021 mm with polar prolongations of middle shell.

Host : *Clarius batracus* (Linnaeus).

Location : Small intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality.

10. Genus ***Gorgorhynchoides*** Cable & Linderoth, 1963

Gorgorhynchoides Cable & Linderoth, 1963 : 706-716; Bhattacharya, 2007 : 108-110.

Diagnosis : Arhythmacanthidae, Arhythmacanthinae. Proboscis clavate with anterior hooks arranged quincunxically in more than 20 longitudinal rows of at least 10 hooks each. First 3 or 4 hooks of each row large, blade-like, followed by an abrupt reduction of size of hooks after which gradually increase in length to about middle of proboscis and then decrease. Blade-like hooks with prominent roots, hooks stouter on ventral than on dorsal surface of proboscis. Neck well developed. Trunk with narrow, cylindrical or slightly tapering, anterior part armed with numerous spines, followed by a swelling which may or may not encompass trunk, or with spines; swelling most conspicuous dorsally. Lemnisci with many nuclei, slender, sinuous, much longer than proboscis receptacle. Ligament sacs open; uterus long. Vagina short. Eggs smooth, oval to widely spindle-shaped, without polar prolongations of middle shell membrane. Testes not contiguous, oval or bean-shaped, well apart. Cement glands 6, tubular, forming a slender bundle in which some glands reach posterior testis. Bursa with rays and numerous papillae. Parasites of marine fishes particularly of the family Carangidae.

Type species : *Gorgorhynchoides elongatus* Cable & Linderoth, 1963.

This genus includes eight species, *Gorgorhynchoides cablei* (Gupta, V. Fatma 1987) Bhattacharya, 2007, 2. *G. golvani* (Chandra, Rao & Shyamasundarim 1984) Bhattacharya, 2006, 3. *G. indicus* Bhattacharya & Banerjee, 2003, 4. *G. valiathurae* (Nadakal, John & Jacob, 1990) Bhattacharya, 2005, %. G. bullocki & Manfarchisti, 1979, 6. *G. elongates* Cable & Linderoth, 1963, 7. *G. epinephali* Wang, 1986, 8. *G. lintoi* Cable & Manfrachisti, 1979, of which first four occur in this subcontinent.

Key to Indian species of genus *Gorgorhynchoides*

1. Proboscis divided into anterior bulbus and posterior narrow parts, former with 18-22 rows of 10-12 hooks and latter with 14-16 longitudinal rows of 2-24 hooks each ... . *Gorgorhynchoides valiyathurai*

– Proboscis not divided as above 2

2. Proboscis with 12-14 spiral rows of 5-7 hooks each ..... *Gorgorhynchoides golvani*

– Proboscis with more than 14 longitudinal rows of hooks 3

3. Cement glands 2, proboscis with 24-26 longitudinal rows of 14-15 hooks each .... *Gorgorhynchoides cablei*

– Cement glands 6, proboscis with 24-28 longitudinal rows of 10-16 hooks each .... *Gorgorhynchoides indicus*

42. ***Gorgorhynchoides cablei*** (Gupta, V. & Fatma, 1987) Bhattacharya, 2007 (Fig. 41)

Neogorgorhynchoides cablei Gupta, V. & Fatma, 1987 : 17-20, Pl. 6, Fig 1-3; Gupta, V. & Sinha, 1990b : 50; Golvan, 1994 : 166.

Gorgorhynchoides cablei (Gupta, V. & Fatma, 1987) Bhattacharya, 2007: 110-111, Pl. 20, Fig. 105 a-c.

Type locality : Mandapam, Tamil Nadu, India.

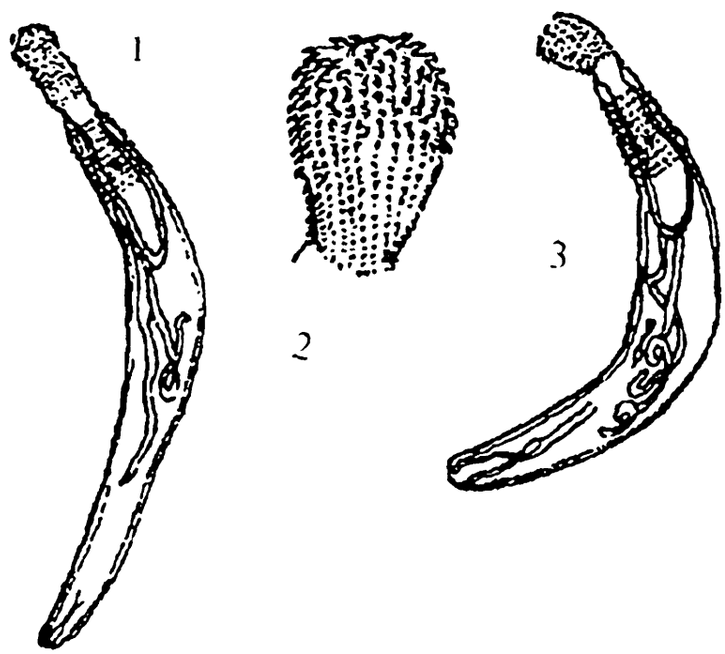


Fig. 41. *Gorgorhynchoides cablei* (Gupta, V & Fatma, 1987) Bhattacharya, 2007. 1. Juvenile female, 2. Proboscis enlarged, 3. Juvenile male (after Bhattacharya, 2007).

Description : Male 6.96-7.42 × 0.56-0.86 mm, female 7.25-7.80 × 0.44-0.78 mm. Proboscis subglobular or claviform, in males 0.95-1.02 x 0.55-0.58 mm, in females 1.0-1.5 × 0.42-0.45 mm, with 24-26 longitudinal rows of 14-18 hooks each of variable size, anterior globular part with recurved roots, with abrupt reduction in size of hooks, after which they gradually increase in length about middle level, then decrease towards base. Hooks of first, second, third and fourth types 0.072-0.080 mm, 0.035-0.040 mm, 0.046-0.05 mm and 0.020-0.28 mm long in male; in female proboscis same hooks 0.082-0.085 mm, 0.040-0.042 mm, 0.050-0.058 mm and 0.025-0.035 mm long. Neck well developed 0.30-0.38 × 0.30-0.35 mm in males, in females 0.32-0.40 × 0.40-0.42 mm. Proboscis receptacle double-walled with ganglion at its middle, in males 2.10-2.15 × 0.40-0.48 mm, in females 1.8-2.0 x 0.40-0.42 mm. Trunk slender, spinose, curved ventrally, tapering to both ends, armed with 13-14 rows of close set spines, 0.035-0.04 mm long, extending up to 0.90-1.2 mm long, anterior to dorsal swelling. Lemnisci long, slender, coiled, much longer than receptacle, subequal extending up to ¾ of trunk length with many nuclei, shorter lemniscus 4.4-4.5 × 0.10-0.12 mm, longer lemniscus 4.7-5.3 × 0.12-0.13 mm in male; in female shorter lemniscus 4.8-4.9 x 0.12-0.15 mm, longer 5.0-5.2 × 0.12-0.13 mm. Testes ovoid , slightly elliptical, in tandem, post-equatorial, anterior 0.15-0.16 × 0.13-0.135 mm, posterior 0.15-0.155 × 0.12-0.13 mm. Cement glands 2, long, tubular, 1.6-1.85 mm long, opening into bursa. Seminal vesicle elongated 0.32-0.45 × 0.22-0.35 mm. Bursa globular, muscular 0.75-0.76 × 0.22-0.26 mm. Uterine bell cylindrical 0.20-0.25 × 0.11-0.15 mm. Vagina 0.26-0.28 × 0.14-0.16 mm. Eggs 0.030-0.042 × 0.12-0.15 mm. Gonopore terminal in male, subterminal in female.

Host : *Caranx kalla* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

43. ***Gorgorhybchoided golvani*** (Chandra, Rao & Shyamasundari, 1984) Bhattacharya, 2007
(Fig. 42)

Paracanthocephaloides golvani Chandra, Rao & Shyamasundari, 1984 : 347-352, Fig. 13; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994: 170.

Gorgorhybchoided golvani (Chandra, Rao & Shyamasundari, 1984) Bhattacharya, 2007 : 111-112, Pl. 18-19, Fig. 102 a-c.

Type locality : Visakapatnam coast, Bay of Bengal, India.

Description : Males 5.26-5.58 × 0.66-0.73 mm. Proboscis medium sized, claviform 0.84-0.97 × 0.38-0.54 mm. Hooks of two types, anterior hooks larger, arranged in12-14 spiral rows of 5-7 hooks each, 0.06-0.11 mm long. Hooks of posterior region thin and spiniform, in 10-12 spiral rows of 12-14 hooks each, 0.03-0.04 mm long, gradually

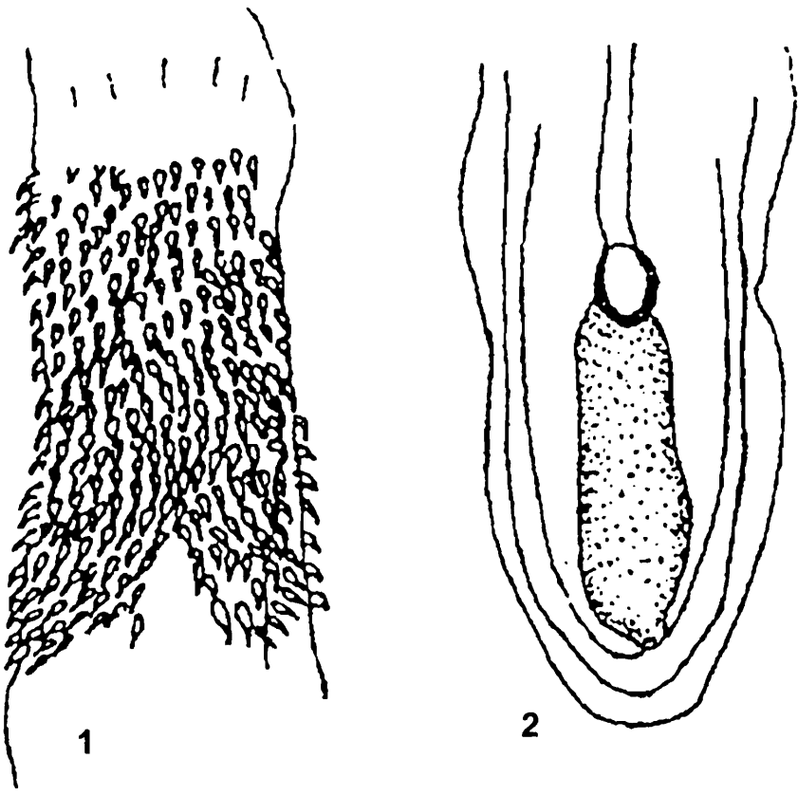


Fig. 42. *Gorgorhynchoides golvani* (Chandra, Rao & Shyamsundari, 1984) Bhattacharya, 2007. 1. Juvenile male, 2. Proboscis enlarged, 3. Proboscis hooks, 4. Trunk spines, 5. Posterior part of female (after Bhattacharya, 2007).

decreasing posteriorly. Neck short, naked, 0.18-0.28 mm long. Proboscis receptacle double-walled, cylindrical, 2.04-2.26 × 0.26-0.42 mm, with ganglion at its middle. Trunk medium sized, ventrally curved, maximum width at middle and norrowing towards both ends, anteriorly with 24-32 longitudinal rows of 18-22 spines each, spines gradually increase in size posteriorly. Lemnisci unequal, longer than receptacle, coiled. Testes ovoid, one behind other, anterior smaller, 0.09-0.14 × 0.07-0.11 mm. Vasa efferens thick, straight unite into vas deferens near base of bursa. Cement glands not observed. Bursa 0.43 × 0.14 mm. Penis and Saefftigen's pouch underdeveloped. Uterine bell 0.09-0.13 mm long. Uterus 1.34-1.60 mm long. Vagina muscular tube 0.07-0.11 × 0.03-0.06 mm. Gonopore terminal. Male not known.

Host : *Saurida tumbil* (Bloch), *S. undosquamis* (Richardson), *Trichocephalus myops* (Bloch & Schnider), *Harpodon nehereus* (Hamilton-Buchanon), *Kathala axillaris* (Cuvier); *Upeneus vittatus* Lecepede, *Johnius areus* Bloch., *Pterolithus maculatus* (Cuvier), *Pannabia argentata* (Houttuyn).

Location : Intestine, wall of stomach and intestine.

Locality : Visakhapatnam coast, Bay of Bengal (Andhra Pradesh).

Distribution : Known only from type locality.

44. ***Gorgorhynchoides indicus*** Bhattacharya & Banerjee, 2003 (Fig. 43)

Gorgorhynchoides indicus Bhattacharya & Banerjee, 2003 : 49-54, Bhattacharya, 2007 : 112, Pl. 19, Fig. 103 a-h.

Type locality : Chennai, Tamil Nadu, India.

Description : Male 17.00-60.75 × 1.0-1.5 mm. Proboscis 0.5-0.92 × 0.3-0.4 mm, with24-26 longitudinal rows of 10-16 hooks each, anterior 3-4 hooks large, blade-like, followed by few small hooks near mid-proboscis and then increase in size but decrease in size near base. Ventral hooks a little stouter than dorsal hooks. 1st hook of each row 0.090-0.091 × 0.0415; 2nd 0.099-0.124 × 0.024, 3rd 0.083-0.117 × 0.0415, 4th 0.0830.091 × 0.0415, 5th 0.033-0.091 × 0.016, 6th 0.041-0.057 × mm long. Basal hooks 0.033 mm long, roots 0.073-0.124 × 0.0249 mm. Proboscis receptacle 1.5-2.5 × 0.35-0.40 mm, with central ganglion. Trunk swelling anterior, trunk spines 24-30 longitudinal rows dorsally and 20-

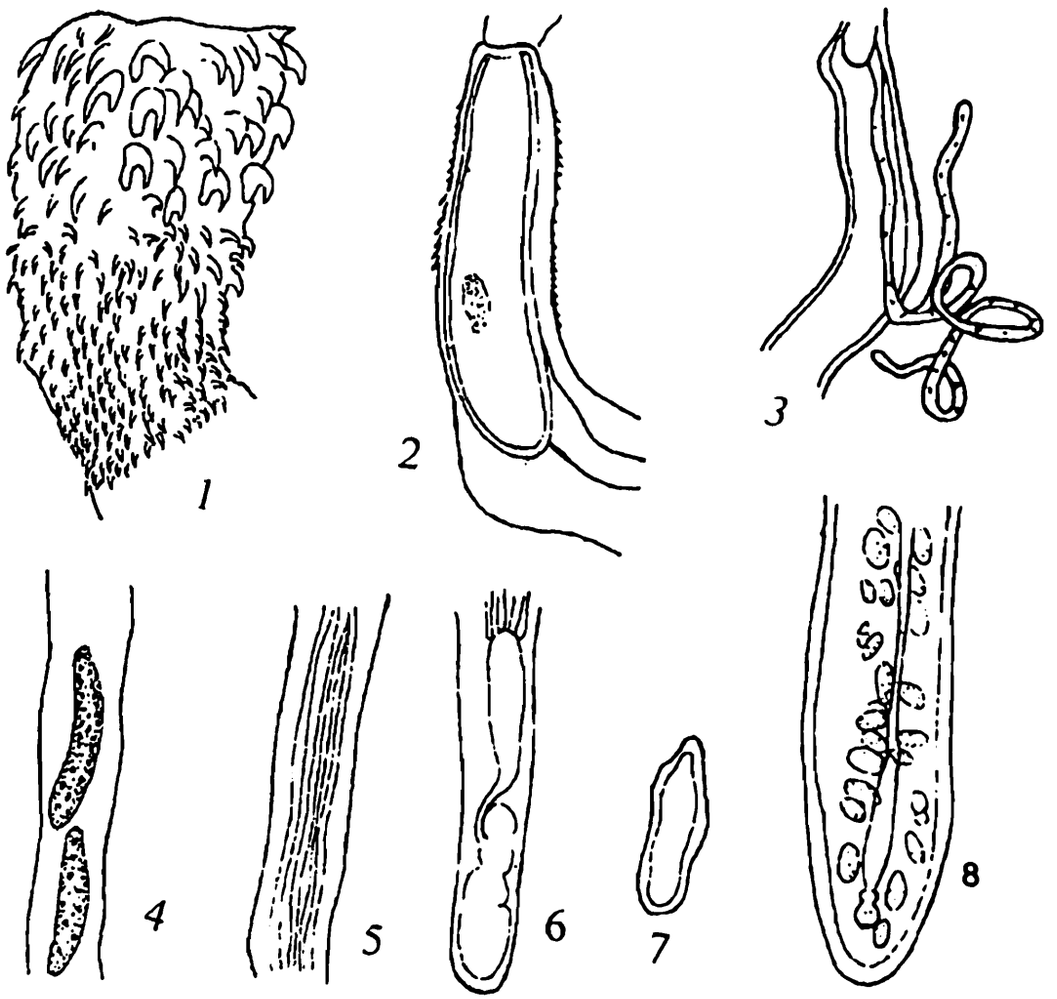


Fig. 43. *Gorgorhynchoides indicus* (Bhattacharya & Banerjee, 2003) 1. Proboscis enlarged, 2. Anterior trunk with bulge, 3. Nucleated and coiled lemnisci, 4. Testis, 5. Elongated cement gland, 6. Posterior end of female, 7. Ovum, 8. Posterior par of female (after Bhattacharya, 2007).

25 rows ventrally, not reaching the swelling. Lemnisci very long, slender, multinucleated, sinuous. Cement glands 6, long, tubular. Testes elliptical, anterior testis 0.85-1.625 × 0.275-0.4 mm, posterior testis 0.825-1.75 × 0.3-0.35 mm. Mature females with pseudosementation, gonopore subterminal, 0.06 mm from posterior end. Eggs 0.04-0.064 mm long without polar prolongations of middle shell.

Host : *Megalaspis cordyla, Psettodes erunei, Lutianus fulbiflama, Polymerurus tetradactylus, Triacanthus trigitifer, Gerres abreviatus, Therpon jarbua, Plectorhynchus cuveri*

Location : Intestine.

Locality : Chennai (Tamil Nadu).

Distribution : Known only from type locality in this subcontinent.

45. ***Gorgorhynchoides valiyathurae*** (Nadakal, John & Jacob, 1990) Bhattacharya, 2007 (Fig. 44)

Metarhadinorhynchus valiyathurae Nadakal, John & Jacob, 1990: 377-382, Fig. 1-7; Golva,

Gorgorhynchoides valiyathurai (Nadakal, John & Jacob, 1990) Bhattacharya, 2007: 112-114, Pl. 19, Fig. 104 a-f.

Type locality : Velayathura near Trivandrm, Kerala, India.

Description : Male 78-112 × 1.56-1.75 mm; female 81-138 × 1.56-1.75 mm. Proboscis short, club-shaped with a prominent swelling at tip, 1.01-1.06 × 0.29-0.36 mm but at middle of bulbous part 0.48-0.54 mm wide. Bulbous part of proboscis with 18-22 longitudinal rows of 10-12 large, rooted hooks each, of 0.075-0.083 mm long. Hooks on straight part of proboscis 14-16 rows of 22-24 rootless hooks each, decreasing posteriorly in size, largest 0.05 mm long, smallest 0.03 mm long. Proboscis receptacle saccular, double-walled and swollen posteriorly, with large central ganglion, 3.1-0.93 mm long, 0.39-0.46 mm wide in male. Hypodermal nuclei numerous and scattered beyond collar. Trunk slender, elongate, cylindrical, with characteristic collar-like swelling anteriorly. Anterior trunk spination extends up to base of collar like swelling, ventrally and laterally with 20-22 complete longitudinal rows of 44-48 spines each and 12-14 incomplete longitudinal rows of 30-34 spines each medially. Trunk spines 0.03-0.05 × 0.02-0.03 mm. Spines larger, scattered, wide apart anteriorly and become smaller and crowded posteriorly. Mid-dorsal region of anterior trunk aspinose. Lemnisci 2, slender, long, extending almost to middle of trunk. Testes in tandem, elongate, cylindrical, anterior 3.12-3.62 × 0.84-0.94 mm; posterior 3.0-3.5 × 0.85-0.96 mm. Vas deferens 0.2 mm wide. Cement glands 6, equal, elongate, tubular, enclosed in a sheath forming a compact mass, 0.64-0.68 × 0.36-0.41 mm, they open posteriorly into cement reservoir 2.89-2.97 × 0.68-0.83 mm. Seminal vesicle globular1.12-1.43 × 0.46-0.64 mm Copulatory bursa bulbous, supported by fan-like bursal rays with retractor muscles, 1.31-1.44 × 1.15-1.24 mm. Gonopore

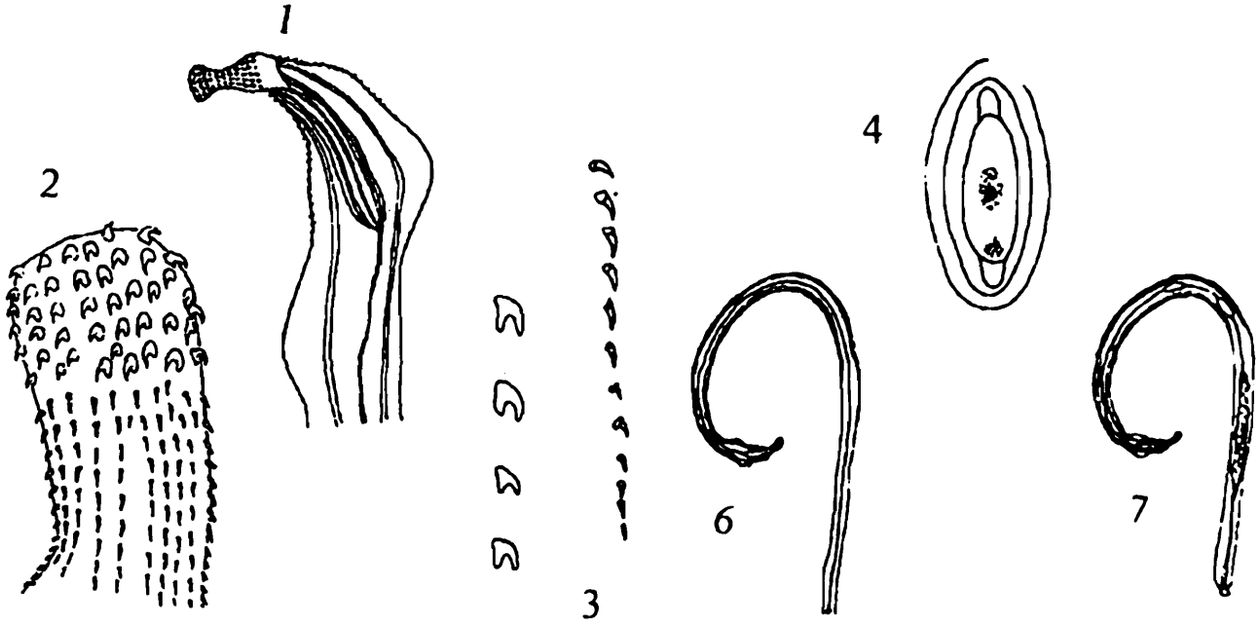


Fig. 44. *Gorgorhynchoides vailyathurai* (Nadakal, John & Jacob, 1990) Bhattacharya, 2007. 1. Anterior part of female, 2. Proboscis enlarged, 3. Proboscis hooks and trunk spines, 5. Eggs enlarged, 5. Male, 6. Female (1-4, 7-8 after Nadakal, John and Jacob, 6 Bhattacharya, 2007).

terminal. Uterine bell long, tubular, post-equatorial. Vagina divided into two parts. Vulva terminal Ovarian balls and embryonated eggs float in trunk pseudocoel. Ovarian balls, 0.11-0.15 mm wide. Eggs 0.090-0.104 × 0.029-0.035 mm, with three membranes, with polar prolongation of middle membrane. Embryo 0.064-0.078 × 0.016-0.02 mm. Uterus, vagina and vestibule packed with mature eggs. Vestibule opens out by terminal gonopore.

Host : *Caranx melanopygus* (Cuvier & Valenciennes); *C. malabaricus* (Cuvier & Valenciennes); *C. nigripinnis* (Russel).

Location : Duodenum.

Locality : Valiyathura, Trivandrum (Kerala).

Distribution : Known only from type locality.

Subfamily PARACANTHOCEPHALOIDINAE Golvan, 1969

Paracanthocephaloidinae Golvan, 1969 : 178; Amin, 1985 : 39; Bhattacharya, 2007 : 103.

Diagnosis : Arhythmacanthidae. Proboscis cylindrical or claviform, with two types of hooks. Apical hooks with well developed roots and basal hooks with poorly developed roots. Proboscis receptacle double-walled with ganglion at base or middle. Trunk fusiform with posterior end dilated, partly cylindrical. Hypodermal nuclei numerous. Cement glands six. Eggs with polar prolongations of middle shell.

Type genus : *Paracanthocephaloides* Golvan, 1969.

Includes three genera, 1. *Euzetacanthus* Golvan & Houin, 1964, 2. *Paracanthocephaloides* Golvan, 1969 and 3. *Breizacanthus* Golvan, 1969, of which first two genera occur in the subcontinent.

Key to Indian genera of subfamily PARACANTHOCEPHALOIDINAE

- Neck absent; trunk cylindrical, bulbous about the middle ..... *Euzetacanthus*
- Neck present; trunk fusiform, narrowing to both ends .....*Paracanthocephaloides*

11. Genus ***Euzetacanthus*** Golvan & Houin, 1964

Euzetacanthus Golvan & Houin, 1964 : 67; Golvan, 1969 : 182-183; 1994 : 157; Bhattacharya, 2007 : 103.

Diagnosis : Arhythmacanthidae, Paracanthocephaloidinae. Body slender elongated. Proboscis cylindrical. Proboscis receptacle double-walled, inserted at base of proboscis, with ganglion at its base. Trunk cylindrical bulbous about its middle. Hypodermal nuclei numerous fragments of nuclei. Lacunar system with lateral longitudinal channels and reticular anastomoses. Lemnisci longer than receptacle. Testes two in tandem. Cement glands 6, disposed in pairs. Male gonopore terminal. Uterus tubular. Vagina with two sphincters. Vulva subterminal. Eggs ellipsoid with polar prolongations in middle shell.

Type species : *Euzetacanthus simplex* (Rudolphi, 1810) Golvan & Houin, 1964.

Includes three species, 1. *Euzetacanthus chorinemusi* Gupta, S. P. & Naqvi, 1986, 2. *E. golvani* Gupta, V. & Fatima, 1968 and 3. *E. simplex* (Rudolphi, 1810) Golvan & Houin, 1964, of which first two species occur in India.

Key to Indian species of genus *Euzetacanthus*

- Trunk bulged subapically, proboscis hooks larger, 0.039-0.058 in male, 0.030-0.048 mm in female ..... *Euzetacanthus chorinemusi*
- Trunk not bulged subapically, proboscis hooks small, 0.021-0.03 mm in both sexes ..... *Euzetacanthus golvani*

46. ***Euzetacanthus chorinemusi*** Gupta, S.P. & Naqvi, 1984
(Fig. 45)

Euzetacanthus chorinemusi Gupta, S.P. & Naqvi, 1984a: 67-69, Pl. 3, Fig. 1-4; Gupta, V. & Sinha, 1990b : 51; Golvan, 1994 : 137; Bhattacharya, 2007 : 105.

Type locality : Ernakulam, Kerala, India.

Description : Male 6.94 × 0.32 mm, female 6.99-7.10 × 0.36-0.52 mm. Proboscis elongated, cylindrical 0.50 × 0.13 mm in male with 14 longitudinal rows of 8 hooks each; in female 0.41 × 0.15 mm with 14 longitudinal rows of 9 hooks each, similar in shape but differ in size. First six hooks of each row large, with well developed long roots directed

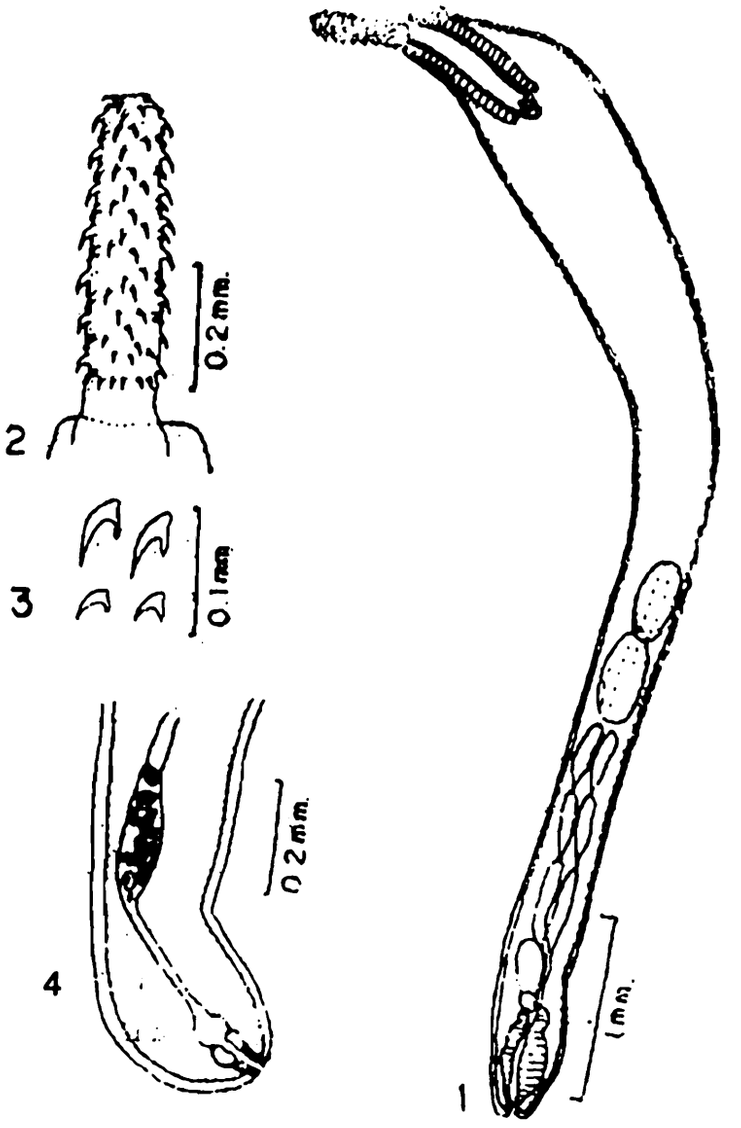


Fig. 45. *Euzetacanthus chorinemusi* (Gupta, S.P. & Naqvi, 1986). 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged. 4. Posterior part of female (after Gupta, S.P. & Naqvi, 1984).

towards base of proboscis, rest 2 or 3 hooks of each row small with less developed roots. Ventral hooks slightly larger than dorsal hooks. First six ventral hooks 0.055-0.058 mm long, last two hooks 0.039-0.041 mm long in male; in female first 6 hooks of dorsal surface 0.044-0.048 mm long and last 3 hooks 0.036-0.039 mm long. Neck absent. Proboscis receptacle elongated, claviform, double-walled, extending up to anterior part of receptacle; 0.52-0.62 × 0.10-0.13 mm in female. Trunk elongated, slender, spinose, widest subapically and tapering at both ends, 6.44 × 0.18 mm in male, in female 6.58-6.61 × 0.36-0.52 mm. Lemnisci elongated, claviform, equal, and shorter than receptacle, 0.76 mm long in male, in female 0.44-0.58 mm long. Testes oval, in tandem, subequal, slightly overlapping, lying in posterior half of trunk, anterior 0.44 × 0.20 mm, posterior testis 0.48 × 0.21 mm. Cement glands 6, pyriform, lying one behind other in two rows, 0.29-0.45 × 0.06-0.08 mm. Saefftigen's pouch pyriform, 0.37 × 0.22 mm, opening into bursa by a narrow tubular duct. Seminal vesicle pyriform, 0 0.09 mm. Bursa elongated, muscular

without rays, 0.57 × 0.22 mm. Uterine bell 0.30-0.34 × 0.05-0.07 mm, uterus duct, 0.21-0.0.24 × 0.02 mm. Uterus 0.13-0.17 × 0.05-0.06 mm, with two kidney-shaped cells. Vagina with two sphincters. Ovarian balls 0.02-0.04 × 0.02-0.03 mm. Eggs not observed. Gonopore terminal in male and subterminal in female.

Host : *Chorinemus moadetta* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Ernakulam (Kerala).

Distribution : Known only from type locality.

47. ***Euzetacanthus golvani*** Gupta, V. & Fatma, 1986
(Fig. 46)

Euzetacanthus golvani Gupta, V. & Fatma, 1986: 140-180, Golvan, 1994 : 137; Bhattacharya, 2007 : 105, Pl. 18, Fig. 99 a-c.

Type locality : Mandapam, Tamil Nadu, India.

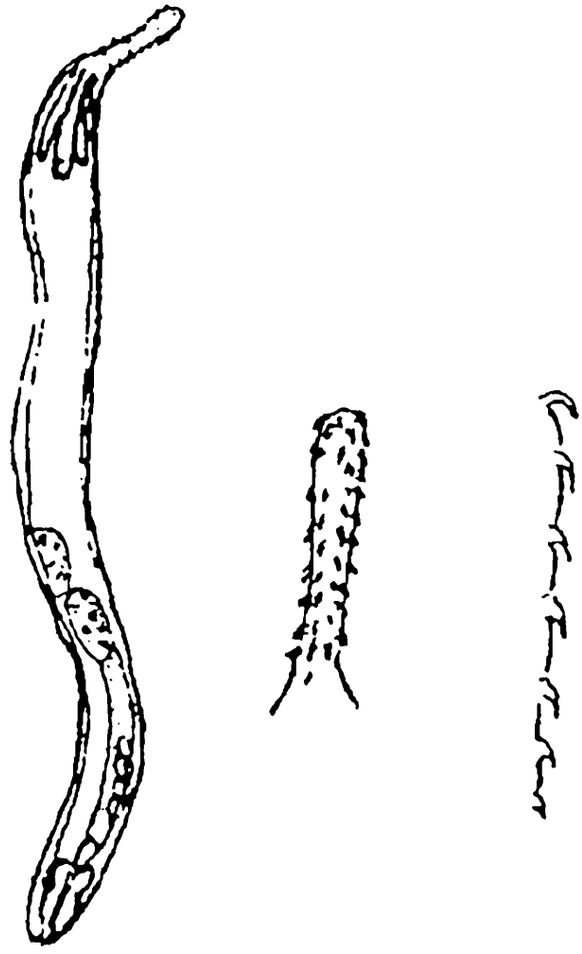


Fig. 46. *Euzetacanthus golvani* (Gupta, V. Fatma, 1985). Male 1. lateral view, 2. Proboscis hook and trunk, spine enlarged, 3. Proboscis hooks enlarged, 4. Posterior part of Female (after Gupta, V. & Fatma, 1985).

Description : Males cylindrical, with swollen anterior trunk, 6.42 × 0.45 mm. Proboscis cylindrical, 0.50 × 0.10 mm, with14 longitudinal rows of 8 hooks each, Hooks in 1st row 0.03, in 2nd row 0.029, 3rd row0.028, 4th row 0.025, 5th row 0.025, 6th row 0.024, 7th ow 0.022, 8th row 0.021 mm long. Proboscis receptacle double-walled, 0.90 × 0.15 mm with basal ganglion. Trunk cylindrical Lemnisci shorter than proboscis receptacle. Testes oval, in tandem, post-equatorial. Cement glands 6 pyriform, 3 in tandem in pairs. Gonopore terminal.

Host : *Tachysurus jella.*

Location : Inteatine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

12. Genus ***Paracanthocephaloides*** Golvan, 1969

Paracanthocephaloides Golvan, 1969 : 179; 1994: 170; Bhattacharya, 2007 : 103.

Diagnosis : Arhythmacanthidae, Paracanthocephaloidinae. Proboscis armed with longitudinal rows of two types of hooks, larger anteriorly and smaller posteriorly. Proboscis receptacle double-walled, with ganglion at its base. Neck short aspinose. Trunk fusiform narrowing towards both end, spinose. Lemnisci longer than receptacle. Testes ovoid in midtrunk. Cement glands 6, pyriform. Eggs with polar prolongations of middle shell.

Type species : *Paracanthocephaloides chabanaudi* (Dollfus 1951) Golvan, 1969.

Includes three species, 1. *Paracanthocephaloides cabelleroi* (Gupta, V. & Fatma, 1983) Bhattacharya, 2007. 2. *P. golvani* Chandra, Rao & Shyamasundari, 1984, 3. *P. tripathi* Golvan, 1969 and 4. *P. chabanaudi* (Doll, 1951) Golvan, 1969, of which first two species occur in Indian subcontinent.

Key to Indian species of genus *Paracanthocephaloides*

Anterior proboscis with 12-14 spiral rows of 5-7 hooks each, posterior proboscis with 10-12 spiral rows of 12-14 hooks each ..... *Paracanthocephalus golvani*

Anterior proboscis with 6 spiral rows of 5 hooks each, posterior proboscis with 14 longitudinal rows of 3-4 hooks each ..... *Paracanthocephalus tripathii*

48. ***Paracanthocephaloides cabelleroi*** (Gupta, V. & Fatma, 1983) Bhattacharya, 2007 (Fig. 47)

Heterosentis caballeroi Gupta, V. & Fatma, 1985 : 137-148, Gupta, V. & Sinha, 1990b : 50; Golvan, 1994 : 160.

Paracanthocephaloides cabellereoi Bhattacharya, 2007 : 104, Pl. 18, Fig. 98 a-c.

Type locality : Mandapam, Tamil Nadu, India.

Description : Male 1.14-1.22 × 0.16-0.20 mm. Trunk armed anteriorly, hypodermal nuclei numerous. Proboscis globular, 0.15-0.18 × 0.12-0.15 mm, with 10 rows of 6 hooks each. Two types of hooks, anterior rooted hooks 0.054-0.062 mm, and posterior less developed rooted hooks 0.022-0.026 mm. Proboscis receptacle 0.14-9.22 × 0.02-0.025mm. Lemnisci 0.09-0.18 mm and 0.016-0.02 mm, Testes in midtrunk, anterior 0.12-0.14 × 0.08-0.10 mm, posterior 0.10-0.12 × 0.060-0.085 mm. Cement glands pyriform, six.

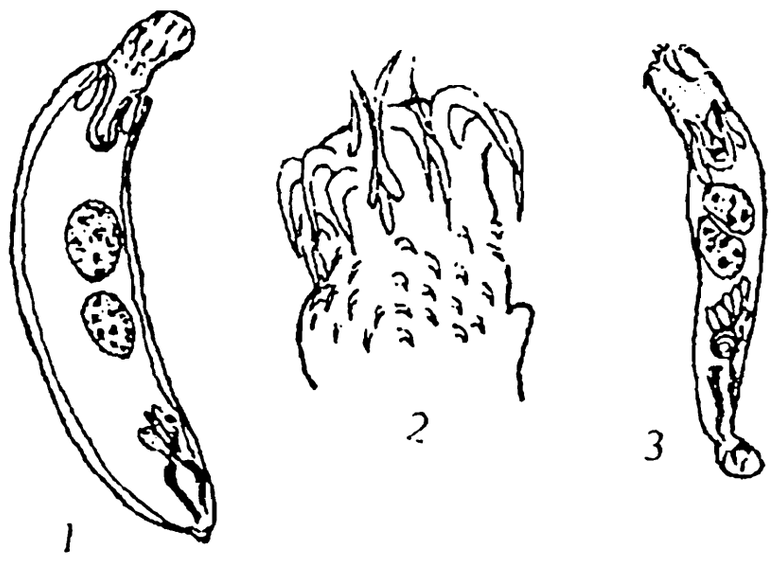


Fig. 47. *Paracanthocephaloides cabelleroi* (Gupta, V. Fatma, 1985), Bhattacharya, 2007. 1. Male, 2. Proboscis enlarged, 3. Female (after Bhattacharya, 2007).

Host : *Polynemus paradaiseus* Linnaeus.

Location : Intestine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

49. ***Paracanthocephaloides tripathii*** Golvan, 1969
(Fig. 48)

Heterosentis plotosi sensu Tripathi, 1959: 77-79, Fig. 9 d;

Paracanthocephaloides tripathii Golvan, 1969: 182-183, Fig. 131;

Heterosentis plotosi Anantaraman, M. & Anantaraman, S., 1970: 4; Ahmed & Rauf, 1981: 118; Ahmed, 1985: 229; Gupta, V. & Sinha, 1990b: 44; Ahmed & Ezaz, 1997: 155; Arthur & Ahmed, 2007-08,

Paracanthocephaloides tripathii Golvan, 1994: 170.

Type locality : Chilka Lake, Orissa, India.

Description : Males 2.39-2.52 × 0.36-0.50 mm; female 5.29 × 0.72 mm. Proboscis short, 0.17-0.29 × 0.11- 0.2 mm, with two kinds of hooks, anterior larger hooks in 6 spiral rows of 5 hooks each, 0.036-0.072 mm long and longer posteriorly, have long slender blade strongly recurved at base and a simple posteriorly attenuated root, of posterior hooks in 14 longitudinal rows of 3-4 hooks each, first hook about 0.018 mm long and rest decrease in size posteriorly, last hooks 0.009 mm long, being paired in each row. Neck unarmed 0.11 mm long. Proboscis receptacle double-walled, 0.38 × 0.12 mm, with ganglion located at its base. Trunk slightly fusiform, 2.18 × 0.57 mm anteriorly with exceedingly

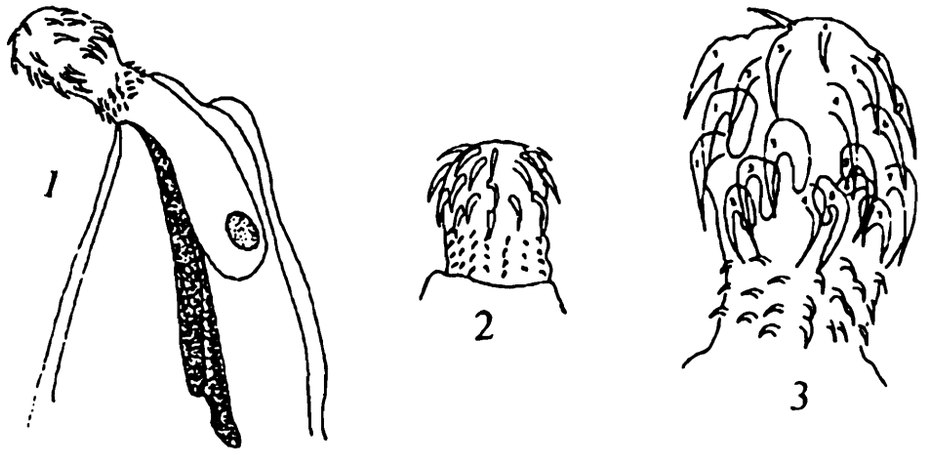


Fig. 48. *Paracanthocephaloides tripathi* (Golvan, 1969). 1. Male, 2. Proboscis, 3. Proboscis enlarged (after Bhattacharya, 2005).

fine spines not ensheathed in cuticular folds. Hypodermal giant nuclei 4 in transverse row. Lemnisci 2, elongate, about 0.4 mm long. Testes ovoid, 0.37-0.40 × 0.33-0.35 mm, directly in tandem at midtrunk. Vasa efferentia very wide, not twisted. Cement glands 6, pyriform just behind posterior testis. Seminal vesicle oval, 0.11 mm wide, lies at posterior end of cement glands. Proximal end of ejaculatory duct forms sphincter-like bulb, 0.054 mm wide. Saefftigen's pouch elongate, about 0.45 mm long. Bursal cap muscular with two anterior saccular diverticula and small digitiform rays. Bursa globular, 0.088 mm wide, with muscular wall 0.012 mm thick. Gonopore terminal.

Host : *Plotosus canius* Hamilton-Buchanan, *P. anguilliaris* Linnaeus.

Location : Small intestine.

Locality : Chilka lake (Orissa); Malta river (West Bengal); Barisal (Bangladesh).

Distribution : Known only from Indian subcontinent.

6. Family CAVISOMIDAE Meyer, 1932

Cavisominae Meyer, 1932 : 161;

Cavisomatidae Petrotschenko, 1956 : 329;

Cavisomatinae Yamaguti, 1963 : 50; Bhattacharya, 2007 : 141

Diagnosis : Echinorhynchida. Proboscis claviform to elongate, slender. Testes middle to posterior region of trunk. Cement glands 4, elongated, tubular or filiform. Neck neither elongate nor bulbous. Parasites of fishes.

Type genus : *Cavisoma* Van Cleave, 1931.

Includes ten genera, 1. *Cavisoma* Van Cleave, 1931, 2. *Filisoma* Van Cleave, 1928, 3. *Pseudocavisoma* Golvan & Houin, 1964, 4. *Neorhadinorhynchus* Yamaguti, 1939, 5. *Echinorhynchoides* Achmerov & Dombrowskaja-Achmerova, 1941, 6. *Rhadinorhynchoides* Fukui & Morisita, 1937, 7. *Femogibbosus* Paruchin,1973, 8. *Cabellerorhynchus* Salgado-Maldonado, 1977, 9. *Megapriapus* Golvan, Garcia-Rodrigo & Diaz-Ungria, 1964, and 10. *Paracavisomsa* Kritcsher, 1957 of which first three genera occur in this subcontinent.

Key to Indian genera of family CAVISOMAIDAE

1. Proboscis with 10-13 longitudinal rows of 9-10 hooks each ..... *Cavisoma*
– Proboscis with more than 13 longitudinal rows of hooks 2
2. Cerebral ganglion at base ..... *Filisoma*
– Cerebral ganglion at base 3
3. Proboscis with 14-15 longitudinal rows of 5-8 hooks each ..... *Peudocavisoma*
– Proboscis with 14-18 longitudinal rows of 17-25 hooks each .. *Neorhadinorhynchus*

13. Genus ***Cavisoma*** Van Cleave, 1931

Cavisoma Van Cleave, 1931c : 348-362 ; Meyer, 1932 : 161; Petrotschenko, 1956 : 330; Yamaguti, 1963 : 51; Golvan & Houin, 1964 : 571; Golvan, 1969 : 140; Arthur, Regidor & Albert, 1993 : 39-40; Golvan, 1994 : 141.

Diagnosis : Echinorhynchida, Cavisomidae. Proboscis short, clavate, armed with longitudinal rows of hooks, posterior hooks slender, rootless, anterior hooks robust, strongly recurved with well developed simple roots. Proboscis receptacle double-walled attached at base of proboscis, its ganglion located near its middle. Trunk medium sized, unarmed, elongate, subcylindrical. Lemnisci digitiform, of varying length, generally about equal to receptacle. Testes 2, in tandem, contiguous. Cement gland 4, tubular. Gonopore terminal in both sexes. Ova fusiform, thin-membraned, with well developed polar prolongations of middle membrane. Parasites of marine fishes.

Type species : *Cavosoma magnum* (Southwell, 1927) Van Cleave, 1931.

Includes single species, *Cavisoma magnum* (Southwell), Van Cleave, 1932, and occurs in Indian subcontinent.

50. ***Cavisoma magnum*** (Southwell, 1927) Van Cleave, 1931 (Fig. 49)

Oligacanthorhynchus magnum Southwell, 1927 : 165-169, Fig. 1-4;

Cavisoma magnum (Southwell), Meyer, 1932 : 161; Petrotschenko, 1956 : 330-331; Yamaguti, 1963 : 51, Pl. 20, Fig. 204-207; Golvan & Houin, 1964 : 571-573, Fig. 19 A-C; Golvan, 1969 : 141, Fig. 102; Arthur, Regider & Albert, 1993 : 40-42; Fig. 1-6; Golvan, 1994 : 141.

Type locality : Unspecified locality off Sri Lanka.

Description : Male 19.42-51.36 × 0.73-1.53 mm, female 10.67-48.93 × 0.54-1.89 mm. Proboscis 0.91-1.05 × 0.33-0.48 mm, with 12-13 rows of 8-10 hooks each in male; in female 0.79-1.08 × 0.32-0.43 mm, armed with 12 rows 8-9 hooks each, basal hooks 0.070-0.090 mm long, largest hook 0.105-0.125 mm long, its root 0.090-0.110 mm long in male. In female basal hooks 0.065-0.095 long, their roots 0.080-0.101 mm long, largest hooks

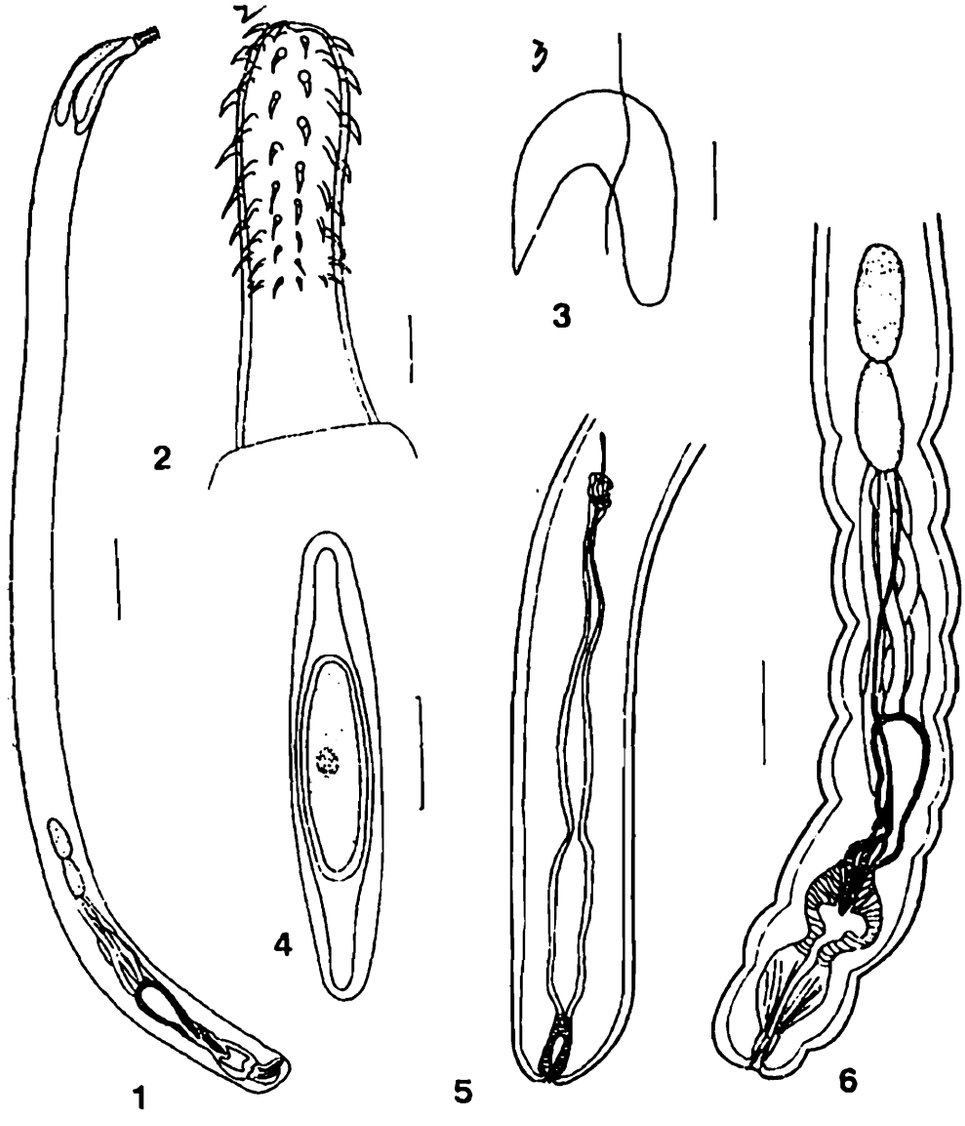


Fig. 49. *Cavisoma magnum* (Southwell, 1927) Van Cleave, 1931. 1. Male lateral view, 2. Proboscis and neck enlarged, 3. Proboscis hook enlarged.

0.105-0.130 mm long, their roots 0.0800.105 mm long. Four basal hooks in each row slender, slightly curved, rootless; 5th to apical hooks more robust, recurved, with well developed simple roots. Hooks increase in size anteriorly from basal hook. Neck short, often retracted, 0.25-0.40 × 0.46-0.50 mm in male; in female 0.39-0.44 × 0.43-0.57 mm. Proboscis receptacle elongate, digitiform, often with constriction at middle, 1.23-3.09 × 0.34-0.52 mm in male; in female 1.57-3.21 × 0.23-0.61 mm. Trunk elongate, subcylindrical. Lemnisci approximately equal in length, extending to distal end of receptacle, 1.46-4.05 × 0.25-0.58 mm in male; in female 1.58-4.14 × 0.13-0.44 mm. Testes 2, elongate to oval, in tandem, anterior 0.70-2.53 × 0.25-2.09 mm, posterior 0.60-1.49 × 0.24-0.94 mm. Vas deferens runs ventrally along cement glands, extends from posterior margin of posterior testis to proximal end of penis, often enlarged at anterior and posterior ends. Seminal vesicle not detected. Cement glands 4, elongate, tubular, 1.52-4.49 × 0.06-0.27 mm extending from near posterior margin of posterior testis to mid level of Saefftigen's pouch before narrowing into cement ducts. Saefftigen's pouch highly muscular, 1.28-2.82 × 0.39-0.98 mm. Eggs fusiform, with well developed polar prolongations of middle membrane, 0.103-0.121 × 0.015-0.020 mm.

Host : *Acanthurus strigosus*, *Serranus* sp.

Location : Stomach, pyloric caeca and intestine.

Locality : Indian ocean unspecified locality off Sri Lanka.

Distribution : North Carolina in North America.

14. Genus ***Filisoma*** Van Cleave, 1928

Filisoma Van Cleave, 1928 : 148; Meyer, 1932 : 60-61; Petrotscchenko, 1956 : 332; Yamaguti, 1963 : 51-52; Golvan & Houin, 1964 : 582; Golvan, 1969 : 141-142; 1994 : 157; Bhattacharya, 2007 : 143.

Diagnosis : Echinorhynchida. Cavisomidae. Proboscis cylindrical, long, slender, arcuate with 16-24 longitudinal rows of 24-25 hooks each, which decrease in size towards anterior and posterior ends. Proboscis receptacle very long, double-walled with ganglion near its base. Trunk very long, slender, cylindrical, aspinose. Lemnisci saccular, nearly as long as or longer than receptacle. Testes elongate, cylindrical, in posterior half of trunk. Cement glands 4, very long and tubular. A pair of lateral cuticular papillae may be present at level of ventral genital pore of female. Eggs with polar prolongations of middle shell. Vulva ventro-terminal. Parasites of fishes.

Type species : *Filisoma indicum* Van Cleave, 1928.

Includes eight species, 1. *Filisoma indicum* Van Cleave, 1928, 2. *F. inglisi* Gupta, S. P. & Naqvi, 1984, 3. *F. scatophagus* Datta & Soota, 1962, 4. *F. bucerium* Van Cleave, 1940, 5. *F. fidum* Van Cleave & Manter, 1947, 6. *F. longicementglandlatus* Amin & Nahhas, 1994, 7. *F. micracanthi* Harada, 1938 and 8. *F. rizainum* Tubangui & Masilungan, 1946, of which first three species occur in Indiam subcontinent.

Key to Indian species of *Filisoma*

- Proboscis hooks in 12-14 longitudinal rows of 23-28 hooks each ..... *Filisoma indicum*
- Proboscis hooks in 14-16 rows with 26-32 hooks each ..... *Filisoma scatophagus*
- Proboscis hooks in 17-18 longitudinal rows of 26 hooks each ..... *Filisoma inglisi*

51. ***Filisoma indicum*** Van Cleave, 1928
(Fig. 50)

Filisoma indicum Van Cleave, 1928 : 148-149, Textfig. 3; Meyer, 1932 : 61, FIG. 39; Petrotschenko, 1956 : 333-334, Fig. 143; Datta & Soota, 1962 : 68-69, Textfig.1;

Filisosma hoogliensis Datta & Soota, 1062 : 67-70, Textfig. 2;

Filisoma indicum Yamaguti, 1963 : 52, Pl. 20, Fig. 197, Pl. 77. 784, 785; Golvan & Houin, 1964 : 582-584, Fig. 26. 27; Golvan, 1969 : 142-143, Fig. 103; Anantaraman & Anantaraman, 1970 : 4;

Filisoma hoogliensis Anantaraman, M. & Anantaraman, S., 1970 : 4; Gupta, P.D. & Ghosh, 1979 : 313;

Filisoma indicum Gupta, P.D. & Ghosh, 1974 : 314; Gupta, N.K. & Jain, 1979b : 135-137; Soota & Bhattacharya, 1981 : 232; Chandra, Rao & Shyamasundari, 1982 : 333;

Filisoma hoogliensis Chandra, Rao & Shyamasundari, 1982b : 333; Gupta, S.P. & Naqvi, 1984 : 64-66, Pl. 2, Fig. 1-5; Gupta, V. & Sinha, 1990b : 44, 49; Bhattacharya, 2007 : 140; Pl. 23, Fig. 128

Filisoma indicum Golvan, 1994 : 157; Bhattacharya, 2007 : 143-144; Pl. 23, Fig. 131.

Type locality : Chilka Lake, Orissa, India.

Description : Male 11.93 × 0.51 mm; female 10.11 × 0.12 mm. Proboscis cylindrical, elongated, 0.90-1.05 × 0.097-0.146 mm in male; in female 1.24 × 0.18 mm, with 14-17 longitudinal rows of 20-24 hooks each in male and in female with 17-18 longitudinal rows of 26 hooks each. Hooks on ventral surface slightly larger than those on dorsal surface and hooks of anterior and posterior parts smaller and of middle part larger. Hooks of anterior part 0.025-0.030 mm, middle part 0.031-0.040 mm, posterior part 0.020-0.022 mm. Neck small, 0.146-0.162 × 0.243-0.365 mm towards it base. Proboscis receptacle long, cylindrical, double-walled with ganglion at its base, 0.93 × 0.15 mm. Trunk elongated, aspinose, wide anteriorly, gradually tapering posteriorly, 10.93 × 0.51 mm in male; in female 9.87 × 1.12 mm, with number of nuclei. Lemnisci cylindrical, wide, equal, as long as receptacle, and extending far above anterior testis, 0.84 × 0.18-0.19 mm in male, 1.26 mm long in female. Testes elliptical, equal, contiguous, in posterior half of trunk, 1.2 × 0.25 mm. Cement glands 4, elongated, tubular behind posterior testis, 2.38-2.40 × 0.01-0.02 mm. Seminal vesicle 0.53 × 0.16 mm. Saefftigen's pouch claviform. Bursa elongated, muscular, 0.43 × 0.16 mm. Uterine bell 2.61 × 0.14 mm, with 20 digitiform rays. Uterus tubular or fusiform 0.30 × 0.18 mm. Vagina 0.14-0.015 × 0.045-0.06 mm with sphincter of 0.072-0.09 mm long and bulb of 0.055-0.09 mm. Ovarian balls oval or spherical, fill entire trunk cavity. Eggs 0.054-0.057 × 0.016-0.017 mm with polar prolongations of middle shell. Acanthor 0.027-0.033 × 0.011-0.013 mm Gonopore opens ventrally between two papillae.

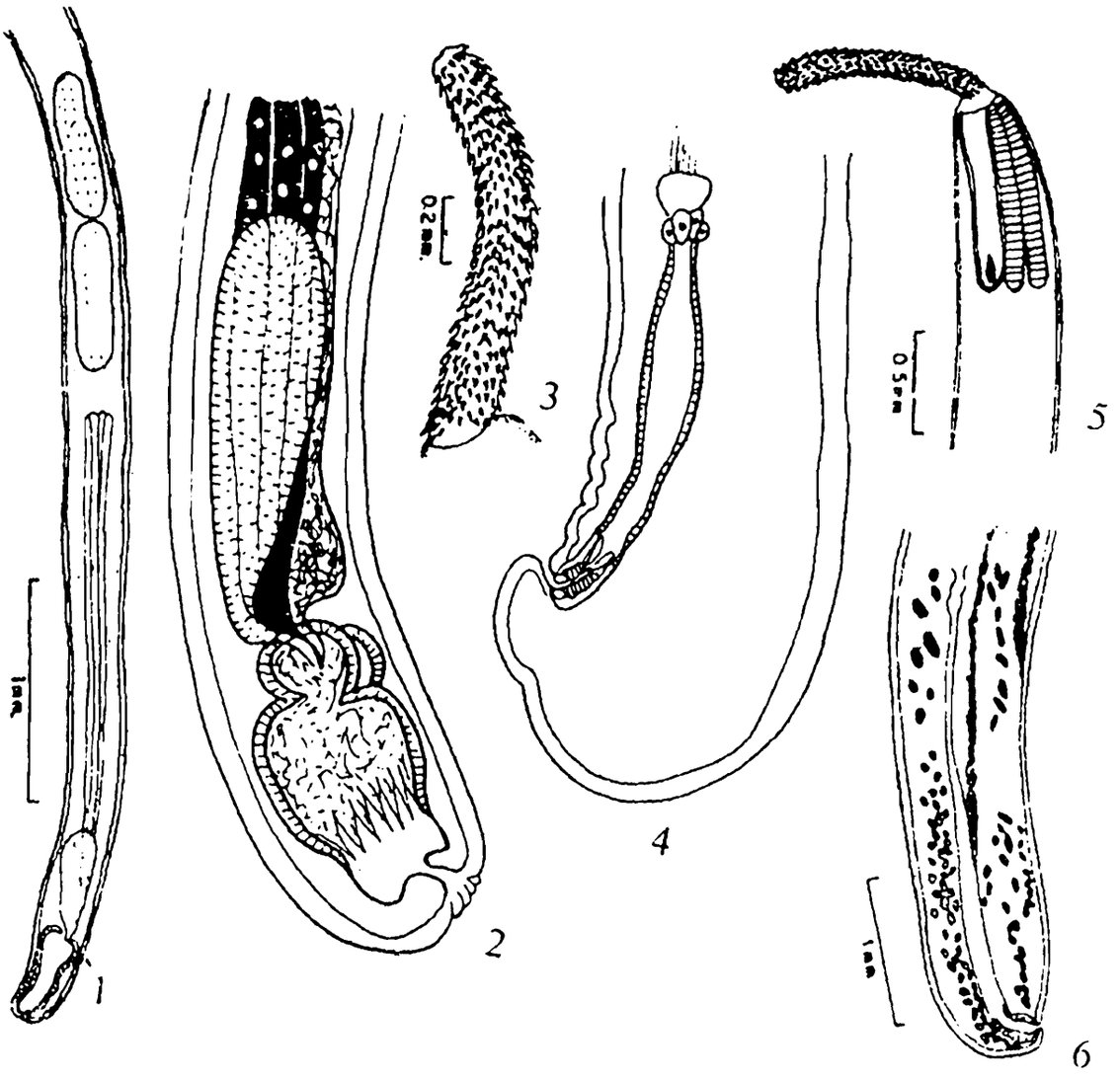


Fig. 50. *Filisoma indicum* Van Cleave, 1928. 1. Posterior part of male, 2. Posterior part of male enlarged. 3. Proboscis enlarged. 4. Posterior end of female, 5. Anterior part of worm, 6. Posterior part of female (after Golvan, 1964).

Host : *Scatophagus argus* (Cuvier & Valenciennes); *Arius serratus* Day, *Siganus vermiculatuus* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Porto Novo (Tamil Nadu); Panaji and Vasco-da-gama (Goa); Waltair coast, Bay of Bengal (Andhra Pradesh); Mumbai (Maharastra); Barkul, Chilka lake (Orissa); Hooghly River, Kolkatra (West Bengal); Sindh (Pakistan).

Distribution : Sulawesia

Remarks : Indian worms are much smaller than Van Cleave (1928) worms of 20-30 × 0.28-0.69 mm and of Yamaguti (1954).

52. ***Filisoma inglisi*** Gupta, S.P. & Naqvi, 1984
(Fig. 51)

Filisoma inglisi Gupta, S.P. & Naqvi, 1984 : 61-64, Pl. 1, Fig. 1-4; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994 : 157.

Type locality : Cochin, Kerala, India.

Description : Male 12.05-23.99 × 0.50-0.58 mm, female 7.11-35.49 × 0.22-0.50 mm. Proboscis cylindrical, long, slender 0.40-0.75 × 0.12-0.13 mm in male; in females 0.34-0.72 × 0.08-0.10 mm, with 17-18 longitudinal rows of 23-24 hooks each in both sexes. Hooks decrease in size antero-posteriorly, hooks of ventral surface stout and less pointed than those on dorsal surface. Apical hooks 0.032-0.035 mm long, subapical hooks 0.027-

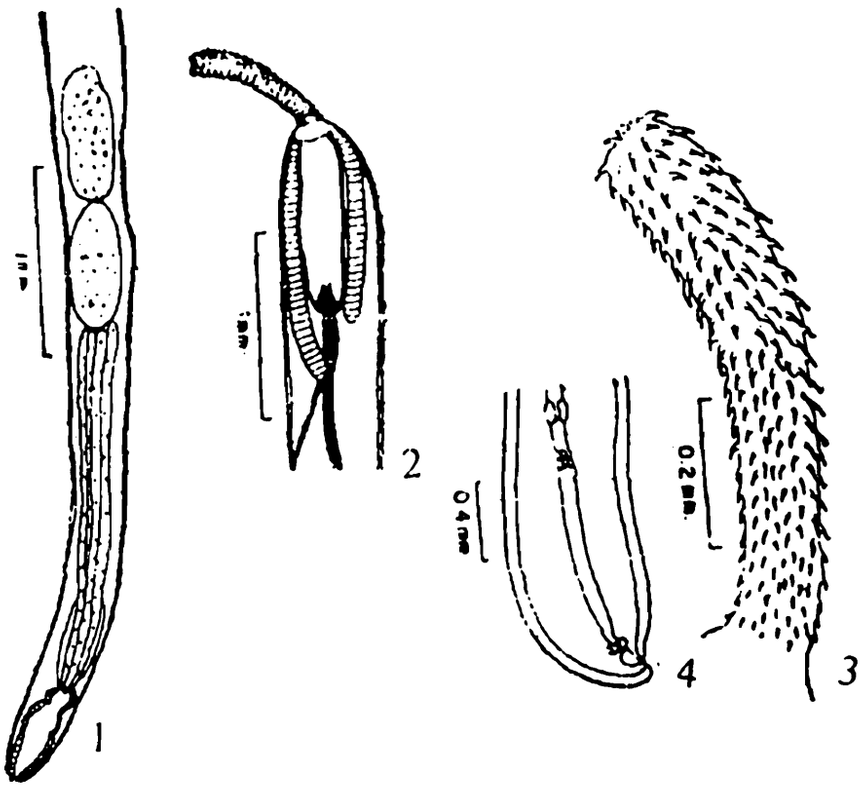


Fig. 51. *Filisoma inglisi* Gupta, S.P. & Naqvi, 1984. 1. Posterior part of male, 2. Anterior part of worm, 3. Proboscis enlarged, 4. Posterior part of female (after Gupta, S.P. & Naqvi, 1984).

0.030 mm long and basal hooks 0.018-0.020 mm long in male; the same 0.031-0.034 mm long, 0.025-0.029 mm long and 0.015-0.018 mm long respectively. A small neck-like part 0.09-00.14 × 0.09-0.123 mm in male, in female 0.07-0.10 × 0.08-0.19 mm present behind proboscis. Neck aspinose, 0.09-0.14 × 0.09-0.123 mm in male; in female 0.07-0.10 x0.08-0.19 mm. Proboscis receptacle long, cylindrical, double-walled with ganglion at its base, 0.92-0.99 × 0.25-0.28 mm in male, in female 0.40-1.01 × 0.10-0.20 mm. Trunk very long, slender, aspinose, wide anteriorly, gradually tapering posteriorly, 11.21-23.45 × 0.50-0.58 mm in male; in female 6.70-34.67 × 0.22-0.50 mm. Lemnisci cylindrical, subequal, longer than receptacle, extend above anterior testis; smaller lemniscus 0.98-1.10 mm long, larger

1.23-1.29 mm long in male, in female smaller lemniscus 0.50-1.05 mm long, larger 0.64-1.22 mm long. Testes elongated, or elliptical, contiguous, in tandem, subequal, in posterior third of trunk; anterior testis 0.71-1.40 × 0.26-0.42 mm, posterior testis 0.68-1.25 × 0.28-0.44 mm. Cement glands 4, long, tubular, with several small nuclei, lie just behind posterior testis, 0.86-2.0 × 0.05-0.09 mm. Seminal vesicle 0.55-0.85 × 0.18-0.32 mm. Bursa elongated without rays or papillae, 0.56-0.70 × 0.19-0.32 mm. Uterine bell opens into a wide uterine duct, 0.45-0.63 mm long, guarded by kidney-shaped cells, uterus 0.10-0.16 mm long with one prominent spherical cell on either side. Vagina funnel shaped. Gonopore terminal in male and subterminal in female.

Host : *Saurus myops* (Cuvier); *Trachinocephalus myops.*

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

53. ***Filisoma scatophagus*** Datta & Soota, 1960
(Fig. 52)

Filisoma scatophagus Datta & Soota, 1960 : 67-69, Textfig.1 A-C; Golvan, 1969 : 147-146, Fig. 109; Anantaraman, M. & Anantaraman, S., 1970: 4; Gupta, P.D. & Ghosh, 1974 : 313; Gupta, V. & Sinha, 1990b : 49; Golvan, 1994: 157; Bhattacharya, 2007: 144; Pl. 24, Fig. 130.

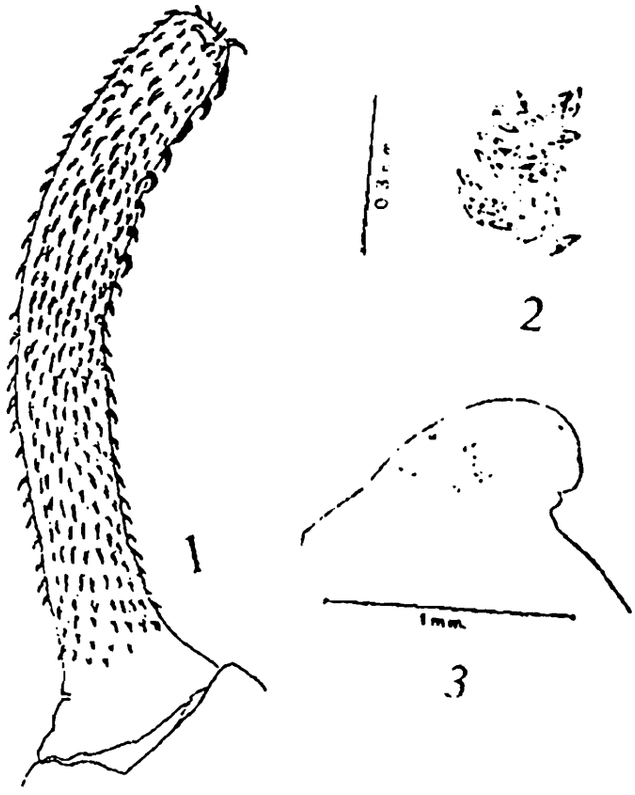


Fig. 52. *Filisoma scatophagus* Datta & Soota, 1960. 1. Proboscis and neck enlarged, 2. Ova, 3. Posterior end of trunk (after Datta & Soota, 1960).

Description : Female nearly 115 mm long, narrow anteriorly 0.5 mm wide, and 1.6 mm wide posteriorly. Proboscis 1.1 × 0.9 mm, with 14-16 longitudinal rows of 26-32 hooks each. Dorsal and ventral hooks distinct, former thicker and stouter than later. First 10 hooks of median dorsal row exceptionally distinct, 0.04-0.06 × 0.01-0.02 mm; subsequent hooks gradually diminish towards posterior end and measure 0.02-0.04 × 0.004-0.005 mm. First submedian dorsal row with 0.02-0.04 × 0.004-0.01 mm, second submedian row with 0.02-0.04 × 0.008 mm. Ventrals measure 0.008-0.03 × 0.004 mm, and gradually diminish in size antero-posteriorly. Proboscis receptacle double-walled. Neck 0.1 × 0.3 mm.

Host : *Scatophagus argus* Cuvier & Valenciennes.

Location : Intestine.

Locality : (Orissa); River Hooghly, Kolkata (West Bengal)

Distribution : Known only from Indian subcontinent.

15. Genus ***Pseudocavisoma*** Golvan & Houin, 1964

Rhadinorhynchoides Fukui & Morishota, 1931 : 759; Petrotschenko, 1956 : 331; Yamaguti, 1963 : 54;

Pseudocavisoma Golvan & Houin, 1964 : 573; Golvan, 1969 : 128; 1994 : 175.

Diagnosis : Echinorhnchida, Cavisomatidae. Proboscis cylindrical, short, with 14-15 longitudinal rows of 5-8 hooks each. Proboscis receptacle double-walled, cylindrical with ganglion at its middle. Trunk subcylindrical or fusiform, aspinose. Lemnisci digitiform, nearly as long as or longer than receptacle. Testes in tandem, in middle third of trunk. Cement glands 4, all at same level. Ova elongate, with polar prolongations of middle shell. Parasites of fresh water and marine fishes.

Type species : *Pseudocavisoma chromatidis* (Cable & Quick, 1954) Golvan & Houin, 1964.

Includes one species, *Pseudocavisoma chromatidis* (Cable & Quick, 1954) Golvan & Houin, 1964, which occurs in India.

54. ***Pseudocavisoma chromatidis*** (Cable & Quick, 1954) Golvan & Houin, 1964 (Fig. 53)

Cavisoma chromatidis Cable & Quick, 1954 : 393-400;

Rhadinorhynchoides chromatidis, Yamaguti, 1963 : 54, Pl. 16, Fig. 165; Gupta, N. K. & Lata, 1963 : 338-340, Fig. 22, 23;

Pseudocavisoma chromatidis (Cable & Quick) Golvan & Houin, 1964 : 573-574, Fig. 20 A-C;

Rhadinorhynchoides chromatidis, Golvan, 1969 : 129, Fig. 91 A-C;

Pseudocavisoma chromatidis (Cable & Quick) Golvan, 1994 : 176.

Type locality : Puerto Rico, South America.

Description : Males 3.3 × 0.48 mm. Females 7.4-10.1 mm long, 1.66-1.85 mm in maximum width and 0.50-0.98 mm in minimum width. Proboscis short, cylindrical, 0.32-0.36 × 0.15-0.18 mm, with 14 longitudinal rows of 8-9 hooks each. Apical hooks 0.030-0.39 mm long, basal hooks smaller than others, 0.012- 0.014 × 0.004 mm. Neck 0.14 × 0.21 mm without spines. Proboscis receptacle cylindrical, double-walled, 1.06-1.14 × 0.22-0.25 mm, with ganglion at its middle. A set of retractor and invagination muscles, pierce receptacle wall and lie in trunk pseudocoel as dorsal and ventral receptacle retractors. Trunk fusiform, aspinose. Lemnisci paired, cylindrical, longer than receptacle 1.01-1.33 × 0.18-0.19 mm and 0.72-1.0 × 0.18-0.19 mm. Testes paired, ovoidal, in midtrunk, anterior 0.61-0.96 × 0.53-0.71 mm, posterior 0.60-0.85 × 0.42-0.70 mm, contiguous overlap each

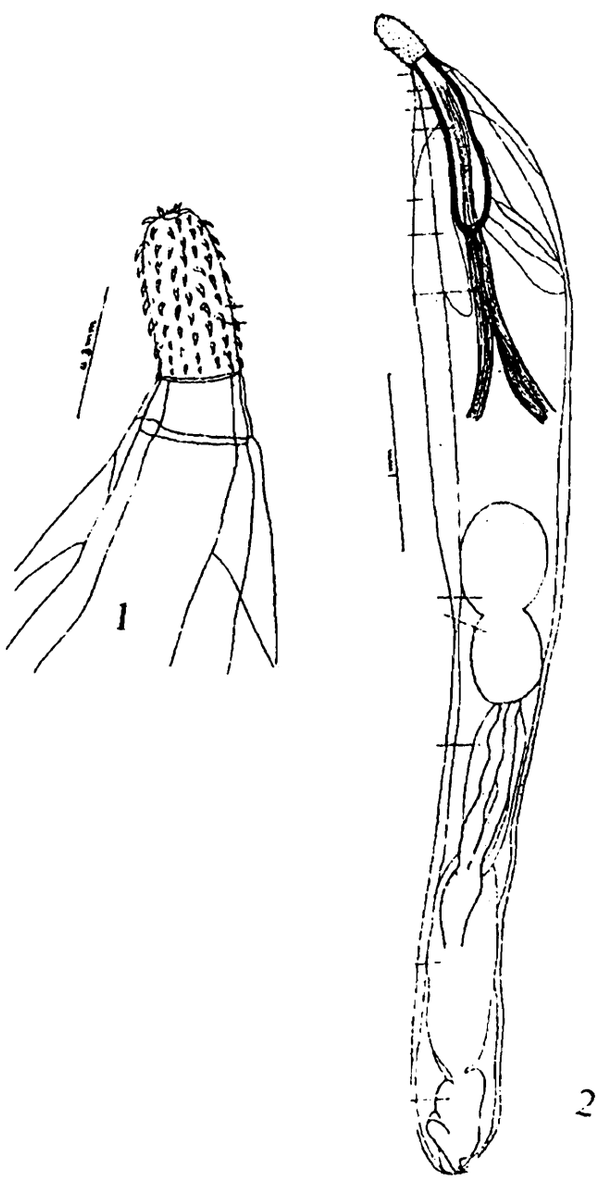


Fig. 53. *Pseudocavisoma chromitidis* (Cable & Quick, 1953) Golvan & Houin, 1964. 1. Proboscis enlarged, 2. Male (after Golvan & Houin, 1964).

other. Sperm duct start from posterior testis. Cement glands four, syncytial, tubular, lie immediately behind posterior testis, 0.98-2.45 × 0.29-0.56 mm, its reservoir, 0.70 × 0.56 mm. Saefftigen's pouch, 0.43 × 0.30 mm. Genital sheath saccular, 1.4 × 0.39 mm. Bursa inverted, 0.58-0.98 × 0.28-0.47 mm. Uterus long, 0.28-0.32 mm long. Vagina with sphincters. Eggs 0.046-0.045 × 0.07-0.009 mm with polar prolongations of middle membrane.

Host : *Teuthis* (*Teuthis*) *bamin.*

Location : Intestine.

Locality : India.

Distribution : Puerto Rico;

Note : Worms of Cable & Quick (1956) are much smaller.

16. Genus ***Neorhadinorhynchus*** Yamaguti, 1939. emended Bhattacharya, 2007

Neorhadinorhynchus Yamaguti, 1939: 317-351; Bhattacharya, 2007: 145.

Diagnosis : Echinorhynchida, Cavusomidae. Trunk subcylindrical, slender, aspinose. Proboscis cylindrical with 14-18 longitudinal rows of 17-25 hooks each; ventral hooks may be slightly larger than dorsal hooks. Neck present. Proboscis receptacle double-walled, with ganglion at middle or more posteriorly. Lemnisci claviform, mloderately long. Testes contiguous, equatorial or post-equatorial. Cement glands 4, in twos in tandem. Parasites of fishes.

Type species : *Neorhadinorhynchus aspinosus* (Fukui & Morisita, 1937) Yamaguti, 1939.

This genus includes six species, 1. *Neorhadinorhynchus robustus* (Edmonds, 1964) Golvan, 1969, 2. *N. aspinosus* (Fukui & Morisita, 1937) Yamaguti, 1939, 3. *N. atlanticus* Gaevaskaja & Nigamatullin, 1977, 4. *N. madagascarensis* Golvan, 1969, 5. *N. myctophumi* Moridanova, 1988 and *N. nudus* (Harada, 1938) Yamaguti, 1939, of which first one occurs in this subcontinent.

55. ***Neorhadinorhynchus robustus*** (Edmonds, 1964) Golvan, 1969
(Fig. 54)

Neogorgorhynchus robustus Edmonds, 1964: 41-45;

Neorhadinorhynchus robustus (Edmonds, 1964) Golvan, 1969: 130; Bhattacharya, 2007: 145-146, Pl. 24, Fig.132 a-f.

Type locality : Sizuoka, Japan.

Description : Male of medium size, slender, ventrally curved, 15 × 2 mm. aspinose. Female 28 -37 × 3.5 mm. Proboscis cylindrical 0.755 × 0.255 mm with 14-16 longitudinal rows of 12-13 hooks each. In male; in female proboscis cylindrical 0.9-1.0 x0.3 mm with

14-16 longitudinal rows of 12-14 hooks each. Dorsal and ventral hooks are of same size, hooks 0.05-0.08 mm long, hooks of apical and basal are smaller than rest. Proboscis receptacle double-walled, with ganglion in middle, 22 × 0.3 mm. Lemnisci claviform, sacciform, longer than proboscis receptacle. Testes elliptical, post-equatorial, in tandem, anterior 1.2 × 0.40-0.45 mm, posterior 1.5 × 0.45-0.50 mm. Cement glands 4 in pairs in tandem. Seminal vesicle long. Eggs 0.04-0.045 × 0.012-0.015 mm with polar prolongations of middle shell. Male gonopore terminal.

Host : *Siganus canaliculatus.*

Location : Intestine.

Locality : Tutucorin Tamil Nadu).

Distribution : Australia, New Caledonia.

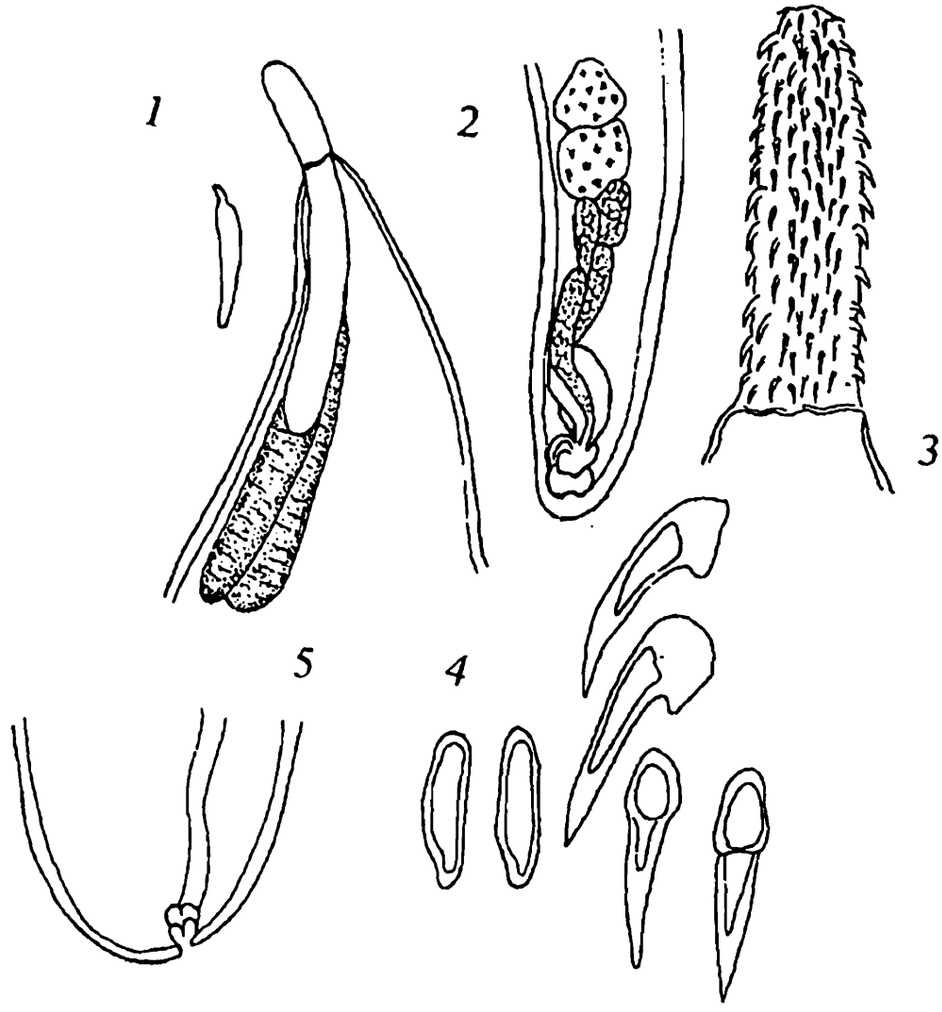


Fig. 54. *Neorhadinorhynchus robustus* (Edmonfs, 1964) Golvan, 1969. 1. Male and anterior part of male, 2. Posterior part of male, 3. Proboscis enlarged, 4. Proboscis hooks enlarged, 5. Posterior part of female, 6. Ova (after Bhattacharya, 2007).

7. Family DIPLOSENTIDAE Tubangui & Masilungan, 1937

Diplosentidae Tubangui & Masilungan, 1937: 183-189; Yamaguti, 1963 : 61; Golvan & Houin, 1963 : 809; Golvan, 1969 : 148-149; Bhattacharya, 2007 : 127.

Diagnosis : Palaeacanthocephala, Echinorhynchida. Proboscis elongate, with numerous hooks in longitudinal rows with dorso-ventral dissymmetry, decreasing in size from apex to base. Proboscis receptacle double-walled. Trunk aspinose, with lateral lacunar channels. Lacunar system with main lateral channels and transverse anastomoses. Lemnisci variable in length. Genital organs in posterior half of trunk. Testes globular or ovoidal in posterior half of trunk. Cement glands 2, tubular. Saefftigen's pouch large. Uterus long. Eggs with polar prolongations of middle shell. Parasites of fishes.

Type genus : *Diplosentis* Golvan & Houin, 1963.

Includes three subfamilies, 1. Diplosentinae Golvan & Houin, 1963, 2. Allorhadinorhynchinae Golvan, 1969 and 3. Slendrorhynchinae Amin & Otto, 1996, of which first subfamily occurs in this subcontinent.

Subfamily DIPLOSENTINAE Golvan & Houin, 1963

Diplosentinae Golvan & Houin, 1963: 817; Golvan, 1969 : 151.

Diagnosis : Proboscis with number of longitudinal rows of some hooks. Proboscis receptacle double-walled with ganglion about its middle. Trunk cylindrical aspinose. Lacunar system with lateral longitudinal channels. Lemnisci much coiled. Testes ovoid, contiguous and pre-equatorial. Cement glands 2, elongated. Eggs with polar prolongations of middle shell.

Type genus : *Diplosentis* Tubangui & Masilungan, 1937.

17. Genus ***Diplosentis*** Tubangui & Masilungan, 1937

Diplosentis Tubangui & Masilungan, 1937 : 183-189; Petrotschenko, 1956: 252; Golvan & Houin, 1963 : 817; Yamaguti, 1963 : 62; Golvan, 1969 : 151; 1994 : 145; Bhattacharya, 2007: 127.

Diagnosis : Diplosentidae, Diplosentinae. Proboscis club-shaped, with 12-13 longitudinal rows of 6-9 hooks each. Proboscis receptacle double-walled, with ganglion near its middle. Neck absent. Trunk subcylindrical, wide anteriorly, cuticle unarmed, wrinkled transversely, spinose or aspinose. Lacunar system with lateral longitudinal channels. Protonephridia absent. Lemnisci much coiled, enclosed in membranous sac. Testes contiguous, spherical, in midtrunk. Cement glands 2, tubular, its reservoir tubular. Ova elliptical with polar prolongations of middle shell. Parasites of marine fishes.

Type species : *Diplosentis amphiacanthi* Tubangui & Masilungan, 1937.

Includes three species, 1. *Diplosentis manteri* Gupta & Fatima,1979, 2. *D. ikedai* Machida, 1992 and 3. *D. amphiacanthi* Tubangui & Masilungan, 1937, of which first species occurs in India.

56. ***Diplosentis manteri*** Gupta, V. & Fatma, 1979
(Fig. 55)

Diplosentis manteri Gupta, V. & Fatma, 1979 : 48-50, Pl. 2, Fig. 1, 2; Gupta, V. & Sinha, 1990b : 52; Golvan, 1994 : 147; Bhattacharya, 2007 : 128.

Type locality : Mindanao, Philippine Islands.

Description : Diplosentinae. Male 3.85 mm long, 0.4 mm wide. Proboscis elongated, 0.32 × 0.4 mm, with 13 longitudinal rows of 6 hooks each. Hooks gradually decrease in size towards base of proboscis. Hooks of first row 0.04 mm long, second row 0.035 mm long, third and fourth rows 0.03 mm long, fifth row 0.025 mm long and basal row 0.023

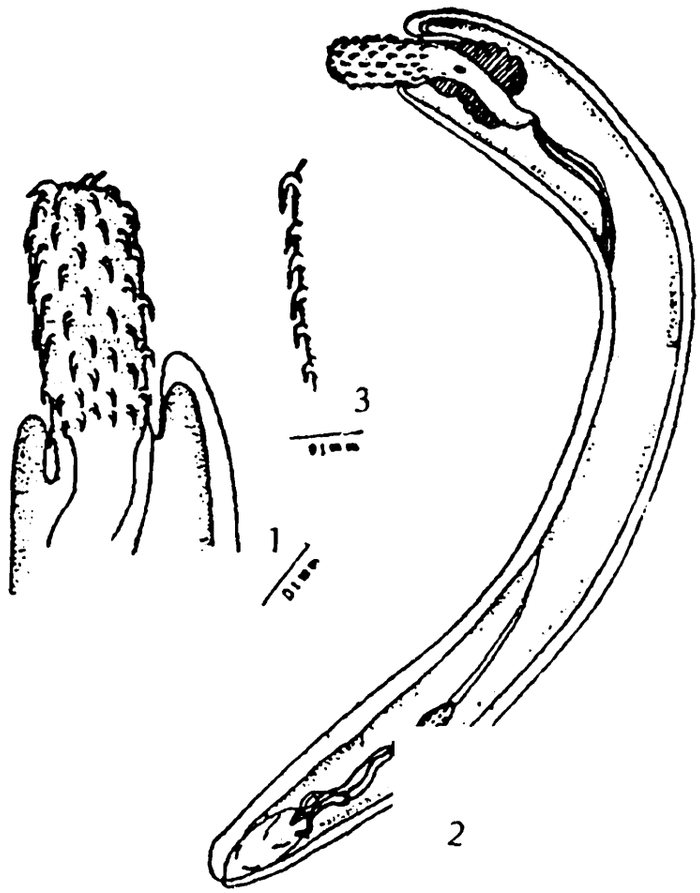


Fig. 55. *Diplosentis manteri* Gupta, V. & Fatma, 1979. 1. Proboscis and neck enlarged, 2. Male, 3. Row of proboscis hooks (after Gupta, V. & Fatma 1979).

mm long. Neck absent. Proboscis receptacle double-walled, elongated, cylindrical, 0.43 × 0.12 mm, with ganglion anterior to middle. Trunk elongate, subcylindrical, cuticle unarmed, wrinkled transversely. Lacunar system with lateral longitudinal channels. Lemnisci 0.24 mm long, 0.15 mm wide, much coiled, enclosed in membranous sac, extending upto ¾ of receptacle. Testes contiguous, ovoid, in tandem, subequal and post-equatorial, anterior 0.15 × 0.03 mm, posterior 0.135 × 0.095 mm. Cement glands 2, tubular, 0.45-0.48 ×

0.080-0.085 mm. Seminal vesicle tubular 0.22 × 0.55 mm. Saefftigen's pouch pyriform, 0.15 × 0.085 mm. Bursa elongated, muscular, 0.35 × 0.12 mm, opening outside through subterminal gonopore. Female not encountered.

Host : *Arius arius* (Bleeker).

Location : Intestine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

8. Family ECHINORHYNCHIDAE Cobbold, 1876

Echinorhynchidae Cobbold, 1876 : 200-205; Van Cleave, 1919a : 235; Southwell & Macfie, 1925 : 174; Travassos, 1926b : 32; Thapar, 1927 : 116; Petrotschenko, 1956 : 254-255; Yamaguti, 1963 : 37; Golvan, 1969 : 194; Bhattacharya, 2007 : 115.

Diagnosis : Echinorhynchida. Proboscis more or less cylindrical, of moderate length and usually with numerous hooks, or spherical and with a small number of hooks. Proboscis receptacle inserted at base of proboscis, double-walled, with ganglion at varying levels. Trunk fusiform or cylindrical, aspinose, only exceptionally faintly spinose. Hypodermic nuclei usually small, numerous. Lemnisci 2, more or less claviform, rather short. Testes oval to elliptical, never cylindrical. Cement glands 6, pear-shaped or riunded. Ova elliptical to fusiform. Parasites of fishes.

Type genus : *Echinorhynchus* Zoega in Müller, 1776.

Includes three subfamilies, 1. Circinatechinorhynchinae Bhattacharya, 2007, 2. Echinorhynchinae Cobbold, 1876 and 3. Yamagutisentinae Golvan, 1969, all three occur in this subcontinent.

Key to subfamilies of family ECHINORHYNCHIDAE

1. Trunk fusiform tapering to both ends, with minute spines anteriorly, transition between true apical proboscis hooks and basal spimiform hooks abrupt ..... YAMAGUTISENTINAE

– Trunk aspinose, transition between apical proboscis hooks and basal hooks spiniform gradual 2

2. Lemnisci claviform, not very long ..... ECHINONORHYNCHINAE

– Lemnisci circinate or ring like compact mass, encircling junction of proboscis and proboscis receptacle ..... CIRCINATECHINORHYNCHINAE

Subfamily ECHINORHYNCHINAE Cobbold, 1876

Echinorhynchinae Cobbold, 1876 : 200-205; Travassos, 1920 : 6; Meyer, 1931c : 58; Petrotschenko, 1956 : 267; Yamaguti, 1963 : 37; Bhattacharya, 2007 : 116-117.

Diagnosis : Echinorhynchidae without long neck or cervical bulb. Proboscis cylindrical or subcylindrical, sometimes ovoid, with large or small number of hooks in longitudinal rows. Proboscis receptacle and lemnisci more or less claviform. Trunk usually cylindrical. Testes in mid trunk region. Cement glands six round or club-shaped. Ova with polar prolongations of middle shell.

Type genus : *Echinorhynchus* O. F. Müller, 1776.

Includes five genera, 1. *Acanthocephalus* Koelreuther, 1771, 2. *Echinorhynchus* Zoega in Müller, 1776, 3. *Pseudoacanthocephalus* Petrochenko, 1956, 4. *Frlloechinorhynchus* Bhattacharya, 2000, and 5. *Pilum* Williams, 1976, of which first three genera occur in this subcontinent.

Key to Indian genera of subfamily ECHINORHYNCHINAE

1. Ganglion at base of proboscis receptacle; Proboscis slightly swollen ..... *Acanthocephalus*

– Ganglion near middle of proboscis receptacle, proboscis cylindrical 2

2. Eggs with polar prolongations of middle shell ..... *Echinorhynchus*

– Eggs without polar prolongations of middle shell ..... *Pseudoacanthocephalus*

18. Genus ***Acanthocephalus*** Koelreuther, 1771

Acanthocephalus Koelreuther, 1771 : 595-596; Van Cleave, 1919a : 239; Southwell & Macfie, 1925 : 176; Meyer, 1932 : 140;

Pseudoechinorhynchus Petrotschenko, 1956 : 292;

Acanthocephalus, Petrotschenko, 1956, I : 292; Yamaguti, 1963 : 44; Golvan, 1969 : 245; 1994 : 136; Bhattacharya, 2007 : 119.

Diagnosis : Echinorhynchidae, Echinorhynchinae. Proboscis fairly long, ovoid or claviform to cylindrical, with 6-28 longitudinal rows of 4-15 hooks each, hooks increase in size from apex to middle and thence gradually decrease towards base. Neck absent. Proboscis receptacle saccate to cylindrical, double-walled, with ganglion at base. Neck short. Trunk nearly cylindrical, with numerous, small hypodermic nuclei. Lacunar system with reticular anastomoses. Lemnisci digitiform or claviform, usually not much longer than receptacle. Testes oval, spherical in tandem in midtrunk. Cement glands 6, round or pear-shaped, arranged roughly in three pairs, some one behind other. Ova greatly elongated, fusiform, with prominent polar prolongations of middle shell. Gonopore terminal in both sexes. Parasites of fishes, amphibians and reptiles.

Type species : *Acanthocephalus anguillae* (Müller, 1780) Lühe, 1911.

Includes fifty one species, 1. *Acanthocephalus goanensis* Jain & Gupta, N. K. 1981, 2. *A. hastae* Baylis, 1944, 3. *kabulensis* Datta & Soota, 1956, *A. kashmirensis* Datta, 1935, 5. *A. leithii* Bilqees, Muti-ur-Rehman & Khan, 2004, 6. *A. lucidus* Van Cleave, 1925,

7. *Acanthocephalus manipurensis* Bhattacharya, 2007: 8. *A. nikoli* Khan & Bilqees, 1994, 9. *A. serendibensis* Cruz & Mills, 1970, 10. *A. srilankensis* Cruz & Ching, 1976, 11. *A. acerbus* Van Cleave, 1931, 12. *A. acutispinus* Machado Filho, 1968, 13. *A. acutulus* Van Cleave, 1931, 14. *A. anguillae* (Müller, 1780) Lühe, 1011, 15. *A. anthuris* (Dujardin, 1845) Lühe, 1911, 16. *A. artatus* Van Cleave, 1925, 17. *A. balkanicus* Batcherov & Combes, 1974, 18. *A. breviprostatus* Kennedy, 1982, 19. *A. clavula* (Dujardin, 1845) Grabda-Kazubska & Chubb, 1968, 20. *A. correalimai* Machado Filho, 1970, 21. *A. criniae* Snow, 1970, 22. *A. curtus* (Achmerov & Dombrowskaja-Achmerova, 1941) Yamaguti, 1963, 23. A. *dirus* (Van Cleave, 1931) Van Cleave & Townsend, 1936, 24. *A. domerguei* Golvan, Brygoo & Gassmann, 1972, 25. *A. echigoensis* Fujita, 1920, 26. *A. elongatus* Van Cleave, 1937, 27. *A. etowani* Williams, 1974, 28. *A. falcatus* (Frolich, 1789) Lühe, 1911, 29. *A. fluviatalis* Paperna, 1964, 30. *A. galaxii* Hine, 1978, 31. *A. gotoi* Van Cleave, 1925, 32. *A, haranti* Golvan & Oliver in Golvan, 1969, 33. *A. japonicus* (Fukui & Morisita, 1936) Petrotschenko, 1956, 34. *A. lizus* Li-Minmin, 1984, 35. *A. lucii* (O. F. Müller, 1776) Lühe, 1911, 36. *A. madagascarensis* Golvan, 1965, 37. *A. minor* Yamaguti, 1935, 38 *A. nanus* Van Cleave, 1925, 39. *A. oncorhynchi* Fujita, 1921, 40. *A. opsariichthydis* Yamaguti, 1935, 41. *A. parallelotestis* Achmerov & Dombrowskaja-Achmerova, 1941, 42. *A. paronoi* (Condoelli, 1897) Meyer, 1934, 43. *A. pesteri* Tadros, 1966, 44. *A. ranae* (Schrank, 1788) Lühe, 1911, 45. *A. rauschi* Golvan, 1969, 46. *A. sinensis* Van Cleave1937, 47. *A. tahlequahensis* Oetinger & Buckner, 1970, 48. A. *tenuirostris* (Achmerov & Dombrowskaja-Achmerova, 1941) Yamaguti, 1963, 49. *A. tigrinae* (Shipley,1903) Yamaguti, 1963, 50.*A. tumescens* (Linstow, 1896) Porta, 1905 and 51. *A. ula* Lent, Santos & Portes-Santos, 1989, of which first ten occur in Indian subcontinent.

Key to Indian species of genus *Acanthocephalus*

1. Proboscis with 7-9 longitudinal rows of 4-7 hooks each ..... *Acanthocephalus kabulensis*

– Proboscis with more than 9 longitudinal rows of hooks each 2

2. Proboscis with 10-12 longitudinal rows of 3-4 hooks each ..... *Acanthocephalus sebendibensis*

– Proboscis with 11-14 longitudinal rows of 14 hooks each ..... *Acanthocephalus leithii*

– Proboscis with 12 or more longitudinal rows of hooks 3

3. Proboscis with 12 longitudinal rows of hooks 4

– Proboscis with 12 or more longitudinal rows of hooks 5

4. Proboscis with 12 longitudinal rows of 11 hooks each ..... *Acanthocephalus goaensis*

– Proboscis with 12 longitudinal rows of 14 hooks each ..... *Acanthocephalus hastae*

5. Proboscis hooks 3-5 in each longitudinal row 6

– Proboscis hooks 6 or more in each longitudinal row 7

6. Proboscis hooks 3-5 in each of 14-16 longitudinal rows ..... *Acanthocephalus manipurensis*

– Proboscis hooks 3-4 in each of 10-16 longitudinal rows ..... *Acanthocephalus nickoli*

– Proboscis hooks 4-5 in each of 15-16 longitudinal rows ..... *Acanthocephalus srilankensis*

57. ***Acanthocephalus goaensis*** Jain & Gupta, N. K.
(Fig. 56)

Acanthocephalus goanensis Jain & Gupta, N.K. 1981a : 164-169, 174-175, Fig. 1-5; Gupta, V. & Sinha, 1990b : 49; Golvan, 1994 : 136.

Type locality : Panaji, Goa, India.

Description : Male 5.43 × 0.58 mm; female 5.54 mm long. Proboscis cylindrical, with 12 longitudinal rows of 11 hooks each, hooks increasing in size from apex to middle and gradually decreasing in size towards base, 0.565 × 0.135 mm 0.565 × 0.135 mm, largest hooks 0.044-0.048 mm long, smallest 0.014 mm long in male; and in female 0.671 × 0.169 mm; largest hooks 0.048-0.052 mm long, smallest 0.020 mm long. Basal hooks of all rows appreciably smaller than preceding ones. Proboscis receptacle double-walled, long, cylindrical 0.931 × 0.175 mm, inserted at base of proboscis and reaching anterior testis, with an oval ganglion, 0.145 × 0.048 mm, at its base in male; in female 1.086 ×

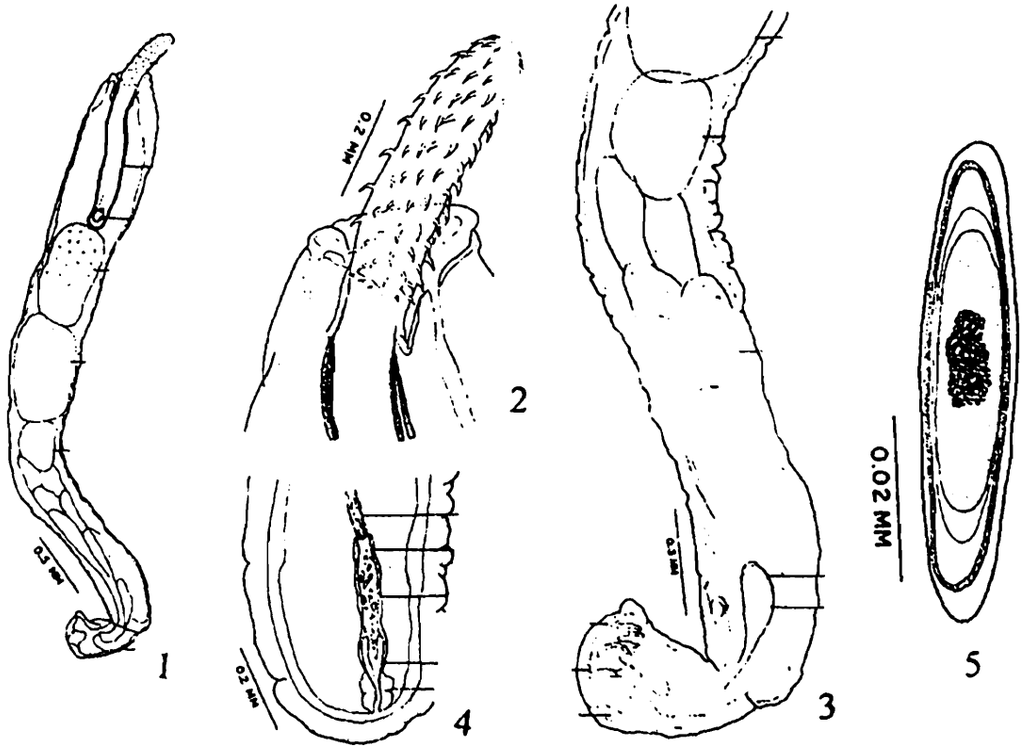


Fig. 56. *Acanthocephalus goaensis* Jain & Gupta, N.K., 1981. 1. Male, 2. Proboscis and trunk enlarged. 3. Posterior part of male, 4. Posterior part of female, 5. Ovum enlarged (after Jain & Gupta, N.K., 1981).

0.194 mm. Trunk cylindrical, aspinose. Lemnisci could not be traced. Genital organs in posterior two-thirds of body in male. Testes large, oval, in tandem, contiguous, anterior 0.795 × 0.407 mm, posterior 0.815x 0.40 mm. Cement glands 6, anterior most nearly spherical, 0.308 × 0.252 mm, lying immediately behind posterior testis, followed by 5 claviform, four of these in two pairs, one behind other, fifth posterior most and smallest and unpaired. Cement ducts two open at base of penis along with ejaculatory duct from elongated seminal vesicle. Copulatory bursa bell-shaped when everted, 0.485 × 0.388 mm with 20 bursal rays and two antero-lateral diverticula of muscular cap on sides of penis. In female, genital tube 0.425 mm long, of nearly uniform diameter, anterior part 0.043 mm wide, posterior part muscular 0.058 mm wide. Vagina with two sphincters. Eggs elliptical without polar prolongations, 0.055-0.058 × 0.012-0.017 mm. Genital pore terminal in both sexes.

Host : *Pumadasys* (=*Pristipoma) hasta* (Bl.och).

Location : Intestine.

Locality : Panaji (Goa).

Distribution : Known only from type locality.

58. ***Acanthocephalus hastae*** Baylis, 1944
(Fig. 57)

Acanthocephalus hastae Baylis, 1944 : 462-472; Petrotschenko, 1956 : 304, Fig. 121; Yamaguti, 1963 : 46, Pl. 18, Fig. 185; Golvan, 1969: 263, Fig. 200; Chandra, Rao & Shyamasundari, 1982b : 333; Golvan, 1994 : 136.

Type locality : Queensland, Australia.

Description : Male 4-8 × 0.66-1.0 (0.81) mm; ale 6-12 (5.76-7.95) × 0.6-1.5 (0.66-0.99) mm. Proboscis cylindrical or slightly widened at anterior end, 0.7-1.0 × 0.17-0.21 mm in male, in female 0.7-1.4 × 0.16-0.25 mm, with 12 longitudinal rows of 14 hooks each. Point of anterior hooks about 0.06 mm long, that of posterior hooks 0.02 mm long in male; in female point of anterior hooks 0.06 or 0.08 mm long, point of posterior hooks diminishes to 0.02-0.03 mm long. Ventral hooks more developed than dorsal hooks, their point somewhat bent at tip. Proboscis receptacle 0.95-1.60 × 0.21-0.32 mm in male; in female 1.7-2.2 (0.7-1.4) × 0.16-0.25 mm, with ganglion and retinacula located at its posterior end. Trunk without spines. Lemnisci vary in length, sometimes as long as or even



Fig. 57. *Acanthocephalus hastae* Baykis, 1944. Proboscis enlarged (after Baylis, 1944).

longer than receptacle. Testes lie one behind other, usually in middle part of trunk, 0.44-1.20 × 0.3-0.7 mm, anterior testis slightly larger than posterior testis. Cement glands 6, pear-shaped, arranged in 3 pairs. Uterus-vagina 0.9-1.7 mm long. Vagina 0.15-0.16 × 0.09-0.14 mm, with bulb of 0.07-0.08 × 0.15-0.2 mm. Eggs fusiform 0.066-0.084 × 0.02-0.024 mm with middle membrane slightly thickened at poles but without protrusions.

Host : *Pomadasys hasta* (Bloch), *P. maculatus.*

Location :

Locality : Visakhapatnam coast (Andhra Pradesh).

Distribution : Queensland (Australia).

59. ***Acanthocephalus kabulensis*** Datta & Soota, 1956
(Fig. 58)

Acanthocephalus kabulensis Datta & Soota, 1956a : 185-187, Textfig. 1 a-c; Yamaguti, 1963 : 48, Pl. 16, Fig. 162-164; Golvan, 1969 : 267, Fig. 203 A-C; Gupta, P.D. & Ghosh, 1979 : 312; Golvan, 1994 : 136.

Type locality : Kabul, Afghanistan.

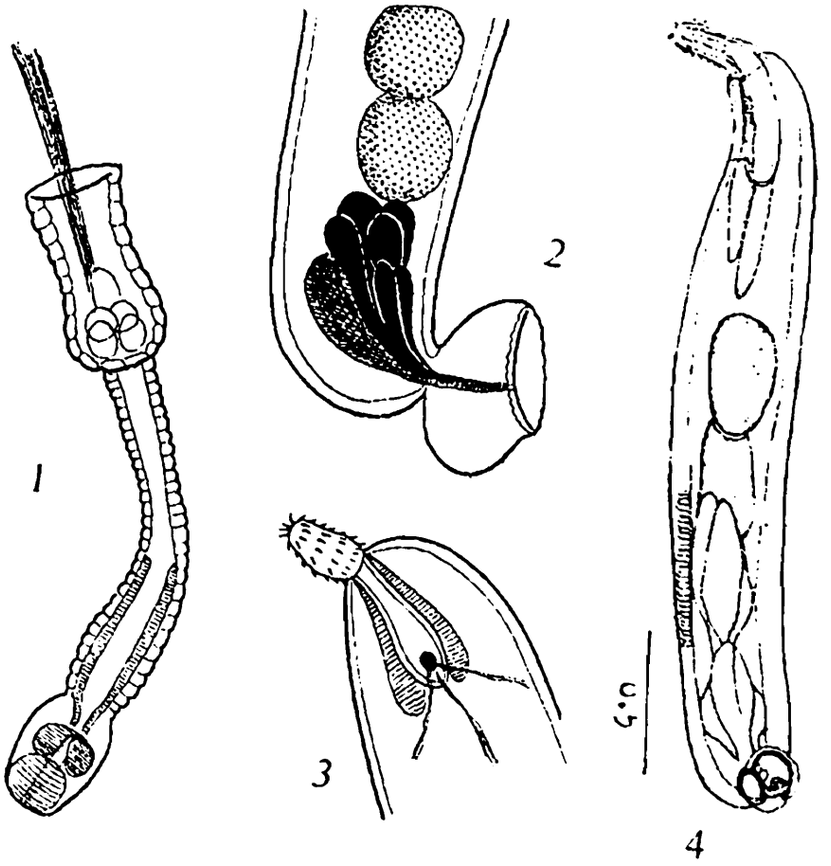


Fig. 58. *Acanthocephalus kabulensis* Datta & Soota, 1954. 1. Female genitalia, 2. Male genitalia, 3. Anterior end of Worm, 4. Male (1,2,3 after Golvan, 1969, 4 after Datta & Soota, 1954).

Description : Male 4.38 × 1.02 mm; female 6.17 × 1.19 mm. Proboscis 0.32 × 0.28 mm in male; in female 0.49 × 0.41 mm, with 7-9 longitudinal rows of 4-7 hooks each in both sexes. Hooks 0.06-0.08 mm long in male; in female 0.07-0.09 mm long. Proboscis receptacle 0.81 mm long, with ganglion in posterior part of receptacle and 0.85 mm from anterior end. Trunk almost cylindrical, anterior region broader than posterior, gradually narrowing posteriorly. Lemnisci longer than receptacle. Testes unequal, anterior larger, 0.58 × 0.43 mm, posterior smaller, 0.55 × 0.39 mm. Cement glands 6, pyriform, situated behind posterior testis partly overlapping it, grouped together, 0.58 × 0.37 mm. Seminal vesicle about 0.65 mm long. Bursa protruded out. Uterine bell 0.29 mm long; uterus along with vagina, 0.58 mm long. Guard cells 5, anteriormost biggest with 6 nuclei. Ova 0.09-0.11 × 0.05-0.08 mm.

Host : *Rana* sp.

Location : Intestine.

Locality : Kabul (Afghanistan).

Distribution : Known only in type locality.

60. ***Acanthocephalus kashmirensis*** Datta, 1936
(Fig. 59)

Acanthocephalus kashmirensis Datta, 1936: 213-216, Textfig. 1, 2; Yamaguti, 1963: 46, Pl. 17, Fig. 166-169; Golvan, 1969: 267-268, Fig. 204 A-D; Anantaraman, M. & Anantraman, S., 1970: 5; Gupta, P. D. & Ghosh, 1979: 312; Gupta, V. & Sinha, 1990b: 45 Golvan, 1994: 136; Bhattacharya, 2007: 121, Pl. 20, Fig. 109 a-d.

Type locality : Station L. 37 in Ladhak, Jammu and Kashmir, India.

Description : Worms dark brown in colour and very stiff. Sexual dimorphism distinct. Males 1.75-8.60 × 0.44-0.99 mm, females 3.48-14.6 × 0.57-1.0 mm. Proboscis long, cylindrical, 1.50 × 0.51 mm, with 13-18 longitudinal rows of 6-8 hooks each, radially and symmetrically arranged. Hooks of anterior rows much stouter than rest, 0.11 × 0.03 mm, basal hooks 0.075 × 0.019 mm. All hooks with wide and pyriform plates embedded in wall of proboscis. Neck short and aspinose. Proboscis receptacle, thick, double-walled, muscular sac, 1.69 × 0.44 mm, with ganglion embedded in its wall near base, giving out nerves to body wall. Trunk long, cylindrical and tapering near posterior end, aspinose. Lacunar system with main channels and canaliculi. Lemnisci 2, equal to or slightly longer than receptacle, 1.276 × 0.22 mm, with a few nuclei embedded in them. Testes a pair, ovoid, subequal, lie one behind other, anterior 1.18 × 0.44 mm; posterior 1.12 × 0.11 mm. Vasa effenentia lead a short distance along side of cement glands, unite into form vas deferens. Cement glands 6, club-shaped, 0.55 mm long, in two groups of 3 each, their ducts join and open at base of penis. Seminal vesicle pear-shaped, 1.18 × 0.48 mm, opens near base of muscular penis. Penis muscular, cone-shaped organ hangs at top of bursa. Saefftigen's pouch 1.18 × 0.48 mm, and cement ducts jointly open at base of cone-shaped, muscular penis. Copulatory bursa 0.59 × 0.39 mm, everted out as funnel shaped organ during

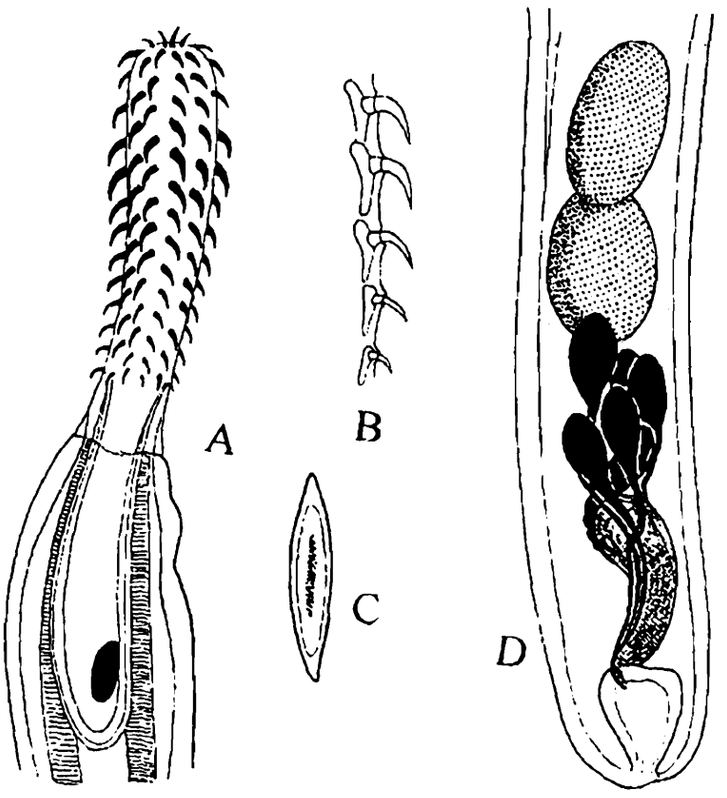


Fig. 59. *Acanthocephalus kashmirensis* Datta, 1936. A. Anterior part of worm, B. Row of proboscis hooks enlarged, C. Egg enlarged, D. Posterior part of male (after Datta, 1936).

mating. Uterine bell funnel-shaped with a few guard cells at its base for sorting out mature ova and allow them to pass into uterus. Uterus thick-walled flabby tube, with a couple of club-shaped cells at its posterior end, open into vagina which in turn ends in vulva opening to exterior postero-ventrally. Ova 0.06 × 0.01 mm.

Host : *Schizopygopsis stoliczkae* Steindachner.

Location : Intestine.

Locality : Station L. 37 in Ladhak (Jammu & Kashmir); Tibet.

Distribution : Known only from type locality.

61. ***Acanthocephalus leithii*** Bilqees, Muti-ur-Rehman & Khan, 2004 (Fig. 60)

Acanthocephalus leithii Bilqees, Muti-ur-Rehman & Khan, 2004.46-48, Fig. 1-3.

Type locality : Karachi, Sindh, Pakistan.

Description : Male 2.35-2.68 × 0.72-0.77 mm. Female 2.56-3.36 × 0.56-1.2 mm, narrower at anterior end and posterior region, greatest width almost at midtrunk.. Proboscis round, small, 0.42-0.59 × 0.19-0.38 mm in male; in female oval to elongate, claviform 0.48-0.86 × 0.29-0.45 mm, with 11-14 longitudinal rows of 14 hooks each in transverse

circle, in female 11-12 longitudinal rows of 14 hooks each, hooks regularly alternated, increase in size from apex to middle and the gradually decrease towards base Hooks of anterior row 0.027-0.03 × 0.006-0.009 mm, middle hooks 0.03 × 0.006 mm, posterior hooks 0.015 × 0.006 mm in male. In female anterior hooks 0.021-0.027 × 0.006 mm, middle hooks 0.03 × 0.006 mm, posterior hooks 0.018-0.021 × 0.003 mm. Proboscis receptacle cylindrical double-walled, 0.45-0.88 × 0.33 mm in male; and in female 0.64-0.88 × 0.26-0.32 mm. Trunk small to medium in size, spindle-shaped or fusiform, thin and smooth. Lemnisci posteriorly swollen, about 0.4-0.49 × 0.1-0.12 mm in male; in female 0.48-0.55 × 0.09 mm. Testis oval to round, in tandem, in midtrunk, anterior 0.08-0.14 mm wide, posterior 0.11-0.13 mm wide. Cement glands 6, long, tubular, connected with each other whole length, 0.32-0.64 mm long, its reservoir 0.08-0.16 × 0.15 mm; Bursa 0.12-0.24 × 0.08-0.13 mm. Ovarian mass 0.21-0.27 × 0.08 mm. Uterine bell 0.08-0.096 × 0.064 mm. Uterus 0.4-0.64 × 0.06 mm. Vagina tubular 0.22-0.32 × 0.048 mm. Vulva 0.015-0.032 mm.

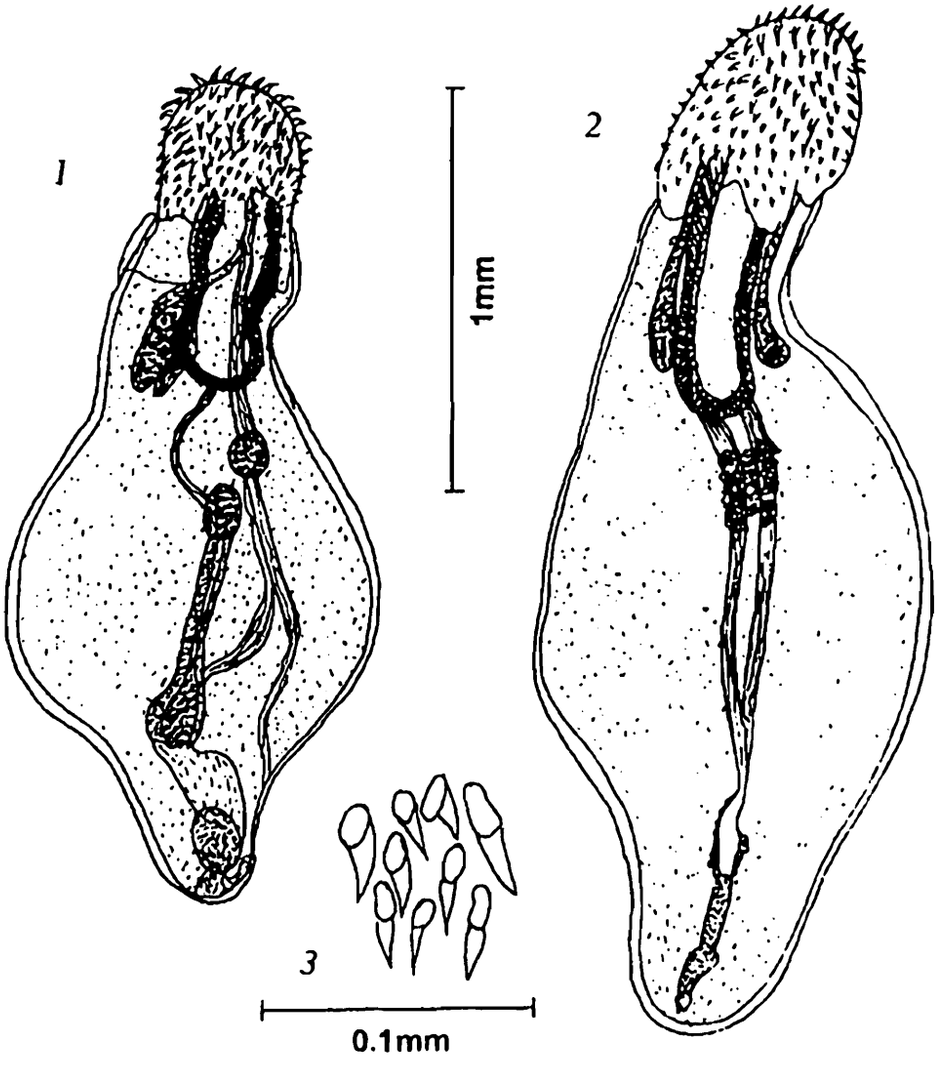


Fig. 60. *Acanthocephalus leithii* Bilqees, Muti-ur-Rahman & Khan, 2004. 1. Male, 2. Female, 3. Proboscis hooks enlarged (after Bilqees, Muti-ur-Rahman & Khan, 2004).

Host : *Psammophis leithii.*

Location : Intestine.

Locality : Karachi, Pakistan.

Distribution : Known only from type locality.

62. ***Acanthocephalus manipurensis*** Bhattacharya, 2007 (Fig. 61)

Acanthocephalus manipurensis Bhattacharya, 2007: 121, P;. 20, Fig. 110 a-e.

Type locality : Manipur.

Description : Worms of medium size ventrally curved, wide anteriorly. Male 7.075-7.375 long, 0.0875-1.125 mm wide. Proboscis cylindrical 0.3-0.375 long, 0.20-0.25 mm wide, with 14-16 longitudinal rows of 5-6 hooks each. Hooks of equal size, 1st hook 0.083-0.099, 2nd hook 0.083-0.099, 3rd hook 0.083-0.099, 4th hook 0.084-0.099, 5th hook

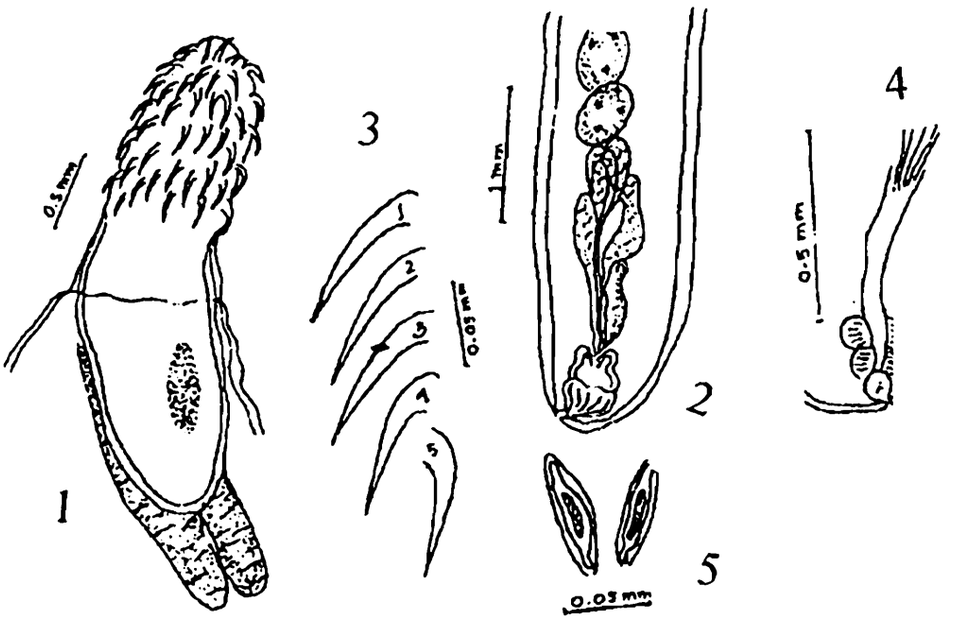


Fig. 61. *Acanthocephalus manipurensis* Bhattacharya, 2007. 1. Anterior part of female, 2. Posterior part of male, 3. Proboscis hooks enlarged, 4. Posterior part of female, 5. Ova. (after Bhattacharya, 2007).

0.083-0,099 mm long. Neck 0.1-0.125 × 0.25-0.30 mm. Proboscis receptacle cylindrical 0.5 × 0.175 mm. Lemnisci longer than proboscis receptacle, equal, leaf[like, 0.95 × 0.175 mm. Testes post-equatorial, contiguous, 0.5-0.675 mm long. Cement glands 6, elongated, compact, 0.4-0.475 × 0.25-0.3 mm. Gonopore ventral. Eggs 0.058-0.066 × 0.0166 mm, elliptical, with polar prolongations of middle shell.

Host : *Bufo* sp.

Location : Intestine.

Locality : Manipur.

Distribution : Known only from type locality.

63. ***Acanthocephalus nickoli*** Khan & Bilqees, 1994
(Fig. 62)

Acanthocephalus nickoli Khan & Bilqees, 1994: 291-298, Fig. 1 A-E, 2-11.

Type locality : Oderolal, Sindh, Pakistan.

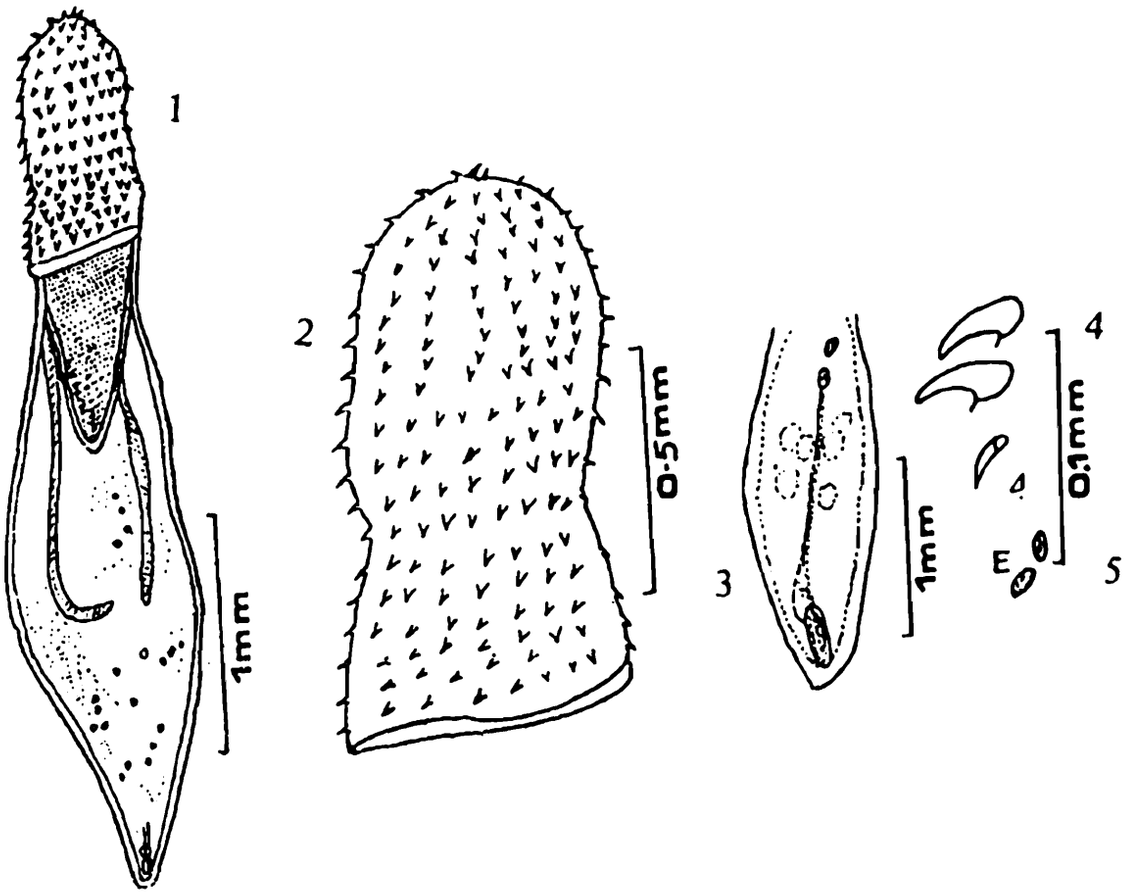


Fig. 62. *Acanthocephalus nickoli* Khan & Bilqees, 1994. 1. Female, 2. Proboscis enlarged, 3. Posterior part of male, 4. Proboscis hooks enlarged, 5. Eggs (after Khan & Bilqees, 1994).

Description : Worms small. Male 1.45-2.64 × 0.33-0.62 mm; female 2.75-2.83 × 0.59-0.71 mm. Proboscis elongated, cylindrical with 16-18 rows of hooks, 0.71-0.86 × 0.31-0.32 mm; with 16-18 rows, first row with 3-6 hooklets while rest with 10-16 hooks each in male; in female proboscis 0.51-0.56 × 0.35-0.37 mm with 16-18 rows of hooks, first row with 3-6 hooklets while rest with 10-16 hooks each. Hooks 0.028-.037 × 0.007-0.010 mm in male; in female 0.028-0.038 × 0.010-0.04 mm. Neck 0.001-0.017 × 0.32-0.39 mm in male; in female 0.054-0.10 × 0.35-0.37 mm. Proboscis receptacle double-walled 0.105-0.26 × 0.098-0.15 mm in male; in female 0.24-0.26 × 0.36-0.37 mm. Lemnisci variable

in size, 1.19-1.88 × 0.11-0.12 mm in both sexes. Testes about equal in size, right 0.066-0.156 × 0.045-0.085 mm, left 0.049-0.134 × 0.042-0.099 mm.. Cement glands 6, ovoid. Bursa 0.36-0.38 × 0.26-0.28 mm. Eggs small 0.010 × 0.007-0.008 mm.

Host : *Rana tigrina* Daudin, 1803.

Location : Small intestine.

Locality : Oderolal, Sindh (Pakistan).

Distribution : Known only from type locality.

64. ***Acanthocephalus serendibensis*** Cruz & Mills, 1970 (Fig. 63)

Acanthocephalus serendibensis Cruz & Mills, 1970 : 14-18, Fig. 1-6; Cruz & Ching, 1975 : 538-542, Fig. 4-8; Breckenbridge & Nathaniel, 1983 : 255-257, Fig. 1; Golvan, 1994 : 136.

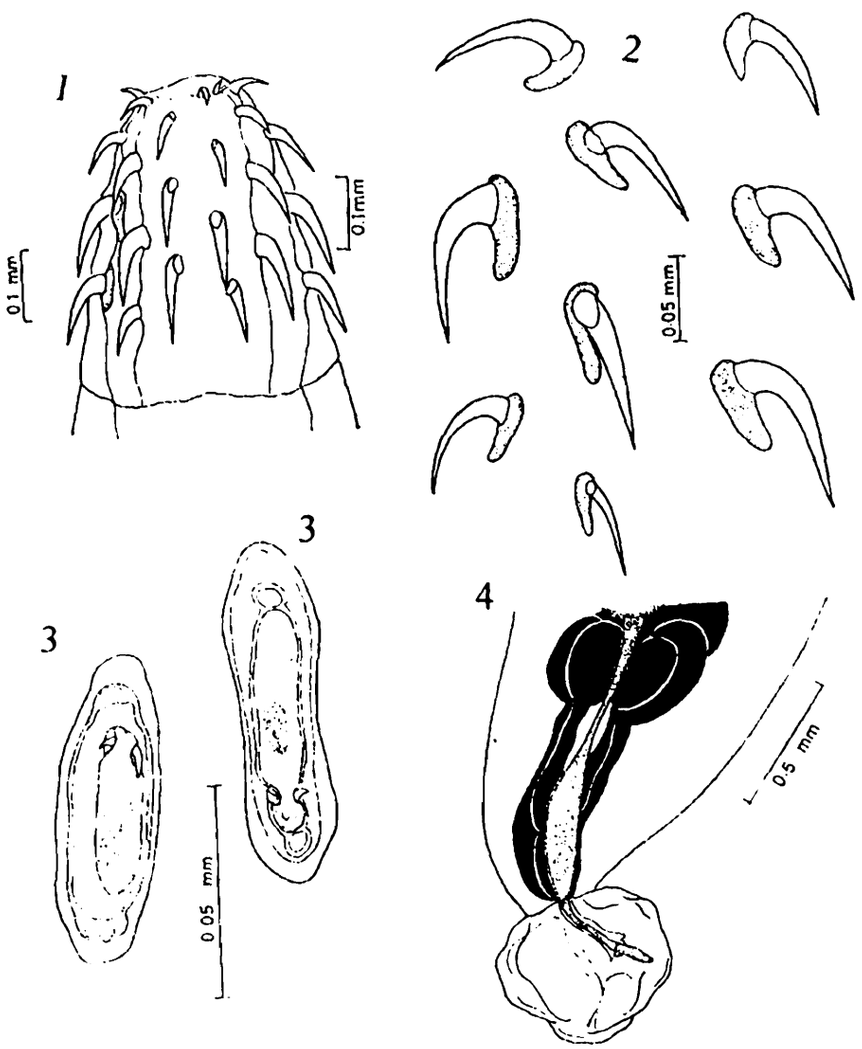


Fig. 63. *Acanthocephalus serendibensis* Cruz & Mills, 1970. 1. Proboscis enlarged, 2. Proboscis hooks enlarged, 3. Ova, 4. Posterior part of male (after Cruz & Mills, 1970).

Type locality : Haptulla estate and Hakgala Strict Natural Reserve, Sri Lamka.

Description : Males 1.14-4.85 × 0.19-1.28 mm. Females 1.86-11.36 × 0.30-2.43 mm. Proboscis 0.123-0.334 × 0.086-0.286 mm in males, in females 0.172-0.318 × 0.124-0.334 mm. Proboscis hooks quincunxially arranged in 10-12 longitudinal rows of 3-4 hooks each, maximum size at third hook, rarely at second or fourth hook. Root of proboscis hook well developed and curved. Proboscis receptacle double-walled, 0.119-0.619 × 0.143-0.280 mm in males, in females 0.20-0.57 × 0.16-0.36 mm. Trunk small, nearly cylindrical. Lemnisci unequal in length, not much longer than proboscis receptacle, left lemniscus 0.152-0.169 × 0.11-0.60 mm, right lemniscus 0.11-0.985 × 0.127-0.206 mm in males; 0.127-0.301 × 0.127-0.301 mm in females. Anterior testis 0.205-0.842 × 0.111-0.566 mm; posterior 0.164-0.746 × 0.103-0.476 mm. Cement glands 6, ovoid, syncytial, with about 8-16 giant nuclei, clustered together behind posterior testis, 0.11-0.18 × 0.07-0.11 mm, 0.04-0.08 mm thick. Each gland continued posteriorly as a long cement duct, ducts arranged in two groups, open into lower part of common sperm duct, after passing Saefftigen's pouch. Copulatory bursa 0.588-0.651 × 0.476-0.572 mm. Female not known.

Host : Gecko, *Cnemsapis kandianus kandianus*; horned lizard, *Ceratophora stoddardi.*

Location : Intestine.

Locality : Haptule estate and Hakgala Strict Natural Reserve, Sri Lanka.

Distribution : Known only from the type locality.

65. ***Acanthocephalus srilankensis*** Cruz & Ching, 1975 (Fig.64)

Acanthocephalus srilankensis Cruz & Ching, 1975 : 542-546, Fig. 9-13; Gplvan, 1994 : 136.

Type locality : Hakgala Strict Natural Reserve, Sri Lanka.

Description : Males 2. 34-3.14 × 0.41-0.7 mm; female 2.76-8.15 × 0.64-1.11 mm. Proboscis 0.20-0.26 × 0.14-0.19 mm in males; in females 0.22-0.31 × 0.16-0.23 mm, with 15-16 longitudinal rows of 4-5 hooks each, hooks steadily increase in size antero-posteriorly or increase in size upto third hook followed by a decrease in size from fourth hook. First hook in males 0.0328-0.0492 × 0.0081-0.0123 mm; second hook 0.0369-0.0647 × 0.0082 mm; third hook 0.0615-0.078 × 0.0164 mm; fourth hook 0.0679-0.0788 × 0.0123-0.0164 mm. First hook in female.00369-0.0492 × 0.0082 mm; second hook 0.053-0.073 × 0.0164 mm; third hook 0.073-0.098 × 0.016-0.205 mm; fourth hook 0.08-0.10 × 0.012-0.016 mm.

Host : *Rhacophorus cruciger eques, R. microtympanus.*

Location : Small intestine.

Locality : Hakgala Strict Natural Reserve and Hortom Plains, Sri Lanka.

Distribution : Known only from type locality.

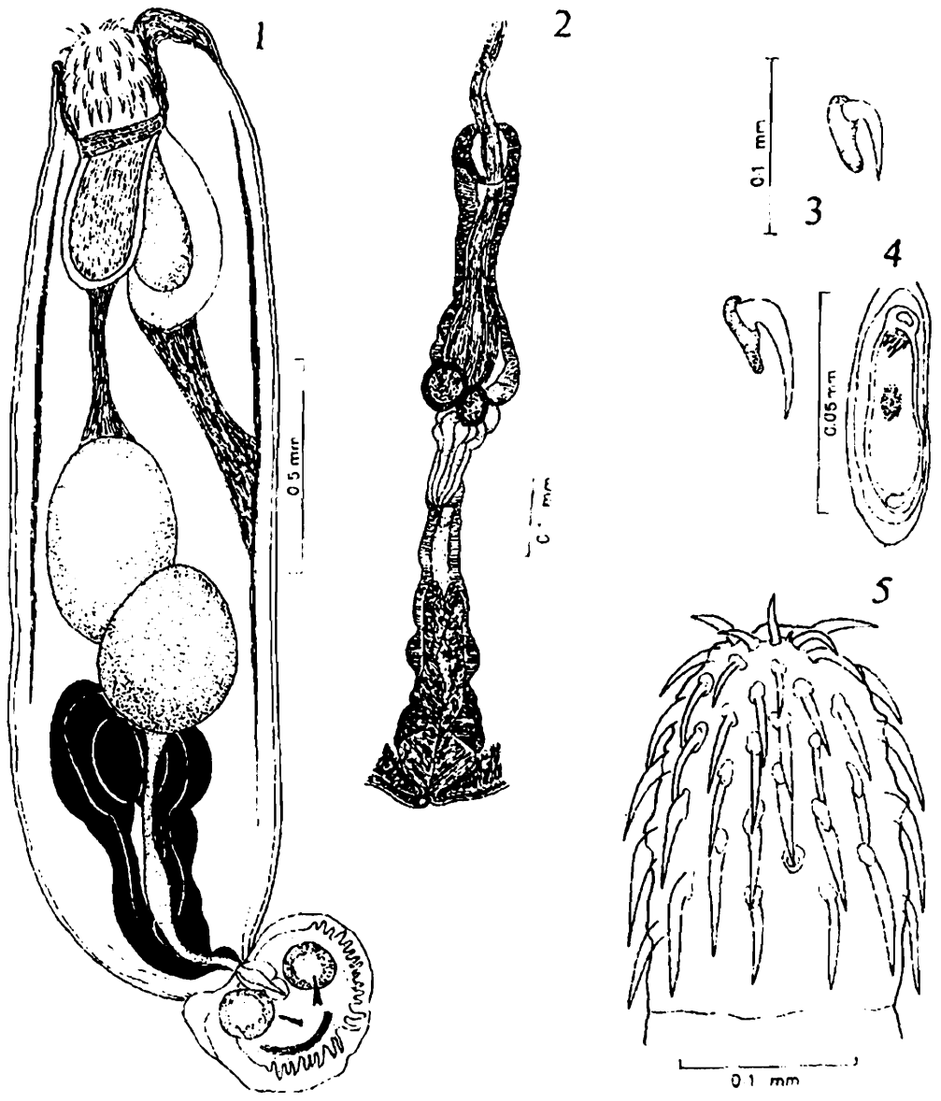


Fig. 64. *Acanthocephalus srilankensis* Cruz & Ching, 1975. 1. Male, 2. Genitalia of female, 3. Proboscis hooks enlarged, 4. Ovum enlarged, 5. Proboscis enlarged (after Cruz & Ching, 1975).

19. Genus ***Echinorhynchus*** Zoega in Müller, 1776

Echinorhynchus Zoega in Müller, 1776 : 214-215; Van Cleave, 1919a : 235-236; Southwell & Macfie, 1925 : 177; Meyer, 1932 : 150;

Pseudoechinorhynchus Petrotschenko, 1956 : 269;

Metaechinorhynchus Petrotschenko, 1956 : 269;

Echinorhynchus Yamaguti, 1963 : 38; Golvan, 1969 : 197-198; 1994 : 145.; Bhattacharya, 2007 : 117-118.

Diagnosis : Echinorhynchidae Echinorhynchinae. Proboscis long, cylindrical, directed ventrad, with 9-26 longitudinal rows of 5-16 hooks each; roots of hooks simple, decrease in size towards base of proboscis where they disappears. Dorsal and ventral hooks dissimilar. Proboscis receptacle cylindrical to claviform, double-walled, with ganglion near its middle.

Trunk small to medium sized, cylindrical swollen anteriorly. Hypodermic nuclei small, numerous. Lacunar system with lateral longitudinal main channels and reticular anastomoses. Lemnisci usually digitiform, claviform longer than receptacle. Testes oval to elliptical, in tandem, contiguous or not, in middle third of trunk. Cement glands 6, more or less compact, spherical, one behind other or close together, arranged in anterior part of trunk. Ova much elongated, fusiform with prominent polar prolongations of middle shell. Gonopore terminal in both sexes. Parasites of fresh water and marine fishes.

Type species : *Echinorhynchus gadi* Zoega in Müller, 1776.

Includes twenty four species, 1. *Echinorhynchus indicus* Chandra, Rao & Shyamasundari, 1982, 2. *E. orientalis* Kaw, 1951, 3. *E. veli* George & Nadakal, 1981, 4. *E. abyssicola* Dollfus, 1931, 5. *E. armoricanus* Golvan, 19—, 6. *E. attenuatus* Linton, 1888 (1890 & 1891), 7. *E. bothinensis* Zdzitowiecki & Valtonen, 1987, 8. *E. brayi* Wayland, Somerville & Gibson, 1999, 9. *E, calloti* Golvan, 1969, 10. *E. canyonensis* Hoffman & Kliever, 1977, 11. *E. cherchiae* Monticelli, 1889, 12. *E. cotti* Yamaguti, 1935, 13. *E. dissimilis* Yamaguti, 1939, 14. *E. ekbaumi* Golvan, 1969, 15. *E. gadi* Zoega in O.F. Müller, 1776, 16. *E. gymnocyprii* Liu Liqing, Wang Baodus & Yang Tso, 1981, 17. *E. hexagrammi* Baeva, 1965, 18. *E. laurentianus* Ronald 1957, 19. *E. longiproboscis* Rodyuk, 1986, 20. *E. lotellae* Yamaguti, 1939, 21. *E. melanoglaeae* Dollfus, 1960, 22. *E. oblitus* Golvan, 1969, 23. *E. trachyrinci* Wayland, Gibson & Somerville, 1997, and 24. *E. vancleavei* Golvan, 1969, of which first three species occur in Indian subcontinent.

Key to Indian species of genus *Echinorhynchus*

1. Proboscis with 16 longitudinal rows of 16 hooks each.... *Echinorhynchus orientalis*
– Proboscis with less than 16 longitudinal rows hooks 2
2. Proboscis with 12 longitudinal rows of 10-14 hooks each .. *Echinorhynchus indicus*
– Proboscis with 12-15 longitudinal rows of 10-14 hooks each.... *Echinorhynchus veli*

66. ***Echinorhynchus indicus*** Chandra, Rao & Shyamasundari, 1982 (Fig. 65)

Echinorhynchus indicus Chandra, Rao & Shyamasundari, 1982a : 255-256, Fig. 1, 2; Gupta & Sinha, 1990b : 49; Golvan, 1994 : 150; Bhattacharya, 2007 : 118, Pl. 20, Fig. 106 a-c.

Type locality : Visakapatnam coast, Andhra Pradesh, India.

Description : Male 3.1-3.5 mm long, 0.7-0.78 mm in maximum width. Proboscis cylindrical, slightly curved ventally, 0.60-0.66 × 0.09-0.093 mm, with 12 longitudinal rows of 16 hooks each, ventral hooks more curved than dorsal hooks. Anterior hooks 0.048 mm long, basal hooks 0.021 mm long. Neck short, naked, almost inserted in anterior trunk, 0.144 mm long. Proboscis receptacle long, cylindrical, double-walled, 0.7-0.72 × 0.0192 mm, with elliptical ganglion lying near its middle. Trunk medium sized, aspinose, with near rounded anterior end, ventrally curved in the form of a comma, narrowing

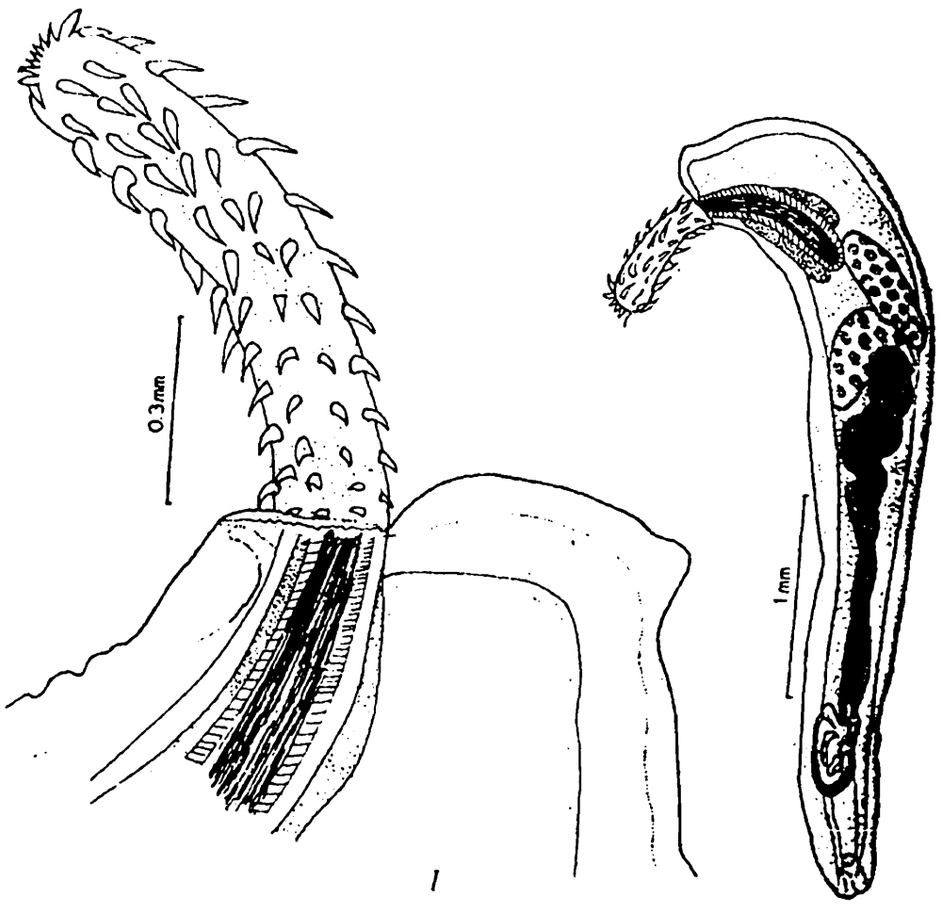


Fig. 65. *Echinorhynchus indicus* Chandra, Rao & Shyamasundari, 1982. 1. Proboscis and neck enlarged, 2. male (after Chandra, Rao & Shyamsundari, 1982).

posteriorly and end bluntly. Lemnisci 2, elongated, 0.90-0.924 × 0.09-0.096 mm. Male genitalia in posterior 4/5 of trunk. Testes 2, in tandem, anterior larger, 0.70-0.74 × 0.3 mm, posterior 0.48-0.552 × 0.268 mm. Cement glands 6, spherical, overlapped, 0.252-0.264 × 0.19-0.23 mm. Vas deferens leads into seminal vesicle. Saefftigen's pouch elongated, club-shaped, 0.9 mm long leads into funnel-shaped copulatory bursa 0.26-0.264 × 0.192 mm. Female not known.

Host : *Pomadasys maculatus* (Bloch.).

Location : Intestine.

Locality : Visakhapatnam coast (Andhra Pradesh).

Distribution : Known only from type locality.

67. ***Echinorhynchus orientalis*** Kaw, 1951
(Fig. 66)

Echinorhynchus orientalis Kaw, 1951 : 118-123, Fig. 1 A-C; Yamaguti, 1963 : 41; Anantaraman, M. & Anantaraman, S., 1970 : 5; Gupta, V. & Sinha, 1990b : 46; Golvan, 1994 : 152; Bhattacharya, 2007 : 118, Pl. 20, Fig. 107 a-c.

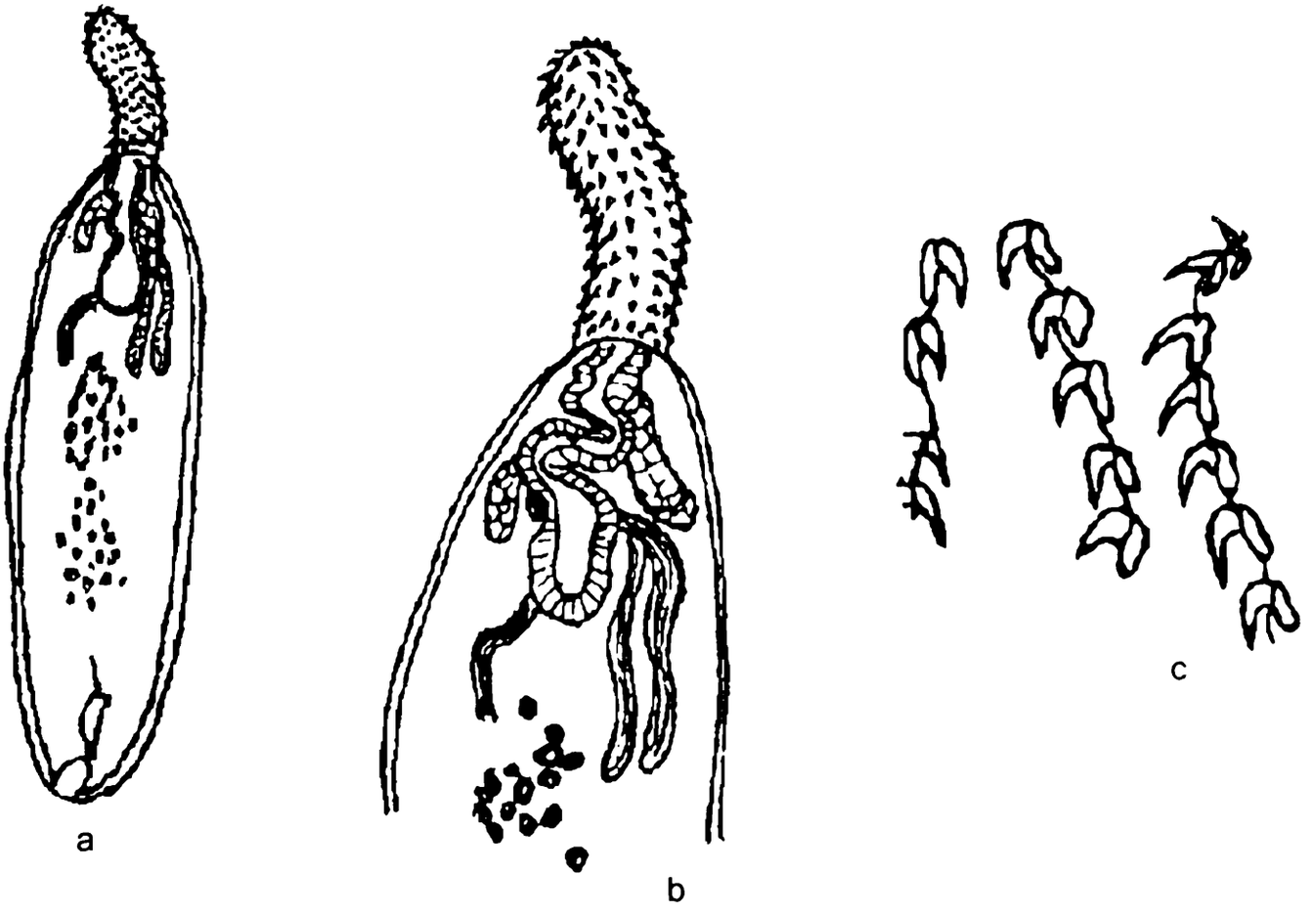


Fig. 66. *Echinorhynchus orientalis* Kaw, 1951. a. female; b. anterior of female; c. proboscis hooks.

Type locality : Dal Lake, Srinagar, Jammu and Kashmir, India.

Description : Female 5.6 mm long. Proboscis elongated, cylindrical, slightly curved, 1.0 × 0.25 mm in female, with 16 longitudinal rows of 16 hooks each. Hooks of alternate rows alternate, largest in middle of proboscis and decrease in size both anteriorly and posteriorly. Roots of hooks single, plate-like and indivisible. In each row, I hook 0.022 mm, root 0.027 mm, increase gradually to 0.07 mm long with root 0.054 in VII hook and gradually decrease in size posteriorly to 0.05 mm long, root of 0.05 mm long in XVI hook. Proboscis receptacle long, double-walled, about ¼ body length greatly coiled, with ganglion in its middle. Trunk elongated, fusiform or subcylindrical, tapering towards both ends. Lacunar system indistinctly represented by two lateral longitudinal channels and a network of intervening transverse canals. Lemnisci 2, pear-shaped, unequal, 0.38 × 0.15 mm and 0.28 × 0.13 mm. Ovary ruptures and releases ovarian balls filling the cavity of trunk, ovarian balls 0.052-0.062 mm in diameter. Uterine bell attached to genital ligament anteriorly and continues into uterus, which measure 0.27 × 0.1 mm. Uterus leads into anterior vaginal funnel with strong sphincter of 0.06 × 0.086 mm. Posterior vaginal bulb 0.15 × 0.07 mm and opens out by genital pore lying subterminally on ventral surface. Eggs elongated and sickle-shaped, 0.112 × 0.009 mm. Male not known.

Host : *Schizothorax* sp.

Location : Intestine.

Locality : Dal Lake, Srinagar (Jammu & Kashmir).

Distribution : Known only from type locality.

68. ***Echinorhynchus veli*** George & Nadakal, 1981
(Fig. 67)

Echinorhynchus veli George & Nadakal, 1978b : 84-86, Fig. 9, 10; 1981: 101; 1985a : 68; 1987a : 75, 78, Fig. 1; 1992 : 297; Golvan, 1994 : 156; Bhattacharya, 2007 : 119, Pl. 20, Fig. 108 a-c.

Type locality : Veli lake near Trivandrum, Kerala, India.

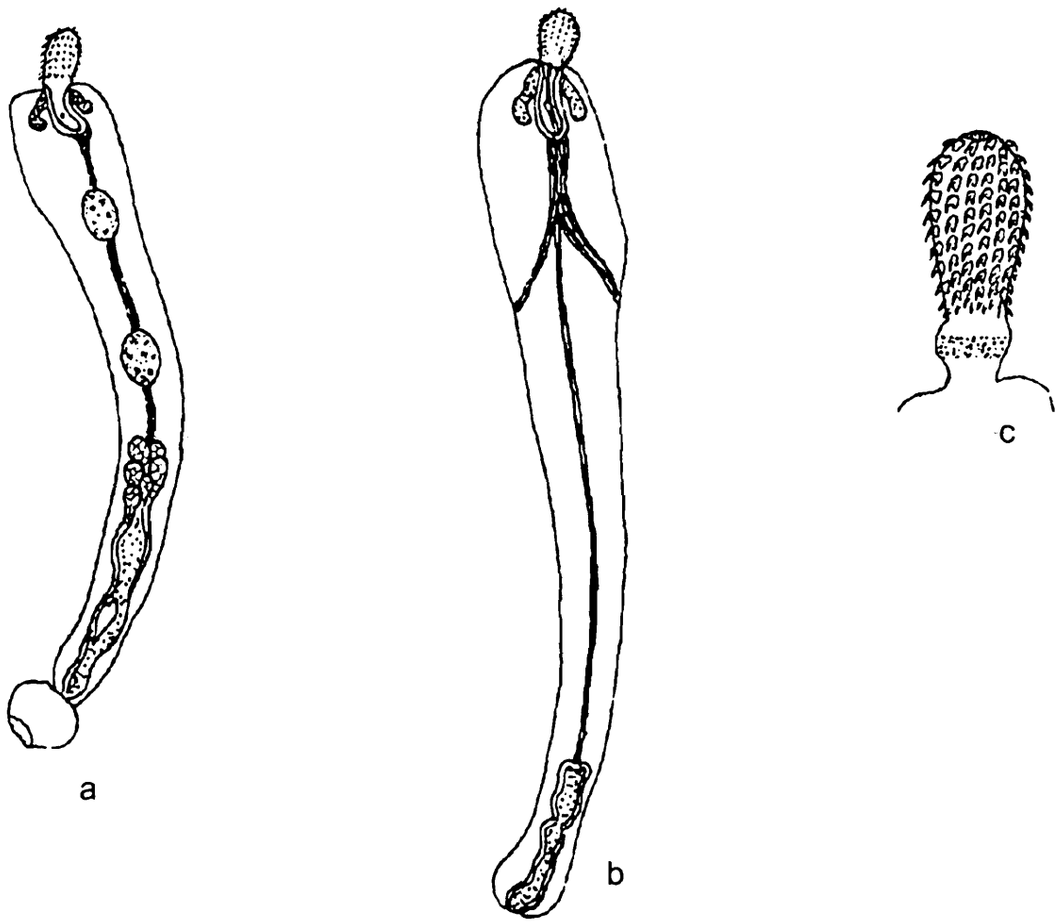


Fig. 67. *Echinorhynchus veli* George & Nadakal, 1981. a. male; b. female; c. proboscis.

Description : Male 6.9 mm long, 0.5-1.5 mm wide at anterior part of trunk; female 7-15 mm long, 1-2 mm wide at anterior end. Proboscis globose or cylindrical, with 12-15 longitudinal rows of 10-14 hooks each, 0.3-0.45 × 0.1-0.25 mm in both sexes. Hooks similar in both sexes, progressively diminish in size towards proboscis base. Basal row of

hooks smaller and spiniform. Anterior, middle and posterior hooks 0.040-0.045 × 0.015-0.25 mm, 0.046-0.95 × 0.016-0.030 mm, 0.030-0.035 × 0.010-0.020 mm. Roots of hooks backwardly directed, 0.020-0.025 × 0.006-0.015 mm. Neck very short 0.2-0.25 × 0.05-0.15 mm in male; in female 0.20-0.25 × 0.10-0.15 mm. Proboscis receptacle cylindrical, double-walled, with ganglion in its middle, 0.56-0.60 × 0.08-0.10 mm in male; in female 0.63-0.7 × 0.2-0.3 mm. Trunk small to medium size, spinose, anterior third enlarged in both sexes and posterior end bulbous in females. Pseudo-segmentation indistinct in both sexes. Lemnisci short, claviform, extending not beyond receptacle, 0.4-0.5 × 0.10-0.2 mm in male; in female 0.4-0.6 × 0.4-0.6 mm. Testes, pre-equatorial, oval to elliptical, in tandem, subequal, contiguous, anterior 0.60-0.71 × 0.30-0.35 mm, posterior 0.45-0.61 × 0.25-0.30 mm. Cement glands 6, pyriform, slightly separated from posterior testis, 0.15-0.18 × 0.12-0.13 mm; its reservoir 0.25-0.30 × 0.20-0.25 mm. Sperm duct and cement ducts pass through bursa and open in penis. Bursa spherical, double-walled, with fringed margin 0.60-0.87 × 0.57-0.96 mm. Uterine bell 0.6-0.75 × 0.2-0.35 mm, post-equatorial, attached to ligament sac, its base surrounded by 8-10 small uterine pockets. Uterus 1.05-1.15 × 0.12-0.16 mm, narrow, tubular. Vagina 0.20-0.25 × 0.26-0.17 mm, bulbous, short. Eggs elliptical or fusiform 0.10-0.15 × 0.02-0.03 mm, with 3-4 membranes, middle with polar prolongations. Embryo with central nuclear mass. Gonopore terminal.

Host : *Synaptura orientalis* (Bloch & Schneider).

Location : Small intestine.

Locality : Veli lake near Trivandrum (Kerala).

Distribution : Known only from type locality.

20. Genus ***Pseudoacanthocephalus*** Petrotschenko, 1958

Pseudoacanthocephalus Petrotschenko, 1958 : 147; Yamaguti, 1963 : 155; Golvan, 1969 : 286-287; 1994 : 176; Bhattacharya, 2007 : 122.

Diagnosis : Echinorhynchidae, Echinorhynchinae. Proboscis almost cylindrical or slightly swollen at middle, its hooks more or less uniform in size, though smaller at base. Trunk fusiform or cylindrical, aspinose, comparatively thick-walled. Lacunar system reticular. Testes close together in midtrunk. Cement glands 6, pyriform or reniform, forming a compact group. Vaginal bulb well developed. Vulva sub-termino-ventral. Eggs oval, without polar prolongations of middle shell. Embryo spied all over. Vulva subterminal-ventral. Parasitic in terrestrial amphibians.

Type species : *Pseudacanthocephalus bufonis* (Shipley, 1903) Petrochenko, 1958.

Includes twelve species, 1. *Pseudoacanthocephalus bufonicola* (Kostylew, 1941) Petrotschenko, 1956, 2. *P. bufonis* (Shipley) Petrotschenko, 1958, 3. *P. crawfordi* Baylis, 1933, 4. *P. golvani* Chandra, Rao & Shyamasundari, 1985, 5. *P. paratiensis* Bhattacharya, 2000: 6. *P. rauscheri* Gupta, V. & Fatima, 1985, 7. P. *shillongensis* Bhattacharya, 1999, 8. *P. betsileo* Golvan, Houin & Brygoo, 1969, 9. *P. bigueti* (Houin, Golvan & Brygoo, 1965) Golvan, 1969, *10. P. caucasicus* (Petrotschenko, 1953) Petrotschenko, 1958119. *P. perthensis* Edmonds, 1971 and 12. *P. xenopeltidis* (Shipley, 1903) Golvan, 1969, of which first seven occur in India.

Key to Indian species of *Pseudoacanthocephalus*

1. Proboscis with different number of longitudinal rows in male and female 2

– Proboscis with same number of longitudinal rows in both sexes 3

2. Proboscis with 12-15 longitudinal rows of 4-6 hooks each in male and 14-16 rows of hooks each in female ..... *Pseudacanthocephalus bufonis*

– Proboscis with 16 longitudinal rows of 4-5 hooks each in male and 16-18 rows of 607 hooks each in female ..... *Pseudacanthocephalus bufonicola*

3. Proboscis with 14 longitudinal rows of 5 hooks each .... *Pseudacanthocephalus shillongensis*

– Proboscis with 20 longitudinal rows of 5 hooks each .... *Pseudacanthocephalus paratiensis*

4. Proboscis with20-22 longitudinal rows of 10-11 hooks each .... *Pseudacanthocephalus rauschi*

Note : *Pseudacanthocephalus crawfordi* Baylis, 1933 and *P. golvani* Chandra, Rao & Shyamasundaris, 1985 are not included in the key.

69. ***Pseudoacanthocephalus bufonicola*** (Kostylew, 1941) Petrotschenko, 1958

Acanthocephalus bufonocola Kostylew, 1941 : 341-345;

Pseudoacanthocephalus bufonicola Petrotschenko, 1958 : 149-150. Fig. 75; Yamaguti, 1963 : 95, Pl. 39, Fig. 396-398; Golvan, 1969 : 295, Fig. 228 A-C; Barus & Tenora, 1976 : 346-349, Fig. 5 A-I;

Acanthocephalus bufonicola, Golvan, 1994 : 176.

Type locality : Tadijkstan, Central Asia.

Description : Worms small to medium, whitish in colour. Male 3.5-5.22 × 0.95-1.37 mm; females 6.5-10.7 × 1.12-2.95 mm. Proboscis rounded at apex, without spines at terminal part, 0.42-0.56 mm long, 0.20-0.27 mm wide anteriorly and 0.31-0.35 mm wide in posterior part in males; in females 0.62-0.74 mm long, 0.34-0.38 mm wide anteriorly, 0.40-0.49 mm wide in posterior part. Proboscis hooks in 16 longitudinal rows of 5 hooks each in males and 16-18 longitudinal rows of 6-7 hooks each in females. Hooks start from anterior part of proboscis, whose blades in hook 1 : 0.074 mm, root 0.066 mm, hook 2 : 0.07 mm, root 0.066 mm; hook 3 : 0.081 mm, root 0.074 mm; hook 4 : 0.081 mm, root 0.051 mm etc. in males; in females hook 1 : 0.074 mm, root 0.051 mm, hook 2 : 0.081 mm, root 0.066 mm, hook 3 : 0.081 mm, root 0.077 mm, hook 4 : 0.088-0.090, root 0.074 mm, root 0.051 mm, hook 5 : 0.088-0.092 mm, root 0.074 mm, hook 6 : 0.090-0.092 mm, root 0.074 mm, hook 7 : 0.074-0.081 mm, root 0.059 mm. Proboscis receptacle sacciform, 0.61-0.78 × 0.25-0.38 mm in males, in females 0.98-1.22 × 0.50-0.59 mm, with basal ganglion. Trunk massive, fusiform. Lemnisci 0.87-1.12 × 0.24-0.31 mm in males; in females 1.2-1.68 ×,0.31-0.35 mm. Testes spherical to slightly ellipsoid, located in middle third of trunk, anterior 0.49 × 0.48 mm, posterior 0.49 × 0.59 mm. Cement glands 6, lie at a small distance behind testes, about 1.71 mm from posterior end of trunk. Eggs markedly elliptical, 0.063-0.067 × 0.023-0.025 mm.

Host : *Rana rudibanda, Bufo viridis.*

Location : Small intestine.

Locality : Vicinity of Kabul, Afghanistan.

Distribution : Russia, Tadjikstan, Central Asia, Eastern Europe.

70. ***Pseudoacanthocephalus bufonis*** (Shipley, 1903) Petrotschenko, 1958 (Fig. 69)

Echinorhynchus bufonis Shipley, 1903 : 145-156,

Acanthocephalus bufonis, Meyer, 1932 : 146-147;

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958 : 147-149, Fig. 74; Yamaguti, 1963 : 155, Pl. 75, Fig. 769, 770; Golvan, 1969 : 287, 291, Fig. 223 A, B, 224 A-C, 225 A-D;

Acanthocephalus bufonis, Yuem & Fernando, 1970: 91-93, Fig. 1; Jain & Gupta, N. K. 1981a : 175, Fig. 6-10; Kennedy, 1982 : 357-360, Fig. 1-6; Golvan, 1994 : 176.

Type locality : Hong Kong.

Description : Male 5.29-9.38 × 0.98-1.51 mm, females 11.5-16.1 × 1.13-2.10 mm. Proboscis 0.31-0.44 × 0.17-0.31 mm, with 12-15 longitudinal rows of 4-6 hooks each in male and in female 14 or 15 rows of 4-6 hooks each. Last hook in each row smaller than preceding ones, which are equal in size. Thorns 0.059-0.093 mm long, root 0.035-0.059

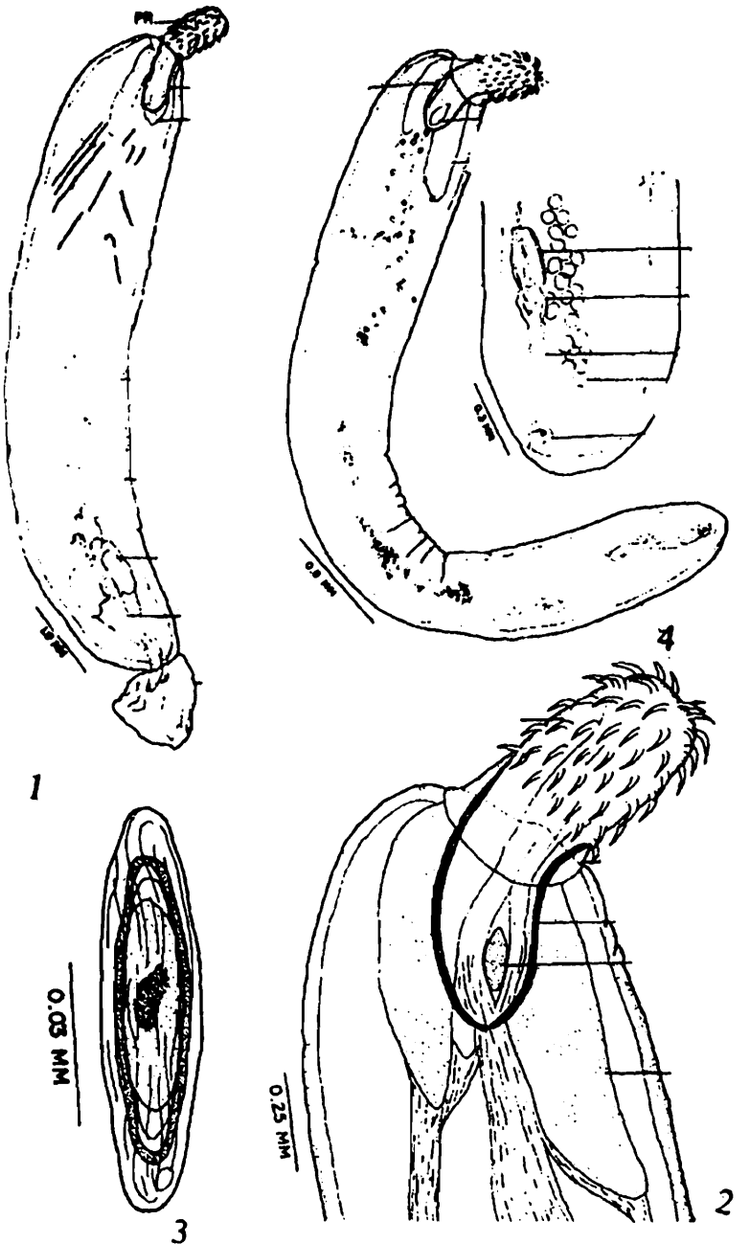


Fig. 69. *Pseudacanthocephalus bufonis* (Shipley, 1903) Petrochenko, 1958. 1. Male, 2. Female, 3. Ovum, 4. Proboscis and trunk enlarged (after Golvan, 1969).

mm wide, for shorter hook; for larger hooks 0.078-0.111 mm long, root 0.062-0.074 mm long. Last hook in a row smallest, blade 0.059-0.093 mm long, root 0.035-0.059 mm long, blade of larger hooks 0.078-0.111 mm long, root 0.062-0.074 mm long in male. In females 0.33-0.54 × 0.22-0.33 mm, with 14-15 longitudinal rows of 4-6 hooks each, last hook in a row smallest, with blade 0.048-0.078 mm long, root 0.041-0.052 mm long, blade of largest hook 0.085-0.11 mm long, root 0.056-0.074 mm. Proboscis receptacle double-walled, 0.065-0.90 × 0.19-0.35 mm in males; in females 0.88-1.10 × 0.31-0.53 mm. Trunk elongate, widest at anterior end, gradually tapering toward posterior end. Lemnisci short, 0.74-1.32 × 0.15-0.22 mm in males; in females1.16-1.7 × 0.10-0.41 mm. Testes elliptical, subequal, in tandem, in middle third of trunk, anterior 0.47-0.79 × 0.31-

0.53 mm, posterior 0.54-0.72 × 0.28-0.50 mm. Seminal vesicle 0.90 × 0.10 mm. Cement glands 6, filiform, in three groups of two each. Uterus 0.60 × 0.104 mm. Vagina 0.16 mm long. Eggs 0.078-0.089 mm long. Acanthor holoechinate with 4 membranes, 0.078-0.089 × 0.024-0.029 mm. A thin membrane closely applied to acanthor. Outside this and separated by a space with fibrous layer is thick shell. Vulva subterminal.

Host : *Bufo melanostictus* (Schneider), *Bufo* sp., *Rana crancvora.*

Further hosts : *Rana chalconta, R. erythrea, R. macrodon, R. tigrina regulosa,Bufo asper, Kaloula palora* from Srilanka, India, Malayasia and China.

Location : Intestine.

Locality : Port Blair (Andaman & Nicobar Islands).

Distribution : China, Japan, Indonesia, Malayasia; Thailand in Asia; Russia Europe.

71. ***Pseudoacanthocephalus crawfordi*** Baylis 1933

Pseudoacanthocephalus crawfordi Baylis, 1933 : 443-449; Ahluwalia, 1959 : 100-107; Golvan, 1994 : 176.

Description : Publiction containing the description and figures of this species could not be procured.

Host :

Locality : Western Uttar Pradesh;

Distribution :

72. ***Pseudoacanthocephalus paratiensis*** Bhattacharya, 2000 (Fig. 70)

Pseudoacanthocephalus paratiensis Bhattacharya, 2000 : 145, Fig. 1 1-c; 2007 : Pl. 21, Fig. 113 a-c.

Type locality : Paratia, Tripura, India.

Description : Female cylindrical 18.5 × 2.25 mm. Proboscis cylindrical 0.625 × 0.45 mm, with 20 longitudinal rows of 5 hooks each, hooksalmost equal in size, roots with anterior tip bulged, points of hooks 0.0913 mm, roots 0.064 mm long. Proboscis receptacle double-walled, 1.125 × 0.5 mm with basal ganglion. Lemnisci equal, leaf-like, 1.026 × 0.375 mm, longer than receptacle. Uterine bell 0.625 mm long. Vagina 0.125 mm long. Gonopore terminal. Eggs oval without polar prolongations of middle shell.

Host : *Bufo melanostictus.*

Location : Intestine.

Locality : Paratia (Tripura).

Distribution : Known only from type locality.

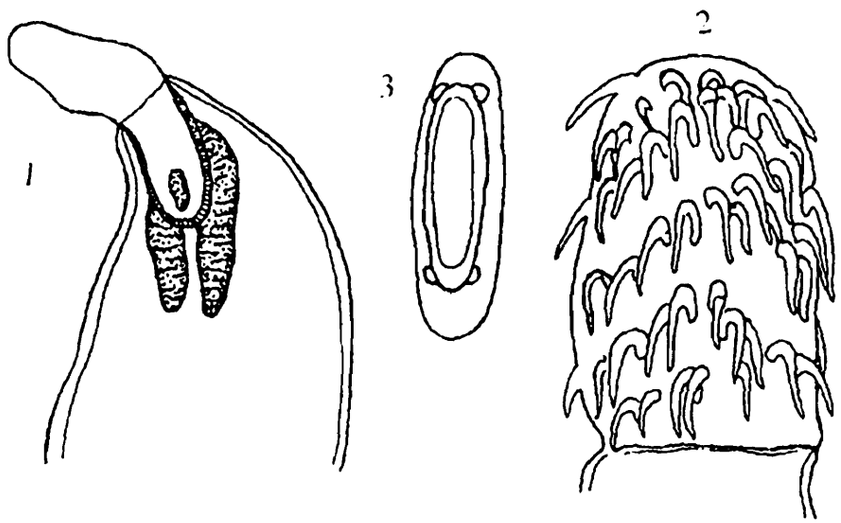


Fig. 70. *Pseudacanthocephalus paratiensis* Bhattacharya, 2000. 1. Anterior part of worm, 2. Proboscis enlarged, 3. Ovum enlarged (after Bhattacharya, 2000).

73. ***Pseudoacanthocephalus rauschi*** Gupta, V. & Fatma, 1986 (Fig. 71)

Pseudoacanthocephalus rauschi Gupta, V. & Fatma, 1986a: 144-146, Pl. 3, Fig. 1-3; Golvan, 1994: 176; Bhattacharya, 2007: 122-123, Pl. 21, Fig. 112 a-c.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 5.15-6.35 × 0.82-0.88 mm; female 8.22-10.20 × 0.94-0.96 mm. Proboscis spherical, 0.51-0.72 × 0.51-0.61 mm, with 20-22 longitudinal rows of 10-11 hooks each, hooks from anterior proboscis to middle 0.05-0.052 mm long, from middle to base 0.03-0.04 mm long in males; in female 0.70-0.85 × 0.90-0.92 mm, armed with 20-22 longitudinal rows of 10-11 hooks each, hooks of anterior proboscis 0.048-0.135 × 0.036-0.042 mm up to base. Hooks with a long blade and simple backwardly directed root. Proboscis receptacle long, cylindrical, double-walled, 1.62-1.65 × 0.43-0.51 mm in males; in females 1.62-2.0 × 0.34-0.40 mm, with ganglion at its middle in both sexes. Trunk elongated, cylindrical, aspinose, thick-walled. Lacunar system with reticular anastomoses. Hypodermic nuclei small, numerous, evenly distributed. Lemnisci elongated, equal, larger than receptacle, extending far beyond anterior testis, 1.8-2.40 × 0.15-0.18 mm in males; in females 1.72-2.20 × 0.034-0.40 mm. Testis ovoid, in tandem, overlapping, subequal, equatorial, anterior 0.24-0.42 × 0.42-0.45 mm, posterior testis larger, 0.30-0.45 × 0.40-0.45 mm. Cement glands 8, pyriform, one behind other, 0.91-1.45 × 0.12-0.5 mm. Seminal vesicle pyriform, 0.46-0.50 × 0.12-0.15 mm. Bursa eversible, muscular, 0.22-0.30 × 0.15-0.20 mm. Uterine bell funnel-shaped, 0.35-0.43 mm long followed by a muscular vagina, 0.24-0.25 mm long. Gonopore terminal in both sexes.

Host : *Rana tigrina* Daudin.

Location : Intestine.

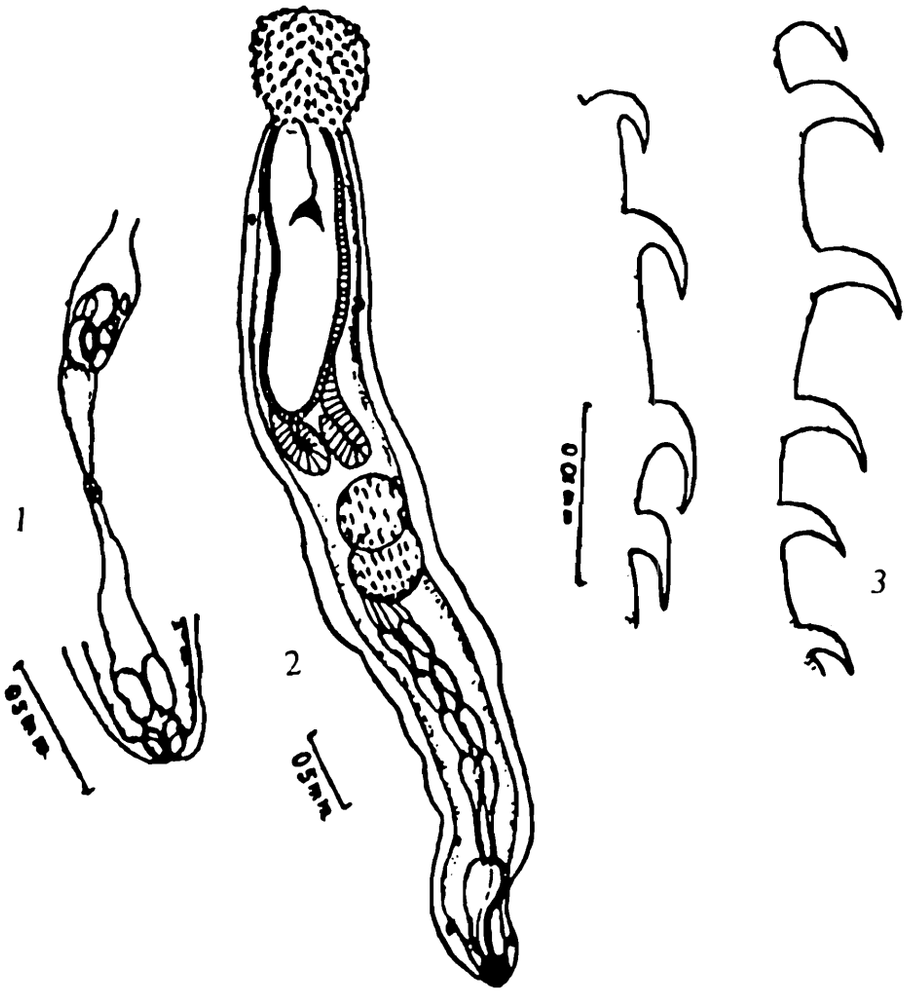


Fig. 71. *Pseudacanthocephalus rauschi* Gupta, V. & Fatma, 1986. 1. Female genitalia, 2. Male, 3. Rows of proboscis hooks enlarged (after Gupta, V. & Fatma, 1985).

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

74. ***Pseudoacanthocephalus shillongensis*** Bhattacharya, 1999

Pseudoacanthocephalus shillongensis Bhattacharya, 1999: 376-377, fig. Pl.. 7; 2000: 145, 148, Fig. 2 a-d; 2003: 71-72; 2007: 122, Pl. 21, Fig. 111 a-d.

Type locality : Shillong, Meghalaya, India.

Description : Male 6.0-9.75 × 1.0-1.75 mm. Female 8.625 × 2.125 mm Proboscis 0.325-0.4 × 0.25-0.325 mm, with14 longitudinal rows of 5 hooks each, about in size and with roots, points larger than roots. Points of hooks 0.084-0.09 mm, roots 0.04-0.05 mm long, similar in both sexes. Neck very short. Lemnisci keaf-like longer than receptacle. Testes post-equatorial, 2.05 × 0.375 mm. Cement glands six. Gonopore subterminal. Uterine bell 0.656 mm long. Eggs oval, 0.07 × 0.024 mm, without polar prolongations of middle shell.Gonopore subterminal in female.

Host : *Bufo melanostictus, Bufo* Sp.

Location : Intestine.

Locality : Shillong (Meghalaya); Melli bazar (Sikkim); Manu (Tripura).

Distribution : Known only from type locality.

21. Genus ***Frilloechinorhynchus*** Bhattacharya, 2007

Echinorhynchoides Gupta, S.P. & Naqvi, 1986 :

Frilloechinorhynchus Bhattacharya, 2007 : 123.

Diagnosis : Echinorhychidae, Echinorhynchinae. Trunk almost cylindrical, elongated, spinose, with numerous small hypodermal nuclei, lacunar system with lateral channels and reticular anastomoses. Proboscis ovoid or subcylindrical with 18-20 longitudinal rows of 5-6 hooks each. Hooks largest at subapical part becoming abruptly small at base with simple roots. Neck small. Proboscis receptacle saccate or subcylindrical, double-walled with ganglion slightly anterior to base. Lemnisci two, very small, frilled 1/3 to ¼ of length of proboscis receptacle. Testes oval or elliptical in tandem or separate or contiguous, pre-equatorial. Cement glands 6, pyriform or claviform, one behind other or close together. Bursa without rays or papillae. Vagina surrounded by muscular bands. Eggs fusiform with polar prolongations of middle shell membrane. Gonopore terminal in male and subterminal in female. Parasites of marine fishes.

Type species : *Frilloechinorhynchus meyeri* (Gupta, S.P. & Naqvi, 1986) Bhattacharya, 2007. 76.

75. ***Frilloechinorhynchus meyeri*** (Gupta, S.P. & Naqvi, 1986) Bhattacharya, 2007 (Fig. 72)

Echinorhynchoides meyeri Gupta, S.P. & Naqvi, 1984 : 69-73, Pl. 4, Fig. 1-6; Gupta, V. & Sinha, 1990b : 52; Golvan, 1994 : 145.

Frilloechinorhynchus meyeri (Gupta, S.P. & Naqvi, 1986) Bhattacharya, 2007 : 125.

Type locality : Ernakulam, Kerala, India.

Description : Male 5.88-8.60 × 0.54-1.05 mm; female 3.01-12.92 × 0.62-1.25 mm. Proboscis short, ovoid to subcylindrical, in line with body axis, with 8-19 longitudinal rows of 5-6 hooks each in male; in female 8-20 longitudinal rows of 5-6 hooks each. Largest hooks at subapical part of proboscis, becoming abruptly small at base with simple roots. Proboscis 0.17-0.32 × 0.23-0.27 mm in male with hooks of apical part 0.026-0l930 mm long, of subapical hooks 0.034-0.037 mm long, of basal hooks 0.019-0.022 mm long in male; in female 0.27-0.34 × 0.23-0.28 mm, apical hooks 0.029-0.033 mm long, subapical hooks 0.036-0.041 mm long, basal hooks 0.020-0.024 mm long. Neck small, 0.10-0.30 × 0.15-0.25 mm in male; in female 0.07-0.13 × 0.18-0.24 0.24-0.70 mm. Trunk spinose, elongated, cylindrical, small to medium size, curved ventrally, wide anterior and gradually

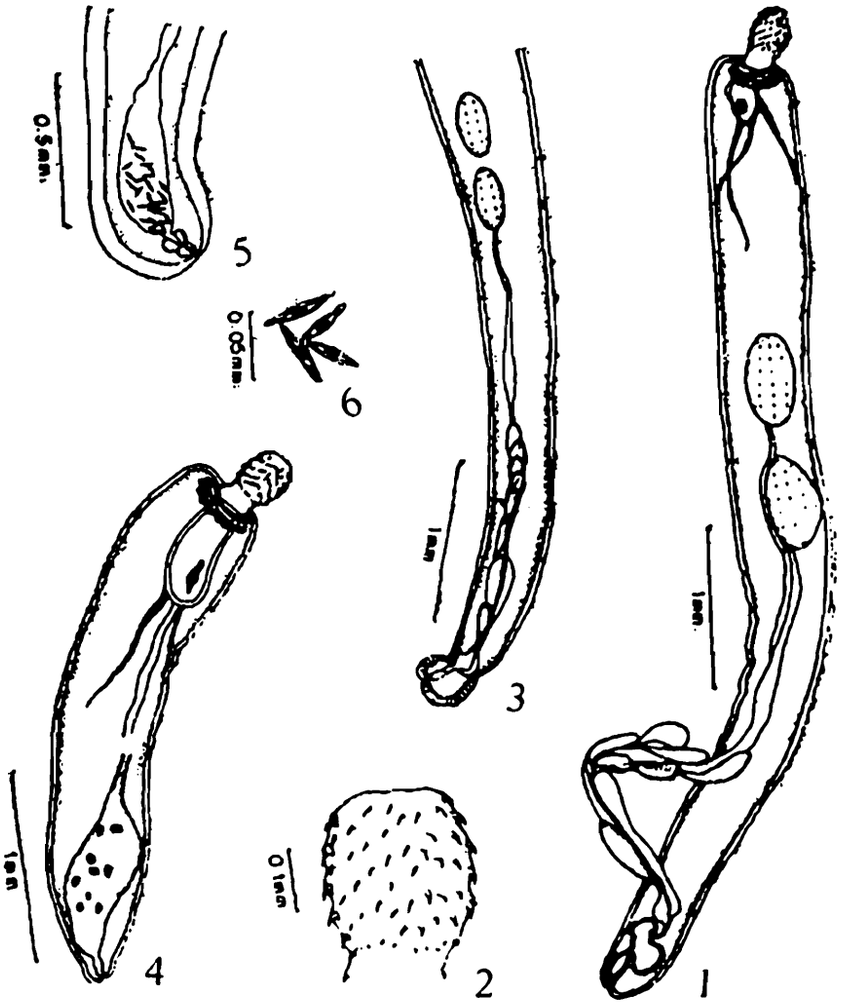


Fig. 72. *Frilloechinorhynchus meyeri* (Gupta, S.P. & Naqvi, 1986). Bhattacharya, 2007. 1. Male, 2. Proboscis enlarged, 3. Posterior end of male, 4. Female, 5. Posterior part of female, 6. Eggs (after Gupta, S.P. Naqvi, 1984).

tapering posteriorly, 5.52-8.13 × 0.45-1.05 mm in male; in female 2.64-12.45 × 0.62-1.25 mm. Hypodermal nuclei very small, numerous. Lacunar system with lateral main channels and reticular anastomoses. Lemnisci 2, equal, frilled, short, 1/3-1/4 length of receptacle, in male 0.09-0.18 × 0.33-0.46 mm; in female 0.13-0.20 × 0.33-0.62 mm. Testes oval to elliptical, equal or subequal, pre-equatorial or equatorial, contiguous or separate, anterior 0.42-0.78 × 0.20-0.43 mm, posterior 0.42-0.69 × 0.19-0.39 mm. Cement glands 6, pyriform or claviform, one behind other or close together, 0.24-0.86 × 0.06-0.13 mm. Saefftigen's pouch pyriform, 0.46-0.86 × 0.14-0.16 mm. Seminal vesicle pyriform, 0.38-0.54 × 0.11-0.30 mm. Bursa muscular without rays, 0.28-0.58 × 0.32-0.59 mm. Uterine bell funnel-shaped, opening into uterus, 0.31-0.47 × 0.11-0.15 mm. Vagina 0.09-0.12 × 0.01-0.02 mm with muscular bands. Eggs fusiform with prominent polar prolongations of middle shell, 0.02-0.05 × 0.01-0.02 mm. Gonopore terminal in male and subtermibal in female.

Host : *Synaptura orientalis* (Bloch & Schnider).

Location : Intestine and body cavity.

Locality : Ernakulam (Kerala).

Distribution : Known only from type locality.

Subfamily CIRCINATECHINORHYNCHINAE Bhattacharya, 2007

Circinatechinorhynchinae Bhattacharya, 2007 : 125.

Diagnosis : Echinorhynchidae. Trunk spinose, medium, subcylindrical, anterior part wide, hypodermal nuclei small and fewer large and many. Lacunar system with main lateral channels with reticular anastomoses. Proboscis spheroidal or subcylindrical, with hooks of uniform size and with roots. Basal rows of hooks much reduced. Proboscis receptacle double-walled with middle or basal ganglion. Lemnisci a compact mass, circinate or ring- like, encircle junction of proboscis and proboscis receptacle. Free ends of lemniscus stretches with the eversion of proboscis and during invagination frilled end folds to form a compact ring around the junction of proboscis and receptacle. Usual type of lemnisci absent. Testes usually in middle or post-equatorial. Cement glands 6, spherical or pyriform. Eggs elliptical with prominent polar prolongations of middle shell. Parasites of marine fish (Pleuronectiformes).

Type genus : *Circinatechinorhynchus* Bhattacharya, 2007.

22. Genus ***Circinatechinorhynchus*** Bhattacharya, 2007

Circinatechinorhynchus Bhattacharya, 2007 : 125.

Diagnosis : Same as subfamily diagnosis.

Type species : *Circinatechnorhynchus pseudorhombi* Bhattacharya, 2007.

76. ***Circinatechinorhynchus pseudorhombi*** Bhattacharya, 2007 (Fig. 73)

Circinatechinorhynchus pseudorhombi Bhattacharya, 2007: 126-127, Pl. 21, Fig. 114 a-e.

Type locality : Mangalore, Karnataka, India.

Description : Male 7.25-12.35 × 1.00-1.25 mm. Female 13.175-17.5 × 1.0-1.5 mm. Proboscis ovoid or subcylindrical, slightly curved ventrad posteriorly, 0.325-0.425 × 0.426- × 0.274-0.325 mm, with 14-18 longitudinal rows of 7-8 hooks each, with slight variation in size of hooks, hooks with strong roots, last row of hooks much reduced, length of points and roots almost equal, points of apical hooks 0.02-0.022 mm, roots 0.02-0.022 mm subapical hooks 0.024-0.03 mm, roots 0.03-0.032 mm, points of last row hooks 0.014-0.016mm. Neck 0.124-0.166 × 0.182-0.21 mm. Proboscis receptacle double-walled, 0.725 × 0.375 mm, in male and in female 1.00-1.25 × 0.35-0.375 mm, with basal ganglion. Trunk medium sized, aspinose anterior part wide, with 3-4 hypodermal nuclei. Lemnisci compact glandular mass, circinate or ring-like encircling the junction of proboscis and receptacle, 0.35-0.40 × 0.50-0.55 mm when proboscis is protruded. Free ends of lemnisci

stretches with eversion of proboscis and during invagination the frilled end folds to form a compact ring around junction of proboscis and receptacle. Usual type lemnisci absent, Testes equatorial, anterior testis slightly pre-equatorial 1.00-1.2 × 0.50-0.55 mm, posterior testis 1.25-1.30 × 0.50-0.55 mm. Cement glands 6, pyriform or spheroidal, arranged irregularly, with single nucleus in each gland. Uterus 2.25-2.50 mm long. Eggs thinly elliptical with prominent polar prolongations of middle shell membrane, 0.057-0.07 mm long. Gonopore terminal in male and subterminal in female.

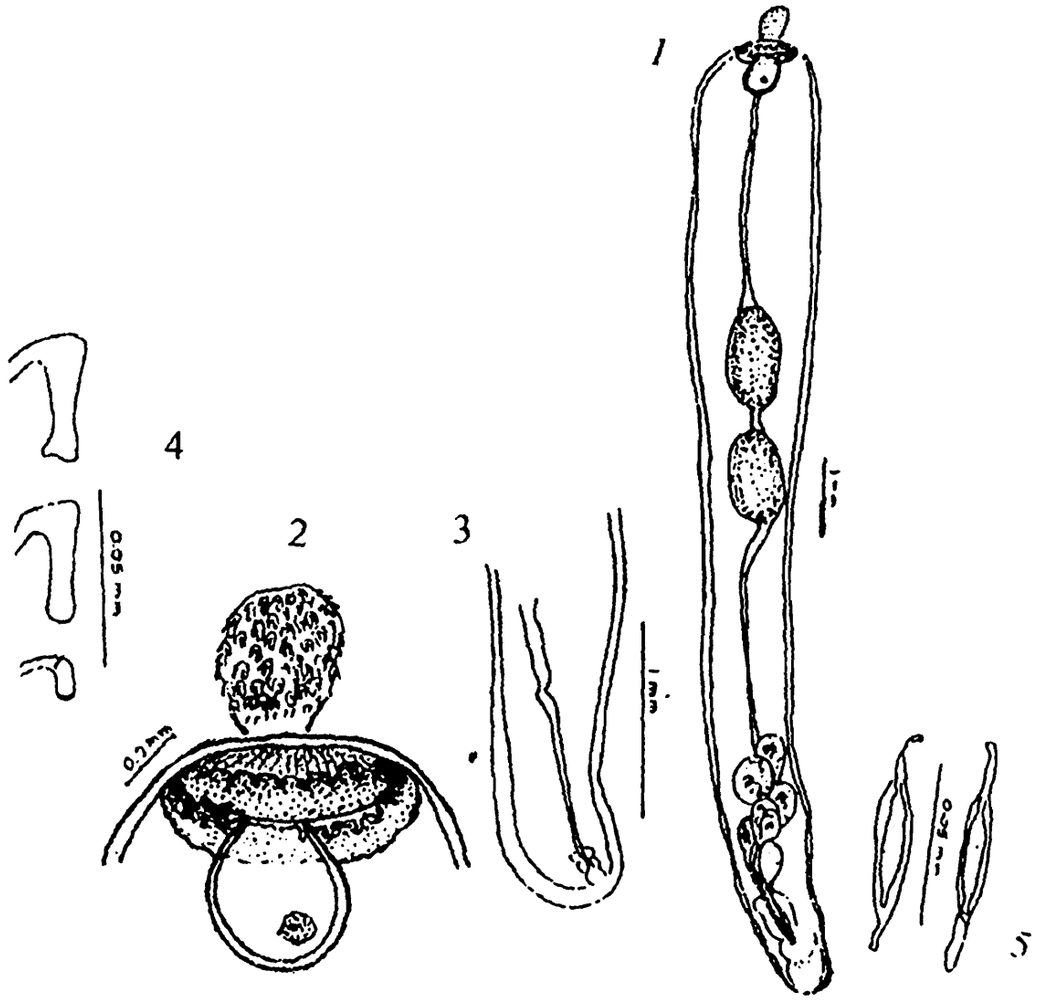


Fig. 73. *Circinatechinorhynchus pseudorhombi* Bhattacharya, 2007. 1. Male, 2. Proboscis with circinate (ring like) type of lemnisci, 3. Posterior part of female, 4. Proboscis hooks enlarged, 5. Ova enlarged (after Bhattacharya, 2007).

Host : *Pseudorhombus artus, Synaptura* sp., *Solea* sp.

Location : Intestine.

Locality : Mangalore (Karnataka).

Distribution : Known only from type locality.

Subfamily YAMAGUTISENTINAE Golvan, 1969

Yamagutisentinae Golvan, 1969 : 194; Bhattacharya, 2007 : 118.

Diagnosis : Echinorhynchida, Echinorhynchidae, Echinorhynchinae. Proboscis relatively large with a number of longitudinal rows of hooks, anterior hooks large, basal hooks spinose. Trunk fusiform tapering to both ends, spinose or aspinose. Testes ovoid. Cement glands 6, in pairs. Eggs without polar prolongations of middle shell.

Type genus : *Yamagutisentis* Golvan, 1969.

Includes only one genus *Yamagutisentis* Golvan, 1969, which occurs in this subcontinent.

23. Genus ***Yamagutisentis*** Golvan, 1969

Yamagutisentis Golvan, 1969 : 195; Golvan, 1994 : 180; Bhattacharya, 2007 : 116.

Diagnosis : Proboscis club-shaped or cylindrical with 14-22 longitudinal rows of 10-18 hooks each. Proboscis receptacle elongated cylindrical or claviform, with ganglion at its base. Trunk fusiform tapering to both ends, anterior part spinose or aspinose. Lemnisci longer or shorter than receptacle. Testes oval, spherical or elongated, equatorial or post-equatorial. Cement glands 6, pyriform, ovoid, spherical or elliptical, disposed of in pairs. Saefftifen's pouch well developed. Eggs with polar prolongations of middle shell. Gonopore terminal both sexes.

Type species : *Yamagutisentis neobythitis* (Yamaguti, 1935) Golvan, 1969.

Includes five species, 1. *Yamagutisentis cochinensis* (Gupta, S.P. & Naqvi, 1983) Kumar, 1992, 2. *Y. mujibi* (Gupta, S.P. & Naqvi, 1983) Kumar, 1992, 3. *Y. nickoli* Kumar, 1992, 4. *Y. rhinoplagusiae* (Yamaguti, 1935) Golvan, 1969, 5. *Y. neobythitis* (Yamaguti, 1939) Golvan, 1969, of which first four occur in this subcontinent.

Key to India species of genus *Yamagutisentis*

1. Proboscis with 14 longitudinal rows of 10 hooks each ..... *Yamagutisentis rhinoplagusiae*

– Proboscis armed with more than 14 longitudinal rows of hooks 2

2. Proboscis with 20-22 longitudinal rows of 15-17 hooks each ..... *Yamagutisentis cochinensis*

– Proboscis with less than 19 rows of hooks each 3

3. Proboscis with 16-18 longitudinal rows of 17-18 hooks each ..... *Yamagutisentis mujibi*

– Proboscis with 18 longitudinal rows of 14 hooks each ..... *Yamagutisentis nikoli*

77. ***Yamagutisentis cochinensis*** (Gupta, S.P. & Naqvi, 1984) Kumar, 1992

Pseudorhadinorhynchus cochinensis Gupta, S.P. & Naqvi, 1984b : 150-153, Pl. 3, Fig. 1-5; Gupta, V. & Sinha, 1990 : 50;

Yamagutisentis cochinensis (Gupta, S.P. & Naqvi, 1984) Kumar, 1992 : 11; Golvan, 1994 : 180.

Type locality : Cochin, Kerala, India.

Description : Male 2.64-2.68 × 0.42-0.48 mm; female 3.55-3.85 × 0.51-0.54 mm. Proboscis elongated, cylindrical with deeply embedded equal hooks, 0.69-0.75 × 0.16-0.24 mm, with 20-22 longitudinal rows of 15-17 hooks each in male; in female 0.71-0.82 × 0.19-0.26 mm, with 18-22 longitudinal rows of 14-16 hooks each. Neck short, 0.10-0.17 × 0.14-0.20 mm in male; in female 0.12-0.20 × 0.18-0.25 mm, aspinose. Proboscis receptacle claviform or cylindrical, double-walled with ganglion at its base, in male 0.56-0.88 × 0.10-0.21 mm; in female 1.10-1.17 × 0.14-0.21 mm. Trunk elongated, cylindrical, wide at middle and tapering to both ends, 1.78-2.03 × 0.42-0.48 mm in males; in females 2.72-2.83 × 0.51-0.54 mm. Anterior trunk covered with stout spines, more extensive ventrally than dorsally. Lemnisci long, claviform or cykindrical, equal, extending up to anterior margin of posterior testis in male 1.05-1.25 mm long; in female 1.24-1.38 mm long. Testes ovoid, in tandem, equal, slightly overlapping and post-equatorial, 0.15-0.19 × 0.14-0.17 mm wide. Cement glands 6, pyriform lying behind posterior testis, 0.03-0.05 × 0.02-0.03 mm with long cement ducts. Saefftigen's pouch well developed, claviform, 0.32-0.41 × 0.12-0.16 mm. Seminal vesicle pyriform 0.04-0.06 × 0.03-0.06 mm. Bursa elongated without bursal cap or rays, 0.39-0.44 × 0.13-0.17 mm. Uterine bell funnel-shaped, 0.18-0.20 × 0.02-0.03 mm, guarded by 4 small cells and leading into a narrow uterine tube, 0.05-0.08 mm long. Vagina thick-walled, muscular, 0.02-0.03 mm long. Ovarian balls fill entire body cavity. Eggs nut observed. Gonopore terminal in both sexes.

Host : *Caranx malabaricus* (Cuvier & Valenciennes). *Rana tigrina* Daudin. *Saurida tunbil, Bufo melanosticus* (Schneider), *Bufo* sp., *Rana crancvora.*

Further hosts : *Rana chalconta, R. erythrea, R. macrodon, R. tigrina regulosa, Bufo asper, Kaloula palora* from Srilanka, India, Malayasia and China. *Bufo melanostictus* (Schneider), *Bufo* sp., *Rana crancvora*; *Rana rudibanda, Bufo viridis. Synaptura orientalis* (Bloch & Schneider). *Schizothorax* sp. *Pomadasys maculatus* (Bloch.).

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

78. ***Yamagutisentis mujibi*** (Gupta, S.P. & Naqvi, 1984) Kumar, 1992

Pseudorhadinorhynchus mujibi Gupta, S.P. & Naqvi, 1984b : 147-150, Pl. 2, Fig. 1-6; Gupta, V. & Sinha, 1990b : 51;

Yamagutisentis mujibi (Gupta, S.P. & Naqvi, 1984) Kumar, 1992c; 8; Golvan, 1994 : 180.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Male 5.72-5.69 × 0.75-0.85 mm. Female 5.94 × 0.94 mm. Proboscis elongate, cylindrical with deeply embedded hooks of similar shape and varying size, 0.94-1.01 × 0.25-0.28 mm; with 16-18 longitudinal rows of 17-18 hooks each in male; in female 0.91 × 0.31 mm with 18 longitudinal rows of 18 hooks each. Hooks decrease in size gradually posteriorly. Larger hooks of apical part 0.064-0.067 × 0.02 mm, decreasing towards base, basal hooks 0.035-0.038 × 0.013 mm in male; in female larger hooks of apical part 0.060-0.062 × 0.017 mm, decreasing towards base, basal hooks 0.031-0.033 × 0.012 mm. Neck short 0.20-0.24 × 0.22-0.24 mm in male; in female 0.24 × 0.30 mm. Proboscis receptacle elongated, muscular, double-walled 1.30-1.37 × 0.31-0.38 mm in male; in female 1.32 × 0.24 mm, with ganglion at its base. Trunk elongated, cylindrical, wide at middle and tapering to both ends, 4.54-4.68 × 0.75-0.85 mm in male; in female 4.79 × 0.94 mm. Anterior trunk covered with stout spines extensive ventrally than dorsally. Lemnisci ribbon-like, subequal, longer than receptacle, longer lemniscus 1.70-1.75 mm long, smaller 1.63-1.68 mm long in male; in female larger lemniscus 1.70 mm long, smaller 1.63 mm long. Testes spherical in tandem, slightly overlapping, equal, equatorial, anterior 0.35-0.37 × 0.30-0.32 mm, posterior 0.36-0.37 × 0.33-0.35 mm Cement glands 6, pyriform 0.10-0.25 × 0.05-0.17 mm. Saefftigen's pouch pyriform, 0.84-0.91 × 0.20-0.25 mm. Seminal vesicle pyriform, 0.30-0.35 × 0.18 mm, opening into globular bursa 0.50-0.60 × 0.48-0.49 mm opening subterminally. Ovarian balls and eggs numerous and fill entire body cavity. Eggs with polar prolongations of middle shell, 0.05-0.07 × 0.03 mm. Gonopore terminal.

Host : *Stromateus sinensis* Day.

Location : Intestine.

Locality : Karachi coast (Pakistan).

Distribution : Known only from type locality.

79. ***Yamagutisentis nickoli*** Kumar, 1992
(Fig. 74)

Yamagutisentis nickoli Kumar, 1992c : 10-12, Fig. 10-15; Golvan, 1994: 180.

Type locality : Chilka Lake, Orissa, India.

Description : Male 3.53 × 0.51 mm; female 3.95 × 0.60 mm. Proboscis claviform, short, with ditypic hooks in 18 longitudinal rows of 14 hooks each in both sexes, 0.40 × 0.23 mm in male; in female 0.60 × 0.30 mm. Anterior hooks larger with strong roots, 0.03-0.04 mm long in male, in female 0.05-0.063 mm long; posterior hooks smaller with weak roots, 0.02-0.21 mm long in male, 0.020.029 mm long in female. Neck 0.06 × 0.09 mm in male, in female 0.80 × 0.30 mm. Proboscis receptacle elongate, cylindrical, double-walled with nerve ganglion at base, 1.14 × 0.26 mm in male; in female 1.12 × 0.21 mm. Trunk fusiform, anteriorly, either end attenuated, middle part wide, with 10 transverse rows of 15 spines each in both sexes; spines 0.010-0.012 mm long in male, 0.02-0.21 mm

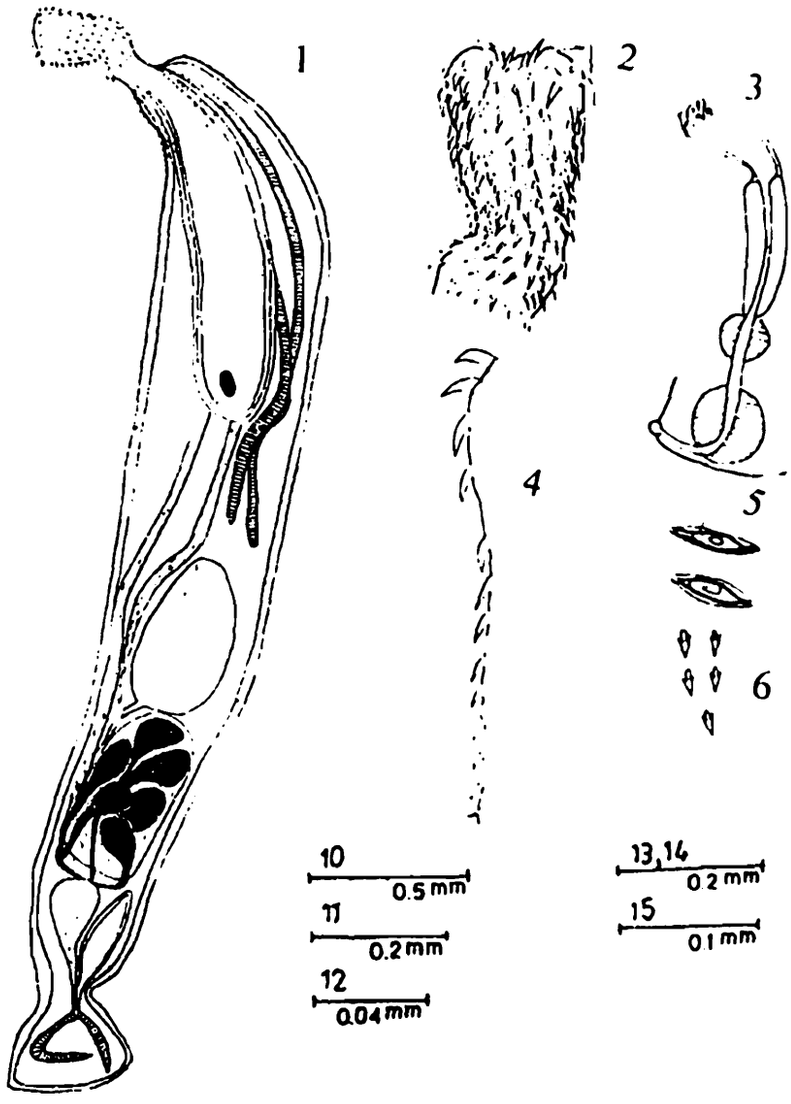


Fig. 74. *Yamagutisentis nickoli* Kumar, 1992, 1. Male, 2. Proboscis enlarged, 3. Female genitalia, 4. Row of proboscis hooks enlarged, 5. Eggs enlarged, 6. Trunk spines (after Kumar, 1992).

long in female. Hypodermal nuclei numerous. Lemnisci 2, uninucleate, unequal, tubular, longer than receptacle, reaching slightly anterior to anterior testis, smaller 1.48 mm long, larger 1.69 mm long in male; in female reaching to equatorial region, smaller 1.71 mm long, larger 1.98 mm long. Testes 2, elliptical, unequal, in tandem, slightly overlapping, post-equatorial, anterior 0.48 × 0.28 mm; posterior larger, 0.50 × 0.27 mm. Cement glands 6, bulbous. Saefftigen's pouch spindle-shaped, 0.31 × 0.09 mm. Seminal vesicle club-shaped, 0.20 × 0.16 mm. Bursa eversible, muscular, curved, 0.21 × 0.22 mm. Uterine bell 0.12 × 0.06 mm, guarded by selective cells. Uterus tubular, 0.18 × 0.05 mm. Vagina 0.24 × 0.018 mm, guarded by two sphincters. Ova 0.071-0.079 × 0.018-0.02 mm with polar prolongation of middle shell. Gonopore terminal.

Host : *Gagata batasio* (Hamilton).

Location : Intestine.

Locality : Chilka Lake (Orissa).

Distribution : Known only from type locality.

80. ***Yamagutisentis rhinoplagusiae*** (Yamaguti, 1935) Golvan, 1969 (Fig. 75)

Acanthocephaloides rhinoplagusiae Yamaguti, 1935 : 256-257, Fig. 9-10;
Pseudorhadinorhynchus rhinoplagusiae Yamaguti, 1963 : 69, Pl. 45, 454-456;
Yamagutisentis rhinoplagusiae Golvan, 1969 : 195-196, Fig. 140 A, B; 1994 : 180.

Type locality : Inland sea, Japan.

Description : Proboscis cylindrical, 0.30-0.37 × 0.11-0.13 mm in male with 14 longitudinal rows of 10 hooks each, largest hooks in middle 0.042-0.057 mm long, smallest 0.016-0.018 mm long in male; in female 0.38-0.5 × 0.11-0.2 mm, with same number of rows and hooks as in male, largest hooks in middle, 0.054-0.063 mm long and smallest basal hooks, 0.018-0.024 mm long. Neck unarmed, 0.15-0.2 mm long in male; in female 0.28 mm long. Proboscis receptacle double-walled, 0.38-0.65 × 0.13-0.17 mm near base in male; in female 0.61-0.98 × 0.13-0.22 mm, with ganglion at its base. Behind proboscis receptacle occur four large nuclei of parietal muscle cells 0.036-0.045 mm long, 0.015-0.020 mm wide. Trunk cylindrical, spindle-shaped, smooth, 2.0-3.1 mm long, 0.5 mm in maximum width at about its middle in male, in female 2.6-6.4 × 0.5-0.8 mm. Lacunar system with two lateral main longitudinal channels. Lemnisci 2, digitiform, slightly shorter than receptacle, but may be as long or longer. Testes ovoid, slightly overlapping each other, 0.18-0.28 × 0.13-0.18 mm, lie one behind other. Vasa efferentia much dilated and twisted. Cement glands 6, elongate, pear-shaped in two groups of three each directly behind posterior testis, continue imperceptibly into their ducts, of which three on each side unite at level of anterior

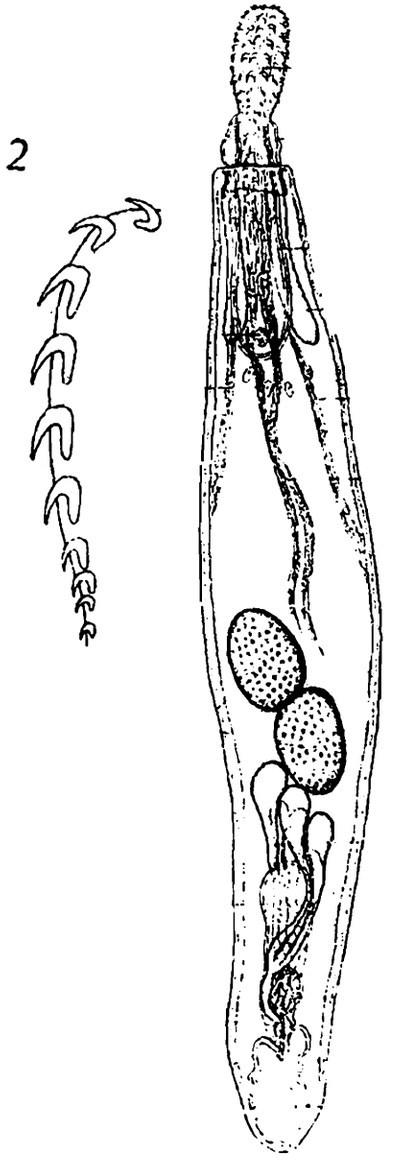


Fig. 75. *Yamagutisentis rhinoplagusiae* (Yamaguti, 1935). Golvan, 1969, 1. Proboscis hooks, 2. Male (after Yamaguti, 1935).

end of seminal vesicle into a wide common duct. Saefftigen's pouch 0.12-0.13 mm wide, lies post-dorsal to cement glands. Ejaculatory duct with thick muscular wall with bulbous sphincter 0.048-0.051 mm wide at its proximal end. Bursal cap muscular with 14 digitiform rays, copulatory bursa 0.12 mm wide, Eggs 0.042-0.063 × 0.009-0.012 mm, with polar prolongations of middle shell.

Host : *Rhinoplagusia japonica* (Temmenick. & Schleg); in unidentified fish,

Location : Intestine.

Locality : Indian ocean near India.

Distribution : Japan.

24. Genus ***Metechinorhynchus*** Petrotschenko, 1956

Metechinorhynchus Petrotschenko, 1956 : 1-435; Golvan, 1969 : 217-218; 1994 : 163.

Diagnosis : Echinorhynchidae. Proboscis cylindrical with 16-25 longitudinal rows of 8-14 hooks each. Proboscis receptacle cylindrical, double-walled, with ganglion about its middle. Lemnisci longer or shorter than receptacle. Cement glands 6, in pairs.

Type species : *Metechinorhynchus salmonis* (O. F. Müller, 1776) Petrotschenko, 1956.

Includes twenty species, 1. *Metechinorhynchu kushiroensis* (Fujita, 1921) Golvan, 1969, 2. *M. alpinus* (Linstow, 1901), 3. *M. briconi* (Machado-Filho, 1959), 4. *M. coregoni* (Linkins in Van Cleave, 1919), 5. *M. cryophilus* Sokoloskaja, 1962, 7. *M. gomesi* (Machado-Filho, 1948), 8. *M. jucundus* (Travassos, 1923) Golvan, 1969, 9. *M. lageniformis* (Ekbaum, 1938), 10. *M. lateralis* (Leidy, 1851), 11. *M. leidyi* (Van Cleave, 1924), 12. *M. malacocephali* Parukin, 1985, 13. *M. muraenolepisi* Rodyuk, 1984, 14. *M. paranensis* (Machado-Filho, 1959), 15. *M. petroschenkai* Rodyuk, 1984, 16. *M. rhenanus* Golvan, 1969, 17. *M. salmonis* (Müller, 1780), 18. *M. salobrensis* (Machado-Filho, 1948), 19. *M. sevani* (Dinnik, 1933) and 20. *M. truttae* (Schrank, 1788), of which first one occur in Indian subcontinent.

81. ***Metechinorhynchus kushiroensis*** (Fujita, 1921) Golvan, 1969 (Fig. 76)

Echinorhynchus kushiroensis Fujita, 1921 : 1-8; Yamaguti, 1963 : 41, Pl. 12, Fig. 116, 117;

Metechinorhynchus kushiroensis (Fujita) Golvan, 1969 : 227-228, Fig. 169 A-C.

Echinorhynchus kushiroensis Khanum, Zaman & Shanaz, 1992 : ?50; 1994; 162; Arthur & Ahmed, 2002 : 39.

Type locality : Japan.

Description : Males 10.0 × 1.1 mm. Females 9.0 × 1.0 mm. Proboscis cylindrical 0.83 × 0.36 mm, with 24 longitudinal rows of 8 hooks each, hooks 0.09 × 0.06 mm. Proboscis receptacle double-walled 1.2 × 0.39 mm, with ganglion about its middle. Trunk elongate, Lacunar system well developed. Lemnisci longer than receptacle, 1.2 × 0.36 mm. Testes oblong, placed one behind other, in posterior half of trunk, 0.59-1.0 × 0.35 mm. Seminal

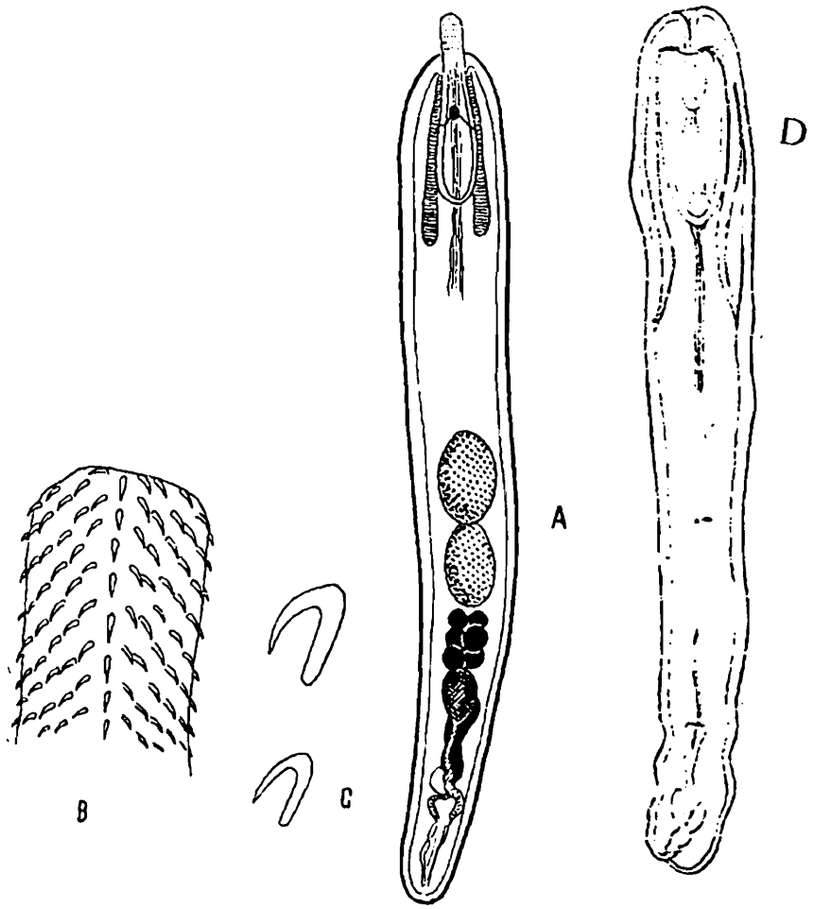


Fig. 76. *Metechinorhynchus kushiroensis* (Fujita, 1921) Golvan, 1921. A. Male, B. Proboscis enlarged, C. Proboscis Hooks enlarged, D. Female (A,B,C after Golvan, 1969, D after Yamaguti, 1963).

vesicle 0.1 mm in diameter. Cement glands 6, ovoid, 0.16 mm wide in two groups of three each, 0.15 mm in diameter. Saefftigen's pouch ovoid, 0.30 mm wide.

Host : *Glossogobius giurus* (Hamilton-Buchanan).

Location : Intestine.

Locality : Dhaka (Bangladesh).

Distribution : Japan.

9. Family HETERACANTHOCEPHALIDAE Petrotschenko, 1956

Heteracanthocephalidae Petrotschenko, 1956: 301;

Heteracanthocephalinae Yamaguti, 1963: 54.

Heteracanthocephalidae Golvan, 1969: 154.

Diagnosis : Palaeacanthocephala, Echinorhynchida. Proboscis cylindrical or nearly so, hooks on one side large with roots, those of other side small without roots. Proboscis

receptacle double-walled with ganglion at its base. Trunk medium sized, aspinose, almost cylindrical or slightly enlarged anteriorly. Lemnisci longer than receptacle. Testes post-equatorial. Cement glands 6, pyriform. Eggs elliptical, with polar prolongations of middle shell. Parasites of fishes.

Includes two subfamilies, 1. Heteracanthocephalinae Petrotschenko, 1956 and 2. Aspersentinae Golvan, 1960, of which first subfamily occurs in this subcontinent.

Subfamily HETERACANTHOCEPHALINAE Petrotschenko, 1956

Heteracanthocephalinae Petrotschenko, 1956 : 301; Yamaguti, 1963: 54-55; Golvan, 1969 : 158.

Diagnosis : Echinorhynchida, Heteracanthocephalidae. Proboscis cylindrical or nearly so, with longitudinal rows of hooks, hooks on one side large with roots, those of other side small without roots. Proboscis receptacle double-walled with ganglion at its base. Trunk of medium size, almost cylindrical or slightly enlarged anteriorly, aspinose. Cement glands 6, spherical. Eggs with polar prolongations. Parasites of marine fishes.

Type genus : *Heteracanthocephalus* Petrotschenko, 1956.

Includes three genera, 1. *Bullockrhynchus* Chandra, Rao & Shyamasundari, 1985, 2. *Heteracanthocephalus* Petrotschenko, 1956 and 3. *Sachalinorhynchus* Krotov & Petrotschenko, 1956, of which first genus occurs in India.

25. Genus ***Bullockrhynchus*** Chandra, Rao & Shyamasundari, 1985

Bullockrhynchus Chandra, Rao & Shyamasundari, 1985 : 294-295; Golvan, 1994: 140; Bhattacharya, 2007 : 129.

Diagnosis : Heteracanthocephalidae. Proboscis very long, filamentous and curved ventrally, with 14 rows of 45-50 hooks each. Proboscis receptacle elongated, cylindrical, double-walled, with ganglion near its anterior end. Trunk medium sized, cylindrical, slightly curved ventrally its spines occurring entire length of trunk and with extreme dorsal-ventral dissymmetry. Lemnisci cylindrical, equal. Gonopore dorsally subterminal. Eggs elliptical. Parasites in intestine of marine teleost (*Leiognathus*).

Type species : *Bullockrhynchus indicus* Chandra, Rao & Shyamasundari, 1985.

Includes single species, *Bullockrhynchus indicus* Chandra, Rao & Shyamasundari, 1985 which occurs in India.

82. ***Bullockrhynchus indicus*** Chandra, Rao & Shyamasundari, 1985 (Fig. 77)

Bullockrhynchus indicus Chandra, Rao & Shyamasundari, 1985 : 295-296, Fig. 1-5; Golvan, 1994 : 140; Bhattacharya, 2007 : 129.

Type locality : Visakapatnam coast, Andhra Pradesh, India.

Description : Female 6.79-7.68 mm long, 0.44 mm in maximum width. Proboscis very long, filamentous and curved ventrally, 0.82-1.0 × 0.05-0.06 mm, with 14 longitudinal rows of 45-50 hooks each, with two types of hooks, ventral hooks larger, stouter and more curved than dorsal hooks. Hooks of anterior dorsal part larger, 0.018-0.021 mm long and gradually decrease in size posteriorly. Hooks of ventral surface 0.042-0.045 mm long. Hooks of ventral and dorsal surface on midproboscis. 0.035-0.40 mm long and 0.018-0.021 mm long respectively. Basal ventral hooks 0.015-0.018 mm long and dorsal hooks 0.012-0.015 mm long. Posterior most circle of hooks with 14 rows of 45-50 hooks each, comparatively larger than preceding hooks. Neck short 0.09-0.10 mm long. Proboscis receptacle, elongated, cylindrical, double-walled, muscular, 1.24-1.86 × 0.14-0.16 mm, with ganglion nearer to its anterior end. Trunk elongated, cylindrical, spinose, with

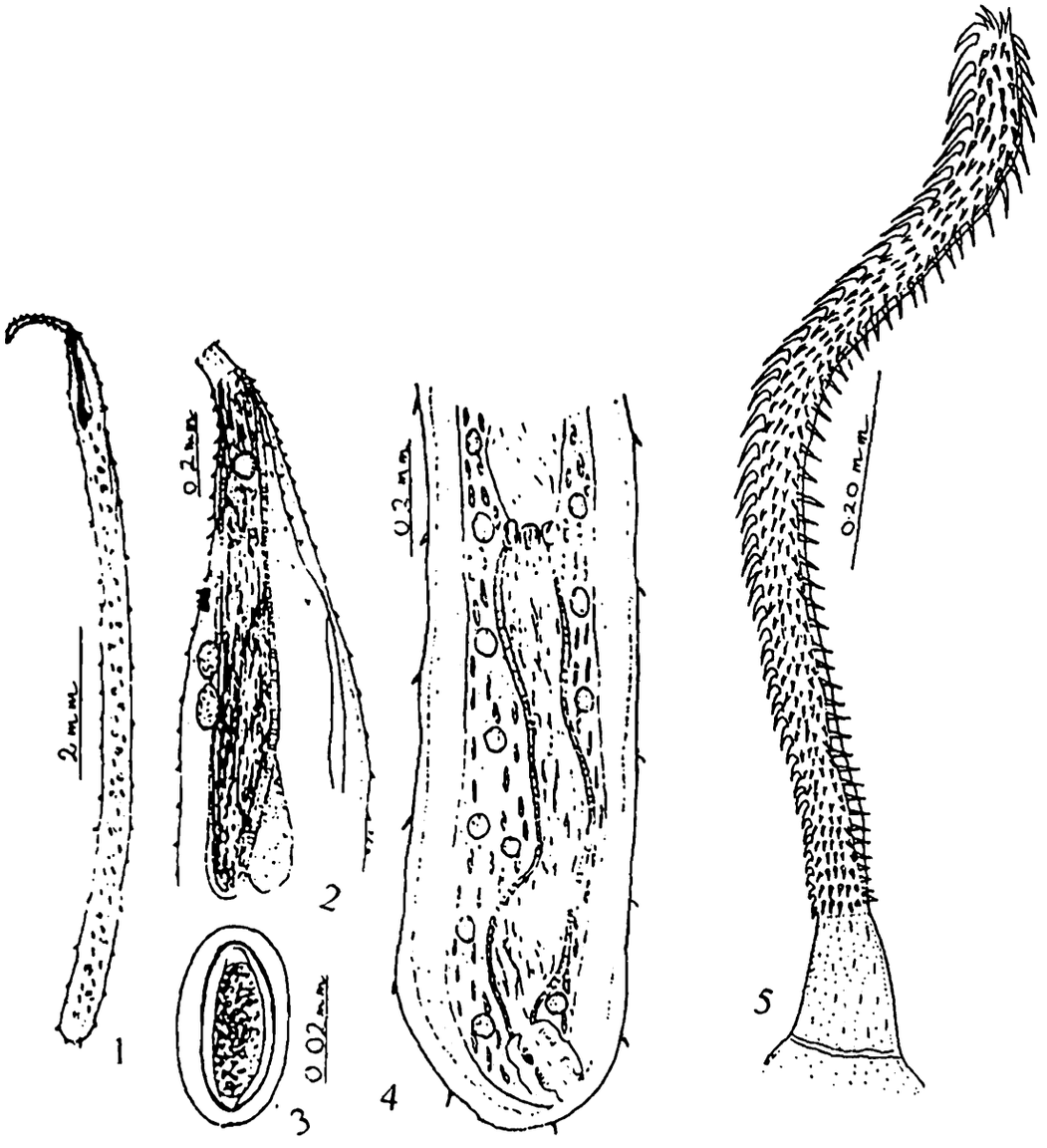


Fig. 77. *Bullockrhynchus indicus* Chandra, Rao & Shyamasundari, 1985. 1. Female, 2. Abterior part of worm, 3. Ovum enlarged, 4. Posterior part of female, 5. Proboscis enlarged (after Chandra, Rao & Shyamasundari, 1985).

maximum width at level of proboscis receptacle and pointed anteriorly, spines of anterior trunk, thicker and larger in number. Lemnisci cylindrical, equal, 1.1-1.4 mm long. Pseudocoel filled with ovarian balls and fertilized eggs. Ovarian balls spherical to oval, 0.06-0.08 × 0.05-077 mm. Uterine bell muscular anteriorly followed by short, thick-walled uterus, which in turn followed by muscular, thick-walled vagina opening to exterior through vulva subterminally on dorsal surface. Eggs elongated, elliptical, 0.03-0.05 × 0.01 mm. Males not known.

Host : *Leiognathus equualus* (Forskaal).

Location : Intestine.

Locality : Visakhapatnam coast, Bay of Bengal (Andhra Pradesh).

Distribution : Known only from type locality.

10. Family HYPOECHINORHYNCHIDAE Golvan, 1980

Hypoechinorhynchinae Yamaguti, 1963 : 55;
Hypoechinorhynchidae Golvan, 1969 : 188-189; Bhattacharyam 2007 : 114.

Diagnosis : Paleacanthocephala, Echinorhynchida. Proboscis rounded, attached to trunk ventro-terminally, with a number (10) of longitudinal rows of hooks, of which posterior distinctly smaller than anterior, basal ones occasionally rudimentary. Proboscis receptacle bulbous or subcylindrical, double-walled, with ganglion at its base. Trunk aspinose, enlarged anteriorly. Lacunar system with reticular anastomoses. Lemnisci cylindrical. Testes continuous, in anterior part of trunk. Testes large, spherical, Cement glands 6, pyriform, close together, in three pairs. 0.036-0.045 mm long, 0.015-0.020 mm wide. Eggs elliptical, with polar prolongations of middle shell. Gonopore terminal in male and in female ventro-terminal. Parasites of marine and fresh water fishes.

Type genus : *Hypoechinorhynchus* Yamaguti, 1939.

Includes two genera, 1. *Hypoechinorhynchus* Yamaguti, 1939 and 2. *Bolborhynchoides* Achmerov, 1959, of which first genus occurs in India.

26. Genus ***Hypoechinorhynchus*** Yamaguti, 1939

Hypoechinorhynchus Yamaguti, 1939 : 326; Petrotschenko, 1956 : 246; Yamaguti, 1963 : 56; Golvan, 1969 : 189; 1994 : 160; Bhattacharya, 2007: 115.

Diagnosis : Echinorhynchida, Hypoechinorhynchidae. Proboscis, attached to trunk ventro-medianally, rounded with 10 longitudinal rows of 2 or 3 hooks each, anterior hooks large, with simple backwardly directed root; posterior hooks small, rootless. Neck very short. Proboscis receptacle bulbous or subcylindrical, double-walled, with ganglion at its base. Trunk curved ventrad, broadest anteriorly, aspinose, thick-walled. Lacunar system reticular. Lemnisci cylindrical, may be crumpled. Testes large, contiguous, in anterior part of trunk. Cement glands 6, elliptical or elongate pyriform, close together. Eggs elongate oval, with polar prolongations of middle shell. Parasites of marine fishes.

Type species : *Hypoechinorhynchus alaeopis* Yamaguti, 1939.

Includes five species, 1. *Hypochinorhynchus golvani* Gupta, P. C. & Kumar, 1988, 2. *H. alaeopis* Yamaguti, 1939, and 3. *H. megellanicus* Szidat, 1950, 4. *H. robustus* Pichlin, 1999 and 5. *H. thermaceri* de Buron, 1988, of which first one occurs in India.

83. ***Hypochinorhynchus golvani*** Gupta, P.C. & Kumar, 1988

Hypochinorhynchus golvani Gupta, P. C. & Kumar, 1988b: 85-89; Golvan, 1994: 160; Bhattacharya, 2007 : 113.

Type locality : Chilka Lake, Orissa, India.

Description : Male 3.57 × 1.1 mm. Anterior proboscis with 3 hooks in each spiral row; posterior proboscis with 4 rows of 7 hooks each. Cement glands 4. The publication containing the description and figures of this species could not be procured.

Host : *Clarius* (*Clarius*) *batrachus*.(Linnaeus).

Location : Intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality

11. Family ILLIOSENTIDAE Golvan, 1960

Illiosentinae Yamaguti, 1963 : 106; Golvan, 1969 : 14; Bhattacharya, 2007 :

Diagnosis : Paleaeacanthocephala, Echinorhynchida. Worms medium sized. Proboscis long, cylindrical or slightly enlarged anteriorly, with 10-22 longitudinal rows of varied number of hooks, which gradually diminish in size towards its base. Proboscis receptacle long, double-walled, inserted at base of proboscis, with ganglion near its middle. Trunk spined anteriorly as well as at extreme posterior end or anteriorly alone. Lemnisci variable in length, longer than receptacle, with ganglion variable in position, Cement glands compact or elongate pyriform, close together. Eggs oval to fusiform, with polar prolongations of middle shell. Parasites of marine fishes.

Type genus : Illiosentis Van Cleave & Lincicome, 1939.

Includes eleven genera, 1. *Goacanthus* Gupta, N.K. & Jain, 1980, 2. *Indorhynchus* Golvan, 1969, 3. *Metarhadinorhynchus* Yamaguti, 1959, 4. *Pseudorhadinorhyncus* Achmerova & Dombrrowskaja-Achmerova, 1941, 5. *Telosentis* Van Cleave, 1923, 6. *Brentisentis* Leotta, Schmidt & Kuntz, 1982, 7. *Dentitruncus* Sinzar, 1955, 8. *Dollfusentis* Golvan, 1969, 9. *Illiosentis* Van Cleave & Lincicome, 1939, 10. *Tegorhynchus* Van Cleave, 1921, 11. *Koranacantha* Scott & Gerardo, 1996, of which first five occur in this subcontinent.

Key to Indian genera of family ILLIOSENTIDAE

1. Proboscis with 10-14 longitudinal rows of 16-26 hooks each ..... ***Telosentis***

– Proboscis with 14 longitudinal rows of 42-46 hooks each ..... ***Goacanthus***

– Proboscis with more than 14 longitudinal rows of hooks each 2

2. Trunk cylindrical swollen anteriorly with spines distributed all round, extending ventrally more than dorsally ..... ***Pseudorhadinorhynchus***

– Trunk cylindrical with 9-12 circles of spines ..... ***Indorhynchus***

3. Trunk cylindrical anteriorly with spines embedded in cutaneous folds and arranged quincunx, forming a single continuous group ..... ***Metarhadinorhynchus***

27. Genus ***Goacanthus*** Gupta, N.K. & Jain, 1980

Goacanthus Gupta, N. K. & Jain, 1980: 58; Golvan, 1994: 158; Bhattacharya, 2007 : 130.

Diagnosis : Illiosentidae. Proboscis long, with 14 longitudinal rows of 42-46 hooks each. Proboscis receptacle long, cylimdrical, double-walled, may reach anterior testis. Trunk cylindrical, armed anteriorly with larger and closely set spines and posteriorly with smaller scattered spines. Lemnisci smaller than receptacle, equal or subequal. Testes in posterior half of trunk, in tandem. Seminal vesicle small, spherical. Cement glands 8, spherical to pyriform, arranged in a compact group just behind posterior testis. Saefftigen; pouch well developed. Eggs elliptical, with polar prolongations of middle membrane. Parasites of marine fishes.

Type species : *Goacanthus panajiensis* Gupta, N.K. & Jain, 1980.

Includes single species, *Goacanthus panajiensis* Gupta, N.K. & Jain, 1980 which occurs in India.

84. ***Goacanthus panajiensis*** Gupta, N.K. & Jain, 1980 (Fig. 78)

Goacanthus panajiensis Gupta, N.K. & Jain, 1980 : 47-58, Fig. 1-14; Gupta, V. & Sinha, 1990b : 50; Golvan, 1994 : 158; 130.

Type locality : Panaji, Goa, India.

Description : Males 5.276-10.107 × 0.426-0.795 mm; females 13.57-24.405 × 0.873-1.145 mm. Proboscis long, filiform, curved ventrally near its anterior end, 1.629-1.688 × 0.116-0.12 mm, with 14 longitudinal rows of 42-46 hooks each in males; ventral subapical hooks largest, 0.046-0.052 × 0.011-0.012 mm, dorsal subapical hooks 0.032-0.034 × 0.004-0.006 mm, and dorsal basal hooks 0.011-0.016 × 0.004-0.005 mm in male; in female proboscis 1.746-2.134 × 0.116-0.155 mm, armed with 14 longitudinal rows of 49-50 hooks each, ventral subapical hooks 0.050-0.056 × 0.015-0.016 mm, dorsal subapical hooks 0.038-0.042 × 0.004-0.008 mm, ventral basal hooks 0.022-0.028 × 0.004-0.010 mm and dorsal basal hooks 0.018-0.020 × 0.004-0.007 mm. Proboscis receptacle long, cylindrical, double-walled, inner wall thicker, with ganglion in posterior part of its middle third, 1.998-3.259 × 0.174-0.213 mm, inner wall 0.019-0.024 mm and outer wall 0.099-

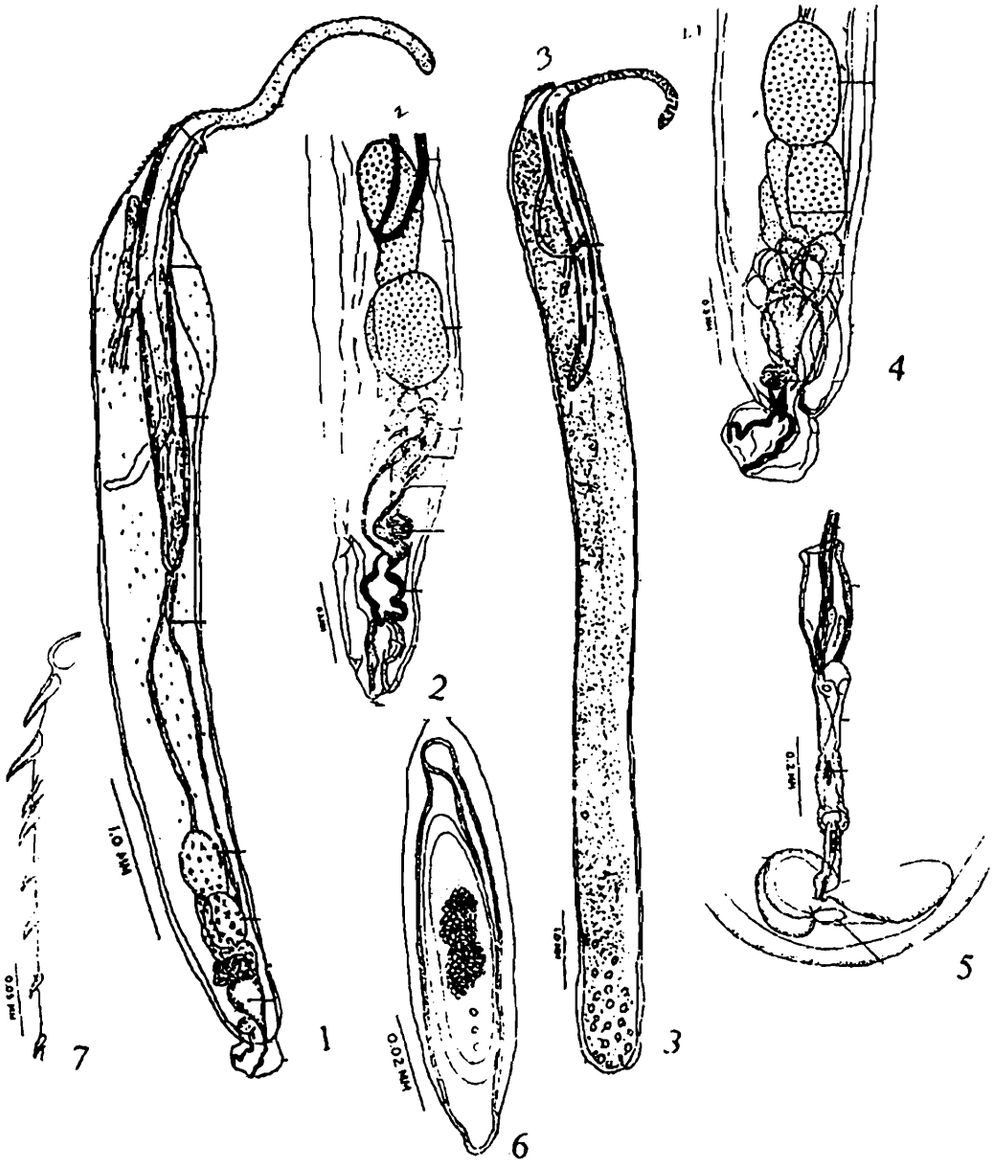


Fig. 78. *Goacanthus panajiensis* Gupta, N.K. & Jain, 1980. 1. Male, 2. Posterior part of male, 3. Female, 4. Posterior part of male, 5. Female genitalia, 6. Ovum enlarged, 6. Row of proboscis hooks (after Gupta N.K. & Jain, 1980).

0.019 mm thick in males. In females receptacle 3.191-4.055 × 0.213-0.272 mm with its inner wall 0.024-0.029 mm and outer wall 0.007-0.015 mm thick. Trunk cylindrical, with rounded posterior end and tapering anterior end, with slight increase in diameter just before it narrows down at anterior end. Trunk armed with spines which are longer and more closely set in anterior part than in posterior part, where they are smaller and irregularly scattered extending almost up to posterior end. In males trunk armed with 18-20 roughly longitudinal rows of 50-60 spines each, anterior spines 0.05-0.06 mm long, posterior spines 0.016-0.020 × 0.004-0.006 mm. In females armed with 24-26 longitudinal rows of 60-65 spines each, anterior spines 0.056-0.060 × 0.008-0.014 mm, posterior spines 0.016-0.020 × 0.004-0.006 mm. Neck small, bent ventrally when extended with a

slight dorsal swelling in some specimens, 0.155-0.194 × 0.155-0.175 mm in male; in female 0.174-0.252 × 0.165-0.233 mm. Hypodermal nuclei numerous, small. Lemnisci narrow, equal or subequal, smaller than receptacle, not bound to body wall at distal end, 1.768-2.44 mm and 2.289-2.89 mm long, 0.097-0.116 mm in maximum width in males; in females, 2.231-0.3.104 mm and 2.483-3.201 mm long, and 0.097-0.116 mm maximum width. Testis oval, in tandem, contiguous, anterior 0.375-0.619 × 0.195-0.318 mm, posterior 0.293-0.571 × 0.244-0.358 mm. Vasa efferentia 0.097-0.163 mm wide, each with 3 spermiducal vesicles along its length, unite posteriorly into a small spherical seminal vesicle, 0.081-0.114 × 0.081-0.13 mm. Cement glands 8, small, spherical, grouped into a cluster, duct from each gland proceed posteriorly along Saefftigen's pouch and opens at base of penis along with ejaculatory duct from seminal vesicle. Saefftigen's pouch with rounded anterior and narrow posterior end, 0.326-0.489 × 0.13-0.228 mm, opens at top of bursa. Copulatory bursa 0.244-0.426 × 0.163 mm, when everted, 0.244-0.367 mm wide, its opening dorsal and obliquely directed. Bursal cap 0.226-0.326 × 0.146-0.228 mm. Penis small and conical with a sphincter at its base. Genital tube 0.873-0.97 mm long with uterine bell 0.299-0.357 × 0.106-0.116 mm, its opening 0.111-0.116 mm wide, narrowest part just behind opening 0.086-0.097 mm wide. Uterus small tubular 0.096-0.169 × 0.063-0.082 mm. Vagina muscular 0.135-0.174 × 0.053-0.058 mm, with a sphincter at posterior end, 0.048-0.067 × 0.053-0.082 mm. Gonopore situated in vestibular depression at posterior end of trunk and guarded by three well developed lip-like muscular structures,·0.096-0.14 × 0.217-0.251 mm. Eggs elongated, elliptical, 0.082-0.096 × 0.019-0.024 mm with polar prolomgations of middle shell.

Host : *Leiognathus* (= *Equula*) *splendens* (Cuvier).

Location : Intestine.

Locality : Panaji (Goa).

Distribution : Known only from type locality.

28. Genus ***Indorhynchus*** Golvan, 1969

Indorhynchus Golvan, 1969 : 40; 1994: 16; Bhattacharya, 2007 : 133.

Diagnosis : Illiosentidae. Proboscis claviform or cylindrical, with 18-20 longitudinal rows of 12-14 hooks each. Proboscis receptacle double-walled, with ganglion not precise in position. Trunk long, cylindrical with 9-12 circular rows of spines. Lemnisci longer than receptacle extending up to anterior testis. Testes located about midtrunk. Cement glands 8, pyriform or cylindrical. Saefftigen's pouch large. Eggs with three membranes, with or without polar prolongations of middle shell.

Type species : *Indorhynchus indicus* (Tripathi, 1959) Golvan, 1969.

Includes two species, 1. *Indorhynchus bilqeesi* Kumar, 1992 and 2. *I. indicus* (Tripathi, 1959) Golvan, 1960 both occur in Indian subcontinent.

Key to Indian species of genus *Indorhynchus*

– Proboscis with 18-2-longitudinal rows of 2-13 4 hooks each .... *Indorhynchus bilqeesi*

– Proboscis with 18-22 longitudinal rows of 14 hooks each ..... *Indorhynchus indicus*

85. ***Indorhynchus bilqeesi*** Kumar, 1992
(Fig. 79)

Indorhynchus bilqeesi Kumar, 1992a : 48-51, Fig. 1-5; Golvan, 1994 : 161.

Type locality : Chilka Lake, Orissa, India.

Description : Male 3.64-4.07 × 0.65-0.68 mm in males; female 4.06 × 0.69 mm. Proboscis long, cylindrical, 0.60-0.64 × 0.26-0.28 mm in male, in female 0.66 × 0.25 mm, with 18-20 longitudinal rows of 12-13 hooks each in male; in female 11 transverse rows of 15 spines each. Anterior hooks 0.049-0.051 mm long in male; in female 0.035-0.04 mm long. Posterior hooks 0.042-0.058 mm long in male; in female 0.02-0.03 mm long. Proboscis receptacle long, slender, double-walled with basal ganglion, 1.32-1.34 × 0.18-

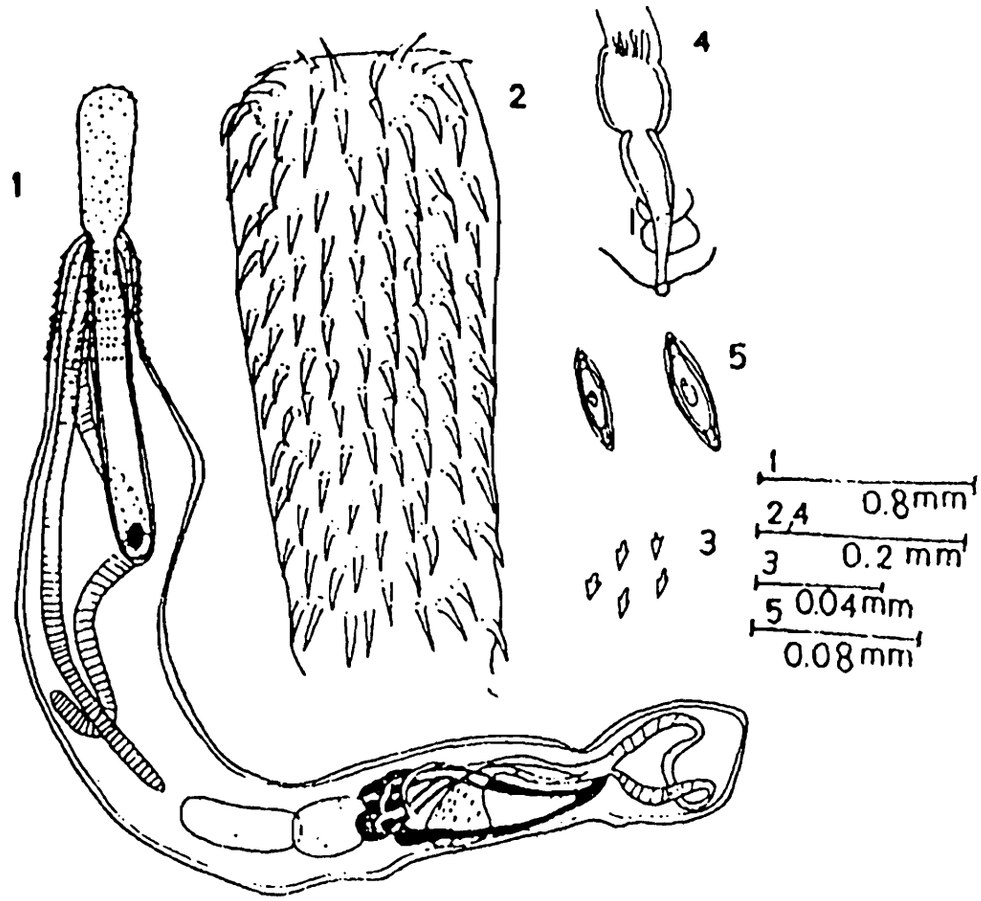


Fig. 79. *Indorhynchus bilqeesi* Kumar, 1992. 1. Male, 2. Proboscis enlarged, 3. Trunk spines, 4. Female genitalia, 5. Ova enlarged (after Kumar, 1992).

0.20 mm in males; in females 1.20 × 0.25 mm. Trunk elongated, cylindrical, with 11 transverse rows of 12-15 spines each in males; in female 11 transverse rows with 15 spines each. Spines 0.0150.022 mm long in males; in females 0.049-0.05 mm. 0.015-0.022 mm long in males, 0.049-0.05 mm long in females. Lemnisci 2, equal, much longer than receptacle, 2.5 mm long in males; in females 1.47 mm long. Testes 2, elongate, unequal, in tandem, contiguous, midtrunk or post-equatorial, anterior 0.50-0.52 × 0.19-0.25 mm at 1.52 mm from anterior end, posterior 0.34-0.36 × 0.20-0.22 mm 1.45-1.50 mm from posterior end. Cement glands 8, in a bunch, cylindrical. Saefftigen;s pouch 0.25-0.38 × 0.15-0.19 mm. Seminal vesicle 0.29-0.41 × 0.14-0.25 mm. Bursa muscular, evaginated, 0.48-0.55 × 0.28-0.34 mm. Uterine bell 0.60 mm wide. Uterus tubular, 0.07 × 0.04 mm. Vagina 0.06 × 0.009 mm, guarded by two sphincters. Eggs 0.05-0.06 × 0.012-0.013 mm, with polar prolongations of middle shell. Gonopore terminal.

Host : *Tachysurus nenga* (Blecker).

Location : Intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality.

86. ***Indorhynchus indicus*** (Tripathi, 1959) Golvan, 1969 (Fig. 80)

Rhadinorhynchus indicus Tripathi, 1959: 79-81, Textfig.10 a-c; Yamaguti, 1963: 101, Pl. 42, Fig. 424, 425, Anantaraman, M. & Anantaraman, S., 1970: 5; Gupta, V. & Sinha, 1990b: 44.

Indorhynchus indicus Golvan, 1969: 40-42, Fig. 24; 1994: 161; Bhattacharya, 2007: 133135, Pl. 22, Fig. 120 a-c.

Type locality : Chilka Lake, Orissa, India.

Description : Males 4.9-5.8 × 0.84-1.01 mm; females 6.27-7.55 × 1.07-1.21 mm. Proboscis long, claviform, 0.60-0.79 × 0.29-0.36 mm with 18-20 longitudinal rows in males; in females 20-22 longitudinal rows of 14 curved hooks each. Hooks 0.041 mm long. Neck short and aspinose. Proboscis receptacle long, double-walled, 1.45-1.59 × 0.29-0.36 mm, reaching anterior testis. Trunk long, cylindrical with 9-12 circular rows of body spines, last row with 36 spines, spines 0.022 mm long. Lemnisci 2, slightly unequal, extend to posterior testis. Testes ovoid, overlapping, in anterior half of body. Cement glands 8, small, pyriform with their ducts opening into ejaculatory duct. Saefftigen's pouch voluminous and pyriform. Seminal vesicle pyriform. Coulatory bursa occupying posterior one-fifth of trunk. Body cavity filled with eggs. Eggs elliptical 0.079 × 0.019 mm, with 3 membranes.

Host : *Tachysurys jella* (Day); *Arius jella* Russell; *Osteogeniosus militaris* (Linnaeus).
Location : Intestine.

Locality : Puri (Orissa).

Distribution : Known only from type locality.

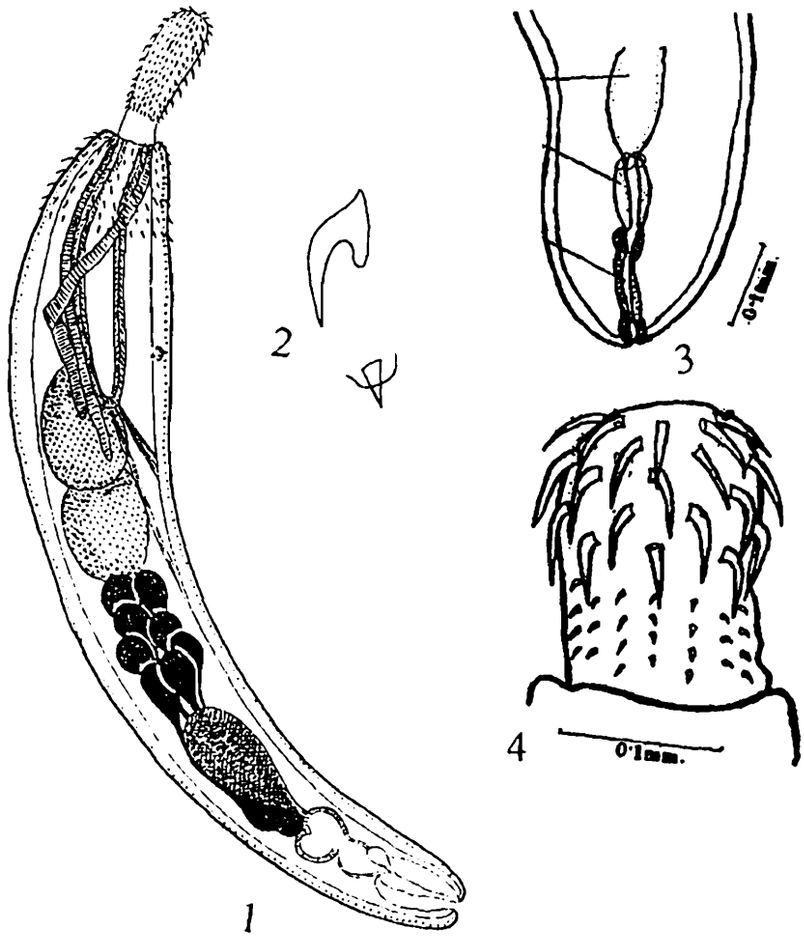


Fig. 80. *Indorhynchus indicus* (Tripathi, 1959). 1. Male, 2. Proboscis hooks enlarged, 3. Posterior part of female, 4. Proboscis enlarged (1,2 after Golvan, 1969, 3,4 after Tripathi, 1959).

29. Genus ***Metarhadinorhynchus*** Yamaguti, 1959

Metarhadinorhynchus Yamaguti, 1959: 323; 1963: 103-104; Golvan, 1969: 38; 1994: 163.

Diagnosis : Illiosentidae. Proboscis slightly claviform with numerous longitudinal rows of hooks, which increase in size from apex down to widest subapical part and then decrease toward base; basal spines smallest and not projecting very prominently. Neck short. Proboscis receptacle fusiform or elongate elliptical, double-walled, with ganglion near its middle. Trunk cylindrical, covered anteriorly with spines embedded in cutaneous folds and arranged quincunx, forming a single continuous group. Hypodermic nuclei small and numerous. Lemnisci slender, long. Testes in tandem, continuous, in anterior third of trunk. Seminal vesicle elongate. Cement glands 8, tubular, very long forming paired elongate reservoirs posteriorly, one on each side of seminal vesicle and attenuated posterior part of Saefftigen;s pouch. Uterus tubular, very long. Vagina divided into two bulbous parts, anterior bulb representing vaginal funnel, with two (anterior and posterior) vaginal sphincters and terminal vaginal bulb present. Vulva terminal. Eggs ? Parasites of marine teleosts.

Type species : *Metarhadinorhynchus lateolabracis* Yamaguti, 1959.

Includes five species, 1. *Metarhadinorhynchus thapari* Gupta, R. C. & Gupta, S. P.1975, 2. *M. valiyathurae* Nadakal, John & Jacob, 1990, 3. *M. arii* (???) Wang, 1986, 4. *M. cyprini* (???) Wang, 1986 and 5. *M. lateolabracis* Yamaguti, 1939, of which first two species occur in India.

87. ***Metarhadinorhynchus thapari*** Gupta, R.C. & Gupta, S.P. 1975 (Fig. 81)

Metarhadinorhynchus thapari Gupta, S. P. 1975: 215; Gupta, R. C. & Gupta, S. P.1975b: 21-24, Fig. 1-5; Gupta, V. & Sinha, 1990b: 53.

Type locality : Puri, Orissa, India.

Description : Males 3.68-7.14 × 0.66-1.15 mm; females 7.71-9.63 × 1.48-1.78 mm. Proboscis claviform with 26 longitudinal rows of 18 hooks each, 0.67-0.81 × 0.19-0.37 mm of 0.04-0.07 mm long in male; in female 1.05-1.34 × 0.38-0.56 mm, of 0.035-0.08 mm long. Hooks increase in size from apex down to widest subapical part and then decrease towards base. Basal hooks smallest and not projecting prominently. Neck separated by cuticular fold from trunk region, 0.70-0.82 × 0.1-0.46 mm in males; in females 0.21-0.28

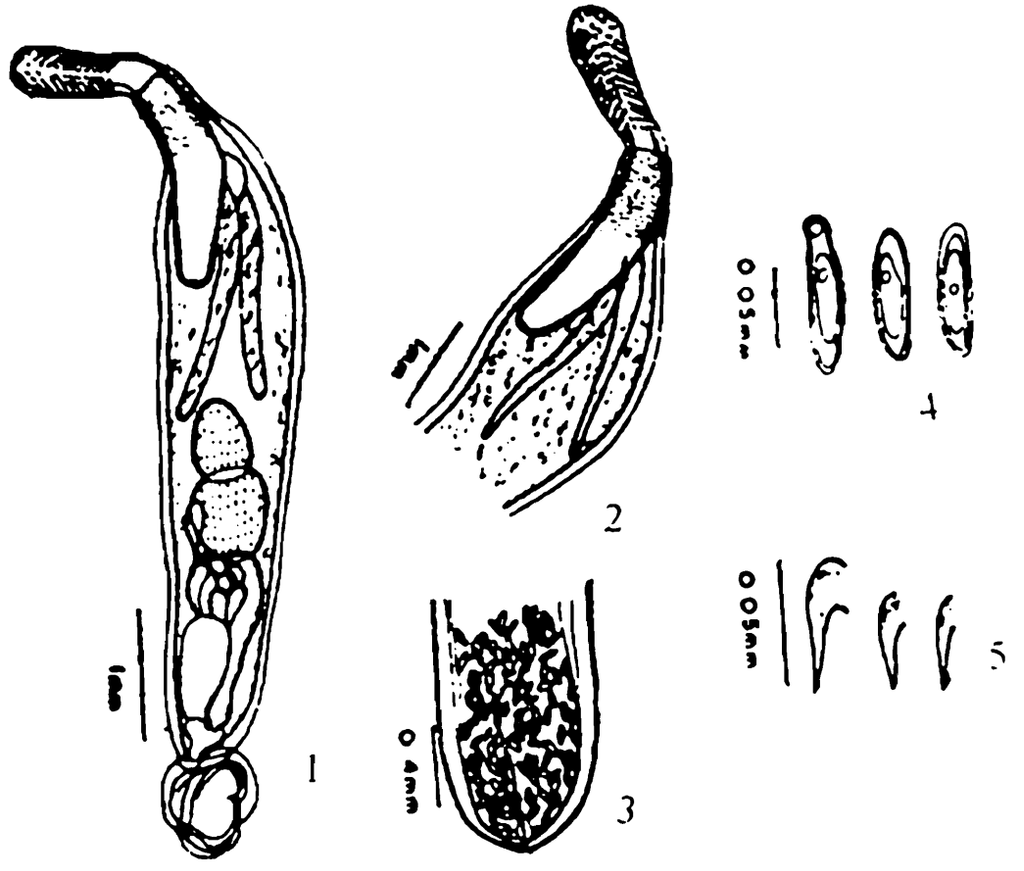


Fig. 81. *Metarhadinorhynchus thapari* Gupta, R.C. & Gupta, S.P. 1975. 1. Male, 2. Anterior part of worm, 3. Posterior part of female, 4. Eggs enlarged, 5. Proboscis hooks enlarged (after Gupta, R.C. & Gupta, S.P., 1975).

× 0.26-0.35 mm. Proboscis receptacle fusiform to elongate, double-walled with ganglion near its base, from which nerve fibers run anteriorly and posteriorly, 1.66 × 0.29-0.46 mm in males; in females 1.53-2.31 × 0.5-0.6 mm. Trunk elongated, slender, cylindrical, gradually enlarging from anterior end to middle and narrowing to posterior end, 2.94-6.01 × 0.66-1.15 mm, anterior part covered with 0.025-0.028 mm long spines for a distance of 0.41-0.6 mm in males, in females 6.45-8.03 × 1.38-1.78 mm, covered with spines of 0.02-0.025 mm long in anterior part for a distance of 0.62-1.09 mm. Lacunar system reticular. Hypodermal nuclei small and numerous. Lemnisci filiform, subequal, slender, much longer than receptacle, shorter lemniscus 0.45-1.74 mm long, longer 0.65-2.28 mm long extending up to slightly posterior to anterior margin of anterior testis in males; in females shorter lemniscus 2.08-2.12 mm long, longer 2.35-2.45 mm long, extending up to middle of trunk. Testes in tandem, contiguous, elongate, subequal, overlapping in midtrunk, anterior 0.31-1.59 × 0.21-0.58 mm, posterior 0.26-0.72 × 0.22-0.61 mm. Seminal vesicle elongate, fusiform, 1.05-2.0 × 0.15-0.25 m. Saefftigen's pouch pyriform, muscular, 0.22-0.84 × 0.36-0.44 mm, lying behind cement glands. Cement glands 8, long, filiform, grouped together. Bursal cap muscular 0.29-0.84 × 0.36-0.85 mm with paired anterior diverticula and posterior bursal rays. Uterus tubular, long. Vagina divided into bulbous parts, anterior bulb vaginal funnel, 0.1-0.12 × 0.1-0.13 mm, and posterior part elliptical, 0.18-0.19 × 0.024-0.095 mm with two sphincters. Vulva terminal. Eggs fully developed, 0.085-0.11 × 0.02-0.021 mm.

Host : *Arius platystomus* (Griffith).

Location : Intestine.

Locality : Puri (Orissa).

Distribution : Known only from type locality.

30. Genus ***Pseudorhadinorhynchus*** Achmerov & Dombrowskaya-Achmerova, 1941

Pseudorhadinorhynchus Achmerov & Dombrowskaya-Achmerova, 1941: 517-520; Petrotschenko, 1956: 359; Yamaguti, 1963: 68-69; Golvan, 1969: 42; Gupta, V. & Sinha, 1993: 10; Golvan, 1994: 176; Bhattacharya, 2007: 130-131.

Diagnosis : Illiosentidae. Sexual dimorphism present. Proboscis cylindrical. Proboscis receptacle long, double-walled, with ganglion at its base. Trunk medium sized, cylindrical, may be slightly swollen anteriorly, where armed with spines distributed all round anteriorly but extend ventrally further backward than dorsally, sometimes also to posterior end. Lemnisci long. Testes spheroidal. Cement glands 6 or 8, claviform to tubular or pyriform. Ova elliptical with polar prolongations of middle shell. Parasites of fishes.

Type species : *Pseudorhadinorhynchus markewitchi* Achmerov & Dombrowskaja-Achmerova, 1941.

Includes eighteen species, 1. *Pseudorhadinorhynchus cinereus* Gupta, S.P. & Naqvi, 1983, 2. *P. cochinensis* Gupta, V. & Naqvi, 1983, 3. *P. deeghai* Saxena, 2004, 4. *P. dhari*

Kumar, 1992, 5. *P. dussamicitatum* Gupta, N.K. & Gupta, K. 1972, 6. *P. ernakulensis* Gupta, N.K. & Gupta, K., 1971, 7. *P. guptai* Gupta, V. & Sinha, 1993, 8. *P. longicollum* Gupta & Naqvi, 1986, 9. *P. machidai* Gupta, S.P. & Naqvi, 1986, 10. *P. mnobi* Gupta, S.P. & Naqvi, 1986, 11. *P. mujibi* Gupta, S.P. & Naqvi, 1983. 12. *P. nandai* Gupta, V. & Sinha, 1993, 13. *P. orissi* Gupta, V. & Fatima, 1985, 14. *P. srivastavi* Gupta, V. & Fatima, 1985, 15. *P. leuciscus* (Krotov & Petrochenko, 1956) Golvan 1969, 16. *P. markewitschi* Achimerov-Dombrewskaja-Achmerovam, 1941, 17. *P. pseudaspii* Achmerov & Dombrowskaja-Achmerova, 1941 and 18. *P. samegaiensis* Nakajima & Egusa, 1975, of which first fourteen occur in Indian subcontinent.

Key to Indian species of genus *Pseudorhadinorhynchus*

1. Cement glands six 2
- Cement glands eight 4
- Proboscis with 16-18 longitudinal rows of 17-18 hooks each in male, in female 18 rows of 18 hooks each ..... *Pseudorhadinorhynchus mujibi*
- Proboscis with more than 18 longitudinal rows of hooks 3
- Proboscis with 20 longitudinal rows of 16 hooks each in male, in female 20 rows rows of 14 hooks each ..... *Pseudorhadinorhynchus deeghai*
- Proboscis with 20 longitudinal rows of 18 hooks each in male, in female 18-20 of 16-18 hooks each ..... *Pseudorhadinorhynchus nandai*
- Proboscis with 20-22 longitudinal rows of 15-17 hooks each in male, in female 18- 20 rows of 14-16 hooks each ..... *Pseudorhadinorhynchus cochinensis*
- Proboscis with 22 longitudinal rows of 5-7 hooks each in anterior part and 28 longitudinl rows of 4 hooks each in posterior part ..... *Pseudorhadinorhynchus ernakulensis*
- Proboscis with different number of longitudinal rows of hooks in male and female ..... 5.
- Proboscis with same number of longitudinal rows of hooks in both sexes 6

2. Proboscis with 17-21 longitudinal rows of 18 hooks each in male; and in female 18-19 rows of 16-18 hooks each ..... *Pseudorhadinorhynchus guptai*
- Proboscis with 20 longitudinal rows of 18 hooks each in male; and in female 18-20 rows of 16-18 hooks each ..... *Pseudorhadinorhynchus machidai*
- Proboscis with 22 longitudinal rows of 14 hooks each in male; and in female 22 rows of 18 hooks each ..... *Pseudorhadinorhynchus cinereus*

3. Proboscis with 16-18 longitudinal rows of 15 hooks each ..... *Pseudorhadinorhynchus srivastavi*

– Proboscis with 18-20 longitudinal rows of 12-14 hooks each .... *Pseudorhadinorhynchus orissi*

– Proboscis with 20 longitudinal rows of 12-13 hooks each .... *Pseudorhadinorhynchus dussamicitatum*

– Proboscis with 20 longitudinal rows of 16 hooks each .... *Pseudorhadinorhynchus dhari*

Note : *Pseudorhadinorhynchus longicollum* Gupta & Naqvi, 1986, *P. mnobi* Gupta, S. P. & Naqvi, 1086 are not included in the key.

88. ***Pseudorhadinorhynchus cinereus*** Gupta, S.P. & Naqvi, 1983 (Fig. 82)

Pseudorhadinorhynchus cinereus Gupta, S.P. & Naqvi, 1983 : 144-147, Pl. 1, Fig. 1-6; Gupta, V. & Sinha, 1990 : 50, 51; Golvan, 1994 : 176.

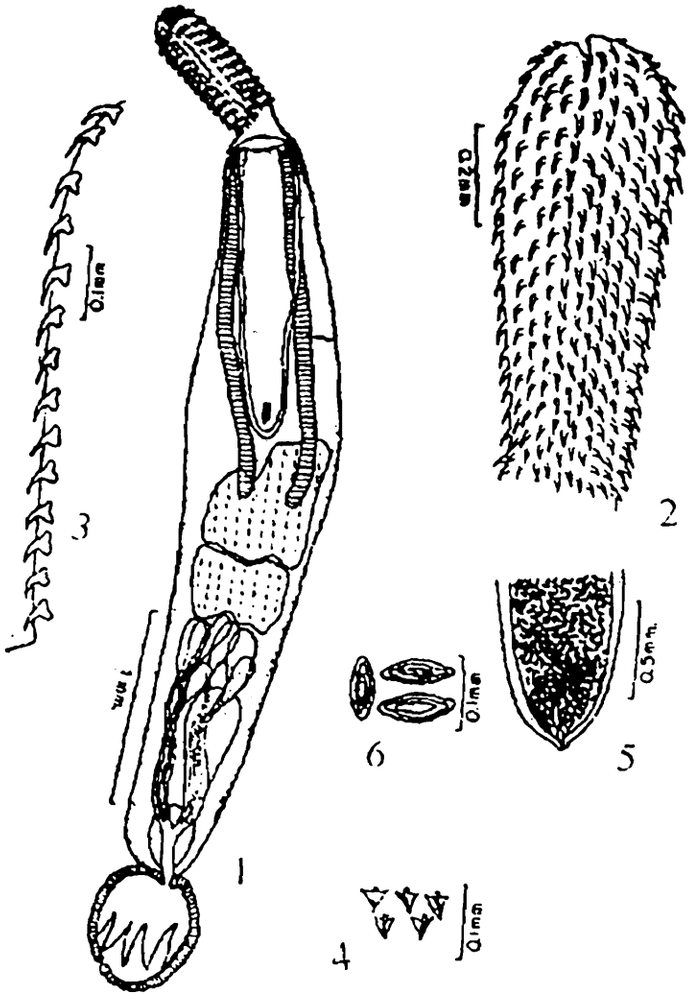


Fig. 82. *Pseudorhadinorhynchus cinereus* Gupta, S.P. & Naqvi, 1983. 1. Male, 2. Proboscis enlarged, 3. Row of proboscis hooks, 4. Trunk spines enlarged, 5. Posterior part of female, 6. Egg enlarged (Gupta S.P. & Naqvi, 1983).

Type locality : Karachi, Sindh, Pakistan.

Description : Male 5.35 × 0.82 mm, female 6.21 × 1.21 mm. Proboscis elongated, cylindrical, with deeply embedded hooks of varying size and similar in shape, in male 0.75 × 0.26 mm with 22 longitudinal rows of 14 hooks each; in female 1.01 × 0.34 mm with 22 longitudinal rows of 18 hooks each. Hooks of anterior part large, 0.045-0.050 × 0.016 mm, decreasing towards base, basal hooks 0.035-0.040 × 0.014-0.015 mm in male; in female corresponding hooks 0.045-0.055 × 0.02 mm, decreasing towards base too.30-0.035 × 0.01 mm. Neck 0.22 × 0.26 mm in male; in female 0.22 × 0.24 mm. Proboscis receptacle claviform, double-walled with ganglion a little above its base, 1.52 × 0.33 mm in male; in female 1.75 × 0.45 mm. Trunk elongated, cylindrical, wide at middle and tapering to both ends, 4.38 × 0.82 mm in male; in female 5.08 × 1.21 mm. Lemnisci long, claviform, equal, arising at base of proboscis, extending up to middle of anterior testis, 1.80 × 0.08 mm in male; in female 2.10 mm long. Testes in tandem, contiguous, subequal, in middle third of trunk, anterior 0.64 × 0.52 mm, posterior smaller, 0.35 × 0.50 mm at 2.01 mm from posterior end. Cement glands 8, pear-shaped, 0.27-0.36 × 0.07-0.09 mm, in two behind posterior testis. Four cement ducts on each side directly unite at level of anterior end of seminal vesicle into wide common duct. Saefftigen's pouch elongated 0.75 × 0.27 mm. Seminal vesicle pyriform 0.35 × 0.23 mm. Bursa globular 0.61 × 0.35 mm with 6 bursal rays. Uterus 0.12 × 0.45 mm. Vagina 0.09 × 0.03 mm with vaginal sphincter. Eggs elliptical 0.08 × 0.0 6 mm, with polar prolongations of middle shell. Gonopore subterminal in male and terminal in female.

Host : *Stomateus cinereus* Day, *Caranx malabaricus (*Cuvier & Valenciennes).

Location : Intestine.

Locality : Karachi coast, Sindh, (Pakistan).

Distribution : Known only from Indian subcontinent.

89. ***Pseudorhadinirhynchus cochinensis*** Gupta, S.P. & Naqvi, 1983 (Fig. 83)

Pseudorgadinirhynchus cochinensis Gupta, S.P. & Naqvi, 1983 : 150-152, Pl. 3 Fig. 1-5; Gupta, V. Sinha, 1990 : 50; Golvan, 1994: 176; Bhattacharya, 2007 : 131

Type locality : Cochin, Kerala, India.

Description : Male 2.64-2.88 × 0.42-0.48 mm, female 3.55-3.85 x0.51-0.54 mm. Neck short, 0.10-0.16 × 0.14-0.20 mm in male, in female 0.12-0.20 x0.18-0.25 mm. Proboscis elongated, cylindrical 0.69-0.75 × 0.16-0.24 mm with 20-22 longitudinal rows of 15-17 hooks each, 0.041-0.047 mm long in male, in female 0.71-0.82 x0.19-0.26 mm with 18-22 longitudinal rows of 14-16 hooks each, 0.39-0.045 mm long, Proboscis receptacle claviform or cylindrical, double-walled with ganglion at its base, 0.56-0.88 × 0.10-0.21 mm in male, in female1.0-1.17 × 0.14-0.21 mm. Trunk elongated, cylindrical, 1.78-2.03 × 0.42-0.48 mm, wide at middle and tapering at both ends, anterior trunk covered with

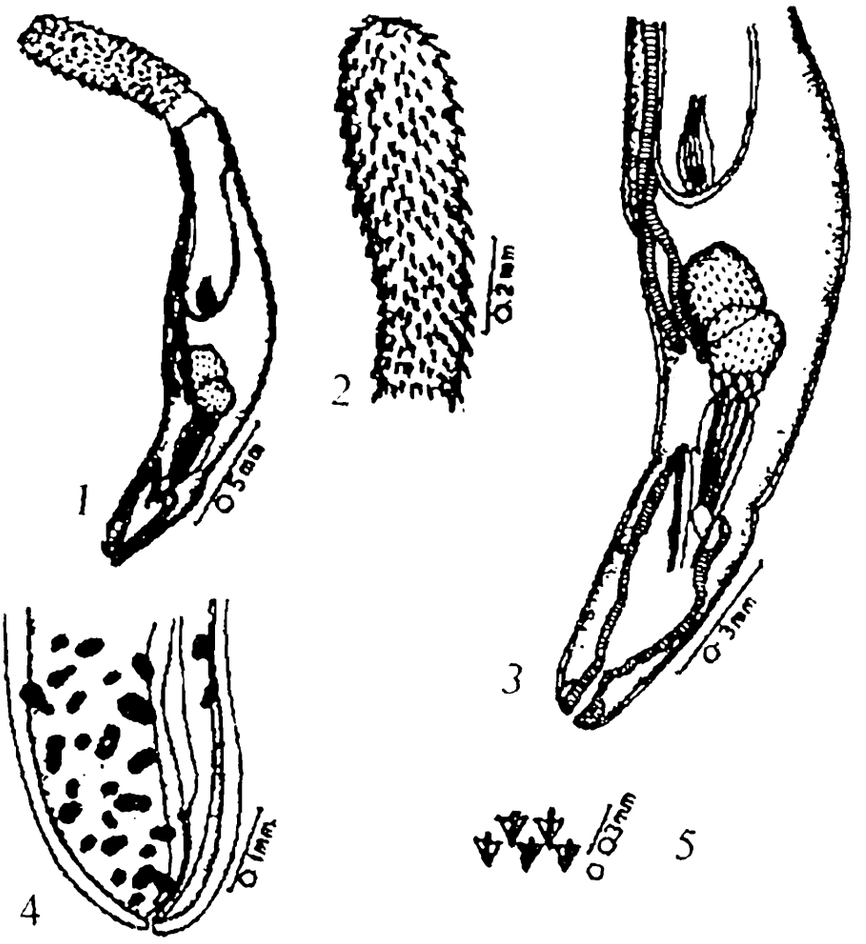


Fig. 83. *Pseudorhadinorhynchus cochinensis* Gupta, S.P. & Naqvi, 1983. 1. Male, 2. Proboscis enlarged, 3. Posterior part of male, 4. Posterior part of female, 5. Trunk spines (Gupta S.P. & Naqvi, 1983).

stout spines, more extensively ventrally than dorsally. Trunk spines 0.019-0.022 × 0.014-0.017 mm in male, in female 2.72-2.83 × 0.51-0.54 mm, spines 0.020-0.024 x0.017-0.018 mm. Lemnisci long, claviform or cylindrical, equal, 1.05-1.25 mm long in male. in female 1.24-1.38 mm long. Testes ovoid, in tandem, equal, slightly overlapping, post-equatorial, 0.15-0.18 × 0.14-0.17 mm, posterior testis. Cement glands 6, pyriform, 0.03-0.05 × 0.02-0.03 mm with long cement ducts. Saefftigen's pouch claviform, 0.32-0.41 × 0.120.16 mm. Seminal vesicle pyriform, 0.04-0.06 × 0.03-0.06 mm. Bursa elongated without bursal cap or rays, 0.39-0.44 × 0.13-0.17 mm. Uterine bell funnel-shaped 0.18-0.20 x0.02-0.03 mm, guarded by four small cells. Uterine tube 0.05-0.08 mm long. Vagina thick-walled, muscular, 0.02-0.03 mm long. Ovarian balls fill pseudocoel. Eggs not observed.

Host : *Caranx malabaricus* (Cuvier & Valanciennes).

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

90. ***Pseudorhadinorhynchus deeghai*** Saxena, 2004
(Fig. 84)

Pseudorhadinorhynchus deeghai Saxena, 2004b: 36-38, Fig. 1-5.

Type locality : Deeghai coast, West Bengal, India.

Description : Male 3.90 × 0.52 mm; female 2.87 × 0.48 mm. Proboscis elongated, cylindrical 0.70 × 0.29 mm with 20 longitudinal rows of 16 hooks each, with hooks 0.040-0.054 mm long in male. In female proboscis 0.75 × 0.29 mm with 20 longitudinal rows of 14 hooks each, of 0.014-0.052 mm long. Hooks similar in shape but differ in size, gradually decreasing in size posteriorly in both sexes. Each hook with recurved blade, resting on a horizontally placed root. Roots of all hooks deeply embedded in proboscis wall. Neck short in both sexes, 0.11 × 0.14 mm in male; in female 0.02 × 0.19 mm. Proboscis receptacle claviform, double-walled 1.35 × 0.28 mm in male, in female 0.75 × 0.29 mm, with ganglion slightly above its base. Trunk elongate, cylindrical, wider in middle and tapering towards both ends, anterior part of trunk covered with regular rows of small triangular spines densely ventrally and less densely dorsally, approximately covering 1/7

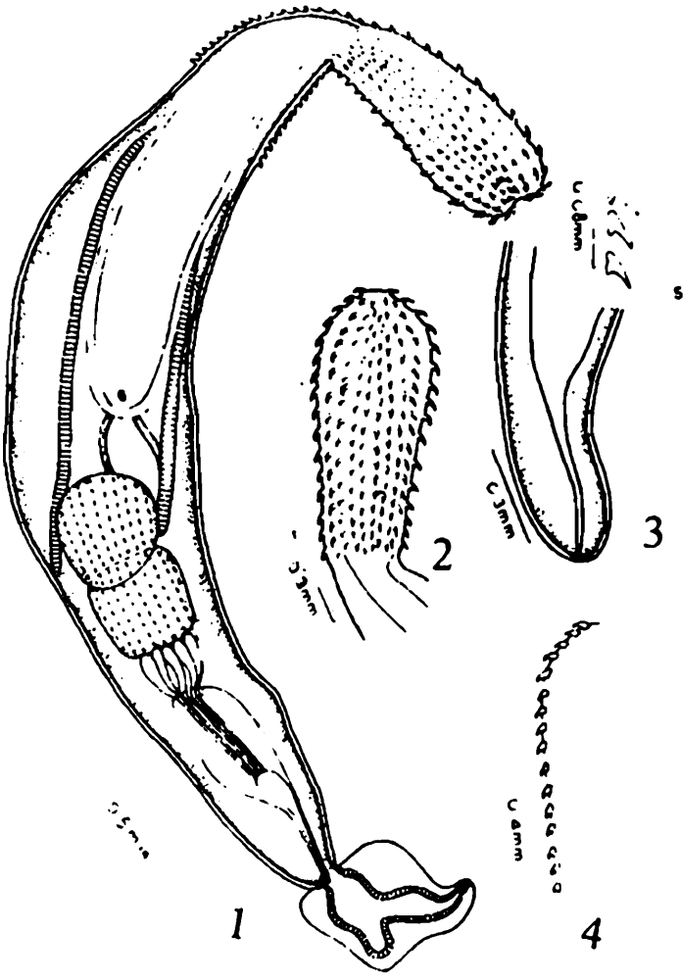


Fig. 84. *Pseudorhadinorhynchus deeghai* Saxena, 2004. 1. Male, ventral view, 2. Proboscis enlarged ventral view, 3. Posterior part of female, 4. Row of proboscis hooks (after Saxena, 2004).

of trunk surface. Lemnisci long, cylindrical, subequal, larger lemniscus larger 1.33 × 0.03, smaller 0.78 × 0.02 mm in male; in female larger one 0.39 × 0.06 mm, smaller one 0.27 × 0.05 mm. Testes in tandem, contiguous, subequal in middle third of trunk, anterior 0.33 × 0.30 mm, posterior 0.23 × 0.24 mm. Cement glands 3 pairs , pear-shaped, situated just behind posterior testis. each gland 0.11-0.12 × 0.04-0.05 mm. Cement ducts unite of anterior end of seminal vesicle. Saefftigen's pouch saccular 0.38 × 0.08 mm, which is not reported from majority of species described. Bursa globular 0.45 × 0.16 mm. Uterus 0.13 × 0.03 mm. Eggs fill entire body cavity.

Host : *Pelamys chilensis* Cuvier & Valenciennes.

Location : Intestine.

Locality : Deeghai coast (West Bengal).

Distribution : Known only from type locality.

91. ***Pseudorhadinorhynchus dhari*** Kumar, 1992c
(Fig. 85)

Pseudorhadinorhynchus dhari Kumar, 1992c : 8-10, Fig 7-9.

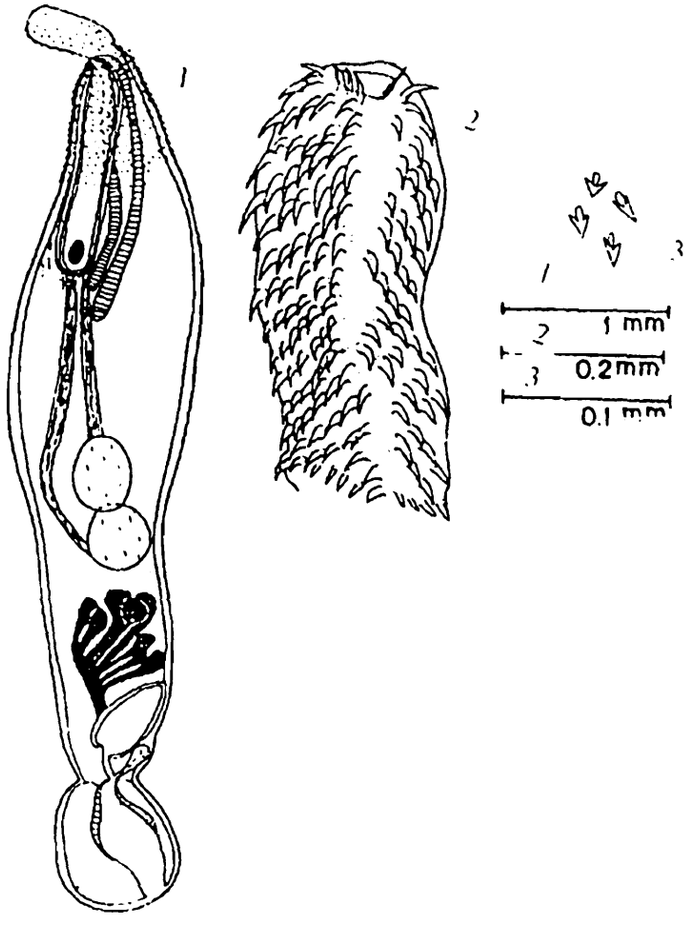


Fig. 85. *Pseudorhadinorhynchus dhari* Kumar, 1992. 1. Male, 2. Proboscis enlarged, 3. Trunk spines (after Kumar, 1992).

Type locality : Chilka Lake, Orissa, India.

Description : Male 5.45 × 1.15 mm. Proboscis elongate, cylindrical, 0.54 × 0.25 mm, with 20 longitudinal rows of 16 hooks each. Hooks quincunxce in arrangement, anterior hooks larger, 0.04-0.06 mm long, posterior hooks 0.030-0.032 mm long. Proboscis receptacle elongate, double-walled, 1.35 × 0.27 mm, with ganglion lying at its base. Trunk elongate, cylindrical, both ends attenuated, but midtrunk wide, anteriorly spinose, spines in 19 transverse rows of 14 spines each, 0.02-0.022 mm long. Lemnisci unequal, slender, longer than receptacle, smaller 1.64 mm long, longer 1.84 mm long. Testis oval, unequal, in tandem, slightly overlapping in middle part of trunk, anterior larger, 0.49 × 0.35 mm, posterior 0.41 × 0.39 mm. Cement glands 8, tubular, opening into bursa through common cement duct. Saefftigen's pouch saccular, 0.55 × 0.30 mm. Seminal vesicle club-shaped, 0.18 × 0.10 mm. Bursa muscular, elongate, 0.46 × 0.40 mm. Gonopore subterminal. Female not known.

Host : *Tachysurus nenga* (Bloch).

Location : Intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality.

92. ***Pseudorhadinorhynchus dussamicitatum*** Gupta, N.K. & Gupta, K. 1972 (Fig. 86)

Pseudorhadinorhynchus dussamicitatum Gupta, N. K. & Gupta, K. 1972a: 348-351, Fig. 3, 4; Gupta, V. & Sinha, 1990: 53; Golvan, 1994: 176; Bhattacharya, 2007: 132, Pl. 22, Fig. 117 a, b.

Type locality : Ernakulam, Kerala, India.

Description : Male 5.52 mm long. Proboscis long, slightly claviform, 0.52 × 0.25 mm, with 20 longitudinal rows of 12 or 13 hooks each, all hooks with well developed roots. Hooks decrease in size towards base, but basal hooks larger. Anterior hooks, 0.035 × 0.007 mm, succeeding posterior hooks, 0.02 × 0.009 mm, and basal hooks 0.045 × 0.007 mm. Neck 0.162 × 0.14 mm, aspinose. Proboscis receptacle cylindrical, double-walled, with ganglion at its base, 1.24 × 0.14 mm, with a set of retractor muscles, dorsal and ventral receptacle retractors. Trunk cylindrical, slightly inflated in anterior half, with spines in anterior part and aspinose in posterior part. Spines, very minute, 0.015 × 0.01 mm, embedded in cuticle. Lacunar system well developed. Lemnisci paired, cylindrical, unequal, 1.24-1.42 × 0.07-0.09 mm, emerge from hind end of neck, longer than receptacle. Testes oval, in tandem, contiguous, in midtrunk, anterior 0.36 × 0.34 mm, posterior 0.23 × 0.27 mm. Cement glands 8, claviform, unequal, 7 glands enclosed in ligament sac and eighth lies free at side of posterior testis, 0.18-0.36 × 0.108-0.162 mm. Cement ducts enter muscular bursal cap, lie close to one another, behind posterior testis. Saefftigen's pouch saccular 0.756 × 0.324 mm. Seminal vesicle and Saefftigen's pouch open into muscular bursal cap, which leads into bursa of 0.63 × 0.63 mm. Female not encountered.

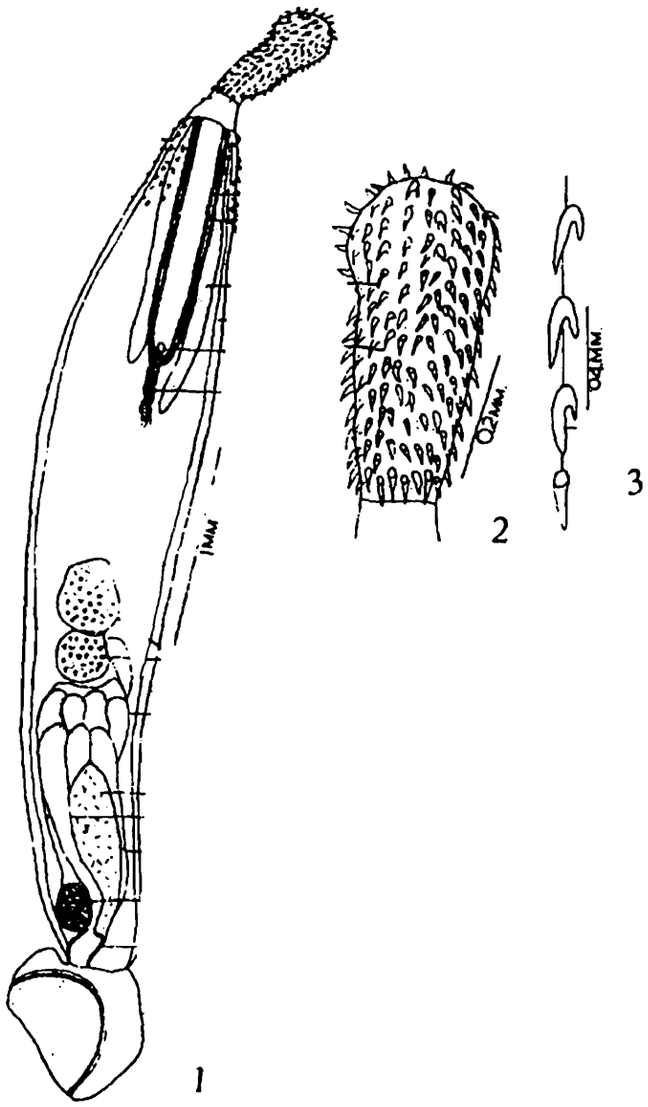


Fig. 86. *Pseudorhadinorhynchus dussamicitatum* Gupta, N.K & Gupta K., 1971. 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged (after Gupta, N.K. & Gupta, K. 1971).

Host : *Arioides dussameiri* (Cuvier & Valenciennes), *Therapon jarbua* (Forskal).

Location : Intestine.

Locality : Ernakulam (Kerala).

Distribution : Known only from type locality.

93. ***Pseudorhadinorhynchus ernakulensis*** Gupta, N.K. & Gupta, K., 1971 (Fig. 87)

Pseudorhadinorhynchus ernakulensis Gupta, N.K. & Gupta, K., 1972a : 345-348, Fig. 1, 2; Gupta, V. & Sinha, 1990 : 49; Golvan, 1994 : 176; Bhattacharya, 2007 : 132, Pl. 22, Fig. 117 a, b.

Type locality : Ernakulam, Kerala, India.

Description : Male 2.25 mm long, 0.4 mm in maximum width, and 0.13 mm wide in rest of trunk. Proboscis elongated, cylindrical, swollen at its anterior part, 0.59 × 0.21 mm, with 22 rows in anterior part with 5-7 hooks each and 28 rows in posterior part with 4-6 hooks each, all hooks with well developed roots. Hooks decrease in size towards posterior part of proboscis. Larger hooks in anterior region, 0.05 × 0.01 mm and posterior hooks 0.04 × 0,.007 mm. Basal hooks larger, 0.05 × 0.007 mm. Proboscis receptacle cylindrical, double-walled, 0.73 × 0.12 mm, with ganglion at its base, from which arise antero-median nerve supplying proboscis region. Trunk cylindrical, slightly swollen at anterior part at level of ganglion, 0.40 mm in maximum width, at other parts 0.134 mm wide. Anterior part of trunk with small spines, 0.01 × 0.005 mm. Lacunar system well developed. Lemnisci paired, filiform, slightly longer than receptacle, 0.75-0.77 × 0.01 mm. Testis oval, in midtrunk, anterior 0.90 × 0.77 mm, posterior 0.72 × 0.72 mm. Single sperm duct arises from hinder margin of posterior testis and enters genital sheath. Cement glands 8, pyriform, close to one another, 0.03-0.04 × 0.02-0.03 mm, their ducts enter genital sheath. Genital sheath sac- like, double-walled, 0.21 × 0.11 mm, terminates in bursa. Bursa 0.43 × 0.16 mm, eversible, and opens to outside through gonopore. Females not known.

Host : *Therapon jarbua* (Forskal).

Location : Intestine.

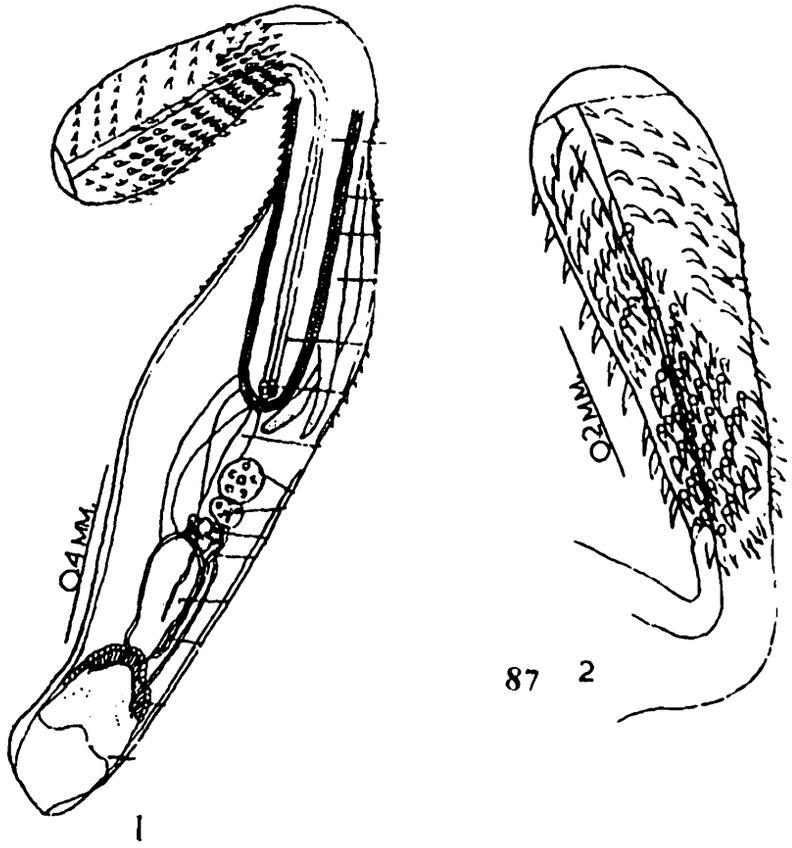


Fig. 87. *Pseudorhadinorhynchus ernakulensis* Gupta, N.K. & Gupta, K., 1971. 1. Male, 2. Proboscis enlarged (after Gupta, N.K. & Gupta, K., 1971).

Locality : Ernakulam (Kerala).

Distribution : Known only from type locality.

94. ***Pseudorhadinorhynchus guptai*** Gupta, V. & Sinha, 1993 (Fig. 88)

Pseudorhadinorhynchus guptai Gupta, V. & Sinha, 1993 : 9-10, Fig. 2 A-D.

Type locality : Cochin, Kerala, India.

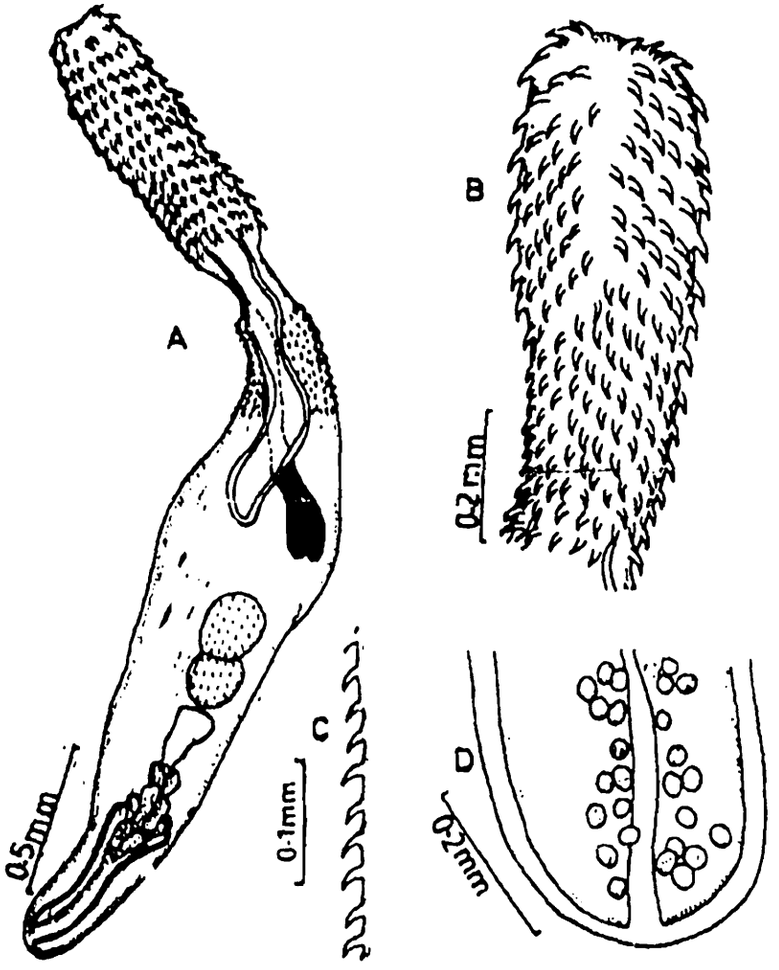


Fig. 88. *Pseudorhadinorhynchus guptai* Gupta, V. & Sinha, 1993. A. Male, dorsal view, B. Proboscis enlarged, C. Row of collar spines, D. Posterior part of female (after Gupta, V. Sinha, 1993).

Description : Male 2.85-3.20 × 0.36-0.42 mm; female 3.52-3.78 × 0.52-0.58 mm. Proboscis cylindrical, elongated, 0.64-0.86 × 0.18-0.25 mm with 17-21 longitudinal rows 16-18 hooks each in male; in female 0.62-0.82 × 0.19-0.26 mm, with 18-19 longitudinal rows of 16-18 hooks each. Each hook with recurved blade and deeply embedded root. Hooks similar in shape, decreases in size towards base. Proboscis receptacle elongated, cylindrical, double-walled, 0.60-80 × 0.14-0.16 mm in male; in female 1.10-1.17 × 0.14-0.20 mm. Trunk elongated, cylindrical, spinose, wide at middle and tapering to both ends,

1.68-2.10 × 0.48-0.50 mm spined 0.012-0.024 × 0.012-0.018 mm in male, in female 2.68-2.76 × 0.56-0.58 mm. Lemnisci long, tubular, subequal, extending up to end of receptacle, 1.08-1.30 mm long in male, in female 1.30-1.38 mm long. Testes ovoid, in tandem, equal, slightly overlapping, post-equatorial, 0.20-0.24 × 0.16-0.24 mm. Cement glands 8, pyriform or tubular, 0.05-0.07 × 0.03-0.04 mm with long slender cement ducts. Saefftigen's pouch pyriform, 0.36-0.42 × 0.12-0.16 mm. Bursa elongated without rays, 0.32-0.52 × 0.16-0.22 mm. Uterine bell funnel-shaped, 0.18-0.22 × 0.06-0.08 mm, guarded by four small cells leading to a narrow uterus, 0.04-0.06 mm long. Vagina thick-walled, muscular, 0.04-0.06 mm long. Ovarian balls fill entire body cavity. Eggs not observed.

Host : *Scianeoides microdon* Bleeker.

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

95. ***Pseudorhadinorhynchus longicollum*** Gupta, S.P. & Naqvi, 1986

Pseudorgadinorhynchus longicollum Gupta, S.P. & Naqvi, 1986a : 61-84; Gupta, V. & Sinha, 1990 : 54.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Engraulis malabaricus* Cuvier & Valenciennes.

Location : Intestine.

Locality : Kerala.

Distribution : Known only from type locality.

96. ***Pseudorhadinorhynchus machidai*** Kumar, 1992
(Fig. 89)

Pseudorhadinorhynchus machidai Kumar, 1992c : 7-8, Fig. 1-6.

Type locality : Chilka Lake, Orissa, India.

Description : Male 4.64 × 0.90 mm; female 3.40 × 0.76 mm. Proboscis cylindrical 0.38 × 0.20 mm in male; in female 0.85 × 0.27 mm, with18 longitudinal rows of 12 hooks each in male, in female 15 hooks each. Anterior hooks larger, 0.03-0.039 mm long, posterior hooks 0.025-0.027 mm long in male, in female 0.035-0.040 mm long and 0.025-0.029 mm long in female. Proboscis receptacle elongated, cylindrical, double-walled with ganglion at base, 1.45 × 0.24 mm in male; in female 1.35 × 0.35 mm Trunk elongated, cylindrical, with either ends attenuated, midtrunk wide, anteriorly spinose, with 14 transverse rows of 19 spines each, 0.016-0.018 mm long in male, 20 rows of 15 spines each, 0.021-0.023 mm long in female. Lemnisci 2, unequal, slender, much longer than receptacle, one 1.77

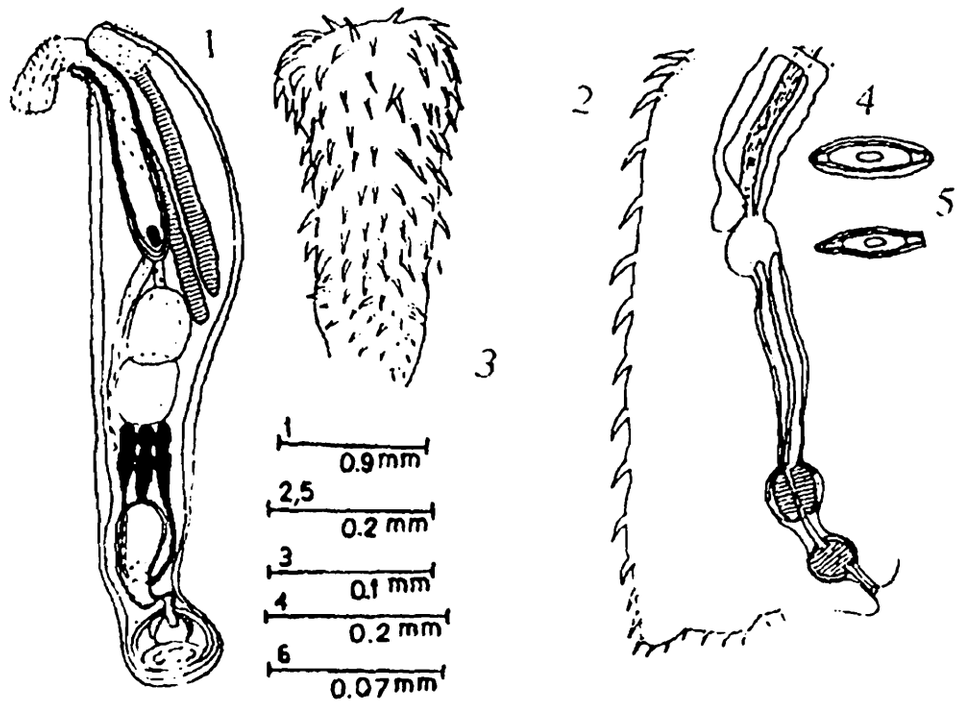


Fig. 89. *Pseudorhadinorhynchus machidai* Kumar, 1992. 1. Male, 2. Row of proboscis hooks, 3. Proboscis enlarged, 4. Female genitalia, 5. Eggs enlarged (after Kumar, 1992).

mm long, other 1.86 mm long in male; in female shorter lemniscus 1.70 mm long, other 2.10 mm long. Testes 2, ovoid, unequal, in tandem, slightly overlapping in midtrunk, anterior 0.45 × 0.36 mm, posterior 0.42 × 0.35 mm. Cement glands 8, club-shaped. Saefftigen's pouch pyriform, 0.67 × 0.31 mm. Seminal vesicle pyriform, 0.30 × 0.15 mm. Bursa muscular, curved, 0.20 × 0.25 mm. Uterine bell 0.22 × 0.081 mm. Uterus tubular, 0.33x 0.042 mm. Vagina 0.04 × 0.001 mm, guarded by two sphincters. Ova 0.05-0.060 × 0.01-0.02 mm, with polar prolongation of middle shell. Gonopore terminal.

Host : *Gagata cenia* (Hamilton).

Location : Intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from the type locality.

97. ***Pseudorhadinorhynchus mnobi*** Gupta, S.P. & Naqvi, 1986

Pseudorhadinorhynchus mnobi Gupta, S.P. & Naqvi, 1986 : 61-83; Gupta, V. & Sinha, 1990b : 51.

Type locality : Kerala coast.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Stomateus sinensis* Day.

Location : Intestine;

Locality : Kerala.coast.

Distribution : Known only from type locality.

98. ***Pseudorhadinorhynchus mujibi*** Gupta, S.P. & Naqvi, 1983 (Fig. 90)

Pseudorhadinorhynchus mujibi Gupta, S.P. & Naqvi, 1983 : 147-150, Pl. 2, Fig. 1-6; Gupta, V. & Sinha, 1990b : 51; Golvan, 1994 : 176.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Male 5.72-5.89 × 0.75-0.85 mm; female 5.94 × 0.94 mm. Proboscis elongated, cylindrical, 0.94-1.01 × 0.25-0.28 mm with 16-18 longitudinal rows of 17-18 hooks each, with larger hooks of apical region 0.064-0.067 × 0.020 mm, decreasing towards base, basal hooks 0.035-0.038 × 0.013 mm in male. In female proboscis 0.91 × 0.31 mm

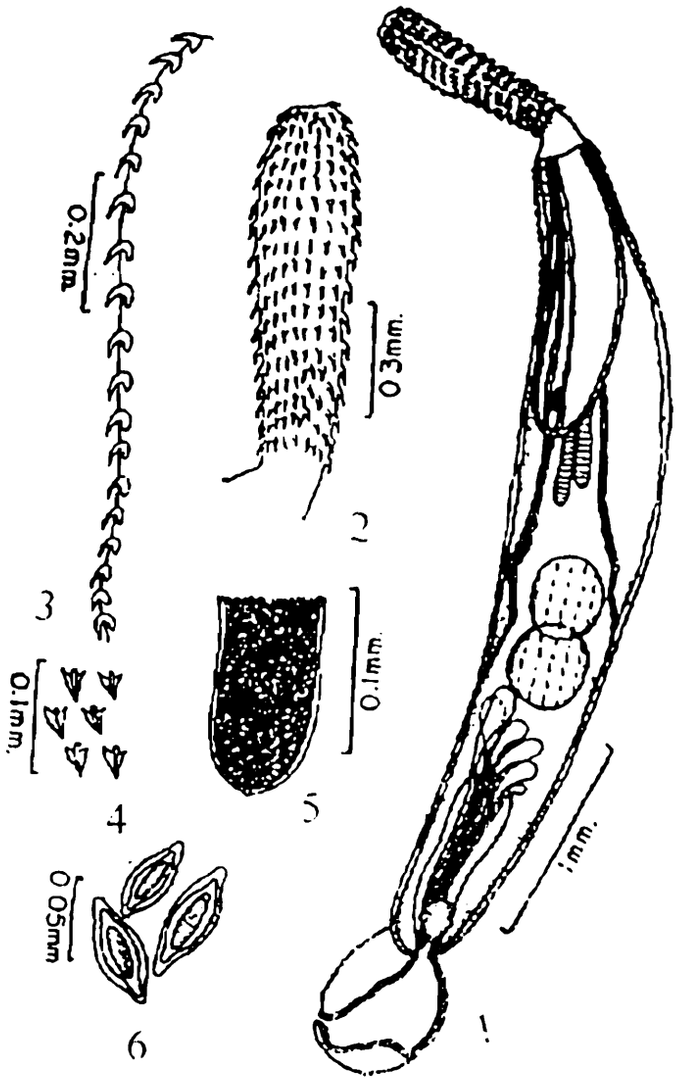


Fig. 90. *Pseudorhadinorhynchus mujibi* Gupta, S.P. & Naqvi, 1983. 1. Male, 2. Proboscis enlarged, 3. Row of proboscis hooks, 4. Trunk spines enlarged, 5. Posterior end of female, 6. Ova enlarged (after Gupta, S.P. & Naqvi, 1983).

with 18 longitudinal rows of 18 hooks each, with larger hooks of apical region 0.060-0.062 × 0.017 mm, decreasing towards base, basal hooks 0.031-0.033 × 0.012 mm. Neck short, 0.20-0.24 × 0.22-0.24 mm in male; in female 0.24 × 0.30 mm. Proboscis receptacle elongated, muscular, double-walled with ganglion at its base, 1.30-1.37 × 0.31-0.38 mm in males; in female 1.32 × 0.24 mm. Trunk elongated, cylindrical, wide at middle and tapering to both ends, 4.54-4.68 × 0.75-0.85 mm in males; in female 4.79 × 0.94 mm. Anterior trunk covered with stout spines more extensively ventrally than dorsally. Lemnisci ribbon like, subeqaul, longer than receptacle, longer 1.70-1.75 mm long, smaller 1.63-1.68 mm long in males; in female longer 1.70 mm long, smaller 1.63 mm long. Testes spherical, in tandem, slightly overlapping, equal and equatorial; anterior 0.35-0.37 × 0.30-0.32 mm, posterior 0.36-0.37 × 0.33-0.35 mm. Cement glands 6, pyriform, 0.10-0.25 × 0.05-0.17 mm. Saefftigen's pouch pyriform, 0.84-0.91 × 0.20-0.25 mm. Seminal vesicle pyriform, 0.30-0.35 × 0.18 mm, opening into globular bursa, 0.50-0.60 × 0.48-0.49 mm. In female ovarian balls and ova numerous and fill entire body cavity. Eggs 0.05-0.07 × 0.03 mm with polar prolongations of middle membrane,. Gonopore subterminal in male, terminal in female.

Host : *Stomateus sinensis* Day.

Location : Intestine.

Locality : Karachi coast (Pakistan).

Distribution : Known only from type locality.

99. ***Pseudorhadinorhynchus nandai*** Gupta, V. & Sinha, 1993 (Fig. 91)

Pseudorhadinorhynchus nandai Gupta, V. & Sinha, 1993 : 79, Fig. 1 A-D.

Type locality : Cochin, Kerala, India.

Description : Male 3.60 × 0.70 mm; female 4.8-5.2 × 0.95-1.05 mm. Proboscis elongated, cylindrical, 0.95 × 0.30 mm in male with 20 longitudinal rows of 18 hooks each in male, in female 1.00-1.10 × 0.95-1.05 mm, 18-20 longitudinal rows with 16-18 hooks each. Each hook with a recurved blade and deeply embedded root. Hooks similar in shape, decreasing in size towards base. Proboscis hooks of anterior part large, 0.258-0.032 mm long, of posterior part small 0.022-0.0.256 mm long in male; in female hooks of anterior part 0.032-0.036 mm long, of posterior part 0.024-0.026 mm long. Neck 0.15 × 0.26 mm in male; in female 0.18-0.22 × 0.32-0.34 mm. Proboscis receptacle saccate to claviform, double-walled, with ganglion slightly above its base, 0.85 × 0.20 mm. Trunk elongated, cylindrical, medium sized, wide in middle and tapering to both ends, 2.85 × 0.75 mm, anterior trunk region spinose, with 20 rows of collar spines of 30-34 spines each. Each spine with wide base and conical free end, 0.012-0.014 × 0.008-0.010 mm wide in male; in female anterior trunk with 14-16 circular rows of 22-28 spines each. Lemnisci long, cylindrical, subequal, extending up to slightly anterior to anterior testis, longer lemniscus

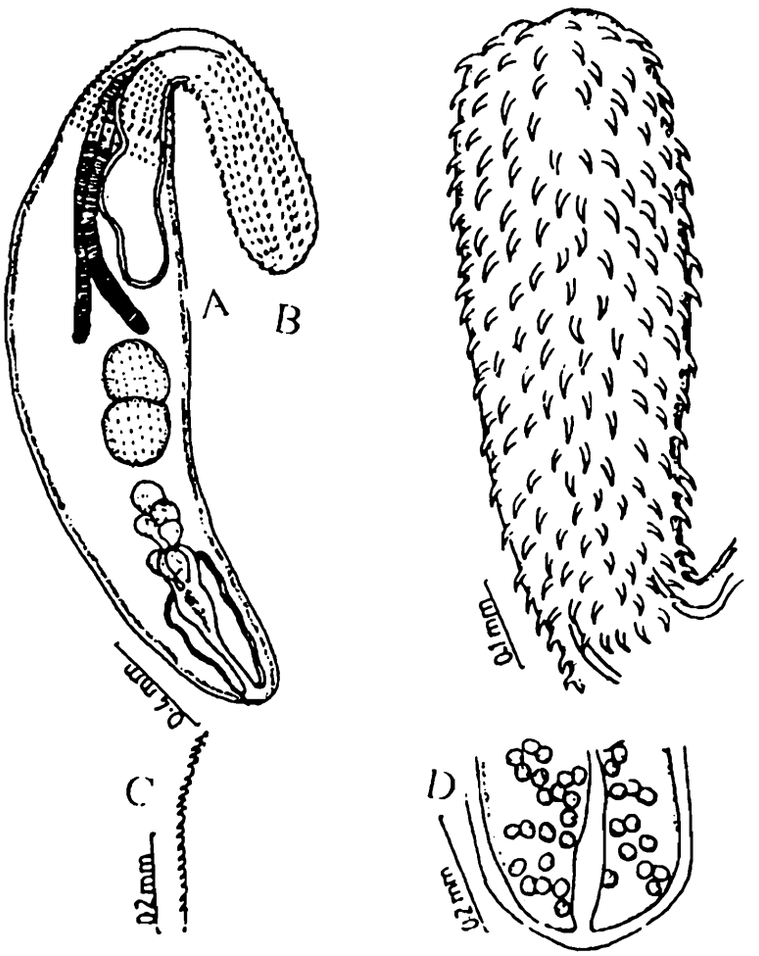


Fig. 91. *Pseudorhadinorhynchus nandai* Gupta, V. & Sinha, 1993. A. Male, dorsal view, B. Proboscis enlarged dorsal view, C. Rows of proboscis hooks, D. Posterior part of female (after Gupta, V. & Sinha, 1993).

1.20 × 0.12 mm, shorter lemniscus, posterior 0.32 × 0.26 mm. Cement glands 6, pyriform in a cluster, 0.65-0.90 × 0.15-0.18 mm, opening into bursa through separate ducts. Saefftigen's pouch elongated, pyriform, 0.65 × 0.15 mm. Bursa globular 0.55 × 0.25 mm. Gonopore terminal. Uterus long funnel-shaped, 0.15-0.22 × 0.36-0.38 mm. Vagina with sphincter. Eggs oval to spherical, 0.04-0.08 × 0.012-0.014 mm with polar prolongations of middle shell.

Host : *Nandus nandus* (Hamilton).

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

100. ***Pseudorhadinorhynchus orissi*** Gupta, V. & Fatma, 1986

Pseudorhadinorhynchus orissi Gupta, V. & Fatma, 1986c: 149-180; Gupta, V. & Sinha, 1990: 52; Golvan, 1994: 176; Bhattacharya, 2007 : 132.

Type locality : Puri, Orissa, India.

Description : Male 5.50-5.58 × 0.70-0.82 mm. Female 6.21-6.50 × 1.0-1.21 mm. Proboscis 1.01-1.15 × 0.30-0.34 mm, with18-20 longitudinal rows of 12-14 hooks each. Anterior hooks 0.045-0.096 mm, posterior hooks 0.03-0.04 mm long. Lemnisci 2.0-2.2 mm long. Anterior testis 0.40-0.45 × 0.35-0.38mm, posterior testis 0.36-0.38 × 0.36-0.40 mm. Cement glands pyriform. Saefftigen's pouch 1.0-1.08 × 0.20-0.24 mm. Eggs 0.055-0.060 × 0.05-0.20 mm with polar prolongations of middle shell membrane.

Host : *Mugil subviridis* Cuvier & Valenciennes.

Location : Intestine.

Locality : Puri (Orissa).

Distribution : Known only from type locality.

101. ***Pseudorhadinorhynchus srivastavai*** Gupta, V. & Fatma, 1983 (Fig. 92)

Pseudorhadinorhynchus srivastavai Gupta, V. & Fatma, 1983 : 137-148, Fig. 5; Gupta, V. & Sinha, 1990 : 52; Golvan, 1994 : 176; Bhattacharya, 2007 : 133, Pl. 22, Fig. 119 1-e.

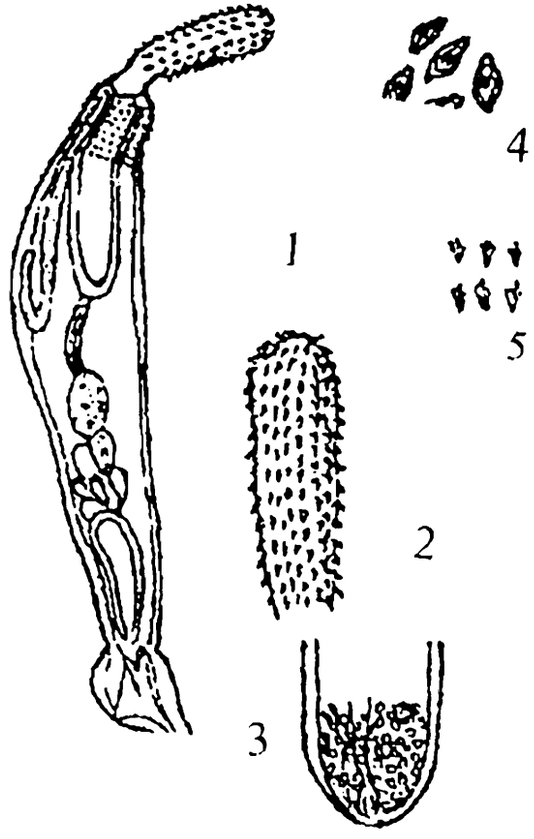


Fig. 92. *Pseudorhadinorhynchus srivastavi* Gupta, V. & Fatma, 1985. 1. Male, 2. Proboscis, 3. Ova, 4. Trunk spines (after Bhattacharya, 2007).

Type locality : Puri, Orissa, India.

Description : male 4.05-4.6 × 0.69-0.95 mm; female 6.0-6.5 × 1.0-1.25 mm. Proboscis 0.70-0.89 × 0.20-0.32 mm, with 16-18 longitudinal rows of 14-15 hooks each. Anterior trunk spines extensive ventrally than dorsally, spines 9-12 circular rows of 10-14 hooks each. Lemnisci 1.60-2.10 mm, and 1.85-2.0 mm long. Anterior testis 0.31-0.40 × 0.22-0.30 mm, posterior testis 0.30-0.35 × 0.20-0.32 mm. Cement glands 8, pyriform. Saefftigen's pouch 0.50-0.60 × 0.25-0.28 mm. Eggs 0.04-0.045 × 0.001-0015 mm..

Host : *Mugil cephalus* Linnaeus.

Location : Intestine.

Locality : Kerala; Puri (Orissa).

Distribution : Known only in India.

31. Genus ***Telosentis*** Van Cleave, 1923

Telosentis Van Cleave, 1923: 174-175; Southwell & Macfie, 1925: 161; Petrotschenko, 1956: 396; Yamaguti, 1963: 108; Golvan, 1994: 180; Bhattacharya, 2007: 135.

Diagnosis : Illiosentidae. Proboscis cylindrical to claviform, with 10-14 longitudinal rows of 16-26 or more hooks each. Proboscis receptacle long, with ganglion away from its base. Trunk armed with spines at anterior and posterior ends. Lemnisci not markedly longer than proboscis receptacle. Cement glands more than 6, close together. Male genital pore subterminal. Eggs oval or more elongate. Parasites of marine fishes.

Type species : *Telosentis molini* Van Cleave, 1923.

Includes five species, 1. *Telosentis lutianusi* Gupta, V. C. & Gupta, P. c. 1990, 2. *T mizellei* Gupta, V. & Fatima, 1988, 32. *Telosentis australiensis* Edmonds, 1964, *4. Telosentis exiguus* (Linstow, 1901) Van Cleave, 1923, and 5. *Telosentis molini* Van Cleave, 1923, of which first two occurs in India.

102. ***Telosentis lutianusi*** Gupta, V. C. & Gupta, P. C. 1989

Telosentis lutianusi Gupta, V.C. & Gupta, P.C. 1989 : 306-310; Bhattacharya, 2007 : 135-136.

Type locality : Puri coast, Orissa, India.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Lutianus leoglossus.*

Location : Intestine.

Locality : Puri coast (Orissa).

Distribution : Known only from type locality.

103. ***Telosentis mizellei*** Gupta, V. & Fatma, 1988
(Fig. 93)

Telosentis mizellei Gupta, V. & Fatma, 1988: 139-141, Pl. 4, Fig. 1-3. Golvan, 1994: 180; Bhattacharya, 2007: 133, Pl. 22, Fig. 121 a-c.

Type locality : Mandapam, Tamil Nadu, India.

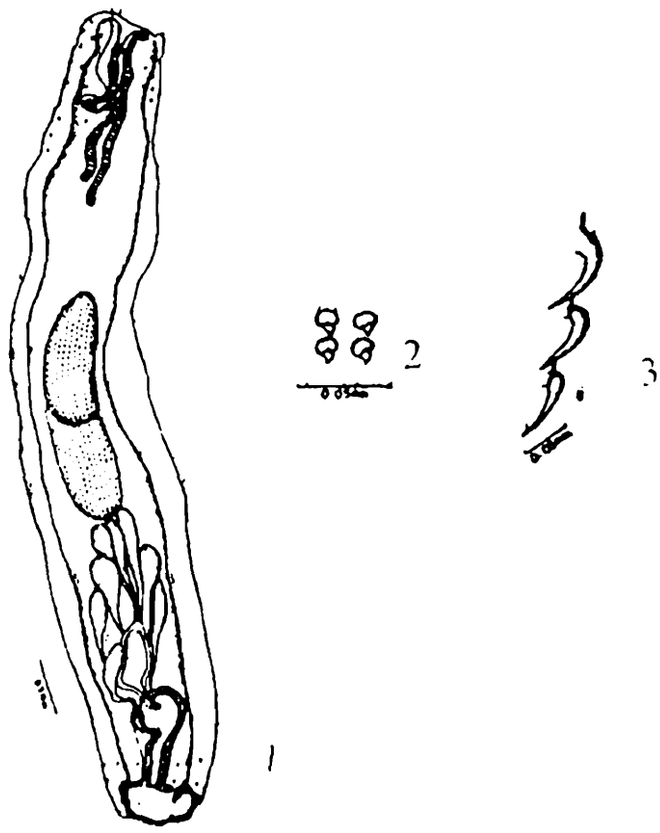


Fig. 93. *Telosentis mizellei* Gupta, V. & Fatma, 1988. 1. Male, 2. Trunk spines enlarged, 3. Row of proboscis hooks enlarged (after Gupta, V. & Fatma, 1985).

Description : Male 7.0 × 1.55 mm, Proboscis cylindrical, 0.60 × 0.56 mm, with 16 longitudinal rows of 20 hooks each. Hooks almost similar in shape but differ in size from anterior to middle, 0.05-0.06 mm long, basal hooks large, 0.065-0.07 mm long. Proboscis receptacle cylindrical, double-walled, 0.7 × 0.22 mm, with ganglion wide apart from its base. Trunk elongated, cylindrical, armed with 15 circular rows of spines extending up to posterior end, spines 0.010-0.012 mm long with wide semilunar base, 0.12-0.0125 mm long. Lacunar system with reticular anastomoses. Lemnisci cylindrical, subequal, smaller than receptacle, smaller 0.45 × 0.05 mm, larger 0.45 × 0.52 mm, extending slightly above to anterior testis. Testes equal, elongated, cylindrical, in tandem, equatorial, overlapping, anterior 1.11 × 0.41 mm, posterior, posterior testis 1.1 × 0.46 mm. Cement glands 8, pyriform, close together forming three groups, anterior group of 3 glands, 1.26-1.6 × 0.20-0.26 mm, middle group of 2 glands, 1.20-1.26 × 0.22-0.3 mm and basal group of 3 glands, 0.90-1.05 × 1.0-1.2 mm. Seminal vesicle elongated, 0.38 × 0.11 mm, opening into bursa

through narrow tubular ducts. Saefftigen's pouch pyriform 9.45 × 0.3 mm. Bursa muscular 1.15 × 0.45 mm. Gonopore terminal with a few genital spines.

Host : *Lutjanus johni* (Bloch.).

Location : Intestine.

Locality : Mandapam (Tamil Nadu); Uttar Pradesh.

Distribution : Known only in India.

12. Family POMPHORHYNCHIDAE Yamaguti, 1939

Pomphorhynchidae Yamaguti, 1939: 328. Petrotschenko, 1956: 338-339; Yamaguti, 1963: 93; Golvan, 1969: 298; Bhattacharya, 2007: 138.

Diagnosis : Pomphorhynchidae. Worms small. Proboscis long, cylindrical with 12-20 longitudinal tows of 10-14 hooks each; posterior hooks much larger than anterior hooks. Neck very long, cylindrical, forming a spherical bulb at its anterior end. Proboscis receptacle double-walled, inserted posterior to proboscis and extending backwards through our length of neck, with basal ganglion. Trunk small, fusiform, aspinose. Hypodermal nuclei small and numerous. Lacunar system with lateral main channels and reticular anasromoses. Lemnisci short, claviform. Testes ovoid, in tandem near midtrunk. Cement glands six usually compact. middle shell. Gonopore in both sexes terminal, not surrounded by spines. Parasites of marine and freshwater fishes.

Type genus : *Pomphorhynchus* Monticelli, 1905.

Includes five genera 1. *Longicollum* Yamaguti, 1935,2 *Paralongicollum* Amin, Bauer & Sidanov, 1991, 3. *Pomphorhynchus* Monticelli, 1905, 4. *Tenuiproboscis* Yamaguti, 1935, 5. *Pyriproboscis* Amin, Shamall, Abdulla & Mhaisen, 2003 of which first four genera occur in this subcontinent.

Key to Indian genera of family Pomphorhynchidae

1. Neck uniformly cylindrical 2
– Neck not uniformly cylindrical 3
2. Proboscis cylindrical, filiform ..... *Tenuiproboscis*
– Proboscis not filiform, may be enlarged anteriorly ..... *Paralongicollum*
3. Neck spirally twisted, fusiform, expanded at places or curved ..... *Longicollum*
– Neck with bulb anteriorly ..... *Pomphorhynchus*

32. Genus ***Longicollum*** Yamaguti, 1935

Longicollum Yamaguti, 1935: 260; Petrotschenko, 1956 : 351; Yamaguti, 1963 : 96; Golvan, 1969 : 316; 1994 : 161; Bhattacharya, 2007 : 139.

Diagnosis : Pomphorhynchidae. Proboscis short, cylindrical, with hooks of different shapes in longitudinal rows, decreasing in size from apex to base. Proboscis receptacle double-walled, with ganglion a little in front of its base. Neck unarmed, very long, spirally twisted, conspicuously expanded at convex side but not forming true bulb or bulla. Trunk elongate, nearly cylindrical, with reticular lacunar system. Lemnisci rudimentary, short, saccular or forming a ring-like thickening. Testes spherical or ovoid, contiguous, equatorial or post-equatorial. Cement glands 6, oval or more elongate. Saefftigen's pouch well developed. Uterine bell comparatively short and wide. Vagina with sphincter. Ova much elongated, elliptical, outer membrane delicate, middle membrane prolonged at each pole, inner shell unusually thick. Parasites of marine fishes.

Type species : *Longicollum pagrosomi* Yamaguti, 1935.

Includes twelve species, 1. *Longicollum cadenati* Gupta, S.P. & Naqvi, 1984, 2. *L. engralisi* Gupta, V. & Fatima, 1986, 3. *L. indicum* Gupta, N.K. & Gupta, K., 1970, 4. *L. lutiani* Jain & Gupta, N.K., 1980, 5. *L. psettodesai* Gupta, S.P. & Gupta, K., 1980, 6. *L. quiloni* Gupta, S.P. & Naqvi, 1984, 7. *L. alemniscus* (Harada, 1935) Fukui & Morisita, 1938, 8. *L. chabanaudi* Dollfus & Golvan, 1963, 9. *L. edmondsi* Golvan, 1969, 10. *L. noellae* Golvan, 1969, 11. *L. pagrosomi* Yamaguti, 1935 and 12. *L. riouxi* Golvan, 1969, of which first six occur in the subcontinent.

Key to Indian species of genus *Longicollum*: See Gupta, S.P & Naqvi, 1982

1. Proboscis with 10-12 longitudinal rows of 11-12 hooks each .. *Longicollum cadenati*
– Proboscis with more than 12 or more rows of hooks 2
2. Proboscis with 12-13 longitudinal rows of 14-15 hooks each ..... *Longicollum lutiani*
– Proboscis with more than 13 longitudinal rows of hooks each 3
3. Proboscis hooks 10-12 in each of 14-16 longitudinal rows ... *Longicollum psettodesi*
– Proboscis hooks 13-14 in each of 14 longitudinal rows..... *Longicollum engralesi*
– Proboscis hooks more tham 14 hooks in each of longitudinal rows 4
4. Proboscis hooks 17-17in each of 14-16 longitudinal rows ..... *Longivollum quiloni*
– Proboscis hooks 23-25 in each of 14 longitudinal rows ..... *Longivollum indicus*

104. ***Longicollum cadenati*** Gupta, S.P. & Naqvi, 1984
(Fig. 94)

Longicollum cadenati Gupta, S. P. & Naqvi, 1984a: 76-79, Pl. 5, Fig. 1-3; Gupta, V. & Sinha, 1990b: 49; Golvan, 1994 : 161.

Type locality : Cochin, Kerala, India.

Description : Male 5.19-6.28 × 0.95-0.98 mm; female 5.5-6.5 × 0.95-0.98 mm. Proboscis club-shaped 0.36-0.51 × 0.22-0.32 mm, with 10-12 longitudinal rows of 11-12 hooks each. Hooks of anterior 4-5 rows largest with stout and much curved blade, 0.07-0.08 mm long,

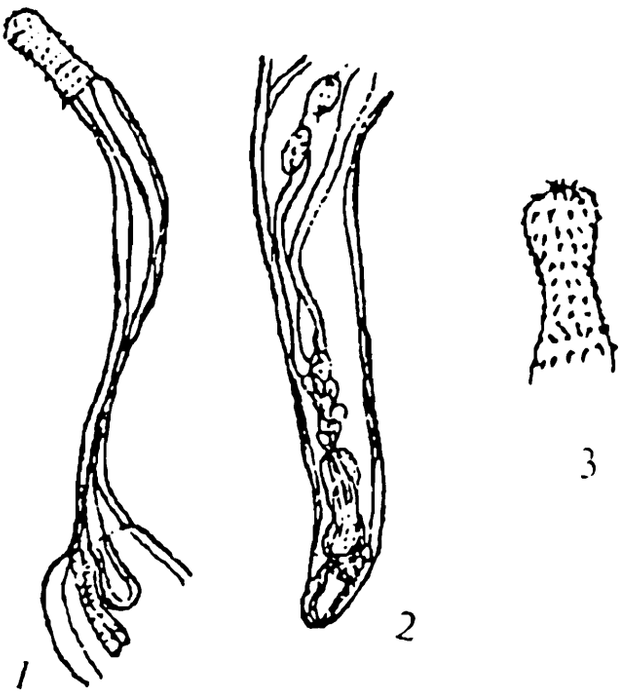


Fig. 94. *Longicollum cadenati* Gupta, S.P. & Naqvi, 1984. 1. Male, 2. Proboscis hooks enlarged, 3. Proboscis enlarged (after Gupta, V. & Famta, 1984).

of middle rows thin and less curved, 0.03-0.04 mm long and of posterior rows 0.06-0.07 mm long. Neck long, aspinose, spirally twisted, 1.30-1.31 × 0.28-0.35 mm. Proboscis receptacle double-walled, 1.88-2.10 × 0.21-0.23 mm, arising from anterior margin of neck and extending slightly into trunk pseudocoel with ganglion slightly above its base. Trunk elongated, swollen anteriorly, aspinose, gradually tapering posteriorly, 3.37-4.62 × 0.95-0.98 mm. Lacunar system with lateral main channels. Lemnisci unequal, saccular or digitiform, smaller than receptacle, extending above anterior testis, smaller0.34-0.35 mm long, longer 0.43-0.48 mm long. Testes in tandem, oval, subequal, contiguous or united by genital ligament, pre-equatorial; anterior 0.31-0.36 × 0.16-0.22 mm, posterior smaller, 0.26-0.32 × 0.15-0.20 mm. Cement glands 6, pyriform, massed together, far behind posterior testis, 0.08-0.22 × 0.04-0.06 mm. Saefftigens pouch pyriform, 0.30-0.53 × 0.14-0.15 mm. Seminal vesicle 0.21-0.44 × 0.04-0.06 mm. Bursa elongated with two anterior diverticula, 0.54-0.62 × 0.15-0.16 mm. Female not known.

Host : *Gerres setifer* (Hamilton).

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

105. ***Longicollum engralisi*** Gupta, V. & Fatma, 1985 (Fig. 95)

Longicollum engralisi Gupta, V. & Fatma, 1985: 137-154, Fig. —; Golvan, 1994: 161; Bhattacharya, 2007: 140; Pl. 23, Fig. 128 a-c.

Type locality : Quilon, Kerala, India.

Description : Male elongate, 8.90 mm long, swollen anteriorly and tapering posteriorly. Proboscis short, cylindrical, 0.68 × 0.25 mm, with14 longitudinal rows of 13-14 hook each, anterior hooks curved, 0.055-0.050 mm, middle 0.045-0.048 mm, basal 0.065-0.070 mm. Neck very long 3.80 × 0.035 mm, spirally twisted. Proboscis receptacle double-walled, 3.75 × 0.22 mm with basal ganglion. Lemnisci 0.58-0.60 mm long. Testes in tandem. Cement glands 6, elongated, 0.27-0.33 x0.085-0.13 mm. Saefftigen's pouch 0.68 × 0.22 mm. Gonopore terminal.

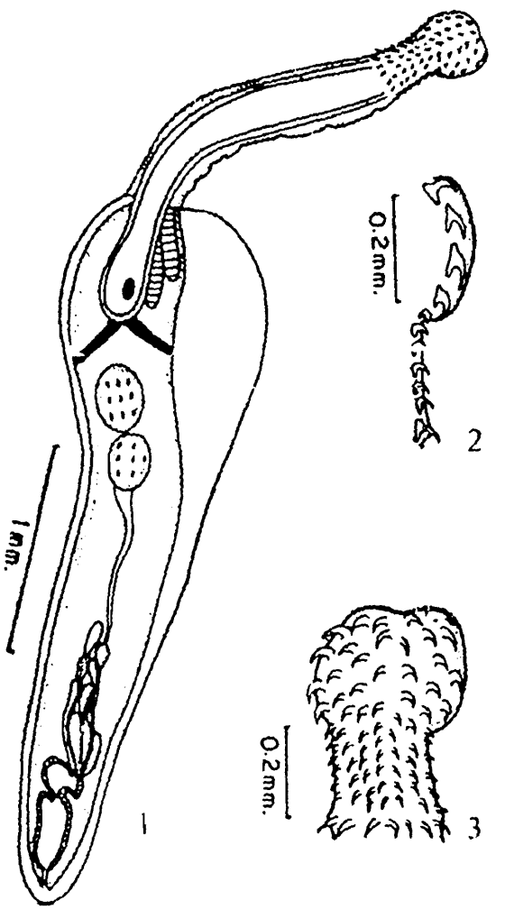


Fig. 95. *Longicollum engralisi* Gupta, S.P. & Naqvi, 1985. 1. Anterior part of male, 2. Posterior part of Male, 3. Proboscis (Bhattacharya, 2007).

Host : *Engralis malabaricus* Cuvier & Valenciennes.

Location : Intestine.

Locality : Quilon (Kerala);

Distribution : Known only from type locality.

106. ***Longicollum indicum*** Gupta, N.K. & Gupta, K. 1970 (Fig. 96)

Longicollum indicum Gupta, N.K. & Gupta, K., 1970b: 507-510, Fig. 1-3; 1979b: 135-137; Soota & Bhattacharya, 1981: 232; Gupta, V. & Sinha, 1990b: 53; Golvan, 1994: 161; Bhattacharya, 2007 : 140-141.

Type locality : Ernakulam, Kerala, India.

Description : Male 15.675-40.236 × 0.465-1.358 mm; female 40.992-56.26 × 0.60-0.99 mm. Proboscis long, claviform, 0.68-0.73 × 0.30-0.326 mm with 14 longitudinal rows of 23-25 hooks each in male; in female 17-18 rows with 15 hooks each, hooks decreasing in size towards base. Larger hooks 0.045 × 0.015 mm. Basal hooks in anterior part 0.02 × 0.01 mm. Dorsal basal hooks 0.013-0.019 × 0.002-0.005 mm. All hooks with well developed roots. Neck long, 0.18 × 0.36-0.39 mm, somewhat spirally twisted. Proboscis

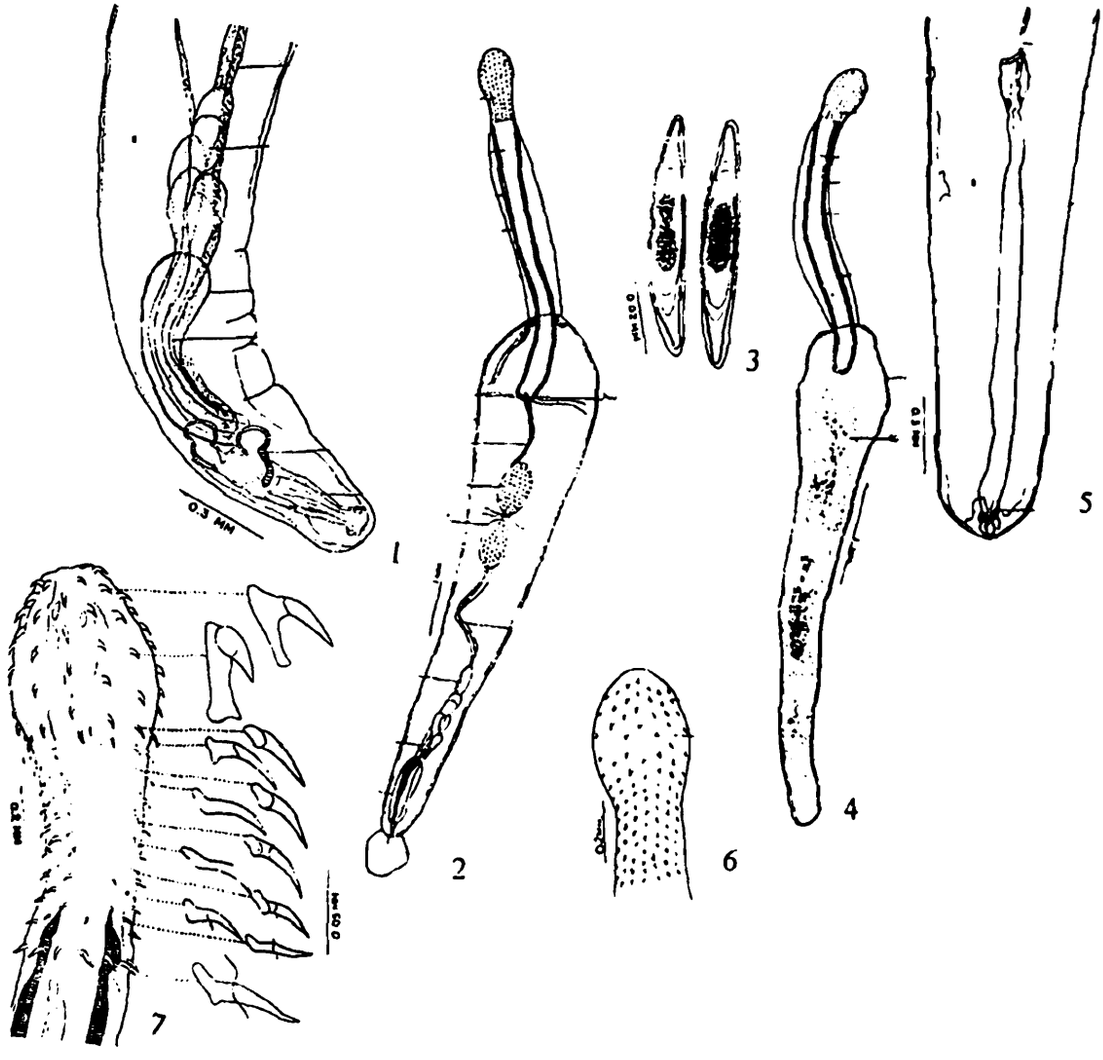


Fig. 96. *Longicollum indicum* Gupta, N.K. & Gupta, K., 1970. 1. Posterior part of male, 2. Male, 4. Eggs enlarged, 5. Female, 6. Posterior part of female, 7. Proboscis enlarged, 8.6. Proboscis enlarged showing position of hooks (2,3,4,6 after Golvan, 1960, 1,5,7 Gupta, N.K. & Gupta, K., 1970).

receptacle cylindrical, double-walled, 2.5 × 0.23 mm, anteriorly extends to anterior margin of neck and posteriorly hangs freely in trunk pseudocoel, provided with retractor muscles. Trunk elongate, swollen anteriorly, anterior trunk 1.13 mm wide in male, 0.84 mm in female, hind trunk 0.46 mm wide at level of cement glands in male and 0.28 mm wide in female. Lacunar system well developed. Lemnisci present. Testes oval, in tandem, united by genital ligament, slightly in front of midtrunk, anterior larger 0.468 × 0.288 mm, posterior smaller, 0.468 × 0.27 mm. Sperm ducts a pair arise from posterior testis, run along cement glands and enter genital sheath. Cement glands 6, claviform, lie one behind other, 0.27-0.30 × 0.07-0.09 mm, their ducts lead to genital sheath, 0.37 × 0.03 mm. Genital sheath ends on bursa. Everted bursa 0.39 × 0.36 mm. In gravid female ovary burst releasing eggs, filling pseudocoel. Eggs 0.028-0.040 × 0.006 mm.

Host : *Tylosurus strongylarus* (V. Hassell), *Scatophagus argus* (Cuvier & Valenciennes), *Siganus vermiculatus* (Cuvier & Valenciennes); *Protonibea diacanthus*; *Lethrinus reticulatus, Strongylura strongylurus, Pennahia macrophthalmus,Lobates surinamensis, Epinephelus chlorostigma, Lobates surinamensis.*

Location : Intestine.

Locality : Ernakulam, Calicut (Kerala); Vasco-da-Gama and Panaji (Goa); Mumbai (Maharastra); Barkul, Chilka lake (Orissa).

Distribution : Known only from India.

107. ***Longicollum lutiani*** Jain & Gupta, N.K. 1980

Longicollum lutiani Jain & Gupta, N.K., 1980b: 270-276, Fig. 1-7; Golvan, 1994: 161; Bhattacharya, 2007: 141.

Type locality : Panaji, Mapusa, Goa, India.

Description : Male 5.86-7.62 × 0.69-1.20 mm, females 8.13-10.47 × 1.29-1.76 mm. Proboscis clavate, 0.68-0.81 × 0.25-0.27 mm in male; in female 0.70-1.06 × 0.29-3.07 mm with 12-13 alternating longitudinal rows of 14-15 hooks each in both sexes Hooks with a posteriorly directed 0.02-0.04 mm long root; apical hooks longest and stout, 0.054-0.060 × 0.013-0.022 mm with 0.054-0.062 mm long roots, posterior to these they gradually decrease in size to smallest hooks, 0.03-0.04 × 0.003-0.011 mm, with roots decreasing in size to knob-like structures. Hooks posterior to these with anteriorly directed blades which gradually increase in size to 0.016-0.024 mm long in last but one hook of each row. Basal hooks 0.51-0.062 × 0.016-0.019 mm. Neck long, 1.45-2.58 × 0.25-0.37 mm in male, in female 1.45-3.07 × 0.23-0.39 mm. Proboscis receptacle long, cylindrical, double-walled, with rounded posterior end, 1.92-3.453 × 0.135-0233 mm in males; in females 2.09-3.24 × 0.19-0.33 mm, with ganglion 0.07-0.09 × 0.03-0.06 mm in male, in female 0.08-0.11 × 0.033-0.058 mm. Trunk conical, with an anterior dorsal swelling with rounded posterior end. Hypodermal nuclei numerous, small. Lacunar system with dorsal and ventral longitudinal channels and reticular anastomoses. Lemnisci digitiform slightly longer than receptacle, 0.26-0.62 mm and 0.28-0.64 × 0.058-0.116 mm in males; in females 0.39-

0.76 and 0.46-0.77 × 0.058-0.136 mm. Testes in midtrunk region, in tandem, slightly overlapping, or slightly or widely apart, anterior testis 0.194-0.621 × 0.135-0.427 mm, posterior 0.194-0.621 × 0.116-0.407 mm. Cement glands 6, clavate, in a compact group, 1.17-1.28 mm long from posterior testis and 0.15-0.37 × 0.058-0.136 mm, each with a separate duct traversing length of Saefftigen's pouch to base of penis. Saefftigen's pouch elongated, 0.48-1.10 × 0.15-0.37 mm. Seminal vesicle 0.35-0.46 × 0.078-0.116 mm. Copulatory bursa, 0.46-0.75 × 0.17-0.27 mm, with two anterior diverticula. In female genital tube 1.57-2.18 mm long, Uterine bell tubular, 0.16-0.23 × 0.087-0.116 mm, uterus 1.49-1.78 × 0.85-1.15 mm; vagina muscular 0.13-0.16 mm long with two sphincters. Eggs 0.054-0.065 × 0.008-0.011 mm with polar prolongations of middle shell. Gonopore median in both sexes.

Host : *Lutianus johnii* (Bloch). *Gerres filamentosus, Pamadasys quckers.*

Developmental stages and juveniles in *Porcillionides prumosus* (Crustacea) *Rana tigrina* (Daudin) and *Bufo* sp. (Amphibia), *Hemidactylus brooki* (wall lizard) *Calotes* sp., *Natrix stolatus* and *Tropidonotus* sp., (Reptiles), *Herpestes edwardsi* (Mammal); *Corvus splendens* (Vieilot) (Aves)

Location : Rectum, immature in intestine.

Locality : Panaji, Mapusa (Goa).

Distribution : Known only from type locality.

108. ***Longicollum psettodai*** Gupta, S.P. & Gupta, K. 1979 (Fig. 97)

Longicollum psettodai Gupta, S.P. & Gupta, K. 1979 : 139-142, Pl. 2, Fig. 1-3; Gupta, V. & Sinha, 1990b: 52; Golvan, 1994: 161; Bhattacharya, 2007: 140, Pl. 23, Fig. 127 a-c.

Type locality : Quilon, Kerala, India.

Description : Male 9.78 × 1.06 mm. Proboscis 0.71 × 0.26 mm with 14-16 longitudinal rows of 10-12 hooks each, anterior hooks largest 0.050-0.055 mm long, middle hooks 0.02-0.03 mm long and posterior hooks 0.039-0.05 mm. Neck unarmed, very long, slightly twisted, 3.26 × 0.32 mm. Proboscis receptacle cylindrical, double-walled, 3.72 × 0.22 mm, with ganglion near its base. Trunk elongated, aspinose, swollen anteriorly and tapering posteriorly, and narrowing in middle, 4.82 × 1.06 mm. Lemnisci short, equal, saccular, 0.06 mm long, extending beyond receptacle. Testes oval, in tandem, in midtrunk, anterior 0.32 × 0.22 mm, posterior 0.34 × 0.22 mm. Sperm ducts two run posteriorly along cement glands, enter into genital sheath. Cement glands 6, closely grouped side by side at some distance behind posterior testis, 0.27-0.33 × 0.081-0.12 mm. Saefftigen's pouch elongate, 0.68 × 0.22 mm with rounded anterior end, opening into bursa. Bursa inverted, elongate without diverticula, 0.76 × 0.27 mm. Gonopore terminal. Female not known.

Host : *Psettodes erumei* (Bloch & Schneider).

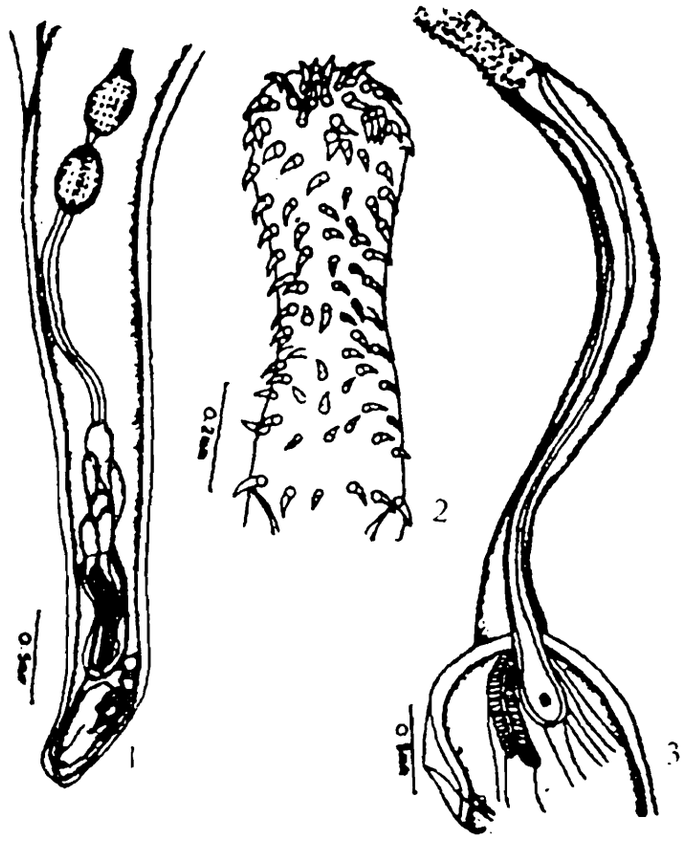


Fig. 97. *Longicollum psettodai* Gupta, S.P. & Gupta, K., 1979. 1. Posterior part of male, 2. Proboscis enlarged, 3. Anterior part of worm (all from Gupta, S.P. & Gupta, K., 1980).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

109. ***Longicollum quiloni*** Gupta, S.P. & Naqvi, 1984 (Fig. 98)

Longicollum quiloni Gupta, S.P. & Naqvi, 1984 : 79-81, Pl. 6, Fig. 1-4; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994 : 161. Bhattacharya, 2007 : 140; Pl. 23, Fig. 128

Type locality : Quilon, Kerala, India.

Description : Male 5.70-7.64 × 0.91-1.0 mm; female 4.23-8.76 × 0.90-1.20 mm. Proboscis cylindrical or claviform, 0.69-0.87 × 0.29-0.38 mm in male; in female 0.71-0.84 × 0.27-0.31 mm, with 14-16 longitudinal rows of 16-17 hooks each. Hooks differently shaped, anterior 6-7 hooks slightly larger, stout, much curved, 0.028-0.033 mm long, of middle part small, thin and less curved, 0.024-0.028 mm long, and of posterior most hooks largest, 0.034-0.036 mm long in male; in female anterior 5-6 hooks, middle and posterior hooks 0.026-0.032 mm, 0.022-0.027 mm and 0.032-0.033 mm long. Neck not armed, very long, spirally twisted, 1.53-1.76 × 0.38-0.46 mm in male; in female 0.87-1.82

× 0.29-0.36 mm Proboscis receptacle cylindrical, double-walled, with ganglion slightly above base; in male 2.0-2.13 × 0.28-0.34 mm, in female 1.52-2.01 × 0.17-0.20 mm.. Trunk elongated, anteriorly swollen, aspinose, tapering posteriorly, 3.48-5.01 × 0.91-1.01 mm in male; in female 2.65-6.0 × 0.90-1.20 mm. Lemnisci cylindrical or claviform, equal, longer than receptacle, extending up to anterior margin or middle of anterior testis, in male 0.65-0.75 mm long, in female 0.78-0.90 mm long. Testes oval or spherical, subequal, contiguous or united by genital ligament, in anterior third of trunk; anterior 0.16-0.32 × 0.12-0.21 mm, posterior 0.15-0.31 × 0.2-0.24 mm Cement glands 6, pyriform or claviform massed together or arranged in tandem and far behind posterior testis, 0.10-0.4 × 0.06-0.11 mm. Saefftigen's pouch pyriform or claviform, 0.29-0.32 × 0.10-0.13 mm. Bursa elongated without diverticula, 0.60-0.70 × 0.21-0.27 mm. Ovary elongated 1.0-1.84 mm long. Uterus thick-walled, vagina with sphincter. Eggs not observed. Gonopore terminal in both sexes.

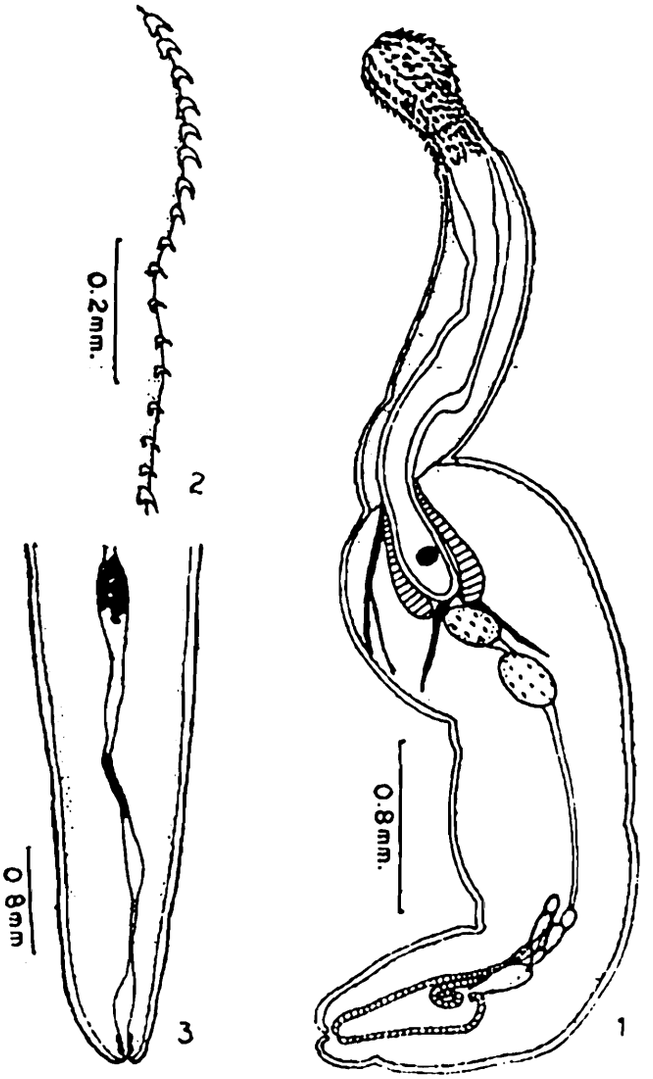


Fig. 98. *Longicollum quiloni* Gupta, S.P. & Naqui, 1984. 1. Male, 2. Row of proboscis hooks, 3. Posterior part of female (after Gupta S.P. & Naqvi, 1986).

Host : *Belone choram* Forsskal. (Ruppell).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

33. Genus ***Paralongicollum*** Amin, Bauer & Sidonov, 1991

Paralongicollum Amin, Bauer & Sidonov, 1991 : 26; Golvan, 1994 : 170.

Diagnosis : Pomphorhynchidae. Trunk cylindrical, elongate with reticular lacunar system. Proboscis cylindrical, may be enlarged anteriorly, armed uniformly with hooks varying anteriorly to those of posterior. Neck very long, uniformly cylindrical. Lemnisci sacciform or elongate, not attached distally to trunk wall. Testes ovoid , equatorial or post-equatorial, in tandem. Cement glands usually 6, ovoid to pyriform. Uterus long. Eggs elongate, outer shell delicate, middle shell with polar prolongations. Gonopore terminal in both sexes. Parasites of fresh water fishes.

Type species : *Paralongicollum nemacheili* Amin, Bauer & Sidenov, 1991.

Includes two species, 1. *Paralongicollum sergenti* (Choquet & Gayot) Amin, Bauer & Sidorov, 1991 and 2.*P. nemacheli* Amin, Bauer & Sidorov, 1991, of which first species occurs in India.

110. ***Paralongicollum sergenti*** (Choquette & Gayot, 1952) Amin, Bauer & Sidorov, 1991 (Fig. 99)

Tenuiproboscis sergenti Choquette & Gayot, 1952 : 51-53, Fig. 1-5; Yamaguti, 1963 : 97, Pl. 40, Fig. 409, 410; Golvan, 1969 : 324-326, Fig. 256 A-C; Gupta, S. P. & Naqvi, 1992 : 24-25, Pl. 4, Fig. 1-4;

Paralongicollum sergenti (Choquette & Gayot) Amin, Bauer & Sidorov, 1991: 26; Golvan, 1994 : 170.

Type locality : Algeria, North Africa.

Description : Males 5.64-5.81 × 0.66-0.69 mm; females 6.82-7.07x 0.71-0.81 mm. Proboscis claviform or cylindrical 0.68-0.76 × 0.14-0.17 mm with 10-12 longitudinal rows of 11-12 hooks each in male, in female 0.72-0.81 × 0.19-0.21 mm with 11-12 longitudinal rows of 11-12 hooks each Hooks similar in shape, decreasing in size posteriorly with simple rod-shaped roots. Hooks of anterior part 0.05-0.07 mm long, of posterior part 0.02-0.03 mm long in males; in females hooks of anterior part 0.06-0.07 mm long, of posterior part 0.03-0.04 mm long.. Neck very long, slender without bulbous swelling, without spiral twist, 1.40-1.44 x0.23-0.25 mm in males; in females 1.39-1.46 × 0.16-0.17 mm. Proboscis receptacle long, slender, double-walled, with ganglion slightly above its base, in males 1.91 (2.18) × 0.17 mm; in females 2.02-2.13 × 0.15-0.16 mm. Trunk elongated, cylindrical, slender, aspinose, in males 3.56-3.65 × 0.14-0.16 mm; in females 4.71-4.80 × 0.71-0.76 mm. Lemnisci equal, digitiform or claviform, longer than receptacle, in males 0.69-0.76 mm long, in females 0.79-0.84 mm long. Testes ovoid equal, exactly or obliquely

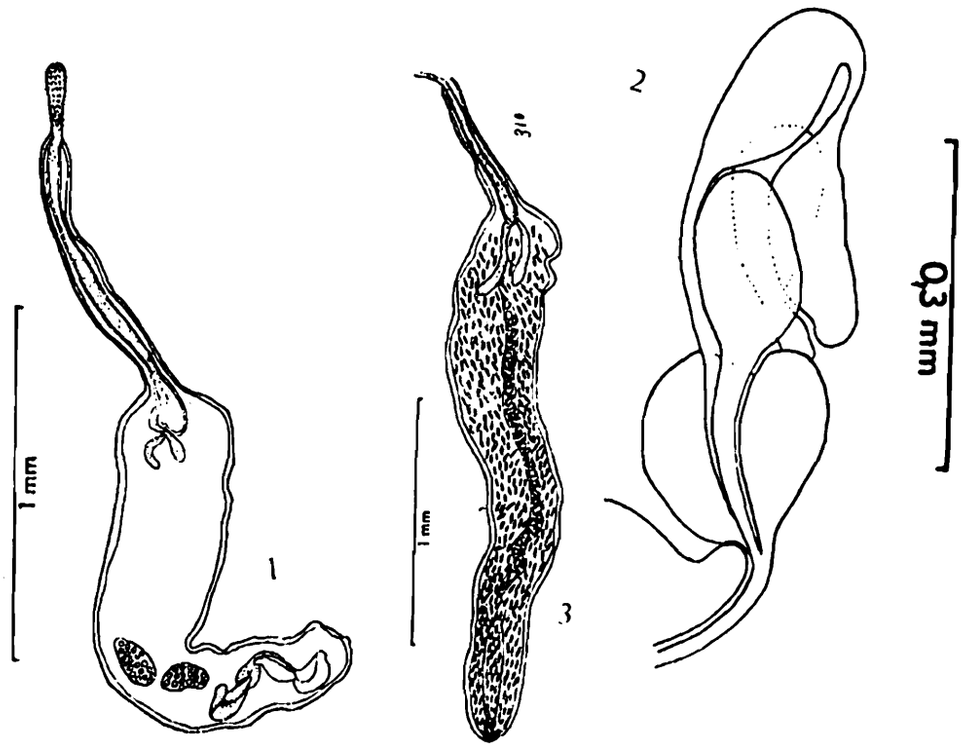


Fig. 99. *Paralongicollum sergenti* (Choquette & Gayot, 1952) Amin, Bauer & Sidorov, 1991. 1. Male, 2. Cement glands enlarged, 3. Female (after Choquette & Gayot, 1952).

in tandem, far apart, in anterior half of trunk, 0.21-0.25 × 0.10-0.12 mm. Cement glands 6, pyriform, massed together, far behind posterior testis, 0.14-0.24 × 0.04-0.05 mm. Genital ligament 4 mm long. Saefftigens's pouch pyriform, 0.22-0.24 × 0.05-0.06 mm. Bursa elongated with two anterior diverticula, 0.26-0.29 × 0.07-0.09 mm. Uterine bell long stalked, widely open in front. Uterus small. Vagina spherical, with inner and outer sphincters of 0.115 mm long, and large vaginal bulb of 0.083 mm long.. Ovarian balls oval or elliptical. Eggs 0.02-0.03 × 0.01 mm, with polar prolongations of middle shell. Gonopore terminal in both sexes.

Host : *Pristipoma quoraka* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Algeria; North Africa.

34. Genus ***Pomphorhynchus*** Monticelli, 1905

Pomphorhynchus Monticelli, 1905: 217-218 ; Van Cleave, 1919a: 237; Southwell & Macfie, 1925: 175; Meyer, 1932: 162; Petrotschenko, 1956: 339; Yamaguti, 1963: 93-94; Golvan, 1969: 298; 1994: 173; Bhattacharya, 2007: 137.

Diagnosis : Pomphorhynchidae. Worms small. Proboscis long, almost cylindrical, with 12-20 longitudinal rows of 10-14 hooks each; posterior hooks much more slender than anterior hooks. Neck very long, cylindrical, forming spherical bulb at its anterior end.

Proboscis receptacle double-walled, inserted at posterior end of proboscis and extending backwards throughout length of neck, with ganglion at its base. Trunk small, fusiform, aspinose. Hypodermal nuclei small and numerous. Lacunar system with reticular anastomoses. Lemnisci short, claviform. Testes ovoid, in tandem near midtrunk. Cement glands 6, oval or pear-shaped compact. Ova fusiform with prominent polar prolongations of middle shell. Gonopore in both sexes terminal, not surrounded by spines. Parasites of marine and fresh water fishes.

Type species : *Pomphorhynchus laevis* (Zoega in Müller 1776) Van Cleave, 1924.

Includes twenty eight species, 1. *Pomphorynchus bufonis* Fotedar, Duda & Raina, 1970, 2. *P. bulbocolli* Linkins in Van Cleave, 1919, 3. *P. clupei* Gupta, V. & Sinha, 1991, 4. *P. dubius* Kaw, 1941, 5. *P. jammuensis* Fotedar & Dhar, 1974, 6. *P. kashmirensis* Kaw, 1941, 7. *P. kawi* Fotedar, Duda & Raina, 1970, 8. *P. laevis* (Zoega in Müller 1776) Van Cleave, 1924, 9. *P. megacanthus* Fotedar & Dhar, 1974, 10. *P. oreini* Fotedar & Dhar, 1974, 11. *P. orientalis* Fotedar & Dhar, 1974, 12. *P. tori* Fotedar & Dhar, 1974, 13. *P. bosniacus* Kiskaroly & Cankovic, 1969, 14. *P. cylindrica* Wang Pu Quin & Guo Qizhi, 1983; 15. *P. francoisae* Golvan, 1969; 16. *P. intermedius* Engelbrechit, 1957; 17. *P. kostylewi* Petrochenko, 1956, 18. *P. lucyi* Williams & Rogers, 1984, 19. *P. patagonicus* Ortubay, Ubeda, Semenas & Kennedy, 1991; 20. *P. perforator* (Linstow, 1908) Meyer, 1932; 21. *P. rocci* Cordonnier & Ward, 1967; 22. *P. sebastichthydis* Yamaguti, 1939; 23. *P. sphaericus* Pertierra Spatz & Doma, 1996, 24. *P. splinleitruncatus* Amin, Shamall, Abdulla & Mhaisen, 2003, 25. *P. tereticollis* (Rudolphi, 1809) Meyer, 1932; 26. *P. tjrancoisae* Golvan, 1969, 27. *P. yamagutii* Schmidt & Huggins, 1973, and 28. *P. yunnanensis* Wang, 1981, of which first twelve species occur in the Indian subcontinent.

Key to Indian species of genus *Pomphorhynchus*

1. Proboscis with 13 longitudinal rows of hooks 2
– Proboscis with more than 13 longitudinal rows of hooks 4
2. Proboscis hooks 14 in each of 13 longitudinal rows ..... *Pomphorhynchus kawi*
– Proboscis with 13 in each of 13 longitudinal rows 3
3. Second, 4th and 6th hooks largest in each longitudinal row ..... *Pomphorhynchus megacanthus*
– Tenth and 11th hooks largest in each longitudinal row ..... *Pomphorhynchus tawi*
– Proboscis with 14 longitudinal rows of hooks 5

Proboscis with more than 14 longitudinal rows of hooks 6

4. Proboscis hooks 11 in each of 14 longitudinal rows ..... *Pomphorhynchus bufonis*
– Proboscis hooks 13 in each of 14 longitudinal rows ... *Pomphorhynchus jammuensis*
5. Proboscis with 14-16 longitudinal rows of hooks 6

– Proboscis with more than 16 longitudinal rows of hooks 4

6. Proboscis with 14-16 longitudinal rows of 11-14 hooks each .... *Pomphorhynchus kashmirensis*

– Proboscis with 16 longitudinal rows of 14 hooks each ... *Pomphorhynchus orientalis*

7. Proboscis with 18-20 longitudinal rows of hooks 8

– Proboscis with more than 24-28 apical circular rows and 9-12 basal circular .... *Pomphorhynchus bulbicolli*

8. Proboscis with 18 longitudinal rows of 14 hooks eachinal rows of 14 hooks each .... *Pomphorhynchus dubius*

– Proboscis with 18 longitudinal rows of 13 hooks each ..... *Pomphorhynchus oreini*

– Proboscis with 18-20 longitudinal rows of 11-13 hooks each .... *Pomphorhynchus laevis*

111. ***Pomphorhynchus bufonis*** Fotedar, Duda & Raina, 1970 (Fig. 100)

Pomphorhynchus bufonis Fotedar, Duda & Raina, 1970 : 41-45, Fig. 1-3; Golvan, 1994 : 173; Bhattacharya, 2007 : 138, Pl. 23, Fig. 124 a-c.

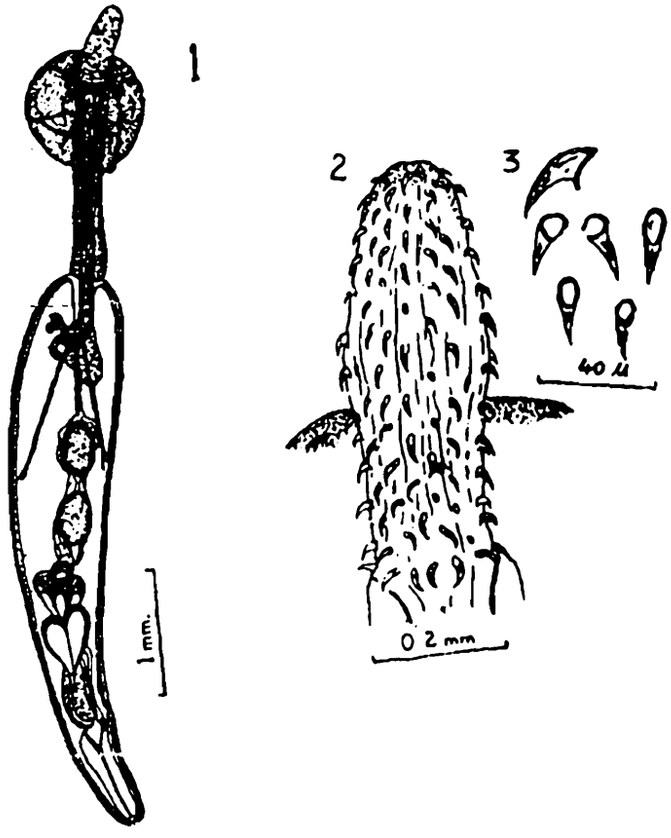


Fig. 100. *Pomphorhynchus bufonis* Fotedar, Duda & Raina, 1970. 1. Male, 2. Proboscis enlarged, 3. Trunk spines enlarged (after Fotedar, Duda & Raina, 1970).

Type locality : Srinagar, Jammu and Kashmir, India.

Description : Single male 6.5 mm long, 1.0 mm in maximum width. Proboscis cylindrical 0.62 × 0.2 mm, with 14 longitudinal rows of 11 hooks each, hooks placed alternately in adjacent rows, except at base, where they lie in a single transverse ring. Hooks rose-thorn-shaped with a very small oval roots. about uniform size, 0.020-0.032 mm long with a definite increase or decrease in length and width of hooks along axis of proboscis. Neck 1.5 × 0.2 mm, with bulb (= bulla) distinct and circular in outline 0.9 mm wide. Proboscis receptacle elongated, double-walled, 2 mm long, with ganglion around its base, with nerves to proboscis and two main trunks run backwards. Trunk 4.4 mm long. Lacunar system with two main lateral longitudinal channels and a network of very small vessels. Lemnisci are pyriform their walls syncytial, 0.7 and 0.8 mm long. Testes oval, in tandem at end of anterior fourth of trunk, 0.4 × 0.24 mm, with two vasa deferentia without marked enlargement into seminal vesicle. Cement glands 6, grouped into two pairs of small glands and one pair of large glands posteriorly. All glands unite posteriorly to form a common duct which joins sperm duct from testes to form ejaculatory duct. Penis small pyramidal body hanging freely in cavity of bursa. Bursa elongated, tubular, 0.81 × 0.16 mm. Before joining into ejaculatory duct, common sperm duct and cement duct remain enclosed in common genital sheath which ends at proximal end of bursa. Saefftigen's pouch located along side of genital sheath. Female unknown.

Host : *Bufo viridis* Daudin.

Location : Intestinal wall.

Locality : Srinagar, Jammu & Kashmir.

Distribution : Known only from type locality.

112. ***Pomphorhynchus bulbocolli*** Linkins in Van Cleave, 1919 (Fig. 101)

Pomphorynchus bulbocolli Linkins in Van Cleave, 1919b : 19-45; Petrotschenko, 1956 : 343-344; Yamaguti, 1963 : 95, Pl. 39, Fig. 396-398; Golvan, 1969 : 302, Fig. 239 A, B; 1994 : 173. Koul & Raina, 1999 : 43-50; Amin *et al.*, 2003 : 234.

Type locality : Cumpeche, Mexico.

Description : Proboscis cylindrical, 0.5-0.6 × 0.07-0.2 mm with 24-28 circular rows of hooks, basal circle with 12 hooks, remaining circles with 6 hooks each, hooks in circles anterior to basal circle alternating. Smallest hooks at proboscis tip, about 0.016 × 0.004 mm, largest hooks in VII and VIII circle from apex, 0.036-0.040 × 0.022 mm. Hooks posterior to VIII circle 0.020-0.036 × 0.004-0.008 mm. Roots of hooks of first eight circles back from apex of proboscis 0.010-0.040 mm long. Neck long, cylindrical in male; in female long and cylindrical with bulbous swelling anteriorly, 2.6-4.0 × 0.15-0.4 mm, in posterior part with spherical enlargement 0.8-1.5 mm wide. Proboscis receptacle elongate, cylindrical with ganglion at base. Trunk elongate, tapering towards posterior end. Lemnisci longer than receptacle with free end thickened. Testes ovoid in anterior half of trunk, one

behind other. Cement glands 6, pyriform. Uterine bell funnel-shaped. Seminal vesicle and Saefftigen's pouch well developed. Embryos within body cavity of gravid female 0.053-0.083 × 0.008-0.013 mm, commonest size 0.063 × 0.010 mm.

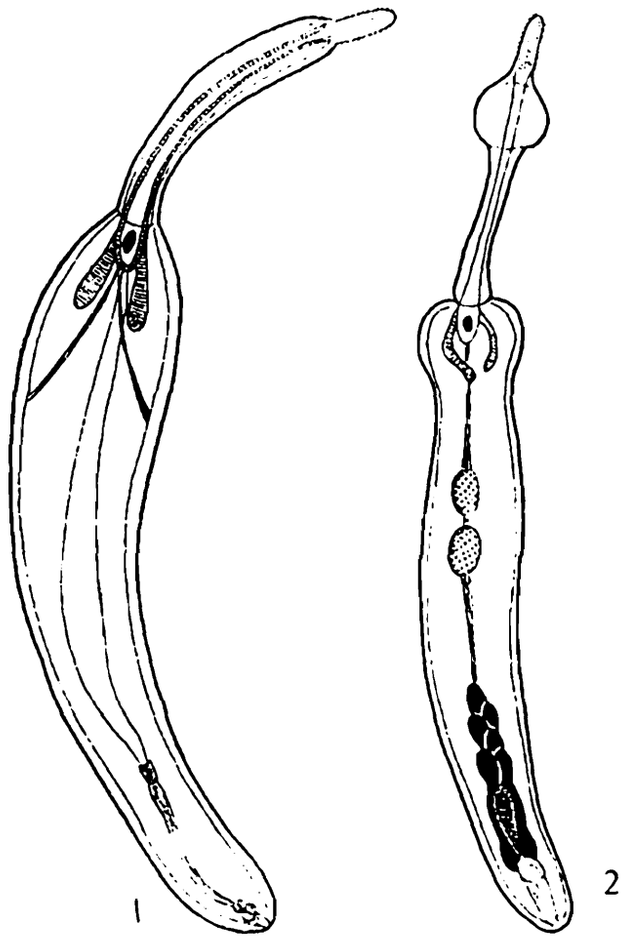


Fig. 101. *Pomphorhynchus bulbocolli* Linkins in Van Cleave, 1919. 1. Female, 2. Male (after Golvan, 1969).

Host : *Schizothorax niger, Channa striatus* (Bloch).

Location : Intestine.

Locality : Srinagar (Jammu & Kashmir).

Distribution : North America; Mexico.

113. ***Pomphorhynchus dubius*** Kaw, 1941
(Fig. 102)

Pomphorhynchus dubiuum Kaw, 1941 : 374-377, Fig. 7-10; Petrotschenko, 1956 : 344, Fig. 149 f; Yamaguti, 1963: 95; Golvan, 1969: 302-307, Fig. 240 A-D; Anantaraman, M. & Anantraman, S., 1970 : 5; Fotedar & Dhar, 1977b : 23; Golvan, 1994: 173. Amin *et al.*, 2003: 233; Bhattacharya, 2007 : 138. Pl.

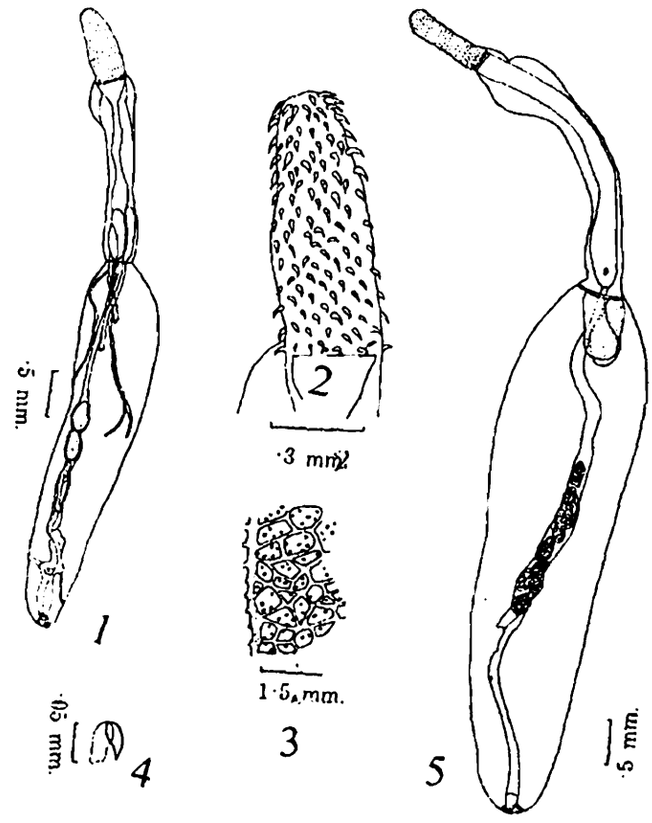


Fig. 102. *Pomphorhynchus dubius* Kaw, 1941. 1. Male, 2. Proboscis, 3. Ovarian balls, 4. Proboscis hook enlarged, 5. Female (after Kaw, 1941).

Type locality : Srinagar, Jammu and Kashmir, India.

Description : Juvenile males 6.9-7.1 mm long; juvenile females 8.75-10.3 mm long. Proboscis cylindrical, 0.75-1.0 × 0.21-0.28 mm, with 18 longitudinal rows of 13 hooks each. Bulb reduced. Hooks of adjacent rows alternate with each other, except basal hooks, arranged in a single transverse row. Hooks of mid-proboscis largest, 0.095 mm long, its root undivided, 0.12 mm long. Neck cylindrical, elongated, 1.95-3.3 × 0.3-0.4 mm with bulla of 0.5-0.7 mm diameter. Proboscis receptacle elongated, tubular, double-walled, its outer wall incomplete, with ganglion of 0.1-0.11 × 0.07-0.08 mm lies near its base of inner wall. Trunk of uniform thickness for greater part and cylindrical, 0.5-0.7 mm thick. Hypodermal nuclei numerous. Lacunar system with two lateral longitudinal channels with close anastomoses of branches. Lemnisci 2, syncytial 0.6-0.9 × 0.2-0.4 mm with large number of nuclei, variable in form and position, Testes small, equal, in tandem, one behind other, 0.37 × 0.2 mm. Cement glands 6, small with large number of nuclei, their ducts unite with vasa differentia to form ejaculatory duct, followed by a muscular, elongated, tubular bursa, 0.65 × 0.18 mm. Between two bursal pouches lies elongated penis, 0.07 × 0.02 mm. In female ovary divided into ovarian balls. Uterine bell with posterior dorsal opening. Uterus elongated, tubular 1.7 × 0.1 mm with thick muscular band outside. Vagina 0.2 × 0.13 mm with a sphincter on outside, and inside a dumb-bell shaped cells with nuclei at posterior end.

Host : *Rana cynophlyctis.*

Location : encysted subperitonium.

Locality : Srinagar (Jammu & Kashmir).

Distribution : Known only from type locality.

114. ***Pomphorhynchus jammuensis*** Fotedar & Dhar, 1974 (Fig. 103)

Pomphorhynchus jammuensis Fotedar & Dhar, 1974 : 1621; 1977b: 17-18, Pl. 1, Fig. 4-7; 1977 : 162; Gupta, V. & Sinha, 1990b : 45; Golvan, 1994 : 173; Amin et al., 2003 : 235.

Type locality : Tawi, Jammu and Kasmir, India.

Description : Male 8.26 mm long, female 9.2 mm long. Proboscis 0.64 × 0.16 mm with 14 longitudinal rows of 13 largely undifferentiated hooks each, hooks 0.029-0.034 mm long, last hook in each row longest hook 0.034 mm long, next longer in third, 0.030 mm long. Basal hooks not in a ring, longest. Neck 0.95 mm long, with distinct bulla at its anterior end. Proboscis receptacle extends well into trunk. Lemnisci 2, equal 0.66 mm long in male; in female 0.97 mm long. Anterior testis 0.59 × 0.3 mm, posterior 0.64 × 0.20 mm.

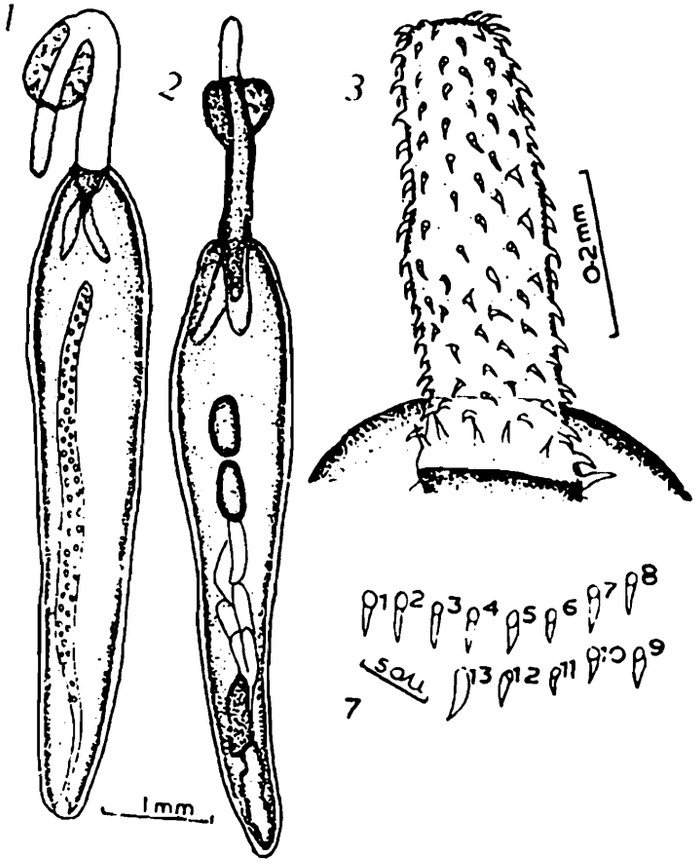


Fig. 103. *Pomphorhynchus jammuensis* Fotedar & Dhar, 1974. 1. Female, 2. Male, 3. Proboscis enlarged, 4. Representative proboscis hooks in rows (after Fotedar & Dhar, 1974).

Host : *Oreinus plagyostomus* Mc Lelland; *Salmo trutta fario.*

Location : Intestine.

Locality : Tawi in Jammu (Jammu & Kashmir).

Distribution : Known only from type locality.

115. ***Pomphorhynchus kashmirensis*** Kaw, 1941
(Fig. 104)

Pomphorhynchus kashmirensis Kaw, 1941 : 370-375, Fig. 1-6; 1948 : 173; Petrotschenko, 1956 : 344-346, Fig. 149 a-e; Datta & Soota, 1961 : 36-38; Yamaguti, 1963 : 95, Pl. 40, Fig. 405-407; Golvan, 1969 : 307-310, Fig. 244 A-F; Anantaraman, M. & Anantaraman, S., 1970 : 5; Fotedar & Dhar, 1977b : 20-21; Pl. 4, Fig. 1-6; Dhar & Majdah, 1988 : 150; Gupta, V. & Sinha, 1990b : 45; Khan & Rashid, 1994: 71; Raina, Koul & Narayan, 1996 : 114-115; Golvan, 1994 : 173; Amin *et al.*, 2003: 235; Bhattacharya, 2007 : 138-139. Pl. 23, Fig. 125 a-c,

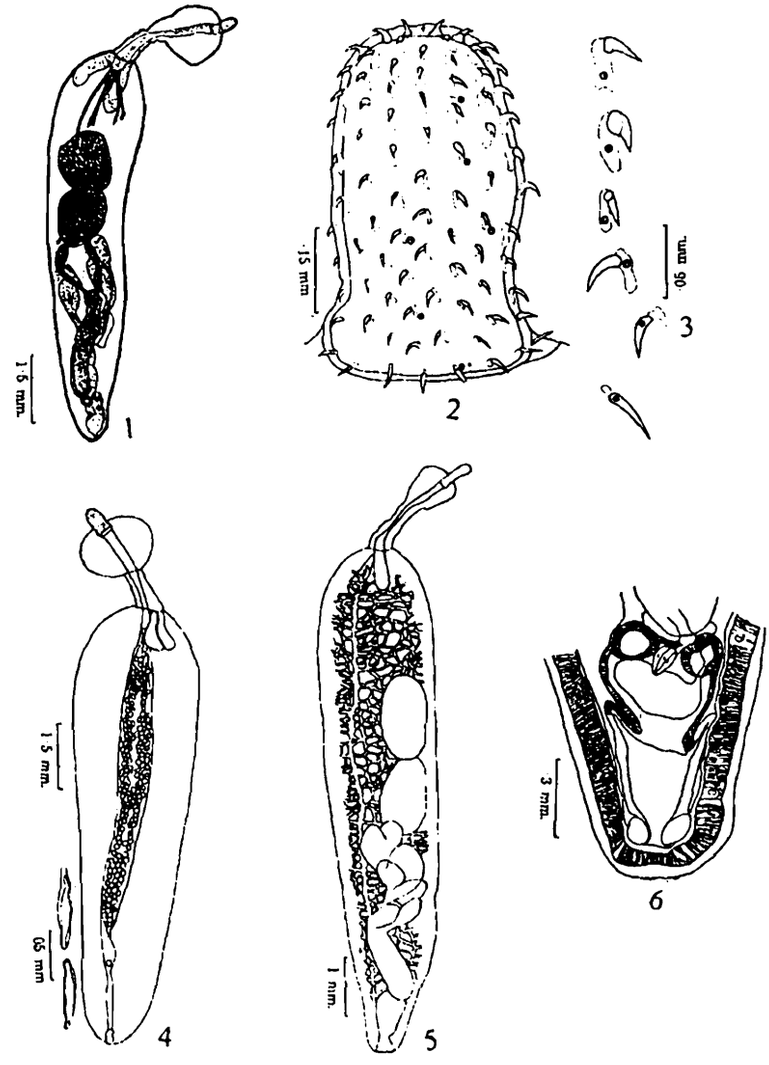


Fig. 104. *Pomphorhynchus kashmirensis* Kaw, 1941. 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged, 4. Female, 5 Male showing lacunar system, 6. Posterior part of male (after Kaw, 1941).

Type locality : Telbei, Walur lake in Jammu and Kashmir, India.

Description : Males 10.3-11.6 × 0.683-1.45 mm; females 12.7 mm long. Proboscis cylindrical, 0.55-0.91 × 0.25-0.36 mm with 14-16 longitudinal rows of 11-14 hooks each, hooks alternate in adjacent rows, basal hooks of longitudinal rows lie in transverse row in males. Hooks 0.022-0.08 mm long, hooks number 5, 6 shortest. Basal hooks in a ring, wide at base, abruptly increase to 0.041 mm long, without backwardly directed roots. Neck elongated, cylindrical, 1.68-2.04 × 0.25-0.5 mm with spherical bulla of 0.65-1.3 × 0.9-1.5 mm. Proboscis receptacle elongated, saccular double-walled 2.2-2.8 mm long, with ganglion 0.095 × 0.065 mm, lies at its base. Trunk elongated, cylindrical, tapers towards hind end, 8.5-10 × 1.9-2.5 mm. Hypodermis with large number of scattered nuclei. Lacunar system with two main lateral longitudinal channels and transverse anastomosess. Lemnisci 2, elongated, cylindrical, 0.8-1.35 × 0.26-0.45 mm, syncytial with large number of nuclei. Testes nearly globular or pyriform, in tandem, equal, anterior 1.4 × 1.0 mm, posterior 1.3 × 1.0 mm. Two sperm duct from testes join cement ducts to form ejaculatory duct, opening into copulatory bursa. A small genital ganglion lies posterior to one side of shield. Cement glands 6, multinucleate, globular to pear-shaped, arranged in linear fashion, 0.65-0.95 × 0.3-0.45 mm, their ducts unite with common vas deferens to form ejaculatory duct, behind which lies bell-shaped copulatory bursa with two lateral bursal pouches anteriorly, between which lies slightly oval muscular penis, 0.12 × 0.8 mm which hangs from bursa, into which ejaculatory duct opens. Saefftigen's pouch open into copulatory bursa. Penis ovoid, muscular, 0.12 × 0.08 mm hangs from terminal end of ejaculatory duct in bursal cavity. Uterine bell muscular, funnel-shaped, tubular narrows into muscular uterus with large guard cells and conspicuous nuclei at its anterior end. Uterus elongated tube 1.4 × 0.12-0.17 mm. Vagina, 0.29 × 0.1 mm wide opening to exterior through terminal gonopore, guarded by a sphincter. Ovijector absent. Eggs fusiform with polar prolongations of middle shell. Embryo spindle-shaped, 0.075-0.085 × 0.01-0.017 mm. Male gonopore terminal.

Host : *Nemachilus kashmirensis, Schizothorax esocinus* Haeckel, *S. niger* Haeckel, *Salmo trutta fario. Oreinus* sp.

Location : Intestine.

Locality : Hardwar (Uttar Pradesh), Kashmir, Telbal, Walur lake (Jammu & Kashmir), Kabul, (Afghanistan).

Distribution : Asia.

116. ***Pomphorhynchus kawi*** Fotedar, Duda & Raina, 1970

Pomphorhynchus kawi Fotedar, Duda & Raina, 1970: 455 (abstract), 1972 : 456; Gupta, V. & Sinha, 1990b: 47; Golvan, 1994 : 173.

Type locality : Kashmir in Jammu and Kashmir, India.

Description : Males 6.9 mm long , females 8.3 mm long. Proboscis with 13 longitudinal rows of 14 hooks each, size of hooks vary 0.04-0.065 mm long. Anterior hooks larger,

more slender than others, 6th and 7th hooks counted from apex in each row in males and 7th in females are widest and with thorn-like root and hooks between 5th and 11th in each row in males and 7th hook in each row of females widest and rise thorn-like. Hooks between 5th and 11th in each row with indistinctly forked roots. Proboscis receptacle double-walled, with outer wall incomplete posteriorly. Length ratio of proboscis + neck and trunk is 2 : 5. Testes globular, located in anterior half of trunk. Cement glands 6.

Host : *Botia birdi* Gray.

Location : Intestine.

Locality : (Jammu & Kashmir).

Distribution : Known only from type locality.

Remarks : Amin, Shamall, Abdulla & Mhaisen (2003) although recognizing this species have reservations as the shape of trunk, neck, bulb, proboscis, proboscis hooks and their roots are not reported.

117. ***Pomphorhynchus laevis*** (Zoega in Müller, 1776) Van Cleave, 1924. (Fig. 105)

Echinorhynchus laevis Zoega in Müller, 1776: 214-215;

Pomphorhynchus laevis (Zoega in Müller) Van Cleave, 1924 : 279-334; Petrotschenko, 1956 : 340-341, Fig. 147, 148; Yamaguti, 1963 : 94, Pl. 39, Fig. 394, 395; Golvan, 1994: 173. Amin *et al.*, 2003: 235.

Description : Male 15-16 mm long, 1.3-1.5 mm wide; female 25-28 mm. Proboscis cylindrical 0.9 mm long, 0.34 mm wide, with 18-20 longitudinal rows of 11-13 hooks each, hooks vary in size and shape. Anterior 7 hooks large, 0.040-0.050 mm long, with well developed posterior split roots, posterior 5 hooks, smaller with poorly developed root, reaching 0.033 mm long. Fifth and sixth hooks stand out as the most developed with thick, massive point and a very long root. Dimensions of I to V hooks: point 0.048 mm long, root 0.048-0.052 mm long, VI and VII hooks: point 0.038 mm long, but approximately twice as thick as point of anterior hooks, root 0.058 mm long, posterior 5 hooks point 0.019 mm long, root 0.038 mm long, roots of these hooks slightly split t end. Neck long about 5.0-5.5 mm long, widening of anterior end into a cuticular bulb about 1.7 mm in diameter. Proboscis receptacle long, narrow, 4.0 mm long, extending over whole length of neck and approximately as long as the latter. Lemnisci short, about 1.1 mm long. Trunk about 3.0 mm wide in anterior part, gradually decreasing towards posterior end aspinose. Testes elongated, 1.47 mm long, 0.48 mm wide, lying in middle part of trunk. Cement glands six, round, arranged in 3 pairs. Eggs fusiform, 0.121 × 0.012 mm, with characteristic narrow protrusions at poles.

Host : *Rana cyanophjyctis.*

Location : Intestine.

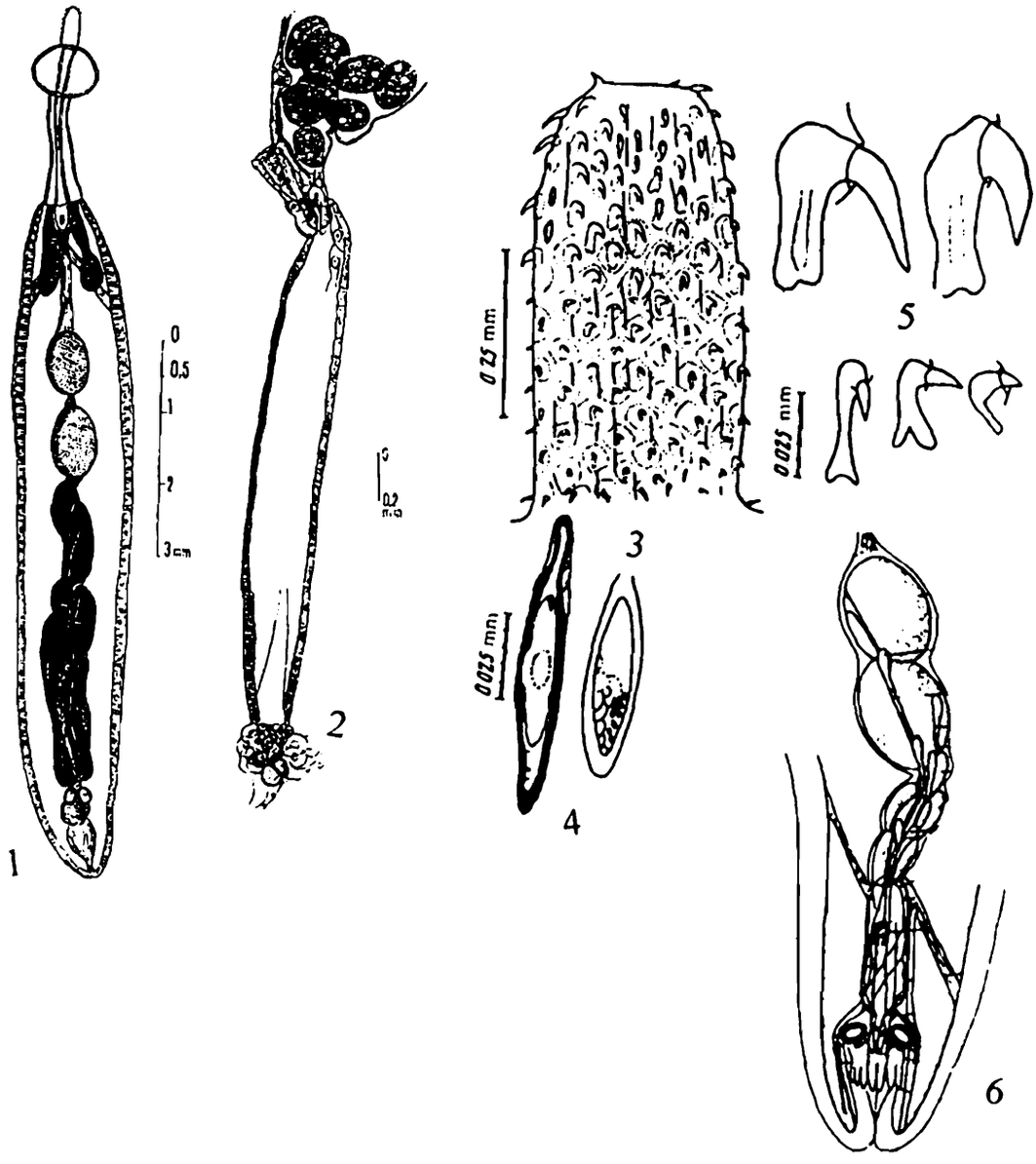


Fig. 105. *Pomphorhynchus laevis* (Zoega in Müller, 1776) Van Cleave, 1924. 1. Male, 2. Female Genitalia, 3. Proboscis enlarged, 4. Egg enlarged, 5. Proboscis hooks enlarged, 6. Male genitalia (after Meyer, 1933).

Locality : Kashmir.

Distribution : Europe, Asia Minor, Arctica.

118. ***Pomphorhynchus megacanthus*** Fotedar & Dhar, 1974

Pomphorhynchus megacanthus Fotedar & Dhar, 1974: 1621; 1977b: 18-19, Pl. 2, Fig. 1-4; Gupta, V. & Sinha, 1990b: 47; Golvan, 1994: 173; Amin *et al.*, 2003: 235.

Type locality : Tal-bal in Srinagar, Jammu and Kashmir, India.

Description : Male 6.6 mm long. Female 7.3 mm long. Proboscis 1.0 mm long, with 13 longitudinal rows of 13 hooks each. Hooks 0.020-0,054 mm long, 6th, 4th and 2nd hooks

of each row longer, 0.054 mm, 0.050 and 0.050 mm long, last hook of each row smallest 0.02 mm long. Proboscis receptacle extends well into trunk. Neck 0.8-1.56 mm long with bulla of 0.95 mm in diameter. Lemnisci unequal, 0.74 mm and 0.54 mm long in male, in female 0.54 mm and 0.36 mm long. Testes equal, anterior testis 0.46 × 0.32 mm; posterior testis 0.42 × 0.3 mm.

Host : *Cyprinus carpio spivularis.*

Location : Intestine.

Locality : Tel-bal in Srinagar (Jammu & Kashmir); Kalri lake, Sindh, Pakistan;

Distribution : Indian subcontinent,

119. ***Pomphorhynchus oreini*** Fotedar & Dhar, 1974

Pomphorhynchus oreini Fotedar & Dhar, 1974: 1621; 1977b: 19-20, Pl. 2, Fig. 5, 6; Gupta, V. & Sinha, 1990b: 45; Golvan, 1994: 173; Amin et al, 2003: 234.

Type locality : Ganderbel Lake, Srinagar, Jammu and Kashmir, India.

Description : Male 17 mm long; female 19 mm long. Proboscis 0.98-1.48 × 0.38-0.52 mm, with 18 longitudinal rows of 14 hooks each. Hooks 0.02-0.04 mm long, 5th and 7th hooks longest, 0.04 mm long each in each row, and 11th and 13th shortest 0.02 mm long. Neck 2.58-3.05 mm long with bulla of 1.26-1.34 × 1.34-1.39 mm. Proboscis receptacle lodged in neck. Lemnisci equal or subequal, 1.38 mm long, and 1.2 mm long. Anterior testis 1.4 × 1.1 mm; posterior testis 1.62 × 1.2 mm. Cement glands 6, arranged in 4 and 2.

Host : *Oreinus striatus* Haeckel.

Location : Intestine.

Locality : Ganderbal lake (Jammu & Kashmir).

120. ***Pomphorhynchus orientalis*** Fotedar & Dhar, 1974 (Fig. 106)

Pomphorhynchus orientalis Fotedar & Dhar, 1974 : 1621; 1977b : 16-17, Pl. 1, Fig. 1-3; Gupta, V. & Sinha, 1990b: 45; Golvan, 1994: 173; Amin et al., 2003: 234.

Type locality :Ganderbel Lake, Srinagar,Jammu and Kashmir, India.

Description : Male 6.0 mm long, 1.26 mm in maximum width; female 7.56 mm long, 1.29 mm in maximum width. Proboscis cylindrical 0.87-1.0 × 0.22-0.25 mm, with 16 longitudinal rows of 14 hooks each, hooks vary in size from 0.026-0.040 mm long, while last in hook in each row longest and apical hook smallest, 7th and 8th hooks long and short hooks respectively. Neck 1.24-1.34 mm long with conspicuous bulla. Proboscis receptacle extends to base of neck. Trunk tapers posteriorly to a bluntly rounded posterior end. Lemnisci elongated, cylindrical, with large number of nuclei, 0.63 mm and 0.55 mm long in male; in female 0.99 mm and 0.64 mm long. Testes 2, oval, in tandem, enclosed

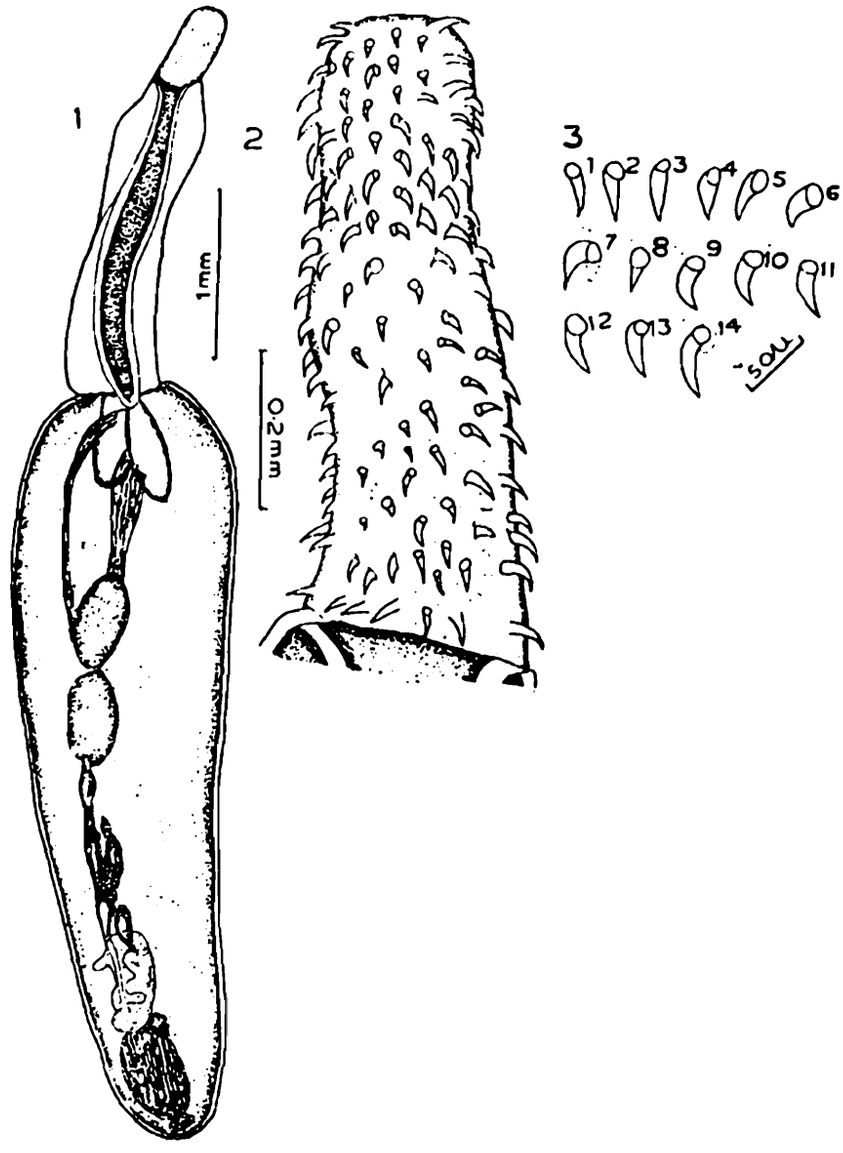


Fig. 106. *Pomphorhynchus orientalis* Fotedar & Dhar, 1974. 1. Male, 2. Proboscis enlarged, 3. Representative proboscis hooks in rows (after Fotedar & Dhar, 1974).

in ligament sac, anterior 0.53 × 0.28 mm, posterior 0.55 × 0.28 mm. Sperm duct from each testis run posteriorly and meet cement ducts to form ejaculatory duct which enter bell-shaped copulatory bursa. Cement glands 6, linearly arranged. Saefftigen's pouch distinct and opens into bursa. In gravid female ovary bursts releasing large number of small ovarian balls covered within genital ligament. Uterine bell funnel-shaped, continuous with posterior end of ligament sac Uterus tubular leads into a long muscular vagina, guarded by muscular sphincters.

Host : *Schizothorax niger* Haeckel.

Location : Intestine.

Locality : Gunderbel lake, Srinagar (Jammu & Kashmir).

Distribution : Known only from type locality.

121. ***Pomphorhynchus tori*** Fotedar & Dhar, 1974

Pomphorhynchus tori Fotedar & Dhar, 1974 : 1621; 1977b : 19-20, Pl. 3, Fig. 1-3; Gupta, V. & Sinha, 1990b : 46; Golvan, 1994 : 173.

Type locality : Kashmir, Jammu & Kashmir, India.

Description : Worms 12.98-13.56 mm long, 1.96 mm in maximum width. Proboscis 0.7 mm long, with 13 longitudinal rows of 13 hooks each, Hooks increase in length posteriorly to 0.036 mm long, hook number 9 shorter. Anterior hooks smaller, apical hook smallest 0.021 mm long, followed by 2nd hook 0.022 mm long, with 9th hook largest 0.036 mm long, followed by 10th and 11th hooks 0.032 mm and 0.035 mm long respectively. Neck 1.22 mm long, with bulla of 0.69x 0.052 mm. Eggs 0.071-0.081 mm long.

Host : *Tor tor* Hamilton.

Location : Intestine.

Locality : (Jammu & Kashmir).

Distribution : Known only from type locality.

35. Genus ***Tenuiproboscis*** Yamaguti, 1935

Tenuiproboscis Yamaguti, 1935: 262; Petrotschenko, 1956: 353; Yamaguti, 1963: 97; Golvan, 1969: 326; Gupta, V. & Naqvi, 1992: 26; Golvan, 1994:180. Bhattacharya, 2007: 136.

Diagnosis : Pomphorhynchidae. Proboscis nearly filiform to claviform, with several longitudinal rows of numerous hooks each, hooks shorter posteriorly with simple rod-shaped roots. Neck very long, slender, without bulbous swelling. Proboscis receptacle slender, double-walled, reaching a little into trunk, with ganglion at base. Trunk approximately cylindrical, fairly long in females, but short in males. Lemnisci slender, digitiform or claviform, longer than receptacle, with ganglion at its base. Testes spherical, in middle third of trunk. Cement glands 4-6, spherical to oval, close together. Vagina with double sphincters. Eggs with polar prolongations of middle shell. Gonopore terminal in both sexes. Parasites of fresh water fishes.

Type species : *Tenuiproboscis misgurni* Yamaguti, 1935.

Includes six species, 1. *Tenuiproboscis bilqeesi* Gupta, S.P. & Naqvi, 1992, 2. *T clupei* Gupta, V. & Sinha, 1991, 3. *T edmondsi* Gupta, S.P. & Naqvi, 1992, 4. *T ernaculensis* Gupta, S.P. & Naqvi, 1992, 5. *T guptai* Gupta, V. & Sinha, 1989, and 6. *T misgurni* Yamaguti, 1935, of which first five occur in the subcontinent.

Key to Indian species of genus *Tenuiproboscis*

1. Cement glands 6 ..... *Tenuiproboscis clupei*

– Cement glands 4 2

2. Neck very long, spirally twisted ..... *Tenuiproboscis guptai*

– Neck very long, not spirally twisted 3

3. Proboscis with 11-12 longitudinal rows of 13-14 hooks each ..... *Tenuiproboscis bilqeesi*

– Proboscis with 13-15 longitudinal rows of 15-16 hooks each ..... *Tenuiproboscis ernakulesis*

– Proboscis with 11-12 longitudinal rows of 16-17 hooks each ..... *Tenuiproboscis edmondsi*

122. ***Tenuiproboscis bilqeesi*** Gupta, S.P. & Naqvi, 1992 (Fig. 107)

Tenuiproboscis bilqeesi Gupta, S. P. & Naqvi, 1992 : 17-19, Fig. 1-4.

Type locality : Cochin, Kerala, India.

Description : Male 4.73-5.63 × 0.86-0.96 mm, female 4.49-4.98 × 0.7-0.87 mm. Proboscis claviform or cylindrical, 0.64-0.82 × 0.30-0.39 mm with 11-12 longitudinal rows of 13-14 hooks each in male, in female 0.65-0.70 × 0.28-0.38 mm, with 10-12

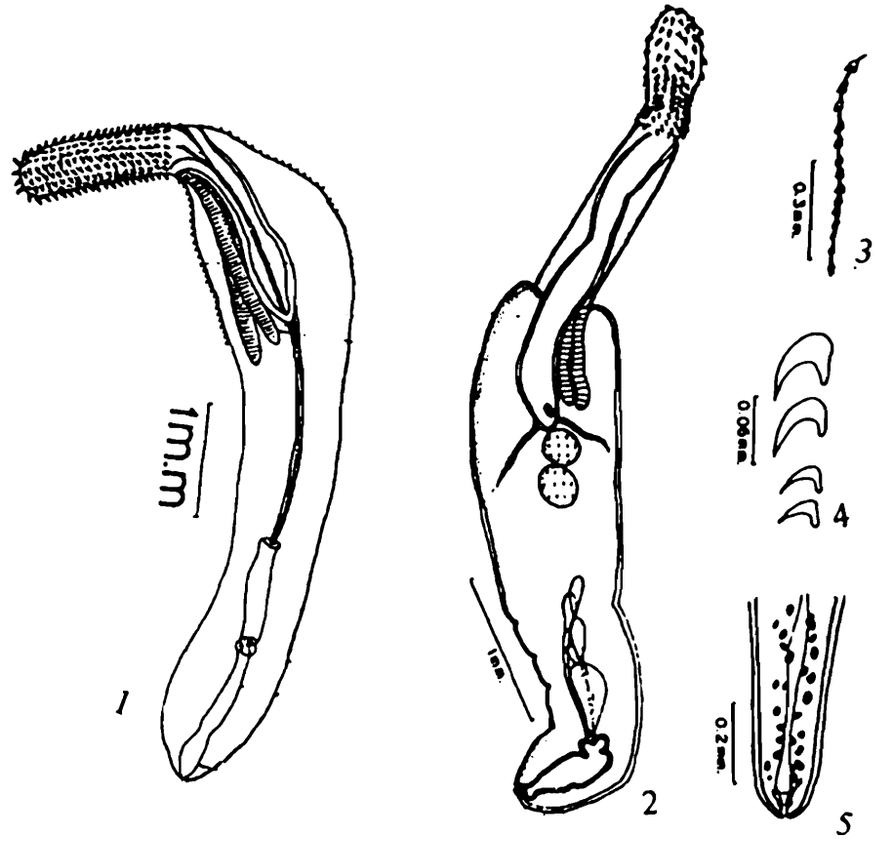


Fig. 107. *Tenuiproboscis bilqeesi* Gupta, S.P. & Naqvi, 1992. 1. Female, 2. Male, 3. Row of proboscis hooks, 4. Proboscis hooks enlarged, 5. Posterior part of female (after Gupta, S.P. & Naqvi, 1992).

longitudinal rows of 13-14 hooks each. Hooks similar in shape, gradually decreasing in size antero-posteriorly with simple rod-shaped roots. Proboscis hooks of anterior part 0.06-0.08 mm long, posterior part 0.03-0.04 mm long in males; in females hooks of anterior part hooks 0.07-0.08 mm long, posterior part 0.03-0.04 mm long. Neck very long, slender, without bulbous swelling and not spirally twisted, 0.92-1.29 × 0.34-0.47 mm in males; in females 0.98-1.02 × 0.32-0.48 mm. Proboscis receptacle slender, double-walled, long, 1.88-2.09 × 0.22-0.28 mm in males, in females 1.76-1.82 × 0.24-0.26 mm, with ganglion slightly above its base. Trunk elongated, cylindrical, aspinose, wide at anterior end and gradually tapering towards hind end, 3.07-3.54 × 0.86-0.96 mm in males; in females 2.78-3.26 × 0.70-0.87 mm. Lacunar system with reticular anastomoses. Hypodermal nuclei small and numerous. Lemnisci equal, digitiform or claviform, shorter than receptacle, extending slightly above anterior testis, 0.56-0.72 mm long in males, in females 0.64-0.81 mm long. Testes spherical or oval, contiguous, subequal, exactly or obliquely in tandem, in anterior third of trunk, anterior testis 0.19-0.24 × 0.18-0.22 mm, posterior 0.25-0.29 × 0.19-0.23 mm. Cement glands 4, oval or pyriform, grouped together far behind posterior testis, 0.15-0.22 × 0.06-0.10 mm. Saefftigen's pouch pyriform, 0.40-0.45 × 0.14-0.19 mm. Bursa elongated with two anterior diverticula, 0.60-0.73 × 0.19-0.25 mm. Uterine bell long, stalked with wide opening in front. Uterus small 0.20-0.28 × 0.04-0.08 mm. Vagina with well developed outer and inner sphincter and single large vaginal bulb below it. Body cavity filled with numerous oval or spherical ovarian balls.

Host : *Triacanthus brevirostris* (Temmenck & Schleg.).

Location : Intestine.

Locality : Cochin (Kerala).

Distribution : Known only from type locality.

123. ***Tenuiproboscis clupei*** Gupta, V. & Sinha, 1992 (Fig. 108)

Tenuiproboscis clupei Gupta, V. & Sinha, 1992: 113-115, Pl. 3, Fig. 1, 2; Bhattacharya, 2007: 137.

Type locality : Puri coast, Orissa, India.

Description : Male 5.80-7.60 × 0.85-1.2 mm. Proboscis short, cylindrical with anterior and basal parts wide and middle part narrow, 0.58-0.60 × 0.24-0.26 mm with 14-16 longitudinal rows of 10 hooks each. Hooks of different sizes, anterior 5 rows with larger, stout and much curved hooks, 0.042-0.046 mm long, of middle part smaller than those of anterior and less curved, 0.038-0.40 mm long, of basal part largest and less curved than anterior hooks, 0.050-0.058 mm long. Neck unarmed, very long, straight not spirally twisted, 1.55-2.60 × 0.32-0.34 mm. Proboscis receptacle cylindrical or claviform, double-walled, 2.35-2.60 × 0.15-0.20 mm. Trunk elongated, aspinose, swollen anteriorly and tapering posteriorly, 4.35-5.30 × 0.85-1.2 mm. Lemnisci short, tubular, equal, smaller than receptacle, 0.55-0.60 × 0.05-0.08 mm. Testes oval, in tandem, separated or united

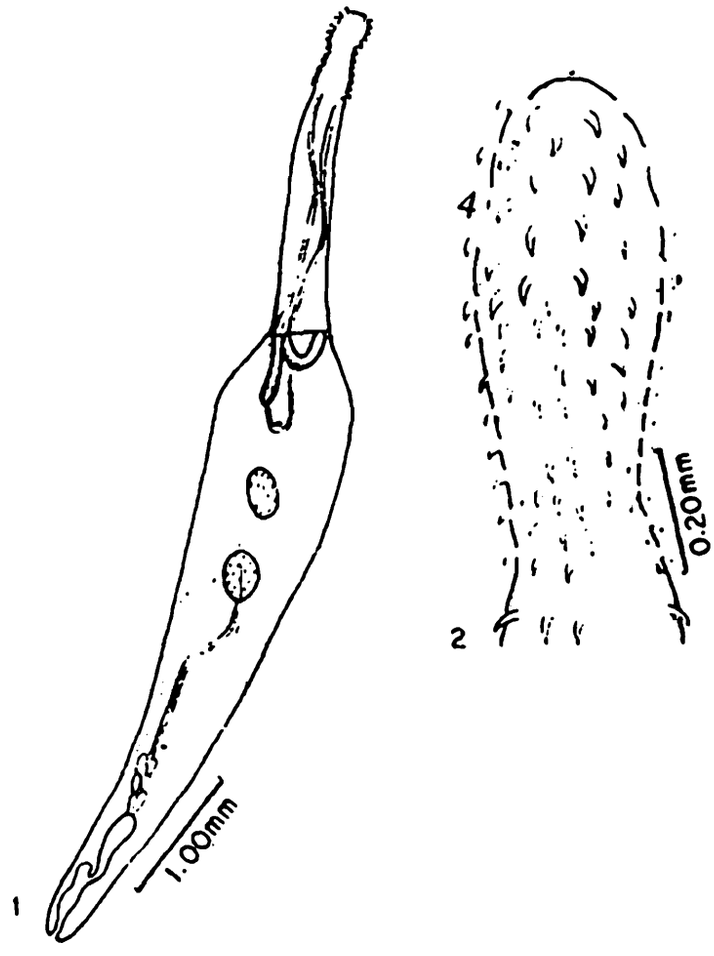


Fig. 108. *Tenuiproboscis clupei* Gupta, V. & Sinha, 1991. 1. Male, 2. Proboscis enlarged (afger Gupta, V. & Sinha, 1991).

by genital ligament, in anterior half of body, anterior 0.45-0.48 × 0.20-0.22 mm, posterior 0.45-0.48 × 0.20-0.22 mm. Sperm ducts a pair runs posteriorly along cement glands. Cement glands 6, elongated, closely arranged in two rows of three each, far away from posterior testis, 0.70-1.10 × 0.05-0.06 mm. Safftigen's pouch elongated with rounded anterior end, 0.55-0.70 × 0.15-0.25 mm. Bursa inverted, elongated without diverticula, 0.65-0.66 × 0.15-0.35 mm. Gonopore terminal. Female not known.

Host : *Clupea longiceps* Gunther. *Scatophsagus argus* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Puri coast (Orissa).

Distribution : Known only from type locality.

124. ***Tenuiproboscis edmondsi*** Gupta, S. P. & Naqvi, 1992 (Fig. 109)

Tenuiproboscis edmondsi Gupta, S. P. & Naqvi, 1992: 22-24, Pl. 3, Fig. 1-4.

Type locality : Quilon, Kerala, India.

Description : Male 5.59 × 0.76 mm; female 9.08-9.13 × 1.20-1.31 mm. Proboscis claviform or cylindrical 0.84 × 0.25 mm with 18 longitudinal rows of 17 hooks each in male, in females 0.88-0.96 × 0.32-0.36 mm, with 16-17 longitudinal rows of 16-17 hooks each. Hooks of similar shape, anterior hooks largest, gradually decreasing in size posteriorly with simple rod-shaped roots. Hooks of anterior part 0.38-0.042 mm, posterior part 0.30-0.32 mm long in males, in female hooks of anterior part 0.034-0.039 mm, of posterior part 0.028-0.032 mm long. Neck very long, slender, without bulbous swelling and not spirally twisted, 1.17 × 0.26 mm in male, in female 1.60-1.64 × 0.34-0.37 mm. Proboscis receptacle long, double-walled, with ganglion a little above its base, 1.91 × 0.17 mm in male, in female 2.78-2.81 × 0.31-0.35 mm. Trunk elongated, cylindrical, aspinose, wide at anterior end and gradually tapering posteriorly, 3.68 × 0.76 mm in male; in female 6.52-6.61 × 1.20-1.31 mm. Lemnisci slender, digitiform, equal, longer than receptacle, reaching up to middle of anterior testis, 0.92 mm long in male, in female 1.18-1.29 mm long. Testes oval, contiguous, unequal, in anterior half of trunk, anterior longer, 0.38 × 0.14 mm, posterior 0.30 × 0.15 mm. Cement glands 4, pyriform, massed together, far behind posterior testis, 0.25-0.33 × 0.07-0.09 mm, opening separately by long cement ducts into bursa.

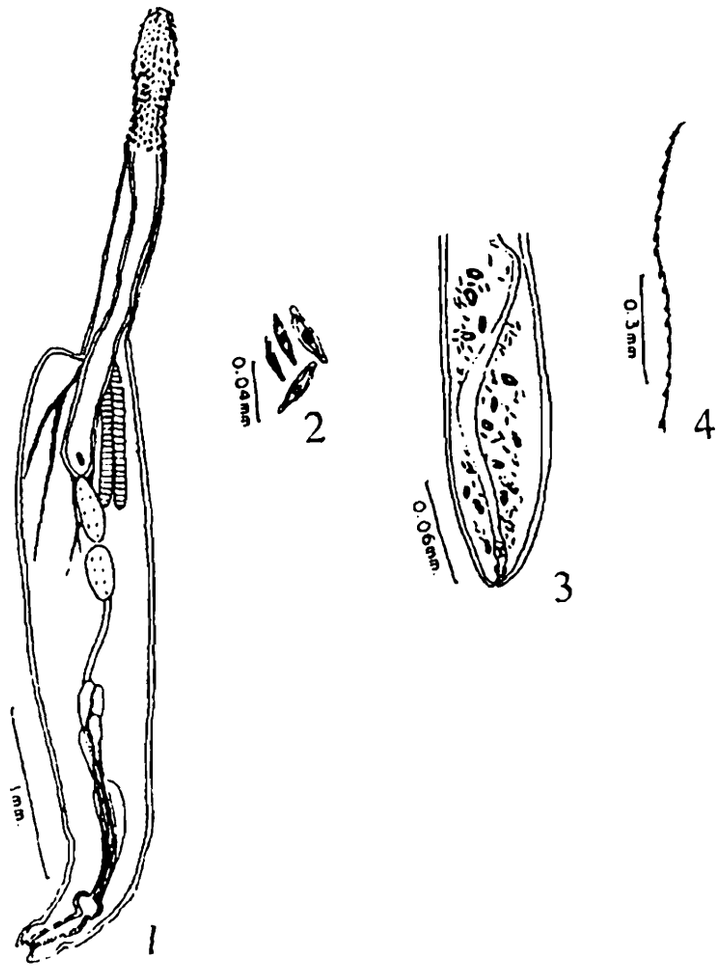


Fig. 109. *Tenuiproboscis edmondsi* Gupta, S.P. & Naqvi, 1992. 1. Male, 2. Ova, 3. Posterior part of female, 4. Row of proboscis hooks (after Gupta, S.P. & Naqvi, 1992).

Saefftigen's pouch pyriform, 0.66 × 0.17 mm. Bursa elongated with two anterior diverticula, 0.48 × 0.17 mm. Uterine bell long stalked, opening widely in front. Uterus short. Vagina with outer and inner sphincters, with a large vaginal bulb below. Body cavity filled with numerous oval or elliptical ovarian balls and eggs. Eggs 0.03-0.05 × 0.005-0.010 mm with polar prolongations of middle shell. Genital pore terminal in both sexes.

Host : *Sciaenoides microdon* (Bleeker).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

125. ***Tenuiproboscis ernakulensis*** Gupta, S.P. & Naqvi, 1992 (Fig. 110)

Tenuiproboscis ernakulensis Gupta, S.P. & Naqvi, 1992 : 20-22, Pl., Fig. 1-4.

Type locality : Ernakulam, Kerala, India.

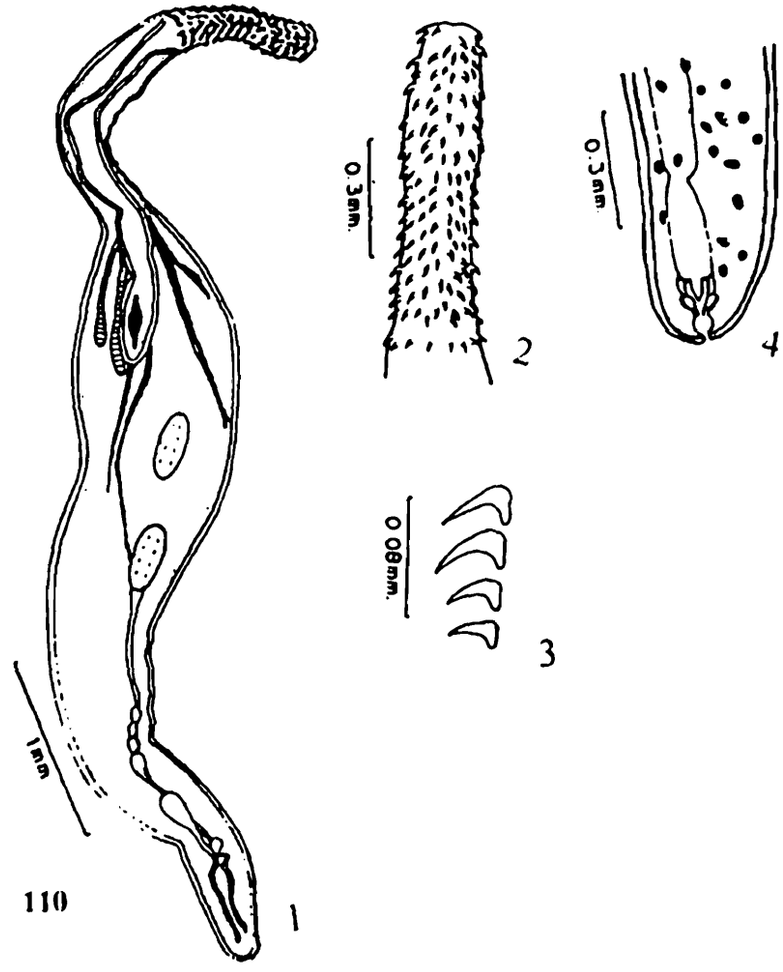


Fig. 110. *Tenuiproboscis ernakulensis* Gupta, V. & Naqvi, 1992. 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks, 4. Posterior end of female (after Gupta, S.P. & Naqvi, 1992).

Description : Male 4.23-6.59 × 0.84-0.87 mm, females 4.50-7.55 × 0.74-0.85 mm. Proboscis filiform or claviform 0.78-0.80 × 0.20-0.22 mm with 13-14 longitudinal rows of 15-16 hooks each in male, in female 0.72-0.84 × 0.20-0.25 mm with 13-15 longitudinal rows of 15-16 hooks each. Hooks of similar shape, anterior hooks largest, decreasing in size posteriorly, with simple rod-shaped roots. Hooks of anterior part 0.04-0.06 mm long and of posterior part 0.03-0.04 mm long in males, in females hooks of anterior part 0.040-0.045 mm long, of posterior part 0.025-0.030 mm long. Neck very long, slender without bulbous swelling and not spirally twisted, 1.25-1.66 × 0.30-0.32 mm in males; in females 1.50-1.76 × 0.30-0.32 mm. Proboscis receptacle long, double-walled, 1.90-2.32 × 0.19-0.22 mm in males; in females 2.20-2.35 × 0.20-0.23 mm, with ganglion slightly above its base. Trunk elongated, cylindrical, wide at middle and tapering towards both ends, aspinose, 2.03-4.20 mm long in males, in females 2.29-4.95 × 0.74-0.85 mm. Lemnisci digitiform or claviform, unequal, smaller 0.45-0.66 mm long, longer 0.65-0.80 mm long reaching slightly above anterior testis in males; in females smaller lemniscus 0.49-0.58 mm long, longer 0.65-0.79 mm long. Testes ovoid or elliptical, equal, exactly or obliquely in tandem, far apart, in anterior half of trunk, 0.31-0.38 × 0.15-0.18 mm. Cement glands 4, pyriform, one behind other or massed together, far behind posterior testis, 0.07-0.17 × 0.04-0.09 mm. Seminal vesicle oval or pyriform, 0.08-0.12 × 0.04-0.07 mm. Saefftigen's pouch pyriform, 0.39-0.46 × 0.10-0.15 mm. Bursa muscular, elongated without anterior diverticula or bursal rays, 0.20-0.44 × 0.10-0.18 mm. Uterus bell wide, long, stalked. Uterus wide, 0.20-0.25 × 0.10-0.13 mm. Vagina with well developed sphincter muscles 0.10-0.12 × 0.12-0.14 mm and single, large vaginal bulb at its posterior end. Ovarian balls numerous filling body cavity. Gonopore terminal in both sexes.

Host : *Scatophsagus argus* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Ernakulam (Kerala).

Distribution : Known only from type locality.

126. ***Tenuiproboscis guptai*** Gupta, V. & Sinha, 1990. (Fig. 111)

Tenuiproboscis guptai Gupta, V. & Sinha, 1990a : 104-107, Fig. 1-6; Golvan, 1994:180; Bhattacharya, 2007 : 137.

Type locality : Kolkata, West Bengal, India.

Description : Male 5.65-6.85 × 0.80-0.85 mm; females 5.60-7.20 × 0.80-1.00 mm. Proboscis filiform 0.50-0.60 × 0.15-0.25 mm in males; in females 0.70-0.80 × 0.80-1.00 mm. with hooks of similar shape gradually decreasing in size antero-posteriorly, anterior hooks largest up to 0.04-0.05 mm long and smallest basal hooks 0.010-0.02 mm long, all with simple roots shorter than blades. Neck very long, spirally twisted, 1.10-1.45 × 0.20-0.30 mm in males; in females 1.40-2.10 × 0.3-0.4 mm. Proboscis receptacle long, double-walled, with ganglion slightly above its base, in males 2.20-2.25 × 0.15-0.25 mm. Trunk

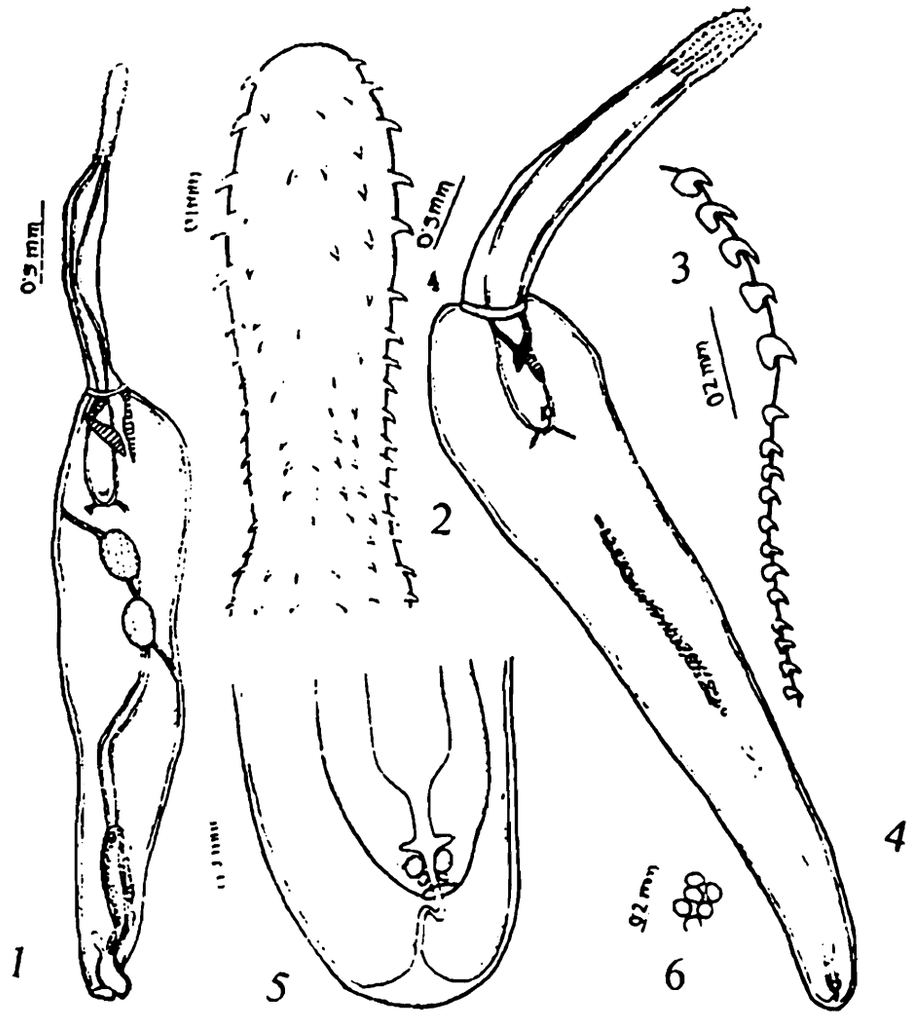


Fig. 109. *Tenuiproboscis guptai* Gupta, V. & Sinha, 1989. 1. Male, 2. Proboscis enlarged, 3. Female, 4. Row of proboscis hooks, 5. Posterior part of female, 6. Ovarian balls (after Gupta, V. & Sinha, 1989).

elongated, cylindrical, aspinose, wide at anterior end, gradually tapering to posterior end, 3.75-4.1 × 0.65-0.83 mm in males; in females 3.35-4.75 × 0.80-1.0 mm. Lemnisci claviform, unequal, extending up to anterior half of receptacle, in males longer lemniscus 0.45-0.50 mm long, shorter 0.35-0.40 mm long; in females, longer lemniscus 0.40-0.50 mm long, shorter 0.40-0.50 mm long. Testes ovoid to spherical, obliquely in tandem or one behind other, united by genital ligament, in anterior half of trunk, anterior testis 0.40-0.45 × 0.20-0.22 mm. Cement glands 4, tubular, far behind testes, 0.70-1.05 mm long. Saefftigens's pouch pyriform. Bursa elongated without digital rays, 0.25-0.45 × 0.20-0.25 mm. Seminal vesicles 1.35-1.45 × 0.20-0.25 mm, with slender duct ending in bursa. Uterine bell large, stalked, widely open in front. Uterus short. Vagina with well developed inner and outer sphincters. Ovarian balls ellipsoid along with eggs fill body cavity. Genital pore terminal in both sexes.

Host : *Gerres setifer* Hamilton.

Location : Intestine.

Locality : Kolkata (West Bengal).

Distribution : Known only from type locality.

13. Family RHADINORHYNCHIDAE Travassos, 1923

Rhadinorhynchidae Travassos, 1923 : 2;. Meyer, 1932 : 40;
Gorgorhynchidae Van Cleave & Lincicome, 1940 : 76;
Rhadinorhynchidae Van Cleave & Lincicome, 1940 : 78; Petrotschenko, 1956 : 371;
Raorhynchidae Tripathi, 1959 : 75;
Micracanthorhynchidae Yamaguti, 1963 : 97;
Rhadinorhynchidae Golvan, 1969 : 57; Bhattacharya, 2007 : 86.

Diagnosis : Paleacanthocephala, Echinorhynchida. Proboscis long or short, cylindrical, claviform, with longitudinal rows of hooks. Proboscis receptacle usually cylindrical, double-walled, with ganglion at or near base, or equatorial. Trunk long, slender, or swollen in anterior or middle third, spined extensively or on anterior part only, occasionally at posterior end too, spines may be lost secondarily and present in young individuals alone. Hypodermal nuclei large and few, or small and numerous. Lemnisci variable in length, longer or shorter than receptacle. Testes contiguous or not, usually in middle third of trunk, occasionally anterior. Cement glands 2-8, globular, pyriform, claviform, cylindrical or very long and slender. Ova elongate or oval.

Type genus : *Rhadinorhynchus* Lühe, 1912.

Includes five subfamilies, 1. Gorgorhynchinae Van Cleave & Lincicome, 1940, 2. Rhadinorhynchinae Lühe, 1912, 3. Serrasentinae Petrotschenko, 1956, 4. Golvanacanthinae Paggi & Orecchia, 1972, 5. Serrasentoidinae Paruchin, 1982, of which first three subfamilies occur in this subcontinent.

Key to Indian subfamilies of family RHADINORHYNCHIDAE

1. Trunk with pseudo-segmental cuticular combs spines on ventral surface ..... SERRASENTINAE
– Trunk without pseudo-segmental cuticular combs of spines 2
2. Eggs with polar prolongations of middle shell ..... GORGORHYNCHINAE
– Eggs without polar prolongations of middle shell ..... RHADINORHYNCHINAE

Subfamily GORGORHYNCHINAE Van Cleave & Lincicome, 1940

Gorgorhynchidae Van Cleave & Lincicome, 1940: 502; Petrotschenko, 1956 : 1-458;
Gorgorhynchinae Golvan & Houin, 1964 : 537; Golvan, 1969: 99; Bhattacharya, 2007 : 95.

Diagnosis : Rhadinorhynchidae. Body length of diverse range. Proboscis clavate or cylindrical, sometimes globate, usually short, its hooks may show dorso-ventral

differentiation. Proboscis receptacle double-walled. Anterior trunk spination may be single or double fields or lacking. Posterior trunk spination absent. Lemnisci about as long as receptacle, usually much longer. Tested elliptical. Cement glands 2-8, either very long and tubular or short and pyriform.

Type genus : *Gorgorhynchus* Chandler, 1934.

Includes eleven genera, 1. *Cleaveius* Subramanian, 1927, 2. *Micracanthorhynchina* Strand, 1936, 3. *Gorgorhynchus* Chandler, 1934, 4. *Gorgorhynchoides* Cable & Linderoth, 1963, 5. *Leptorhynchoides* Kostlev, 1924, 6. *Metacanthocephaloides* Yamaguti, 1959, 7. *Metacanthocephalus* Yamaguti, 1959, 8. *Paracanthorhynchus* Edmonds, 1967, 9. *Pseudauchen* Yamaguti, 1963, 10. *Pseudoleptorhynchoides* Salgado-Maldonado, 1976 and 11. *Selrocollum* Schmidt & Paperna, 1978, of which first three genera occur in this subcontinent.

Key to Indian genera of subfamily GORGORHYNCHINAE

Proboscis with 10 logitudinal rows of 4 hooks each ..... *Cleaveius*

Proboscis with 9-15 longitudinal rows of 4-22 hooks each ..... *Micracanthorhynchina*

36. Genus ***Cleaveius*** Subramanian, 1927

Cleaeius Subramanian, 1927a : 176;

Mehrarhynchus Datta, 1940 : 81;

Cleaveius Meyer, 1932 : 61-62; Petrotschenko, 1956 : 370; Yamaguti, 1964 : 67;

Mehrarhynchus Yamaguti, 1963 : 103; Golvan & Houin, 1964 : 547.

Cleaveius Golvan & Houin, 1964 : 546; Golvan, 1969 : 108; 1994 : 143; Bhattacharya, 2007 : 97-98.

Diagnosis : Rhadinorhynchidae, Gorgorhynchinae. Proboscis very short, cylindrical, with about 18 longitudinal rows of 4 hooks each. Neck short. Proboscis receptacle long, double-walled, with ganglion situated laterally a little anterior to its base. Trunk medium-sized, cylindrical, trunk spines divided into two groups, anterior group irregularly scattered, posterior group in numerous transverse rows. In male anterior group of spines lacking, but in female anterior two-thirds of trunk armed with approximately 41 circular rows of about 14 spines each. Lemnisci very long, filamentous, winding. Testes elliptical. Cement glands 4, compact, pyriform to tubular. Parasites of fresh water fishes. South-east Asia.

Type species : *Cleaeius circumspinifer* Subramanian, 1927.

Includes twelve species, 1. *Cleaveius circunspinifer* Subramanian, 1927, 2. *C. durdanae* Kumar, 1992, 3. *C. fotedari* Gupta, S.P. & Naqvi, 1980, 4. *C. indicus* (Saxena, 2004), 5. *C. inglisi* Gupta, V. & Fatima, 1987, 6. *C. leiognathi* Jain & Gupta, N.K, 1979, 7. *C. mysti* (Sahay & Sinha, 1971) Amin, 1985, 8. *C. portblarensis* Jain & Gupta, N. K.1979, 9. *C. prashadi* (Datta, 1940) Golvan, 1969, 10. *C. puriensis* Gupta, V. & Sinha, 1992, 11. *C. secundus* (Tripathi, 1959) Golvan, 1969, 12. *C. singhai* (Gupta, V. & Fatima, 1989) Golvan 1994 and 13. *C. thapari* (Gupta, S.P. & Naqvi, 1980) Kumar, 1992, all occur in the subcontinent.

Key to Indian species of genus *Cleaveius* : See Gupta, S. P. & Naqvi, 1980

1. Lemnisci bifurcated at thrir free ends ..... *Cleaveius prashadi*
   Lemnisci not bifurcated at their free ends 2
2. Proboscis with 11 longitudinal rows of 4-6 hooks each 3
   Proboscis with more than 11 longitudinal rows of hooks 4
3. Worms small, males 5.29 mm and females 5.10 mm long ..... *Cleaveius leiognathi*
- Worms large females 15.75 mm long ..... *Cleaveius portblairensis*
4. Four proboscis hooks in each of 18 longitudinal rows ..... *Cleaveius circumspinifer*
- More than 4 proboscis hooks in each longitudinal row 5
5. Proboscis hooks 8-10 in each of 22 longitudinal rows ..... *Cleaveius durdanae*
   Proboscis hooks more than 10 in each longitudinal rows 6
6. Proboscis hooks 12-13 in each of 14-16 longitudinal rows ..... *Cleveius fotedari*
   Proboscis hooks more than 13 in each longitudinal rows 7
7. Proboscis hooks 14-15 in each of 18 longitudinal row ..... *Cleveius indicus*
- Proboscis hooks more than 15 in each longitudinal rows 8
8. Proboscis with 14-18 in each of 15-17 longitudinal rows ..... *Cleaveius mysti*
- Proboscis hooks 16-18 in each longitudinal row 9
9. Worms small, males 2.07-2.49 mm and females 1.86-2.69 mm long ..... *Cleaveius secundus*
- Worms more than 4 mm long 10
10. Trunk spines in 8-11 rows ..... *Cleveius thapari*
- Trunk spines in more than 12 rows ..... *Cleaveis thapari*
11. Proboscis with 12-14 longitudinal rows of 16-18 hooks each ..... *Cleveius inglisi*
- Proboscis with 16-18 longitudinal rows of 18-20 hooks each ..... *Cleveius singhai*

Note : *Cleaveius puriensis* Gupta, V. & Sinha, 1992 is not included in the key.

127. ***Cleaveius circumspinifer*** Subramanian, 1927
(Fig. 112)

Cleaeius circumspinifer Subramanian, 1927a: 276-279, Fig. 1-3; Meyer, 1932: 61-62; Petrotschenko, 1956: 370-371; Yamaguti, 1963: 67; Pl. 22, Fig. 221-223; Golvan & Houin, 1964: 546-547; Golvan, 1969: 109, Fig. 75 A-C; 1994: 143.

Type locality : Rangoon, Burma.

Description : Male 5.1 × 0.21 mm. Female 8.1 mm long, anteriorly 0.38 mm wide, midtrunk 0.25 mm wide Proboscis short cylindrical with 18 longitudinal rows of 4 hooks each in male; in female proboscis cylindrical, constricted in middle, 0.157 mm long, 0.175 mm wide anteriorly, 0.105 mm wide in middle, 0.140 mm wide posteriorly, largest hooks 0.055 mm long, smallest 0.030 mm long. A part of proboscis 0.055 mm long unarmed in female. Proboscis receptacle double-walled, muscular; in female 0.63 × 0.175 mm, with ganglion situated laterally at 0.157 mm from posterior end of receptacle. Trunk in both

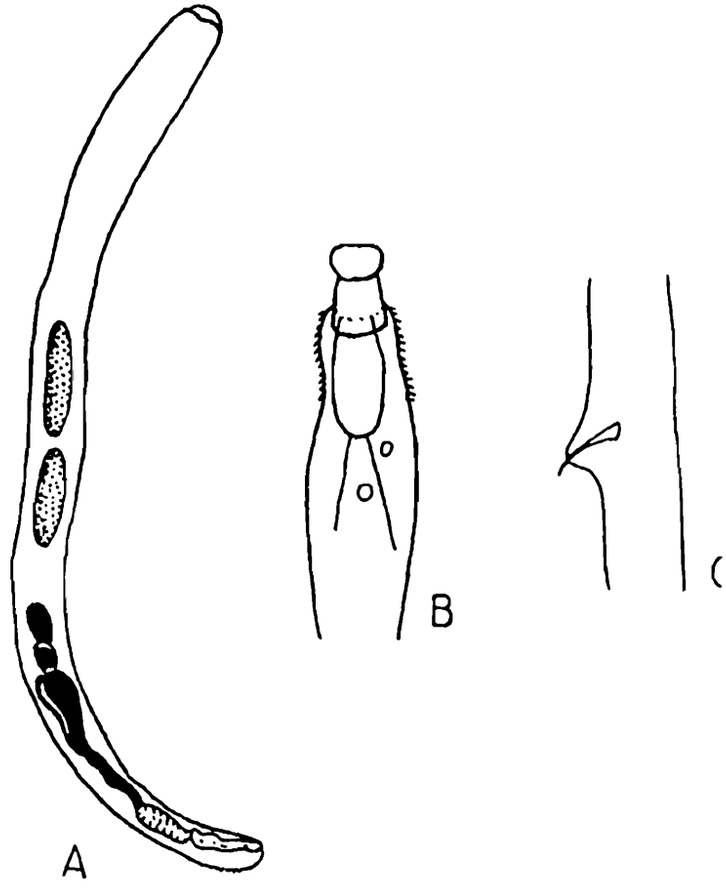


Fig. 112. *Cleaveius circumspinifer* Subramanian, 1927. A. Male, B. Anterior end of female, C. Trunk spine (after Subramanian, 1927).

sexes cylindrical, of almost uniform diameter, anterior part not armed, but from commencement of posterior testis armed with 23 rows of spines, each of 0.027 mm long in male; in female anterior part of trunk to a distance of 0.262 mm with scattered spines of 0.027 mm long. About 2/3 of trunk with about 41 circular rows of 14 spines each, each spine 0.025-0.030 mm. Rows of spines 0.052 mm apart anteriorly, 0.124-0.137 mm apart posteriorly. Lemnisci 2, much coiled. Testes 2, elongated, one behind other, anterior 0.612 × 0.079 mm, posterior 0.49 × 0.105 mm. Cement glands 4, pyriform, compact. Female genitalia well developed. Body cavity filled with immature embryos.

Host : Unidentified fish.

Location : Intestine.

Locality : Rangoon (Burma).

Distribution : Known only from type locality.

128. ***Cleaveius durdanae*** Kumar, 1992
(Fig. 113)

Cleaeius durdanae Kumar, 1992d : 333-336, Fig. 1-4; Bhattacharya, 2007 : 98.

Description : Male 2.32-2.37 × 0.46-0.56 mm. Proboscis short. Cylindrical, angular with trunk, 0l40-0.75 × 0,21 = 0.25 mm, with 22 longitudinal rows of 8-10 hooks each. Dorso-ventral symmetry absent in hook, anterior hooks 0.021-0/04 mm long, posterior hooks 0.0220.04 mm long. Neck very short. Proboscis receptacle elongate, double-walled, 0.74-0/82 × 0.16-0.25 mm with anteriorly located ganglion. Trunk small cylindrical, extremities attenuated, midtrunk wide, anteriorly spinose, with 9-11 transverse rows of 14

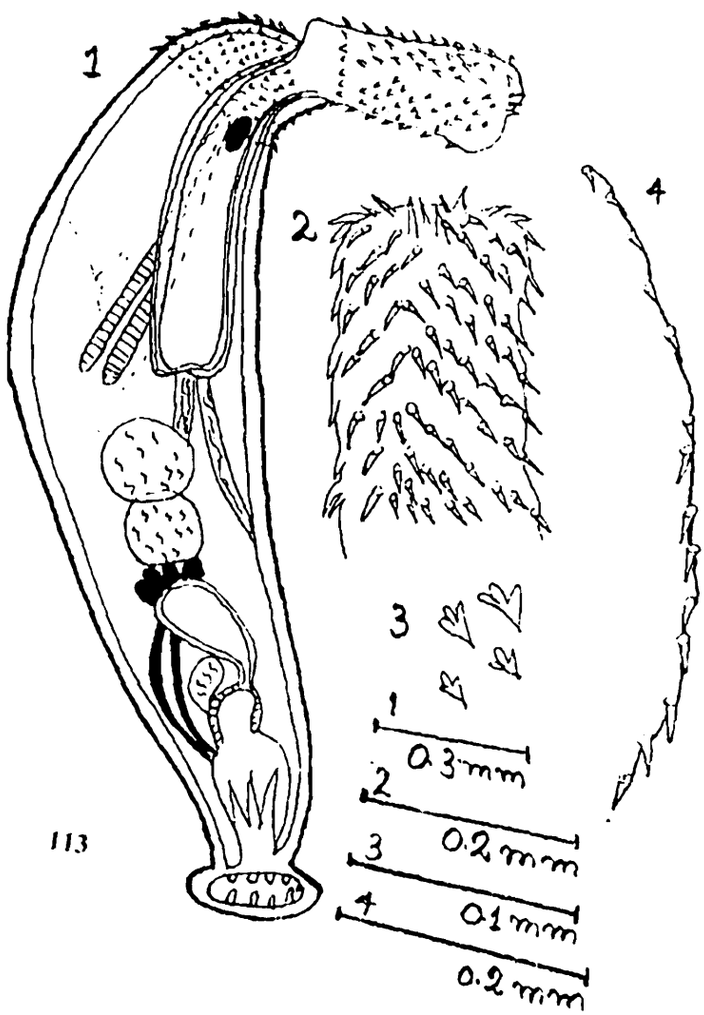


Fig. 113. *Cleaveius durdanae* Kumar, 1992. 1. Male, 2. Proboscis enlarged, 3. Trunk spines, 4. Row of proboscis hooks (after from Kumar, 1992).

hooks each, 0.021-0.022 mm long. Hypodermal nuclei small and numerous. Lacunar system with main lateral channels and treansverse anastomoses. Lemnisci 2, elongated, slender, equal, extend up to end of receptacle or slightly posterior to it, 0.68-0.82 mm long. Testes 2, oval, unequal, in tandem, slightly overlapping, post-equatorial, anterior 0.19-0.30 × 0.19-0.29 mm, posterior 0.15-0.25 × 0.15-0.27 mm Cement glands 4, tubular. Saefftigen's pouch 0.14-0.20 × 0.09-0.17 mm, opening into bursa. Seminal vesicle pyriform, 0.10-0.32 × 0.07-0.14 mm. Bursa muscular 0.10-0.13 × 0.100.11 mm. Gonopore terminal. Female not described.

Host : *Clarius batracus* (Jerdon).

Location : Intestine.

Locality : Chilkla lake (Orissa).

Distribution : Known only from type locality.

129. ***Cleaveius fotedari*** (Gupta, S.P. & Naqvi, 1980), Kumar, 1992 (Fig. 114)

Mehrarhybchus fotedari Gupta, S.P. & Naqvi, 1980 : 83-86, Pl.2, Fig. 1-4;

Cleaeius fotedari (Gupta, S.P. & Naqvi), Kumar, 1992d : 33-336; Bhattacharya, 2007 : 97.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Males 5.17-5.62 × 0.82-0.90 mm; female 6.35 × 0.90 mm. Proboscis flexed at an angle with trunk, long, club-shaped 0.74-0.80 × 0.25-0.30 mm with 14-16 longitudinal rows of 12-13 hooks each in males; in females 0.85 × 0.35 mm, with 16 longitudinal rows of 15 hooks each. Hooks of apical region 0.031-0.035 mm long, middle region 0.024-0.028 mm long, and posterior region 0.040-0.044 mm long. Proboscis receptacle cylindrical to claviform, double-walled 1.60-1.84 × 0.40-0.43 mm in males; in female 1.90 × 0.40 mm, with ganglion at its base. Trunk elongated, cylindrical, gradually enlarging from anterior to middle and narrowing from middle to posterior end, 4.27-4.62 × 0.82-0.90 mm with 11-13 rows of spines, 0.019-0.023 mm long in males; in female 5.36 × 0.90 mm with 14 rows of spines, 0.022-0.024 mm long. Anterior part of trunk covered with regular rows of small triangular spines with basal chitinous sheath. Neck short aspinose. Lacunar system well developed. Lemnisci cylindrical, unequal longer than receptacle extending to anterior margin of posterior testis, larger lemniscus 1.96-2.02 mm long, smaller 1.72-1.81 mm long in males; in female longer lemniscus 2.40 mm long, smaller 2.08 mm long. Testes ovoid, in tandem, contiguous, equal and pre-equatorial, anterior 0.44-0.47 × 0.28-0.30 mm, posterior 0.43-0.47 × 0.29-0.31 mm. Cement glands 4, clavate, 0.24-0.40 × 0.06-0.11 mm, Saefftigen's pouch pyriform 0.30-0.34 × 0.16-0.19 mm. Seminal vesicle 0.77-0.81 × 0.25-0.28 mm. Bursa elongated with thick muscular wall 0.80-0.84 × 0.40-0.47 mm. Eggs filled body cavity obstructing to see female genitalia. Eggs 0.07-0.09 × 0.018-0.023 mm with polar prolongations of middle shell. Gonopore terminal in both sexes.

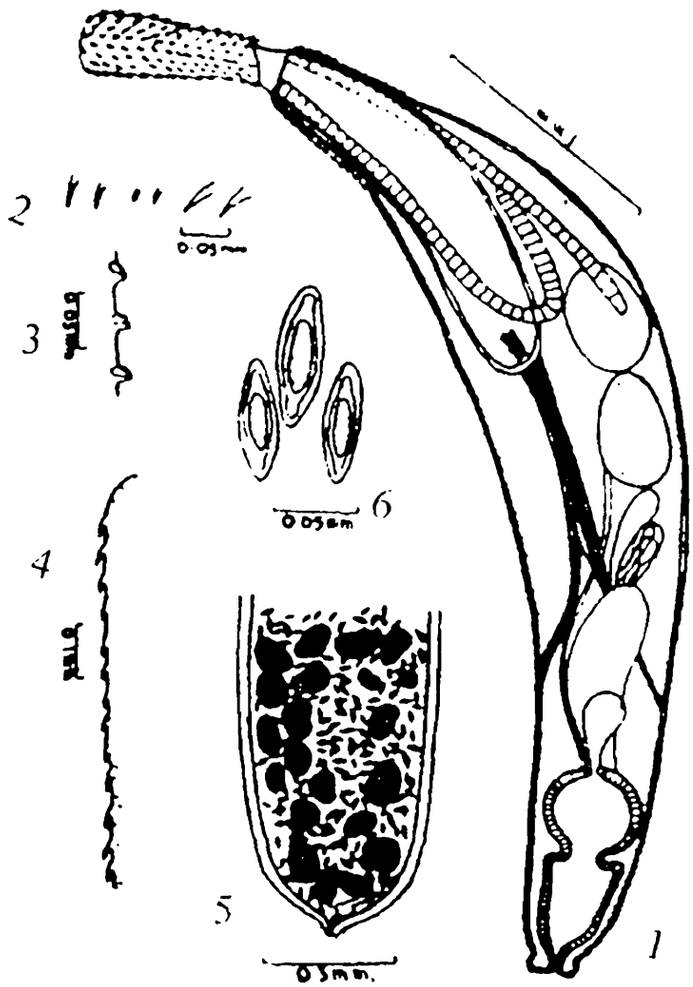


Fig. 114. *Cleaveius fotedari* (Gupta, S.P. & Naqvi, 1980). 1. Male, 2. Proboscis hooks, 3. Row of trunk spines, 4. Row of proboscis hooks, 5. Posterior end of female, 6. Eggs (after Gupta, S.P. & Naqvi, 1980).

Host : *Arius arius* (Bleeker).

Location : Intestine.

Locality : Karachi coast (Pakistan).

Distribution : Known only from type locality.

130. ***Cleaveius indicus*** (Saxena, 2004) Naidu, 2008
(Fig. 115)

Mehrarhynchus indicus Saxena, 2004a : 39-42.

Cleaveius indicus (Saxena, 2004) nov. status.

Type locality : Deegha coast, West Bengal, India.

Description : Male 4.55 × 0.76 mm. Female 5.45 × 0.84 mm. Proboscis long, cylindrical 0.54 × 0.21 mm in male, in female 0.81 × 0.24 mm, with 18 longitudinal rows of 15 hooks

each in male, 14 hooks each in female. Each hook with a recurved blade and a horizontally directed root. Hooks of similar, largest at middle, decreasing antero-posteriorly. Proboscis hooks 0.030-0.040 mm long in male, in female 0.028-0.034 mm long. Neck short, aspinose, 0.10 × 0.16 mm in male, in female 0.14 × 0.16 mm. Proboscis receptacle cylindrical or claviform, double-walled with ganglion at its hind end, 1.17 × 0.27 mm in male; in female 0.81 × 0.24 mm. Trunk elongated, cylindrical, wide at middle and narrow towards both ends, 3.91 × 0.76 mm with 15 rows of spines of 0.019-0.023 mm long in male, in female 4.5 × 0.84 mm with 17 rows of spines each of 0.021-0.023 mm long. Anterior trunk region

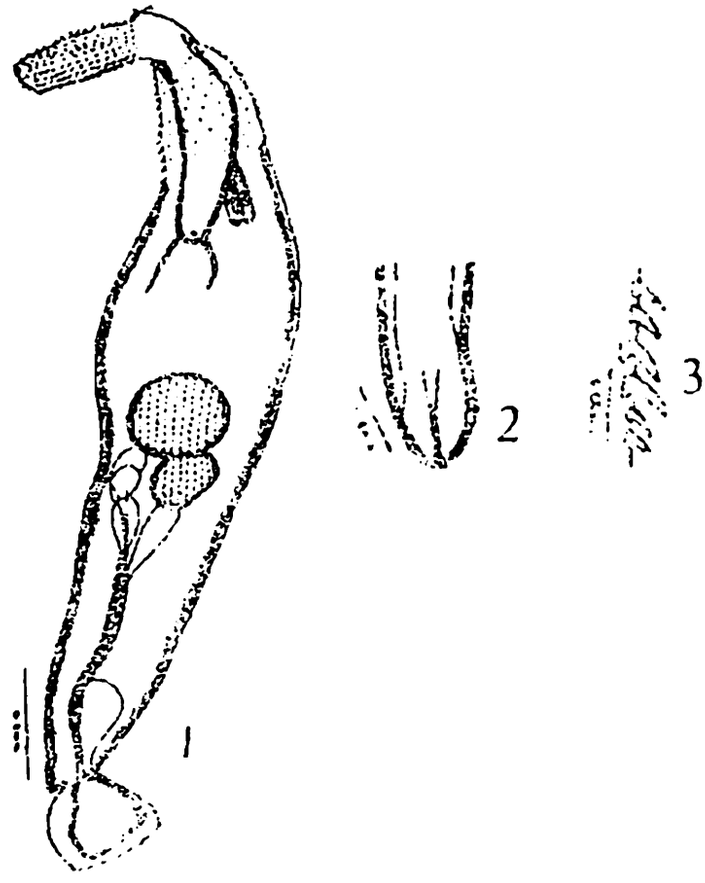


Fig. 115. *Cleaveius indicus* Saxena, 2004. 1. Male ventral view, 2. Posterior part of female, 3. Proboscis hooks (after Saxena, 2004).

covered with regular rows of small triangular spines, with basal chitinous sheath up to 1/7th of trunk. Lemnisci cylindrical, equal, 0.35 × 0.06 mm in male; in female 1.46 × 0.11 mm. Testes ovoid, in tandem, overlapping, pre-equatorial, subequal, anterior 0.43 × 0.44 m, posterior 0.37 × 0.40 mm. Cement glands 4, clavate, 0.15-0.20 × 0.09-0.12 mm with long ducts opening separately into bursa. Saefftigen's pouch absent. Seminal vesicle pyriform 0.24-0.26 mm long. Bursa ovoid, with muscular wall, 0.06 × 0.02 mm. Uterus bell shaped 0.26 × 0.10 mm. Vagina 0.10-0.13 mm long, guarded by dumb-bell-shaped spincter. Eggs not observed.

Host : *Gerres setifer* Hamilton.

Location : Intestine.

Locality : Deegha coast (West Bengal).

Distribution : Known only from type locality.

Remarks : Saxene described a new species *Mehrarhynchus indicus* Saxena, 2004, as *Mehrarhynchus* is syninym of *Cleaveius* Subramanian, 1927, this species is transferred to *Cleaveius* and named *Cleaveius indicus* (Saxena, 2004) nov. status.

131. ***Cleaveius inglisi*** (Gupta, V. & Fatma, 1987) Kumar, 1992 (Fig. 116)

Mehrarhynchus inglisi Gupta, V. & Fatma, 1987: 14-17, Pl. 5, Fig. 1-5; Gupta, V. & Sinha, 1990: 51;

Cleaveius inglisi (Gupta, V. & Fatma), Kumar, 1992d: 335; Golvan, 1994: 143; Bhattacharya, 2007: 97-98, Fig. 91 a-e.

Type locality : Quilon, Kerala, India.

Description : Males 4.85-5.30 × 0.96-1.20 mm. Females 5.5-5.85 × 0.85-1.0 mm. Proboscis club-shaped, wide anteriorly, tapering at base, forming an angle with trunk, with 12-14 longitudinal rows of 16-18 hooks each, 0.80-0.85 × 0.16-0.25 mm in male; in female 0.70-0.85 × 0.25-0.34 mm. Hooks from anterior to middle 0.03-0.035 mm long, and from middle to base 0.023-0.025 mm long in male; in female anterior to middle

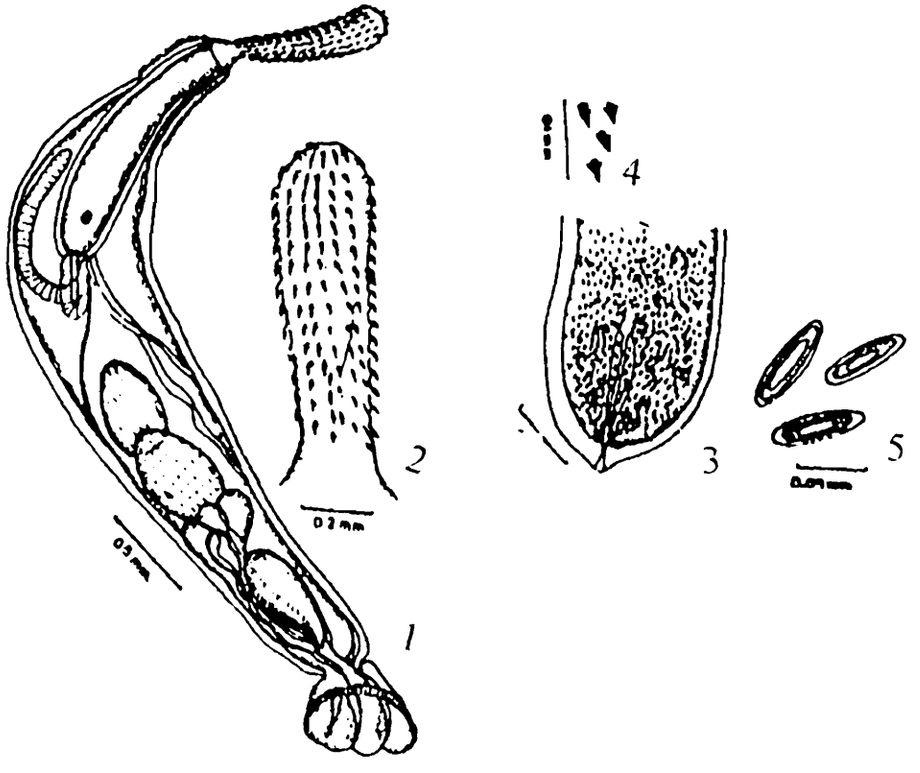


Fig. 116. *Cleaveius inglisi* Gupta, V. & Fatma, 1987, Kumar, 1992. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Trunk spines, 5. Ova (Gupta, V. & Fatma, 1978).

0.025-0.040 mm long, from middle to base 0.030-0.032 mm. Proboscis receptacle cylindrical or claviform, double-walled with ganglion at its base, in males 1.35-1.40 × 0.40-0.45 mm; in female 0.75-0.90 × 0.30-0.35 mm. Trunk elongated, cylindrical, spinose, medium-sized, wide at middle, tapering to both ends, anterior trunk with 8-10 circles of small triangular spines each with wide base and pointed free end, 0.015-0.018 mm long. Lemnisci elongated, tubular, unequal, much longer than receptacle, shorter 1.90-2.05 mm, longer 2.1-2.5 mm in male; in female shorter lemniscus 1.65-1.95 mm, longer 2.0-2.25 mm long and extending up to posterior margin of anterior testis. Testis ovoid, subequal, in tandem, overlapping, equatorial, anterior 0.40-0.45 × 0.30-0.32 mm, posterior larger, 0.50-0.55 × 0.32-0.36 mm. Cement glands 4, pyriform forming a cluster over bursa, 0.30-0.36 × 0.20-0.21 mm. Saefftigen's pouch pyriform, muscular, 0.60-0.65 × 0.26-0.30 mm. Bursa bell shaped with rays 0.50-0.58 × 0.45-0.55 mm. Uterine bell funnel shaped, 0.15-0.18 × 0.050-0.095 mm. Uterus tubular, narrow, 0.15-0.19 × 0.015-0.0155 mm. Vagina muscular, elongated 0.15-0.18 × 0.015-0.0155 mm. Eggs elliptical, 0.070-0.075 × 0.02-0.025 mm. Gonopore terminal in both sexes.

Host : *Mugil tada* (Forsskal).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

132. ***Cleaveius leiognathi*** Jain & Gupta, N.K., 1980
(Fig. 117)

Cleaveius leiognathi Jain & Gupta, N.K., 1980a : 305-307, Fig. 1-6; Gupta, V. & Sinha, 1990b : 50; Golvan, 1994 : 143.

Type locality : Port Blair, Andaman and Nicobar Islands, India.

Description : Males 5.29-7.11 × 0.27-0.28 mm Females 5.00-10.69 × 0.187-0.264 mm. Proboscis small, claviform, with 11 longitudinal rows of 4-5 hooks each, similar in both sexes, 0.088-0.132 × 0.11-0.127 mm in male; in female 0.121-0.165 × 0.11-0.132 mm. Size of proboscis hooks decreases towards posterior end; apical and subapical hooks largest, 0.092-0.11 × 0.007-0.009 mm and posterior most hooks smallest, 0.021-0.033 × 0.004 mm, third and fourth hooks of each row 0.070-0.087 × 0.006-0.008 mm and 0.032-0.054 × 0.005-0.007 mm respectively. Neck cylindrical, longer than proboscis, 0.231-0.253 ×. 0.088-0.099 mm in male; in female 0.144-0.232 × 0.087-0.109 mm. Proboscis receptacle double-walled, with post-equatorial ganglion, anterior to its base; 0.253-0.352 × 0.055-0.066 mm in male; in female, 0.219-0.328 × 0.065-0.099 mm. Trunk delicate, elongate, narrow, with rounded posterior end and spined in mid- region, with 8-9 longitudinal rows of 3-4 spines each, its spines very minute, 0.008- 0.009 × 0.003-0.004 mm, scattered in mid region, 0.473-0.88 mm from anterior end and 0.66-1.73 mm from posterior end. Lemnisci narrow, cylindrical, with rounded tips, equal or subequal, longer than receptacle, 0.56-0.68 × 0.028-0.066 mm and 0.56-0.737 × 0.032-0.055 mm in male;

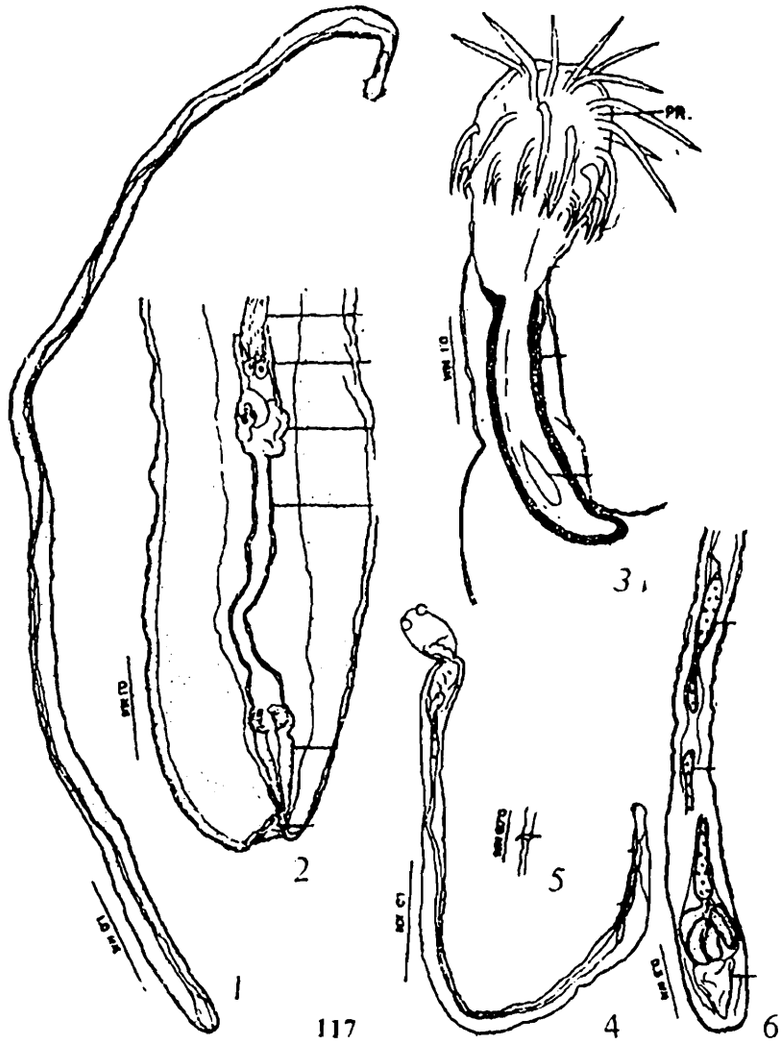


Fig. 117. *Cleaveius leiognathi* Jain & Gupta, N.K. 1980. 1. Female, 2. Posterior part of female, 3. Proboscis and Neck, 4. Male, 5. Trunk spine, 6. Posterior end of male (after Jain & Gupta, N.K. 1980).

in female 0.605 × 0.033 mm. Testes elongated, in tandem, dumb-bell-shaped, anterior 0.374-0.57 × 0.012-0.078 mm; posterior 0.552 × 0.022-0.077 mm. Cement glands 4, compact, 0.132-0.165 × 0.055-0.066 mm. Copulatory bursa 0.286 × 0.132 mm. In female genital tube 0.352-0.452 mm long. Only ovarian balls were present. Uterine bell funnel-shaped, 0.15-0.18 × 0.050-0.095 mm. Uterus narrow, tubular, 0.10-0.12 × 0.05-0.06 mm. Vagina muscular, elongated 0.15-0.28 × 0.15-0.155 mm. Eggs elliptical 0.070-0.075 × 0.02-0.025 mm. Gonopore terminal in both sexes.

Host : *Leiognathus splendens* (Cuvier).

Location : Intestine.

Locality : Panaji (Goa); Port Blair (Andaman & Nicobar Islands).

Distribution : Known only from India.

133. ***Cleaveius mysti*** (Sahay & Sinha, 1971) Amin, 1985 (Fig. 118)

Mehrarhynchus mysti Sahay & Sinha, 1971 : 66-69, Fig. 1-3; Gupta, V. & Sinha, 1990b : 48; *Cleaveius mysti* (Sahay & Sinha) Amin, 1985 : 49; Golvan, 1994: 143; Bhattacharya, 2007 : 97-99.

Type locality : Ranchi, Bihar, India.

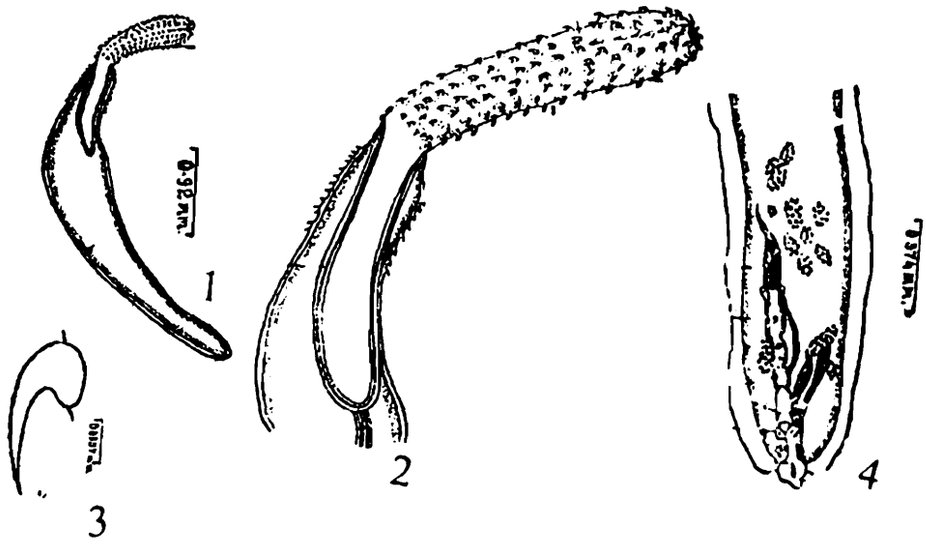


Fig. 118. *Cleaveius mysti* (Sahay & Sinha, 1971) Amin, 1985. 1. Entire worm, 2. Anterior end of female, 3. Proboscis hook enlarged, 4. Posterior end of female (after Sahay & Sinha, 1971).

Description : Female 4.77-5.71 × 0.65-0.69 mm. Proboscis 0.84-0.93 mm long, with 15-17 longitudinal rows of 14-18 hooks each. Anterior larger hooks 0.05-0.06 mm long in 3rd row and posterior hooks 0.04-0.056 mm long. Proboscis receptacle double-walled, 1.215-2.038 mm long with ganglion situated at a distance of 0.26-0.28 mm from its base. Neck short 0.206-0.28 mm long.. Trunk divided into slightly swollen anterior part and ventrally curved narrow cylindrical posterior part, anterior spinose trunk ends anterior to swollen part. Lemnisci longer than receptacle, unequal, 2.39 mm and 2.717 mm long. Trunk filled with irregular ovarian balls. Uterine bell 0.187 mm long. Uterus tubular 0.318 mm long. At junction of uterine bell and uterus a few large glandular nucleated cells present (?). Vagina 0.187-0.206 mm long and opens by subterminal gonopore, guarded by two folds of sphincter and situated 0.056 mm from posterior end of trunk. Eggs 0.016 mm long. Male not known.

Host : *Mystus seenghala* (Sykes) Hamilton.

Location : Intestine.

Locality : Ranchi (Bihar).

Distribution : Known only from type locality.

134. ***Cleaveius portblairensis*** Jain & Gupta, N. K. 1979
(Fig. 119)

Cleaveius portblairensis Jain & Gupta, N. K.1980: 307-309, Fig. 7-11; Gupta, V. & Sinha, 1990b: 50; Golvan, 1994 : 143.

Type locality : Port Blair, Andaman and Nicobar Islands, India.

Description : Female 15.85 × 0.495 mm. Proboscis claviform 0.187 × 0.132 mm, with 11 longitudinal rows of 6 hooks each, posterior 3 hooks of each row much smaller than anterior ones, with slight gradual decrease in their size antero-posteriorly. Of anterior three longer hooks, second hook of each row longest, 0.067-0.072 × 0.008-0.009 mm,

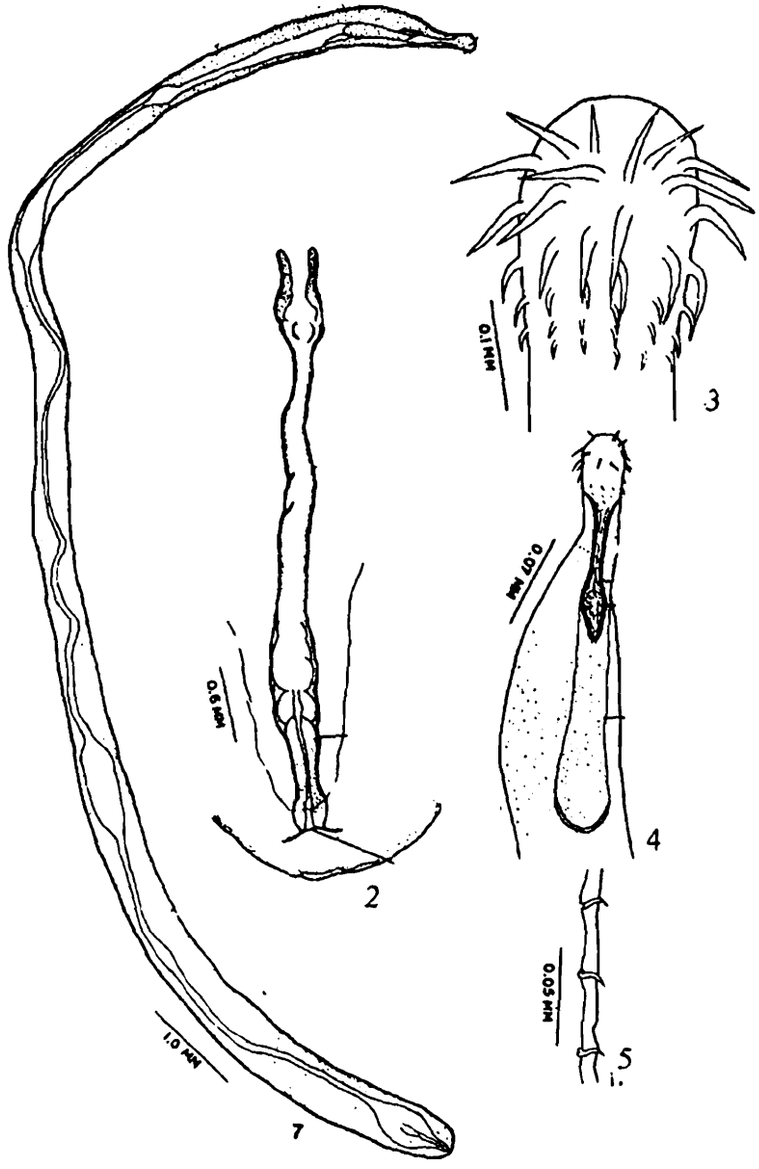


Fig. 119. *Cleaveius portblairensis* Jain & Gupta, N.K., 1979. 1. Female, 2. Female genitalia, 3. Proboscis enlarged, 4. Anterior part of worm, 5. Row of trunk spines (after Jain & Gupta, N.K. 1979).

and first and third hooks smaller, 0.054-0.057 ×, 0.008-0.009 mm, fourth, fifth and sixth hooks of each row, 0.032-0.038 × 0.006-0.007 mm, 0.024-0.027 × 0.004-0.007 mm and 0.017-0.024 × 0.003-0.004 mm. Proboscis receptacle double-walled, inserted at base of proboscis, with tapering posterior end, 0.385 × 0.077 mm, with ganglion slightly anterior to its base. Trunk long, slender, wider anteriorly, with minute 0.010-0.015 mm long spines scattered from level of base of receptacle to about ¾ of total body length. Lemnisci clavate, subequal, 0.847 × 0.176 mm and 0.836 × 0.165 mm. Genital tube 0.44 mm long with subterminal gonopore. Male not known.

Host : *Leiognathus splendens* (Cuvier).

Location : Intestine.

Locality : Port Blair (Andaman & Nicobar Islands).

Distribution : Known only from type locality.

135. ***Cleaveius prashadi*** (Datta, 1940) Golvan, 1969 (Fig. 120)

Mehrarhynchus prashadi Datta, 1940: 81-85, Textfig. 1-3; Yamaguti, 1963: 103, Pl. 42, Fig. 430-42; *Cleaveius prashadi* (Datta) Golvan & Houin, 1964: 547, Fig. 7; Golvan, 1969: 109-110, Fig. 76; *Mehrarhynchus prashadi,* Anantaraman, M. & Anantaraman, S., 1970: 5; Gupta, V & Sinha, 1990b: 53; *Cleaveius prashadi* Golvan, 1994: 143; Bhattacharya, 2007: 99, Pl. 17, Fig. 92 a-c.

Type locality : Kolkata, West Bengal, India.

Description : Worms small, club-shaped and whitish. Males 4.62-6.71 × 0.68-0.79 mm; female 7.99 × 1.53 mm. Proboscis narrow, cylindrical 0.95 × 0.33 mm, with 22 longitudinal rows of 12-14 fine recurved hooks each. Proboscis hooks of anterior part slightly longer than those of posterior part, anterior hooks 0.08 mm long, posterior hooks 0.055 mm long Proboscis receptacle narrow, double-walled, muscular, nearly twice as long as proboscis, 1.83 × 0.29 mm, with both retractors and protractors and ganglion single, spindle-shaped with radiating nerve retinacula embedded in wall of receptacle slightly away from its base. Neck, slightly narrow, aspinose. Trunk with slight external furrows, anterior trunk with 12-13 rows of 15-17 small and thick spines, 0.025 mm long. Lacunar system with longitudinal channels and circular canaliculi. Hypodermal nuclei granular all over trunk. Lemnisci 2, thin, cylindrical, 2.71 × 0.15 mm, longer than receptacle, extending up to anterior testis, with free ends bifurcated as digitiform diverticula. Testes oval, in tandem, close to each other, anterior 0.22 × 0.37 mm, posterior 0.33 × 0.37 mm. Vasa efferentia emerge from testes unite into vas deferens behind cement glands. Cement glands 4, club-shaped, unequal 0.33 × 0.15 mm, with a few small nuclei, duct from each gland unite to form a thick cement duct ending in muscular penis.. Seminal vesicle 0.81 mm long, thin-walled sac to which vas deferens unites and jointly open into cement duct at base of penis. Penis cone-shaped, muscular hangs on top of bursa. Bursa 0.46 × 0.53 mm. Uterine bell funnel-shaped, 0.46 × 0.20 mm, with a few guard cells near its base, regulate exit of ripe ova to uterus. Uterus

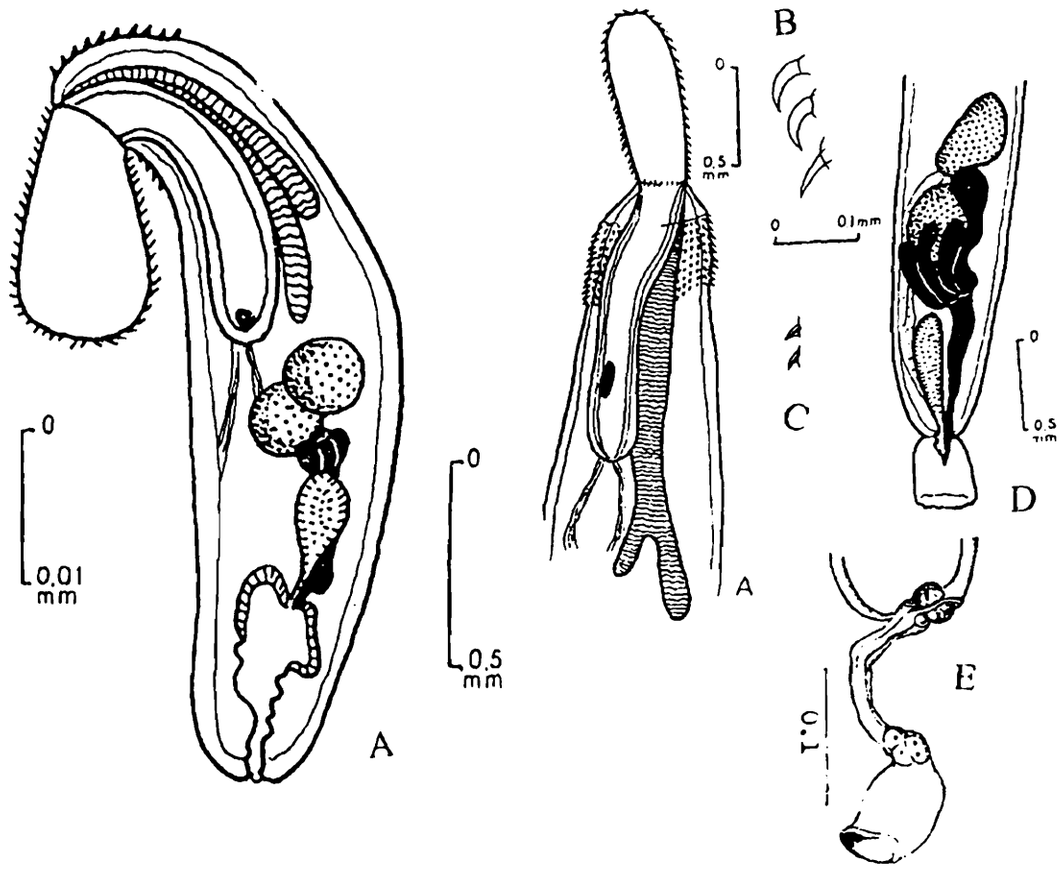


Fig. 120. *Cleaveius prashadi* (Datta, 1940) Golvan, 1969. A. Anterior end of worm, B. Row of proboscis hooks enlarged, C. Trunk spines, D. Posterior end of male, E. Female genitalia (A-D after Golvan, 1969, E after Yamaguti, 1963).

narrow, thin-walled, 0.31 mm long, leads into long vagina 0.29 mm long, guarded at its posterior end by two sets of strong muscular bands, controlling mature ova in a single file. Vulva situated postero-ventrally. Eggs 0.065 mm long.

Host : *Pangasius pangasius* (Hamilton).

Location : Intestine.

Locality : Kolkata (West Bengal).

Distribution : Known only from type locality.

136. ***Cleaveius puriensis*** Gupta, V. & Sinha, 1992

Cleaveius puriensis Gupta, V. & Sinha, 1992:

Type locality : Puri, Orissa, India.

Description : Literature containing the description and figures of this species could not be procured.

Locality : Puri (Orissa).

137. ***Cleaeius secundus*** (Tripathi, 1959) Golvan, 1969

Mehrarhynchus secundus Tripathi, 1959: 77, Textfig. 9 a-c; Yamaguti, 1963: 103, Pl. 43, Fig. 433-436; Golvan & Houin, 1964: 547, Fig. 8;

Cleaveius secundus (Tripathi, 1959) Golvan, 1969:110-111, Fig. 77A, B.;

Mehrarhynchus secundus Anantaraman, M. & Anantaraman, S., 1970: 5;

Cleaveius secundus (Tripathi), Ahmed & Rauf, 1981: ?120; Ahmed, 1981 : ?230;

Mehrarhynchus secundus Gupta, V. & Sinha, 1990b: 42, 44;

Cleaveius secundus, Golvan, 1994 : 143; Ahmed & Ezaz, 1997: 156; Arthur& Ahmed. 2002: 39; Bhattacharya, 2007: 99-100, Pl. 17, Fig. 93 a, b.

Type locality : Chilka Lake, Orissa, India.

Description : Male 2.07-2.49 × 0.37-0.49 mm; female 1.84-2.69 × 0.29-0.40 mm. Proboscis flexed at an angle with trunk, club-shaped and wider anteriorly, 0.551-0.797 × 0.244-0.304 mm, with 16-20 longitudinal rows of 16-18 curved hooks each. Hooks 0.049-0.053 mm long. Roots of hooks longer than blades. Proboscis receptacle 0.493-0.754 × 0.145-0.217 mm, with ganglion at its base. Neck small aspinose. Trunk long and tapering posteriorly, with its anterior part armed with 9-10 rows of small spines with basal chitinous sheath. Trunk spines 0.019-0.022 mm long. Lemnisci 2, unequal, 0.785 × 0.029 mm, smaller than receptacle. Testes spherical to oval, in tandem, slightly overlapping, anterior testis behind or just touching receptacle, 0.116-0.145 × 0.145-0.188 mm. Cement glands 4, pyriform, 0.065 mm wide, with long ducts in two pairs, opening near penis. Seminal vesicle pyriform 0.10 mm wide. Copulatory bursa with thick muscular wall, oval when everted, 0.259 × 0.145 mm. Uterine bell funnel-shaped, in posterior third of trunk 0.076 × 0.053 mm. Uterus long, tubular, 0.087 × 0.049 mm. Vagina long, 0.149 × 0.038 mm, with sphincter muscle. Eggs not present.

Host : *Plotosus canius* Hamilton-Buchanan, *Pama pama* (Hamilton-Buchanaon), *Osteogeiosus militaris* (Linnaeus); *Arius gagor* (Hamilton).

Location : Intestine.

Locality : Chilka lake (Orissa); Malta River, Port Canning (West Bengal); Barisal (Bangladesh).

Distribution : Known only from Indian subcontinent..

138. ***Cleaveius singhai*** (Gupta, V. & Fatma, (1987) 1989 Kumar, 1992 (Fig. 121)

Mehrarhynchus singhai Gupta, V. & Fatma, 1989: 12-14, Pl. 4, Fig. 1-5;

Cleaveius singhai (Gupta, V. & Fatma), Kumar, 1992: 335; Golvan 1994: 143; 1994: 143; Bhattacharya, 2007: 100, Pl. 17, Fig. 94 a-e.

Type locality : Quilon, Kerala, India.

Description : Males 5.54-5.85 × 1.0-1.2 mm; females 5.40-6.55 × 0.90-1.0 mm. Proboscis club-shaped, wide anteriorly, tapering at base, forming an angle with trunk, 1.03-1.05 × 0.25-0.80 mm with 16-18 longitudinal rows of 18-20 hooks each, in males; in females 0.80-0.85 × 0.30-0.32 mm. Hooks of anterior part to middle part 0.03-0.05 mm long, from middle part to base 0.025-0.030 mm long in male; in female hooks from anterior to middle part 0.030-0.045 mm long, middle to base, 0.03-0.04 mm long. Proboscis receptacle cylindrical or claviform, double-walled, 1,4-1.5 × 0.40-0.45 mm in male; in females 0.75-0.90 × 0.3-0.4 mm.with basal ganglion. Neck short, aspinose, 0.19-0.22 × 0.28-0.30 mm. Trunk elongated, cylindrical, spinose, wide at middle, tapering to both ends, anterior trunk armed with 9-11 circles of small, triangular spines with wide base and pointed free end, 0.018-0.02 mm long. Lemnisci cylindrical, equal, longer than receptacle, reaching up to anterior testis, 1.95-2.0 mm long in male; in females 1.20-1.28 mm long. Testes ovoid, in tandem, subequal, overlapping, post-equatorial, anterior 0.40-0.50 × 0.30-0.35 mm, posterior larger, 0.45-0.55 × 0.30-0.32 mm. Cement glands 4, pyriform, in a cluster anterior to bursa, opening into bursa through separate ducts, 0.22-0.46 × 0.22-0.46 mm. Seminal vesicle pyriform, 0.50-0.65 × 0.30-0.35 mm. Bursa bell-shaped, 0.45-0.55 × 0.30-0.35 mm, with bursal rays. Uterine bell funnel-shaped, 0.16-0.18 ×

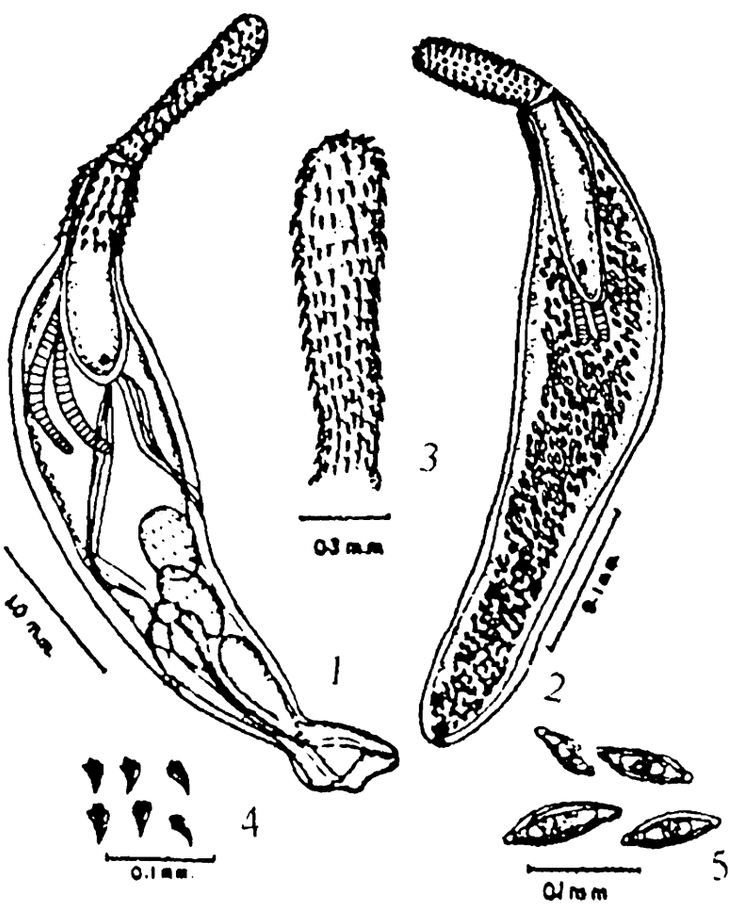


Fig. 121. *Cleaveius singhai* Gupta, V. & Fatima, 1987. 1. Male, 2. Female, 3. Proboscis enlarged, 4. Trunk spines, 5. Ova enlarged. (after Gupta, V. & Fatima, 1987).

0.055-0.080 mm. Uterus tubular, narrow, 0.15-0.18 × 0.05-0.06 mm, enclosing a few guard cells. Vagina muscular, elongated, 0.12-0.15 × 0.01-0.018 mm. Ovarian balls 0.025-0.085 × 0.015-0.018 mm, scattered in body cavity. Eggs elliptical, 0.030-0.035 × 0.015-0.022 mm with polar prolongations of middle shell. Gonopore terminal in male.

Host : *Osteogeniosus militaris* (Linnaeus) Bleeker.

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

139. ***Cleaveius thapari*** (Gupta, S.P. & Naqvi, 1980) Kumar, 1992 (Fig. 122)

Mehrarhynchus thapari Gupta, S.P. & Naqvi, 1980 : 80-83, Pl. 1, Fig. 1-5;
Cleaveius thapari (Gupta, S.P. & Naqvi) Kumar, 1992d : 335.

Type locality : Karachi coast, Sindh, Pakistan.

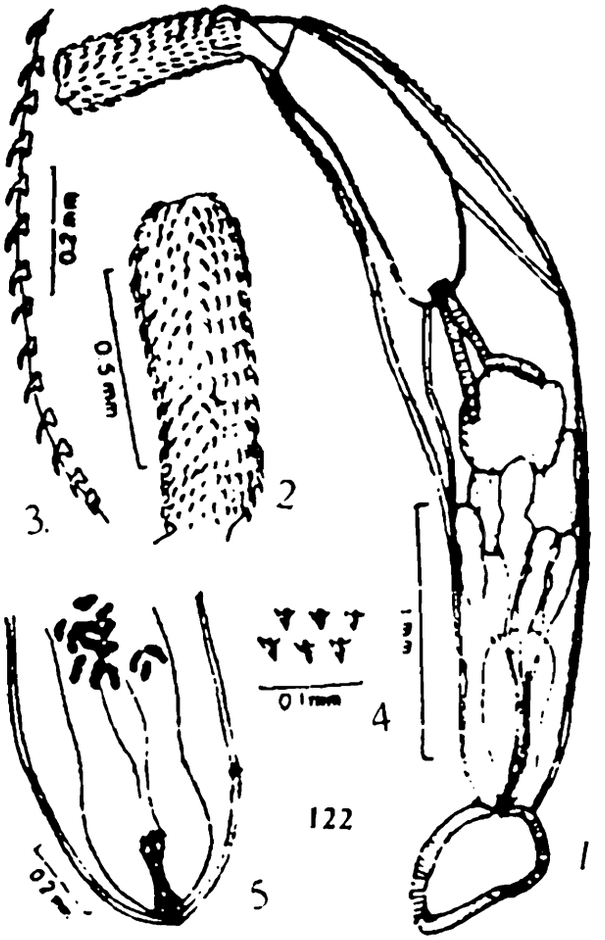


Fig. 122. *Cleaveius thapari* Gupta, S.P. & Naqvi, 1980. 1. Male, 2. Proboscis enlarged, 3. Row of proboscis hooks, 4. Trunk spines, 5. Posterior part of female (after Gupta, S.P. & Naqvi, 1980).

Description : Males 4.75-5.35 × 0.75-1.02 mm; female 5.44 × 0.73 mm. Proboscis flexed at an angle with trunk, long, club-shaped, wide anteriorly with 15-17 longitudinal rows of 16-18 hooks each in males; and in female 16 longitudinal rows of 14 hooks each. Hooks 0.03-0.05 × 0.01-0.02 mm. Proboscis receptacle cylindrical to claviform, double-walled with ganglion at its base, 1.35-1.38 × 0.35-0.39 mm in males; in female 1.24 × 0.29 mm. Neck short aspinose, 0.19-0.22 × 0.27-0.30 mm in males; in female 0.24 × 0.30 mm. Trunk elongated, cylindrical, medium sized, wide at middle and tapering to both ends, anterior trunk covered with rows of small irregular spines with basal chitinous sheaths.3.75-4.21 × 0.75-1.02 mm with 19-21 rows of spines, 0.020-0.024 × 0.014-0.019 mm in males; in female 4.4 × 0.73 mm with 19 rows of spines, 0.019-0.022 × 0.015-0.020 mm. Lemnisci cylindrical, subequal, longer than receptacle, reaching up to anterior testis, longer lemniscus 2.00-2.31 mm long, smaller 1.86-1.98 mm long in males; in female longer lemniscus 1.61 mm long, smaller 1.52 mm long. Testes ovoid, in tandem, slightly overlapping, equatorial and posterior to receptacle, anterior 0.35-0.38 × 0.45-0.49 mm, posterior 0.42-0.45 × 0.46-0.47 mm. Cement glands 4, clavate, 0.39-0.45 × 0.11-0.16 mm with long ducts opening separately into bursa. Seminal vesicle pyriform, 0.70-0.78 × 0.32-0.36 mm. Bursa ovoid with thick muscular wall, 0.51-0.65 × 0.46-0.48 mm. Uterine bell funnel-shaped 0.18 × 0.07 mm. Uterus narrow 0.17 × 0.02 mm, with a few guard cells at its base. Vagina 0.14 × 0.01 mm. Ovarian balls numerous. Eggs not observed. Gonopore subterminal in male and terminal in female.

Host : *Mugil cephalus* (Linnaeus).

Location : Intestine.

Locality : Karachi coast (Pakistan).

Distribution : Known only from type locality.

37. Genus ***Micracanthorhynchina*** Strand, 1936

Micracanthorhynchina Strand, 1936: 167-176; Petrotschenko, 1956: 1-458 Yamaguti, 1963: 66; Golvan & Houin, 1964: 550; Golvan, 1969: 111; 1994: 163; Bhattacharya, 2007: 96-97.

Diagnosis : Rhadinorhynchidae. Worms very small. Proboscis claviform with 9-15 longitudinal rows of 4-22 hooks each, larger anterior hooks with bifurcate root, one directed forwards and other directed backwards. Proboscis receptacle saccate, double-walled, with ganglion about its middle. Trunk fusiform, its middle third, covered ventrally in type species with about 20 transverse rows of minute spines, of which anterior 8-11 rows encircle body, but posterior rows confined to ventral surface, reaching to middle of trunk. Hypodermaal nuclei small, numerous. Lacunar system with lateral main channels and pseudo-segmented transverse anastomoses. Lemnisci claviform, as long as receptacle. Testes contiguous in middle third of trunk. Cement glands 4, pyriform. Ova elliptical with polar prolongations of middle shell. Gonopore dorso-terminal in male and ventro-terminal in female. Parasites of fresh water fishes.

Type species : *Micracanthorhynchina motomurai* (Harada, 1935) Ward, 1951.

Includes ten species, 1. *Micracanthorhynchina chandrai* Bhattacharya, 2007, 2. *M. golvani* Gupta, V. & Sinha, 1991, 3. *M. cynoglossi* Wang Pu Qin, 1980, 4. *M. dakusuiensis* (Harada, 1938) Ward, 1951, 5. *M. hemiculturus* Demshin, 1965, 6. *M. hemirhamphi* (Baylis, 1944) Ward, 1951, 7. *M. kuwaitensis* Amin & Sey, 1996, 8. *M. latelabracis* Wang Pu Qin, 1980, 9. *M. motomurai* (Harada, 1935) Ward, 1951, 10. *M. sajori* (Belous, 1952) Golvan, 1969, of which first two occur in India.

Key to Indian species of genus *Micracanthorhynchina*

– Proboscis with 10-11 longitudinal rows of 4-5 hooks each .... *Micracanthorhynchina chandrai*

– Proboscis with 14-15 longitudinal rows of 16-22 hooks each .... *Micracanthorhynchina golvani*

140. ***Micracanthorhynchina chandrai*** Bhattacharya, 2007 (Fig. 123)

Hanumantharaorhynchus hemirhamphi Chandra, 1983 : 119-123, Fig. 1-4; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994 : 159.

Micracanthorhynchina chandrai Bhattacharya, 2007 : 96-97, Pl. 17, Fig. 90 a-d.

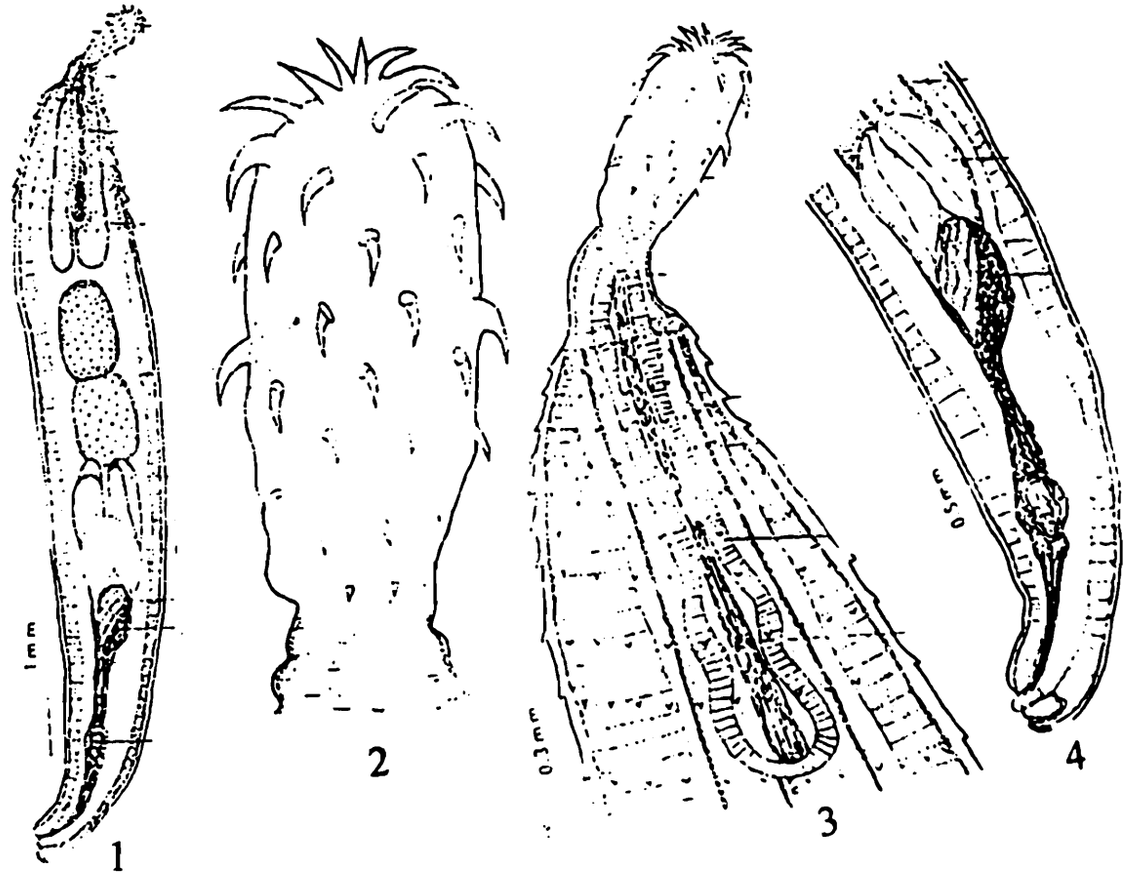


Fig. 123. *Micracanthorhynchina chandrai* Bhattacharya, 2007. 1. Male, 2. Proboscis enlarged, 3. Anterior part of worm, 4. Posterior part of female (after Chandra, 1983).

Type locality : Visakhapatnam coast, Andhra Pradesh, India.

Description : Male 3.56-3.96 × 0.53-0.55 mm. Proboscis short, slightly dilated 0.28-0.30 × 0.128-0.132 mm, with 6 spiral rows of 10-11 hooks each; hooks of anterior part 0.054-0.063 mm long, posterior hooks 0.012-0.036 mm long. Neck aspinose, 0.142-0.146 mm long. Proboscis receptacle cylindrical, double-walled, inserted at base of proboscis, larger than proboscis, 0.800-0.816 × 0.096-0.120 mm, with ganglion of 0.045 × 0.030 mm, lies close to its middle. Trunk cylindrical, with 10 circles of spines covering about 1/5 trunk, anterior-most circle with 18 hooks, their number gradually increases posteriorly with posterior circle with 24 hooks. Trunk spines very small, 0.009 mm long. Lemnisci subequal, longer than receptacle, 0.960-0.996 mm long. Testes oval, contiguous, in anterior half of trunk, anterior 0.46-0.48 × 0.264 mm, posterior 0.472-0.48 × 0.264-0.288 mm. Cement glands 4, pyriform, 3.0-3.6 × 0.096-0.132 mm, their reservoirs 2, claviform, 0.336-0.394 × 0.12-0.15 mm, lie just posterior to cement glands. Cement ducts arise from them and run posteriorly beside seminal vesicle. Seminal vesicle elongate, 0.168-0.18 × 0.076-0.084 mm. Copulatory bursa 0.228 × 0.12 mm with muscular cap. Saefftigen's pouch 0.30-0.336 × 0.12 mm, lie posterior to cement reservoir along side seminal vesicle. Gonopore narrow dorsally subterminal. Female not known.

Host : *Hemirhamphus marginatus* (Bleeker).

Location : Intestine.

Locality : Visakhapatnam coast, Bay of Bengal (Andhra Pradesh).

Distribution : Known only from type locality.

141. ***Micracanthorhynchina golvani*** Gupta, V. & Sinha, 1992 (Fig. 124)

Micracanthorhynchina golvani Gupta, V. & Sinha, 1992 : 111-113, Pl. 2, Fig. 1-5; Bhattacharya, 2007 : 97, Pl. 16, Fig. 89 a-d.

Type locality : Puri coast, Orissa, India.

Description : Males 3.90-4.65 × 0.62-0.65 mm, female 4.55 × 0.50 mm. Proboscis claviform or tubular with 14-15 longitudinal rows of 16-22 hooks each, 0.70-0.95 × 0.16-0.20 mm in male; in female 0.70 × 0.16 mm; anterior hooks with bifurcated root, one directed forwards and other backwards, hooks 0.046-0.048 mm long, decreasing slightly towards base to 0.036-0.038 mm long in males; in female anterior hooks 0.042-0.048 mm long, decreasing towards base to 0.034-0.036 mm long. Proboscis receptacle saccate, double-walled, with ganglion at its base. Trunk very small, anterior third with about 10-13 transverse rows of minute spines, of which anterior 6-8 rows encircle trunk, but posterior rows of spines confined to ventral surface, spines 0.032-0.038 × 0.012-0.016 mm with feeble roots. Lacunar system with main channels. Lemnisci cylindrical, subequal, longer than receptacle, extending up to anterior testis, shorter lemniscus 1.55 × 0.12-0.18 mm, longer 1.70 × 0.12-0.18 mm. Testis subequal, contiguous, lying one behind other, post-

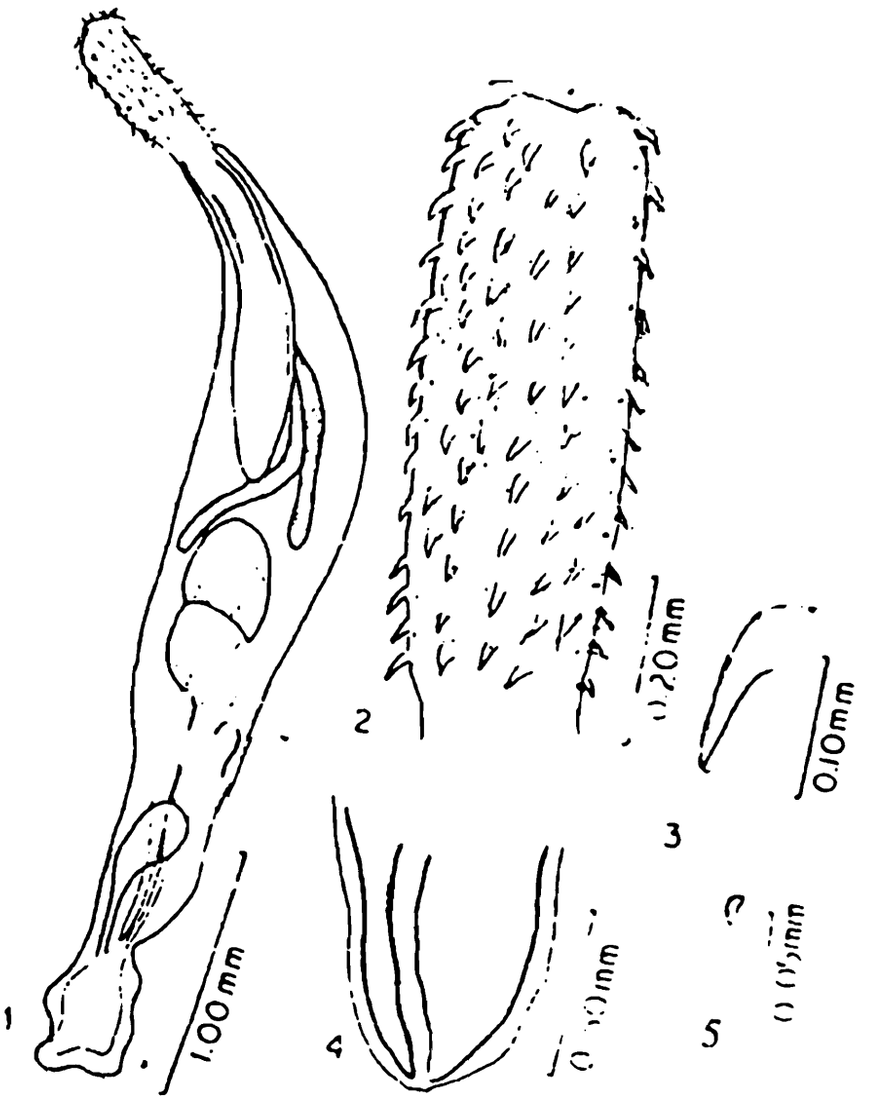


Fig. 124. *Micracanthorhynchina golvani* Gupta, V. & Sinha, 1992. 1. Male, 2. Proboscis enlarged, 3. Proboscis hook enlarged, 4. Posterior part of female, 5. Trunk spine enlarged (after Gupta, V. & Sinha, 1991).

equatorial, anterior 0.45-0.48 × 0.32-0.42 mm, posterior 0.52-0.56 × 0.30-0.36 mm. Cement glands 4, pyriform, overlapping posterior testis 0.85-1.45 × 0.10-0.14 mm, continue into separate ducts and open into bursa. Saefftigen's pouch pyriform, thin walled, 0.70-0.78 × 0.35-0.40 mm. In gravid female body cavity filled with eggs as such female genitalia could not be observed. Eggs elongated, 0.020-0.024 × 0.012-0.016 mm. Genital pore subterminal or terminal in male, terminal in female.

Host : *Arius platystoma* Bleeker.

Location : Intestine.

Locality : Puri coast, Bay of Bengal (Orissa).

Distribution : Known only from type locality.

Subfamily RHADINORHYNCHINAE Lühe, 1911

Rhadinorhynchinae Tripathi, 1959: 61-99; Petrotschenko, 1956 : 377; Yamaguti 1963: 98; Golvan & Houin, 1963: 810; Golvan, 1969: 57; Bhattacharya, 2007: 87.

Diagnosis : Rhadinorhynchidae. Worms of medium to large size. Proboscis cylindrical or claviform, long with numerous hooks. Proboscis receptacle double-walled, with ganglion near its middle or at anterior end. Trunk spines limited to anterior part or extending nearly to posterior end. Lemnisci usually long, slender. Cement glands 2-8, elongate, tubular or clavate. Ova spindle-shaped, with polar prolongations of middle shell. Parasites of marine, sometimes fresh water fishes.

Type genus : *Rhadinorhynchus* Lühe, 1911.

Includes six genera, 1. *Raorhynchus* Tripathi, 1959, 2 *Rhadinorhynchus* Lühe, 1911, 3. *Neorhadinorhynchus* Gupta, V. & Fatma, 1987, 4. *Cathyacanthus* Lühe, 1912 Golvan, 1969, 5. *Megistacanthus* Golvan, 1969 and 6. *Paragorgorhynchus* Golvan, 1957, of which first three genera occur in this subcontinent.

Key to Indian genera of subfamily RHADINORHYNCHINAE

1. Eggs without polar prolongations of middle shell ..... *Rhadinorhynchoides.*

   Eggs with polar prolongations of middle shell 2

2. Trunk spines in 2 groups separated by aspinose area ..... *Rhadinorhynchus*

   Trunk spines not in 2 groups ..... *Raorhynchus*

38. Genus ***Raorhynchus*** Tripathi, 1959

Raorhynchus Tripathi, 1959 : 73-74; Yamaguti, 1963 : 105-106; Golvan & Houin, 1963 : 810; Golvan, 1969 : 86; Golvan, 1994 : 177; Bhattacharya, 2007: 92.

Diagnosis : Rhadinorhynchidae, Rhadinorhynchinae. Proboscis cylindrical with 11-26 rows of 22-37 hooks each, varying in size and shape dorso-ventrally as well as antero-posteriorly as in *Rhadinorhynchus*. Proboscis receptacle cylindrical, long, double-walled, with ganglion variable in position. Neck short. Trunk long, cylindrical, curved dorsally with rows of spines separated by aspinose area into two groups, of which anterior group encircles trunk and posterior confined to ventral surface. Lacunar system with main lateral channels and reticular anastomoses. Lemnisci slender, shorter than receptacle. Testes directly in tandem, largely pre-equatorial. Cement glands 2-4, long, tubular. Uterus long and narrow. Vaginal sphincter single, with vaginal bulb. Vulva subterminal. Eggs elliptical with polar prolongations of middle shell. Gonopor

Type species : *Raorhynchus terebra* (Rudolphi, 1819) Tripathi, 1959.

Includes seven species, 1. *Raorhynchus guptai* Gupta, P.C. & Kumar, 1984, 2. *R. meyeri* (Heinze, 1934) Golvan, 1969, 3. *R. polynemi* Tripathi, 1959, 4. *R. schmidti* George &

Nadakal, 1978, 5. *R. terebra* (Rudolphi, 1819) Tripathi, 1959, 6. *R. thapari* Gupta, V. & Fatima, 1981, 7. *P. inexspectatus* Golvan, 1969, of which first six species occur in India subcontinent.

Key to Indian species of genus *Raorhynchus*

1. Proboscis with 10 longitudinal rows of 24-28 hooks each ..... *Raorhynchus thapari*
– Proboscis with 11 longitudinal rows of 22-24 hooks each .....*Raorhynchus polynemi*
– Proboscis with more than 11 longitudinal rows hooks each 2
2. Proboscis with 12-16 longitudinal rows of 20-26 hooks each .... *Raorhynchus schmidti*
– Proboscis with 19 longitudinal rows of 14-26 hooks each ..... *Raorhynchus guptai*
– Proboscis with more than 19 longitudinal rows of hooks each 3
3. Proboscis with 33 longitudinal rows of 43 hooks each .....*Raorhynchus meyeri*
– Proboscis with 24-26 longitudinal rows of 26-37 hooks each ... *Raorhynchus terebra*

142. ***Raorhynchus guptai*** Gupta, P.C. & Kumar, 1987

Raorhynchus guptai Gupta, P.C. & Kumar, 1987a : 75-80; Golvan, 1994 : 177; Bhattacharya, 2007 : 93.

Type locality : Puri coast, Bay of Bengal, India.

Description : Male 19.80 × 0.65 mm wide in ingle male. Proboscis club-shaped, cylindrical, 0.50 × 0.25 mm with 19 longitudinal rows of 14-26 hooks each. Anterior hooks 0.044-0958 mm long, of posterior region 0.052-0.058 mm long with less developed roots. Neck absent. Proboscis receptacle double-walled, 0.95 × 0.25 mm with ganglion slightly anterior to its base. Trunk elongated, cylindrical, dorsally reflexed and tapering posteriorly, posterior end slightly attenuated. Lemniscus shorter 1.78 mm long, longer 1.86 mm long. Testes unequal, oval, one behind other, separated, pre-equatorial, anterior 0.60 × 0.20 mm, posterior larger than anterior testis. Cement glands 2, cylindrical, long, tubular, 9.85-9.20 × 0.10-0.12 mm. Seminal vesicle pear-shaped 1.65 × 0.25 mm. Saefftigen's pouch pyriform 1.68 × 0.25 mm opening into bursa through separate tubular duct. Bursa with 12 bursal rays, 0.50 × 0.60 mm opening outside through terminal genital pore. Female not known.

Host : *Polynemus sextarius.*

Location : Intestine.

Locality : Puri coast (Orissa).

Distribution : Known only from type locality.

143. ***Raorhynchus meyeri*** (Heinze, 1934) Golvan, 1969
(Fig. 125)

Rhadinorhynchus meyeri Heinze, 1934 : 255-256, Petroyschenko, 1956 : 383; Fig. 1-4; Yamaguti, 1963 : 101;

Raorhynchus meyeri Golvan, 1969 : 93;

Rhadinorhynchus meyeri Anantaraman, M. & Anantaraman, S., 1970 : 5; Golvan, 1994 : 177.

Description : Worms 25 mm long, 1.0-1.4 mm wide. Proboscis almost cylindrical, with very slight widening towards anterior end, 2.7 × 0.27-0.36 mm, with 22 longitudinal rows of 43 hooks each, hooks with simple roots directed posteriad. Ventral hooks weaker than dorsal hooks, proximal hooks longer and more slender than distal hooks. Last hooks

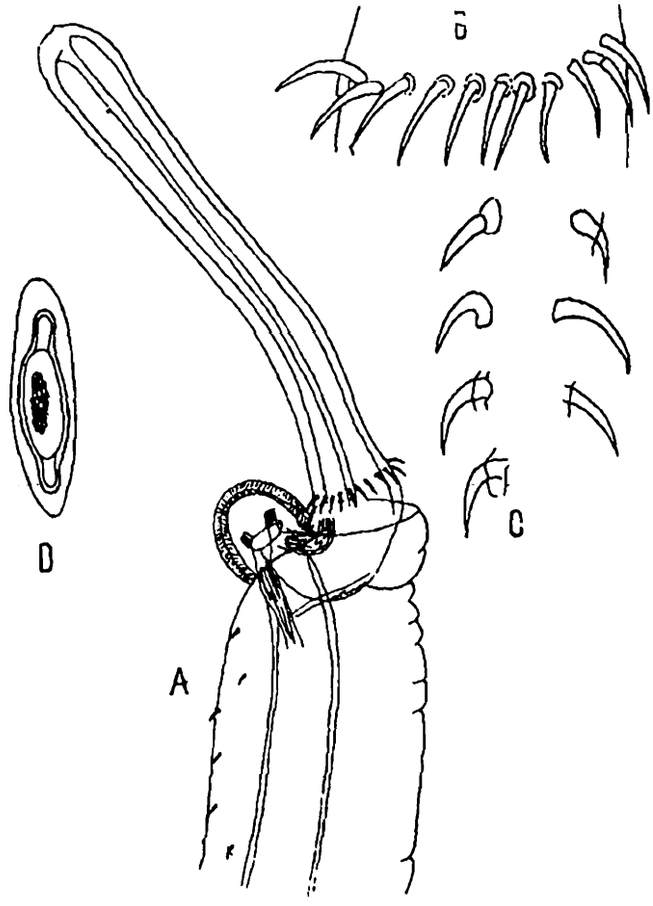


Fig. 125. *Raorhynchus meyeri* (Heinze, 1934) Golvan, 1969. A. Anterior part of worm, B. Type of hook of rostrum, C. Types of hooks enlarged (after Golvan, 1969).

distinguishable from others by their size forming a ring, much larger than preceding hooks. Proboscis receptacle about 4 mm long. Trunk widened anteriorly, narrowed towards posterior end, displaying slight annulation, ventral surface with poorly developed spines, widened part of trunk without spines. Trunk spines extend up to a point of proboscis receptacle. Eggs elliptic 0.1 × 0.01 mm, with punctate outline of membrane.

Host : *Scomber pelamys* Linnaeus, *Scomber japoiocus.*

Location : Intestine.

Locality : Indian Ocean.

Distribution : Indian Ocean.

144. ***Raorhynchus polynemi*** Tripathi, 1959
(Fig. 126)

Raorhynchus polynemi Tripathi, 1959: 73-75, Textfig. 7; Yamaguti, 1963: 106, Pl. 43, Fig. 440-442; Golvan & Houin, 1963: 812-813, Fig. 5-8; Golvan, 1969: 93-94, Fig. 63; Anantaraman, M. & Anantaraman, S., 1970: 5; Gupta, N. K. & Gupta, K., 1972b: 419-420, Fig. 5-8; Soota & Bhattacharya, 1981: 229-230, Fig. 2 A-D; Gupta, V. & Sinha, 1990b: 50; Golvan, 1994: 177; Bhattacharya, 2007: 93-95, Pl. 16, Fig. 87 a, b.

Type locality : Puri, Orissa, India.

Description : Worms orange coloured in life. Males 4.71-6.55 × 0.378-0.455 mm; female 7.23-8.74 × 0.396-0.522 mm. Cuticular plications present near proboscis receptacle.

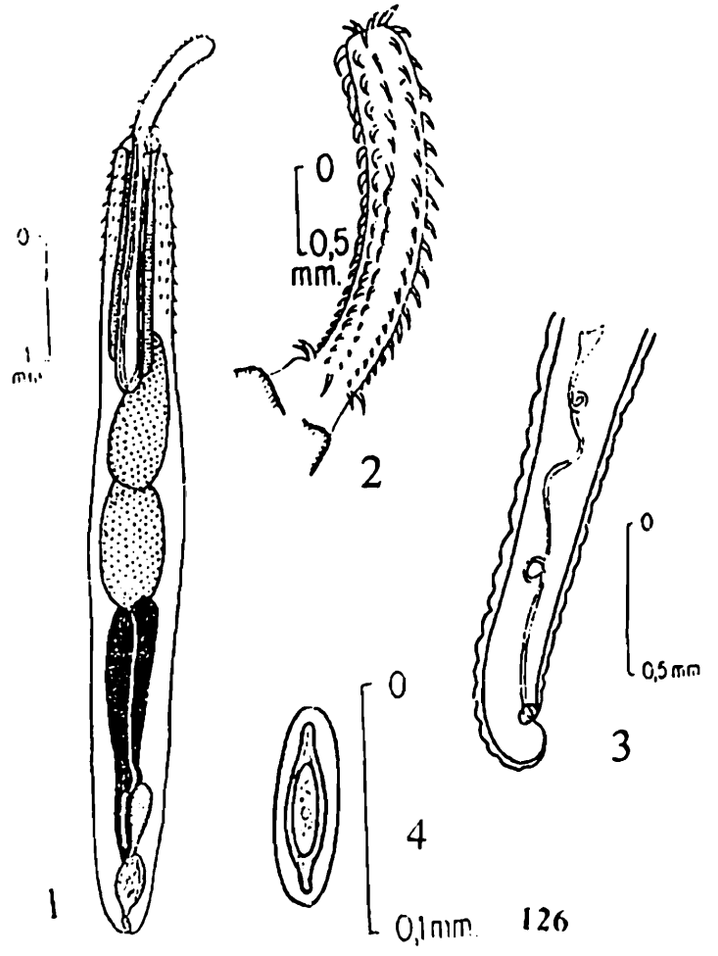


Fig. 126. *Raorhynchus polynemi* Tripathi, 1959. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Egg enlarged (after Tripathi, 1959).

Proboscis long, cylindrical forming an angle with main body axis, 0.414-0.864 × 0.09-0.144 mm, with 11 longitudinal rows of 22-24 hooks each; hooks decrease in size posteriorly, basal most hooks abruptly larger than those of penultimate row, long and slender. Anterior hooks 0.035-0.055 × 0.007-0.008 mm. Small posterior hooks 0.017-0.020 × 0.006 mm; basal hooks 0.035-0.040 × 0.006 mm. Neck 0.072-0.108 × 0.108-0.18 mm, aspinose. Proboscis receptacle elongated, tubular, double-walled, 1.26-2.106 × 0.126-0.252 mm, with ganglion slightly in its anterior with a pair of antero-median nerves and a pair of postero-median nerves. Trunk dorsally reflexed, cylindrical with small spines closely set at anterior end, posterior region aspinose. Spines 0.0015 × 0.003-0.006 mm. Lacunar system not well developed. Lemnisci elongate, slender, equal, 1.170 × 0.072-0.090 mm. Testes paired, oval, contiguous. in anterior half of trunk, anterior 0.468-1.008 × 0.216-0.378 mm, posterior 0.360-0.792 × 0.216-0.396 mm. Cement glands 2, tubular, 0.774-1.80 × 0.126-0.216 mm. Saefftigen's pouch 0.36 × 0.126 mm. Gonopore terminates on extroverted bursa. Bursa 0.988-1.134 × 0.252-0.378 mm. Uterine bell thistle-funnel-shaped, 0.120 × 0.132 mm leads into uterine tube with several large cells, bell pockets. Uterine tube opens into long, narrow uterus, 1.266 × 0.069 mm, it leads into vagina 0.288 × 0.036 mm, provided with single sphincter, opening laterally. Eggs 0.054-0.60 × 0.009-012 mm with polar prolongations of middle shell. Gonopore terminates on extroverted bursa in male, in female ventro-subterminal.

Host : *Polynemus sexfilus* (Bloch & Schnider), *P. plebius*, *Polynemus* sp., *Alectis indica*, *Harpodon* sp.

Location : Intestine.

Locality : Ernakulam, Trivandrum (Kerala); Chennai, Karaikal, Tuticorin (Tamil Nadu); Pondicherry, Mangalore (Karnataka); Puri (Orissa); Mumbai (Maharatra).

Distribution : Known only from India.

Note **:** Tripathi (1959) measurements: Male 6.06-6.29 × 0.62-0.65 mm; female 4.42-9.5 × 0.551-0.696 mm; proboscis armed with 11-12 longitudinal rows of 22-24 hooks each. Neck 0.087 × 0.217 mm. Proboscis receptacle 1.45-1.986 × 0.188-0.203 mm. Trunk with spines in anterior part in 8 rows dorsally and 12 rows ventrally. Lemnisci 1.23-1.52 × 0.145mm. Antereior testis 0.768-1,087 × 0.257-0.333 mm, posterior 0.58-0.768 × 0.333 mm. cement glands 4, 0.217-0.29 mm wide. Uterine bell 3.03 mm long. Eggs 0.076 × 0.015 mm with polar prolongations of middle shell.

145. ***Raorhynchus schmidti*** George & Nadakal, 1978
(Fig. 127)

Raorhynchus schmidti George & Nadakal, 1978a: 94-96, Fig. 6-8; Golvan, 1994: 177.

Type locality : Trivandrm coast, Kerala, India.

Description : Worms colourless. Males 6-10 × 0.18-0.2 mm; females 8-15 × 0.5-1.35 mm. Proboscis Proboscis long, cylindrical 0.60-0.95 × 0.14-0.20 mm in males; in females

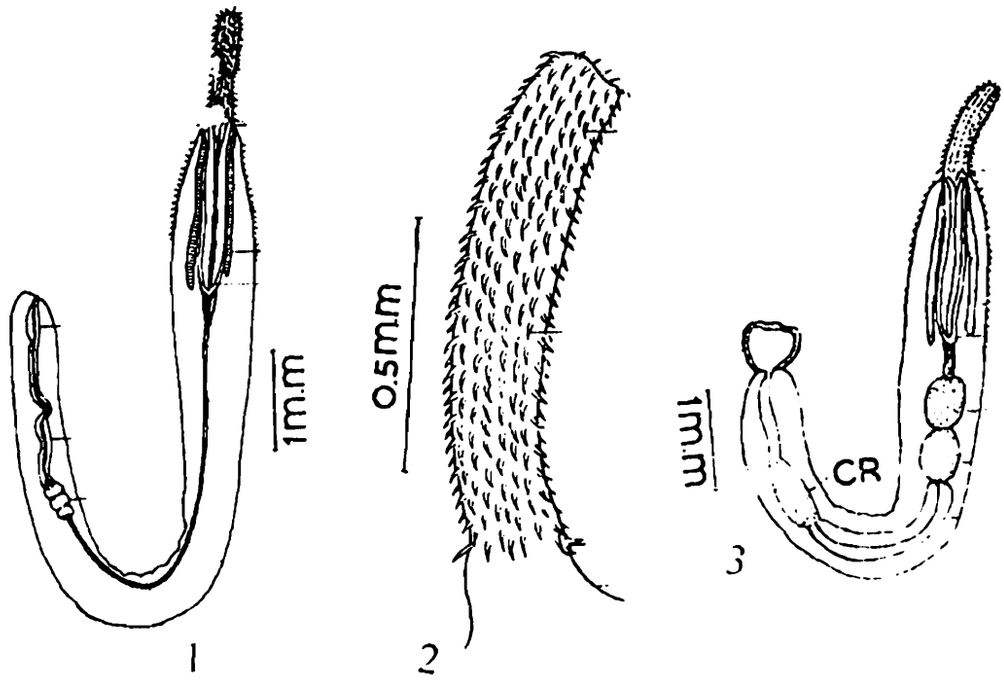


Fig. 127. *Raorhynchus schmidti* George & Nadakal, 1978. 1. Male, 2. Proboscis and neck enlarged, 3. Female (after George & Nadakal, 1978).

0.9-1.05 × 0.17-0.28 mm, with 12-16 longitudinal rows of 20-26 hooks each. Anterior hooks 0.04-0.05 mm long, middle hooks 0.05-0.06 mm long and last row hooks 0.06-0.07 mm long. Neck short, 0.04-0.05 × 0.2-0.22 mm in males; and in females 0.06-0.075 × 0.21-0.235 mm. Proboscis receptacle long, cylindrical, double-walled, 1.6-1.65 × 0.2-0.3 mm in males; in females 1.7-1.72 × 0.16-0.26 mm. Trunk long and of uniform width, reflexed dorsally in both sexes, anterior part with 10-14 rows of spines dorsally and 16-20 rows ventrally. Trunk armed with more spines in female than in males. Lemnisci 2, filiform, equal, extend to base of receptacle, in males 1.5–1.6 × 0.045-0.058 mm; in females 1.5-1.7 × 0.04-0.048 mm. Testes ovoid, pre-equatorial, unequal, in tandem, contiguous, anterior 0.36-0.50 × 0.30-0.40 mm, posterior 0.4-0.6 × 0.40-0.465 mm. Cement glands 2, attached to posterior testis, 0.90-0.95 × 0.08-0.12 mm. Cement duct enter into cement reservoir 0.90-1.0 × 0.30-051 mm, open into common genital duct. Bursa 0.41-0.465 × 0.41-0.46mmm. Uterine bell 0.327-0.410 × 0.07-1.0 mm attached to ligament sac. Uterus long, narrow 1.0-1.5 × 0.05-0.80 mm. Vagina 0.300-0.515 × 0.10-0.185 mm. Eggs elliptical, 0.060-0.075 × 0.010-0.016 mm, with three shells and polar prolongations of middle shell. Embryo with distinct central nucleus. Gonopore terminal in both sexes.

Host : *Pseudorhombus triocellatus* (Gunther), *Leiognathus equuulus* (Forsskal).

Location : Small intestine.

Locality : Trivandrum coast, Arabian sea (Kerala).

Distribution : Known only from type locality.

146. ***Raorhynchus terebra*** (Rudolphi, 1819) Tripathi, 1959 (Fig. 128)

Echinorhyncus terebra Rudolphi, 1819 : 1-81;

Raorhynchus terebra Tripathi, 1959: 66-99; Yamaguti, 1963: 106; Golvan & Houin, 1963: 810; Golvan, 1969: 89-92, Fig. 58 A-E, 59; Anantaraman, M. & Anantaraman, S., 1970: 5; Gupta, V. & Sinha, 1990b: 42; Golvan, 1994: 177.

Type locality : Hawai, North America.

Description : Worms yellowish in colour, cylindrical. Male up to 12 × 0.3 mm; female 9-14 × 0.3-0.5 mm. Proboscis long, almost cylindrical, with very slight widening towards anterior end, 1.75 mm long, 0.25 mm wide at tip, 0.15 mm wide at base, with 24-26 longitudinal rows of 36-37 hooks each. Hooks with a simple root directed posteriad. Ventral

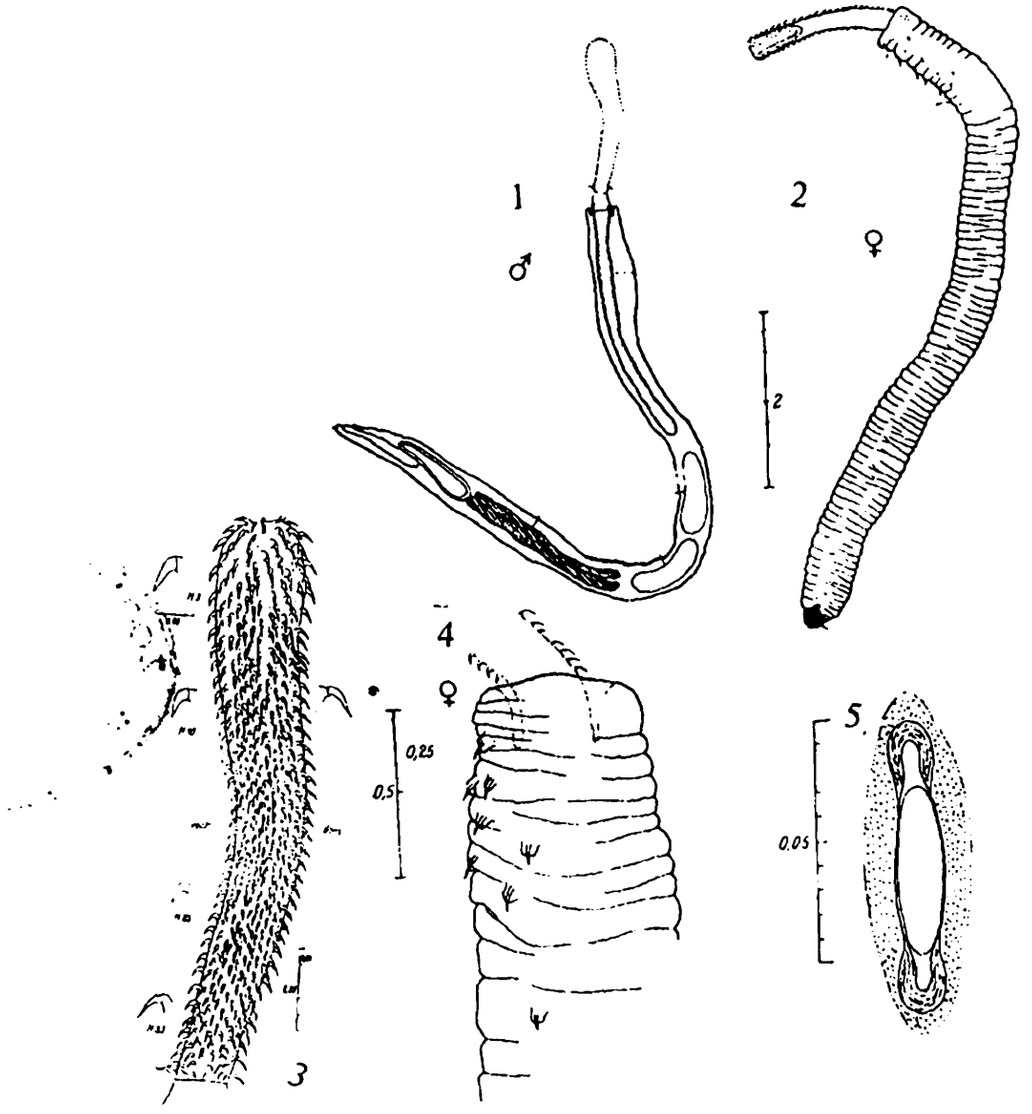


Fig. 128. *Raorhynchus terebra* (Rudolphi, 1819) Tripathi, 1959. 1. Male, 2. Female, 3. Proboscis Enlarged, 4. Anterior part of trunk, 5. Egg enlarged (after Golvan, 1969).

hooks slightly compressed, dorsal hooks almost perpendicular. Proboscis receptacle 2.25 mm long in male, ganglion about middle. Anterior part of trunk armed with spines only in female, spines absent in male, may have been lost due to poor preservation. Lacunar system and nuclei not determined. Lemnisci long and filiform. Testes elongated, one behind other. Cement glands 4, long, intestiform. Saefftigen's pouch pyriform. Eggs 0.07 × 0.022 mm, with polar prolongations of middle shell.

Host : *Pelamys sarda* (Linnaeus).

Location : Intestine.

Locality : Bihar.

Distribution : Hawai, North America.

147. ***Raorhynchus thapari*** Gupta, V. & Fatma, 1981 (Fig. 129)

Raorhynchus thapari Gupta, V. & Fatma, 1981: 443-450; Golvan, 1994: 177; Bhattacharya, 2007: 95.

Type locality : Chennai, Tamil Nadu, India.

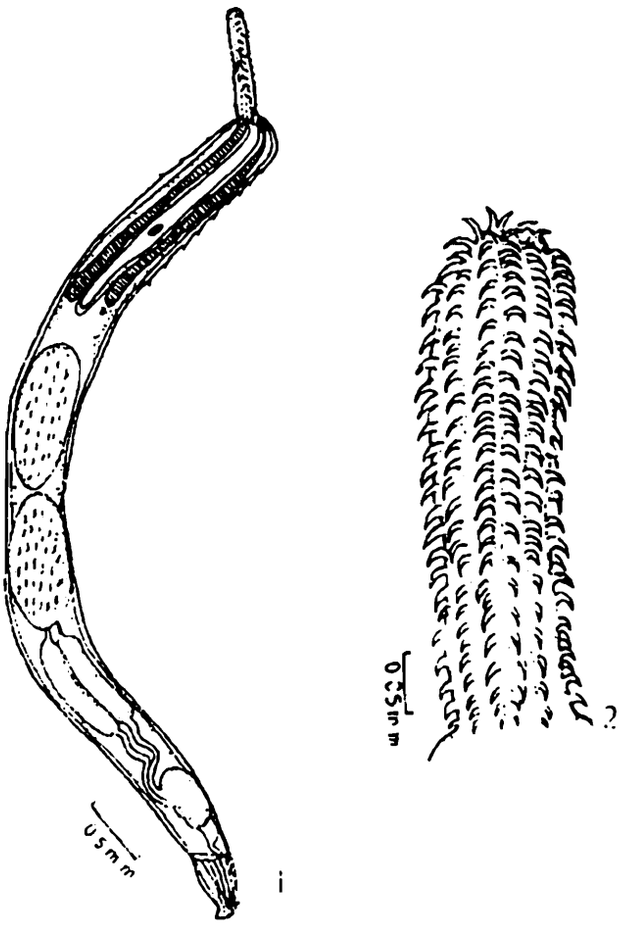


Fig. 129. *Raorhynchus thapari* Gupta, V. & Fatma, 1981. 1. Male, 2. Proboscis enlarged (after Gupta, V. & Fatma, 1981).

Description : Male 6.52-7.0 × 0.48-0.52 mm. Proboscis long, cylindrical, 0.76-0.79 × 0.15-0.18 mm, with 10 longitudinal rows of 24-30 hooks each. Anterior hooks 0.04-0.042 mm long, curved ventrally, middle hooks 0.060-0.62 mm long, posterior hooks small, 0.040-0.044 mm long with less developed roots. Posterior hooks small 0.04-0.045 mm long with less developed roots. Neck short 0.03-0.032 mm long aspinose. Neck short 0.30-0.32 mm long without spines. Proboscis receptacle elongated, double-walled, arising from base of neck, 1.76-179 × 0.22-0.26 mm. Trunk elongated, cylindrical, dorsally reflexed, tapering posteriorly, with 7-8 rows of spines on its dorsal surface. Lemnisci subequal, cylindrical, shorter than receptaclee, larger lemniscus 1.65-1.70 × 0.20-0.22 mm, smaller 1.55-1.60 × 0.18-0.20 mm. Testes elongated, subequal, in tandem and contiguous, anterior 1.10-1.13 × 0.33-0.35 mm, posterior testis 0.90-0.91 × 0.34-0.37 mm. Cement glands 2, cylindrical, 0.80-0.84 mm long opening into bursa Seminal vesicle pear-shaped, 0.45-0.48 × 0.30-0.32 mm, opening into bursa. Bursa 0.42-0.45 × 0.36-0.40 mm wide. Female not known.

Host : *Nematolosia nausus* (Bloch.).

Location : Intestine.

Locality : Chennai (Tamil Nadu).

Distribution : Known only from type locality.

39. Genus ***Rhadinorhynchus*** Lühe, 1911

Rhadinorhynchus Lühe, 1911 : 1-116; Van Cleave, 1919 : 238;
Protorhadinorhynchus Southwell & Macfie, 1925 : 159;
Rhadinorhynchus Meyer, 1932 : 47;
Nipporhynchus Van Cleave, 1940 : 79;
Protorhadinorhynchus Petrotschenko, 1956: 377-378;
Rhadinorhynchus Petrotschenko, 1956: 377-378;Yamaguti, 1963 : 99-100;
Nipporhynchus Golvan & Houin, 1964 : 554;
Rhadinorhynchus Golvan, 1969 : 99; 1994 : 177; Bhattacharya, 2007 : 87-88.

Diagnosis : Rhadinorhynchida, Rhadinorhynchinae. Proboscis usually very long, claviform, with 8-26 longitudinal rows of 8-37 hooks each, ventral hooks usually larger than dorsal; basal hooks projecting at right angles to proboscis. Proboscis receptacle long, double-walled with ganglion near its middle. Trunk cylindrical, spines usually separated by aspinose area into two groups, of which anterior encircles body but posterior confined to ventral surface and extend further backwards in female than in male. Hypodermal nuclei small, numerous. Lacunar system with lateral main channels and reticular anastomoses. Lemnisci usually long, slender. Testes elongate, in tandem. Cement glands 2-8, long, tubular. Uterus very long. Ova elongate, with polar prolongations of middle shell. Gonopore terminal in male, subterminal in female, both without spines. Parasites of marine, sometimes fresh water fishes.

Type species : *Rhadinorhynchus pristis* (Rudolphi, 1802) Lühe, 1911.

Includes thirty eight species, 1. *Rhadinorhynchus cadenati* (Golvan & Houin, 1964) Golvan, 1969, 2. *R. dollfusi* Gupta, V. & Fatima, 1988, 3. *R. echeneiis* Gupta, S.P. & Gupta, R.C. 1980, 4. *R. erumei* (Gupta, V. & Fatima, 1981) Amin, 1985, 5. *R. ganapatii* Chandra, Rao & Shyamasundari, 1985, 6. *R. hiansi* Soota & Bhattacharya, 1981, 7. *R. keralensis* Gupta, V. & Fatima, 1987, 8. *R. pelamysi* Gupta, S.P. & Gupta, P.C., 1980, 9. *R. polynemi* Gupta, N.K. & Lata, 1967, 10. *R. pristis* (Rudolphi, 1802) Lühe, 1911, 11. *R. stunkardi* Gupta, V, & Fatima, 1989, 12. *R. trivandeicus* George & Nadakal, 1978, 13. *R. africanus* (Golvan, Houin & Deltour, 1963) Golvan, 1969, 14. *R. alosae* (Hermann, 1782) Meyer, 1932, 15. *R. atheri* (Farooqi, 1981) Amin, 1985, 16. *R. bicircumspinis* Hooper, 1983, 17. *R. camerounensis* Golvan, 1969, 18. *R. capensis* Bray, 1974,19. *R. carangis* Yamaguti, 1939, 20. *R. chongmingnensis* Huang, Zheng, Deng, Fan & Ni, 1988, , 21. *R. chromatidis* (Cable & Quick, 1954) Yamaguti, 1991, 22. *R. cololabis* Lours & Mc Cauley, 1964, 23. *R. decapteri* Parukhin & Kovalenko, 1976, 24. *R. ditrematis* Yamaguti,1939, 25. *R. dujardini* Golvan, 1969, 26. *R. japonicus* Fujita, 1920, 27. *R. johnstoni* Golvan, 1969, 28. *R. katsuwonis* Harada, 1928, 29. *R. lintoni* Cable & Linderoth, 1963, 30. *R. ornatus* Van Cleave, 1918, 31. *R. plagioscionis* Thatcher, 1980, 32. *R. plotosi* Parukhin, 1985, 33. *R. saltatrix* Troncy & Vassiliades, 1973, 34. *R. selkirki* Van Cleave, 1920, 35. *R. seriolae* (Yamaguti, 1963) Golvan, 1969, 36. *R. trachuri* Harada, 1935, 37. *R. vancleavei* Golvan, 1969 and 38. *R. zhukovi* Golvan, 1969, of which first twelve species occur in this subcontinent.

Key to Indian species of genus *Rhadinorhynchus*

1. Cement glands 8 in number ..... *Rhadinorhynchus trivandricus*
– Cement glands 2 in number ..... *Rhadinorhynchus echenesi*
– Cement glands 4 in number 2
2. Proboscis with 8-10 longitudinal rows of 24-265 hooks each ..... *Rhadinorhynchus stunkardi*
– Proboscis with 10 longitudinal rows of hooks each 3
3. Proboscis with 10 longitudinal rows of 26 hooks each ..... *Rhadinorhynchus erumei*
– Proboscis with 10 longitudinal rows of 20-21 hooks each ..... *Rhadinorhynchus polynemi*
– Proboscis with more than 10 longitudinal rows of hooks each 4
4. Proboscis with 12-14 longitudinal rows of 24-26 hooks each ..... *Rhadinorhynchus dollfusi*
– Proboscis with 12-14 longitudinal rows of 12 ..... *Rhadinorhynchus pelamysi*
– Proboscis with 14 or more longitudinal rows of hooks each 5
5. Proboscis with 14-16 longitudinal rows of 26 hooks each .. *Rhadinorhynchus pristis*

– Proboscis with 14-16 longitudinal rows of 26-28 hooks each ..... *Rhadinorhynchus keralensis*

– Proboscis with more than 16 or more longitudinal rows of hooks each 6

6. Proboscis with 16-18 longitudinal rows of 23-25 hooks each ..... *Rhadinorhynchus ganapatii*

– Proboscis with more than 18 longitudinal rows of hooks each 7

7. Proboscis with 19 longitudinal rows of 25-26 hooks each ..... *Rhadinorhynchus cadenati*

– Proboscis with 20-22 longitudinal rows of 40-44 hooks each ..... *Rhadinorhynchus hiansi*

148. ***Rhadinorhynchus cadenati*** (Golvan & Houin, 1964) Golvan, 1969 (Fig. 130)

Nipporhynchus cadenati Golvan & Houin, 1964 : 532-537, Fig. 17 A-D, F;
Rhadinorhynchus cadenati (Golvan & Houin) Golvan, 1969 : 61-65, Fig. 35-37;
Raorhynchus cadenati Gupta, V. & Sinha, 1992 : 115-117, Pl. 4, Fig. 1, 2;
Golvan, 1994 : 177; Bhattacharya, 2007 : 93, Pl. 16, Fig. 86 a-c.

Type locality : Senegal, Nigeria.

Description : Male 19.8-20.5 × 0.65-2.35 mm. Proboscis club-shaped, cylindrical, 4.1 × 0.45 mm, with 19 longitudinal rows of 25-26 hooks each. Anterior hooks 0.044-0.058 mm long, of posterior region 0.052-0.058 mm long with less developed roots. Neck absent. Proboscis receptacle double-walled, 0.95 × 0.25 mm with ganglion about middle or anterior to its base. Trunk elongated, cylindrical, dorsally reflexed and tapering posteriorly, posterior end slightly attenuated. Lacunar system with main lateral longitudinal channels and transverse anastomoses. Lemnisci shorter 1.78 mm long, longer 1.86 mm long. Testes unequal, ovoid, one behind other, separated, pre-equatorial, anterior testis 1.15 × 0.60 mm, posterior testis larger 1.60-1.95 × 0.50 mm. Cement glands 4, massive in pairs, 9.05-9.20 × 0.10-0.12 mm. Seminal vesicle pear-shaped 1.65 × 0.25 mm. Bursal funnel 0.45 × 0.18 mm. Saefftigen's pouch pyriform 1.6 × 0.6 mm with 2 diverticula anteriorly, opening into bursa through separate tubular duct. Bursa with 12 bursal rays, 0.50 × 0.60 mm opening outside through terminal gonopore. Uterus 0.45 × 0.18 mm. Vagina with 2 sphincters. Eggs ellipsoidal,0.08 × 0.017 mm with polar prolongations of middle shell. Acanthore 0.045 × 0.11 mm. Male and female gonopores terminal.

Host : *Stromateus cinereus* Bleeker.

Location : Intestine.

Locality : Puri coast, Bay of Bengal (Orissa).

Distribution : Senegal; Nigeria.

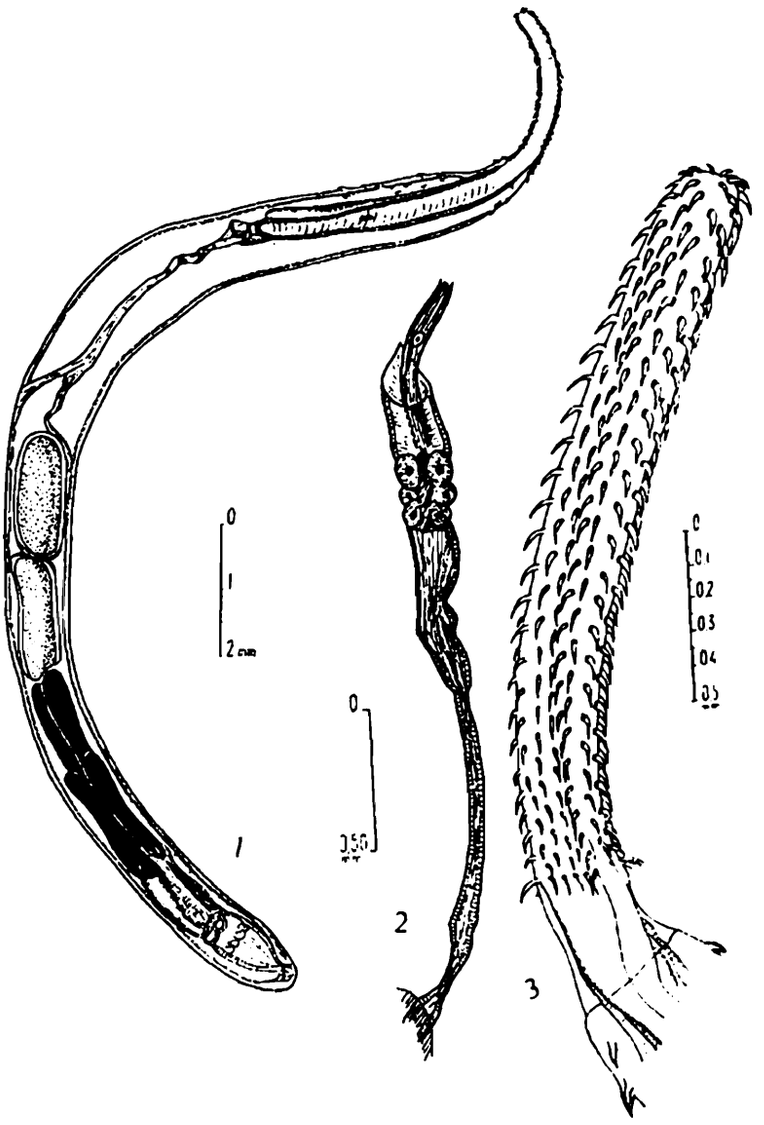


Fig. 130. *Rhadinorhynchus cadenati* (Golvan & Houin, 1964) Golvan, 1969. 1. Male, 2. Female genitalia, 3. Proboscis enlarged (after Golvan, 1969).

149. ***Rhadinorhynchus dollfusi*** Gupta, V. & Fatma, 1987 (Fig. 131)

Rhadinorhynchus dollfusi Gupta, V. & Fatma, 1988: 9-11, Pl. 3, Fig. 1-4; Gupta, V. & Sinha, 1990b: 51; Golvan, 1994: 177; Bhattacharya, 2007: 88, Pl. 15, Fig. 78 a-d.

Type locality : Quilon, Kerala, India.

Description : Male 7.85 × 0.60 mm. Proboscis elongated, cylindrical, 1.60 × 0.22 mm with 12-14 longitudinal rows of 24-26 hooks each, hooks gradually decreasing in size from apex to base. Hooks of anterior region to base, 0.036-0.042 mm. Neck short. Proboscis receptacle elongated, cylindrical, double-walled, with ganglion at its base. Trunk elongated, cylindrical, not pseudo-segmented, anterior and posterior extremities tapering. Anterior trunk with 3 circles of 6 spines each in one field, encircling anterior trunk, and 4-5 spines in second field extending ventrally. Lacunar system with two main longitudinal channels

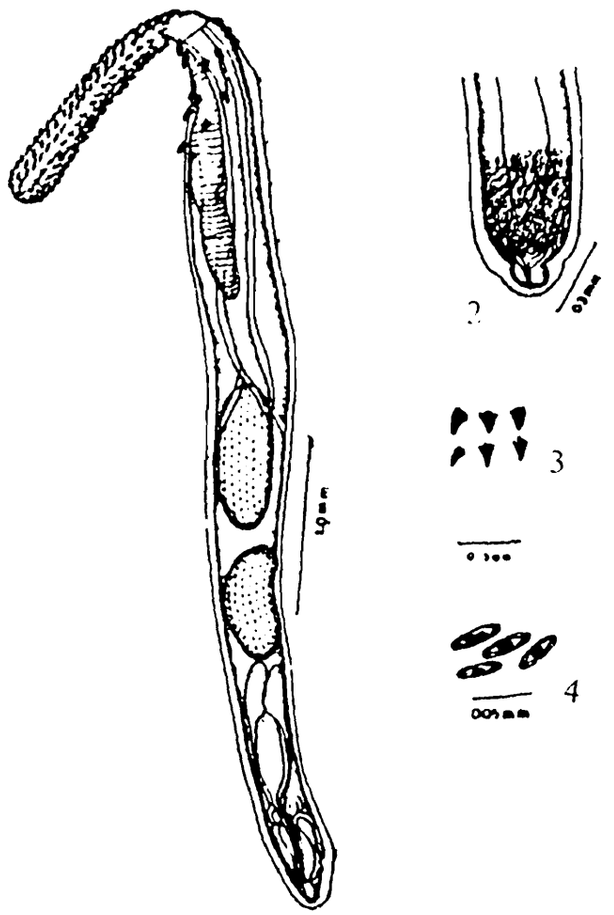


Fig. 131. *Rhadinorhynchus dollfusi* Gupta, V. & Fatma, 1987. 1. Male, 2. Posterior end of female, 3. Collar spines, 4. Ova (after Gupta, V. & Fatma, 1987).

and reticular anastomoses. Lemnisci equal, claviform paired, ribbon-shaped shorter 1.45-1.5 mm long, longer 1.55- 1.62 mm long, almost equal to receptacle.. Testes in midtrunk, ovoid one behind other. Cement glands 4, elongated, in 2 pairs. Uterine bell elongated, tubular, 0.40-0.50 × 0.25-0.26 mm. Uterus 0.25-0.38 × 0.10-0.21 mm. Vagina muscular with sphincter, 0.24-0.25 × 0.12-0.15 mm. Eggs elongated, 0.12-0.15 × 0.030-0.035 mm, with polar prolongations of middle shell. Female not known.

Host : *Pelamys chilensis* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

150. ***Rhadinorhynchus echeneisi*** Gupta, S.P. & Gupta, R.C. 1981 (Fig. 132)

Rhadinorhynchus echeneisi Gupta, S. P. & Gupta, R. C. 1981: 146-149, Pl. 4, Fig. 1-6; Gupta, V. & Sinha, 1990b: 51; Bhattacharya, 2007: 88-90, Pl. 15, Fig. 79 a-e.

Type locality : Quilon, Kerala, India.

Description : Males 7.27-7.48 × 0.58-0.59 mm, females 11.62-13.05 × 0.56-0.63 mm. Proboscis elongated, cylindrical, 1.47-1.57 × 0.20-0.27 mm, with 24-25 longitudinal rows of 14-15 hooks each in males, Ventral hooks stouter and more curved and basal hooks longer and more curved than adjacent hooks of basal circle. with 4 kinds hooks, apical hooks 0.03-0.040 mm long, subapical hooks 0.055-0.075 mm long, median hooks 0.062-0.065 mm long, basal hooks 0.065-0.070 mm long. in males, in females 1.8-1.85 × 0.30-043 mm armed with 25-26 longitudinal rows of 16-18 hooks each. an adjacent ones, with 4 kinds of hooks, apical hooks 0.02-0.04 mm long, subapicals 0.065-0.085 mm long, medians 0.05-0.92 mm long, basals 0.062-0.075 mm long, more curved and well rooted. Neck short. 0.20-0.24 × 0.27-0.30 mm in females. Proboscis receptacle elongate, tubular, double-walled, tapering at posteriad, 2.40-2.76 × 0.30-0.33 mm. Ganglion not observed. Neck short0.21-0.22 × 0.21-0.24 mm in males, in females 0.20-0.24 × 0.27-0.30 mm. Trunk elongate, cylindrical, 5.58-5.80 × 0.58-0.59 mm covered up to 0.88-1.01 mm from anterior end with spines of 0.02-0.028 mm long in male, in female 9.0-10.96 × 0.56-0.63 mm covered up to 1.86-2.26 mm from anterior end with spines of 0.04-0.098 mm long.

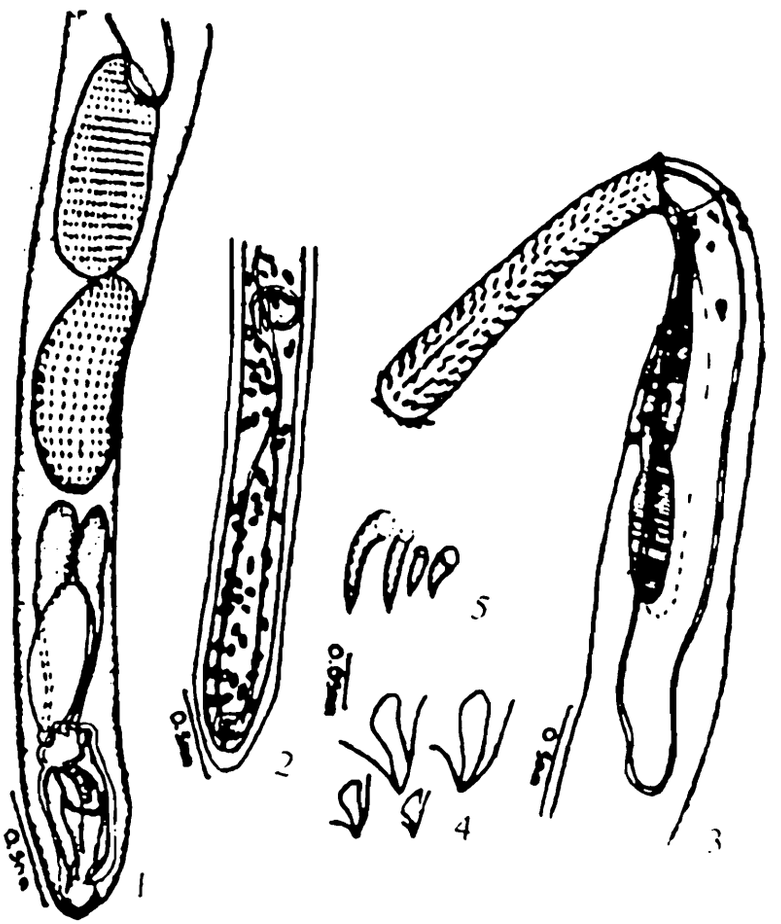


Fig. 132. *Rhadinorhynchus echeneisi* Gupta, S.P. & Gupta, R.C. 1981. 1. Posterior part of male, 2. Posterior part of female, 3. Anterior part of worm, 4. Trunk spines enlarged, 5. Proboscis hooks enlarged (after Gupta, V. & Sinha, 1991).

Posterior spines confined to ventral surface and extend further backwards in female than in males, with spines of posterior zone larger than those of anterior zone. Lacunar system inconspicuous with two main longitudinal channels. Lemnisci elongate, slender, subequal, longer 1.66-1.85 mm long, shorter 1.56-1.58 mm long in males; in females longer lemniscus 1.26-2.7 mm long, shorter 0.94-2.46 mm long. Testes contiguous, elongate, in tandem, in middle third of trunk, anterior 0.57-0.92 × 0.21-0.37 mm, posterior 0.48-0.88 × 0.18-0.36 mm. Cement glands 2, elongate, 0.35-0.76 × 0.12-0.16 mm. Saefftigen's pouch pyriform, muscular, saccular, 0.44-0.65 × 0.17-0.23 mm. Bursa elongate 0.39 × 0.10-0.12 mm. Uterine bell thistle-funnel-shaped 0.33-0.35 × 0.10-0.12 mm. Uterus long, slender, 2.03-2.9 × 0.13-0.22 mm. Vagina 0.16-0.20 0.10-0.15 mm with muscular bulb (sphincter) of 0.08-0.15 × 0.12-0.14 mm. Eggs not observed, but ovarian masses occupy whole of trunk region.

Host : *Echeneis naucrates* (Day).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

151. ***Rhadinorhynchus erumei*** (Gupta, V. & Fatma, 1981) Amin, 1985 (Fig. 133)

Nipporhynchus erumei Gupta, V. & Fatma, 1981: 443-446, Pl. 1, Fig. 1, 2:
Rhadinorhynchus erumei (Gupta, V. & Fatma) Amin, 1981 : 52;
Nipporhynchus erumei Gupta, V. & Sinha, 1990b : 52; Golvan, 1994 : 177.

Type locality : Mandapam. Tamil Nadu, India.

Description : Male 6.0 × 0.4 mm. Proboscis long, cylindrical, with numerous hooks, 0.75 × 0.2 mm, with 10 longitudinal rows of 26 hooks each. Anterior hooks small, 0.022 mm long, basal hooks larger and more curved, 0.026 mm long. Proboscis receptacle cylindrical, double-walled, much longer than proboscis, 1.64 × 0.4 mm, with ganglion at its middle. Trunk elongated, cylindrical, posterior end slightly tapering, anterior trunk with spines arranged in two fields, 0.022-0.025 mm long. First field behind proboscis, with 8-9 transverse rows of 10-12 spines each and second field with 5-6 transverse rows of 12 spines each. Lemnisci paired ribbon-shaped. 1.58 × 0.2 mm, almost equal to receptacle. Testes 2, in tandem, elongated, subequal, post-equatorial, anterior 0.95 × 0.21 mm, posterior 0.82 × 0.22 mm. Cement glands 4, pear-shaped, 0.50-0.56 × 0.22-0.25 mm opening separately into bursa. Saefftigen's pouch pyriform 0.34 × 0.14 mm opening into bursa through a separate duct. Seminal vesicle bean-shaped, 0.32 × 0.28 mm. Bursa bell-shaped, muscular, 0.48 mm long with bursal rays. Female not known.

Host : *Psettodes erumei* (Bloch & Schneider).

Location : Intestine.

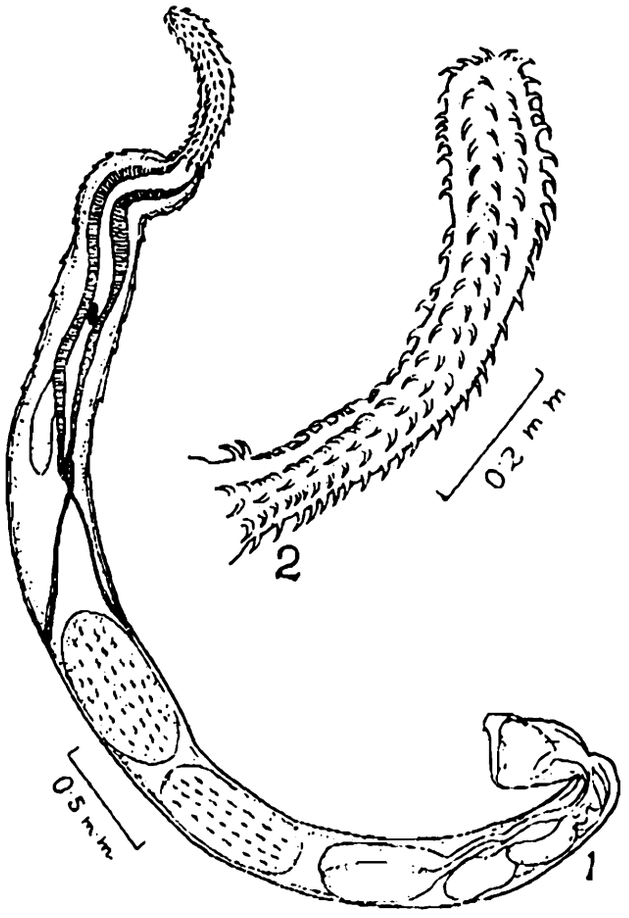


Fig. 133. *Rhadinorhynchus erumei* (Gupta, V. & Fatma, 1981) Amin, 1985. 1. Male, 2. Proboscis enlarged (after Gupta, V. & Fatma, 1981).

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

152. ***Rhadinorhynchus ganapatii*** Chandra, Rao & Shyamasundari, 1985 (Fig. 134)

Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985: 298-299, Fig. 6-12; Murugesh, 1994 : 421-424, Fig. 10-16; Golvan, 1994: 177; Madhavi & Sairam, 2000: 339; Bhattacharya, 2007: 92, Pl. 16, Fig. 88 a-d.

Type locality : Visakhapatnam coast, Andhra Pradesh, India.

Description : Male 4.76-6.32 × 0.37-0.61 mm, females 10.72-15.42 × 0.51-0.64 mm. Proboscis long, cylindrical, 0.96-1.16 × 0.14-0.18 mm, with 16-18 longitudinal rows of 23-25 hooks each. Ventral hooks shorter and stouter than dorsal hooks. Basal hooks larger than preceding hooks, on dorsal surface. Hooks of anterior, middle and posterior part measure 0.075 mm, 0.065 mm and 0.045 mm long; and on ventral surface the same 0.08 mm, 0.08 mm and 0.05 mm long. Neck 0.15-0.31 mm long, slightly pointed anteriorly. Proboscis receptacle, elongated, cylindrical, double-walled, muscular, 1.92-3.56 × 0.18-

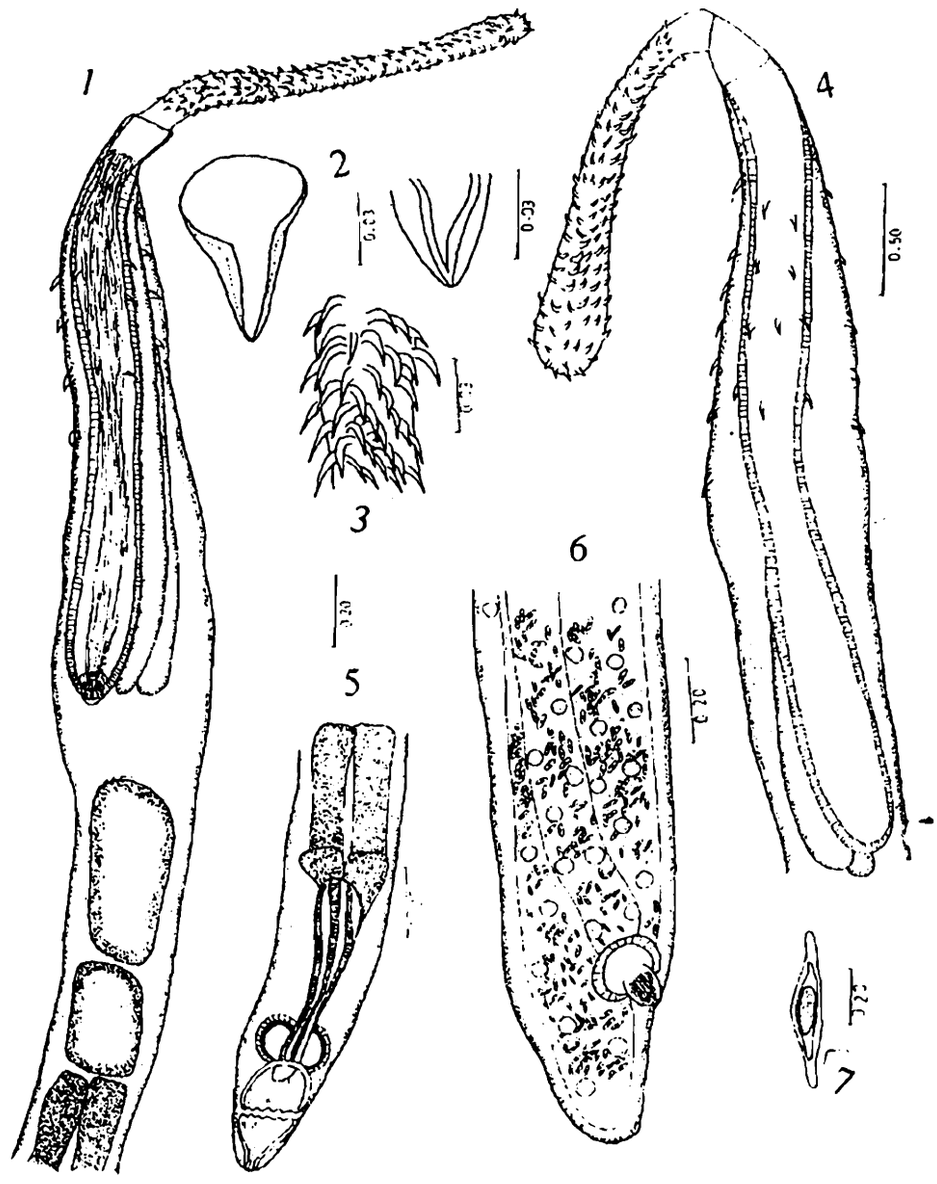


Fig. 134. *Rhadinorhynchus ganapatii* Chandra, Rao & Shyamasundari, 1985. 1. Anterior part of male, 2. Trunk spine enlarged, 3. Part of proboscis enlarged, 4. Anterior part of female, 5. Posterior part of male, 6. Posterior part of female, 7. Ovum enlarged (after Murgesh, 1991).

0.24 mm, longer than proboscis, with ganglion of 0.14-0.18 × 0.13-0.14 mm, embedded in its wall nearer base. Trunk long, cylindrical and slightly curved dorsally, slightly tapering posteriorly. Anterior trunk covered with spines, in females spines often bifurcated. Lemnisci equally long, slightly longer than receptacle, 2.1-3.6 × 0.18-0.21 mm. Testes 2, close to each other, anterior 0.70-1.13 × 0.30-0.43 mm, posterior 0.46-0.48 × 0.28-0.32 mm. Vasa efferentia lead posteriorly to form vas deferens. Seminal vesicle small lies at posterior end of cement glands with its opening near base of penis. Cement glands 4, cylindrical, elongated, in pairs, very close to one another, their ducts run posteriorly and open at base of penis. Penis muscular, cone-shaped situated at tip of bursa. Bursa evertible to outside

as a funnel-shaped organ. In gravid female numerous ovarian balls fill body cavity of trunk. Uterus elongated open into muscular vagina, which opens dorsally through subterminal vulva with muscular sphincter. Eggs elliptical, 0.04-0.05 × 0.01 mm.

Host : *Euthynus affinis* (Canter), *Scomberomorus commeronianus* Lacepede, *S. guttatus* (Bloch & Schnider), *Leptacanthus savala* (Cuvier), *Auxis thazard*;

Location : Intestine.

Locality : Visakhapatnam coast, Bay of Bengal (Andhra Pradesh).

Distribution : Known only from type locality.

153. ***Rhadinorhynchus hiansi*** Soota & Bhattacharya, 1981 (Fig. 135)

Rhadinorhynchus hiansi Soota & Bhattacharya, 1981 : 227-128, Fig. 1 A-C; Bhattacharya, 2007 : 90, Pl. 15, Fig. 80 a-c.

Type locality : Trivandrum, Kerala, India.

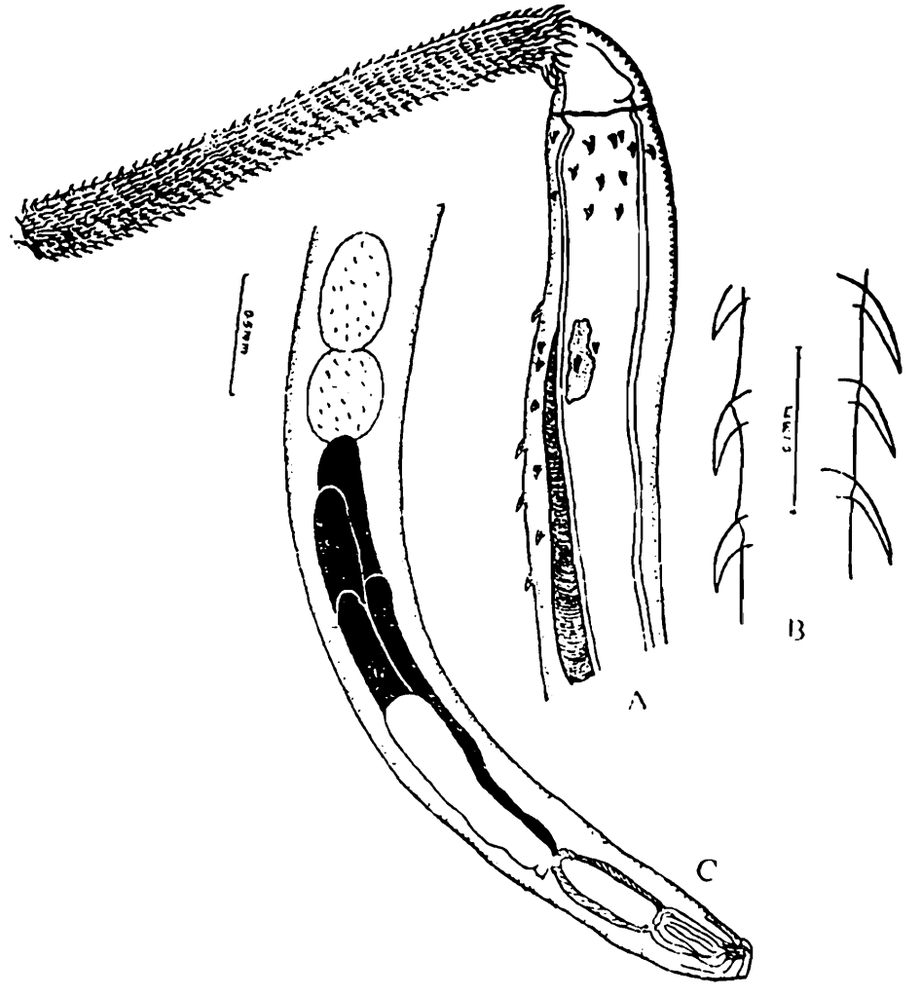


Fig. 135. *Rhadinorhynchus hiansi* Soota & Bhattacharya, 1981. A. Anterior part of male, B. Proboscis hooks enlarged, C. Posterior part of male (after Golvan, 1969).

Description : Male 8.5-10.0 × 0.44-0.55 mm. Proboscis 2.2-2.25 mm long in male, with 20-22 longitudinal rows of 40-44 hooks. Hooks apparently two dissimilar types. Ventrals slightly thicker, 0.033-0.055 mm long, dorsals thinner, 0.033-0.066 mm long, both gradually decreasing in size posteriorly, and then last few rows progressively increase in size until subsequent hooks at basal crown become very conspicuous with a length of 0.066-0.077 mm long. Proboscis receptacle elongated, cylindrical, double-walled, 3.0-4.3 mm long, with ganglion at its base. Lemnisci 2.5-2.6 mm long. Female unknown.

Host : *Ablennes hians.*

Location : Intestine.

Locality : Trivandrum (Kerala).

154. ***Rhadinorhynchus keralensis*** Gupta, V. & Fatma, 1989 (Fig. 136)

Rhadinorhynchus keralensis Gupta, V. & Fatma, 1989 : 1-6, Pl. 1, Fig. 1-6; Golvan, 1994: 178; Bhattacharya, 2007: 90, Pl. 15, Fig. 81 a-f.

Type locality : Quilon, Kerala, India.

Description : Males 7.65-7.80 × 0.60-0.68 mm; females 8.0-8.2 ×, 0.60-0.65 mm. Proboscis elongated, cylindrical 1.55-1.77 × 0.25-0.28 mm in male; in female 1.6-1.8 × 0.60-0.65 mm, with 14-16 longitudinal rows of 26-28 hooks each. Hooks of anterior region 0.046-0.048 mm long, decreasing gradually up to base, 0.030-0.032 mm long in males; in females 0.045-0.048 mm long decreasing gradually up to base, 0.035-0.040 mm long. Proboscis receptacle elongated, cylindrical, double-walled with ganglion at its base, 1.95-2.5 × 0.20-0.25 mm in males; in females 2.0-2.4 × 0.19-0.25 mm. Trunk elongated, cylindrical, spinose, with both ends tapering, not pseudo-segmented. Spines in anterior trunk arranged in 2 groups, in 5 circles of 5-6 spines in one field, encircling anterior trunk and 3-4 spines in second field extending ventrally in male; in female anterior spines in 5-6 circles of 6-8 spines in one field, encircling entire trunk and 3-4 spines in second field, extending ventrally. Each spine with a triangular structure, with wide base and pointed blade, 0.040-0.065 mm long in males; in females the same 0.50-0.65 × 0.030-0.035 mm. Lemnisci equal, slender, claviform, 1.75-1.90 mm long in males; in females 2.0-2.3 × 0.12-0.20 mm. Testes ovoid , subequal, in tandem, overlapping, post-equatorial, anterior 0.62-0.85 mm long, posterior smaller, 0.50-0.58 × 0.26-0.30 mm. Cement glands 4, pyriform, overlapping posterior testis, 0.24-0.28 × 0.10-0.15 mm, opening into bursa through separate ducts. Seminal vesicle elongated, thin-walled, 0.65-0.70 × 0.20-0.22 mm. Saefftigen's pouch pyriform, muscular, 0.64-0.68 × 0.25-0.30 mm. Uterine bell elongated, tubular, 0.40-0.45 × 0.25-0.26 mm. Uterus 0.25-0.38 × 0.10-0.21 mm. Vagina muscular, 0.20-0.25 × 0.12-0.15 mm, with sphincter. Eggs elongated, 0.30-0.32 × 0.10-0.12 mm, with polar prolongations of middle shell. Gonopore terminal in male, subterminal in female.

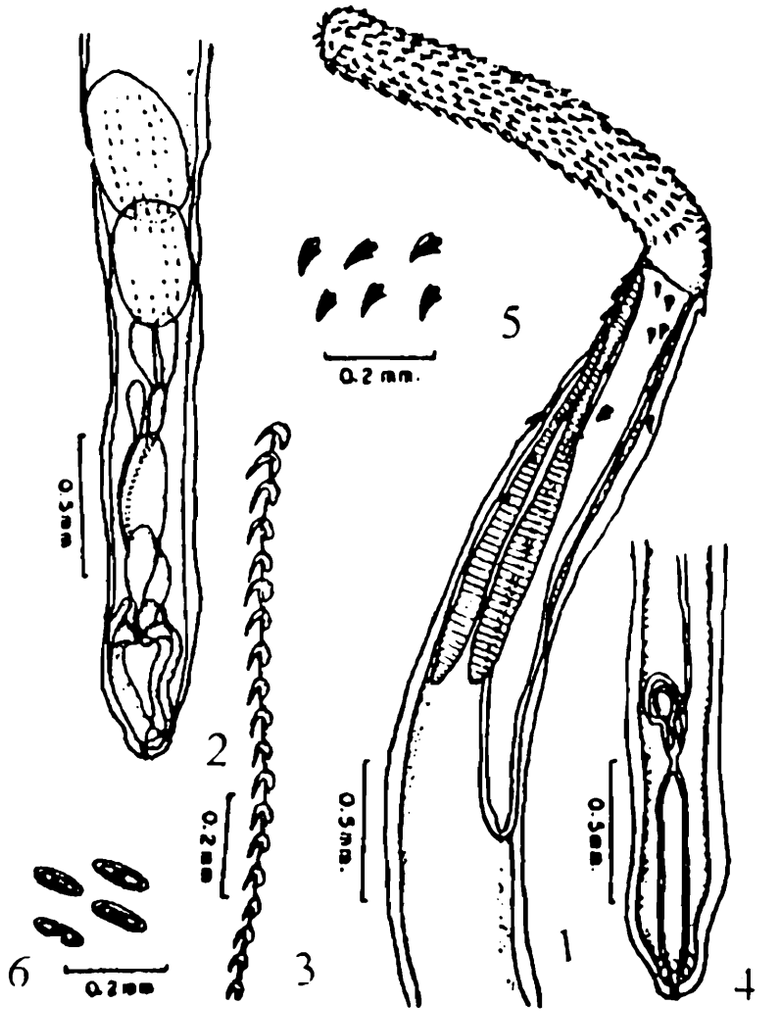


Fig. 136. *Rhadinorhynchus keralensis* Gupta, V. & Fatma, 1987. 1. Anterior part of worm, 2. Posterior part of male, 3. Row of proboscis hooks, 4. Posterior part of female, 5. Collar spines enlarge, 6. Ova (after Gupta V. & Fatma, 1987).

Host : *Polydactylus indicus* (Bloch).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

155. ***Rhadinorhynchus pelamysi*** Gupta, S.P. & Gupta, R.C., 1980 (Fig. 137)

Rhadinorhynchus pelamysi Gupta, S.P. & Gupta, R.C., 1980: 142-146, Pl. 3, Fig. 1-5; Golvan, 1969: 85; Gupta, V. & Sinha, 1990b: 51; Bhattacharya, 2007: 90-91, Pl. 15, Fig. 82 a-d.

Type locality : Quilon, Kerala, India.

Description : Male 6.8-13.71 × 0.46-1.1 mm. Female 7.83-20.25 × 0.46-0.96 mm. Proboscis elongate, cylindrical, 1.34-1.57 × 0.19-0.21 mm in male; in female 1.67-1.95 × 0.24-0.34 mm, with 23-24 longitudinal rows of 12-14 hooks each in males; in females 26-

27 longitudinal rows of 14-16 hooks each, with hooks of ventral surface stouter and more curved and hooks of basal circle longer, more curved than adjacent ones. Hooks of three kinds: apical hooks 0.06-0.75 mm, median hooks 0.050-0.065 mm and basal hooks 0.055-0.061 mm long in males; and in females the same hooks 0.068-0.08 mm, 0.055-0.079 mm and 0.063-0.087 mm long, more curved and well rooted than apical hooks. Neck short, 0.18-0.25 mm long in males; in females 0.15-0.35 × 0.27-0.47 mm. Proboscis receptacle elongated, tubular, double-walled, tapering posteriorly, a set of retractor muscles traverse whole length of proboscis receptacle, extend into trunk pseudocoel. Trunk elongate, cylindrical, 5.25-11.89 × 0.46-1.10 mm, covered up to 1.04-1.58 mm from anterior end with spines of 0.02-0.25 mm long. Anterior trunk region covered with stout ensheathed spines irregularly arranged in two zones, of which anterior encircles trunk but posterior confined to ventral surface in males, with spines of posterior zone longer than those of anterior zone. Lemnisci slender, elongate, equal, 1.54-2.28 mm long in males, in females 1.8-3.92 mm long, extending up to posterior end of receptacle in both sexes. Testes in tandem, contiguous, elongate, subequal, equatorial, anterior 0.52-1.08 × 0.36-0.52 mm,

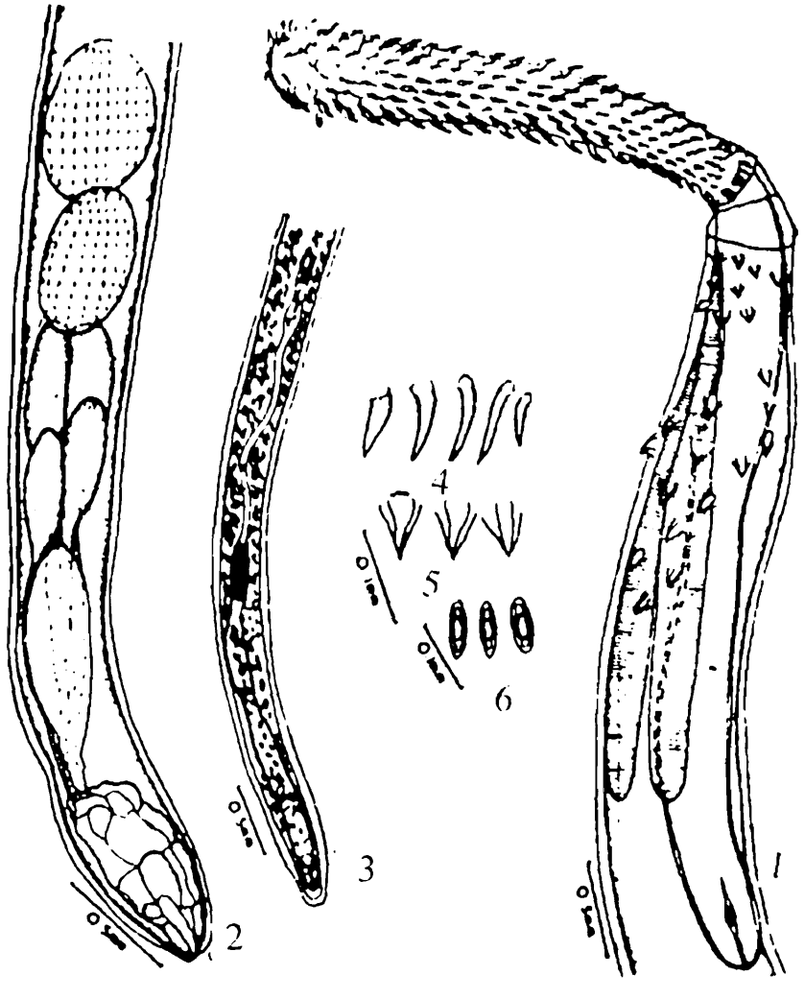


Fig. 137. *Rhadinorhynchus pelamysi* Gupta, S.P. & Gupta, R.C., 1980. 1. Anterior part of worm, 2. Posterior part of male, 3. Posterior part of female, 4. Proboscis hooks enlarged, 5. Trunk spines enlarged, 6. Eggs (Gupta, S.P. & Gupta R.C., 1980).

posterior 0.38-0.75 × 0.31-0.55 mm. Cement glands 4, elongate, tubular, 0.33-1.35 × 0.17-0.30 mm, lying behind posterior testis in posterior third of trunk. Saefftigen's pouch pyriform 0.6-1.05 × 0.22-0.32 mm. Bursa elongate, 0.52-1.04 × 0.22-0.51 mm. Uterine bell thistle-funnel-shaped, 0.24-0.61 × 0.10-0.12 mm. Uterus long, convoluted, 2.32-3.45 × 0.13-0.19 mm. Vagina 0.13-0.20 × 0.06-0.13 mm, with sphincter. Eggs and ovarian balls occupy most of trunk. Eggs three-membraned, 0.062-0.075 × 0.011-0.014 mm. Genital pore terminal in female.

Host : *Pelamys chilensis* (Cuvier & Valeniennes).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

156. ***Rhadinorhynchus polynemi*** Gupta, N. K. & Lata, 1968 (Fig. 138)

Rhadinorhynchus polynemi Gupta, N. K. & Lata, 1968b: 259-262, Fig. 9-13; Golvan, 1969: 85; Gupta, V. & Sinha, 1990b: 49; Golvan, 1994: 178; Bhattacharya, 2007: 91, Pl. 15, Fig. 83 a-c.

Type locality : Locality not mentioned in India.

Description : Males 5.8-6.8 × 0.47-0.97 mm. Females 6.9-10.1 × 0.53-0.58 mm. Proboscis elongate, cylindrical, forming an angle to main axis of body, 0.60-0.84 × 0.15-0.16 mm, with 10 longitudinal rows of 20-21 recurved hooks each, with three kinds of hooks, apical hooks 0.028 × 0.008 mm subapical hooks 0.30 × 0.006 mm, and basal hooks 0.006 × 0.002 mm. Neck 0.07-0.18 × 0.18-0.23 mm. Proboscis receptacle elongated, tubular, double-walled, extending from base of neck to slightly in front of anterior testis, 1.79-2.73 × 0.18-0.29 mm, with ganglion at its middle. Anterior part of trunk spinose, spines embedded in cuticle, posterior end rounded in both sexes. Lacunar system inconspicuous with only two main longitudinal channels. Lemnisci elongated, slender, 1.26-1.59 × 0.042-0.056 mm. Testes paired, ovoid, contiguous, located about midtrink, anterior 0.56-0.71 × 0.36-0.47 mm, posterior 0.50-0.56 × 0.39-0.42 mm. Sperm ducts from testes run along cement glands and open at posterior margin of genital sheath. Cement glands 4, elongated, ovoid, in two pairs, overlapping each other, anterior pair 0.49-0.58 mm long, posterior pair 0.51-0.78 mm long. Two cement ducts from cement glands, traverse through genital sheath and open in its posterior part. Genital sheath slightly cylindrical, thick-walled, 0.63-0.77 × 0.22-0.33 mm. Penis small, rod-shaped, 0.46 × 0.11 mm, attached to bursa. Copulatory bursa 0.71-0.72 × 0.23-0.28 mm, attached anteriorly to suspensory ligament, 0.014-0.042 mm wide while posteriorly leads into uterus. Uterine bell 0.28-0.37 × 0.08 mm. Uterus long, tubular, thick-walled, 1.51-2.47 × 0.07-0.11 mm, leads into vagina, 0.09-0.14 × 0.07-0.08 mm, with a pair of sphincters posteriad, opens to outside through female gonopore. Ovary disintegrate into number of eggs. Embryos spindle-shaped, 0.032-0.040 × 0.008-010 mm.

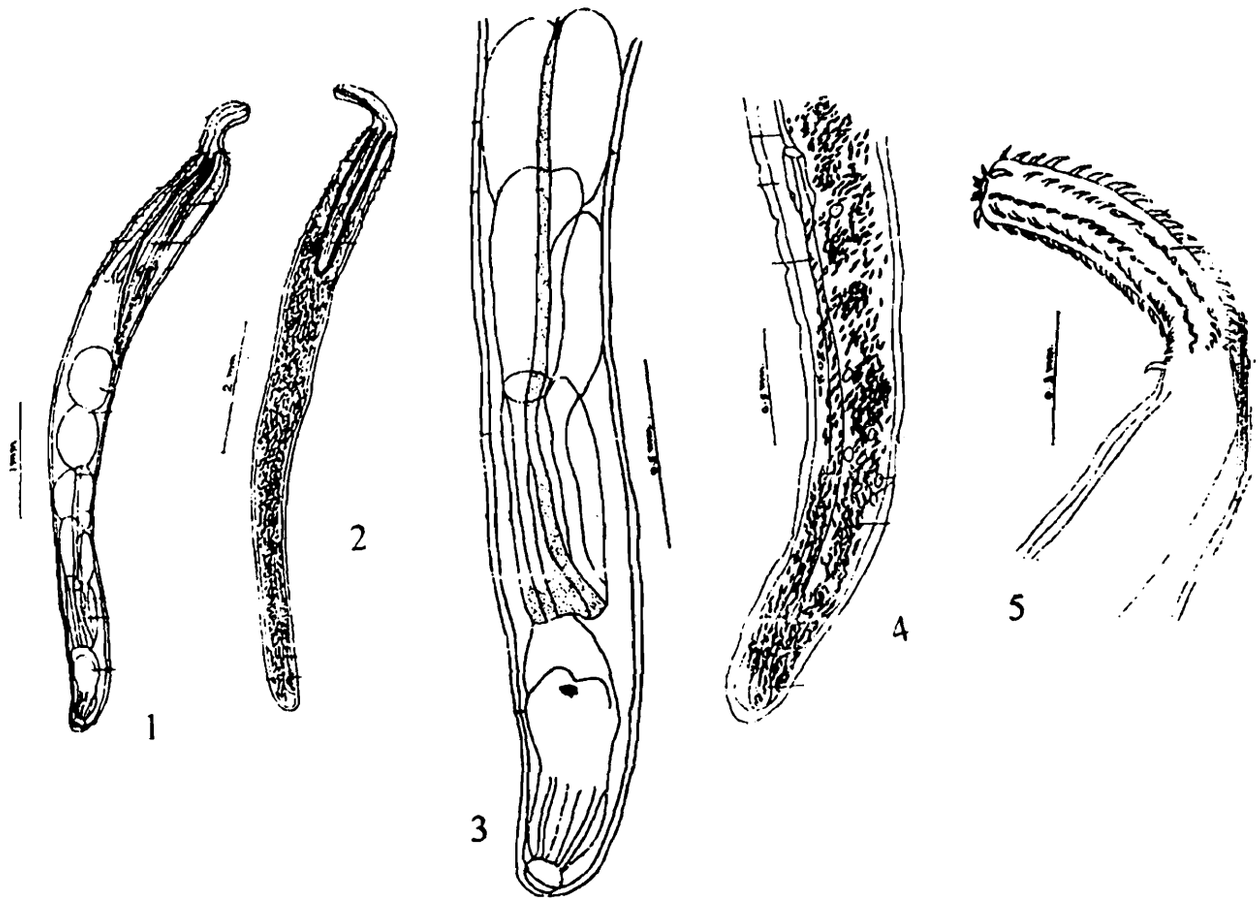


Fig. 138. *Rhadinorhynchus polynemi* Gupta, N.K. & Lata, 1968. 1. Male, 2.Female, 3. Posterior part of male, 4. Proboscis and neck enlarged (after Gupta, N.K. & Lata, 1968).

Host : *Polynemus heptadactylus* Cuvier & Valenciennes; *P. sexfilus* (Bloch & Schneider), *P. chilensis* Cuvier & Valenciennes.

Location : Intestine.

Locality : Kerala; Mumbai (Maharastra;) West Bengal.

Distribution : Known only from India.

157. ***Rhadinorhynchus pristis*** (Rudolphi, 1802) Lühe, 1911 (Fig. 139)

Echinorhynchus pristis Rudolphi, 1802:

Rhadinorhynchus pristis (Rudolphi) Lühe, 1911: 1-144; Meyer, 1932: 47, Fig.23-25; Petrotschenko, 1956: 378-380, Fig. 170; Yamaguti, 1963: 100, Pl. 41, Fig. 417-422; Golvan, 1969: 59; 1994: 178; Murugesh, 1995: 418-420, Fig. 6, 7;

Type locality : North of Atlantic ocean.

Description : Males 9.80-10.96 × 0.26-0.31 mm; females 10.8-12.60 × 0.42-0.48 mm. Proboscis flexed to one side, 1.92-2.34 × 0.262-0.348 mm, hooks in 14-16 longitudinal rows

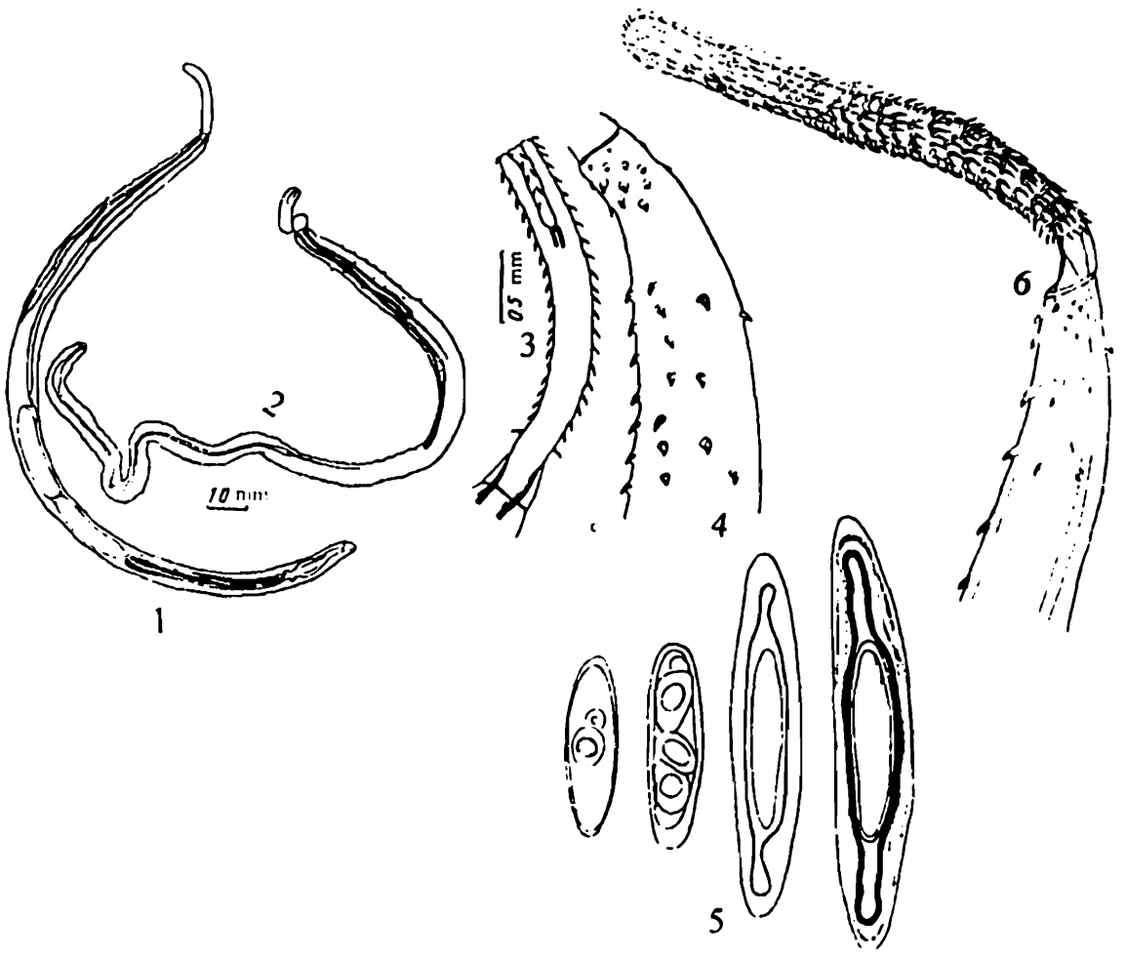


Fig. 139. *Rhadinorhynchus pristis* (Rudolphi, 1819) Lühe, 1. Male, 2. Female, 3. Proboscis enlarged, 4. Anterior part of trunk 5. Ova enlarged, 6. Proboscis and neck enlarged (after Murgesh, 1991).

of 26 hooks each, hooks 0.014-0.026 mm long jn male; in female with 25-26 longitudinal rows of 40 hooks each. Hooks of different sizes, ventral hooks 0.042-0.068 mm long, basal hooks longer, very thin. Proboscis receptacle elongated, cylindrical, double-walled, with ganglion about its middle. Trunk cylindrical, spines few scattered in rings, then aspinose space, then scattered spines on ventral surface to beyond end of proboscis receptacle, dorsal surface practically without spines. Lemnisci unequal, longer than receptacle. Testes contiguous, in tandem, in midtrunk, anterior 0.88 × 0.32 mm, posterior 0.48 × 0.25 mm. Cement glands 4, cylindrical, posterior to testes, 4.8-4.96 mm long, discharging directly into ejaculatory duct. Saefftigen's pouch elongate, 1.28 mm long. Bursa muscular with numerous papillae on its inner surface. Eggs 0.02 × 0.012 mm in size.

Host : *Katsuwonus pelamis.*

Location : Intestine.

Locality : Visakhapatnam coast (Andhra Pradesh).

Distribution : Bay of Bengal; Atlantic ocean, Japan, Mediterranean, Portuguese coast; South Australia.

158. ***Rhadinorhynchus stunkardi*** Gupta, V. & Fatma, 1987 (Fig. 140)

Rhadinorhynchus stunkardi Gupta, V. & Fatma, 1987: 6-9, Pl. 2, Fig. 1-5; Golvan, 1994: 178; Bhattacharya, 2007: 91, Pl. 16, Fig. 84 a-e.

Type locality : Puri, Orissa, India.

Description : Males 6.0-6.5 × 0.4-0.72 mm; females 6.8-6.95 × 0.50-0.55 mm. Proboscis elongated, cylindrical with 8-10 longitudinal rows of 24-26 hooks each, 0.95-1.10 × 0.20-0.25 mm in male. in female1.05-1.10 × 0.20-0.21 mm. Hooks of anterior part 0.042-0.046 mm long, gradually decreasing to base, 0.030-0.045 mm long, basal row prominent 0.050-0.055 mm long in males; in females they are 0.030-0.038 mm long, decreasing gradually up to base, to 0.025-0.028 mm long, basal row with prominent hooks, 0.029-0.030 mm long. Proboscis receptacle elongated, cylindrical, double-walled with ganglion at its base,

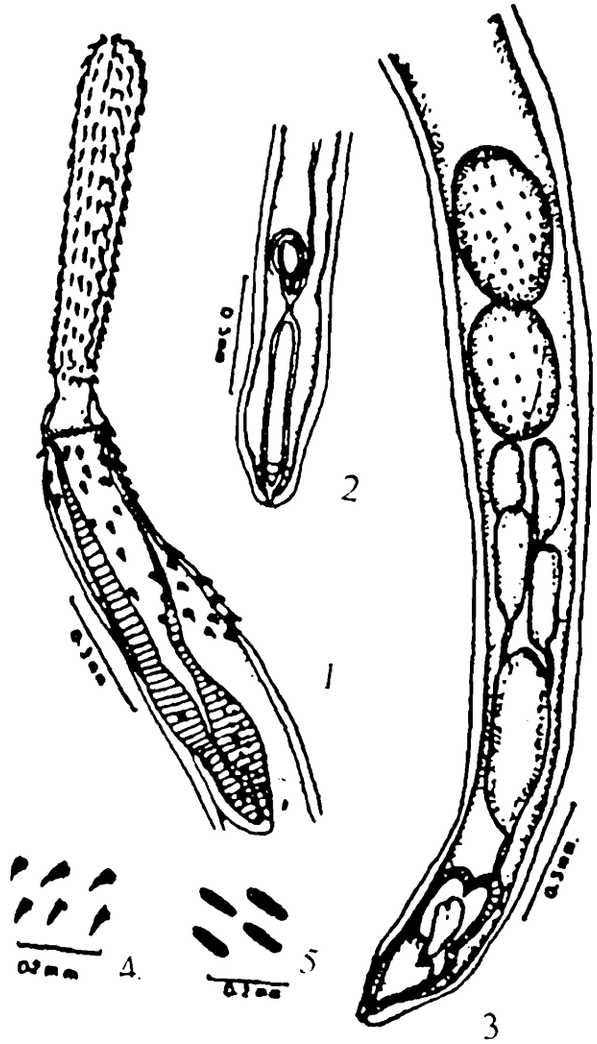


Fig. 140. *Rhadinorhynchus stunkardi* Gupta, V. & Fatma, 1987. 1. Anterior part of male, 2. Posterior part of female, 3. Posterior part of male, 4. Trunk spines, 5. Eggs (after Gupta, V. & Fatma, 1987).

1.64-1.70 × 0.25-0.40 mm in males; in females 1.85-2.0 mm long. Trunk elongated, cylindrical, spinose, tapering to both ends. Anterior trunk spines in two groups, first group of spines encircle trunk with 8-9 circles of 4-5 spines each in one field, 3-4 spines in second field, extending ventrally in males; in females anterior trunk spines with 6-8 circles of 4-5 spines each in one field and 3-4 spines in second field extending posteriorly, each spine with a wide base and pointed blade, 0.060-0.068 × 0.025-0.028 mm. Lemnisci equal, ribbon-shaped, slender, equal to receptacle, 1.5-1.6 mm long in males, in females 2.0-2.5 mm long. Testes ovoid, cylindrical, in tandem, subequal, post-equatorial, anterior 0.95-1.0 × 0.20-0.22 mm, posterior smaller, 0.85-0.95 × 0.22-0.25 mm. Cement glands 4, pyriform, overlapping posterior testis, 0.55-0.60 mm long opening separately through their ducts into bursa. Seminal vesicle pyriform, 0.32-0.35 × 0.28-0.30 mm, opening through its tubular duct into bursa. Bursa elongated, muscular 0.48-0.52 × 0.30-0.32 mm. Uterine bell elongated, tubular 0.35-0.45 × 0.20-0.22 mm. Uterus 0.22-0.32 × 0.20-0.21 mm. Vagina muscular with sphincter, 0.20-0.32 × 0.10-0.12 mm. Eggs elongated, with polar prolongations of middle shell, 0.12-0.16 × 0.026-0.028 mm. Gonopore terminal in male,

Host : *Cynoglossus lingua* Hamilton.

Location : Intestine.

Locality : Puri (Orissa).

Distribution : Known only from type locality.

159. ***Rhadinorhynchus trivandricus*** George & Nadakal, 1978 (Fig. 141)

Rhadinorhynchus trivandricus George & Nadakal, 1978b: 87-89, Fig. 13-16; 1992: 287; Bhattacharya, 2007: 91-92, Pl. 15, Fig. 85 a-c.

Type locality : Veli lake. Near Trivandrum, Kerala, India.

Description : Male 4-6 × 0.5-1.5 mm, female 6-9 × 1-2 mm. Proboscis long, cylindrical with 18-22 longitudinal rows of 20-26 hooks each, similar in both sexes; in males 0.70-0.856 × 0.215-0.30 mm, in females 1.4-1.5 × 0.4-0.45 mm, Proboscis hooks anteriorly 0.03-0.05 × 0.01-0.018 mm, middle 0.04-0.05 × 0.012-0.016 mm, posterior 0.024-0.032 × 0.008-0.012 mm in males. Neck short, distinct, 0.12-0.15 × 0.08-0.11 mm in males, in females 0.25-0.28 × 0.16-0.19 mm. Proboscis receptacle cylindrical, double-walled, 1.5-1.65 × 0.13-0.26 mm in males, in females 1.7-1.85 × 0.13-0.17 mm. Trunk with indistinct pseudo-segmentation, anterior one-third swollen and spinose posteriorly narrow and aspinose, anterior part 1.4-1.7 × 0.05-0.07 mm with 18-20 circles of 16-25 spines each in males; in females 1.6-1.9 × 0.12-0.13 mm, with 3-5 circles on ventral surface than in males. Lemnisci equal, filiform, longer than receptacle. Testes ovoid, contiguous, equal, post-equatorial, 0.30-0.34 × 0.35-0.38 mm. Cement glands 8, pyriform 0.14-0.16 × 0.15-0.16 mm, open into cement reservoir 0.12-0.15 × 0.12-0.14 mm, and then open through their ducts into bursal cap. Bursa spherical, 0.70-0.76 × 0.65-0.69 mm. Uterine bell post-equatorial 1.3 × 0.08-

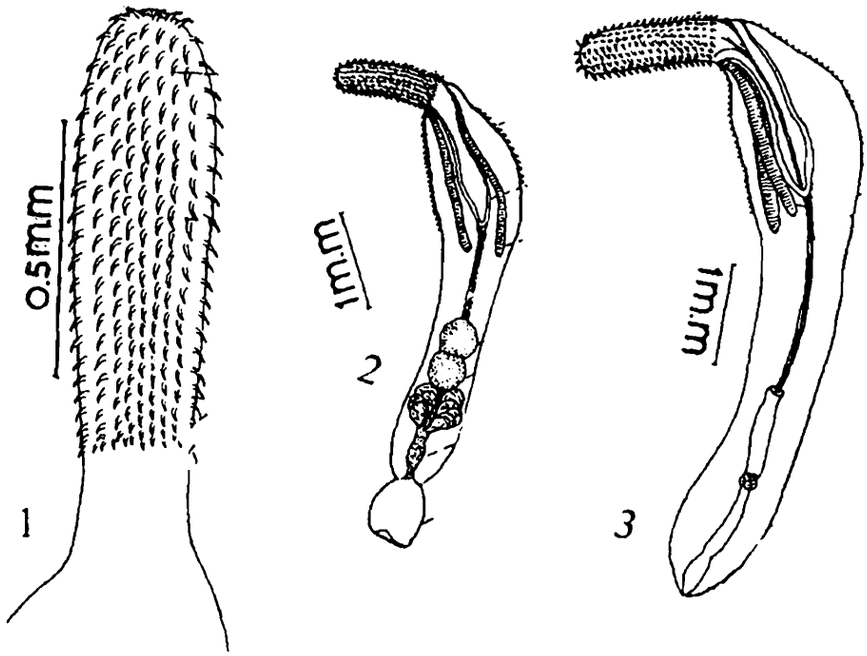


Fig. 141. *Rhadinorhynchus trivandricus* George & Nadakal, 1978. 1. Proboscis and neck enlarged, 2. Male, 3. Female (after George & Nadakal, 1978).

0.18 mm attached to ligament sac. Uterus narrow 1.0-1.4 × 0.10-0.16 mm. Vagina 0.25-0.30 × 025-0.27 mm. Eggs oval or elliptical 0.04-0.07 × 0.02-0.035 mm, with polar prolongations of middle shell. Embryos with distinct central nuclear material.

Host : *Arius platistomus* (Day).

Location : Small intestine.

Locality : Veli lake, Vellayani and Neendakara (Kerala).

Distribution : Known only in India.

40. Genus ***Neogorgorhynchoides*** Gupta, V & Fatma, 1987.

Neogorgorhynchoides Gupta, V. & Fatma, 1987 : 21; Golvan, 1994 : 166.

Diagnosis : Rhadinorhynchidae, Rhadinorhynchinae. Proboscis subglobular or claviform with 24-26 longitudinal rows of 14-18 hooks each. Anterior part of proboscis with 3 or 4 larger stout recurved hooks of different size then abruptly reducing in size of hooks, after which they gradually increase in length about middle, then decrease up to its base. Neck well developed. Proboscis receptacle double-walled with ganglion at its middle. Trunk slender, spinose, curved ventrally in anterior third. Anterior trunk spines irregularly arranged, closrly set anteriorly. Lemnisci long, slender, coiled, much longer than receptacle. Testes ovoid or slightly elliptical, in tandem, post-equilateral. Cement glands 2, very long, slender. Bursa globular, without bursal rays or papillae. Eggs elliptical, without polar prolongations of middle shell. Genopore terminal in male, subterminal in female. Parasites of marine fishes.

Type species : *Neogorgorhynchoides cablei* Gupta, V. & Fatma, 1987.

Includes single species *Neogorgorhynchoides cablei Gupta, V. & Fatma, 1987 which occurs in India.*

160. ***Neogorgorhynchoides cablei*** Gupta, V. & Fatma, 1987 (Fig. 142)

Neogorgorhynchoides cablei Gupta, V. & Fatma, 1987 : 17-20, Pl. 6, Fig 1-3; Gupta, V. & Sinha, 1990b: 50; Golvan, 1994 : 166.

Type locality : Mandapam, Tamil Nadu, India.

Description : Male 6.96-7.42 × 0.56-0.86 mm, female 7.25-7.80 × 0.44-0.78 mm. Proboscis subglobular or claviform, in males 0.95-1.02 × 0.55-0.58 mm, in females 1.0-1.5 × 0.42-0.45 mm, with 24-26 longitudinal rows of 14-18 hooks each of variable size, anterior globular part with recurved roots, with abrupt reduction in size of hooks, after which they gradually increase in length about middle level, then decrease towards base. Hooks of first, second, third and fourth types 0.072-0.080 mm, 0.035-0.040 mm, 0.046-0.05 mm and 0.020-0.28 mm long in male; in female proboscis same hooks 0.082-0.085

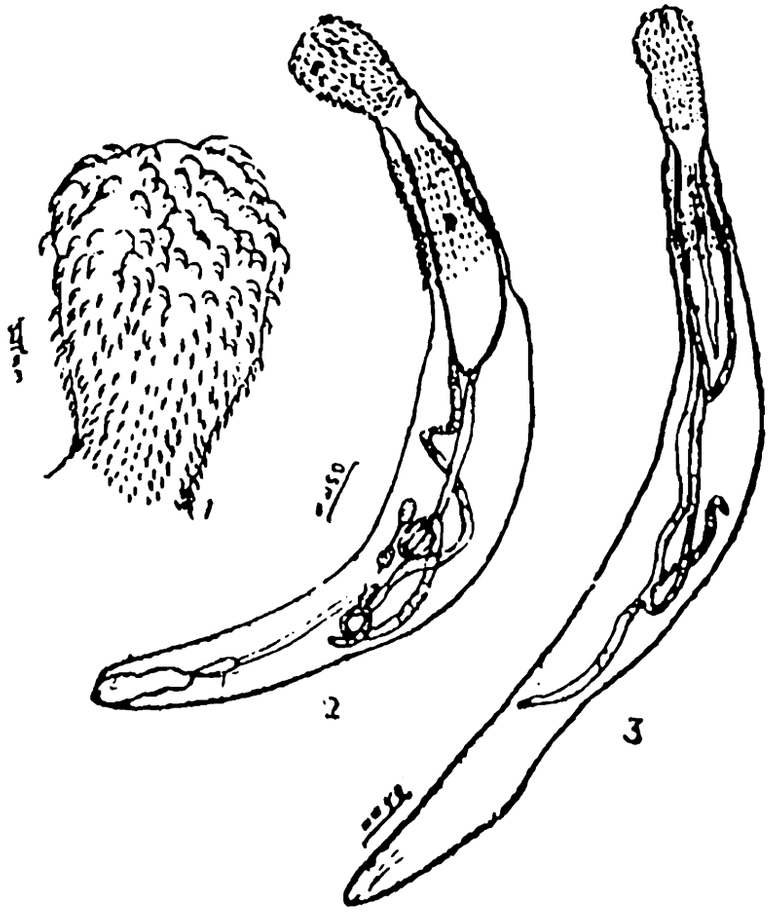


Fig. 142. *Neogorgorhynchoides cablei* Gupta, V. & Fatma, 1987 1. Proboscis enlarged, 2. Male, 3. Female (after Gupta, V. & Fatma, 1987).

mm, 0.040-0.042 mm, 0.050-0.058 mm and 0.025-0.035 mm long. Neck well developed 0.30-0.38 × 0.30-0.35 mm in males, in females 0.32-0.40 × 0.40-0.42 mm. Proboscis receptacle double-walled with ganglion at its middle, in males 2.10-2.15 × 0.40-0.48 mm, in females 1.8-2.0 × 0.40-0.42 mm. Trunk slender, spinose, curved ventrally, tapering to both ends, armed with 13-14 rows of close set spines, 0.035-0.04 mm long, extending up to 0.90-1.2 mm long, anterior to dorsal swelling. Lemnisci long, slender, coiled, much longer than receptacle, subequal extending up to ¾ of trunk length with many nuclei, shorter 4.4-4.5 × 0.10-0.12 mm, longer 4.7-5.3 × 0.12-0.13 mm in male; in female shorter 4.8-4.9 × 0.12-0.15 mm, lpnger 5.0-5.2 × 0.12-0.13 mm. Testes ovoid , slightly elliptical, in tandem, post-equatorial, anterior 0.15-0.16 × 0.13-0.135 mm, posterior 0.15-0.155 × 0.12-0.13 mm. Cement glands 2, elongated, tubular, 1.6-1.85 mm long, opening into bursa. Seminal vesicle elongated 0.32-0.45 × 0.22-0.35 mm. Bursa globular, muscular 0.75-0.76 × 0.22-0.26 mm. Uterine bell cylindrical 0.20-0.25 × 0.11-0.15 mm. Vagina 0.26-0.28 × 0.14-0.16 mm. Eggs 0.030-0.042 × 0.12-0.15 mm. Gonopore terminal in male, subterminal in female.

Host : *Caranx kalla* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Mandapam (Tamil Nadu).

Distribution : Known only from type locality.

Subfamily SERRASENTINAE Petrotschenko, 1956

Serrasentinae Petrotschenko, 1956 : 392; Yamaguti, 1963 : 110; Golvan & Houin, 1964: 593; Golvan, 1969 : 118 Bhattacharya, 2007 : 100-101.

Diagnosis : Rhadinorhynchida. Serrasentinae. Proboscis elongate, massive, enlarged anteriorly. Trunk armed with spines arranged in anterior part, but with cuticular transverse combs of spines arranged in regular transverse rows on ventral surface. A spined collar may be present at anterior end of trunk. Proboscis receptacle longer than proboscis. Lemnisci longer than proboscis. Testes spherical in second quarter of trunk. Cement glands four elongate pyriform. Parasites of marine fishes.

Type genus : *Serrasentis* Van Cleave, 1923.

Includes single genus *Serrasentis* Petrotschenko, 1956, which occurs in this subcontinent.

41. Genus ***Serrasentis*** Van Cleave, 1923

Serrasentis Van Cleave, 1923 : 147-149; Meyer, 1932 : 40-41; Datta, 1953a : 51; t, 1956 : Petrotschenko, 1956 : 392; Yamaguti, 1963 : 111; Golvan & Houin, 1964 : 593; Golvan, 1969 : 120; 1994 : 178; Bhattacharya, 2007 : 101.

Diagnosis : Rhadinorhynchidae, Serrasentinae. Proboscis globular, short claviform or subcylindrical, with longitudinal rows of variable number of hooks.. Proboscis receptacle

clavate or cylindrical, with ganglion in its anterior or middle part. Neck short. Trunk with ventral transverse rows of spines which are fused to form combs. A collar of spines may be present at anterior end of trunk. Lemnisci slender. Testes anterior. Cement glands 4 or elongate pyriform. Ova elliptical, with polar prolongations of middle shell. Parasites of marine fishes.

Type species : *Serrasentis lamelliger* (Diesing, 1854) Meyer, 1932.

Includes eleven species, 1. *Serrasentis engralisi* Gupta, S.P. & Gupta, K., 1980, 2. *S. fotedari* Gupta, V. & Fatma, (1979) 1980, 3. *S. golvan* Gupta, P.C. & Kumar, 1989, 4. *S. indicus* Singh, Agarwal & Lakshmi, 1988, 5. *S. mujibi* Bilqees, 1972, 6. *S. nadakali* George & Nadakal, 1978, 7. *S. psenesi* Gupta, S.P. & Gupta, R.C. 1980, 8. *S. sagittifer* (Linstow, 1889) Linton, 1932, 9. *S. sciaenus* Bilqees, 1972, 10. *S. lamelliger* (Diesing, 1854) Meyer, 1932 and 11. *S. sidaroszakaio* Tadros, Iskandar & Wassef, 1979, of which first nine species occur in this subcontinent.

Key to Indian species of genus *Serrasentis*

1. Proboscis with16-17 longitudinal rows of hooks 2
– Proboscis with more than 17 longitudinal rows of hooks 3
2. Worms small, males 6.05-9.25, females 8.78-8.9 mm long ..... *Serrasentus psenesi*
– Worms large, males 23,55-75.5 mm, females 28.5-105.5 mm long ..... *Serrasentis engralisi*
3. Proboscis with18-20 longitudinal rows of hooks 4
– Proboscis with more than 20 longitudinal rows of hooks 5
4. Trunk with 24 comb-like transverse bands ..... *Serrasentis scienus*
– Trunk with 26 comblike transverse bands ..... *Serrasentis mujibi*
5. Worms large, males 40-120, females 50-170 mm long ..... *Serrasentis nadakali*
– Worms small, below 10 mm long in both sexes 6
6. Pseudo-segmental outicular combs 16-21 in males, 12-19 in females ..... *Serrasentis sagittifer*
– Pseudo-segmental cuticular combs 23 in both sexes ..... *Serrasentis fotedari*

Note : *Serrasentis golvani* Gupta, P.C. & Kumar, 1989

161. ***Serrasentis engralisi*** Gupta, S.P. & Gupta, R.C. 1980 (Fig. 143)

Serrasentis engralisi Gupta, S.P. & Gupta, R.C. 1980 : 149-152, Pl. 5, Fig. 1-7; Gupta, V. & Sinha, 1990b : 54.

Type locality : Quilon, Kerala, India.

Description : Males 28.55-75.50 × 0.95-1.93 mm, females 28.50-105.5 × 0.72-1.18 mm. Proboscis cylindrical, claviform 1.10-1.15 × 0.45-0.47 mm with 16-17 longitudinal rows of 20-21 hooks each, hooks 0.035-0.095 mm long in males, in females 0.83-1.3 × 0.25-0.45 mm with 16-17 longitudinal rows of 22-24 hooks each, hooks 0.038-0.098 mm long. Neck short 0.26-0.39 × 0.035-0.040 mm in male, in females 0.30-0.40 × 0.50-0.55 mm. Proboscis receptacle long, cylindrical, double-walled, with ganglion at its anterior part, 2.16-2.30 × 0.47-0.51 mm in male, in female 1.8-2.5 × 0.40-0.53 mm. Trunk elongated, cylindrical, anteriorly curved ventrad, 27.19-73.96 × 0.95-1.93 mm, with 6-7 longitudinal rows of 12-18 collar spines, 0.10-0.11 mm long with a broad base in each row at its anterior end, and covered with 25-28 rows of transverse pseudo-segmental cuticular combs of maximum 28 spines and minimum of 4 spines in each row in males; in females 27.35-103.25 × 0.72-1.18 mm armed with 7-9 longitudinal rows of 14-26 collar spines each, 0.10-0.13 mm long, in each row at its anterior end and covered with 26-29 rows of transverse pseudo-segmental cuticular combs of maximum 29 spines and minimum 4 spines in each row. Lemnisci 2, long, slender subequal, occasionally folded, smaller 5.30-7.22 mm long,

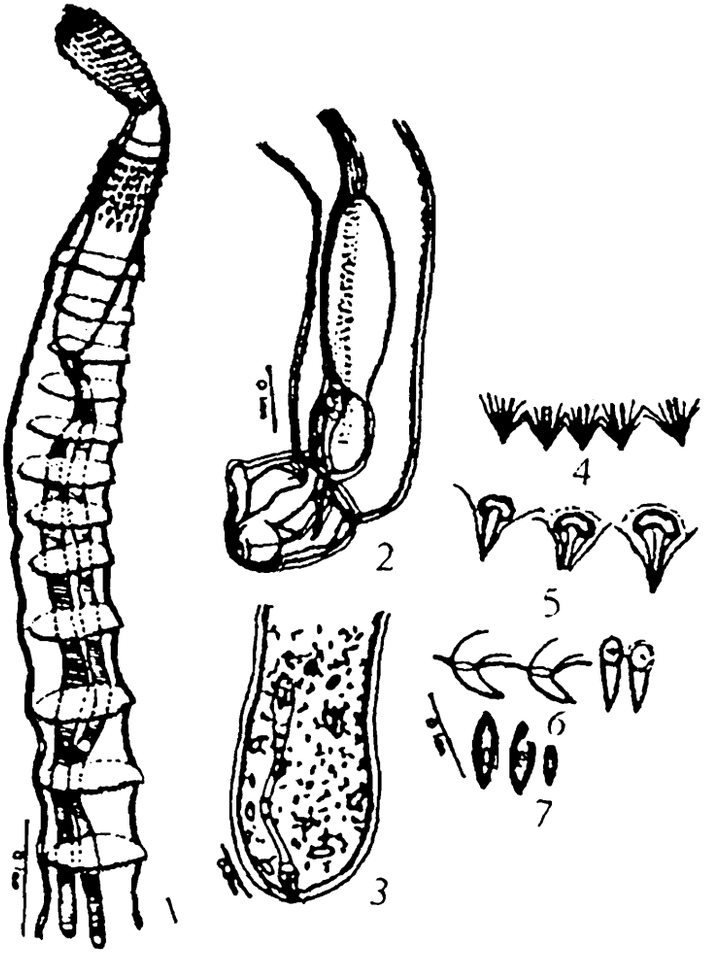


Fig. 143. *Serrasentis engralisi* Gupta, S.P. & Gupta, R.C. 1980. 1. Anterior part of worm, 2. Posterior part of male, 3. Posterior part of female, 4-5. Trunk spines enlarged, 6. Proboscis hooks enlarged, 7. Eggs enlarged (after Gupta, S.P. & Gupta, R.C., 1980).

longer 5.55-8.80 mm long in males; in females smaller lemniscus 4.5-5.5 mm long, longer 6.5-7.5 mm long. Testes ovoid, separated, in midtrunk, anterior 0.75-1.57 × 0.45-0.60 mm, posterior 0.75-1.17 × 0.41-0.62 mm, their sperm ducts unite to form common sperm duct, runs posteriorly along dorsal margin of trunk cavity. Cement glands 4, long, tubular followed two cement reservoir vesicles, 0.53-1.20 × 0.21-0.56 mm, present along side of seminal vesicle inside genital sheath and opens individually lateral to opening of sperm duct anterior to bursa. Seminal vesicle small, elongate, 0.60-0.95 × 0.15-0.28 mm. Saefftigen's pouch large, elongate with thick covering, 1.17-3.0 × 0.54-1.01 mm. Bursa globular without bursal rays, 1.53-2.40 × 1.01-1.8 mm at extreme posterior end of trunk. Ovarian balls 0.18-0.25 × 0.08-0.19 mm. Uterine bell short, 0.20-0.42 × 0.12-0.27 mm with distinct funnel. Uterus short, muscular tube, 1.20-2.10 × 0.06-0.12 mm, with distinct swelling just behind junction of uterine bell and uterus. Vagina short, muscular 0.24-0.32 × 0.12-0.16 mm, opening subterminal to exterior. Eggs elliptical with polar prolongations of middle shell, 0.095-0.11 × 0.03-0.035 mm.

Host : *Engraulis malabaricus* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

162. ***Serrasentis fotedari*** Gupta, V. & Fatma, 1980
(Fig. 144)

Serrasentis fotedari Gupta, V. & Fatma, 1980 : 45-48, Pl. 1, Fig. 1-4; Gupta, V. & Sinha, 1990b : 52; Golvan, 1994: 176.

Type locality : Mandapam, Tamil Nadu, India.

Description : Males 5.02 × 0.4 mm; females 4.5-4.68 × 0.55-0.60 mm. Proboscis elongated, claviform 0.62 × 0.25 mm with 22-24 longitudinal rows of 14-15 hooks each in male, in females 0.6-0.6.5 × 0.20-0.22 mm with 20-22 longitudinal rows of 14-15 hooks each. Hooks larger and more curved in midproboscis and smaller and less curved anteriad and basal parts. Hooks of anterior and posterior parts 0.010-0.015 mm long, middle hooks 0.020-0.022 mm long in males, in females hooks of anterior part 0.012-0.016 mm long, middle hooks 0.020-0.025 mm long in male; in female hooks of anterior and posterior parts 0.0120.016 mm long, of middle part 0.020-0.025 mm long. Neck short. Proboscis receptacle elongated, claviform, double-walled with anterior ganglion, 1.05 × 0.05 mm in male; in females 1.40-1.45 × 0.3-0.32 mm. Trunk elongated, cylindrical, anterior end wide and slightly curved with proboscis bent on one side, narrow and rounded at posterior end, 4.48 × 0.45 mm with 23 transverse rows of 10-15 spines which are fused as pseudo-segmental cuticular combs extending up to ¾ of trunk in male; in female 4.55-4.82 × 0.50-0.55 mm with 23 cuticular combs of spines, each with 9-18 spines per comb. Lemnisci long, slender, subequal, longer the receptacle, in females longer lemnisci 2.2-2.3 mm long, smaller 1.8-1.9 mm long. Testes ovoid, contiguous, subequal, anterior 0.08 × 0.025 mm,

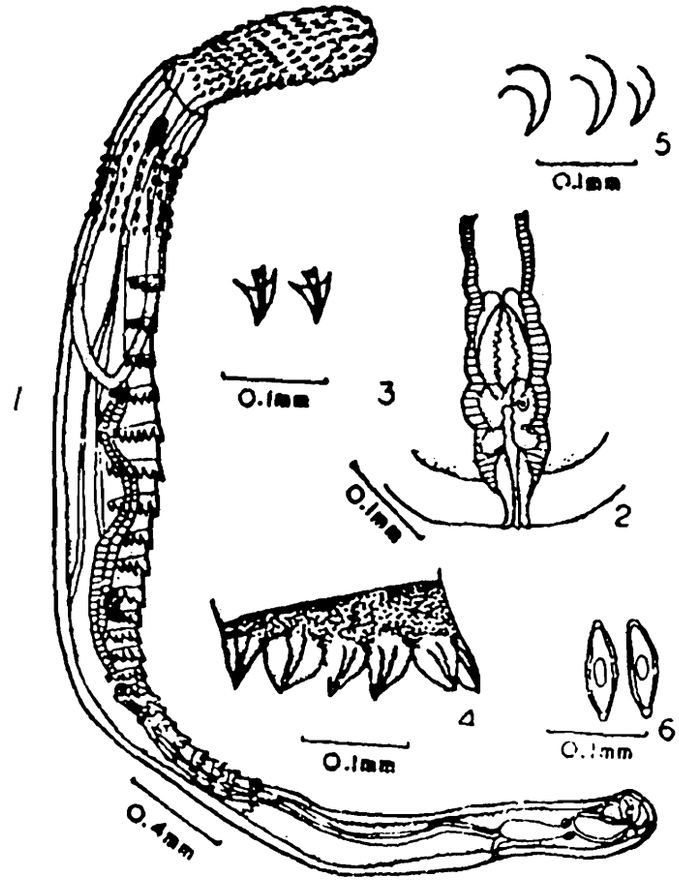


Fig. 144. *Serrasentis fotedari* Gupta, V. & Fatma, 1980. 1. Male, 2. Female genitalia, 3. Trunk spines enlarged, 4. Ventral comb. 5. Proboscis hooks enlarged, 6. Ova enlarged (after Gupta, V. & Fatma, 1979).

posterior 0.085 × 0.022 mm. Cement glands 4, tubular, elongated, 1.8 × 0.34 mm. Saefftigen's pouch elongated with thick muscular covering 0.3 × 0.05 mm. Seminal vesicle elongated 0.32 × 0.35 mm with ligament attached to its anterior end on one side. Bursa globular 0.38 × 0.25 mm. Uterine bell short, tubular 1.6-2.0 × 0.25-0.31 mm opening into vagina of 0.10-0.15 × 0.040-0.055 mm. Eggs elliptical 0.022-0.025 × 0.016-0.018 mm. Gonopore subterminal.

Host : *Psettodes erumei* (Bloch & Schneider).

Location : Intestine.

Locality : Mandapam (Tamil Nadu); (Maharastra).

Distribution : Known only from India.

163. ***Serrasentis golvani*** Gupta, P.C. & Kumar, 1989

Serrasentis golvani Gupta, P.C. & Kumar, 1989: 78-80: Gupta, V. & Sinha, 1990b: 51; Golvan, 1994: 176.

Type locality : Puri coast, Orissa, India.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Mugil dussamieri* Cuvier & Valenciennes.

Location : Intestine.

Locality : Puri, Bay of Bengal (Orissa); (West Bengal).

Distribution : Known only from India.

164. ***Serrasentis indicus*** Singh, Agarwal & Laksmi, 1988

Serrasentis indicus Singh, Agarwal & Laksmi, 1988 : 73-81;

Type locality : Visakhapatnam coast, Andhra Pradesh, India.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Elops saurus.*

Location : Intestine and body cavity.

Locality : Visakhapanam coast, Bay of Bengal (Andhra Pradesh).

Distribution : Known only from type locality.

165. ***Serrasentis mujibi*** Bilqees, 1972
(Fig. 145)

Serrasentis mujibi Bilqees, 1972c : 124; Bilqees & Khan, 1987 : 22, Fig. 33 a-d, Golvan, 1994 : 176.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Female 3.7-6.2 mm long. Proboscis hooks in 18-20 longitudinal rows, anterior hooks wider than long, and progressively become longer than wide towards posterior part of proboscis. Proboscis receptacle double-walled. Collar aspinose. Trunk curved ventrally, anterior end flat, posterior end narrow, with greatest width posterior to proboscis receptacle. Anterior trunk wall smooth and posterior much more folded, ventrally with 26 transverse bands of hooks. Number of hooks decrease from anterior to posterior bands of different regions of trunk. Bands of middle region largest. First two bands with small hooks and posterior bands with smallest hooks. Lemnisci two, much longer than

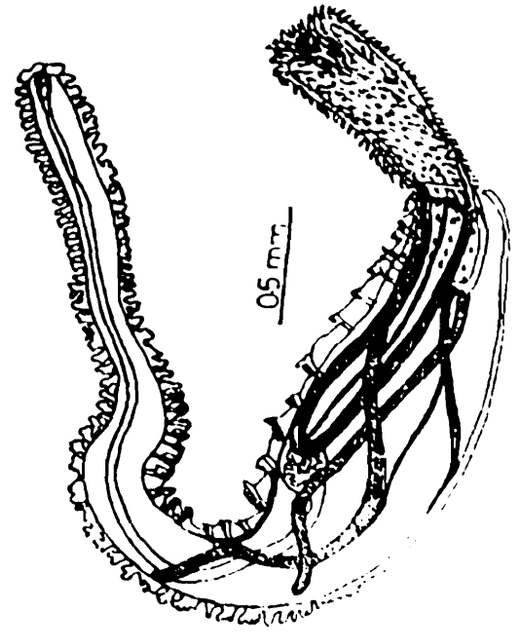


Fig. 145. *Serrasentis mujibi* Bilqees, 1972. Female (after Bilqees, 1972).

receptacle. Genital organs located near posterior part of trunk. Uterus short, tubular; vagina muscular and vulva terminal. Male not known.

Host : *Gamphorus coeruleus.*

Location : Intestine.

Locality : Karachi coast, Sindh, Pakistan.

Distribution : Known only from type locality.

166. ***Serrasentis nadakali*** George & Nadakal, 1978 (Fig. 146)

Serrasentis nadakali George & Nadakal, 1978a : 93-94, Fig. 1-4, 10; 1981 : 59-61, Fig. 1-3; Golvan, 1994 : 176.

Type locality : Trivandrum, Kerala, India.

Description : Males 40-120 × 0.5-2.5 mm; females 50-170 × 0.5-3.0 mm. Proboscis club-shaped or globular, with 24-28 longitudinal rows of 20-26 hooks each, similar in both sexes, in males 1.4-2.0 × 0.2-0.6 mm, in females 2.0-2.5 × 0.2-0.25 mm. Hooks small at apex and basal parts, anterior hooks 0.045-0.050 × 0.015-0.018 mm, middle hooks 0.075-0.080 × 0.020-0.024 mm, basal hooks 0.03-0.04 × 0.012-0.016 mm. Neck short.? Proboscis receptacle cylindrical, double-walled with three retractor muscles attached to base of receptacle, 1.6-2.0 × 0.2-0.4 mm in males, 2.0-2.5 × 0.22-0.26 mm wide. Collar

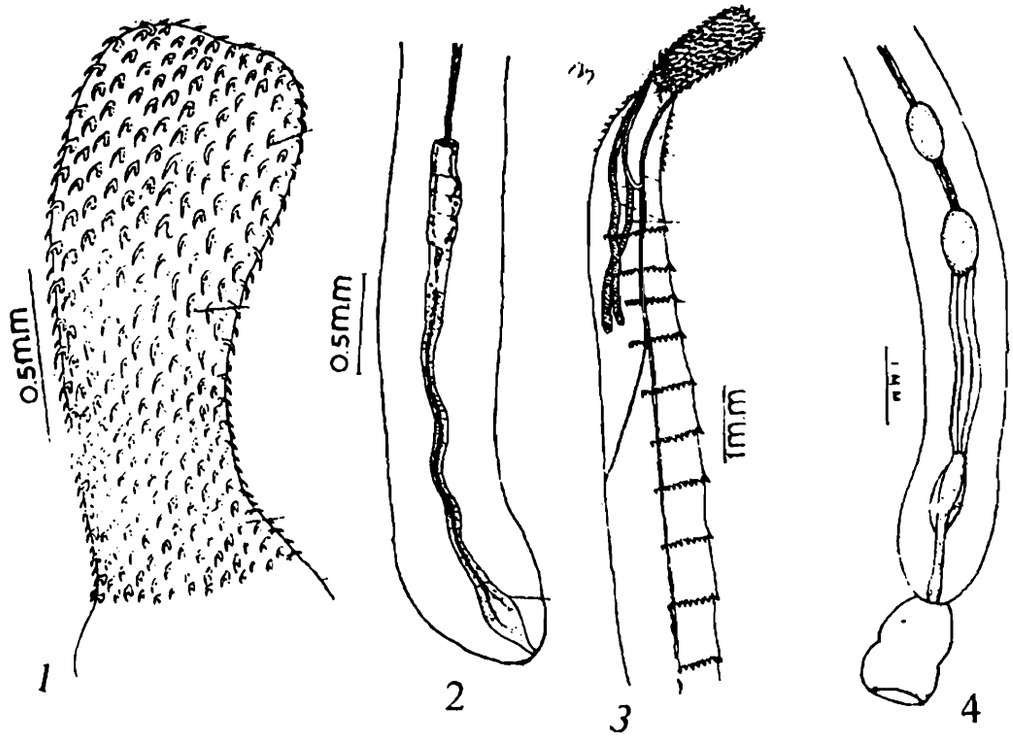


Fig. 146. *Serrasentis nadakali* George & Nadakal, 1978. 1. Proboscis enlarged, 2. Posterior part of female, 3. Anterior part of male, 4. Posterior part of male (after George & Nadakal, 1978).

spination existing in regular intervals of 8-15 circles of 25-30 spines each, followed by a short non-spiny area. Trunk cylindrical, elongated, slightly swollen anteriorly in both sexes and aspinose posteriorly in females. Anterior trunk combs closely placed but those of posterior region widely set. Trunk spination with 18-34 ventral semicircular combs, each with 8-36 spines, spine number diminishes in trunk combs posteriorly. Trunk combs differ in number in both sexes. Pseudo-segmentation reflected in trunk spination. Lemnisci slender, equal, extending far beyond receptacle; in males 3.0-3.8 × 0.09-0.1 mm, in females 3.5-4.0 × 0.10-0.12 mm. Testes ovoid, subequal, in tandem, post-equatorial, not contiguous, anterior 0.75-0.85 × 0.30-0.41 mm, posterior 0.96-1.20 × 0.30-0.45 mm. Cement glands 5, elongate, 2.0-3.5 × 0.07-0.08 mm, their reservoir 0.60-0.80 × 0.20-0.30 mm. Bursa spherical, double-walled, 1.5-2.0 × 1.0-1.3 mm with bulbous cap. Uterine bell post-equatorial, wide anteriorly and narrow at posterior end, 0.45-0.50 × 0.09-0.10 mm. Uterus wide anteriorly and narrow posteriorly 1.70-20 × 0.060-0.09 mm. Vagina 0.30-0.325 × 0.12-0.25 mm. Eggs elliptical or ovoid, 0.10-0.12 × 0.03-0.04 mm, with polar prolongations of middle membrane. Embryos 0.085-0.090 × 0.027-0.035 mm, with three shells and polar prolongations of middle shell. Central nuclear mass prominent in embryo. Female gonopore terminal on a knob.

Host : *Rachycentron canadus* (Linnaeus). *Caranx kalla* (Cuvier & Valenciennes).

Paratenic hosts : *Nemipterus japonicus* (Bloch), *Johnius axillaris* (Cuvier & Valenciennes), *Pseudorhombus triocellatus* (Gunther), *Cynoglossus lingua* (Hamilton & Buchanon), *Silago sihama* (Rupp.), *Pterois miles* (Bonnett) in mesenteries.

Location : Intestine and pyloric caeca.

Locality : Trivandrum (Kerala).

Distribution : Known only from type locality.

167. ***Serrasentis psenesi*** Gupta, S.P. & Gupta, R.C. 1980 (Fig. 147)

Serrasentis psenesi Gupta, S.P. & Gupta, R.C. 1980 : 152-155, Pl. 6, Fig. 1-7; Gupta, V. & Sinha, 1990b : 50.

Description : Males 6.05-9.25 × 0.55-0.68 mm, females 8.78-8.98 × 0.67-0.68 mm. Proboscis club-shaped 0.7-1.2 × 0.45-0.48 mm, with 14-16 longitudinal rows of 20-22 in male; in female 1.05-1.24 × 0.43-0.61 mm with 15 longitudinal rows of 20-22 hooks each; hooks 0.05-0.105 mm long in each row, which increase in size at anterior subapical region and decrease in size towards base. Neck short 0.25-0.36 × 0.35-0.36 mm in males, in females 0.35-0.40 × 0.36-0.41 mm. A collar of spines present immediately behind neck. Proboscis receptacle long, cylindrical, double-walled with ganglion near its middle., 1.4-1.76 × 0.3-0.4 mm in males, in females 1.6-1.7 × 0.4-0.47 mm. Trunk elongate, flattened, slightly thinner at posterior end, 5.1-7.69 × 0.65-0.68 mm, with 14-16 rows of ventral transverse combs of 8-24 spines in each row in males, in females 7.34-7.4 × 0.67-0.68

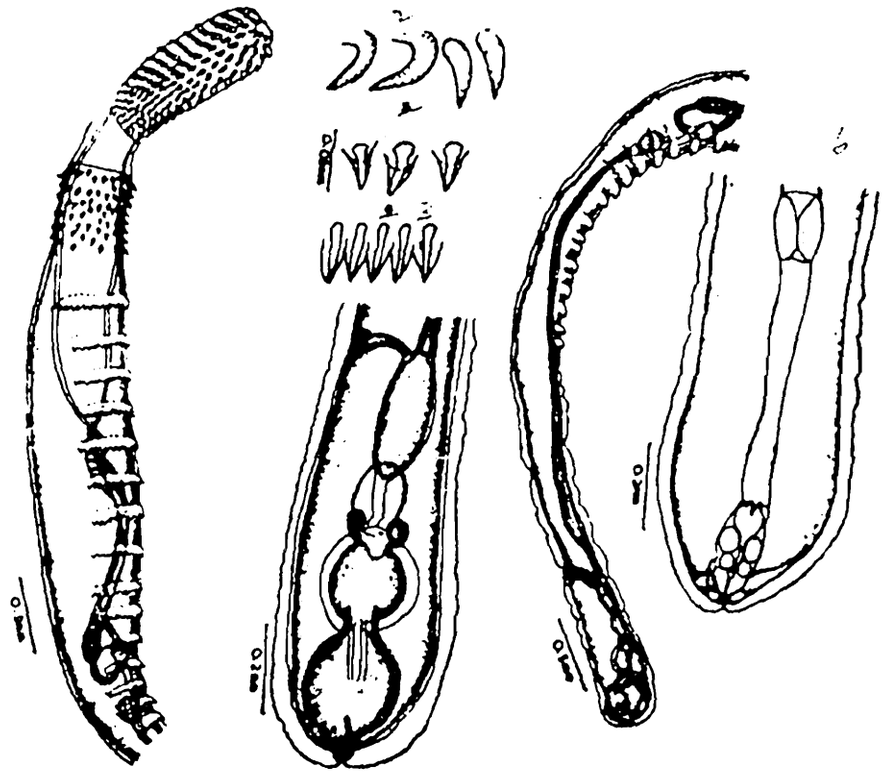


Fig. 147. *Serrasentis psenesi* Gupta, S.P. & Gupta, R.C. 1980. 1. Anterior part of worm, 2. Proboscis hooks enlarged, 3. Trunk spines enlarged, 4. Posterior part of female, 5. Posterior part of male (after Gupta, S.P. & Gupta, R.C., 1980).

mm, with 15-27 rows of ventral transverse combs of 18-28 spines in each row. Lemnisci 2, unequal, long, smaller 2.8-5.01 mm long, longer 3.0-5.43 mm long, extending up to testis in males, in females smaller lemniscus 3.02-3.18 mm long, longer 3.24-3.34 mm long extending up to midtrunk. Testes ovoid, separated, anterior 0.15-0.17 × 0.085-0.12 mm,, posterior 0.12-0.21 × 0.08-0.12 mm Common sperm duct runs posteriorly from testis. Cement glands 4, with long cement ducts and two cement reservoirs 0.06-0.09 × 0.04-0.005 mm, which open individually lateral to opening of sperm duct anterior to bursa. Seminal vesicle elongate 0.24-0.33 × 0.06-0.12 mm, with cuticular covering and connected by a ligament formed by union of outer covering of seminal vesicle and inner wall of body proper, 0.125-0.223 mm long. Bursa globular, elongate, 0.50-0.52 × 0.22-0.26 mm. Saefttigen's pouch ovate, 0.130.17 × 0.06-0.12 mm. Uterine bell 0.142-0.145 × 0.10-0.11 mm. Uterus elongate 0.72-0.74 × 0.075-0.080 mm. Vagina short, muscular 0.06-0.08 × 0.075 mm, with 2 pairs of vaginal muscles and vulva at its terminal end, Eggs and ovarian balls not observed.

Host : *Psenes indicus* (Day).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

168. ***Serrasentis sagittifer*** (Linton, 1889) Linton, 1932 (Fig. 148)

Echinorhynchus sagittifer Linton, 1889 : 493;

Serrasentis sagittifer (Linton) Van Cleave, 1924b : 326;

Serrasentis socialis (Leidy) Meyer, 1932 : 41;

Serrasentis chouhani Datta, 1953b : 52-54, Textfig, 1 a-d, 2 a-c;

Serrasentis longus Tripathi, 1959 : 75-76, Fig. 8 a, b;

Serrasentis sagittifer Yamaguti, 1963 : 111, Pl. 47, Fig. 477-479; Golvan & Houin, 1964 : 593-601, Fig. 33 A-L; Golvan, 1969 : 120-123, Fig. 84-87;

Serrasentis longa Golvan & Houin, 1964 : 602; Golvan, 1969 : 123;

Serrasentis chauhani Yamaguti, 1963 : 111, Pl. 46, Fig. 467, 468; Golvan & Houin, 1964 : 593-601, Fig. 33; Golvan, 1969 : 123; Anantaraman & Anantaraman, 1970 : 6;

Serrasentis socialis (Leidy) Anantaraman, M. & Anantaraman, S., 1970 : 6;

Serrasentis longa Anantaraman, M. & Anantaraman, S., 1970 : 6;

Serrasentis longiformis Bilqees, 1972a : 64-65,

Serrasentis giganticus Bilqees, 1973 : 60-65,

Serrasentis socialis Gupta, N.K. & Jain, 1977 : 3;

Serrasentis sagittifer, Gupta, P.D. & Ghosh, 1979 : 313; Farooqi, 1980 : 17; Soota & Bhattacharya, 1981 : 230-232,

Serrasentis socialis Gupta, N.K. & Jain, 1985 : 23-26, Textfig. 1-8;

Serrasentis socialis Duggal & Kaur, 1986b : 152-153, Fig, 9-17;

Serrasentis chouhani Textfig, 1 a-d, 2 a-c; Gupta, V. & Sinha, 1990b : 49; 52;

Serrasentis giganticus Gupta, V. & Sinha, 1990b: 49, 56; Bilqees & Khatoon, 1992 : 11-24;

Serrasentis sagittifer, Chandra, 1992 : 404, 406; 1993 : 648; Golvan, 1994 : 176. Arthur & Ahmed. 2002 : 39; Bhattacharya, 2007 : 101-102, Pl. 17, Fig. 96 a-h.

Description : Males 6.02-8.62 × 0.43-0.55 mm; females 6.03-6.43 × 0.40-0.63 mm. Proboscis large, club-shaped 0.85-0.94 × 0.37-0.39 mm in males; in females 0.90-0.97 × 0.34-0.39 mm, with strongly curved 24-26 longitudinal rows of 17-19 hooks each in males; in females 26 longitudinal rows of 17-19 hooks each hooks each Hooks 0.037-0.075 mm long in males; in females 0.045-0.073 mm long in females. Neck aspinose, short, 0.195-0.285 × 0.245-0.27 mm in male; in female 0.202-0.292 × 0.252-0.27 mm. Proboscis receptacle large, elongated, double-walled, with oval ganglion at its middle, 1.35-1.725 × 0.33-0.36 mm in males, in females 0.93-1.35 × 0.19-0.37 mm. Collar spines double, closely set, in 7-8 dorsally in complete circles of 14-16 spines each, of 0.036-0.46 mm long in males; in females 0.043-0.06 mm long. Trunk small, ventrally curved, slightly swollen in middle; externally furrowed giving appearance of annulation towards posterior end, with ventral transverse cuticular combs of spines, 16-21 in males and 17-19 in females. Each comb with 14-19 spines measuring 0.046-0.050 mm long in males; in females 16-19 spines measuring 0.048-0.057 mm long. Lemnisci a pair, long, filamentous, subequal, covering 1/3 of trunk, up to posterior testis, 0.3.44-0.39 mm and 3.0-4.45 mm long in male and

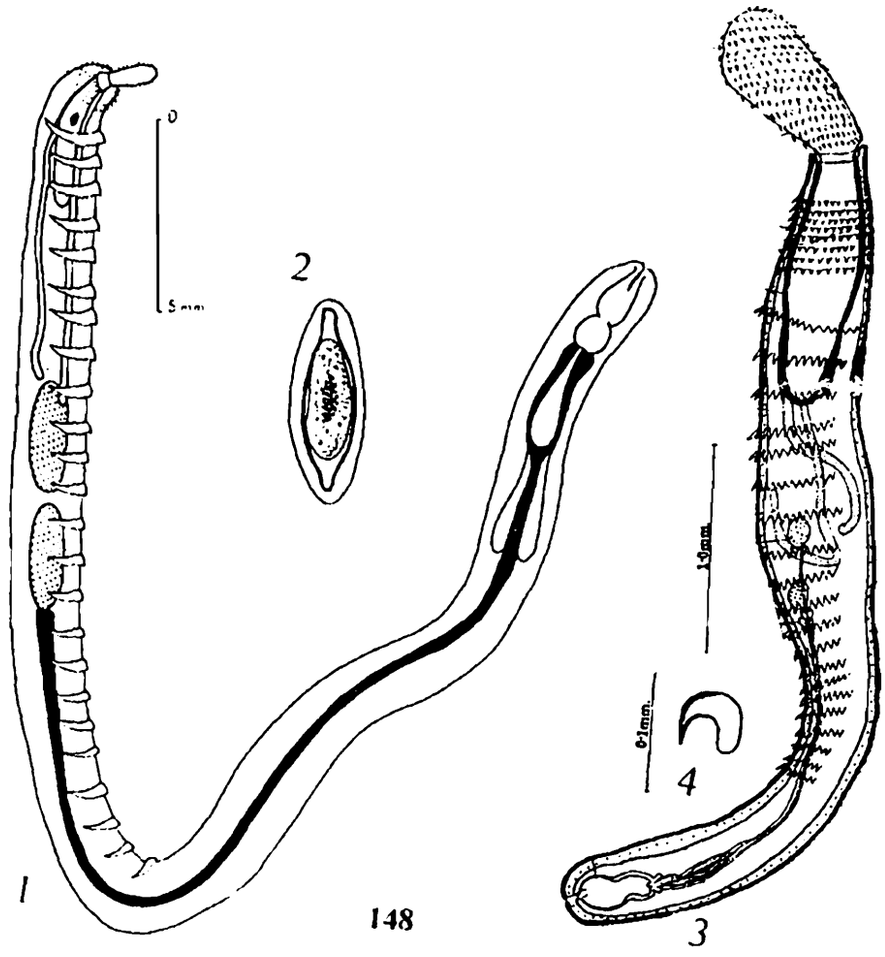


Fig. 148. *Serrasentis sagittifer* (Linton, 1889) Linton, 1932. 1. Male, 2. Egg enlarged, 3. Female, 4. Proboscis hook enlarged, (1,2 after Golvan, 1964, 3,4, after Tripathi, 1959).

in female 3.02-3.40 mm and 3.40-3.51 mm long. Testes small, oval, equatorial, one behind other, 0.18-0.24 mm apart, anterior 0.135-0.142 × 0.067-0.103 mm and posterior 0.15-0.16 × 0.11 mm. Cement glands 4, long, filamentous, 1.695-2.175 × 0.037-0.045 mm. Seminal vesicle 0.15-0.17 × 0.03-0.033 mm. Saefftigen's pouch 0.34-0.51 × 0.057-0.0575 mm. Bursa 0.225-0.465 × 0.15-0.30 mm. Uterus tubular 0.525-0.63 × 0.03-0.045 mm, leads into vagina, 0.15-0.165 × 0.06-0.063 mm, latter provided with vaginal muscles anteriorly. Vulva opens to outside terminally.

Host : *Psettodes erumei* (Bloch & Schnider); *Lutjanus johnii* (Bloch); *L. calcarifer* (Bloch); *Lutjanus* sp., *Rhinobates djaddensis* (Forskall) (=*Raja djeddensis*). *Cybium guttatum* (Lacepede), *Psenes indicus* (Day), *Arius serratus* Day, *Elacate nigra, Therapon jarbua* (Forsskal). *Rynchobates djeddensis. Nemipterus* sp.; *Rachycentrum canadus* (Linnaeus), *Istiophorus gladius*; *Synaltura cornuta; Trachinocephalus myops.* Juveniles in *Johnius dussamieri, Elops saurus, Pseudorhombus* sp.;

Location : Membranes on intestine.

Locality : Cochin, Calicut (Kerala); Chennai, Porto Novo (Tamil Nadu); Pondicherry;

Kakinada (Andhra Pradesh); Mumbai (Maharastra); Puri (Orissa); Chittagong, Cox's Bazar, Taknaf (Bangladesh); Karachi (Pakistan).

Distribution : West Africa; Atlantic coast of North America; Australia.

169. ***Serrasentis sciaenus*** Bilqees, 1972
(Fig. 149)

Serrasentis sciaenus Bilqees, 1972 : 121-124; Bilqees & Khan, 1987 : 21, Fig. 31; Golvan, 1994 : 176.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Worms medium sized. Male body elongated, 5.35-5.50 mm long, with posterior end narrow. Proboscis cylindrical armed with 20 longitudinal rows of hooks. Neck aspinose, short, 0.195-0.285 × 0.245-0.27 mm in male; in female 0.202-0.292 × 0.252-0.27 mm. Proboscis receptacle double-walled with ganglion about its middle. Neck short and separated from trunk by a dark stained band of tissue. Collar region prominent, with 9 rows of spines. Twenty four comb-like ventral transverse bands of hooks. Trunk elongated, maximum width in region of testes, narrow posteriorly. First band with more hooks than 23 bands which have equal number of spines. Lemnisci shorter than receptacle. Testes in anterior half of trunk. Cement glands 4, pyriform, situated in posterior quarter of trunk and connected with testes by a duct. Bursa well developed. Female not known.

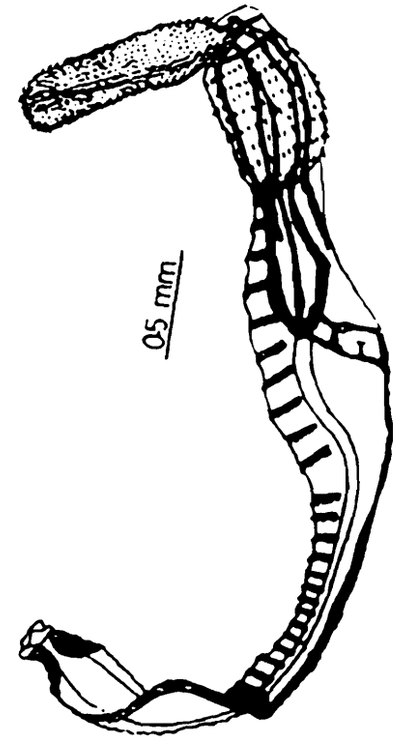


Fig. 149. *Serrasentis sciaenus* Bilqees, 1972. Male (after Bilqees, 1972).

Host : *Sciaena dussamieri* Cuvier & Valenciennes.

Location : Intestine.

Locality : Karachi coast, Sindh, Pakistan.

Distribution : Known only from type locality.

6. Order POLYMORPHIDA Petrotschenko, 1956

Polymorphidae Petrotschenko, 1956 : 354; Yamaguti, 1963 : 69; Bhattacharya, 2007 : 146.

Diagnosis : Palaeacanthocephala. Proboscis or trunk may be bulbous. Proboscis long, cylindrical or ovate club-shaped. Hooks on proboscis often differ in size, either along proboscis or on ventral and dorsal surfaces. Proboscis receptacle double-walled with ganglion in its middle. Trunk spinose. Hypodermal nuclei small and numerous. Lemnisci long, often flattened. Cement glands 1-6, exceptionally 8, multiple, long and tubular or

pear-shaped. Eggs elongated, fusiform, with three membranes, middle membrane always with forms of protrusions at poles. Embryonic larva of hemiechinate type. Parasites of birds and mammals.

Includes three families, 1. Polymorphidae Meyer, 1931, 2. Centrorhynchidae Van Cleave, 1916 and 3. Plagiorhynchidae Golvan, 1960, all occur in this subcontinent.

Key to families of order POLYMORPHIDA

1. Trunk spinose ..... POLYMORPHIDAE
– Trunk aspinose 2
1. Eggs with or without polar prolongations of middle shell ..... LAGIORHYNCHIDAE
– Eggs without polarprolongations of middle shell ..... CENTRORHYNCHIDAE

14. Family CENTRORHYNCHIDAE Van Cleave, 1916

Centrorhynchidae Van Cleave, 1916 : 227; Southwell & Macfie, 1925 : 161;
Centrorhynchinae Travassos, 1920 : 7; Meyer, 1931 : 51; 1932 : 100;
Centrorhynchidae Petrotschenko, 19568 : 196; Yamaguti, 1963 : 119;
Centrorhynchinae Yamaguti, 1963 : 119.
Centrorhynchidae Bhattacharya, 2007 : 166.

Diagnosis : Polymorphida. Proboscis usually cylindrical, sometimes swollen basally, divided by insertion of its receptacle into 2 parts, with longitudinal rows of hooks. Proboscis receptacle elongate, double-walled, inserted at about middle of proboscis, with central ganglion. Trunk slender, aspinose, occasionally with internal pseudo-segmentation. Hypodermic nuclei small, numerous, or large and less numerous. Lacunar system with lateral main channels and circular or reticular anastomoses. Lemnisci long. Testes in anterior part of trunk. Cement glands 1-6, slender. Ova with concentric membranous shells, without polar prolongations of middle shell. Parasites of birds and mammals.

Type genus : *Centrorhynchus* Lühe, 1911.

Includes three genera, 1. *Centrorhynchus* Lühe, 1911, 2. *Sphaerirostris* Golvan, 1956 and 3. *Neolacunisoma* Amin & Al, 1997, of which first two genera occur in this subcontinent.

Key to genera of family CENTRORHYNCHIDAE

– Proboscis short and spherical ..... *Sphaerirostris*
– Proboscis long and cylindrical ..... *Centrorhynchus*

42. Genus ***Centrorhynchus*** Lühe, 1911

Centrorhynchus Lühe, 1911 : 1-116;
Centrorhynchus Southwell & Macfie, 1925 : 162-163;

Gordiorhynchus Meyer, 1932 : 100;

Centrorhynchus Petrotschenko, 1958 : 197; Yamaguti, 1963 : 119-120;

Travassosina Yamaguti, 1963 : 119;

Centrorhynchus Golvan, 1994 : 141; Bhattacharya, 2007 : 167.

Diagnosis : Polymprphida, Centrorhynchidae. Proboscis usually cylindrical, sometimes slightly swollen, divided by insertion of receptacle into two parts, of which anterior part entirely or partially armed with rooted hooks, and posterior part with rootless spines. Hooks and spines arranged in 16-48 longitudinal rows of 8-40 hooks each. Neck absent. though portion of proboscis posterior to insertion of receptacle may be termed "neck" by some authors. Proboscis receptacle cylindrical or subcylindrical, double-walled, inserted to inside of proboscis at about its middle. Ganglion usually about middle of receptacle. Trunk cylindrical, slender, sometimes fusiform, aspinose, occasionally showing internal pseudo-segmentation as artifact. Lemnisci usually slender, reaching beyond receptacle. Testes in tandem, near anterior end of trunk. Cement glands 1-6, very long and slender, not well defined from their ducts. Genital pores not exactly terminal, not surrounded by spines, occasionally with a digitiform appendage and/or a small protuberance. Eggs oval to elliptical, with concentric membranes, middle shell without polar prolongations. Adults parasitic in birds, especially Raptores and mammals; larvae in invertebrates., Amphibia, reptiles and mammals.

Type species : *Centrorhynchus aluconis* (Müller, 1780) Lühe, 1911.

Includes ninety two species, 1. *Centrorhynchus albense* Rengaraju & Das, 1975, 2. *C. aluconis* (Muller, 1780) Lühe, 1911, 3. *C. amphibius* Das, 1950, 4. *C. atheni* Gupta, V. & Fatma, 1983, 5. *C. batrachus* Das, 1952, 6. *C. bengalensis* Datta & Soota, (1954) 1955, 7. *C. bethaniae* George & Nadakal, 1987, 8. *C. bilqeesi* Gazi, Khan & Noorun-Nisa, 2005, 9. *C. brama* Rengaraju & Das, 1980, 10. *C. brevicaudatus* Das, (1949) 1950, 11. *C. buckleyi* Gupta, V. & Fatma, 1981, 12. *C. buteonis* (Goeze, 1782 in Schrank, 1782) Kostylew, 1914, 13. *C. clitorideus* (Meyer, 1931) Golvan, 1956, 14. *C. conspectus* Van Cleave & Pratt, 1940, 15. *C. crocidurus* Das, 1950, 16. *C. fisheri* Bhattacharya, 1999, 17. C. *gibsoni* Khan, Gazi & Bilqees, 2002, 18. *C. gigantesm* Travassos, 1921, 19. *C. globocaudatus* (Zeder, 1800) Lühe, 1911, 20. *C. golvani* Anantaraman, M. & Anantaraman, S. 1969, 21. *C. guptai* Golvan, 1969, 22. *C. hargisi* Gupta, V. & Fatma, 1983, 23. *C. horridus* (Linstow,1897) Meyer, 1932, 24. *C. javanicus* Rengaraju & Das, 1975, 25. *C. knowlesi* Datta & Soota, (1954) 1958, 26. *C. latai* Golvan, 1994, 27. *C. longicephalus* Das, 1950, 28. *C. lucknowensis* Gupta, V. & Fatma, 1983, 29. *C. macrorchis* Das, (1949) 1950, 30. *C. magnus* Fukui, 1929, 31. *C. microcephalus* (Bravo-Hollis, 1947) Golvan, 1956, 32. *C. microrchis* Fukui, 1929, 33. *C. migrans* Zuberi & Farooqui, 1974, 34. *C. milvus* Ward, 1956, 35. *C. mysentri* Gupta, V. & Fatma, 1983, 36. *C. opimus* Travassos, 1919, 37. *C. ovali* Bhattacharya, 1999, 38. *C. ptyasus* Gupta, 1950, 39. *C. sharmai* (Gupta, N.K. & Lata, 1966), 40. *C. sholapurensis* Rengaraju & Das, 1975, 41. *C. sikkimensis* Bhattacharya. 2003, 42. *C. sindensis* Khan, Khatoon & Bilqees, 2002, 43. *C. smyrnensis Bhattacharya, 2007*,44. *C. spilornae* Schmidt & Kuntz, 1969, 45. *C. spinosus* (Kaiser, 1893) Van Cleave, 1924, 46. *C. tumidulus* (Rudolphi, 1819)

Neiva da Cunha & Travassos, 1914, 47. *C. tytoensis* Rengaraju & Das, 1975, 48. *C. acanthotrias* (Linstow, 1883) Petrotschenko, 1958, 49. *C. albidus* Meyer, 1932, 50. *C. appendiculatus* (Westrumb, 1821) Joyeux & Baer, 1937, 51. *C. asturinus* (Johnston, 1912) Johnston, 1918, 52. *C. bancrofti* (Johnston & Best, 1943) Golvan, 1958, 53. *C. bazaleticus* Kurshvili, 1955, 54. *C. brunpti* Golvan, 1965, 55. *C. brygooi* Golvan, 1965, 56. *C. bubonis* Yamaguti, 1939, 57. *C. californicus* Millzner, 19609. *C. dimorphocephalus* (Westrumb, 1821) Meyer, 1932, 61. *C. dipsadis* (Linstow, 1888) Golvan, 1956, 62. *C. falconis* (Johnston & Best, 1943) Golvan, 1956, 63. *C. freundi* (Hartwich, 1953) Golvan, 1956, 64. *C. fukiensis* Wang Pu Qin, 1966, 65. *C. gallardi* Golvan, 1956, 66. *C. gendrei* (Golvan, 1957) Golvan, 1960, 67. *C. glaucidii* Wang Pu Qin, 1966, 68. *C. (Malgacanthus) grassei* Golvan, 1965, 69. *C. hagiangensis* (Petrotschenko & Phan The Viet, 1969) Amin,1985, 70. *C. hartwichi* Golvan, 1994, 71. *C. insularis* Tubangui, 1933, 72. *C. itatsinis* Fukui, 1929, 73. *C. kuntzi* Schmidt & Neiland, 1966, 74. *C. leptorhynchus* Meyer, 1932, 75. *C. mabuiae* (Linstow, 1980) Golvan, 1956, 76. *C. madagascariensis* (Golvan, 1957) Golvan, 1960, 77. *C. merulae* Dollfus & Golvan, 1961, 78. *C. narcissae* Florescu, 1942, 79. *C. nicaraguensis* Schmidt & Neiland, 1966, 80. *C. ninnii* (Stosich, 1891) Meyer, 1932, 81. *C. olssoni* Lundstrom, 1942, 82. *C. petrotschenkoi* Kurashvili, 1955, 83. *C. polemaeti* Troncy, 1970, 84. *C. polyacanthus* (Creplin, 1825) Kostelew, 1914, 85. *C. pycnonoti* Wang, 1986, 86. *C. renardi* (Linderman, 1895) Van Cleave, 1924, 87. *C. robustus* Richardson & Nickol, 1995, 88. *C. simplex* Meyer, 1932, 89. *C. sinicus* Wang Pu Qin, 1966, 90. *C. undulatus* (Nitzsch in Giebel, 1886) Dollfus1951,91. *C. wardae* Halloway, 1958 and 92. *C. wedli* (Sonsino, 1896) Porta, 1909 of which first 47 occur in the subcontinent :

Key to Indian species of genus *Centrorhynchus*

1. Cement gland single ..... *Centrorhynchus brevicaudatus*
– Cement glands six ..... *Centrorhynchus hargisi*
– Cement glands two to four on none 2
2. Cemeny glands two 3
– Cement glands three 8
– Cement glands four 13
– Cement glands not known 15
3. Proboscis with 23-30 longitudinal rows of 21-23 hooks each ..... *Centrorhynchus latai*
– Proboscis with24-26 longitudinal rows of 9-10 hooks each ..... *Centrorhynchus mysentri*
– Proboscis with26 longitudinal rows of hooks 4
4. Proboscis with 26 longitudinal rows of 10 hooks each ..... *Centrorhynchus albense*

– Proboscis with 26 longitudinal rows of 11-12 hooks each ..... *Centrorhynchus tumidulus*

– Proboscis with 26 longitudinal rows of 20-25 hooks each ..... *Centrorhynchus buckleyi*

– Proboscis wuth more than 26 longitudinal rows of hooks 5

5. Proboscis with 26-28 longitudinal rows of 28-30 hooks each ..... *Centrorhynchus atheni*

– Proboscis with 26-28 longitudinal rows of 30-32 hooks each ..... *Centrorhynchus spilornae*

Proboscis with 28 longitudinal rows of hooks 6

6. Proboscis with 28 longitudinal rows of 9 hooks each ..... *Centrorhynchus javanicus*

– Proboscis with 28-30 longitudinal rows of 10+10 hooks each ..... *Centrorhynchus tytoensis*

– Proboscis with 28 longitudinal rows of 10+10 hooks each ..... *Centrorhynchus brama*

– Proboscis with 28 and more longitudinal rows 7

7. Proboscis with 28-32 longitudinal rows of 15-16 hooks each ..... *Centrorhynchus horridus*

– Proboscis with 30-32 longitudinal tows of 8 hooks each ..... *Centrorhynchus buteonis*

– Proboscis with 30-32 longitudinal tows of 8 hooks each ..... *Centrothynchis ovali*

8. Proboscis with 30-34 longitudinal rows of 20-21 hooks each ..... *Centrorhynchus amphibius*

– Proboscis with 40-42 longitudinal rows of 28-30 hooks each ..... *Centrorhynchus sikkimensis*

9. Proboscis with 14 longitudinal rows of 8-9 hooks each ..... *Centrorhynchus golvani*

– Proboscis with 18 longitudinal rows of 15-16 hooks each ..... *Centrorhynchus smyrnensis*

– Proboscis with more than 18 longitudinal rows of hooks 10

10. Proboscis with 20 longitudinal rows of 18 hooks each .....

– Proboscis with 24-28 longitudinal rows of hooks 11

11. Proboscis with 24 longitudinal rows of 6-7 hooks each ..... *Centrorhynchus opimus*

– Proboscis with 28 longitudinal rows of 15-16 hooks each .... *Centrorhynchus fisheri*

– Proboscis with more tham 28 longitudinal rows of hooks each 12

12. Proboscis with 30 longitudinal rows of 12-13 hooks each .... *Centrorhynchus clitoredius*

– Proboscis and nexk with 30-32 longitudinal rows of 20-22 hooks each .... *Centrorhynchus lucknowensis*

– Proboscis with 32 longitudinal rows of 13 hooks each, ...*Cventrorhynchus microrchis*

13. Proboscis with 12 longitudinal rows of 10 hooks each..... *Centrorgynchus bilqeesi*

– Proboscis with 28-30 longitudinal rows of 23-26 hooks each in male, in female 24-28 longitudina,l rows of 10 hooks each.....*Centrorhynchus macrorchis*

– Proboscis with 29-32 longitudinal rows of 22-27 hooks each .... *Centrorhynchus spinosus*

– Proboscis with 30 longitudinal rows of 16 hooks each ..... *Centrorhynchus migrans*

– Proboscis with 28-32 longitudinal rows of 11-13 hooks each .... *Centrorhynchus conspectus*

– Proboscis with up to 35 and 40 longitudinal tows of hooks 14

14. Proboscis with 30-34 longitudinal rows of 18-19 hooks each .... *Centrorhynchus globocaudatus*

proboscis with 32-35 longitidinal rows of 16-20 hooks eacheach in male and in female 32-38 longitudinal rows of 16-20 hooks ..... *Centrorhynchus bethanae*

– Proboscis with 35-40 longitudinal rows of 24-26 hooks each..... ..... *Centrorhynchus magnus*

15. Proboscis with 14 longitudinal rows of 20 hooks each ..... *Centrorhynchus gibsoni*

– Proboscis with 14 longitudinal rows of 8-9 hooks each.....*Centrorhynchus guptai*

– Proboscis with more than 14 and up to 20 longitudinal rows of hooks 16

16. Proboscis and neck with 18-20 longitudinal rows of 16-24 hooks each .... *Centrorhynchus sindensis*

– Proboscis with 22-24 lomgitudinal rows of hooks..... 17

17 Proboscis with 22-24 longitudinal rows of 24-26 hooks each..... ..... *Centrorhynchus giganteum*

– Proboscis with 22-24 longitudinal rows of 26-28 hooks each..... .....*Centrorhynchus ptyasus*

– Proboscis with up to 28 longitudinal rows of hooks..... 19

19. Proboscis with 24-26 longitudinal rows of 30 hooks each ..... *Centrorhynchus longicephalus*

– Proboscis with26-28 longitudinal rows of 13 hooks each ..... *Centrorhynchus sholapurensis*

– Proboscis with 28 longitudinal rows of 9-10 hooks each *Centrorhynchus batracus*

– Probosxis with 28 and more longitudinal rows of hooks 20

20. Proboscis with 28-30 longitudinal rows of 15 hooks each ..... *Centrorhynchus aluconis*

– Proboscis with 28-30 longitudinal rows of 15 hooks each ..... *Centrorhynchus elongatus*

– Proboscis with 32 longitudinal rows of 13 hooks each ..... *Centrorhynchus milvus*

– Proboscis with 32 longitudinal rows of 10-11 hooks each ..... *Centrorhynchus sharmai*

– Proboscis with 32 longitudinal rows of 10-15 hooks each ..... *Centrorhynchus microcephalus*

– Proboscis with more than 34 longitudinal rows of 13 hooks each 21

21. Proboscis with 34-38 longitudinal rows of 23-25 hooks each ..... *Centrorhynchus crocidurus*

– Proboscis with 35-40 longitudinal rows of 14-18 hooks each ..... *Centrorhynchus bengalensis*

– Proboscis with 42-46 longitudinal rows of 14-16 hooks each ..... *Centrorhynchus knowlesi*

170. ***Centrorhynchus albense*** Rengaraju & Das, 1975
(Fig. 150)

Centrorhynchus albense Rengaraju & Das, 1975: 42-44, Fig. 1-3; Golvan, 1994 : 141.

Type locality : Sholapur, Maharastra, India.

Description : Mature male 19 × 0.9 mm. Proboscis 0.78 × 0.36 mm, with 26 longitudinal rows of 10 hooks each, Neck 0.64 × 0.48 mm. Proboscis receptacle double-walled, 1.3 × 0.2 mm. Lemnisci 2.43 mm long, extends to a distance of 1.1 mm beyond base of receptacle. Testes subequal, anterior smaller 1.02 × 0.39 mm, posterior 1.11 × 0.42 mm. Cement glands 2, long, tubular, extend from posterior testis to Saefftigen's pouch. Saefftigen's pouch 3.95 × 0.7 mm. Bursal cap everted with distally attenuated digitiform rays. Bursa 1.25 × 1.1 mm. Female not known.

Host : *Tyto alba javanica.*

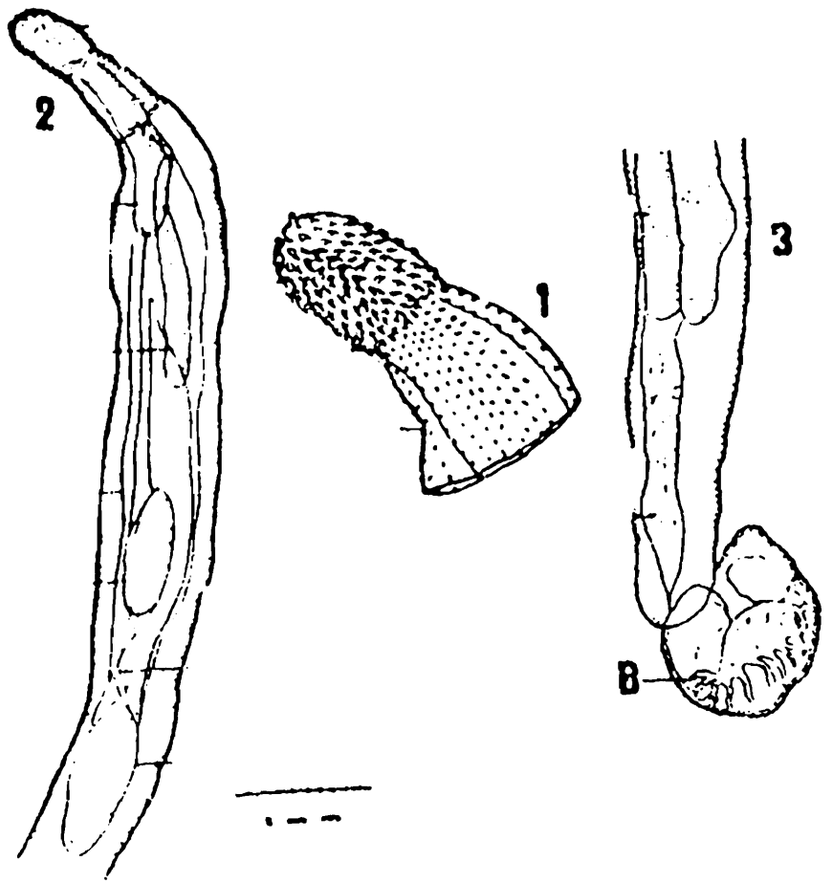


Fig. 150. *Centrorhynchus albense* Rengaraju & Das, 1975. 1. Proboscis and neck enlarged, 2. Anterior part of male, 3. Posterior part of male (after Rengaraju & Das, 1975).

Location : Small intestine.

Locality : Sholapur (Maharastra).

Distribution : Known only from type locality.

171. ***Centrorhynchus aluconis*** (Müller, 1780) Lühe, 1911
(Fig. 151)

Centrorhynchus aluconis (Müller, 1780) Lühe, 1911 : 1-60, 1-116; Subramanian, 1927c: 211-212; Meyer, 1932 : 100-101, Fig. 80-81; Petrochenko, 1958 : 201-202, Fig, 98; Yamaguti, 1963 : 120, Pl. 57, Fig. 590-592; Gupta, N.K. & Jain, 1973 : 555; Rengaraju & Das, 1976b : 263-269; Jain & Gupta, N.K. 1984 : 15; Duggal, Soloman & Ambardar, 1987 : 25, Golvan, 1994 : 141; Bhattacharya, 2003 : 75; 71-78, 2007: 173, Pl. 30, Fig. 162 a-c.

Description : Male 6-25 × 0.5-0.8 mm; female 11-45 × 0.8-1.5 mm. Anterior part of proboscis elongated, 0.50 × 0.30 mm, posterior part short, 0.23 × 0.20 mm, with about 28-30 longitudinal rows of 15 hooks each, of which 6-7 anterior hooks with well developed roots and widening towards posterior end and 11-11 hooks undeveloped, spine like, which are small radical processes directed anteriad. × 0.27 mm. Neck 0.075 × 0.27 mm. Proboscis

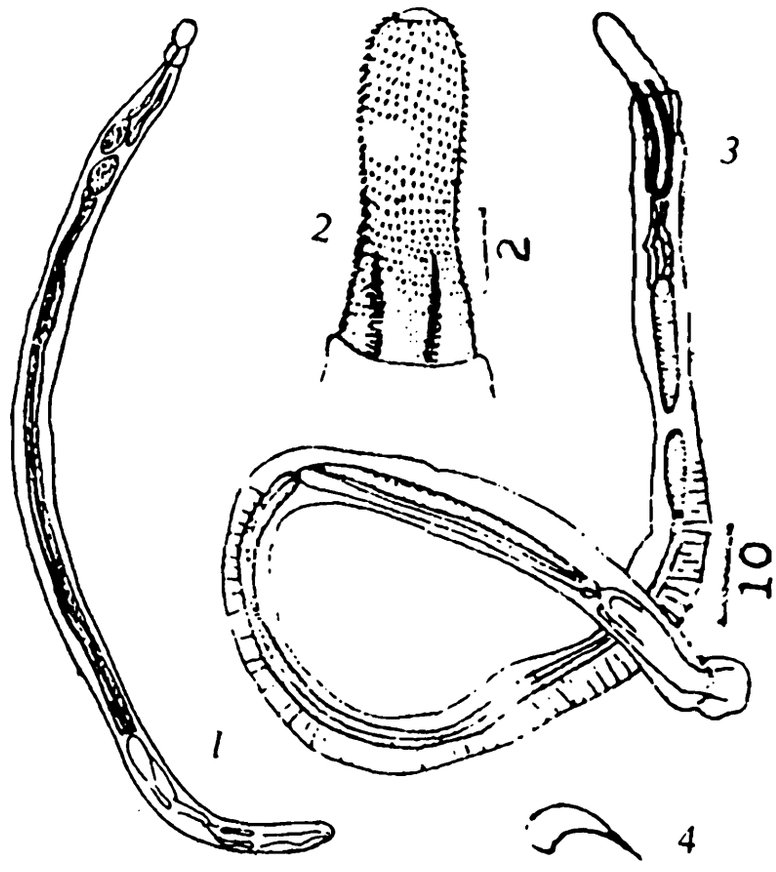


Fig. 151. *Centrorhynchus aluconis* (Müller, 1780) Lühe, 1911. 1. Male, 2. Proboscis enlarged, 3. Female, 4. Proboscis hooks enlarged (after Yamaguti, 1963).

receptacle attached to middle of proboscis, 1.32 × 0.27 mm. Trunk long, cylindrical, slightly swollen anteriorly. Lemnisci equal, 1.39 × 0.15 mm. Uterus 0.483 × 0.085 mm. Vagina 0.0295 × 0.085 mm. Vaginal sphincters two, 0.08 and 0.09 mm wide.

Host : *Falco jugger* (Gray), *Milvus migrans* (Boddaert); encysted juveniles from toad; *Bufo* sp.

Location : Intestine.

Locality : Amboya (Uttar Pradesh); Foodong (Sikkim), Rangoon (Burma).

Distribution : China; Morocco; Europe; Australian preserve; France.

172. ***Centrorhynchus amphibius*** Das, 1950
(Fig. 152)

Centrorhynchus amphibius Das, 1950a : 51-53, Fig. 2 (juvenile); Petrotschenko, 1958 : 203; Yamaguti, 1963 : 127; Anantaraman, M. & Anantaraman, S., 1970 : 6; Schmidt & Kuntz, 1969 : 331, Fig. 6-10; Golvan, 1994 : 141; Bhattacharya, 2007 : 180, Pl. 31, Fig. 168 a,b.

Type locality : Amraoti, Maharastra, India.

Description : Male 20-21 × 0.40-0.57 mm; females 66-70 × 0.6-0.7 mm. Proboscis with swelling near middle, just above insertion of proboscis receptacle, in males 0.77-0.87 mm long, 0.22-0.27 mm wide at middle swelling and 0.25-0.32 mm wide at base; in females 0.86-0.90 mm long, 0.28-0.29 mm wide at middle swelling, about 0.38 mm wide at base. Armature similar in both sexes, with 30-34 longitudinal rows of 20-21 hooks each, first 7 or 8 hooks in each row with strong roots and slight anterior blade, next 3 hooks transitional, each with reduced root, with 2 anteriorly directed blades, rest of hooks spiniform rootless, each with small blade. First 4 hooks 0.021-0.044 mm long, next 3 hooks 0.36-0.042 mm long, remaining spines 0.031-0.039 mm long. Neck almost non-existant. Proboscis receptacle receptacle 1.3 × 0.26 mm in males, in females 1.3-1.5 × 0.30 mm. Trunk cylindrical, elongate, slightly swollen near anterior end. Lemnisci flat, bound

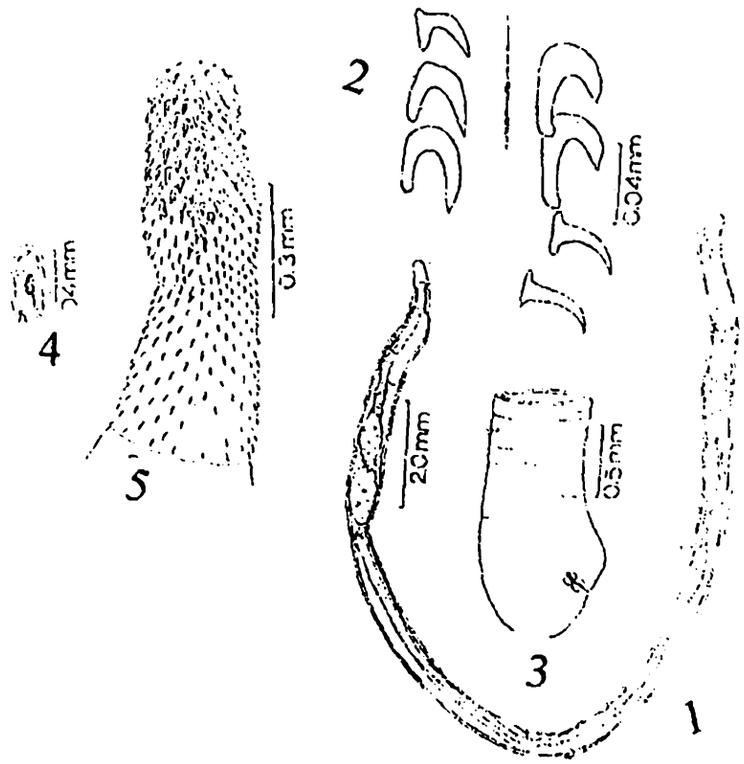


Fig. 152. *Centrorhynchus amphibius* Das, 1950. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Eggs enlarged, 5. Proboscis enlarged (after Das, 1950).

distally to trunk wall by ligaments, slightly longer than receptacle, in males 1.45-1.5 mm long, in females 1.7-1.8 mm long. Testes ovoid, in tandem, or slightly overlapping, anterior 0.87-0.96 × 0.36-0.39 mm, posterior 1.0-1.1 × 0.36-0.48 mm. Cement glands 2, tubular behind posterior testis. Bursa not observes. In female genitalia obscured by eggs. Eggs 0.047-0.049 × 0.021-0.023 mm, outer shell sculptured with longitudinal ridges and grooves. Gonopore terminal in male, and vento-subterminal in females.

Host : *Rana tigrina* (Daudin). *Ptyas mucosus* Linnaeus.

Location : Mesentery, intestine.

Locality : Amraoti (Maharastra).

Distribution : China.

173. ***Centrorhchus atheni*** Gupta, V. & Fatma, 1983 (Fig. 153)

Centrorhynchus atheni Gupta, V. & Fatma, 1983: 105-107, Pl. 1, Fig. 1-5;

Centrorhynchus (Malgacanthus) atheni Golvan, 1994 : 141; Bhattacharya, 2007 : 167, Pl. 28, Fig. 151 a-d.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Males 18.5-21.24 × 0.61-0.84 mm, female 30 × 0.78 mm. Proboscis cylindrical, 0.85-0.86 mm long, 0.30-0.60 mm in males; in females 0.95 × 0.28 mm. Both proboscis and neck armed with 26-28 longitudinal rows of 28-30 hooks each, radially and symmetrically arranged, 6-8 hooks on anterior proboscis, long, curved, broad based, with recurved blade 0.045-0.06 mm long, embedded in proboscis wall, remaining spines on neck 0.025-0.035 mm long. Neck 0.25-0.30 × 0.20-0.30 mm in males; in females 0.40 ×

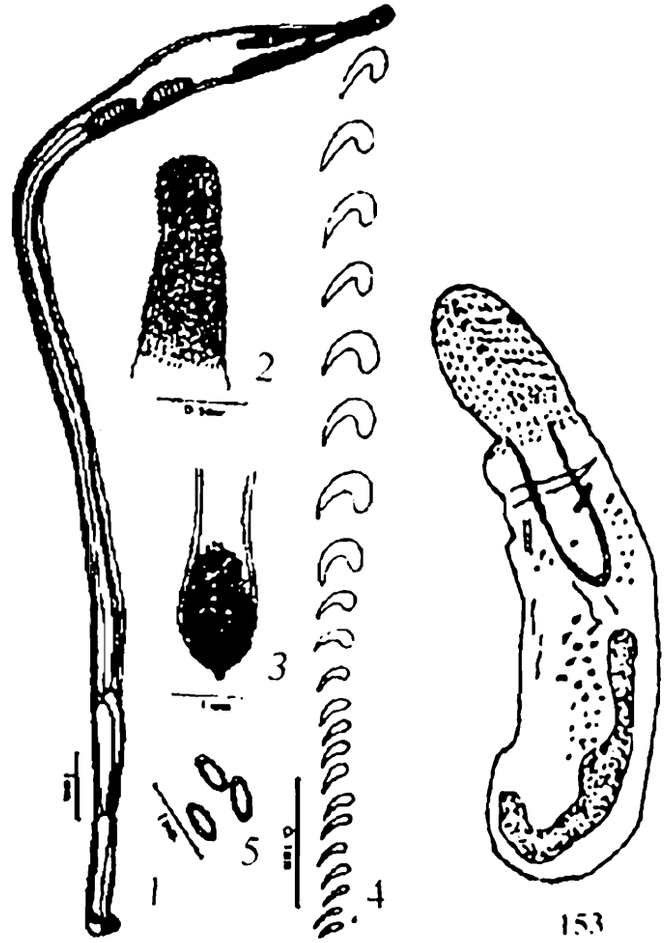


Fig. 153. *Centrorhynchus atheni* Gupta, V. & Fatma, 1983. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Ova, 5. Row of proboscis hooks enlarged (after Gupta, V. & Fatma, 1983).

0.45 mm. Proboscis receptacle cylindrical, double-walled, 0.82-0.90 × 0.15-0.20 mm in males, in females 0.80 × 0.55 mm, with ganglion at its middle. Trunk elongated, cylindrical, aspinose, with internal pseudo-segmentation, slightly swollen towards anterior end, with rounded distal end. Lacunar system with lateral channels and circular or reticular anastomoses. Hypodermal nuclei small, numerous, evenly distributed. Lemnisci two, equal, elongated, narrow, longer than proboscis receptacle, 1.15-1.56 mm long in males, in females 1.6 mm long. Testes ovoid, equal, in tandem, pre-equatorial, overlapping each other, anterior 0.72-0.76 × 0.20-0.22 mm, posterior 0.72-0.76 × 0.20-.022 mm. Cement glands 2, tubular, 10.8-11.64 mm long. Seminal vesicles pyriform 1.85-2.0 × 0.15 –0.18 mm. Bursa muscular, elongated, eversible 1.80-1.92 × 0.20-0.25 mm. Gonopore terminal. Ovarian balls and ova scattered all over body cavity. Uterine bell 0.45 × 0.15 mm. Uterus 0.64 × 0.20 mm. Vagina 0.21 × 0.15 mm, opening posteriorly by subterminal genital pore, with a digitiform appendage. Eggs elliptical, without polar prolongation of middle shell, 0.0287-0.040 × 0.018-0.020 mm.

Host : *Athene brama* (Temminck).

Location : Intestine.

Locality : Prince of Wales Zoological Gardens, Lucknow (Uttar Pradesh).

Distribution : Known only from type locality

174. ***Centrorhynchus batracus*** Das, 1952

Centrorhynchus batrachus Das, 1952c : 148-154, Pl. 4, Fig. 1-6; (juvinile): Yamaguti, 1963: 127; Anantaraman, M. & Anantaraman, S., 1970: 7;

Type locality : Amraoti, Maharastra, India.

Description : Male and female of same size, female 11.7 × 1.82 mm. Proboscis globular anteriorly, 0.51 × 0.43 mm, posterior part cylindrical, 0.22 × 0.42 mm wide, with 28 longitudinal rows of 9-10 hooks each. Hooks of anterior part large, rooted, 0.02-0.04 × 0.022-0.030 mm, of posterior part short, rootless, 0.015-0.022 × 0.006 mm. Neck 0.12 × 0.44 mm. Proboscis receptacle anteriorly inserted almost up to middle of proboscis, 1.26 × 0.45 mm. Trunk cylindrical. Lemnisci subequal, 0.6-0.75 × 0.18-0.22 mm. Uterine bell ovoid, 1.5 × 0.1 mm. Uterus wide 0.52 × 0.06 mm. Vagina funnel-shaped, 0.24 × 0.1 mm with anterior vaginal sphincter 0.1 × 0.15 mm and posterior sphincter 0.12 × 0.13 mm.

Host : *Corvus splendens* (Vieillot) *Hierococcyx varius* (Vahl); *Dendrocitta vagabunda* (Latham), juvenile in *Rana tigrina* Daud, *Bufo* sp., *Hemidactylus brooki*, *Calotes* sp., *Bungarus coeruleus*, *Boiga trigonata*, *Natrix stolatus*, *Tropidonotus* sp., *Herpestes edwardsii*, *Porcillanides pruinosus;* (Crustacean).

Location : Intestine, gizzard.

Locality : Juvenile in Amroti (Maharastra); Chandigarh; Punjab.

Distribution : Known only from Indian subcontinent.

175. ***Centrorhynchus bengalensis*** Datta & Soota, 1958
(Fig. 154)

Centrorhynchus bengalensis Datta & Soota, 1958 : 18-20, Textfig. 3 a, b; Yamaguti, 1963 : 121, Pl. 53, Fig. 552, 553; Sahay & Sinha, 1969: 292-296, Fig. 1-6; Anantaraman, M. & Anantaraman, S., 1970 : 6; Gupta, P.D. & Ghosh, 1979 : 313; Golvan, 1994 : 141; Bhattacharya, 2007 : 179, Pl. 30, 35, Fig. 165 a, b, 194 a-c.

Type locality : Kolkata, West Bengal, India or Patna, Bihar.

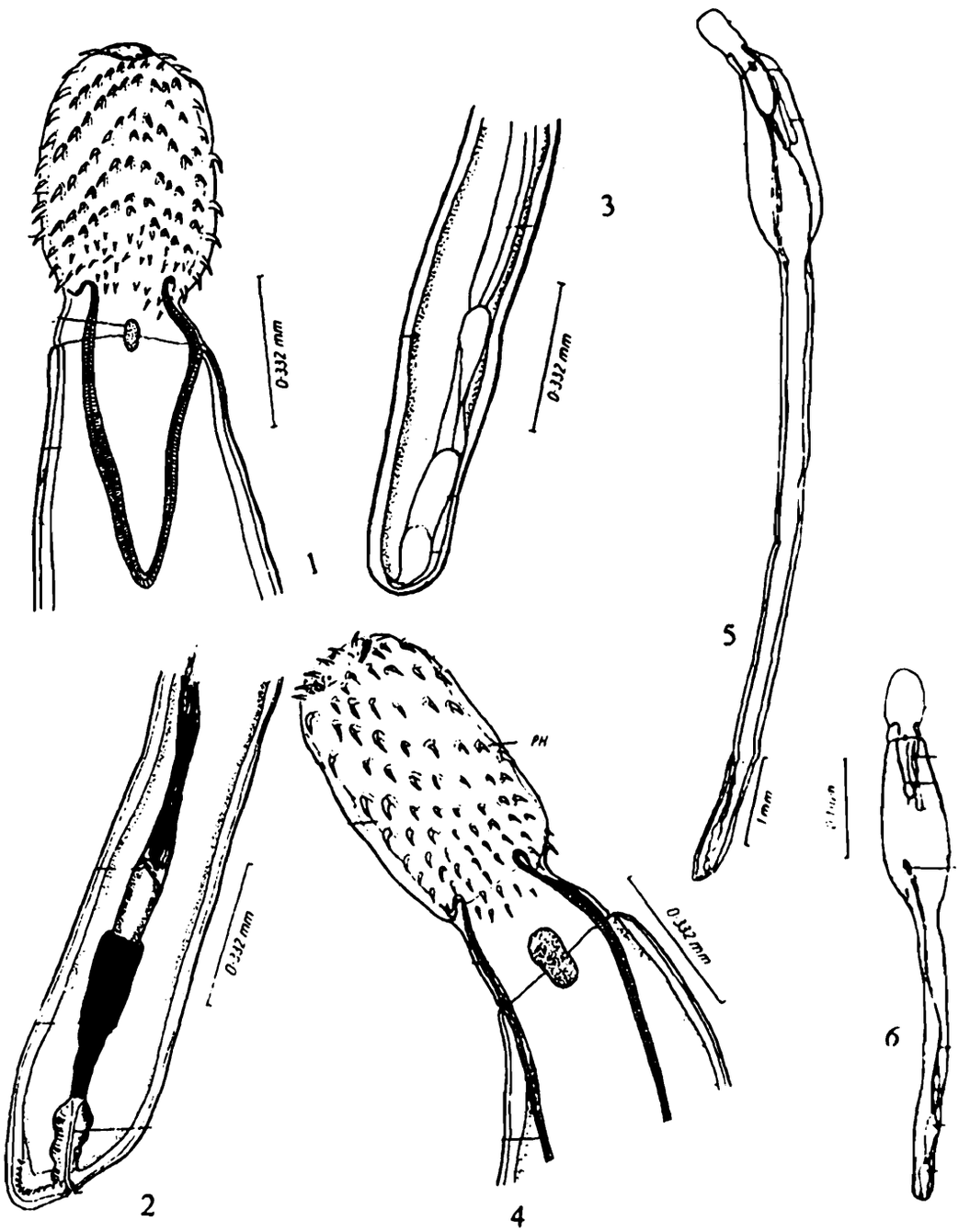


Fig. 154. *Centrorhynchus bengalensis* Datta & Soota, 1958. 1. Anterior part of male, 2. Posterior part of male, 3. Posterior part of female, 4. Anterior part of worm, 5. Female (Sahay & Sinha, 1969).

Description : Male 5.35 mm long, anterior wide part 0.065 mm wide, posterior part 0.022 mm wide in male, in female 5.39 mm long, anterior part 0.078 mm wide, posterior part 0.033 mm wide. Proboscis 0.47 × 0.28 mm in male, in female 0.34 × 0.37 mm, with 35-40 longitudinal rows of 14-18 hooks each in both sexes. Hooks in anterior part measure 0.02-0.04 mm long, in posterior part 0.022-0.025 mm long. Neck 0.27 × 0.32 mm in male; in female 0.29 × 0.30 mm. Proboscis receptacle 0.73 mm long with ganglion at 0.87 mm from anterior end in male, in female 0.52 × 0.32 mm wide, with ganglion located at 0.83 mm from anterior end. Trunk divided into a wide oval anterior part and a narrow cylindrical posterior part. Lemnisci equal 0.7 mm long in male. Testes almost equal, one behind other, 0.31x 0.23 mm long. Cement glands 1.28 mm long with a cement reservoir. Seminal vesicle pea-shaped 0.49 mm long. Bursa 0.56 mm long. Ovary attached to proboscis receptacle by a ligament. Uterine bell 0.187 mm long; uterus 0.41 mm long. vagina 0.20 mm long. Vulva at 0.093 mm from posterior end. Posterior tip with 14-16 papillate structures.

Host : *Corvus splendens* Vieillot; red backed woodpecker, *Dinopium* sp.

Location : Intestine.

Locality : Patna (Bihar); Kolkata (West Bengal).

Distribution : Known only from India.

176. ***Centrorhynchus bethaniae*** George & Nadakal, 1987 (Fig. 155)

Centrorhynchus bethaniae George & Nadakal, 1987b : 9-12, Fig. 1-5; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994 : 141; Bhattacharya, 2007: 182, Pl. 34, Fig. 188.

Type locality : Bellany hills near Trivandrm, Kerala, India.

Description : Male 10-30 × 0.5-2.0 mm; female 15-46 × 1-3 mm. Proboscis cylindrical, long, with swelling in middle, 0.8-1.2 × 0.33-0.38 mm in male; in female 1.2-1.45 × 0.30-0.456 mm, armed at anterior part with 30-35 longitudinal rows of 10-14 hooks each and posterior part with 32-38 longitudinal rows of 16-20 spines each in both sexes. Hooks 0.035-0.055 × 0.016-0.030 mm, with backwardly directed root 0.020-0.030 mm long and spines 0.020-0.030 × 0.006-0.010 mm, with basal papillae and without blade. Neck short, 0.31-0.35 × 0.22-0.25 mm in males; in females 0.35-0.40 × 0.24-0.30 mm. Proboscis receptacle narrow proximally and swollen distally, double-walled, with ganglion in its middle, in males 1.6-1.65 × 0.2-0.25 mm; in females 1.63-1.67 × 0.23-0.27 mm. Pseudo-segmentation apparent at posterior region of trunk in both sexes. Lemnisci 2, unequal, filiform, not extending beyond receptacle, in males 0.975-1 025 × 0.10-0.18 mm and 0.90-1.0 × 0.2-0.25 mm in males; in females 0.97-1.1 × 0.10-0.18 mm and 0.93-1.0 × 0.10-0.18 mm. Testes ovoid, unequal, in tandem, closely placed, pre-equatorial, anterior 0.30-0.36 × 0.20-0.25 mm, posterior 0.376-0.40 × 0.20-0.26 mm. Cement glands 4, tubular, lie immediately behind posterior testis. Cement reservoir swollen, 0.70-0.78 × 0.14-0.21 mm, terminate in copulatory bursa. Bursa 0.86-0.90 × 0.46-0.50 mm. Uterine bell wide, pre-

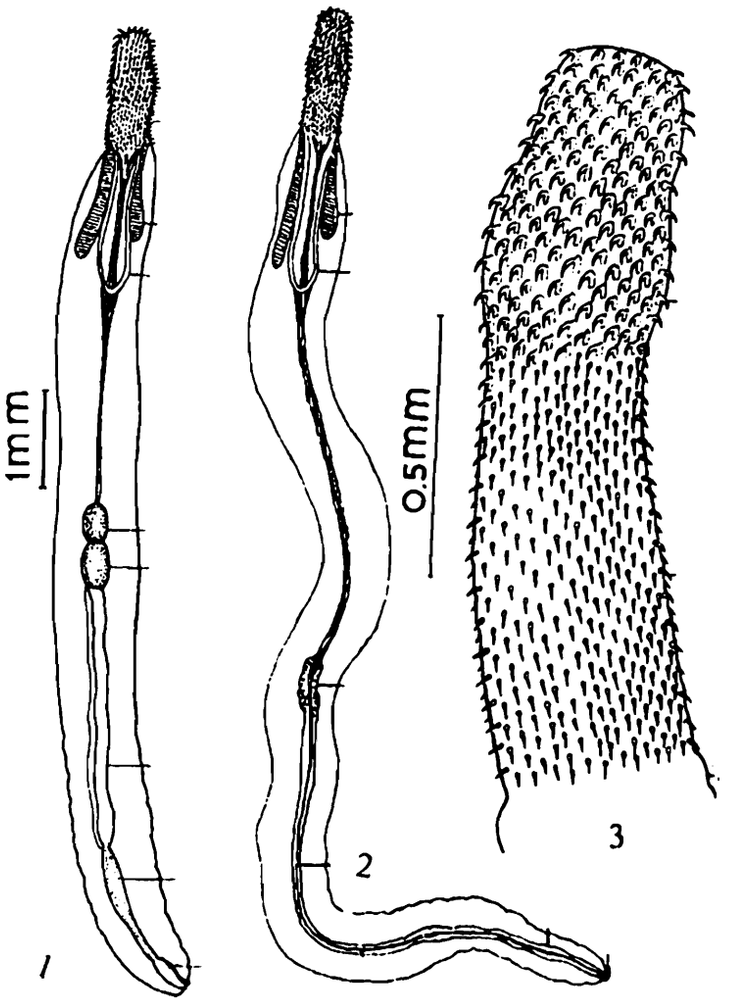


Fig. 155. *Centrorhynchus bethaniae* George & Nadakal, 1987. 1. Male, 2. Female, 3. Proboscis enlarged (after George & Nadakal, 1987).

equatorial attached to ligament sac, 0.37-0.41 × 0.12-0.16 mm; uterus long 2.5-4.2 × 0.09-012 mm; vagina tubular, 0.20-0.34 × 0.10-0.12 mm. Ovarian balls and embryonated eggs fill membranes, Eggs 0.048-0.056 × 0.20-0.026 mm, with three shells, outer shell sculptured with longitudinal ridges, with one pole slightly pointed. Embryos 0.036-0.040 × 0.014-0.018 mm. Female gonopore terminal on a small prominence.

Host : *Accipiter badius* (Gmelin), *Clarius batracus* Hamilton.

Location : Posterior part of small intestine.

Locality : Bellany hills near Trivandrum (Kerala).

Distribution : Known only from type locality.

177. ***Centrorhynchus bilqeesae*** Gazi, Khan & Noor-un-Nisa, 2005 (Fig. 156)

Centrorhynchus bilqeesae Gazi, Khan & Noorun-Nisa, 2005 : 108-110, Fig. 1-3.

Type locality : Oderolal Station, Sindh, Pakistan.

Description : Male 3.26-3.58 × 0.67-0.73 mm. Proboscis divided by slight divided into two parts, 0.40-0.41 × 0.33-0.35 mm, with 12 longitudinal rows of 10 hooks each, hooks 0.030-0.041 × 0.011-0.015 mm. Neck short 0.43-0.45 × 0.064-0.066 mm. Proboscis receptacle double-walled, 0.50-0.55 × 0.33-0.35 mm. Lemnisci 2, 0.54-0.56 × 0.45 mm. Testes small, oval, anterior 0.16-0.18 × 0.10 mm, posterior 0.15-0.16 × 0.09-0.10 mm. Cement glands 4, slender. Saefftigen's pouch oval 0.21-0.22 × 0.073-0.075 mm. Bursa small 0.16-0.19 × 0.11-0.13 mm. Female not known.

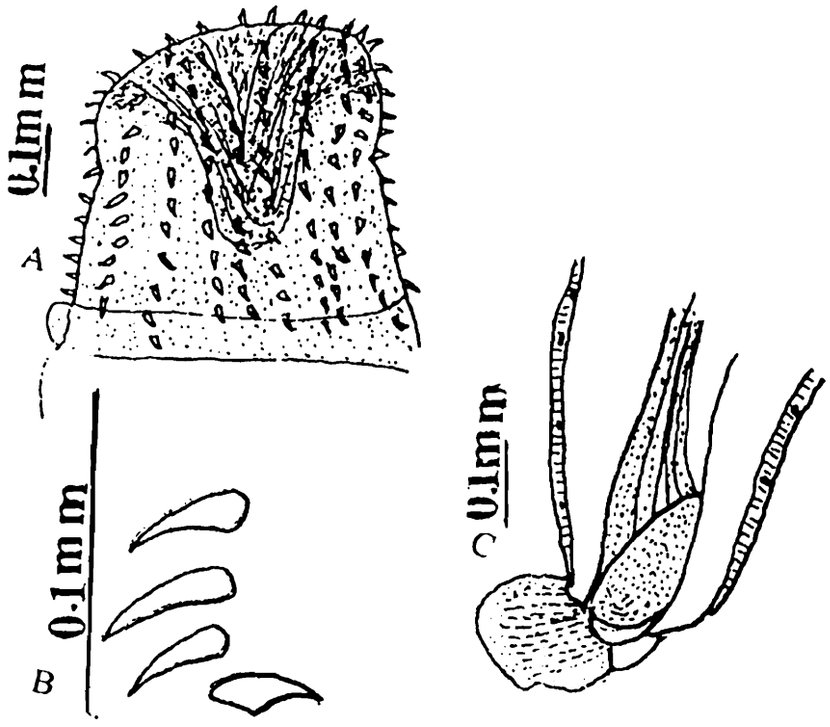


Fig. 156. *Centrorhynchus bilqeesae* Gazi, Khan & Noor-un-Nissa, 2005. A. Proboscis enlarged, B. Proboscis hooks enlarged, C. Posterior part of male (after Gazi, Khan & Noor-un-Nissa, 2005).

Host : *Rana tigrina* Daudin.

Location : Small intestine.

Locality : Oderolal Station, Sindh (Pakistan).

Distribution : Known only from type locality.

178. ***Centrorhynchus brama*** Rengaraju & Das, 1980 (Fig. 157)

Centrorhynchus brama Rengaraju & Das, 1980: 83-85, Fig. 1 A-E. Golvan, 1994: 141; Bhattacharya, 2007: 186, Pl. 32, 180 a-c.

Type locality : Sholapur, Maharastra, India.

Description : Male 17 × 0.59 mm; female 19 × 0.6 mm. Proboscis 0.8 mm long, 0.40 mm in maximum width, 0.30 mm wide at constriction, where it is divided by insertion of proboscis receptacle into anterior and posterior regions, with 28 longitudinal rows of 20 (10+10) hooks each. Proboscis hooks 0.03-0.04 mm long; spines 0.015 mm long. Proboscis receptacle double-walled 1.0 × 0.4 mm. Terminal end of trunk with a small appendix. Lemnisci 0.8 mm long. Anterior testis 0.75 × 0.25 mm, posterior 0.95 × 0.32 mm. Cement glands 2, each 10.4 mm long. Saefftigen's pouch 2.7 mm long. Bursa 2.0 mm long. Uterus 1.6 × 0.2 mm. Vagina tubular 0.35 mm long, with 2 sphincter muscles. Eggs ovate 0.029 × 0.013 mm.

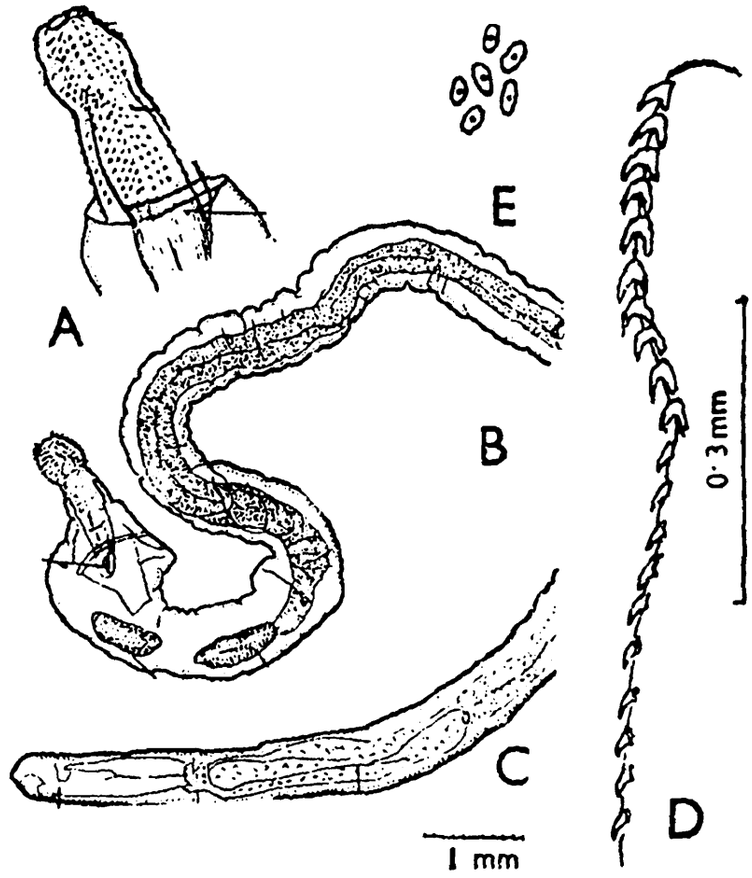


Fig. 157. *Centrorhynchus brama* Rengaraju & Das, 1980. A. Proboscis enlarged, B. Anterior and middle parts of male, C. Posterior part of male, Row of proboscis hooks, D. Row of proboscis hooks, E. Ova (after Rengaraju & Das, 1980).

Host : *Athene brama* (Temminck).

Location : Intestine.

Locality : Sholapur (Maharastra).

Distribution : Known only from type locality.

179. ***Centrorhynchus brevicaudatus*** Das, 1950
(Fig. 158)

Centrorhynchus brevicaudatus Das, 1950b (juvenile) 296-298, Textfig. 3 a-d; Yamaguti, 1963: 127; Anantaraman, M. & Anantaraman, S., 1970: 7; Gupta, N. K. & Jain, 1973b: 555; Gupta, P. D. & Ghosh, 1979: 313; Golvan, 1994: 141.

Type locality : Nagpur, Maharastra, India.

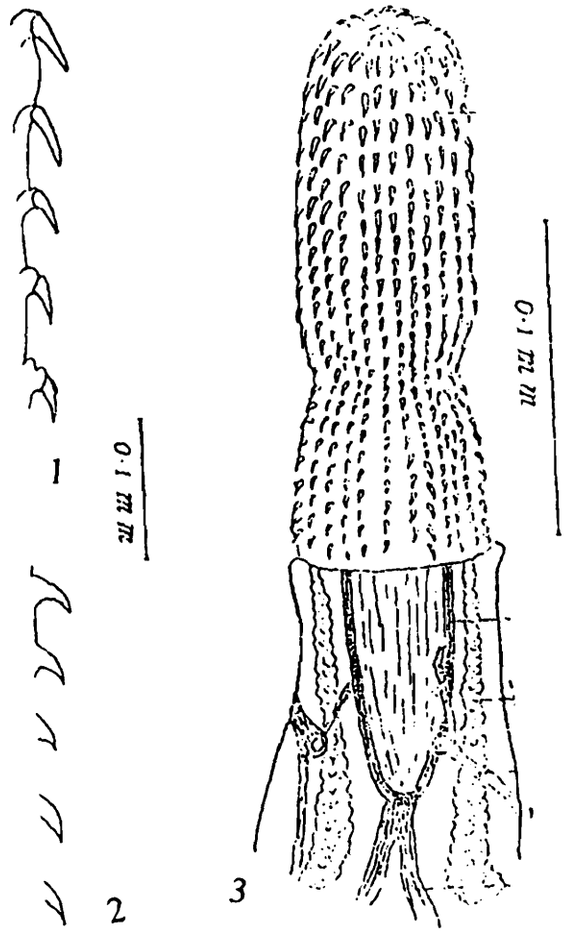


Fig. 158. *Centrorhynchus brevicaudatus* Das, 1950. 1. Row of proboscis hooks, 2. Trunk spine enlarged, 3. Proboscis and neck enlarged (after Das, 1950).

Description : Male 3.31 mm long, 0.32 mm wide at anterior end, 0.70 mm wide in widest middle part, posterior part narrows, slightly wider at extreme end 0.75 mm wide. Proboscis 0.50 × 0.28 mm, with 24-26 longitudinal rows of 23-24 hooks each, hooks 0.038 × 0.030 mm larger than spines of neck. Neck 0.51 mm long. Proboscis receptacle double-walled, 0.62 × 0.18 mm. Retractor muscles of proboscis seem to come down, bend over themselves for some distance and finally attach to musculature of body wall on each side. Trunk fusiform. Lemnisci thin, coiled, 0.55 and 0.48 mm long. Genital ligament arises from posterior end of proboscis, proceed backwards in body cavity enclosing genitalia. Testes present. Cement gland single, coiled filling completely posterior part of trunk. Ejaculatory duct and bursa with muscular bands attached to body wall. Female not known.

Host : *Channa* sp., *Rana tigrina* Daudin, *Corvus spendens* Viellot, *Temanuchus pagaodorsum* (Gmelin).

Location : Intestine.

Locality : Nagpur (Maharastra).

Distribution : Known only from India.

180. ***Centrorhynchus buckleyi*** Gupta, V. & Fatma, 1981 (Fig. 159)

Centrorhynchus buckleyi Gupta, V. & Fatma, 1981: 110-112, Pl. 2, Fig. 1-2; Golvan, 1994: 141. Bhattacharya, 2007: 169, Pl. 28, Fig. 152 a, b.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 4.54 mm long, 0.40 mm wide anteriorly, 0.15 mm wide posteriorly with rounded end. Proboscis short. 0.30 × 0.25 mm, with 26 longitudinal rows with 20-25 hooks each, radially and symmetrically arranged. Ten hooks on anterior proboscis with long recurved blade and broad base, 0.022-0.028 mm long, remaining spines 12-15 on

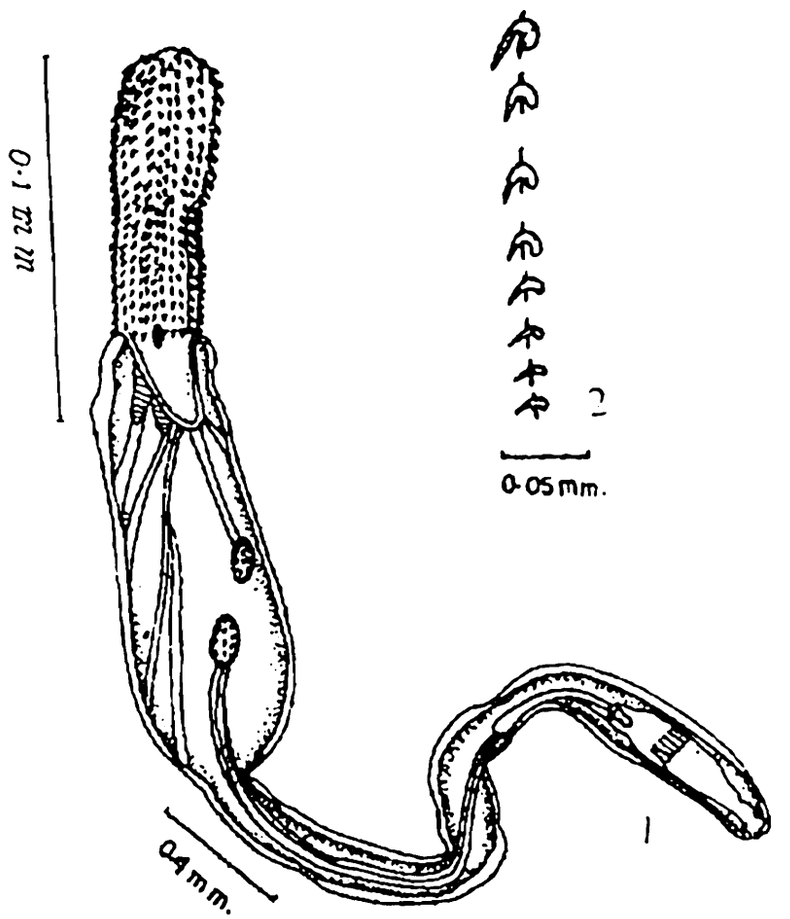


Fig. 159. *Centrorhynchus buckleyi* Gupta, V. & Fatma, 1981. 1. Male, 2. Proboscis hooks enlarged (after Gupta, V. & Fatma, 1983).

neck region, long, slender, 0.015-0.016 mm long. Neck long, slender, with 25 rows of 12-15 spines, each 0.015-0.016 mm, long. Proboscis receptacle cylindrical or claviform, double-walled, 0.6 × 0.2 mm, extending up to middle of proboscis, with ganglion at its middle. Trunk elongate, cylindrical, aspinose, divided into two parts due to constriction in middle. Lacunar system with main lateral channels and circular or reticular anastomoses. Hypodermal nuclei numerous, evenly distributed. Leminisci small ribbon-shaped, subequal, shorter lemniscus 0.52 × 0.015 mm, longer 0.35 × 0.015 mm. Testes ovoid, equal, in tandem, pre-equatorial, anterior 0.12 × 0.095 mm, posterior 0.12 × 0.09 mm. Cement glands 2, elongated, cylindrical, 1.5- 1.8 mm long. At the base of cement glands and anterior to copulatory bursa is present a subpenial sphincter. Seminal vesicle pyriform 0.2 × 0.059 mm, opening into bursa. Bursa muscular, elongated, 0.37 × 0.15 mm with few bursal rays, opening to outside subterminally. Female not known.

Host : *Anastomus oscitanus* (Boddaert).

Location : Intestine.

Locality : Prince of Wale's Zoological Gardens, Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

181. ***Centrorhynchus buteonis*** (Goeze, 1782 in Schrank, 1788) Kostylew, 1914 (Fig. 160)

Echinorhynchus buteonis Goeze, 1782 in Schrank, 1788: 1-116;

Centrorhynchus buteonis (Schrank, 1788) Kostylew, 1914: 186-188; Meyer,1932: 102; Petrochenko, 1958: 205-206, Yamaguti, 1963 : 121-122. Gupta, N. K. & Gupta, K., 1972c: 1-3, Fig. 1-3; Golvan, 1994 : 141; Bhattacharya, 2007: 184, Pl. 31, 32, Fig. 173 a, b.

Type locality : Not known.

Description : Female 23.4-24.0 mm long, anterior end 0.99-1.08 mm wide, posterior end 1.35-1.47 mm wide. Proboscis small, globular, with 30-32 longitudinal rows of 8 hooks each, with well developed roots. Hooks decrease in size towards posterior end. Anterior hooks 0.048-0.064 × 0.012 mm, posterior hooks 0.02-0.04 × 0.004-0.008 mm. Neck 0.39-0.41 × 0.59-0.63 mm with 32 longitudinal rows of 5-6 similar spines each. Spines 0.028-0.032 × 0.004-0.008 mm with poorly developed roots. Proboscis receptacle cylindrical, double-walled, 1.20-1.19 × 0.34-0.39 mm, arising from anterior part of neck and hangs freely in pseudocoel of trunk. Lacunar system well developed. Trunk cylindrical, pseudo-segmented and slightly narrows towards anterior end. Lemnisci paired, cylindrical, slightly longer than receptacle, 1.28-1.46 × 0.24 mm, anteriorly attached to base of neck. In a mature female ovary burst releasing a number of ovarian balls and eggs. Uterine bell elongated, 0.28-0.14 mm long, anteriorly attached to suspensory ligament and posteriorly leads into uterus. Uterus narrow, tubular, 0.75 × 0.12 mm. Vagina small, 0.16 × 0.08 mm with a pair of sphincters at its anterior end, and opens to outside by subterminal female gonopore. Eggs oval, 0.039-0.054 × 0.012-0.021 mm. Male not known.

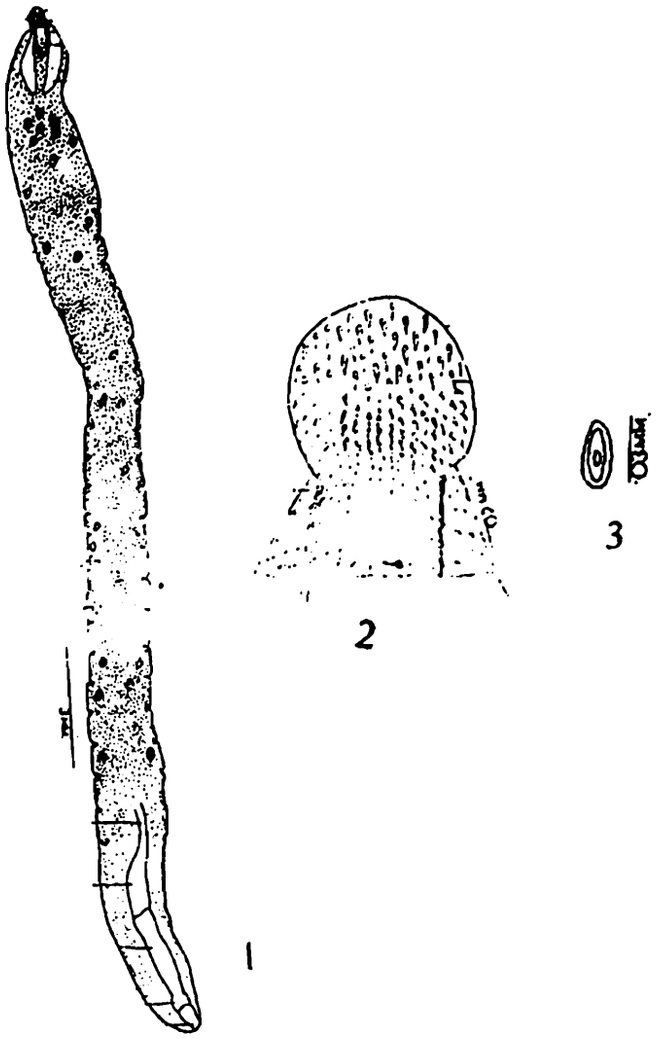


Fig. 160. *Centrorhynchus buteonis* (Goeze in Schrank, 1788) Kostylew, 1914. 1. Female, 2. Proboscis enlarged, 3. Ovaum (after Gupta, N.K. & Gupta, K. 1972).

Note : In literature: length of female: 35-47 or even68 mm; male 22-35 mm; proboscis with 30-34 rows of 7-16 hooks each; Dollfus: 30-32 rows with 7-10: 9-14 hooks each. Anterior 7-10 with strong roots and posterior 9-12 spiniform; eggs 0.052-0.060 × 0.018-0.020 mm.

Host : *Buteo* sp., *Accipiter virgatus*,

Location : Intestine.

Locality : Chandigarh, India; Sri Lanka.

Distribution : Asia; Europe; Australia.

182. ***Centrorhynchus clitoredeus*** (Meyer, 1931) Golvan, 1956 (Fig. 161)

Gordiorhynchus clitoredeus Meyer, 1931c: 53-108; 1932: 120-122, Fig, 103-105.

Centrorhynchus clitoredeus Golvan, 1956: 767; Yamaguti, 1963: 122, Pl. 52, Fig. 532-536; Gupta, N. K. & Lata, 1968c: 333-336, Fig. 15-18; Gupta, N. K. & Jain: 1973b: 555; Jain & Gupta, N. K. 1984: 15-16; Duggal, Solomon & Ambardar, 1987: 28-29; Golvan, 1994: 141; Bhattacharya, 2003: 73; 71-78; 2007: 174-175, Pl. 30, Fig. 163 a-e.

Description : Male 20.80-23.79 × 1.3-1.5 mm, female 25 × 1.5 mm. Proboscis 0.56-0.65 × 0.35-0.37 mm, slightly inflated at base, with 30 longitudinal rows of 12-13 hooks each. Hooks equal in size and shape 0.020-0.028 × 0.004-0.006 mm, except those at base, which are smaller than others. Basal hooks tend to form spiral arrangement. All hooks with well developed roots. Neck 0.29-0.42 × 0.42-0.51 mm with 36 longitudinal rows of 8-9 spines each, 0.12 × 0.006 mm. Spines form spiral arrangement with their roots not well developed. Proboscis receptacle cylindrical, double-walled, 1.51-1.54 × 0.40-0.44 mm,

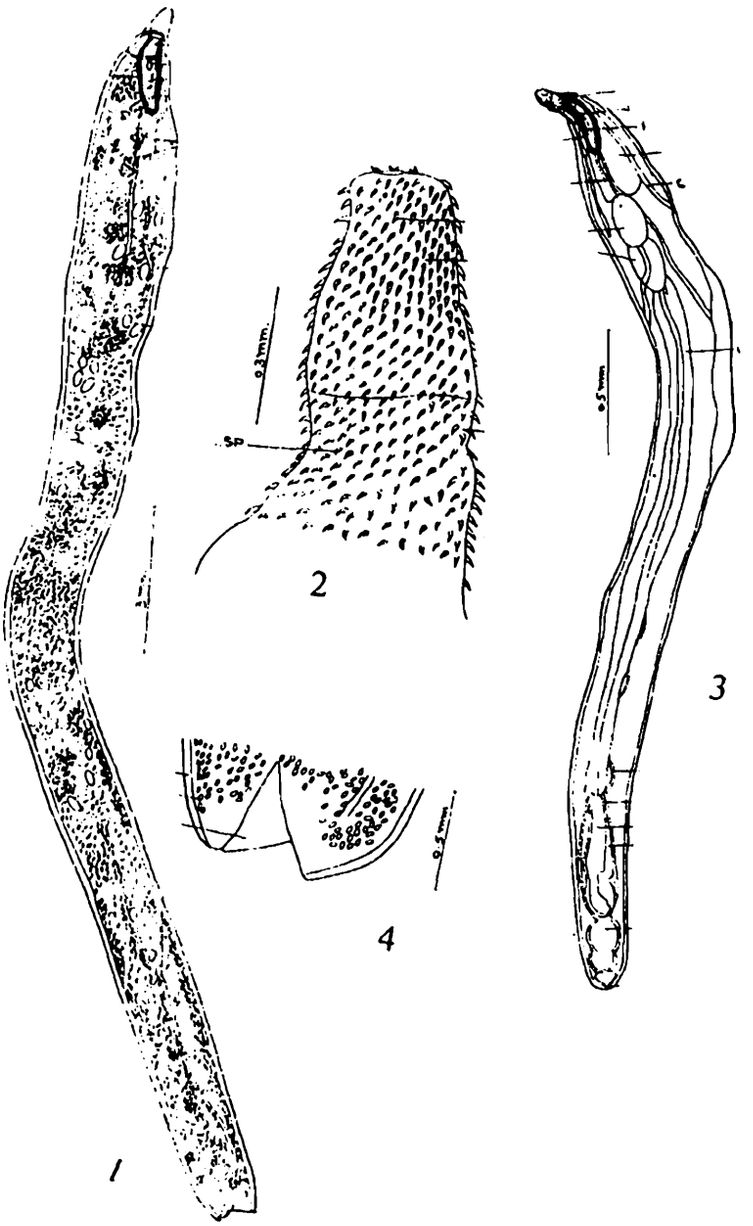


Fig. 161. *Centrorhynchus clitoridens* (Meyer, 1931), Golvan, 1956. 1. Female, 2. Proboscis enlarged, 3. Male, 4. Posterior part of female (after Gupta, N.K. & Gupta, K. 1972).

with. ganglion located about its middle. Trunk cylindrical, aspinose, posterior tip of male rounded and of female with a cleft. Lacunar system not well developed. Lemnisci paired, cylindrical, equal, 1.75-1.76 × 0.39-0.56 mm, longer than receptacle. Testes ovoid, contiguous, partly overlap each other, lie in anterior part of trunk, anterior 1.24 × 0.60-0.63 mm, posterior 1.21 × 0.65-0.70 mm. Vas deferens traverse along cement glands and open into anterior part of genital sheath. Cement glands 3, syncytial, tubular, 11.55-12.01 × 0.56-0.61 mm, collectively lie very close to each other, their ducts arise from hind margin of cement glands. Genital sheath saccular, double-walled, 2.45 × 0.65-0.77 mm. Saefftigen's pouch thick-walled, 2.45 × 0.57 mm. Penis small, 0.93 × 0.32 mm. Bursa double-walled, 1.50-1.58 × 0.61-0.64 mm, opens to outside through male genital pore. Ovary disintegrate releasing ovarian balls and eggs filling body cavity. Suspensory ligament 0.07 mm wide. Eggs oval 0.028 × 0.014 mm.

Host : *Astur badius* (Gmelin); Owl, *Tyto alba* (Scopoli), *Halcyon smyrnensis* (Linnaeus) Sykes. Juvinile in *Rana tigrina* Daudin, *Ptyas mucosus* (Linnaeus); *Picus flavinuncha*

Location : Intestine.

Locality : Juvenile in Amraoti (Maharastra); Hoshiarpur, Sangrur (Punjab); Kasipur (Uttar Pradesh); Mali Bazaar, Sikkim.

Distribution : Palestine; Egypt in Africa; Europe;

183. ***Centrorhynchus conspectus*** Van Cleave & Pratt, 1940 (Fig. 162)

Centrorhynchus conspectus Van Cleave & Pratt, 1940: 297-299; Petrotschenko, 1956 206-208, Fig. 102; Yamaguti, 1963: 122, Pl. 55, Fig. 567-570; Gupta, N. K. & Gupta, K., 1972c: 5-8, Fig. 7-10; Nama & Rathore, 1984: 144; Golvan, 1994L 141; Bhattacharya, 2007: 183, Pl. 31, Fig. 172 a-c.

Type locality : New York, United States of America.

Description : Male 26.64 mm long, female 12.85-33.71 mm long. Proboscis long, cylindrical 0.35-0.41 × 0.32-0.45 mm, with 28-32 longitudinal rows of 11-13 hooks each, 0.35-041 × 0.32-0.45 mm All hooks with strong roots, 0.045-0.066 × 0.006-0.016 mm. Hooks in posterior region smaller in size, 0.032-0.033 × 0.006-0.016 mm. Hooks in posterior part smaller , 0.032-0.033 × 0.006-0.007 mm. Neck long, 0.63-0.72 × 0.35-0.64 mm, with 28-32 longitudinal rows of 7-8 spiniform hooks each, with poorly developed roots, and measure 0.039-0.0040 × 0.008-0.009 mm long, basal spines 0.033 × 0.004 mm. Proboscis receptacle cylindrical, double-walled, 1.07-1.36 × 0.18-0.25 mm, with a set of invaginator muscles, which pierce its wall and come to lie as dorsal and ventral receptacle retractors in body cavity. Trunk elongate, apinose, with anterior part swollen measure 0.81-0.99 mm wide, rest of trunk 0.57-0.72 mm wide. Lacunar system well developed with two main longitudinal channels and reticular anastomoses. Lemnisci a pair, much longer than receptacle, 1.20-1.35 × 0.16-0.19 mm. Testes oval, in tandem, in anterior half of trunk, anterior 1.0 × 0.37 mm, posterior 1.17 × 0.34 mm. Cement glands 3, syncytial, tubular, 14.99 × 0.27 mm, they lead into genital sheath of 2.61 × 0.37 mm. Bursa inverted,

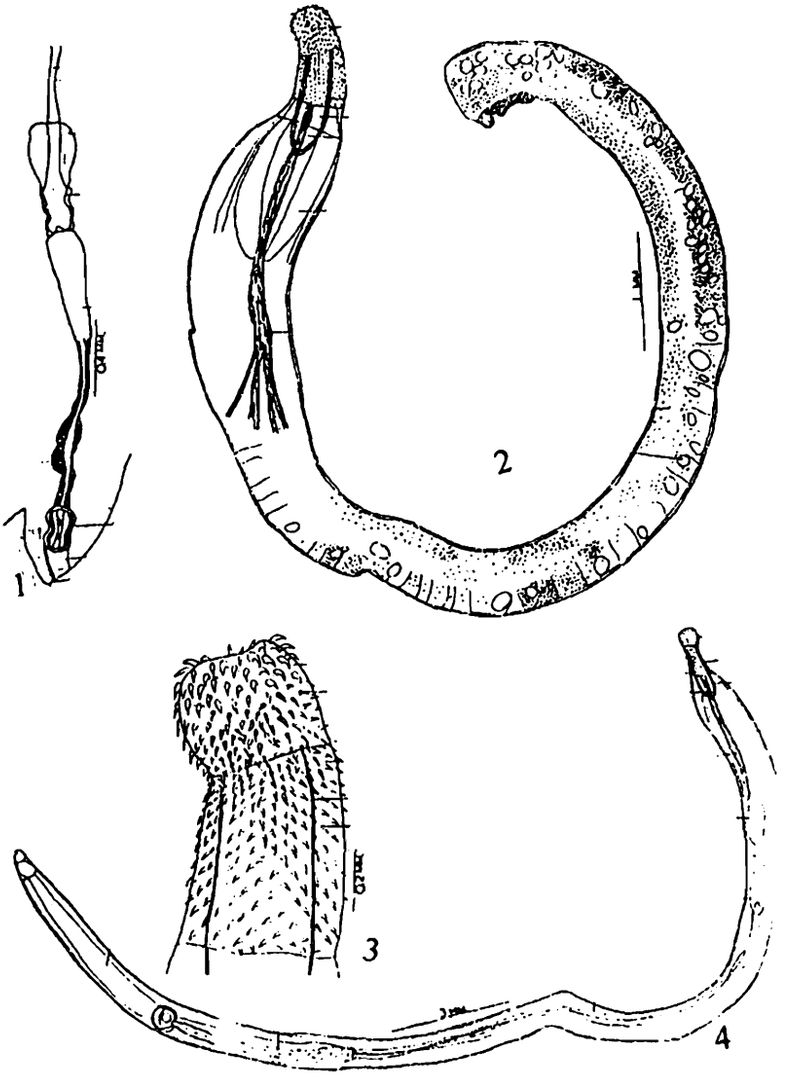


Fig. 162. *Centrorhynchus conspectus* Van Cleave & Pratt, 1940. 1. Female genitalia, 2. Female, 3. Proboscis enlarged, 4. Male (after Van Cleave & Pratt, 1940).

long, 0.64 × 0.096 mm, opens to outside by male gonopore. Uterine bell cup-shaped, 0.224 × 0.176 mm, anteriorly attached to suspensory ligament and posteriorly leads into uterus. Uterus long, narrow tube, 1.136 × 0.08 mm. Vagina with sphincter 0.18 × 0.12 mm opens to outside through terminal female gonopore. Eggs ovoid, 0.033-0.048 × 0.015-0.021 mm. Ovarian balls also present.

Note : In literature: Length male 25-35 mm, female 28-55 mm; Proboscis hooks in 28-32 rows with 16-19 hooks each; Eggs 0.060-0.078 mm, 0.021-0.026 mm.

Host : *Athene brama* (Temminck). *Tyto alba* (Scopoli).

Location : Intestine.

Locality : Jodhpur (Rajasthan); Chandigarh.

Distribution : North Carolina, Louisiana North America.

184. ***Centrorhynchus crocidurus*** Das, 1950
(Fig. 163)

Centrorhynchus crocidurus Das, 1950a: 50-51, Fig. 1; Petrotschenko, 1958: 208; Yamaguti, 1963: 128; Anantaraman, M. & Anantaraman, S., 1970: 7; Gupta, N.K. & Jain, 1973b: 555; Jain & Gupta, N.K., 1984: 16; Golvan, 1994: 141; Bhattacharya, 2007: 179-180, Pl. 29, Fig. 158 a-d.

Type locality : Nagpur, Maharastra, India.

Description : Male and Female 2.4-4.38 mm long, 0.23 mm wide anteriorly, middle part widest 0.39 mm wide, posterior tapering end 0.13 mm wide. Proboscis, long, cylindrical 0.49 × 0.22 mm with well developed apical sense organ and with 34-38 longitudinal rows of 23-25 hooks each; largest hooks 0.038 mm long; hooks in constriction smallest, 0.19 mm. Neck 0.69 × 0.22 mm with spines of 0.030 mm long. Proboscis receptacle short, 0.38 × 0.13 mm. Trunk elongate, cylindrical. Lemnisci 0.2 mm long. Genital ligament and small cap-like bursa present in male. Genital ligament and ovary present in female. Uterus muscular and vagina observed.

Host : *Crocidura caerulea* (Anderson), Juvenile in *Bungarus crocidurus* (Schneider).

Location : Intestine, cysts in peritoneum.

Locality : Nagpur (Maharastra); Dhandipur (Orissa); Chandigah.

Distribution : Known only from India

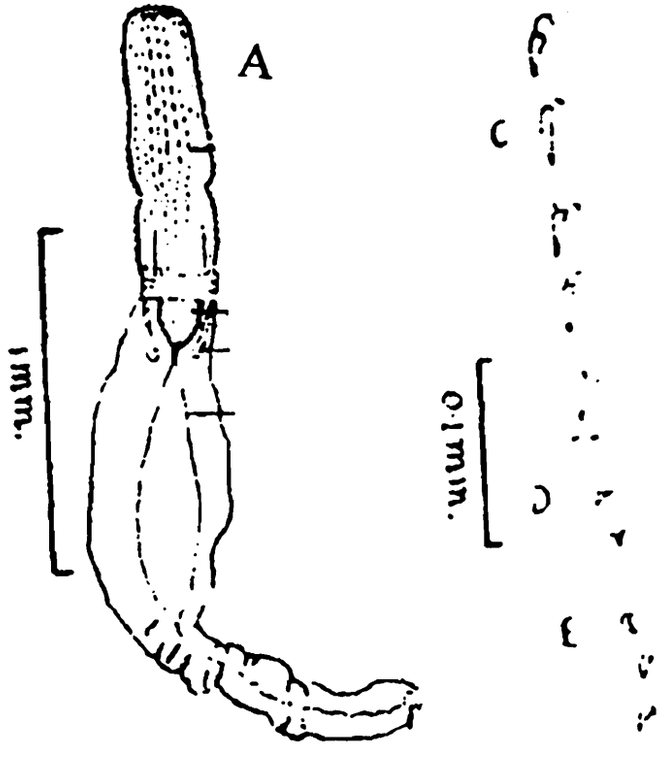


Fig. 163. *Centrorhynchus crocidurus* Das, 1950. A. Male, B. Female, C. Trunk spines enlarged, D. Proboscis hooks enlarged, E. Proboscis enlarged (after Das, 1950).

185. ***Centrorhynchus elongatus*** Yamaguti, 1935
(Fig. 164)

Centrorhynchus elongatus Yamaguti, 1935: 247-278; Bhattacharya, 1999: 175-176; 2007: 186, Pl. 32, Fig. 179 a, b.

Type locality : Japan.

Description : Male 36.09 × 0.84 mm. Female 32-53 × 0.86-1,6 mm. Posterior end of female widened with processese of on which vulva opens. Proboscis cylindrical, elongated, 0.78 × 0.29 mm, with 30-32 longitudinal rows of 20-22 hooks each, anterior 4-5 hooks with roots, others without roots. Proboscis receptacle elongated, cylindrical, 1.54 × 0.36 mm, with central ganglion. Lemnisci equal, 7.5 mm lomg. Testes 0.38-1.2 × -.18-0.5 mm. At the margin of bursal valve are 14 digitate lobes about 0.5 mm long. Cement glands tubular, 2.76 × 0.66 mm. Uterine bell 0.40.6 × 0.14-0.29 mm. Vulva opens ventrally. Eggs 0.072-0.84 × 0.027-0.39 mm.

Host : *Accipiter badius.*

Location : Intestine.

Locality : Meghalaya.

Distribution : Japan, Taiwan.

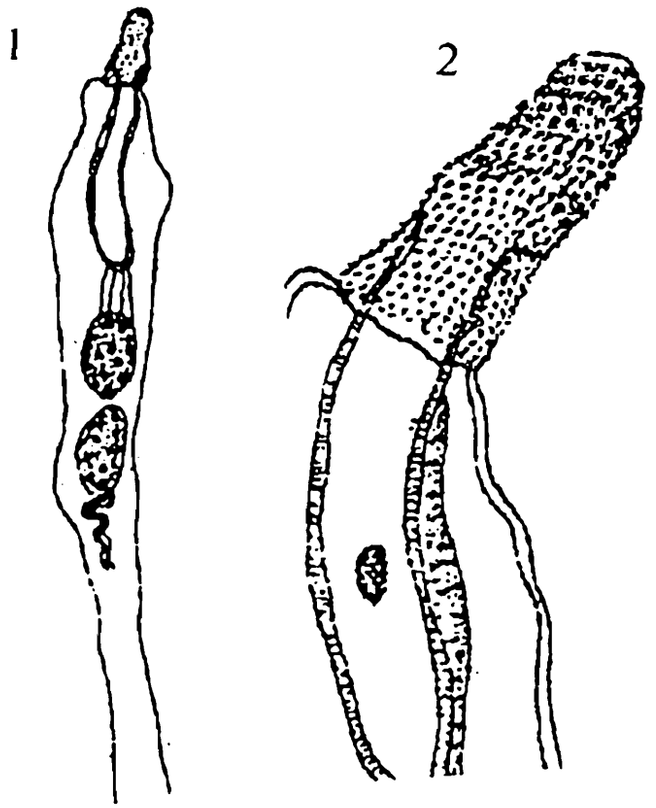


Fig. 164. *Centrorhynchus elongatus* Yamaguti, 1935. 1. Anterior part of male, 2. Proboscis and anterior part of trunk (after Bhattacharya, 2007).

186. ***Centrorhynchus fisheri*** Bhattacharya, 1999
(Fig. 165)

Centrorhynchus fisheri Bhattacharya, 1999: 173-174, fig. Pl. 5, 6; 2007: 188, Pl. 33, Fig. 183 a-e.

Type locality : Meghalaya, India.

Description : Male 22.5 × 0.75 mm; female 30.5 × 1.25 mm. Proboscis elongated, cylindrical, 0.875 × 0.3 mm, with wide mid-proboscis, with 28 longitudinal rows of 15-16 hooks each, hooks with strong root , roots of 1st hook 0.026 mm and points 0.04 mm long, roots of 2nd hooks 0.04 mm and points 0.044 mm long, roots of 3rd hook 0.03 mmand points 0.024 mm, roots of 4th hook s 0.036 mm and points 0.02mm , roots of 5th hooks 0.036 mm and points 0.024 mm long, roots of 6th hooks 0.03 mm and points 0.026 mm long, rootless hooks 0.02 mm long. Proboscis receptacle elongated, cylindrical, 1.875 × 0.25 mm, with ganglion anteriorly. Lemnisci very long, 3.5 × 0.5 mm. Testes elliptical, 0.875 × 0.5 mm. Cement glands three, long, 15.375 mm long, Eggs elliptical, 0.056 × 0.024 mm. Gonopore subterminal in female.

Host : King fisher.

Location : Intestine.

Locality : Meghalaya.

Distribution : Known only from type locality.

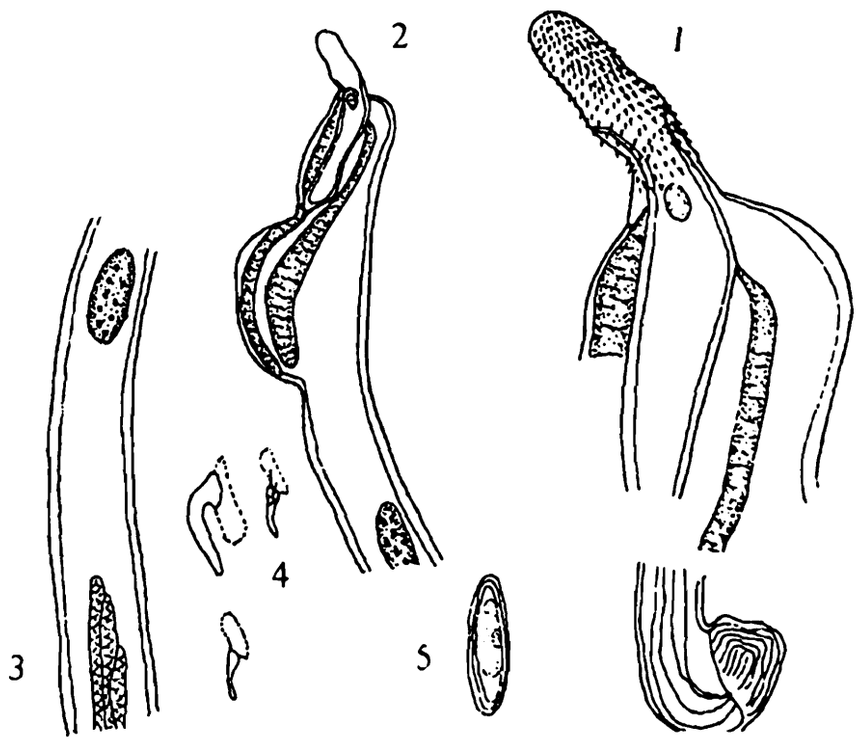


Fig. 165. *Centrorhynchus fisheri* Bhattacharya, 1999. 1. Proboscis and trunk enlarged, 2. Anterior part of male, 3. Mid trunk, 4. Proboscis hooks enlarged, 5. Ovum (after Bhattacharya, 2007).

187. ***Centrorhynchus gibsoni*** Khan, Gazi & Bilqees, 2002 (Fig. 166)

Centrorhynchus gibsoni Khan, Gazi & Bilqees, 2002: 139-145, Fig. 1, 2.

Type locality : Odorlal Station, Sindh, Pakistan.

Description : Female 14.6-16.3 × 3.08-3.64 mm. Proboscis cylindrical divided by slight insertion, 0.50-0.57 × 0.30-0.32 mm, with 14 longitudinal rows of 20 hooks each. Hooks 0.030-0.038 × 0.012-0.015 mm. Neck 0.03-0.13 × 0.27-0.28 mm at junction with proboscis and at base. Proboscis receptacle small, elongate, double-walled, 0.31-1.4 × 0.30-0.32 mm. Trunk elongate, anterior end pointed, posterior end rounded, greatest width at anterior third. Hypodermal nuclei small and numerous. Lemnisci subeqaual, elongate, 2.26-2.30 × 0.21-0.48 mm. Eggs numerous, elongate, wider at middle 0.026-0.027 × 0.0083-0.0091 mm with slight polar prolongations of middle shell. Male not known.

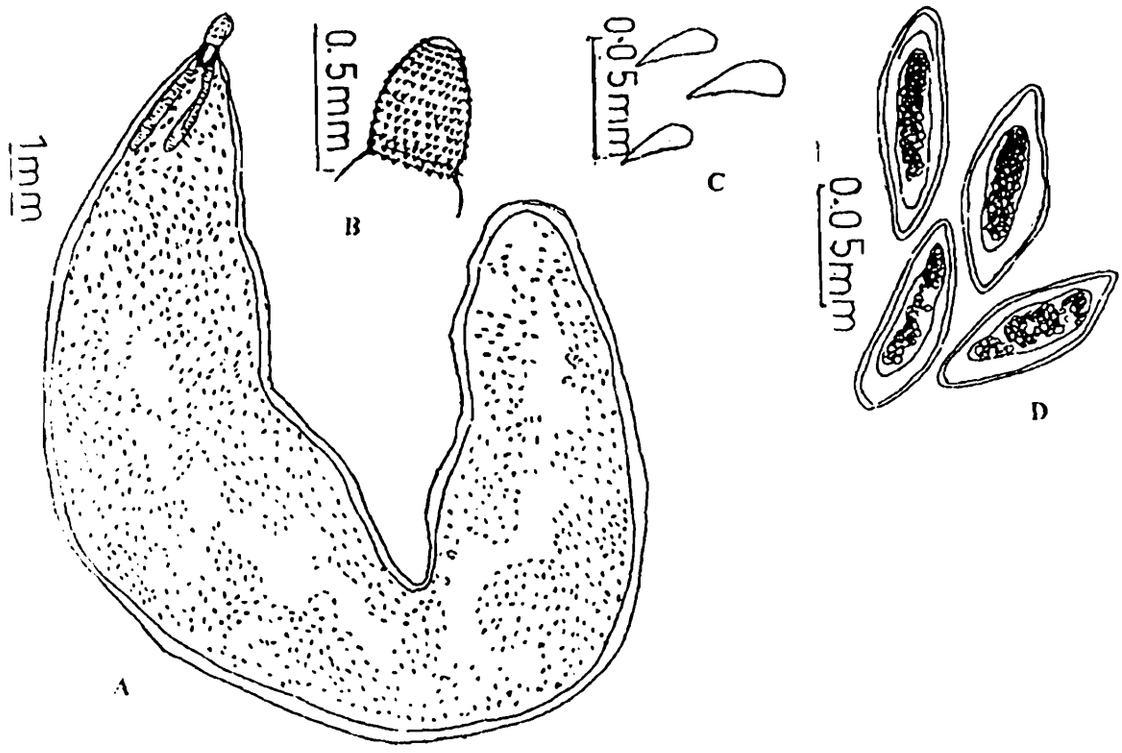


Fig. 166. *Centrorhynchus gibsoni* Khan, Gazi & Bilqees, 2002. A. Female, B. Proboscis enlarged, C. Proboscis hooks enlarged, D. Eggs enlarged (after Khan, Gazi & Bilqees, 20002).

Host : *Corvus splendens* Vieillot.

Location : Small intestine.

Locality : Odorolal station, Sindh (Pakistan).

Distribution : Known only from type localty.

188. ***Centrorhynchus giganteus*** Travassos, 1921

Centrorhynchus giganteus Travassos, 1921 : 42-43; Bhattacharya, 2005 : 123-157, 2007 : 192-193.

Type locality : Brazil.

Description : Male 24-50 × 0.75 mm. Female 37-55 × 2.9-2.5 mm. Trunk cylindrical, anterior part wide. Proboscis nearly vylindrical with slight widening at anteriorly 1.87 × 0.5-0.7 mm. with 24-26 longitudinal rows of 27-28 hooks each, of which 16-17 are located before the site of attachment of proboscis receptacle and 11 spines behind it. Maximum size of point of hooks 0.00325 mm, maximum size of roots 0.05 mm long. Lemnisci about 5.2 mm long. Testes anterior 1.00 × 0.35 mm, posterior 1.10 × 0.25 mm. Cement glands very long about 7 mm long. Eggs 0.056 × 0.028-0.032 mm. Larval forms found in trunk.

Host : Shirka.

Location : Intestine.

Locality : Srisailam (Andhra Pradesh).

Distribution : Brazil; Panama.

189. ***Centrorhynchus globocaudatus*** (Zeder, 1800) Lühe, 1911 (Fig. 167)

Echinorhynchus globocaudatus Zeder, 1800 : 101-143;

Centrorhynchus globocaudatus (Zeder, 1800) Lühe, 1911 : 1-144; Meyer, 1932 :102-105, Fig. 82; Petrotschenko, 1958 : 212-215, Fig. 105, 106; Yamaguti, 1963 : 123, Pl. 55, Fig. 564-566; Patnaik & Acharjyo, 1970 : 725; Gupta, N.K. & Gupta, K., 1972c : 10-11, Fig. 13, 14; Golvan, 1944: 142; Bhattacharya, 2000 : 156-157; 2003 : 75; 71-78; 2007 : 178, Pl. 34, Fig. 191 a, b.

Type locality : Germany

Description : Male 15-20 × 0.90-1.314 mm. Female 37-55 × 1.1-1.5 mm. Cuticle compact, pale gray, with delicate cross strtations in anterior part and smooth in posterior end. Proboscis elongate, cylindrical rounded at apex and widening in lower part, 0.89-1.0 mm lomg, width of upper half 0.35-0.40 mm, of lower half 0.44 mm, with 32-34 longitudinal rows of 18-19 hooks each. Starting with sixrg hook roots are markedly reduced and remain as thickenings in cuticle to which reduced slender micros are attached. Apical hooks 0.040-0.050 × 0.01 mm, basal hooks 0.020 × 0.005 mm. Neck very short, rectangular, 0.035 mm lomg. Proboscis receptacle long, cylindrical, sacciform, double-walled, 1.27 × 0.31 mm, with ganglion at its middle. Lacunar system not well developed anastomoses. Trunk cylindrical, long, aspinose, with slight widening near testes in male and at posterior end of female. Lemnisci in the shape of two lobes 1.36 mm long. Testes orbicular, one behind otherlie in anterior half of trunk, anterior 0.468 × 0.36 mm, posterior could not be measured. Cement glands 3, tubular, syncytial, collectively 8.25 × 0.21-0.36 mm, tighrly contiguous and forminy a long cord, extebding to from middle of posterior testis. Ducts 2,45 mm long extend from from glands to copulatory bursa. Saefftigen's pouch long,

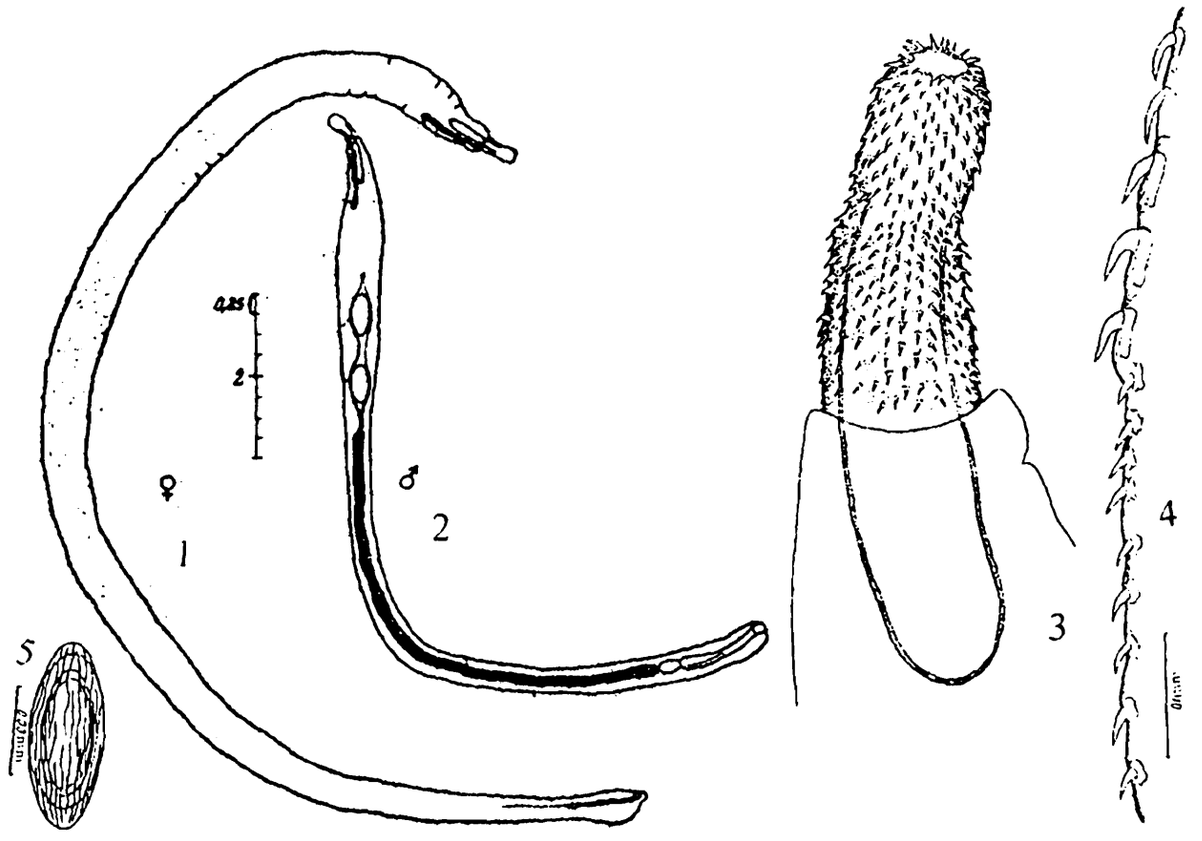


Fig. 167. *Centrorhynchus globocaudatus* (Zeder, 1800) Lühe, 1911. 1. Female, 2. Male, 3. Proboscis and anterior part of trunk enlarged, 4. Row of proboscis hooks enlarged, 5. Ova enlarged (after Petrochenko, 1956).

saccular, 2.52 × 0.29 mm lies behind cement glands. Seminal vesicle long, tubular, 1.93 × 0.18-0.19 mm. Both Saeftigen's pouch and seminal vesicle open into muscular cap of bursa. Bursal cap with muscular processes, 0.75 × 0.54 mm. Everted bursa semicircular 0.738 × 1.1 mm. Female not known. Mature eggs 0.049-0.055 × 0.022 mm.

Host : *Glaucidium radiatum*, *Milvus migrans* (Boddaert); Otus sp.; Owl.

Location : Intestine.

Locality : Baranga Zoo (Orissa); Chandigarh; Punjab; Tripura; Sikkim.

Distribution : Israel, Egypt; Japan; Europe; West Indies;

Note : In literature : Male 29 mm long; female 30-40 mm long; proboscis hooks 30 rows with 18 hooks each; eggs 0.049-0.055 × 0.022 mm.

190. ***Centrorhynchus golvani*** Anantaraman, M. & Anantaraman, S., 1969. (Fig. 168)

Centrorhynchus golvani Ananataraman, S. & Anantaraman, M, 1 963: 138-139; *Centrorhynchus* (*Centrorhynchus*) *golvani* Anantaraman, M. & Anantaraman, S. 1969 : 7-11, Fig. 1-6; 1970 : 7; *Centrorhynchus golvani* Golvan, 1994 : 142.

Type locality : Chennai, Tamil Nadu, India.

Description : Males 15 × 0.9-1.0 mm, females 21-23 × 1 mm. Proboscis cylindrical, club-shaped when fully extended, 0.6 × 0.32 mm, and globular when contracted, 0.58 × 0.45 mm, with 26 longitudinal rows of 8 or 9 hooks each, in two series, one of 5 hooks and other of 4 hooks. Each hook strongly arched with blade and root. Fourth hook largest, 0.086 × 0.033 mm and last hook smallest, 0.04 × 0.011 mm. Proboscis receptacle double-walled, 1.0 × 0.20 mm, with a pair of retractor muscles. Trunk elongated, cylindrical, sturdy, aspinose, of uniform width with rounded posterior end in both sexes. Lemnisci 1.8-1.9 × 0.2 mm.

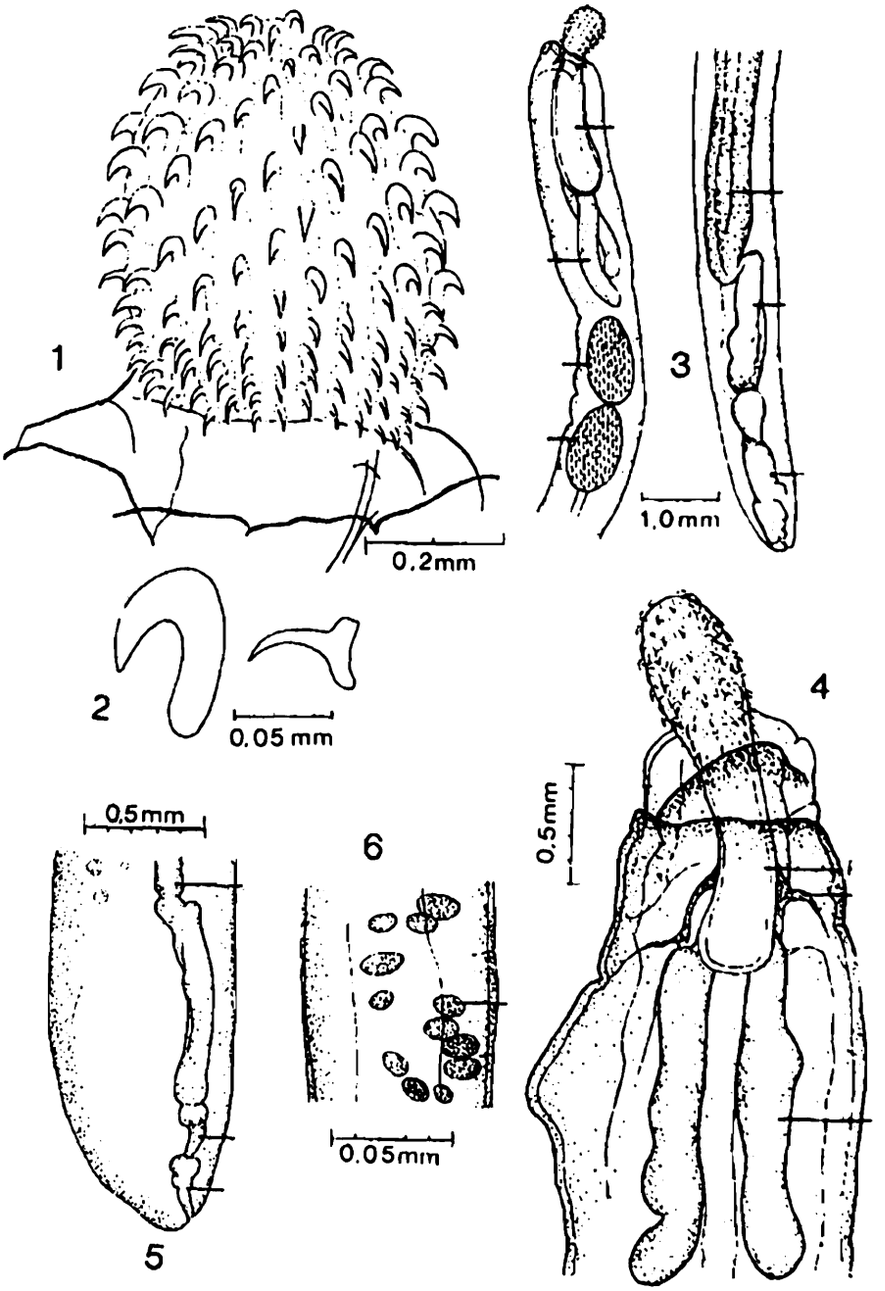


Fig. 168. *Centrorhynchus golvani* Anantaraman & Anantaraman, 1969. 1. Proboscis enlarged, 2. Proboscis hooks enlarged, 3. Anterior and posterior part of male, 4. Anterior part of female, 5. Posterior part of female, 6. Middle part of female with ovarian balls (after Anantaraman & Anantaraman, 1969).

Testes ovoid, 1.1 × 0.6 mm, one behind other, anterior about 3.3 mm from base of proboscis. Cement glands long, tubular 3 (or 4?). Ejaculatory duct muscular 1.4 mm long, copulatory bursa 1.5 mm long with folded and twisted walls, opening subterminally. In female floating ovarian balls oval, 0.17 × 0.1 mm scattered in body cavity. Genital ligament along middle of body, supporting uterus 0.23 mm long, with enlarged anterior end and opening posteriorly into vagina, 0.27 mm long opening ventro-terminally.

Host : *Hiractus pennatus.*

Location : Intestine.

Locality : Chennai (Tamil Nadu).

Distribution : Known only from type locality.

191. ***Centrorhynchus guptai*** Golvan, 1969
(Fig. 169)

Pomphorhynchus indicus Gupta, N.K. & Lata, 1968a : 264-266, Fig. 17-19; Golvan, 1969 : 316; *Centrorhynchus guptai* Golvan, 1994: 142.

Type locality : Hoshiarpur, Punjab, India.

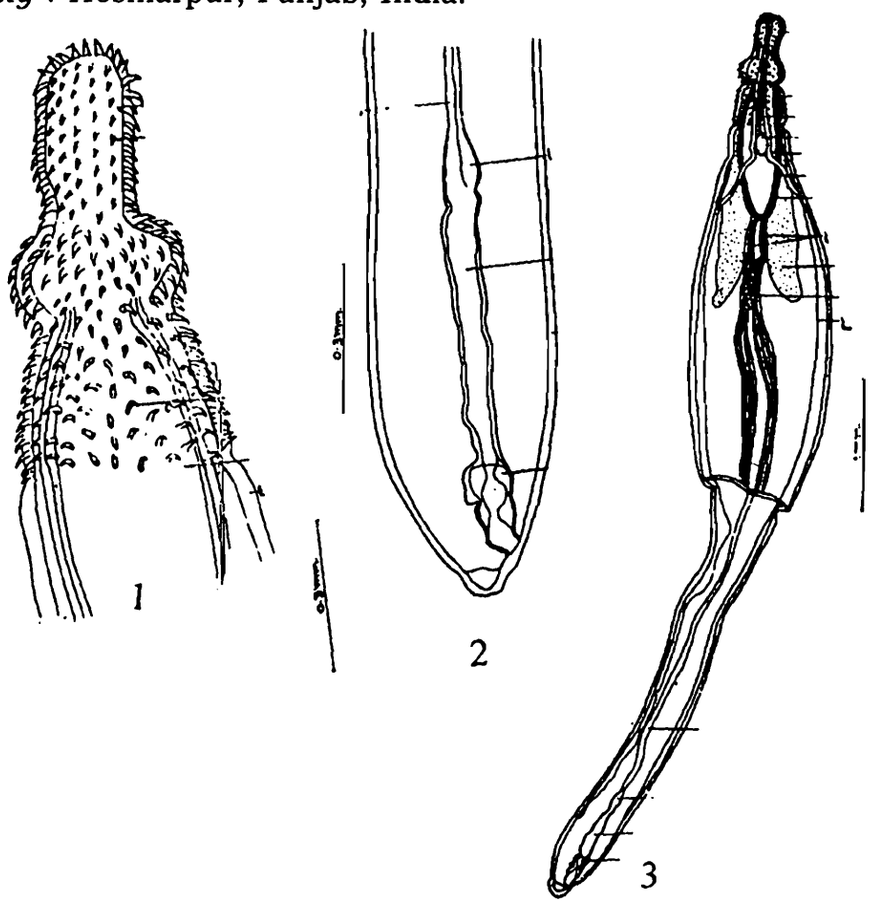


Fig. 169. *Centrorhynchus guptai* Golvan, 1969. 1. Proboscis and trunk enlarged, 2. Posterior part of female, 3. Female (after Gupta, N.K. & Lata, 1968).

Description : Female 7.07 mm long, anterior part bulbous 1.02 mm wide. Proboscis 0.308 × 0.10 mm with 14 longitudinal rows of 8-9 hooks each, hooks 0.016 × 0008 mm. Marginal hooks 0.028 × 0.004 mm. Neck 0.64 mm long differentiated into anterior swollen part forming a bulb, 0.154 × 0.0308 mm, with 22 longitudinal rows of 2-3 spines each, spines of this part large with poorly developed roots. Posterior cylindrical part neck, 0.49 × 0.037 mm with 22 longitudinal rows of 7-9 spines each, spines here 0.02 × 0.03 mm. At base of bulb spines very minute, 0.006 × 0.002 mm. Proboscis receptacle cylindrical, double-walled, 1.0 × 0.32 mm, with ganglion at its middle. Trunk fusiform, aspinose. Anterior part of trunk bulbous, 1.02 mm wide, posteriorly abruptly tapers to form a narrow tubular hind trunk, 0.32 mm wide. Lacunar system very well developed. Lemnisci paired, cylindrical, 1.19 × 0.21 mm, emerging from hind end of neck, and longer than receptacle. Ovary 0.44 × 0.14 mm. Uterine bell, 0.14 × 0.07 mm, thick-walled, anteriorly attached to suspensory ligament. Uterus elongated, 0.53 × 0.086 mm, leading into vagina, 0.19 × 0.08 mm, with a pair of sphincters. Male not known.

Host : *Astur badius* (Gmelin); Owl, *Tyto alba* (Scopoli), *Halcyon smyrnensis* (Linnaeus) Sykes. Juvinile in *Rana tigrina* Daudin, *Ptyas mucosus* (Linnaeus).

Location : Intestine.

Locality : Hoshiarpur (Punjab).

Distribution : Known only from type locality.

192. ***Centrorhynchus hargisi*** Gupta, V. & Fatma, 1983 (Fig. 170)

Centrorhynchus hargisi Gupta, V. & Fatma, 1983 : 117-120, Pl. 5, Fig. 1-6; Golvan, 1994 : 142. Bhattacharya, 2007 : 172-173, Pl. 29, Fig. 159 a-e.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 13.0-14.5 ×.1.94-4.50 mm; female 17.93-22.0 × 2.5-6.0 mm. Proboscis ovoid followed by a short neck. Proboscis 0.45-0.95 × 0.3-0.4 mm in male, in female 0.58-0.90 × 0.40-0.50 mm. Proboscis and neck with 18-20 longitudinal rows of 10-12 hooks each, radially and symmetrically arranged. Anterior 8-9 hooks long, curved, with broad base and recurved blade, 0.025-0.035 mm long, remaining hooks on prcboscis and neck small, slender, 0.010-0.20 mm long. Neck 0.20-0.22 × 0.16-0.20 mm in female. Proboscis receptacle elongated double-walled, with ganglion at its middle, 0.8-1.2 × 0.22-0.32 mm in male, in female 1.20-1.30 × 0.25 to 0.30 mm. Trunk elongated, cylindrical, swollen anteriorly, without pseudo-segmentation. Lacunar system with main longitudinal channels and reticular anastomoses. Hypodermal nuclei small, numerous, evenly distributed. Lemnisci elongated, subequal larger than proboscis receptacle, shorter lemniscus 2.02-2.40 × 0.12-0.25 mm, longer lemniscus 2.26-2.60 × 0.15-0.25 mm in male; in female shorter lemniscus 2.0 to 2.5 × 0.25-0.28 mm. Testis ovoid, in tandem, subequal, overlapping, pre-equatorial, anterior 1.50-1.92 × 0.76-1.2 mm, posterior smaller 1.38-1.70

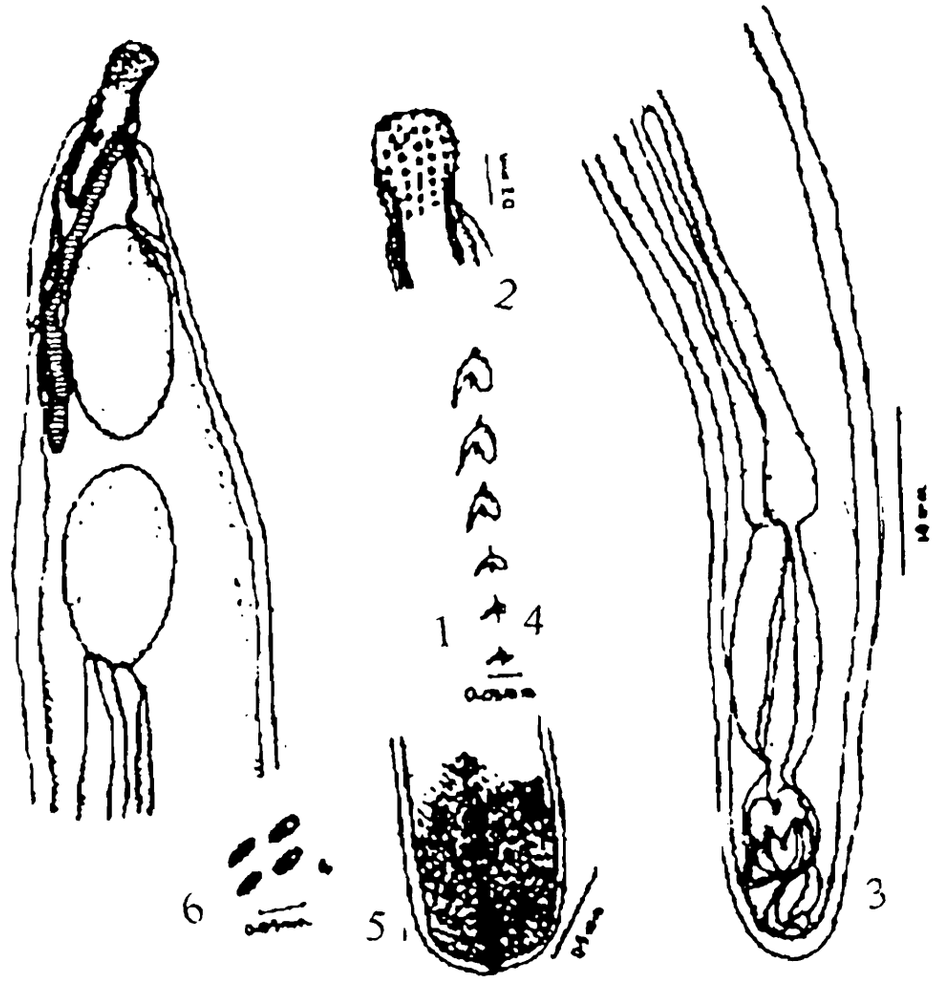


Fig. 170. *Centrorhynchus hargisi* Gupta, V. & Fatma, 1983. 1. Anterior part of male, 2. Proboscis enlarged, 3. Posterior part of male, 4. Row of proboscis hooks enlarged, 5. Posterior part of female, 6. Ova (after Gupta, V. & Fatma, 1983).

× 0.8-1.22 mm long. Cement glands 6, tubular, 3.65-5.0 × 2.25-0.40 mm. Subpenial sphincter absent. Seminal vesicle pyriform 1.32-1.6 × 0.30-0.35 mm. Bursa elongated muscular eversible, 1.30-1.50 × 0.65-0.80 mm. Uterine bell rectangular 0.30-0.35 × 0.15-0.18 mm. Body cavity packed with well developed ova 0.020-0.025 × 0.015-0.018 mm. Gonopore terminal in male and subterminal in female.

Host : *Corvus splendens* (Vieillot).

Location : Intestine

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

Remarks : This species is included in this work on the basis of Dr. D.R.R. Burt's worms collected from a hawk in Sri Lanka.

193. ***Cantrorhynchus horridus*** (Linstow, 1897) Yamaguti, 1963 (Fig. 171)

Cantrorhynchus horridus (Linstow, 1897) Yamaguti, 1963 : 1-423; Bhattacharya, 2000 : 155-156; 2007 : 185-186, Pl. 32, Fig. 178 a, b.

Type locality : Bismark Aechipelago,

Description : Worms of medium size, fusiform. Male 8-12 × 0.5 × 0.5-75 mm. Proboscis long, 0.5 × 0.2-0.3 mm, with 26-28 longitudinal rows of 15-16 hooks each, anterior 6-7 hooks large with roots and 10 smaller rootless hooks in each row. Proboscis receptacle 0.75 mm long; with ganglion in posterior end of proboscis. Trunk cylindrical. Lemnisci flagelliform about 1.5 mm long. Testes pre-equatorial, oval, antereior testis 0.66 × 0.43 mm, posterior testis 0.74 × 0.46. Cement glands two, long intestiform. Seminal vesicle 0.42 mm long. Gonopore subterminal. Eggs unknown.

Host : *Halcyon* sp.; King fisher.

Location : Intestine.

Locality : Tripura.

Distribution : Bismark Archipelago, New Caledonia, Queensland in Australia.

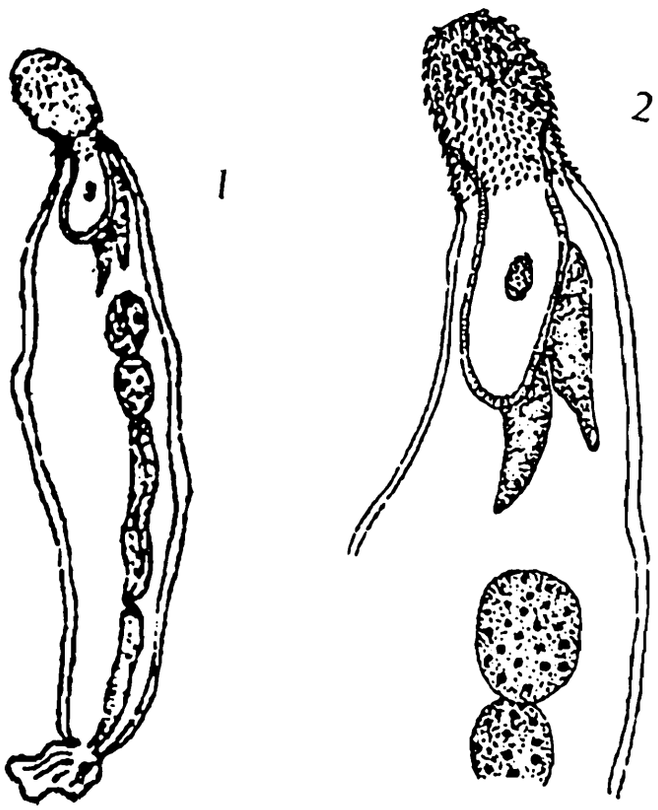


Fig. 171. *Centrorhynchus horridus* (Linstow, 1897) Yamaguti, 1963. 1. Male, 2. Anterior part of male (after Bhattacharya, 2007).

194. ***Centrorhynchus javanicus*** Rengaraju & Das, 1975
(Fig. 172)

Centrorhynchus javanicus Rengaraju & Das, 1975 : 40-42, Fig. 1-3; Golvan, 1994 : 142.

Type locality : Sholapur, Maharastra, India.

Description : Mature male 22 × 0.9 mm. Proboscis 0.45 × 0.30 mm, with 28 longitudinal rows of 10 hooks each. Anterior hooks larger than others. Neck 0.6 × 0.48 mm with 28 longitudinal rows of 9 spines each. Neck spines nearly half size of proboscis hooks. Proboscis receptacle double-walled, 1.44 mm long. Trunk cylindrical. Lemnisci 1.18 mm long. Testes subequal, anterior smaller 0.96 mm long, posterior 1.02 mm long. Cement glands two, 1.29 mm long. Saefftigen's pouch present. Bursa cap 1.17 mm long, bursa 0.45 mm long with bursal cap. Female not known.

Host : *Tyto alba javanica.*

Location : Intestine.

Locality : Sholapur (Maharastra).

Distribution : Known only from type locality.

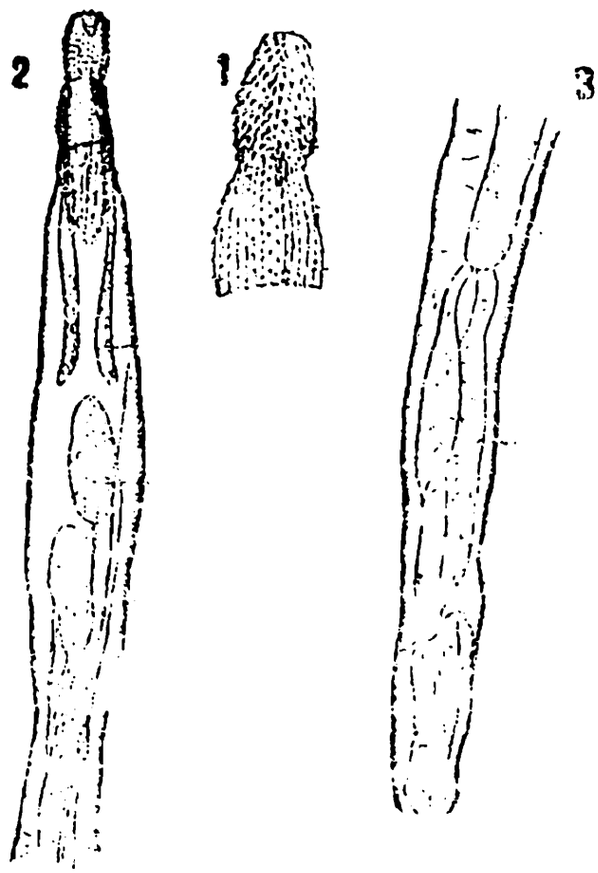


Fig. 172. *Centrorhynchus javanicus* Rengaraju & Das, 1975. 1. Proboscis and neck enlarged, 2. Anterior part of male, 3. Posterior part of male (after Rengaraju & Das, 1975).

195. ***Centrorhynchus knowlesi*** Datta & Soota, 1955
(Fig. 173)

Centrorhynchus knowlesi Datta & Soota, 1955a : 15-18, Fig. 1, 2; Yamaguti, 1963 : 124, Pl. 56, Fig. 575, 576; Anantaraman & Anantaraman, 1970 : 6; Gupta, P. D. & Ghosh, 1979: 314; Golvan, 1994 : 142; Bhattacharya, 2007 : 179, Pl. 31, Fig. 166 a-d.

Type locality : Alipore, Kolkata, West Bengal, India.

Description : Male 7.37 mm long, anterior part including proboscis 2.9 × 0.48 mm, posterior part 0.23 mm. Female 9.16 mm long, anterior part including proboscis 3.71 × 0.46 mm, posterior part 0.21 mm wide. Proboscis 0.53 × 0.23 mm in male; in female 3.71 × 0.46 mm; with 42-46 longitudinal rows of 14-16 hooks each in both sexes. Anterior hooks larger, 0.03-0.04 mm long, posterior hooks 0.02-0.022 mm long. Neck 0.56 × 0.29 mm. Proboscis receptacle 0.86 × 0.29 mm, with ganglion at 0.62 mm from anterior end in male; in female 1.09 mm long, with ganglion at 0.92 mm from anterior end. Trunk divided into wide oval anterior part and a narrow, cylindrical posterior part. Lemnisci longer than receptacle, 0.81 mm long in male, in female 0.93 mm long. Testes 2, lies one behind other, anterior 0.41 × 0.28 mm, posterior 0.38 × 0.23 mm long. Cement glands long, cylindrical, 2.55 mm long with its reservoir. Seminal vesicle 0.79 mm long. Bursa funnel-shaped 0.74 mm long. Penis small, muscular and conical located at top of bursa. Ovary 0.46 mm long with ovarian balls. Uterine bell 0.2 mm long with guard cells. Uterus long, 0.39 mm long. Vagina 0.15 mm long with muscle. Female gonopore subterminal.

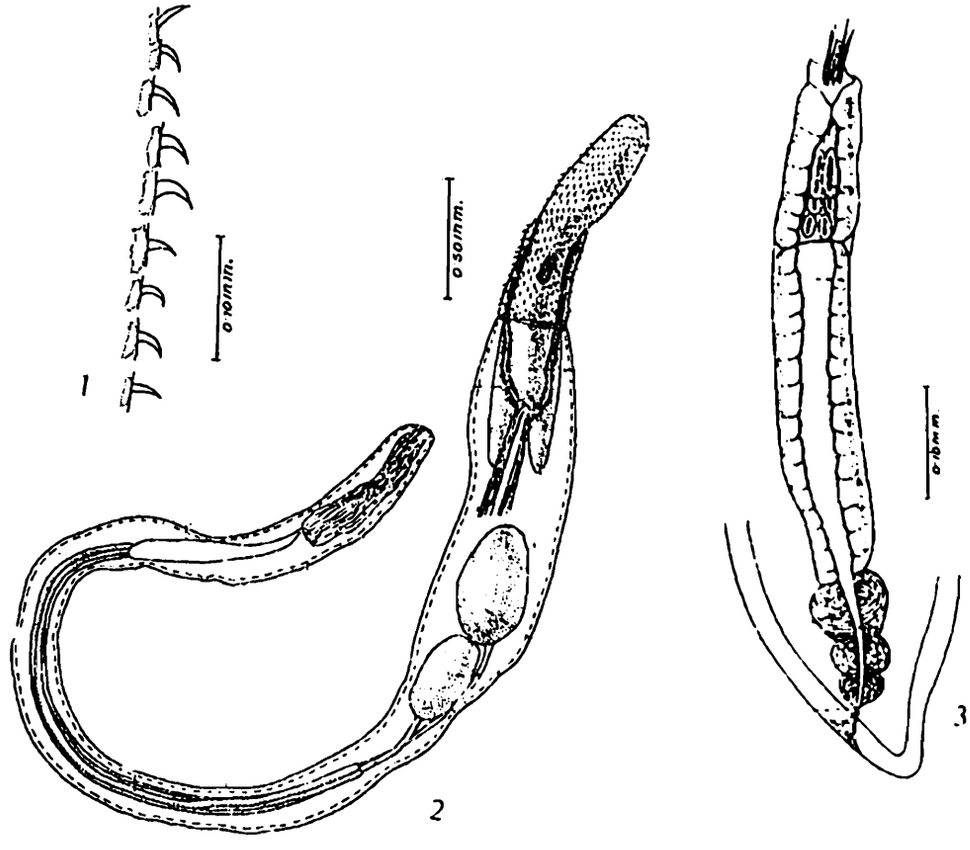


Fig. 173. *Centrorhynchus knowlesi* Datta & Soota, 1955. 1. Row of proboscis hooks enlarged, 2. Male, 3. Female genitalia (after Datta & Soota, 1955).

Host : Scops owl, *Scops* sp.; *Otus* sp.

Location : Intestine.

Locality : Alipore, Kolkata zoo (West Bengal).

Distribution : Known only from type locality.

196. ***Centrorhynchus latai*** Golvan, 1994
(Fig. 174)

Centrorhynchus falconis Das, 1950b : 291-294, Textfig. 1 a-e; 1957 : 71-82, Fig. 1-17;

Centrorhynchus falconis Schmidt & Kuntz, 1969 : 331-332, Fig. 11-15;

Centrorhynchus indicus Yamaguti, 1963 : 124; Anantaraman, M. & Anantaraman, S. 1970 : 6;

Centrorhynchus falconis Rengaraju & Das, 1976b : 263-269; Gupta, P. D. & Ghosh, 1979: 314;

Centrorhynchus latai Golvan, 1994 : 142.

Centrorhynchus indicus Singh & Agarwal, 1999 : 136. Bhattacharya, 2007 : 190-192, Pl. 34, Fig. 185 a-c.

Type locality : Amritsar, Punjab, India.

Description : Male 8.8 × 0.52 mm, female 8.7 × 0.52 mm. Proboscis elongate, cylindrical, 0.95 mm long with 23-30 longitudinal rows of 21-23 hooks each, hooks of adjacent rows alternate with each other throughout its length. Proboscis hooks 12-14, measure 0.036 mm long. Neck 1.62 mm long with 23-30 longitudinal rows of 9 hooks each, 0.017 mm long. Proboscis receptacle double-walled, 1.81 × 0.3 mm. Lacunar system with two main longitudinal channels and transverse vessels. Lemnisci 1.7 mm long extend up to 0.55 mm

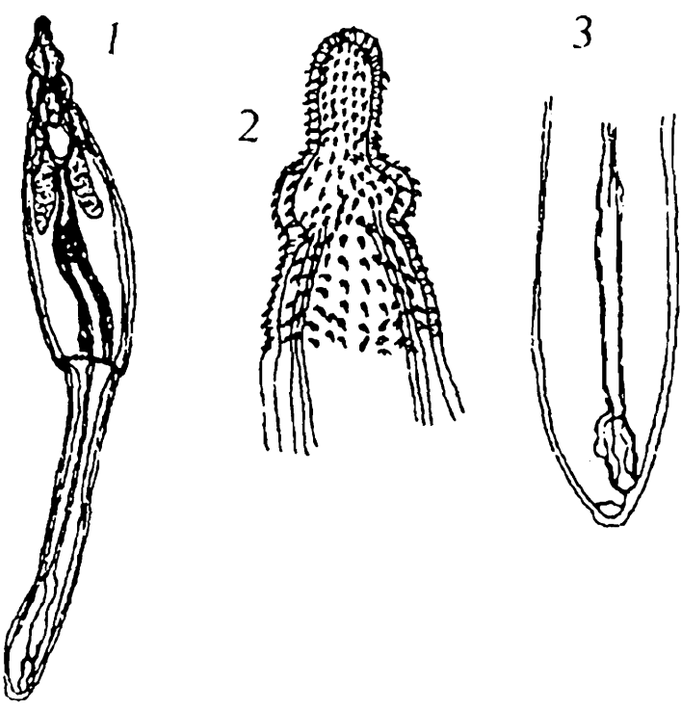


Fig. 174. *Centrorhynchus latai* Golvan, 1994. 1. Male, 2. Proboscis, 3. Female (after Yamaguti, 1963).

beyond base of receptacle. Testes equal in size, 0.3 × 0.2 mm, held in position by genital ligament, anterior testis placed at a distance of 3.8 mm from anterior end, posterior testis at 4.3 mm from anterior end. Cement glands 2, long, tubular. Bursa stout, muscular, 0.95 mm long. Ovary lies about middle of body, 0.2 mm behind hind end of lemnisci, divided into a number egg masses held together within genital ligament. Uterine bell 0.12 × 0.10 mm, communicates with funnel-shaped, tubular uterus 0.25 mm long, Vagina 0.19 × 0.10 mm wide with anterior and posterior sphincter muscles and opens into vulva, which opens to exterior.

Host : *Circus macrourus* (Gmelin), *Ptyas mucosus* (Linnaeus), *Spiloerne cheela hoya, Astur badius.*

Location : Small intestine mesenteries;

Locality : Amrister (Punjab); Kolkata (West Bengal), Sri Lanka.

Distribution : China; Central Australia.

197. ***Centrorhynchus longicephalus*** Das, 1950
(Fig. 175)

Centrorhynchus longicephalus Das, 1950a : 53-54, Fig. 3; Petrotschenko, 1956 : 221; Yamaguti, 1963 : 123, Anantaraman, M. & Anantaraman, S. 1970: 7; Gupta, N. K. & Jain, 1973b : 555; Jain & Gupta, N. K. 1984 : 16-17; Golvan, 1994 : 142; Bhattacharya, 2007 : 180-182, Pl. 31, Fig. 169 a, b.

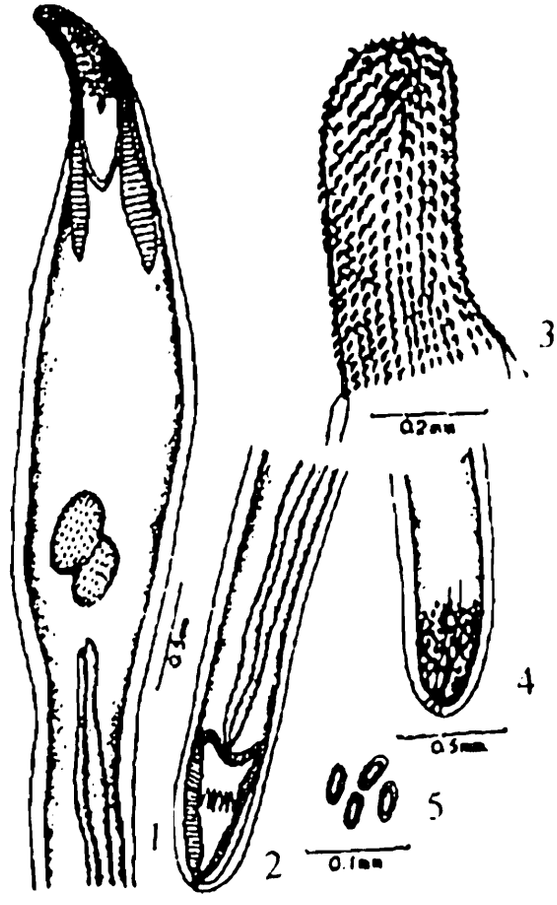


Fig. 175. *Centrorhynchus longicephalus* Das, 1950. 1. Juvenile worm, 2. Acanthella (after Das, 1950).

Type locality : Amraoti, Maharastra, India.

Description : Parasite 2.4 mm long, anterior end 0.25 mm wide, posterior end 0.4 mm wide, middle region 0.6 mm wide. Neck 0.9 mm long. Proboscis 0.7 mm long, with 24-26 longitudinal rows of 30 hooks each. Hooks of proboscis and spines of neck of same size. Proboscis receptacle double-walled, 0.79 × 0.3 mm wide.

Host : *Lycodon* sp., *Tropidonotus* sp. , *Ptyas mucosus, Rana tigrina* Daudin.

Location : Intestine, cyst in peritoneum.

Locality : Amraoti (Maharastra); Chandigarh.

Distribution : Known only from India.

198. ***Centrorhynchus lucknowensis*** Gupta, V. & Fatma, 1983 (Fig. 176)

Centrorhynchus lucknowensis Gupta, V. & Fatma, 1983 : 115-117, Pl. 4, Fig. 1-5; Golvan, 1994 : 142; Bhattacharya, 2007 : 169, Pl. 29, Fig. 153 a-d.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 6.29-6.90 × 0.81-0.90 mm; female 6.94-7.23 × 0.90 to 0.96 mm. Proboscis cylindrical, 0.50-0.54 × 0.21-0 0.24 mm in male; in female 0.54-0.58 × 0.24-0.28 mm, followed by short neck. Proboscis and neck with 30-32 longitudinal rows of 20-22 hooks each, radially and symmetrically arranged 9-10 hooks on anterior region long, rooted with broad base and recurved blade, 0.035-0.040 mm long, remaining spines on proboscis and neck small, slender, 0.028 and 0.030 mm long. Proboscis receptacle cylindrical, double-walled originating from midproboscis near constriction formed by junction of proboscis and neck with ganglion at its middle, 0.68-0.72 × 0.20-0.22 mm in male, in female 0.6-0.8 × 0.22-0.25 mm. Trunk elongated, cylindrical, aspinose with internal pseudo-segmentation, swollen anteriorly up to testes, tapering posteriorly with rounded distal end. Lacunar vessels main longitudinal lateral channels with reticular anastomoses. Hypodermal nuclei small numerous evenly distributed. Lemnisci 2, elongated subequal, narrow, longer than proboscis receptacle, extending far above to anterior testis, shorter lemniscus 0.48-0.80 × 0.10-0.12 mm, longer 0.65-1.12 × 0.12- 0.15 mm in male; in female shorter lemniscus 0.46-0.75 × 0.12-0.15 mm, larger 0.92-1.02 × 0.10-0.15 mm. Testis ovoid, in tandem, subequal, equatorial, close together, anterior 0.42-0.45 × 0.30-0.35 mm, posterior smaller 0.40-0.42 × 0.30-0.32 mm. Cement glands 3, long, tubular overlapping posterior testis, 2.7-3.2 mm long. Subpenial sphincter absent. Seminal vesicle 0.40-0.45 × 0.25-0.30 mm. Bursa muscular, elongated, eversible, 0.60-0.65 × 0.25-0.35 mm. Uterine bell elongated 0.52-0.55 × 0.12-0.15 mm. Uterus 0.45-0.55 × 0.10-0.12 mm. Eggs oval, 0.025-0.035 × 0.015-0.018 mm. Gonopore terminal in male and subterminal in female.

Host : *Haliester indicus* (Boddaert).

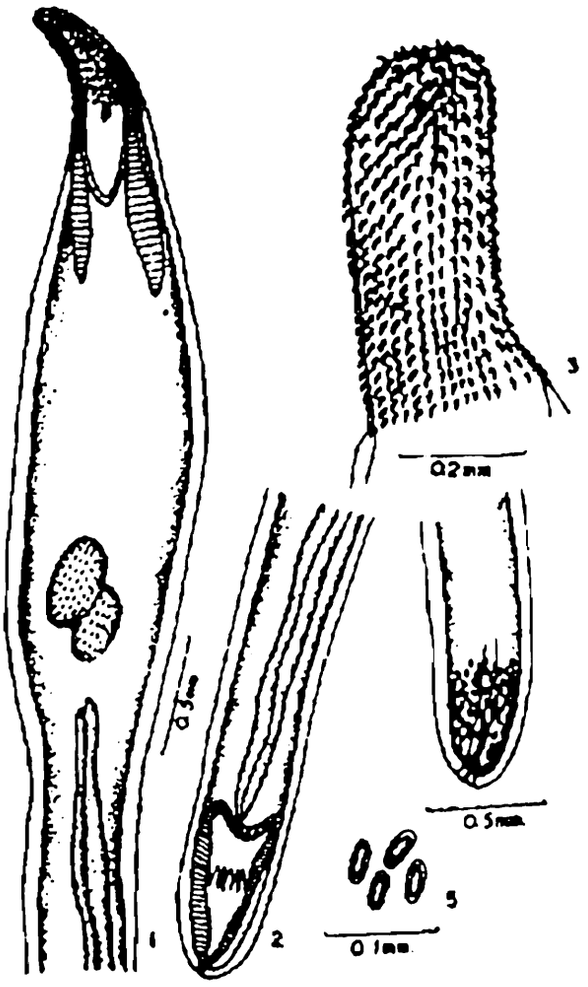


Fig. 176. *Centrorhynchus lucknowensis* Gupta, V. & Fatma, 1983. 1. Anterior part of male, 2. Posterior part of male, 3. Proboscis enlarged, 4. Posterior part of female, 5. Ova (after Gupta, V. & Fatma, 1983).

Location : Intestine

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

199. ***Centrorhynchus macrorchis*** Das, 1950
(Fig. 177)

Centrorhynchus macrorchis Das, 1950b : 294-296, Textfig. 2 a-d;

Yamaguti, 1963 : 124; Anantaraman, M. & Anantaraman, S. 1970: 6; Gupta, P. D. & Ghosh, 1979: 314; Golvan, 1994: 142.

Type locality : Amraoti, Maharastra, India.

Description : Worms dark brown in life. Male 18,8 × 0.82 mm, female 8.7 × 1.4-2.1 mm. In female posterior end drawn out behind vulva into a small blunt conical process. Proboscis almost spherical, 0.74 × 0.32 mm, with 28-30 longitudinal rows of 23-26 hooks each in male, in female 24-28 rows of 10 hooks each, hooks 0.034-0.057 × 0.011-0.013

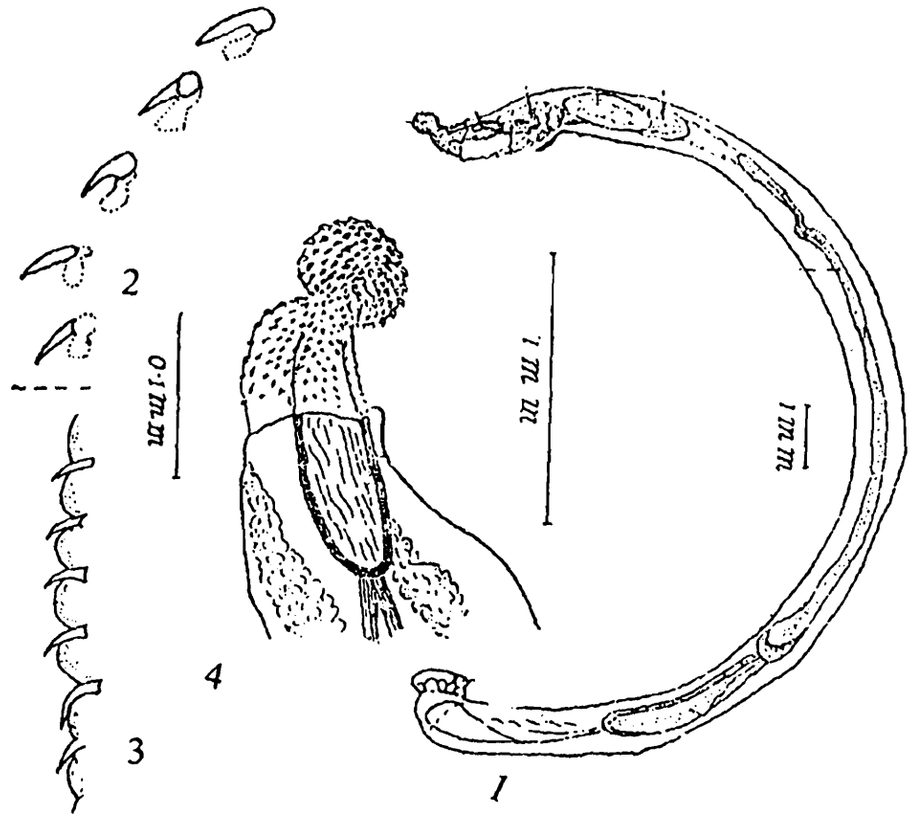


Fig. 177. *Centrorhynchus macrorchis* Das, 1950. 1. Male, 2. Proboscis hooks enlarged, 3. Trunk spines enlarged, 4. Proboscis and receptacle (after Das, 1950).

mm long. Neck 0.42 mm long, with 24-28 rows of 9 spines each. Proboscis receptacle double-walled, 0.95 × 0.29 mm1.2-1.6 × 0.3-0.5 mm penetrated by a pair of retinacula a little behind its middle. Trunk stout, tubular, anterior part swollen, cylindrical, of uniform girth and curved. Lacunar system reticular. Lemnisci 1.2-3.0 mm long, extending beyond receptacle. Testes oval to ellipsoidal, directly in tandem or partly overlapping each other in anterior third of trunk, anterior testis 1.40 × 0.51 mm at 2.19 mm from anterior end, posterior testis smaller 1.10 × 0. 41 mm0.38-1.30 × 0.2-0.63 mm. Cement glands 4, in 2 pairs, long, tubular, anterior pair longer than posterior. Saefftigen's pouch elongate. Bursal cap 0.18-0.30 mm long, distally attenuated, with digitiform 18 rays. Bursa thick, muscular with plate-like structures at its base. Floating ovarian balls elliptical, 0.2-0.5 mm long. Uterine bell 0.3-0.4 mm long. Uterus 1.0-1.35 mm long. Vagina with anterior sphincter of 0.09-0.12 mm, posterior 0.087-0.108 mm in diameter, vaginal bulb 0.075-0.11 mm in diameter. Eggs with three membranes, outer 0.047-0.057 × 0.021-0.031 mm, middle 0.041-0.052 × 0.018-0.027 mm, inner 0.036-0.039 × 0.016-0.021 mm, embryo 0.034-0.036 × 0.015-0.017 mm.

Host : *Falco* (*Cerchneis*) *tinunculus tinunculus*; *Urocissa melanocephala occipatalis* (Blyth).

Location : Intestine.

Locality : Amraoti (Maharastra); Berar; Bhowali, Kumaon hills (Uttar Pradesh); Hoshiarpur (Punjab).

Distribution : Known only from India.

200. ***Centrorhynchus magnus*** Fukui, 1929

Centrorhynchus magnus Fukui, 1929: 225-270; Das, 1950b: 294; Meyer, 1932: 110; Petrotschenko, 1958: 221-222; Yamaguti, 1939: 330-332, Pl. 49, Fig.42; 1963: 124; Schmidt & Kuntz, 1969: 332; Golvan, 1994: 142.

Type locality : Japan.

Description : Male 9.6-20 × 0.9-1.4 mm, females 20-32 × 2.1 mm. In females posterior end drawn out behind vulva into a small, blunt conical process. Proboscis 0.6-0.8 × 0.3-0.42 mm, with 35-40 longitudinal rows of 24-26 hooks each, 0.037-0.043 mm long in male, in female 37-43 rows of 25-28 hooks each, hooks 0.033-0.057 mm long. Neck 0.5-0.6 mm long. Proboscis receptacle 1.2-1.8 × 0.3-0.5 mm, double-walled, with a pair of retinacula a little behind middle. Lacunar system reticular. Trunk more or less swollen at anterior part, in female posterior part drawn out behind vulva into a small blunt conical process. Lemnisci shorter or as; long as receptacle when contracted, 1.3-3.0 mm long. Testes oval to ellipsoidal, directly in tandem or partly overlapping each other in anterior third, 0.38-1.3 × 0.20-0.63 mm. Cement glands 4, very long. Saefftigen's pouch elongated. Bursal cap 0.18-0.3 mm long with 18 distally attenuated, digitiform rays, without anterior diverticula. Floating ovarian balls elliptical, 0.2-0.5 mm long. Uterine bell 0.3-0.4 mm long. Uterus 1.0-1.35 mm long. Anterior vaginal sphincter 0.096-0.12 mm and posterior 0.087-0.106 mm diameter. Vaginal bulb 0.0750.11 mm wide. Eggs 0.048-0.057 × 0.021-0.031. Embryo 0.034-0.036 × 0.015-0.017 mm.

Host : *Astur badius* (Gmelin); Owl, *Tyto alba* (Scopoli), *Halcyon smyrnensis* (Linnaeus) Sykes. Juvinile in *Rana tigrina* Daudin, *Ptyas mucosus* (Linnaeus). Cystacanths from *Rana tigrina* Daudin. and *Bufo melanostictus* Schneider.

Location : Intestinal wall.

Locality : Dhaka (Bangladesh).

Distribution : China, Japan; Russia.

201. ***Centrorhynchus microcephalus*** (Bravo-Hollis, 1947) Golvan, 1956 (Fig. 178)

Gordiorhynchus microcephalus Bravo-Hollis, 1947 : 499-506;

Centrorhynchus microcephalus (Bravo-Hollis) Golvan, 1956 : 766; Petrotschenko, 1958 : 222; Yamaguti, 1963: 125, Pl. 53, Fig. 545-551; Gupta, N. K. & Gupta, K., 1972c: 3-5, Fig. 4-6. Golvan, 1994 : 142; Bhattacharya, 2007: 183, Pl. 31, Fig. 174 a, b.

Type locality : Mexico.

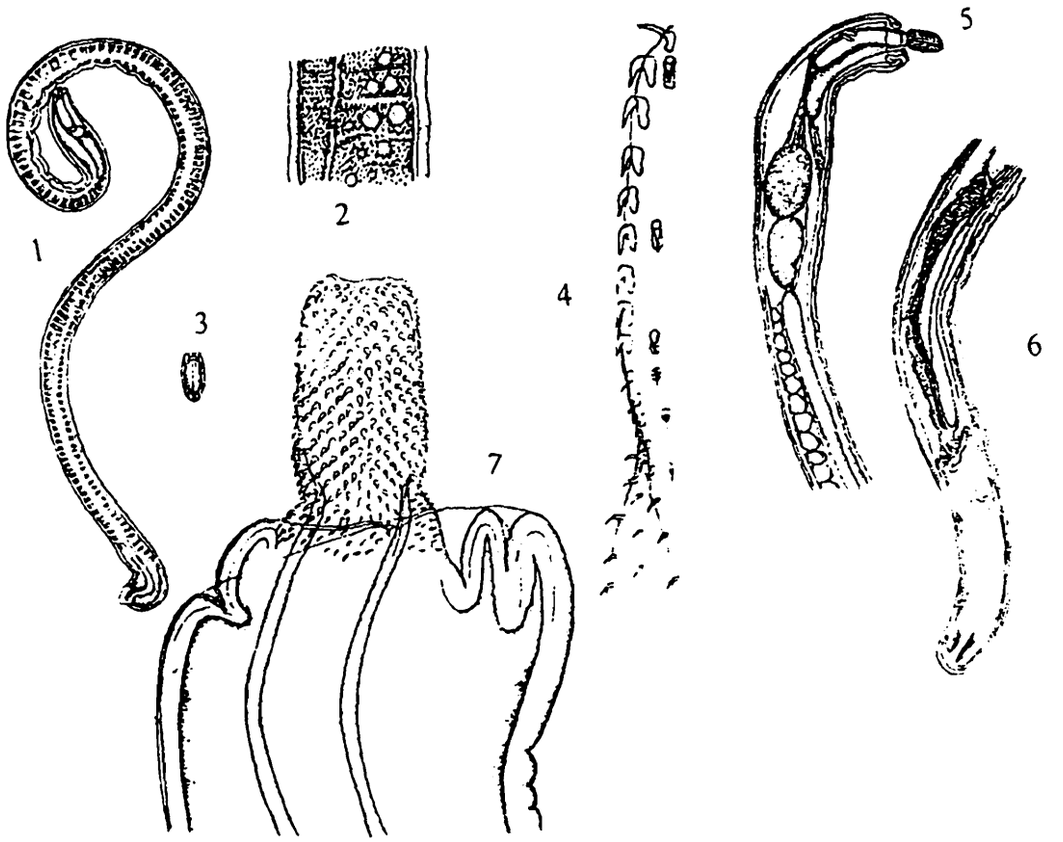


Fig. 178. *Centrorhynchus microcephalus* (Bravo-Hollis, 1947) Golvan, 1956. 1. Female, 2. Part of female trunk, 3. Ovum, 4. Row of proboscis hooks enlarged, 5. Anterior part of male, 6. Posterior part of male, 7. Proboscis enlarged (after Yamaguti, 1963).

Description : Female 19.62-20.55 × 1.44-1.65 mm. Proboscis small, cylindrical 0.63 × 0.36 mm, with 32 longitudinal rows of 10-15 hooks each, hooks 0.045 × 0.006 mm. Basal hooks smaller, 0.033 × 0.009 mm. Except apical hooks, all hooks in proboscis tend to form spiral arrangement. Apical hooks with well developed roots.. Neck short, 0.46-0.48 mm long with 38 longitudinal rows of 9-12 hooks each, all hooks with poorly developed roots, 0.024-0.033 × 0.001-0.002 mm Proboscis receptacle cylindrical, double-walled, 1.22-1.37 × 0.43 mm, with ganglion at its middle. Trunk elongate, aspinose. Lacunar system well developed with two main longitudinal channels and reticular anastomoses. Lemnisci paired, cylindrical, 2.10-2.16 × 0.41 mm, longer than receptacle. Ovary burst up into a number of ovarian balls and eggs, scattered throughout body cavity. Uterus narrow, long attached to suspensory ligament. Vagina with sphincters opens to exterior through subterminal female gonopore. Eggs oval, 0.042-0.057 × 0.021-0.027 mm, Male not known.

Host : *Athene brama* (Temminck).

Location : Intestine.

Locality : Chandigarh.

Distribution : Mexico.

Note : In literature male 19.35-23-37 mm, female 24-43-43.05 mm; Proboscis with 36-38 × 18-20 in male, 36-38 × (9+9-11). hooks each. Eggs 0.053-0.061 mm, 0.024-0.028 mm.

202. ***Centrorhynchus microrchis*** Fukui, 1929
(Fig. 179)

Centrorhynchus microrchis Fukui, 1929 : 225-270; Meyer, 1932 : 110; Yamaguti, 1963 : 125; Gupta, N.K. & Lata, 1968a : 330-331, Fig. 6-9;

? Anantaraman, M. & Anantaraman, S., 1970: 6; Golvan, 1994 : 142; Bhattacharya, 2007 : 195, Pl. 32, Fig. 177 a-d.

Type locality : Japan.

Description : Male 9-20 × 0.9-1.5 mm, female 20-32 x1.4-2.1 mm wide. Proboscis elongate, cylindrical, 0.65-0.77 × 0.28-0.40 mm with 32 longitudinal rows of 13 hooks each, hooks 0.022 × 0.006 mm. Basal hooks smaller, 0.008 × 0.004 mm with well developed roots. Neck 0.39-0.56 × 0.30-0.518 mm, with 32 longitudinal rows of 10 spines each, spines 0.012 × 0.004 mm with poorly developed roots. Proboscis receptacle cylindrical, double-walled 0.81-1.31 × 0.18-0.35 mm with ganglion at its middle. Trunk fusiform, anterior part swollen

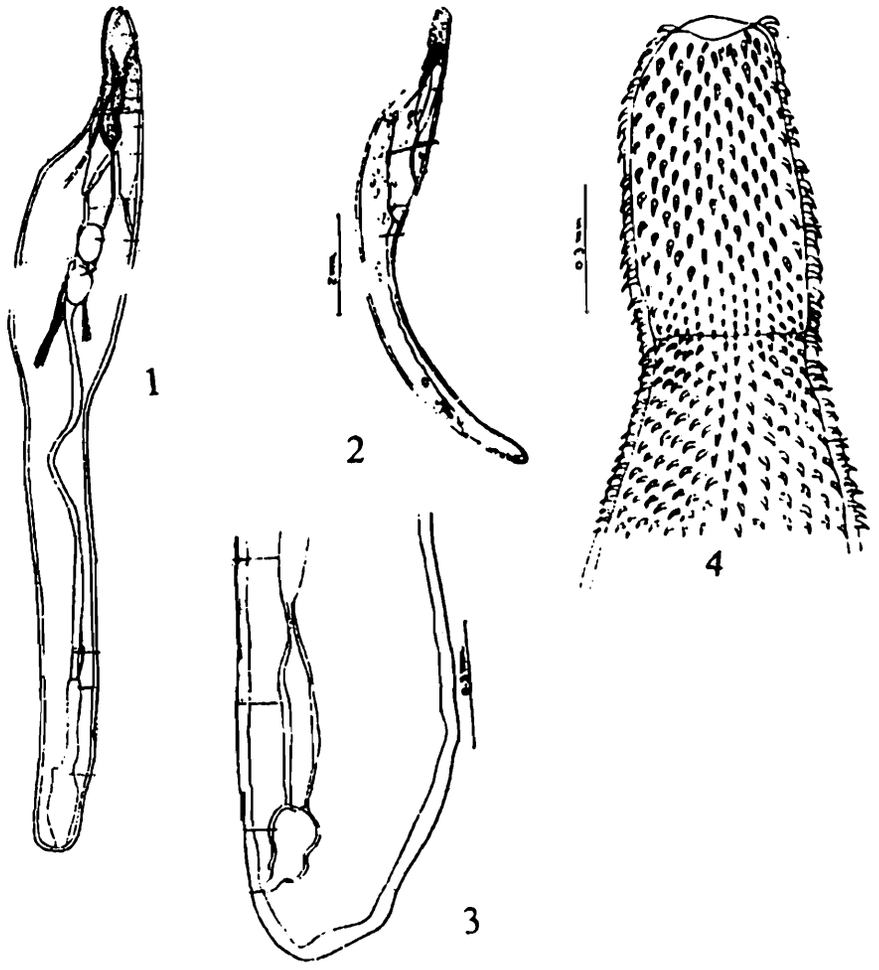


Fig. 179. *Centrorhynchus microrchis* Fukui, 1929. 1. Male, 2. Female, 3. Posterior part of female, 4. Proboscis enlarged (after Gupta, N.K. & Lata, 1967).

like a bulb 1.3-1.4 mm long, then abruptly tapers to form narrow tubular hind part 0.61-0.74 mm wide at level of cement glands in male and 0.22-0.75 mm wide at level of uterus in female. Lemnisci paired cylindrical, 0.91-1.21 × 0.18-0.19 mm, longer than receptacle. Testes paired, oval, in tandem, connected with each other, anterior 0.49-0.56 × 0.26-0.32 mm, posterior 0.56-0.58 × 0.26-0.32 mm. Cement glands 3, tubular, syncytial, collectively 4.0-4.8 × 0.056-0.084 mm in anterior half of trunk. Bursa inverted 1.03-1.19 × 0.28-0.36 mm. Uterine bell 0.14-0.21 x0.042-0.07 mm. Uterus 0.44-0.49 × 0.05-0.08 mm. Vagina 0.18-0.21 × 0.07-0.11 mm. Eggs 0.028-0.15 × 0.01-0.084 mm.

Host : Bird.

Location : Intestine.

Locality : Hoshiarpur (Punjab).

Distribution : Japan.

Note : Fukui (1929) reports male 11-16 mm, female 14-26 mm; proboscis hooks in 34-44 rows with 13-16 and 10-12 hooks each.

203. ***Centrorhynchus migrans*** Zuberi & Farooqi, 1974
(Fig, 180)

Centrorhynchus migrans Zuberi & Farooqi, 1974 : 147-150, Fig. 1 A-E; Golvan, 1994 : 142.

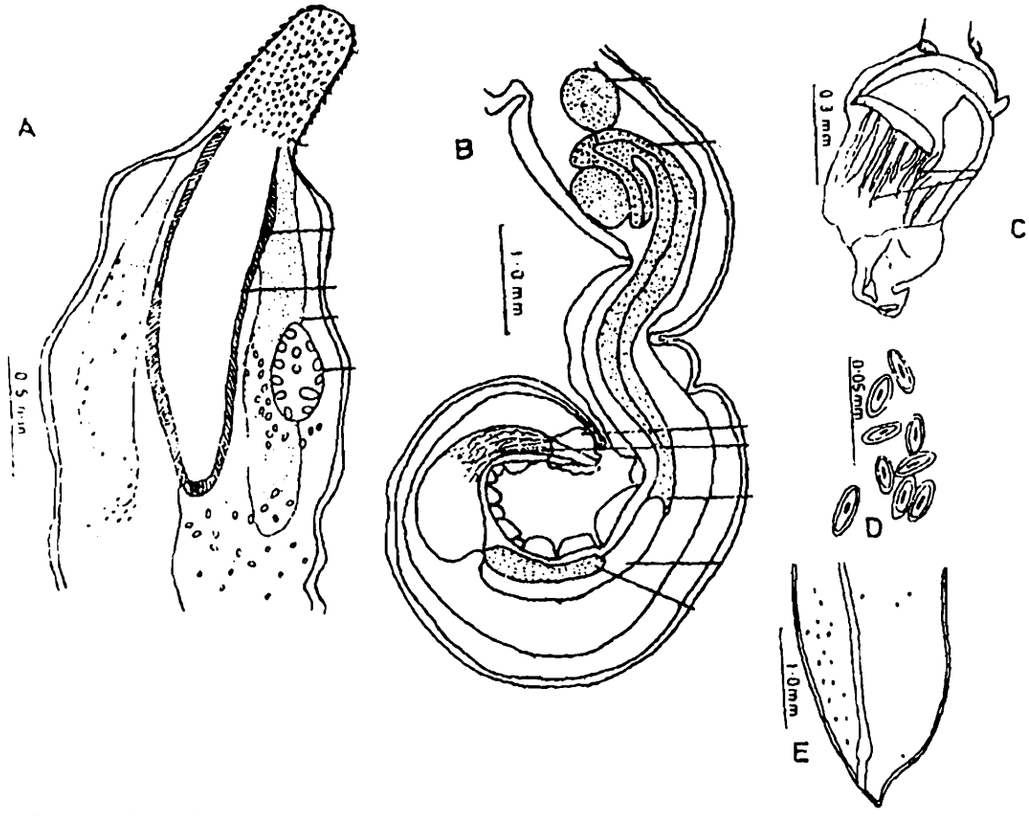


Fig. 180. *Centrorhynchus migrans* Zuberi & Farooqi, 1974. A. Anterior part of female, B. Posterior part of male, C. Burasa enlarged, D. Eggs, E. Posterior part of female (after Zuberi & Farooqi, 1971).

Type locality : Karachi, Sindh, Pakistan.

Description : Male 7.8-23.3 × 1.26-2.5 mm, female 10.0-36.1 × 2.3-2.4 mm. Proboscis short, 1.65 × 0.25 mm in male; in female 1.64 × 0.25 mm, with 30 longitudinal rows of 16 hooks each. Hooks measure 0.05 × 0.02-0.04 mm. Proboscis receptacle elongated, thick-walled, 1.35-1.85 × 0.25-0.40 mm in male, in female 1.32-1.85 × 0.32-0.57 mm. Trunk elongated, curved ventrally, aspinose. Lemnisci long, extend beyond receptacle, 1.43-2.11 × 0.27-0.38 mm in male, in female 1.99-2.15 × 0.52-0.83 mm. Testes one behind other, anterior 1.21-1.40 × 0.27-0.34 mm, posterior 1.67-1.69 × 0.50-0.90 mm. Cement glands 4, long, unequal, lie behind posterior testis, 0.47-1.47 × 0.23-0.40 mm, with a reservoir, wide anteriorly and narrow behind, 3.54-7.94 × 0.33-0.93 mm. Saefftigen's pouch elongated, 1.42-2.65 × 0.4-0.8 mm. Bursa with 13 rays and a bursal cap. Ovarian balls 0.20-0.34 mm in diameter, ova numerous filling body cavity, 0.045-0.05 × 0.015-0.02 mm.

Host : *Milvus migrans* (Boddaert).

Location : Intestine.

Locality : Karachi (Pakistan).

Distribution : Known only from type locality.

204. ***Centrorhynchus milvus*** Ward, 1956
(Fig. 181)

Centrorhynchus milvus Ward, 1956 : 39-40, Pl. 1, Fig. 1-5; Petrotschenko, 1958: 222-223; Yamaguti, 1963: 125, Pl. 56, Fig. 577-579; Gupta, N. K. & Lata, 1968b: 325-327; Nama & Rathore, 1982: 144; Golvan, 1994: 142; Bhattacharya, 1999: 176 359-392, 2000 : 156; 2007 : 166.

Type locality : Egypt.

Description : Female 7.42-10.4 × 1.0 mm. Proboscis long, cylindrical, 0.49-0.74 × 0.28-0.39 mm, with 32 longitudinal rows of 13 hooks each, hooks 0.022-0.024 × 0.0080.01 mm, with well developed roots. Proboscis receptacle cylindrical, double-walled, 1.09-1.26 × 0.30-0.40 mm, with ganglion about its middle, with a pair of postero-lateral nerves enclosed in a muscular sheath, retinaculum. Nerves pierce through wall of receptacle and run posteriorly in lateral wall of trunk. From anterior part of ganglion paired anterior median nerves given off anteriorly supplying proboscis. Trunk cylindrical, fusiform, aspinose, anterior fourth distinctly swollen, posterior tip of female with a small rounded projection. Lacunar system very well developed with two main longitudinal channels and reticular anastomoses. Lemnisci paired, cylindrical, arise from posterior end of neck, each lemniscus 1.09-1.91 × 0.21-0.35 mm. Testes 0.8-1.1 × 0.3-0.5 mm. Cement glands very long, 8-10 × 0.2-0.3 mm. Ovary 0.46 × 0.12 mm. Uterine bell 0.14-0.28 × 0.056-0.098 mm attached anteriorly to suspensory ligament. Uterus narrow, 0.56-0.74 × 0.056-0.126 mm, leads into small vagina, of 0.14-0.29 × 0.05-0.16 mm, with a pair of sphincters at its posterior end and opens to outside by female genital pore. Eggs round to ovoidal, 0.060-0.156 × 0.03-0.09 mm.

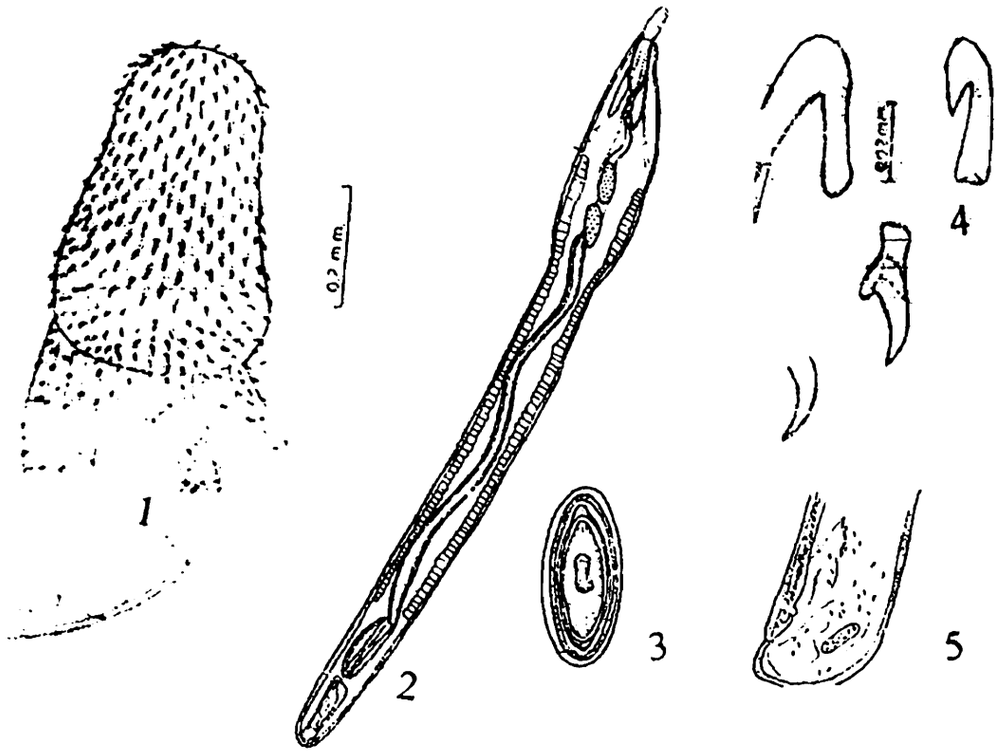


Fig. 181. *Centrorhynchus milvus* Ward, 1956. 1. Proboscis enlarged, 2. Male, 3. Ovum, 4. Proboscis hooks enlarged, 5. Posterior part of female (after Yamaguti, 1963).

Host : *Milvus migrans* (Boddaert); *Milvus migrans govinda, Astur badius* (Gmelin); *Corvus splendens* (Vieillot).

Location : Intestine.

Locality : Jodhpur (Rajasthan); Hoshiarpur (Punjab); Karachi (Pakistan); Meghalaya; Ambasa (Tripura).

Distribution : Isreal, Egypt; Senegal.

Note : Ward (1956) reports female 24-32 m long, proboscis hooks in 28-32 of 18-21 hooks, posterior spinose.

205. ***Centrorhynchus mysentri*** Gupta, V. & Fatma, 1983
(Fig. 182)

Centrorhynchus mysentri Gupta, V. & Fatma, 1983 : 112-115, Pl. 3, Fig. 1, 2; Golvan, 1994: 142. Bhattacharya, 2007: 170, Pl. 29, Fig. 155 a-c.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 2.6-4.15 × 0.84-0.85 mm; female 3.15-4.5 × 0.60-0.65 mm. Proboscis ovoid and followed by cylindrical neck 0.70-0.80 × 0.30-0.32 mm in male; in female proboscis 0.550-1.06 × 0.25 to 0.35 mm. with 24-26 longitudinal rows of 9-10 hooks each,

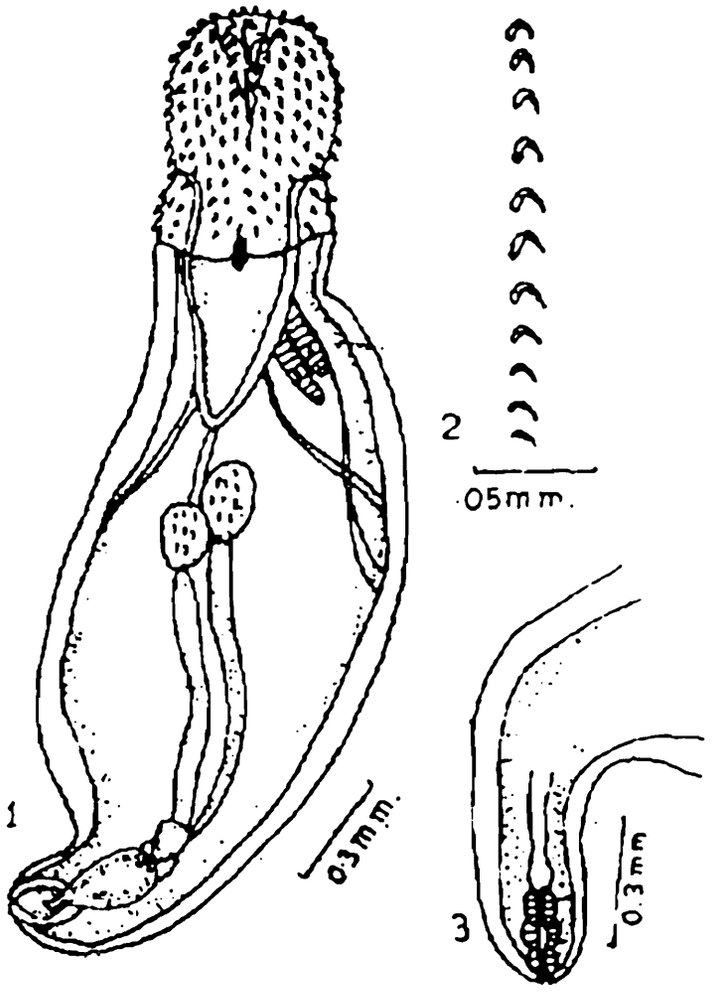


Fig. 182. *Centrorhynchus mysentri* Gupta, V. & Fatma, 1983. 1. Male, 2. Row of proboscis hooks enlarged, 3. Posterior part of female (after Gupta, V. & Fatma, 1983).

radically and symmetrically arranged, 4-5 hooks on anterior proboscis strong, curved 0.040-0.045 mm long, embedded in proboscis wall, remaining spines rootless, 5-6 on neck of 0.30-0.32 mm long. Proboscis receptacle cylindrical, double-walled, muscular 0.70-1.05 × 0.5 to 0.62 mm, with ganglion at its middle. Trunk small fusiform, aspinose, with internal pseudo-segmentation, swollen middle region, tapering at both ends. Lacunar system with main longitudinal lateral channels and reticular anastomoses. Hypordermal nuclei small, numerous, evenly distributed. Lemnisci tubular, equal, extending far above to anterior testis, 1.15-1.3 mm long in male; in female 1.0-1.1 mm long. Testis ovoid, subequal, in tandem, equatorial and symmetrical, anterior 0.17-0.32 × 0.11- 0.25 mm, posterior testis smaller 0.16-0.30 × 0.11-0.25 mm. Cement glands 2, elongated, tubular, 0.41-0.85 × 0.12 to 0.15 mm, opening into bursa through a narrow tubular duct. Seminal vesicle pyriform, 0.15-0.25 × 0.12-0.15 mm, opening into bursa through narrow tubular duct. Bursa short, muscular, globular without bursal rays, 0.12-0.15 × 0.10 to 0.12 mm. Ovary developing posterior to proboscis receptacle suspended in a ligament sac. Vagina 0.40-0.45 mm long, with two sphincters, 0.20-0.25 mm. Gonopore subterminal in male, ventro-terminal in female.

Host : *Rana tigrina* Daudin.

Location : Intestinal mysentery (encysted).

Locality : Lucknow (Uttar Pradeh).

Distribution : Known only from type locality.

206. ***Centrorhynchus opimus*** Travassos, 1919
(Fig. 183)

Centrorhynchus opimus Travassos, 1919 : 7; Meyer, 1932 : 114-115; Petrotschenko, 1958 : 2224 Yamaguti, 1963 : 125; Gupta, N. K. & Gupta, K., 1972c : 8-10, Fig. 11, 12; Duggal, Solomon & Ambardar, 1987 : 25-26; Golvan, 1994: 142; Bhattacharya, 2007: 193, Pl. 30, Fig. 160 a,b.

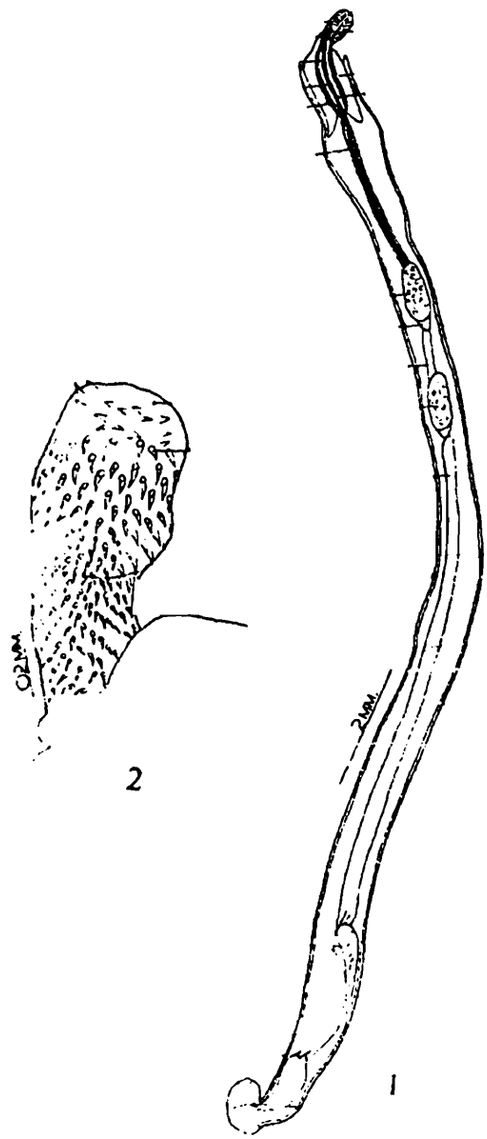


Fig. 183. *Centrorhynchus opimus* Travassos, 1919. 1. Male, 2. Proboscis enlarged (after Gupta, N.K. & Gupta K., 1972).

Type locality : Sao Paulo, Brazil.

Description : Female 19.67 × 0.59-0.79 mm. Proboscis small, anterior part globular, posterior part cylindrical, 0.54 × 0.36 mm, with 24 longitudinal rows of 6-7 hooks each. All hooks with well developed roots, 0.055 × 0.012 mm. Basal hooks smaller 0.03 × 0.009 mm. Neck short, 0.28 × 0.27 mm, with 24 longitudinal rows of 5-7 spines each, with poorly developed roots, 0.02-0.03 × 0.006-0.007 mm. Proboscis receptacle cylindrical, double-walled, 1.27 × 0.62 mm. Lacunar system well developed. Trunk elongate cylindrical, of uniform width. Lacunar system well developed. Lemnisci paired, equal, digitiform, slightly longer than receptacle. Testes elongated, cylindrical, in tandem, anterior 0.82 × 0.36 mm, posterior 0.86 × 0.34 mm connected to genital ligament. Cement glands 3, syncytial, tubular, collectively, enclosed in ligament, measure 7.95 × 0.27 mm. Saefftigen's pouch saccular, tubular, 2.35 × 0.21 mm. Seminal vesicle lies behind cement glands, 1.98 × 0.34 mm and end in rod-like penis, 0.21 × 0.10 mm, opens in muscular bursal cap. Bursa everted 0.47 × 0.56 mm, with digitiform rays. Female not known.

Note : Travassos (1919) reports : length of male worm 12-16 mm; proboscis hooks in 24 rows with12-13 hooks each).

Host : *Haliaetus leucorhyphus* (Pallas), *Dicrurus macrocercus* (Vieillot), *Pitangus sulfuratus maxmiliani.*

Location : Intestine.

Locality : Chandigarh; Punjab.

Distribution : Brazil.

Note : In literature: Male 12-16 mm, female 15-20 × 1.2 mm; proboscis hooks in 24 rows with 12-14 hooks each; eggs 0.049-0.053 × 0.021 mm.

207. ***Centrorhynchus ovali*** Bhattacharya, 1999
(Fig. 184)

Centrorhynchus ovali Bhattacharya, 1999 : 172-173; 2007 : 188, Pl. 33, Fig. 182 a-d.

Type locality : Meghalaya, India.

Description : Male 30.0 mm long with anterior swelling. Proboscis elongated, cylindrival, 1.2 × 0.325 mm, with 30-32 longitudinal rows of 20-22 hooks each, three types of rooted hooks, rest rootless. 1st and 2nd hooks with simple roots, 3rd and 4th hooks with bifurcated roots and 5th, 6th and 7th hooks of each row with two dorsal manubria, rest rootless. Roots of 1st an2nd 0.034 × 0.006 mm and points 0.036 × 0.002 mm, roots of 3rd and 4th 0.04 × 0.008 mm and points 0.026 × 0.006 mm; roots of 5th, 6th and 7th 0.016 mm long and points 0.00.016 mm. Rootless hooks 0.03-0.036mm long. Proboscis receptacle cylindrical, 1.125 × 0.2 mm. Lemnisci longer than receptacle, 1.875 mm long. Testes ovoid, overlapping, anterior testis 0.875 × 0.425 mm, posterior 0.9 × 0.25 mm, Cement glands two, tubular.

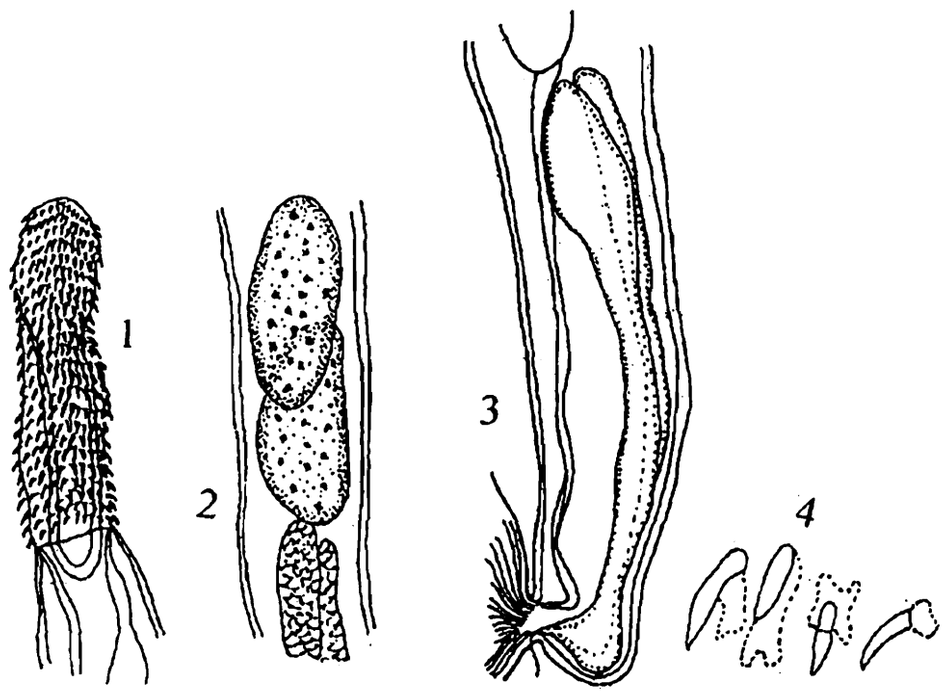


Fig. 184. *Centrorhynchus ovali* Bhattacharya, 1999. 1. Anterior part of male, 2. Middle trunk of male, 3. Posterior part of male, 4. Proboscis hooks enlarged (after Bhattacharya, 2007).

Host : *Bubo* sp. (Owl).

Location : Intestine.

Locality : Near Shillong (Meghalaya).

Distribution : Known only from type locality.

208. ***Centrorhynchus ptyasus*** Gupta, 1950
(Fig. 185)

Centrorhynchus ptyasus Gupta, P.V. 1950 : 41-47, Fig. 1-6; Petrotschenko. 1958 : 226; Yamaguti, 1963 : 128, Pl. 52, Fig. 541-544; Anantaraman, M. & Anantaraman, S., 1970: 7; Golvan, 1994 : 142; Bhattacharya, 2007 : 170, Pl. 29, Fig. 154.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Juvenile female up to 2.35 × 0.68 mm. Proboscis with a constriction in middle divided into two parts, anterior wide part with larger and wider hooks with roots and posterior part with smaller and thinner hooks without roots, with 22-24 longitudinal rows of 26-28 hooks each. Longest hooks 0.05 mm long and smallest hooks 0.025 mm long. Proboscis receptacle double-walled, with inner wall much thicker and muscular, with ganglion about its middle. Trunk widest in middle and tapering to both ends. Hypodermal nuclei small and numerous. Lacunar system well developed with main lateral longitudinal channels and circular vessels. Lemnisci well developed. Testes ovoid lie apart from each other. Cement glands tubular. Ovary 0.15 mm long lies behind receptacle and

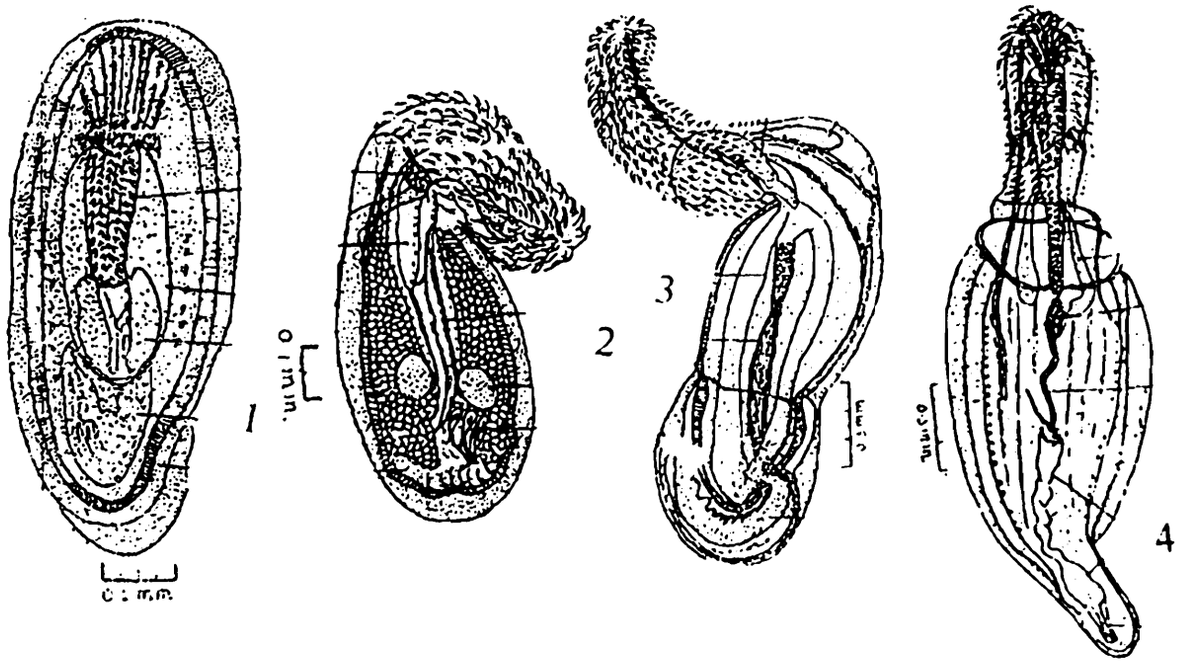


Fig. 185. *Centrorhynchus ptyasus* Gupta, P.V. 1950. 1. Infective stage of larva, 2. Infective male second stage, 3. Infective male, 4. Juvenile male (after Gupta P.V., 1950).

attached to ligament, which runs up to uterus. Uterus long and zigzag, 0.35 mm long, wide at anterior end and narrowing posteriorly leading into vagina. Vagina 0.15 mm long, opens out by double lipped vulvar aperture a little anterior to posterior end.

Host : *Ptyas mucosus* (Linnaeus).

Location : Cysts in mesentery.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

209 ***Centrorhynchus sharmai*** (Gupta, N.K. & Lata, 1966) Gupta. V & Fatma, 1967 (Fig. 186)

Mediorhynchus sharmai Gupta, N.K. & Lata, 1966: 256-257; Fig. 6-8; Gupta, V. & Sinha, 1990b : 52;

Centrorhynchus sharmai (Gupta, N. K. & Lata, 166) Schmidt & Kuntz, 1977. Golvan, 1994 : 142; Bhattacharya, 2007 : 192, Pl. 28, Fig. 198 a-c.

Type locality : Kerala, India.

Description : Female 11.2 mm long, anterior part swollen, 0.54 mm wide and then abruptly tapering posteriorly to form a tubular hind trunk, 0.23 mm wide at level of uterus. Proboscis elongate, 0.56 × 0.26 mm with 32 longitudinal rows of 10-11 hooks each, 0.01-0.014 × 0.006 mm. Basal hooks smallest, 0.008 × 0.002 mm. All hooks with well developed roots. Neck 0.4 × 0.32 mm at its base armed with 32 longitudinal rows of 10-11 spines each, and spines 0.02 × 0.094 mm. Marginal spines 0.022 × 0.004 mm. Proboscis

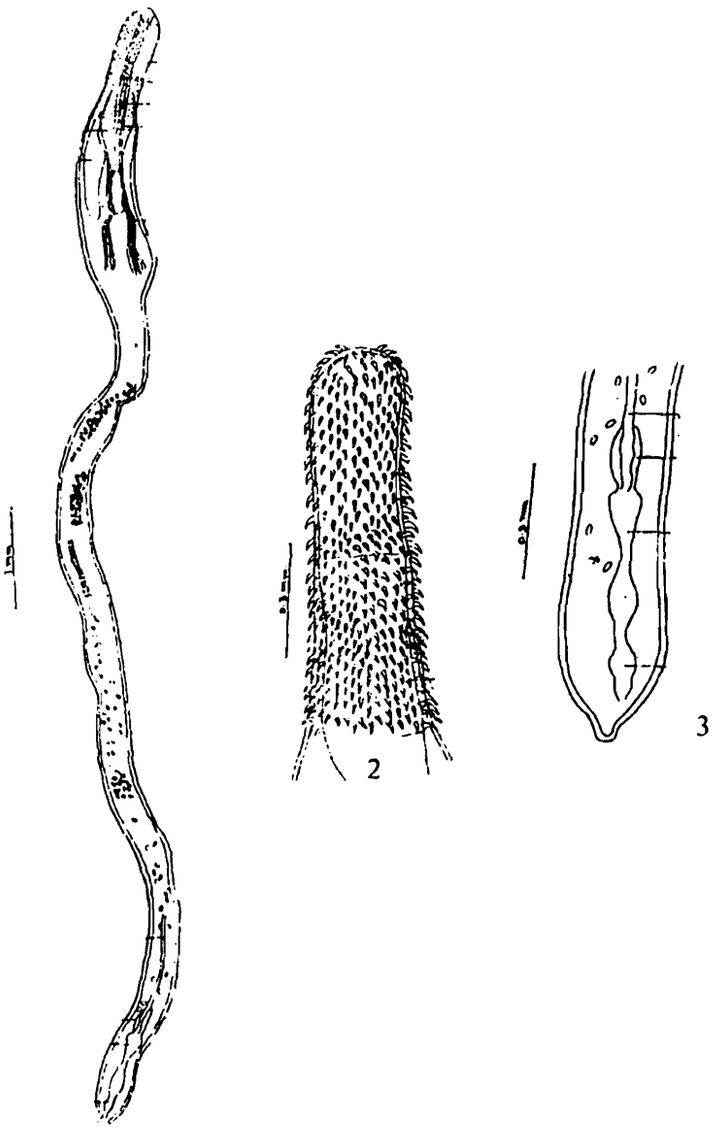


Fig. 186. *Centrorhynchus sharmai* (Gupta, N.K. & Lata, 1966), Gupta, V. & Fatma 1967. 1. Female, 2. Proboscis enlarged, 3. Posterior part of female (after Gupta, N.K. & Lata, 1966).

receptacle cylindrical, single-walled, 0.74 × 0.25 mm, tapering towards posterior end and provided with a set of retractor muscles, which traverse whole length of receptacle and lie in body cavity as dorsal and ventral receptacle retractors. Ganglion lies at anterior part of receptacle. Lacunar system with two main longitudinal channels and reticular anastomoses. Trunk elongated, cylindrical and aspinose. Ovary bursts and releases a number of eggs scattered throughout body cavity. Uterine bell 0.19 mm long, anteriorly attached to a suspensory ligament and posteriorly opens into tubular uterus, 0.44 × 0.09 mm, which leads into a small vagina, 0.14 × 0.07 mm. Eggs round to oval, 0.024-.0.040 × 0.02 mm. Male not known.

Host : *Mugil* sp.

Location : Intestine.

Locality : Kerala.

Distribution : Known only from type locality.

210. ***Centrorhynchus sholapurensis*** Rengaraju & Das, 1977 (Fig. 187)

Centrorhynchus sholapurensis Rengaraju & Das, 1977 : 37-40, Fig. 1-3. Golvan, 1994 : 142.

Type locality : Sholapur. Maharastra, India.

Description : Mature female 50 × 0.99 mm. Proboscis 0.75 × 0.49 mm, with 26-28 longitudinal rows of 13 hooks each. Hooks on proboscis large and double the size of spines. Neck 0.75 × 0.57 mm, with 12 spines each. Proboscis receptacle double-walled with ganglion situated in its center. Trunk cylindrical, posterior end slightly tapered. Lemnisci extends beyond receptacle. Vulva subterminal. Eggs elliptical, with three shells. Male not known.

Host : Adults in *Tyto alba javanica*; juveniles in *Ptyas mucosus* (Linnaeus) *Mugil* sp.

Location : Intestine, mesentery.

Locality : Sholapur (Maharastra).

Distribution : Known only from type locality.

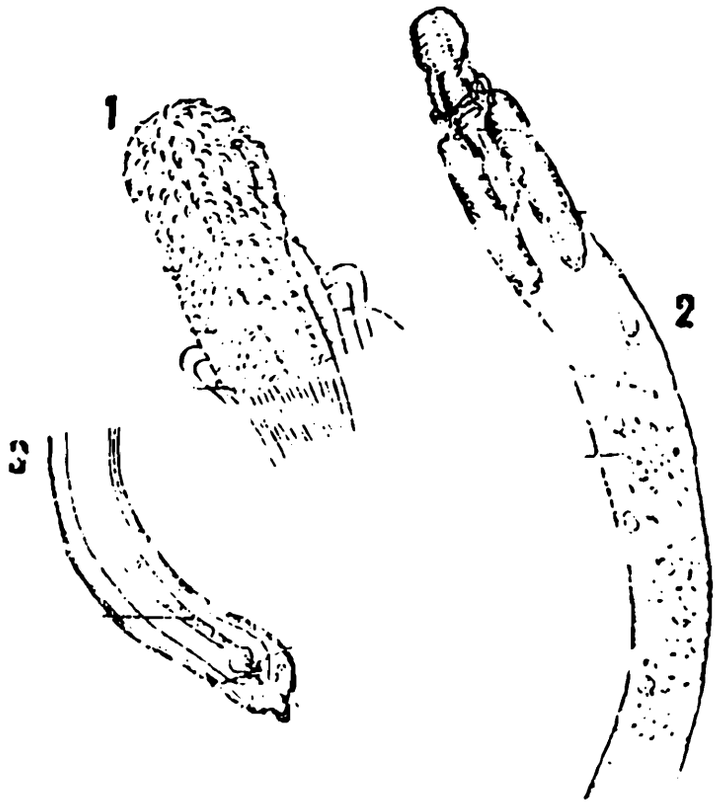


Fig. 187. *Centrorhynchus sholapurensis* Rengaraju & Das, 1975. 1. Proboscis and neck enlarged, 2. Anterior part of mature female, 3. Posterior part of female (after Rengaraju & Das, 1975).

211. ***Centrorhynchus sikkimensis*** Bhattacharya, 2003 (Fig. 188)

Centrorhynchus sikkimensis Bhattacharya, 2003 : 73-75, Pl. 1, Fig. 1-5; 2007: 186-188, Pl. 32, Fig. 181 a-e.

Type locality : Singtam, Sikkim, India.

Description : Male 43.75 × 0.5 mm; female 61.5 × 1.625 mm, with digitate process at posterior end. Proboscis elongated, cylindrical, 1.5 × 0.375 mm, with 40-42 longitudinal rows of 28-30 hooks each, anterior 10 hooks with roots and rest without roots, roots longer than points, points 0/10124-0.036 mm long, roots 0.036-0.040 mm long, triangular roots 0.04 × 0.01 mm. Proboscis receptacle elongated, cylindrical, 1.75 × 0.3 mm, with ganglion near centre. Lemnisci longer than receptacle, 2.125 mm and 2.00 mm long. Testes ovoid, post-equatorial, 0.875 mm long. Cement glands two, Eggs ovoid, 0.04-0.946 × 0.016-0.018 mm.

Host : Eagle.

Location : Intestine.

Locality : Singtam (Sikkim).

Distribution : Known only from type locality.

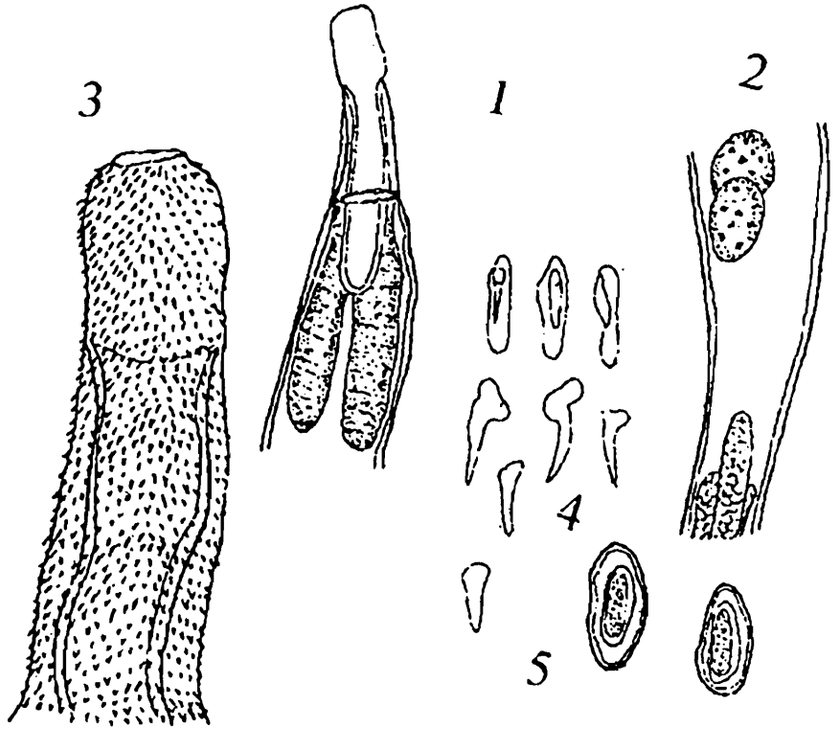


Fig. 188. *Centrorhynchus sikkimensis* Bhattacharya, 2003. 1. Anterior part of male, 2. Mid trunk of male, 3. Proboscis enlarged, 4. Proboscis hooks enlarged, 5. Ova (after Bhattacharya, 2007).

212. ***Centrorhynchus sindensis*** Khan, Khatoon & Bilqees, 2002 (Fig. 189)

Centrorhynchus sindensis Khan, Khatoon & Bilqees, 2002 : 309-310, Fig. 1 A-C.

Type locality : Karachi, Sindh, India.

Description : Male 3.12-3.20 × 0.82-0.84 mm; female 3.12-3.24 × 0.76-0.80 mm. Proboscis cylindrical 0.73 × 0.55-0.56 mm in male; in female 0.83-0.88 × 0.52-0.53 mm, with 18-20 rows 16-24 hooks each. Three anterior rows of 16 hooks each, while middle rows have 24 hooks each and last two rows with 22 hooks each in both males and females. Proboscis hooks measure 0.036-0.052 × 0.010-0.012 mm in males. Neck short 0.04 × 0.44-0.46 mm in males; in females 0.04- × 0.46-0.50 mm. Proboscis receptacle double-walled, 0.75-0.78 × 0.42-0.45 mm in male; in female 0.58-0.68 × 0.38-0.40 mm. Lemnisci 0.80-1.05 × 0.10-0.20 mm. Testes two, anterior 0.15 × 0.09-0.12 mm, posterior 0.13-0.14 × 0.09-0.11 mm. Saefftigen's pouch 0.35-0.39 × 0.10-0.12 mm. Bursa 0.22-0.28 × 0.12-0.14 mm. Eggs 0.0057-0.0058 × 0.0036-0.0038 mm.

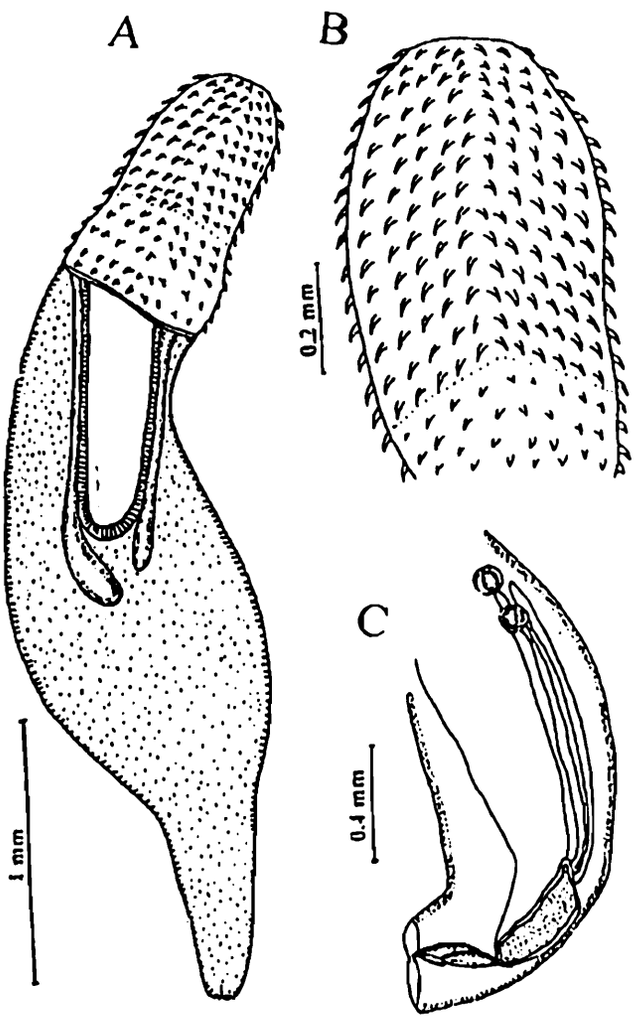


Fig. 189. *Centrorhynchus sindensis* Khan, Khatoon & Bilqees, 2002. A. Female, B. Proboscis enlarged, C. Posterior part of male (after Khan, Khatoon & Bilqees, 2002).

Host : *Naja naja* (Linnaeus).

Location : Small intestine.

Locality : Karachi, Sindh (Pakistan).

Distribution : Known only from type locality.

213. ***Centrorhynchus smyrensis*** Bhattacharya, 2007 (Fig. 190)

Centrorhynchus smyrensis Bhattacharya, 2007 : 190, Pl. 33, Fig. 184 a-d.

Type locality : Kolkata, West Bengal, India.

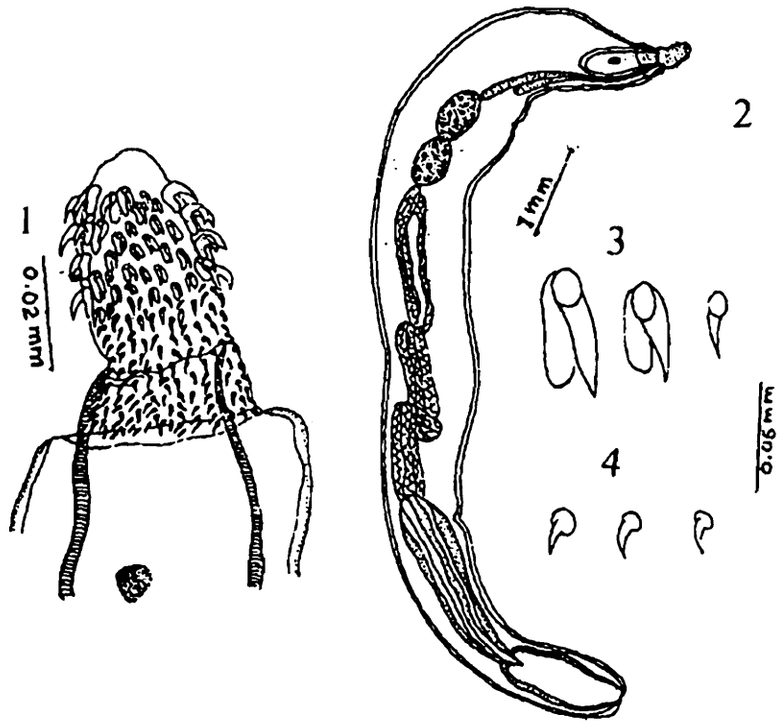


Fig. 190. *Centrorhynchus smyrensis* Bhattacharya, 2007. 1. Proboscis enlarged, 2. Male, 3. Proboscis hooks enlarged, 4. Posterior proboscis hooks (after Bhattacharya, 2007).

Description : (after Bhattacharya, 2007) Worms of medium size, ventrally curved. Male 19.00-10.75 × 1.25-1.30 mm. Proboscis 0.50-0.52 × 0.25-0.30 mm, with 18 longitudinal rows of 15-16 hooks each. Apical part of proboscis without hooks. Anterior 4-5 hooks of each row with roots, conspicuous, almost double the rootless hooks. Remaining hooks rootless, basal hooks minute, roots almost equal to points. Hook points 0.049-0/05 × 0.0166 mm, roots 0.045-0.05 × 0.0249; rootless hooks 0.038 × 0.0249 mm. Neck short. Proboscis receptacle double-walled0.95-1.00 × 0.35-0.375 mm with central ganglion Lemnisci long reaching anterior testis, subequal, 2.00-2.15 mm long and 1.70-1.85 mm long. Testes pre-equatorial, oval, contiguous, anterior testis 0.65-0.70 × 0.35 mm and

posterior testis 0.70-0.75 × 9.375-0.385 mm. Cement glands 3, long and tubular. Seminal vesicle 2.25-2.50 mm long.

Host : *Halcyon smyrnensis.*

Location : Intestine.

Locality : Kolkata (West Bengal).

Distribution : Known only from type locality.

214. *Centrorhynchus spilornae* Schmidt & Kuntz, 1969 (Fig. 191)

Centrorhynchus spilornae Schmidt & Kuntz, 1969: 329-331, Fig. 1-5;

Centrorhynchus andamanensis Soota & Kansal, 1970 : 450; 1972: 303-304, Textfig. 1 a-c; Gupta, P.D & Ghosh, 1979 : 313; Zafar & Farooqi, 1981 : 181-182;

Centrorhynchus spilornae Zafar & Farooqi, 1981 : 181-182, Golvan, 1994 : 143; Bhattacharya, 2000: 157; 2007 : 170-172, Pl. 28, Fig. 156 a-c

Type locality : Taiwan, China.

Description : Male 33-48 × 0.7-1.0 mm; female 52-65 × 1.0-1.4 mm. Proboscis with swelling near middle, just above insertion of proboscis receptacle, 1.8-1.9 × 0.30-0.34 mm in male; in female 1.9-2.1 × 0.30-0.39 mm, with 28-30 longitudinal rows of 30-32 hooks each. First 9-10 hooks in each row with strong roots, next 3 hooks transitional, each with reduced root and long, single, anterior blade, remaining hooks spiniform rootless. First 4

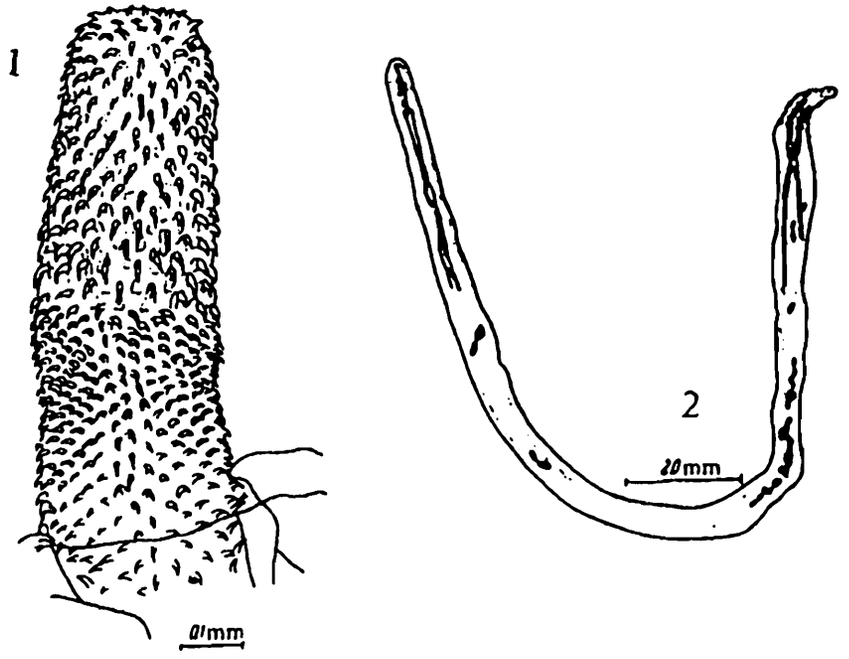


Fig. 191. *Centrorhynchus spilornae* Schmidt & Kuntz, 1989. 1. Proboscis enlarged, 2. Anterior middle and posterior hooks enlarged, 3. Male, 4. Posterior part of female, 5. Ovum (after Schmidt & Kuntz, 1969).

hooks 0.059-0.073 mm long, next 5-6 hooks 0.031-0.042 mm long, remaining spines 0.029-0.039 mm long. Neck about 0.050 mm long in male; in female 0.075 mm long. Proboscis receptacle 2.1-2.8 × 0.40 mm in male; in female 2.4-3.5 × 0.40 mm. Trunk cylindrical, elongate, without swelling near anterior end. Lemnisci flat, attached distally to body wall by ligaments, longer than receptacle, 1.8-2.1 mm long in male; in female about 1.8 mm long. Testes elongate oval with conspicuous vacuoles 1.1-1.7 × 0.36-0.60 mm. Cement glands 2, tubular beginning immediately behind posterior testis. Bursa with 20 rays. Uterine bell 2.5-3.0 mm long. Eggs 0.050-0.055 × 0.020-0.021 mm, outer shell sculptured by longitudinal ridges and grooves. Gonopore terminal in male, ventro-subterminal in female.

Host : *Spilorene cheela*, *Otus bakkamoena* Hogson; Owlet.

Incidental host : *Otus bakkamoena lettia* Hogson;

Location : Small intestine.

Locality : Aligarh (Uttar Pradesh); Burma Dera, Maya Bundar in Middle Andaman (Andaman & Nicobar Islands); Tripura; Dhaka (Bangladesh).

Distribution : Taiwan, China.

215. ***Centrorhynchus spinosus*** (Kaiser, 1893) Van Cleave, 1924 (Fig. 192)

Echinorhynchus spinosusus Kaiser, 1893 : 1-136;

Centrorhynchus spinosus Meyer, 1932 : 112-113, Fig. 90, 91;

Centrorhynchus spinosus (juvinile) Pujatti, 1950a : 1-3. Fig. 1-8; 1950b : 1-4, Fig. 1-5; 1952c : 1-2, Pl. 1, 2;

Centrorhynchus spinosus Petrotschenko, 1958 : 228-230, Fig. 116; Yamaguti, 1963 : 126, Pl. 52, Fig. 234, 235; Anantaraman, M. & Anantaraman, S., 1970 : 6; Nickol, 1983 : 221-222. Fig. 2, 4, 6; Golvan, 1994 : 143; Bhattacharya, 2007 : 193.

Description : Males 20.0-27.2 mm long, 0.8-1.1 mm at widest point, 0.3-0.5 × 0.4-0.7 mm. Female 19.0-33.7 × 0.4-1.2 mm. Proboscis nearly cylindrical, 0.80-1.0 × 0.24-0.26 mm with 29-32 longitudinal rows of 22-27 hooks each in males. In females proboscis 0.93-1.10 × 0.24-0.35 mm, with 30-33 longitudinal rows of 22-26 hooks each. First 8-11 hooks in each row with long, simple root, next 12-17 rootless. First 10 hooks in male, 8-11 hooks in female in each row with long, simple roots, next 13-17 hooks rootless. Anterior most hooks in each row transitional, with four short laterally directed root-like processes. Hooks 0.031-0.043 mm long anteriad, 0.034-0.048 mm long at end of rooted row; rootless spines 0.029-0.046 mm long. Largest hook-roots 0.053-0.073 mm long. Neck short, 0.022-0.053 × 0.31-0.41 mm armed with 30-32 rows of 14 spines each. Proboscis receptacle double-walled, 1.06-1.78 mm long, with elliptical ganglion 0.140-0.254 × 0.058-0.067 mm, about its middle. Trunk cylindrical, elongate, with slight constriction anteriorly, but swelling absent. Female trunk with prominent laterally flattened papillae at posterior end,

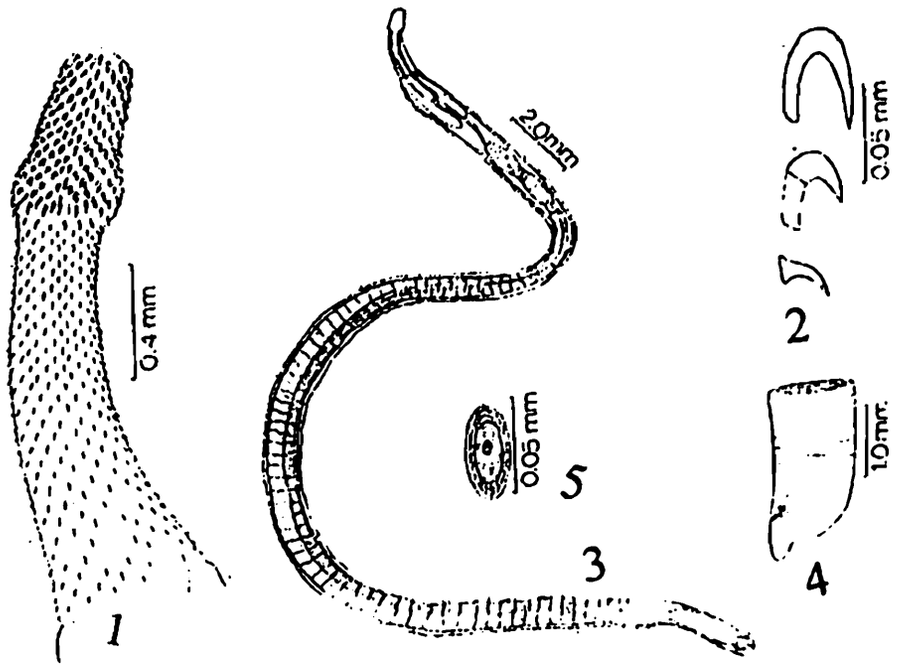


Fig. 192. *Centrorhynchus spinosus* (Kaiser, 1893) Van Cleave, 1924. 1. Proboscis enlarged, 2. Female (after Van Cleave, 1928).

varying in shape from digitiform to conical, depending upon of trunk distension. Lemnisci 1.10-1.78 mm long, extends well beyond posterior end of receptacle. Testes 2, elliptical, about equal, 0.59-0.92 × 0.27-0.61 mm. Cement glands 4, tubular, begin at rear of second testis and extend 6.9-11.4 mm posteriad. Saefftigen's pouch 1.4-1.8 mm long. Uterine bell to subterminal gonopore 1.7-2.4 mm long. Gravid female with eggs 0.042-0.053 × 0.017-0.022 mm, outer 9shell, thin, sculptured with longitudinal ridges and grooves, fertilization membrane with small polar prolongation. Spined acanthors, 0.019-0.33 × 0.4-1.2 mm.

Host : *Spilorene cheela*, *Otus bakkamoena* Hogson, *Milvus migans govinda*, *Corvus coronoides culminatus*, *Corvus splendens splendens* (Vieillot), *Tyto alba javanicus*, *Lycodon flavomaculatus*, *Zamensis gracilis*, *Sinotes arnensis*, *Dryophis mycterizans*.

Incidental host : *Otus bakkamoena lettia* Hogson;

Host : Juviniles: *Lycodon flavomaculatus*, *Zamensis gracilis*,

Location : Intestine.

Locality : Bangalore (Karnataka).

Distribution : Central Asia, Galapogas Islands; Russia; Florida.

216. ***Centrorhynchus tumidulus*** (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914 (Fig. 193)

Echinorhynchus tumidulus Rudolphi, 1819 : 1-91;

Centrorhynchus tumidulus (Rudolphi, 1819) Meyer, 1932 : 115-118, Fig. 96, 97;

Centrorhynchus microcerviacanthus Das, 1950a : 54-55, Fig. 4; Petrochenko, 1958: 226;

Centrorhynchus microcerviacanthus Yamaguti, 1963 : 128;

Centrorhynchus tumidulus Anantaraman, M. & Anantaraman, S., 1970 : 7;

Centrorhynchus microcerviacanthus Anantaraman, M. & Anantaraman, S. 1970 : 7;

Centrorhynchus tumidulus Duggal, Solomon & Ambardar, 1987 : 28; Golvan, 1994 : 143; Bhattacharya, 1999 : 174-175; 2007 : 175-177, Fig. 164 a-c.

Description : Males 15.32-23.82 × 0.78-0.85 mm, females 29.49 × 0.72 mm. Proboscis short cylindrical 0.49-0.58 × 0.25-0.30 mm in male; in female anterior part 0.45 × 0.21 mm and posterior part 0.3 × 0.35 mm, with 26 longitudinal rows of 11-12 hooks each, hooks with well developed roots, apical hooks 0.028 × 0.004 mm, subapical hooks 0.022 × 0.006 mm, basal hooks 0.01 × 0.002 mm in males. Neck 0.46-0.57 × 0.37-0.42 mm in male, in female 0.4 × 0.3 mm, with 26 longitudinal rows of 11-12 spines, spines with poorly developed roots,

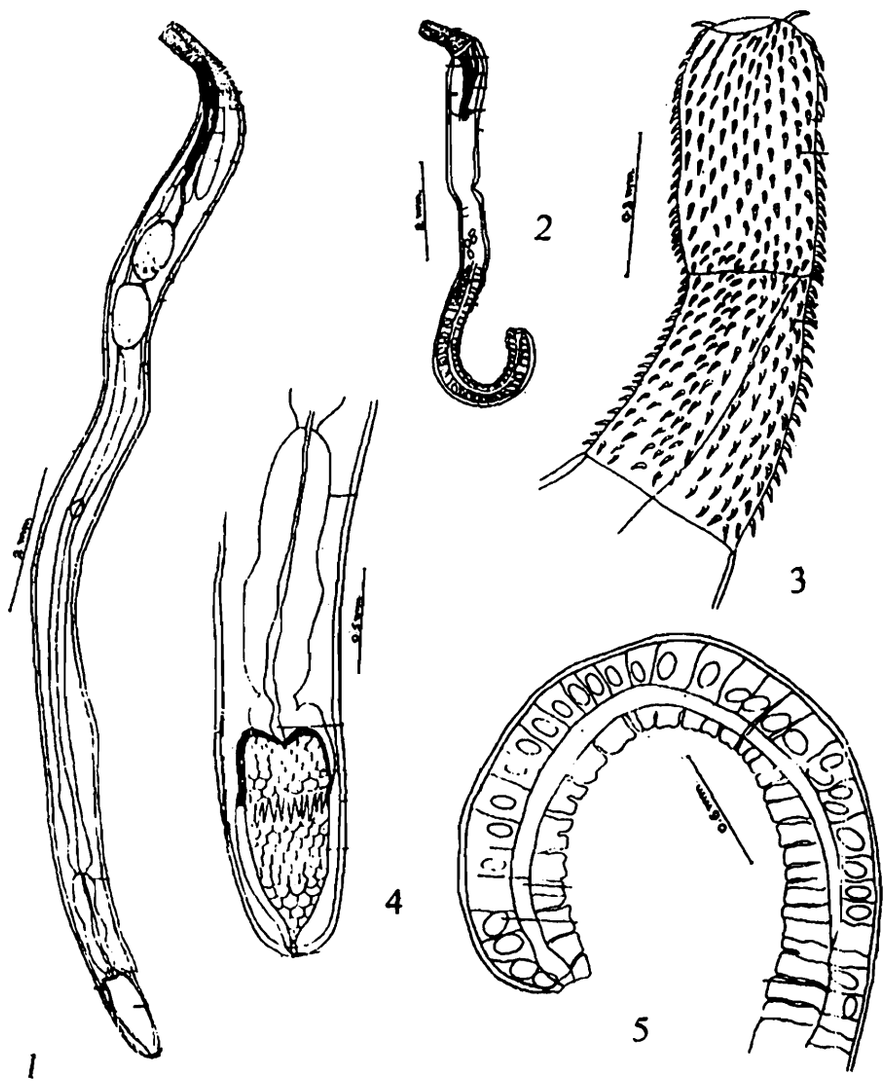


Fig. 193. *Centrorhynchus tumidulus* (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914. 1. Male, 2 Female, 3. Proboscis enlarged, 4. Posterior part of male, 5. Posterior part of female (after Rudolphi, 1819).

but of uniform shape and size. Spines 0.020-0.016 × 0.005 mm. Proboscis receptacle cylindrical, double-walled 1.02-1.29 × 0.35-0.38 in male, in female 1.2 × 0.38 mm, with pre-eqatorial a ganglion. Trunk aspinose. Lacunar system very well developed. Lemnisci paired, tubular, equal 1.23-2.247 in male; in female 2.2-0.27 mm with many nuclei, extend up to anterior margin of anterior testis. Testes paired, ovoid anterior 0.85-1.01 × 0.36-0.45 mm, posterior 0.83-0.92 × 0.32-0.35 mm, connected to each other by genital connective. Single sperm duct emerges from posterior testis and enters cement glands. Cement glands two, 10.05-10.55 × 0.24-0.30 mm collectively, each gland 0.014-0.098 mm wide. Cement reservoir 0.7 × 0.37 mm. Genital sheath 1.28-1.62 × 0.35-0.47 mm. Penis small, rod-shaped opens into bursa. Bursa 1.2-1.4 × 0.37-0.50 mm, with 2 bursal pockets anteriorly, opens to exterior by genital pore. Uterus long, tubular, 0.098 mm wide, leads into vagina 0.15 × 0.09 mm, opens to outside through female genital pore. Vaginal sphincters 0.11 × 0.18 mm. Eggs ovoidal 0.29-0.30 × 0.015-0.0165 mm.

Host : *Athene brama, Spilorne cheela Higson, Tyto alba;* (Scopoli), *Milvus migans govinda, Corvus coronoides culminatus, Corvus splendens splendens* (Vieillot), *Tyto alba javanicus, Lycodon flavomaculatus, Zamensis gracilis, Sinotes arnensis, Dryophis mycterizans, Ptyas mucosus* (Linnaeus); *Naja tripudianus* (Laurents).

Incidental host : *Otus bakkamoena lettia* Hogson; Juviniles : *Lycodon flavomaculatus, Zamensis gracilis.*

Location : Intestine; juvenile encysted in *Naia tripudianus. Lycodon* sp.

Locality : Amraoti (Maharastra); Lucknow (Uttar Pradesh); Sangrur (Punjab); Meghalaya.

Distribution : South America, Panama, Cuba.

217. ***Centrorhynchus tytoensis*** Rengaraju & Das, 1975 (Fig. 194)

Centrorhynchus tytoensis Rengaraju & Das, 1975: 33-37, Fig. 1-3; Golvan, 1994 : 143.

Type locality : Sholapur, Maharastra, India.

Description : Males 2.3 × 1.05 mm. Proboscis is separated from neck by a constriction. Proboscis 0.54 × 0.33 mm, with 28-30 alternating longitudinal rows of 10+10 hooks each, hooks 0.03 mm long, point backwards with flattened bases. Neck 0.54 × 0.51 mm, armed with 28-30 alternating longitudinal rows of 10 spines each; spines about half size of hooks. Proboscis receptacle saccular, double-walled, muscular, 1.45 × 0.35 mm. Hypodermal nuclei small and numerous. Lemnisci 2, finger-like 2 mm long, with nuclei similar to those of trunk wall. Testes unequal, in tandem, anterior 0.99 mm long and posterior 1.11 mm long, each giving off vas deferens. Cement glands 2, extend from near posterior end of testis. Saefftigen's pouch extends from posterior end of cement glands to bursa, 2.34 × 0.67 mm. Bursa divisible into muscular bursal cap and bursa proper. Bursa 1.83 mm long, with sphincters muscles in its wall posteriorly. Female not known.

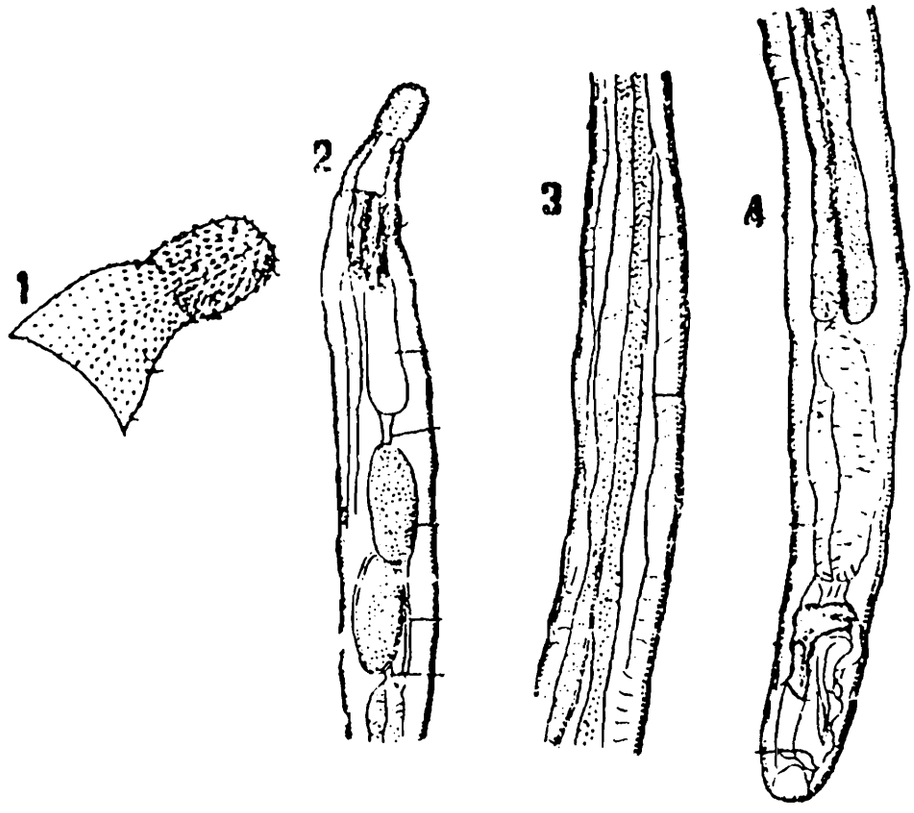


Fig. 194. *Centrorhynchus tytoensis* Rengaraju & Das, 1975. 1. Proboscis and neck enlarged, 2. Anterior part of male, 3. Midtrunk of male, 4. Posterior part of male (after Rengaraju & Das, 1975).

Host : *Tyto alba javanicus.*

Location : Intestine.

Locality : Sholapur (Maharastra).

Distribution : Known only from type locality.

43. Genus ***Sphaerirostris*** Golvan, 1956

Sphaerirostris Golvan, 1956 : 737-738; Yamaguti, 1963, 120; Golvan, 1994 : 179.

Diagnosis : Proboscis short, anterior part globular (widest at middle), posterior part somewhat cylindrical. Trunk spindle-shaped. Lacunar system with secondary vessels anastomoses in dendritic manner. Testes spheroidal, often large. Cement glands long, 3-4. Parasites of Corvidae and Turdidae with arthropods as intermediate hosts.

Type species : *Sphaerirostris picae* (Rudolphi, 1819) Golvan, 1956.

Includes twenty six species, 1. *Sphaerirostris areolatus* (Rudolphi, 1819) Golvan, 1956, 2. *S. cinctus* (Rudolphi, 1819) Golvan, 1956, 3. *S. corvi* (Fukui, 1929) Golvan, 1956, 4. *S. erraticus* (Chandler, 1925) Golvan, 1956, 5. *S. globuli* (Nama & Rathore, 1984) Golvan, 1994, 6. *S. lancea* (Westrumb, 1821) Golvan, 1956, 7. *S. lanceoloides* (Petrotschenko,

1949) Golvan, 1956, 8. *S. maryasis* (Datta, 1933) Golvan, 1956, 9. *S. pinguis* (Van Cleave, 1918) Golvan, 1956, 10. *S. reptans* (Bhalerao, 1931) Golvan, 1956, 11. *S. robustus* (Datta, 1928) Golvan, 1994, 12. *S. saxicoloides* Nama & Rathore, 1984, 13. *S. splendi* (Gupta, N.K. & Gupta, K. 1970) Golvan, 1994, 14. *S. turdi* (Yamaguti, 1939) Golvan, 1956, 15. *S. bipartitus* (Solowjew, 1912) Golvan, 1956, 16. *S. dollfusi* Golvan, 1994, 17. *S. leguminosus* (Solowjew, 1912) Golvan, 1956, 18. *S. lesiniformis* (Molin, 1859) Golvan, 1994, 19. *S. physocoracis* (Porta, 1913) Golvan, 1956, 20. *S. picae* (Rudolphi, 1819) Golvan, 1956, 21. *S. scanensis* (Lundstrom, 1941) Golvan, 1956, 22. *S. serpenticola* (Linstow, 1908) Golvan, 1956, 23. *S. skrjabini* (Petrochenko, 1949) Golvan, 1956, 24. *S. tenuicaudatus* (Marotel, 1889) Amin, 1985, 25. *S. teres* (Westrumb, 1821) Golvan, 1956 and 26. *S. wertheimae* Schmidt, 1975, of which first fourteen species occur in the subcontinent.

Key to Indian species of genus *Sphaerirostris*

1. Cement glands three 2
– Cement glands four 5
– Cement glands not known 6
1. Proboscis with 15-16 longitudinal rows of 14-18 hooks each ..... *Sphaeriristrus globuli*
– Proboscis with more than 16 longitudinal rows of hooks each 2
2 Proboscis with 22-24 longitudinal rows of 12-14 hooks each ..... *Spjaerirostris saxicoloides*
– Proboscis with 24 longitudinal rows of 24 hooks each ..... *Spjaerirostris reptans*
– Proboscis with 24-32 longitudinal rows of hooks 33
3. Proboscis with 24-26 longitudinal rows of hooks ..... *Spjaerirostris areolatus*
– Proboscis with 24-28 longitudinal rows of 8-12 hooks each ..... *Spjaerirostris maryasis*
– Proboscis with more than 28 longitudinal rows of hooks 4
4. Proboscis with 32 longitudinal rows of 16 hooks each ..... *Spjaerirostri.pinguis*
– Proboscis with 36-38 longitudinal rows of 11-12 hooks each ..... *Spjaerirostris lanceoloides*
5. Proboscis with 26-29 longitudinal rows of 11-13 hooks each ..... *Spkaerirostris turdi*
– Proboscis with 32-38 longitudinal rows of 11-13 hooks each ..... *Sphaerirostris corvi*
6. Proboscis with alternating transverse rows of hooks 6
– Proboscis with longitudinal rows of hooks 7

7. Proboscis with 36 longitudinal rows of 21-22 hooks each ... *Sphaerirostris erraticus*

– Proboscis with 28-30 longitudinal rows of 8-12 hooks each ..... *Sphaerorostris robustus*

8. Proboscis with 28 longitudinal rows of 9-10 hooks each..... *Sphaerirostris splendi*

– Proboscis with 30 and more longitudinal rows of hooks.....9

– Proboscis with 30 longitudinal rows of 11-14 hooks each..... *Sphaerirostris lancea*

– Proboscis with 30-32 longitudinal rows of 2 hooks each .....*Sphaerirostris cinctus*

218. ***Sphaerirostris areolatus*** (Rudolphi, 1819) Golvan, 1956

Echinorhynchus areolatus Rudolphi, 1819 : 1-81;

Centrorhynchus areolatus Petrotschenko, 1958 : 203; Yamaguti, 1963 : 121;

Centrorhynchus (Sphaerirostris) *areolatus* (Rudolphi, 1819) Golvan, 1956 : 739

Centrorhynchus areolatus Yamaguti, 1963 : 121; Duggal, Solomon & Ambardar, 1987 : 27; Gupta, P. D. & Ghosh, 1979 : 313;

Sphaerirostris areolatus Golvan, 1994 : 179.

Centrorhynchus areolatus Bhattacharya, 2007 : 175.

Type locality : Punjab, India.

Description : Male 5.91 × 0.84 mm. Proboscis with anterior part globular, 0.37 × 0.3 mm, posterior part cylindrical 0.27 × 0.24 mm with 24-26 longitudinal rows of 12-14 hooks each, anterior 5 hooks rooted and rest rootless. Proboscis receptacle double-walled, 1.28 × 0.29 mm. Neck 0.45 × 0.27 mm. Trunk wide at midtrunk, decreasing in width to both ends. Lemnisci equal, 1.42 × 0.18 mm wide extending up to posterior testis. Anterior testis 0.60 × 0.24 mm, posterior 0.72 × 0.33 mm. Cement glands three, 1.87 × 0.3 mm. Genital sheath 0.60 × 0.24 mm. Eggs 0.047 × 0.021 mm.

Host : Pied myna, *Sturnopaster contra* (Linnaeus).

Location : Intestine.

Locality : Punjab.

Distribution : Europe; Russia.

219. ***Sphaerirostris cinctus*** (Rudolphi, 1819) Golvan, 1956 (Fig. 195)

Echinorhynchus cinctus Rudolphi, 1819 : 1081;

Sphaerirostris cinctus (Rudolphi, 1819) Golvan, 1956 : 240-241; Petrotschenko, 1956 : 206;

Centrorhynchus cinctus; Datta & Soota, 1956 : 363-365; 1958, 187-188, Textfig. 3 a-c; Yamaguti, 1963 : 128, Pl. 54, Fig. 558; Anantaraman, M. & Anantaraman, S., 1970: 7; Gupta, N. K. & Jain, 1973b : 555; Jain & Gupta, N. K. 1984 : 16;

Sphaerirostris cinctus Golvan, 1994 : 179.

Centrorhynchus cinctus; Bhattacharya, 2007 : 193.

Type locality : Italy.

Description : Male 3.19 mm long 0.77 mm wide at middle; female 3.38 mm long, 0.75 mm in maximum width at middle. Proboscis 0.58 × 0.37 mm in male, in female 0.75 × 0.38 mm, with 30-32 longitudinal rows of 12 hooks each in both sexes. Hooks of longitudinal rows divisible antero-posteriorly into three groups of 5, 4 and 3 depending on the shape of roots. Hooks 0.02-0.05 mm long. Proboscis receptacle double-walled, 0.96 mm long. Trunk bulged at middle gradually narrowing towards both ends. Testes unequal, anterior smaller and posterior larger, anterior testis situated 1.55 mm from anterior end. From testis emerges vasa efferentia and form vas deferens ending in bursa. Cement glands present. Seminal vesicle pyriform 0.33 mm long. Bursa with muscular cap measures 0.66 mm long. Uterine bell 0.16 mm long with guard cells. Uterus along with vagina 0.41 mm long, vagina with vaginal muscles.

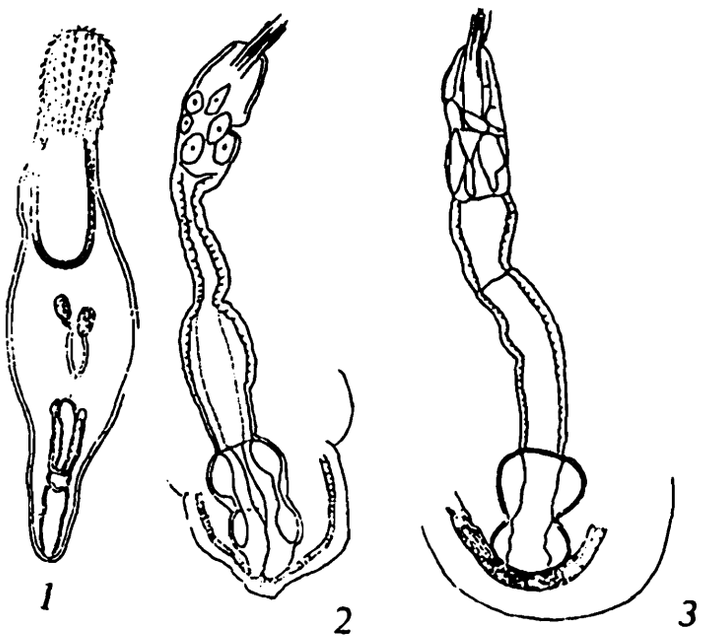


Fig. 195. *Sphaerirostris cinctus* (Rudolphi, 1819) Golvan, 1956. 1. Male, 2, 3. Female genitalia.

Host : *Ptyas mucosus* (Linnaeus).

Location : Intestine.

Locality : Varanasi (Uttar Pradesh).

Distribution : Italy.

220. ***Sphaerirostris corvi*** (Fukui, 1929) Golvan, 1956

Centrorhynchus corvi Fukui, 1929: 225-270; Meyer, 1932 : 111;

Sphaerirostris corvi (Fukui, 1929) Golvan, 1956 : 738;

Centrorhynchus corvi Yamaguti, 1963 : 122; Parashad & Guraya, 1977a : 932-859; 1977b : 244, 253, Pl. I, Fig. A-E, Pl. 2, Fig. A-G; 1977a : 932-859; Duggal, Solomon & Ambardar, 1987 : 28;

Sphaerirostris corvi Golvan, 1994 : 179.

Centrorhynchus corvi Bhattacharya, 2007 : 177.

Type locality : Siga, Japan.

Description : Male 14.0-18.4 × 2.0-2.55 mm, female 15-22 × 2.5-3.8 mm. Proboscis divided by a cleft, anterior part subglobular 0.4-0.5 × 0.35-0.48 mm in male, in female 0.43-0.5 × 0.44-0.48 mm with 32-38 longitudinal rows of 11-13 hooks each, largest hooks, strongly recurved behind apex, 0.012 mm long and with a simple rod-shaped root longer than blade; 0.39 × 0.3 mm, posterior part cylindrical, 0.225 × 0.32 mm. Proboscis receptacle double-walled, 1.2-1.65 × 0.35-0.40 mm, with elliptical ganglion at about of its middle. Neck armed with 3-4 spines in male. Neck 0.37-0.42 × 0.45-0.6 mm in male, in female about 0.38 mm long, with spines 0.036 mm long, with reduced roots long, lie widely apart from one another. Trunk spindle-shaped, tapering to both ends. Lacunar system reticular. Lemnisci elongate, club-shaped, equal 2.8 × 0.34 mm, nearly twice as long as receptacle. Testes ellipsoidal, anterior testis 1.20-1.30 × 0.56-0.76 mm, posterior 1.14 × 0.84 mm. Cement glands four, 5.8 × 0.48 mm. Ejaculatory duct with two sphincters, anterior sphincter 0.11 mm , posterior 0.15 mm long. Saefftigen's pouch 2.08 mm long. Bursal cap muscular 0.31 mm long, with a number of digitiform rays. Genital sheath 0.83x 0.54 mm. Bursa 0.80 × 0.61 mm. Uterine bell complex, 0.62-0.67 × 0.2-0.28 mm. Uterus 1.2-1.3 mm long. Vaginal funnel 0.38-0.47 × 0.08-0.15 mm, anterior vaginal sphincter 0.105-0.138 mm wide, posterior sphincter 0.135 mm wide. Vaginal bulb 0.13 mm wide. Eggs 0.059-0.072 × 0.027-0.029 mm, embryo 0.041-0.048 × 0.015-0.018 mm.

Host : *Corvus splendens* (Vieillot).

Location : Intestine.

Locality : Punjab.

Distribution : Japan.

221. ***Sphaerirostris erraticus*** (Chandler, 1925) Golvan, 1956 (Fig. 196)

Centrorhynchus erraticus Chandler, 1925 : (immature) : 222-223, Pl. 6, Fig. 7, 8; Meyer, 1932 : 110; Bhalerao, 1935 : 324;

Sphaerirostris erraticus Golvan, 1956 : 748-749;

Centrorhynchus erraticus Petrotschenko, 1958 : 211;

Centrorhynchus erraticus Yamaguti, 1963 : 129; Anantaraman, M. & Anantaraman, S., 1970 : 7; Gupta, P.D. & Ghosh, 1979 : 313; Golvan, 1994: 179.

Sphaerirostris erraticus Golvan, 1994 : 179.

Centrorhynchus erraticus Bhattacharya, 2007 : 178-179.

Type locality : Kolkata, West Bengal. India.

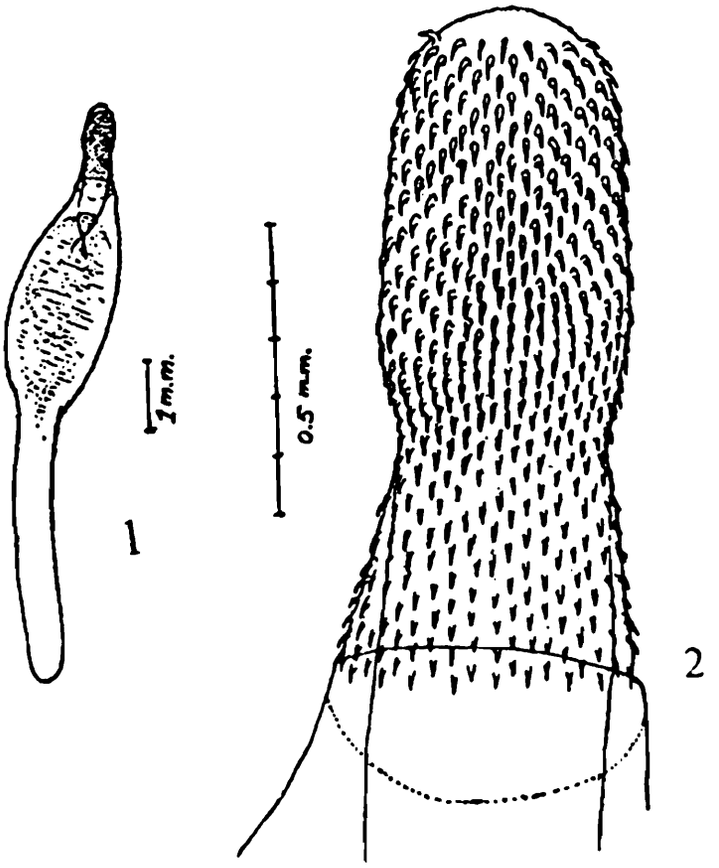


Fig. 196. *Sphaerirostris erraticus* (Chandler, 1925) Golvan, 1956. 1. Entire worm, 2. Proboscis enlarged (after Chandler, 1925).

Description : Immature worm 7.5-8.5 × 1.2-1.4 mm Anterior part of worm oval in shape, 4.25-5.0 mm long including proboscis, maximum width 1.2-1.4 mm. Posterior part of worm cylindrical with parallel sides, 3.3-4.0 mm long,0.42-0.50 mm wide. Proboscis 1.1-1.2 × 0.39-0.45 mm, armed with about 36 alternating transverse rows of about 21 -22 hooks each, anterior hooks 0.055-0.065 × 0.018 mm with large recurved roots, posterior hooks slender, moderately curved, without roots, largest hook 0.042 mm long. Rootless hooks 0.042 mm long. Proboscis receptacle saccular, double-walled, inserted just behind middle of proboscis and pointed posteriorly. Genital organd insufficiently developed.

Host : *Felis catus.*

Location : Posterior part of small intestine.

Locality : Kolkata (West Bengal).

Distribution : Palestine.

222. ***Spherrirostris globuli*** (Nama & Rathore, 1984) Golvan, 1994 (Fig. 197)

Centrorhynchus globuli Nama & Rathore, 1984 : 144-146, Fig. 1-3.

Sphaerirostris globuli (Nama & Rathore, 1984) Golvan, 1994. 179.

Centrorhynchus globuli Bhattacharya, 2007: 193, Pl. 34, Fig. 186 a-c.

Type locality : Jodhpur, Rajasthan, India.

Description : Male 15.0-17.2 × 2.0-2,5 mm, female 14-19 × 2.16-2.8 mm. Proboscis globular, similar in both sexes, 0.40-0.58 × 0.40-0.45 mm in male; in female 0.46-0.48 × 0.45-0.57 mm, with 15-16 longitudinal rows of 14-18 hooks each, 10-11 hooks well rooted. Anterior hook 0.037-0.40 mm, middle ones 0.042-0.050 mm and posterior ones 0.035-0.037 mm long. Proboscis receptacle 1.30-1.35 × 0.40-0.45 mm in both sexes. Neck distinct, 0.28-0.35 × 0.37-0.58 mm in male, in female 0.25-0.36 × 0.5-0.6 mm, armed with 5-6 longitudinal rows of 14-18 spines each, each spines 0.03-0.035 × 0.28-0.35 mm in male, in female 0.25-0.36 mm long. Trunk elongated, rounded at posterior end armed with 20-22 longitudinal rows of 14-18 spines each. Lemnisci long, slender, equal, 2.35-2.45 × 0.31-0.35 mm in male, in female 2.22-2.25 × 0.3-0.4 mm. Testes diagonal, juxtopposed, anterior 1.59-1.80 × 0.80-1.0 mm, posterior 1.52-1.80 × 0.75-0.92 mm. Cement glands three, elongate 4.5-4.8 mm long. Bursa 1.78-1.90 × 0.60-0.95 mm. Genital sheath 1.60-2.27 mm long. Uterine bell 0.36-0.40 × 0.22-0.25 mm. Vagina 0.16-0.18 × 0.20-0.22 mm with well developed sphincter. Eggs oval, 0.040-0.062 × 0.017-0.025 mm. Eggs oval, 0.040-0.062 × 0.017-0.025 mm. Gonopore subterminal.

Host : *Corvus splendens* (Vieillot).

Location : Intestine.

Locality : Jodhpur (Rajastan).

Distribution : Known only from type locality.

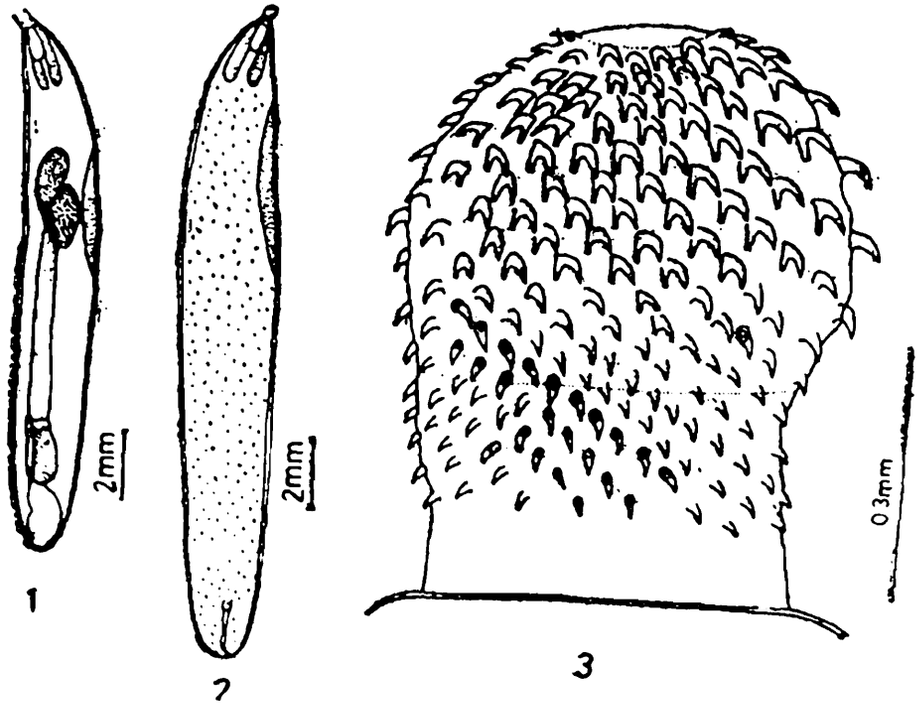


Fig. 197. *Sphaerirostris globuli* (Nama & Rathore, 1984) Golvan, 1994. 1. Male, 2. Female, 3. Proboscis enlarged (after Nama & Rathore, 1984).

223. ***Spherrirostris lancea*** (Westeumb, 1821) Golvan, 1956 (Fig. 198)

Echinorhynchus lancea Westrumb, 1821: 1-85; Meyer, 1933: 106, Fig. 85;

Sphaerirostris lancea Golvan, 1956: 739-740;

Centrorhynchus lancea Yamaguti, 1963: 124;

Centrorhynchus lancea Schmidt & Kuntz, 1969: 333; Gupta, N. K. & Jain, 1973b: 555; Jain & Gupta, N. K. 1984: 16;

Centrorhynchus lancea, Duggal, Solomon & Ambardar, 1987: 25;

Sphaerirostris lancea (Westrumb, 1821) Golvan, 1994: 179.

Bhattacharya, 2003: 72; 2007: 172, Pl. 29, Fig. 157 a-d.

Description : Male 6.3-.8.9 × 0.9-1.6 mm; female 12-20 × 1.7 mm. Anterior part of proboscis globular, 0.49-0.60 mm long, posterior proboscis orbicular-cylindrical, 0.63-9,69 × 0.41-0.42 mm, with 30 longitudinal rows of 11-14 hooks each, Anterior 7-8 hooks large with roots, rest rootless. 0.58 × 0.37 mm in male; in female 0.75 × 0.38 mm. Proboscis receptacle, double-walled, 1.10-1.29 × 0.27-0.39 mm. Neck 0.09-0.11 × 0.36-0.47 mm. Trunk spindle-shaped, posterior end narrower than anterior. Lemnisci 1.02-1.2

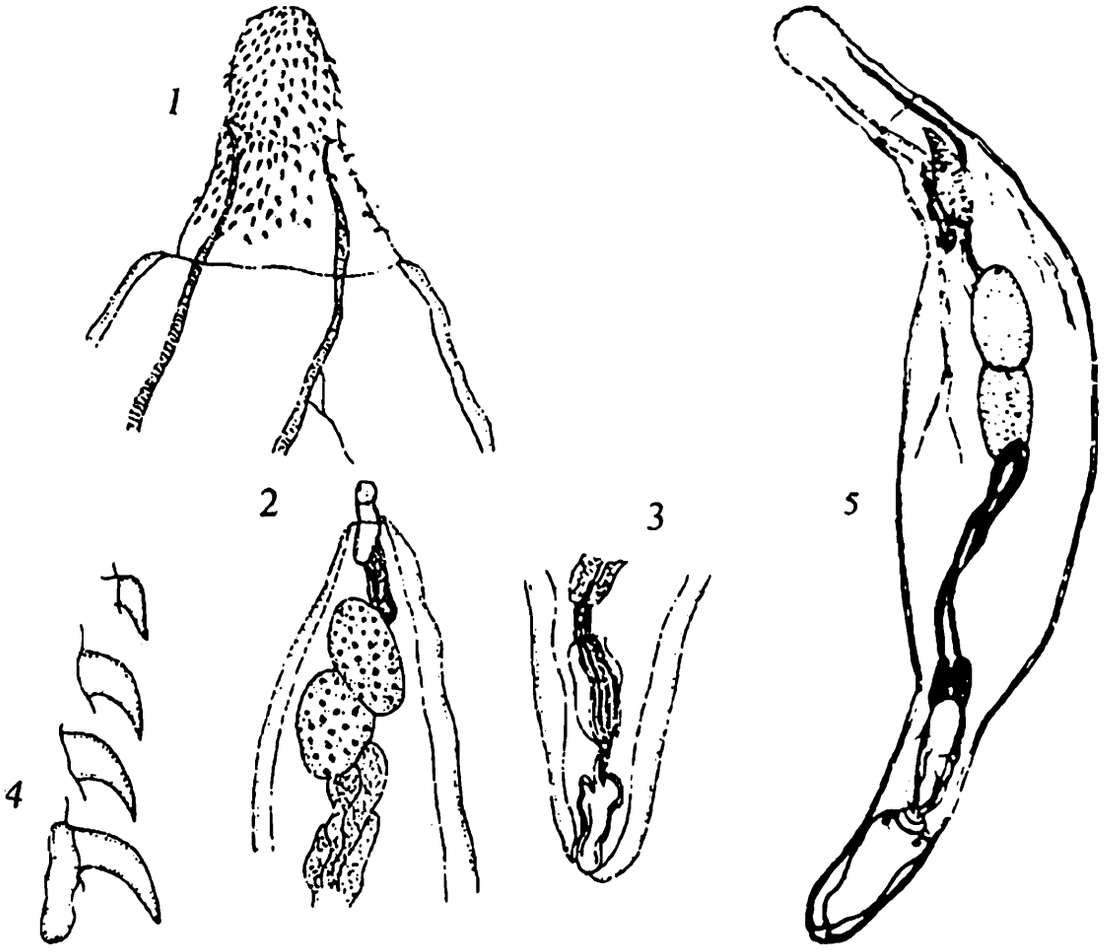


Fig. 198. *Sphaerirostris lancea* (Westrumb, 1921) Golvan, 1956, Male (after Skajabin 1913).

× 0.12-0.15 mm. Testes unequal, at midtrunk. Two vasa efferentia arise from testes and run backwards and unite to form vas deferens which ends in bursa. Cement glands four, long. Seminal vesicle 0.33 mm long. Bursa with its cap 0.66 mm long. Uterine bell 0.16 mm long. Uterus along with vagina 0.41 mm long with guard cells in between them. Vagina with sphincter 0.15-0.19 × 0.08-0.10 mm. Eggs ellipsoidal, with acanthors 0.044-0.052 × 0.018-0.022 mm.

Host : Common myna, *Acridotheres tristis* (Linnaeus), tree pie *Dendrocitta vagabunda* (Latham), Kite, *Milvus migrans* (Boddaert); *Ptyas mucosus* (Linnaeus); *Turdus albocinctum;*

Location : Intestine.

Locality : Varanasi (Uttar Pradesh); Simla (Himachal Pradesh); Sikkim.

Distribution : China; Taiwan; Egypt; Europe.

224. ***Sphaerirostris lanceoloides*** (Petrotschenko, 1949) Golvan, 1956 (Fig. 199)

Centrorhynchus lanceoloiides Petrotschenko, 1949 : 114-127; 1958 : 218-219, Fig. 109;
Sphaerirostris lanceoloides (Petrotschenko, 1949) Golvan, 1956 : 742;

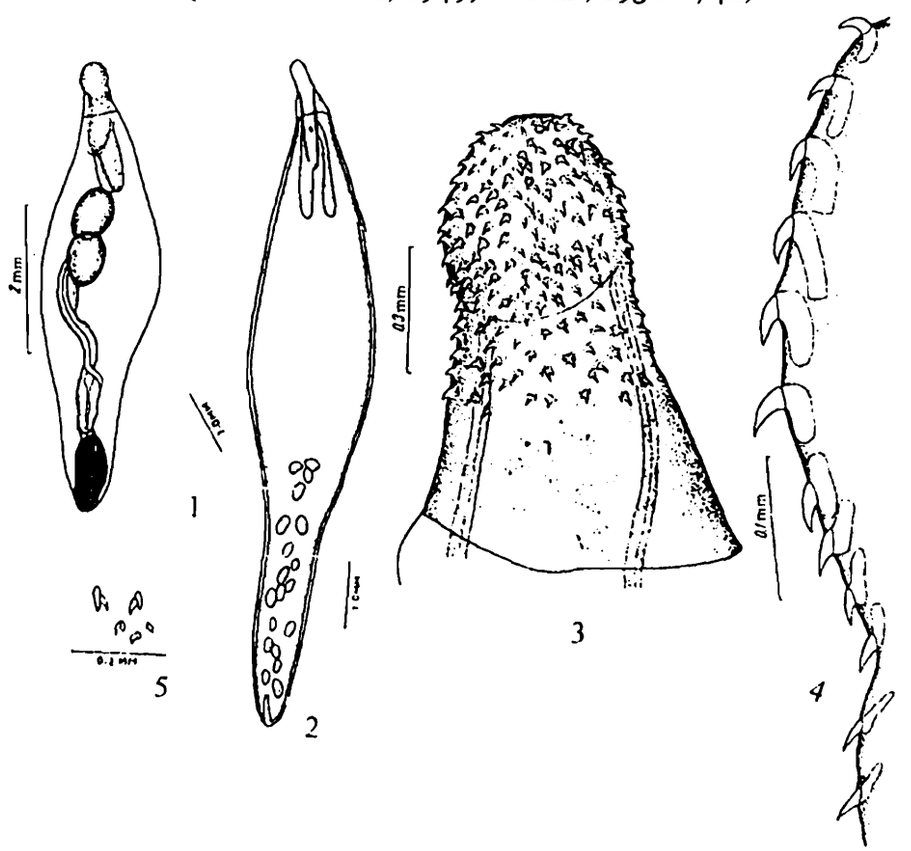


Fig. 199. *Sphaerirostris lanceoloides* (Petrochenko, 1949) Golvan, 1956. 1. Male, 2. Female, 3. Proboscis and neck enlarged, 4. Row of proboscis hooks enlarged, 5. Trunk spines, (1,4 after Petrochenko, 1956, 2,3, after Yamaguti, 1963).

Centrorhynchus lanceoloides Petrotschenko, Yamaguti, 1963 : 124, Pl. 56, Fig. 572, 573; Duggal, Solomon & Ambardar, 1987 : 29-30, Fig. 1-4;

Sphaerirostris lanceoloides Golvan, 1994 : 179.

Centrorhynchus lanceoloiides Bhattacharya, 2007 : 177-178, Pl. 29, Fig. 158 a-d.

Type locality : Central Asia.

Description : Worms large, fusiform. Males 7.46-8.9 mm long, width near testes 1,52 mm. × 0.9-1.45 mm; female 8.62 × 1.65 mm. Proboscis orbiculo-cylindrical, 0.63-0,69 × 0.41-0.42 mm, with 36-38 longitudinal rows of 11-12 hooks each, Anterior 7-8 hooks large with well developed roots in each row. Mucros l 0.027-0.036 mm long, roots 0.0420.062 mm long. Starting with sixth hook roots decreases n size and are antrose. Neck trapezoid, 0.12 × 0.55 mm. Proboscis receptacle sacciform, double-walled, 1.02- 1.05 × 0.3-0.4 mm in male, in female 1.03-1.12 × 0.2-0.3 mm, with oval ganglion located at 13 × 0.39 mm. Trunk spindle-shaped. Lemnisci equal, elongated, flat, 0.84 × 0.60 mm extending to anterior testis. Testes orbicular, obliquely in tandem, pre-equatorial, anterior slightly overlapping anterior testis, 0.9 × 0.52 mm, posterior 0.87 × 0.60 mm. Cement glands three, long, slender, 2.0 × 0.3 mm. Genital sheath 0.9 × 0.38 mm. Copulatory bursa 1.2-1.31 × 0.42-0.51 mm, thick-walled, with a faint constriction in middle and surface wrinkled. Vagina 0.18 × 0.90 mm, its sphincters 0.09 and 0.097 mm in diameter. Eggs ellipsoid 0.067-0.075 mm long.

Host : *Paster roseus* (Linnaeus).

Location : Intestine.

Locality : Punjab.

Distribution : Central Asia; Russia.

225. ***Sphaerirostris maryasis*** (Datta, 1932) Golvan, 1956 (Fig. 200)

Centrorhynchus maryasis Datta, 1932 : 261; 1933 : 325-329, Pl. 7, Fig 1-8;

Sphaerirostris maryasis Golvan, 1956 : 748-749;

Centrorhynchus maryasis Yamaguti, 1963 : 125, Pl. 53, Fig. 545-551; Gupta, N. K. & Lata, 1968b: 327-330, Fig. 4, 5;

Sphaerirostris maryasis Golvan, 1994: 179.

Centrorhynchus maryasis Bhattacharya, 2007: 185, Pl. 32, Fig. 176 a, b.

Type locality : Kumaon hills near Bhowali, Uttar Pradesh, India.

Description : Males 5.5-15.0 × 1.3-2.0 mm, females 4.0-18.0 × 1.0-3.0 mm. Proboscis small, cylindrical 0.79 × 0.48 mm with 24-28 longitudinal rows of 14-16 hooks each, radially and symmetrically arranged. Hooks 0.028 × 0.006 mm, basal hooks smaller, 0.014 × 0.004 mm. Proboscis hooks of anterior row 0.047 × 0.019 mm, middle row 0.056 × 0.019 mm, of last row 0.037 × 0.009 mm. Except apical hooks, all hooks of proboscis

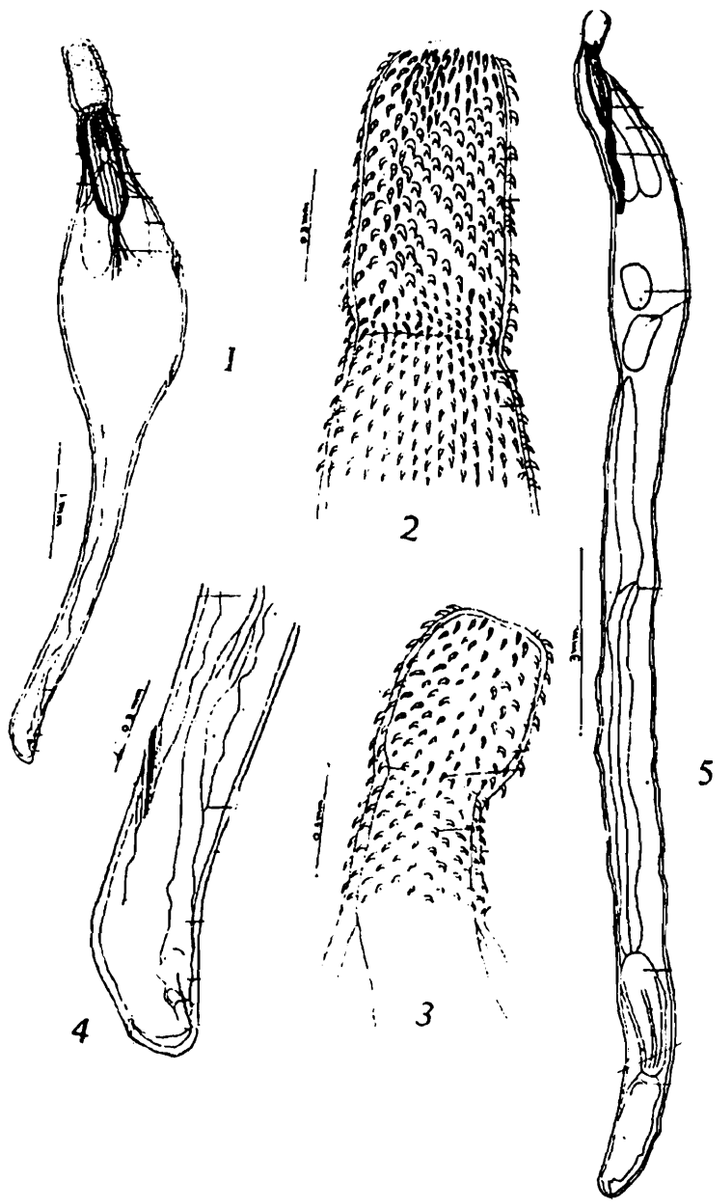


Fig. 200. *Sphaerirostris maryasis* (Datta, 1933) Golvan, 1956. 1. Female, 2,3. Proboscis and Neck enlarged, 4. Posterior part of female (after Gupta, N.K. & Gupta, K. 1972).

tend to form spiral arrangement. Apical hooks with well developed roots. Neck small, conical, 0.44 × 0.32 mm, armed with 24-28 longitudinal rows of 14-16 spines each, Spines slender with last 2 or 3 rows minute and thorny, near middle strong and curved with rectangular base with longitudinal rows of 6-7 spines each. Spines of uniform size and shape, 0.010-0.018 × 0.004 mm, with not well developed roots. Proboscis receptacle cylindrical, double-walled, 1.61 × 0.29 mm, with ganglion at its middle. Trunk long, cylindrical with maximum width near midtrunk, after which it tapers to rounded end posteriorly. Hypodermal nuclei minute, branched, numerous, scattered. Lacunar system with two main longitudinal channels and reticulate anastomoses. Lemnisci 2, cylindrical, nearly equal, 1.96 × 0.4 mm, longer than receptacle. Testes ovoid subequal, in tandem, anterior 0.75-0.87 × 0.30-0.59 mm, posterior 0.69-0.87 × 0.37-0.56 mm, their efferent

ducts unite to vas deferens, ending in strong, muscular penis. Cement glands 3, long, cylindrical, in two groups of 1 anterior and 2 posterior, anterior 3.22 × 0.322 mm and posterior 6.23 × 0.32 mm, behind posterior testis, their ducts run along vas deferens, join it and open in common opening at base of penis, latter projects in bell-shaped bursa with frilled muscular wall. Seminal vesicle club-shaped 1.02-1.49 × 0.26-0.41 mm. Bursa 0.97-1.02 × 0.52-0.79 mm. Ovary rounded attached near posterior end of proboscis receptacle by genital ligament. Uterine bell funnel-shaped 0.26-0.35 × 0.09-0.15 mm, with number of regularly arranged guard cells. Uterus long, tubular 0.78-0.93 × 0.07-011 mm. Vagina 0.19-0.28 × 0.09-0.13 mm with sphincter muscles at two ends. Hind end of vagina with two small sac-like structures opening into vulva.

Host : *Urocissa melanocephala occipitalis* (Blyth).

Location : Intestine.

Locality : Kumaon hills near Bhowali (Uttar Pradesh); Hoshiarpur (Punjab).

Distribution : Known only from type locality.

226. ***Sphaerirostris pinguis*** (Van Cleave, 1918) Golvan, 1956 (Fig. 201)

Centrorhynchus pinguis Van Cleave, 1918 : 164-168; Subramanian, 1927b : 649-650, Fig. 3; Meyer, 1932 : 109;

Sphaerirostris pinguis (Van Cleave, 1918) Golvan, 1956 : 746-747;

Petrotschenko, 1958 : 2242, Fig. 111; Yamaguti, 1963 : 126, Pl. 54, Fig. 557;

Sphaerirostris pinguis Golvan, 1994 : 179.

Type locality : Nanking, China.

Description : Male 8.5 mm long, anterior part 0.71 mm wide, middle part 1.55 mm, posterior part 1.29 mm wide. Female 15 mm long, 2.5 mm maximum width, posterior end about 1.2 mm wide. Proboscis globular anteriorly 0.65-0.70 × 0.36 mm in male; in female 0.65-0.70 × 0.35 mm, with 32 longitudinal rows of 16 hooks each; longest hooks strongly recurvrd, behind apex 0.042 mm long, with simple rod-shaped root longer than blade in male, in female 0.051 mm long anteriorly and 0.042 mm long in last row. Proboscis receptacle double-walled 1.15-1.26 × 0.35-0.54 mm in both sexes, with elliptical anterior half slightly flattened. Neck 0.27-0.42 mm long in male, in female 0.38 mm long with 36 longitudinal rows of 3-4 spines each, spines with reduced roots, 0.037 × 0.05 mm at base in male, in female 0.42 mm long, lie more widely apart from one another than on proboscis Lemnisci equal, club-shaped 2.8 × 0.76 mm in male. Testes 2, elliptical, lie obliquely one behind other, anterior 0.91-1.20 × 0.66-0.76 mm, posterior 0.84-1.14 × 0.52-0.84 mm in second quarter of body. Cement glands three, long, tubular, 5.8 × 0.48 mm. Genital sheath 0.82 × 0.54 mm. Bursal cap muscular 0.21 mm long, bursa 0.81x 0.61 mm with a number of digitiform rays, send out posteriorly two very wide ducts constricted at anterior end of saefftigen's pouch. Eggs 0.048-0.065 × 0.024 mm.

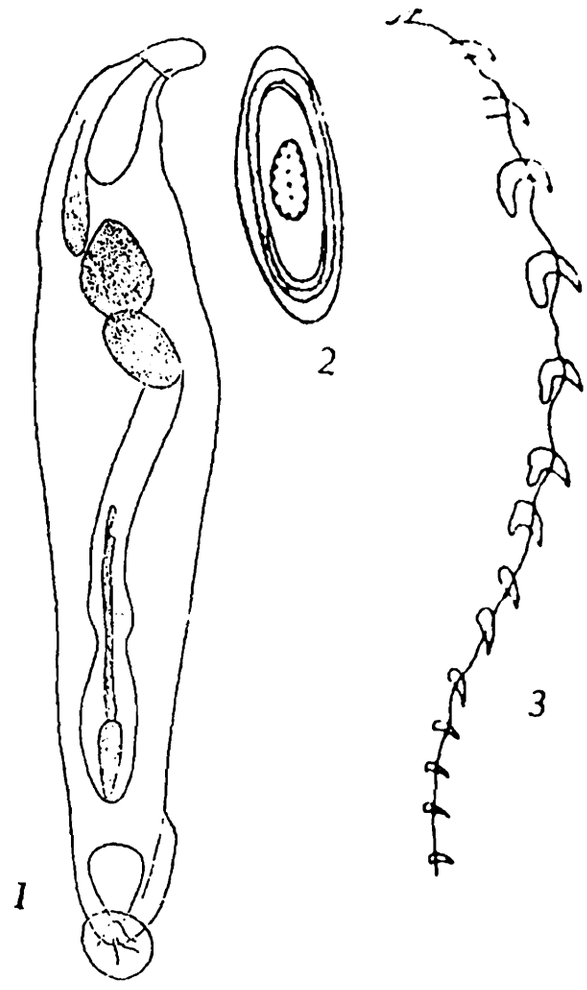


Fig. 201. *Sphaerirostris pinguis* (Van Cleave, 1918) Golvan, 1956. 1. Male, 2. Egg enlarged, 3. Row of proboscis hooks enlarged (after Tripathi, 1959).

Host : *Acridotheres tritis* (Linnaeus), *Corvus corvus interpositus*, *C. splendens* (Vieillot).

Location : Posterior intestine.

Locality : Ludhiana (Punjab); Rangoon (Burma).

Distribution : China, Taiwan; Turkestan. See Van Cleave 1918: 164-167 for female description.

227. ***Sphaerirostris reptans*** (Bhalerao, 1931) Golvan, 1956 (Fig. 202)

Centrorhynchus reptans Bhalerao, 1931 : 106-109, Fig. 4, 5;

Sphaerirostris reptans Golvan, 1956 : 748;

Centrorhynchus reptans, Yamaguti, 1963 : 128; Anantaraman, M. & Anantaraman, S., 1970 : 7;

Sphaerirostris reptans Golvan, 1994 : 179.

Type locality : Mukteswar, Uttar Pradesh, India.

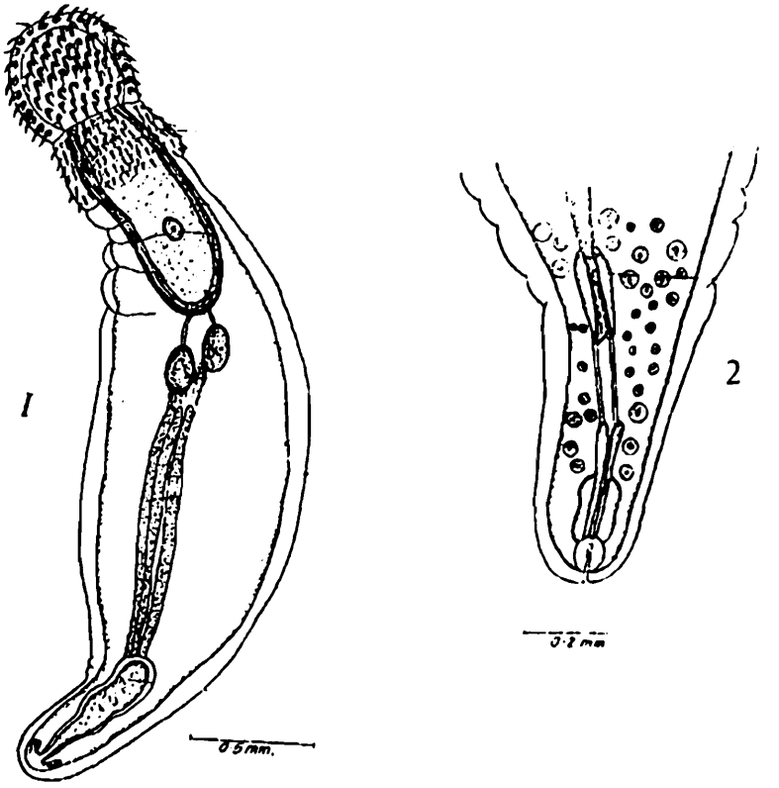


Fig. 202. *Sphaerirostris reptans* (Bhalerao, 1931) Golvan, 1956. 1. Male, 2 Posterior part of female (after Bhalerao, 1931).

Description : Worms of both sexes small and spindle-shaped, with posterior end narrower than anterior end. Males 3.14-3.33 × 0.71-0.92 mm. Proboscis 0.77 mm long, divided into 2 parts, anterior globular part 0.43 mm long, with 24 alternating transverse rows of 24 hooks each, hooks larger with recurved roots, 0.057 mm long. Proboscis receptacle 0.87-0.96 mm long, with ganglion slightly posterior to its middle. Neck cylindrical 0.22-0.33 mm long. Trunk spinose. armed with 24 alternating horizontal rows, trunk spines 0.039 mm long. Lemnisci arise from base of proboscis and extend a little posterior to receptacle. Testes ovoid, lie obliquely on behind other, 0.168 × 0.11-0.13 mm. Cement glands three, long, tubular commencing just behind posterior testis and opening into bursa at about 0.6 mm from posterior end of trunk. Ovarian balls float in body cavity. Uterine bell 0.2 × 0.065 mm, from its posterior end two thin ducts of 0.17 mm long emerge and lead into two uteri, latter after a distance of 0.11 mm are surrounded by dumb-bell-shaped musculature which acts as ovijector. Uteri open posteriorly by wide orifices into a small receptacle, which communicates with exterior by vagina terminally.

Host : *Naja hannah.*

Location : Intestine and rectum.

Locality : Mukteswar (Uttar Pradesh).

Distribution : Known only from type locality.

228. ***Sphaerirostris robustus*** (Datta, 1928) Golvan, 1994
(Fig. 203)

Echinorhynchus robustus Datta, 1928 : 41-60, Pl. 1-9; Yamaguti, 1963 : 157; Anantaraman, M. & Anantaraman, S., 1970 : 8; Gupta, P.D. & Ghosh, 1979 : 312;

Sphaerirostris robustus Golvan, 1994 : 179.

Type locality : Allahabad, Uttar Pradesh, India.

Description : Males of olive colour 16.0-22.0 × 2.0-3. × 3.2-4.0 mm, and females greenish 22.0-24.0 mm × 3.2-40 mm. Proboscis ovoid, 0.48-0.55 × 0.47-0.5 mm in male, in female 0.48-0.53mm, with 28-30 longitudinal rows of 8-12 hooks each in both sexes. Hooks 0.03 × 0/012-0.014 mm at base and 0.003 mm wide at apex in male and in female 0.03 × 0.915-0.016 mm in female. Proboscis receptacle double walled, with central ganglion,

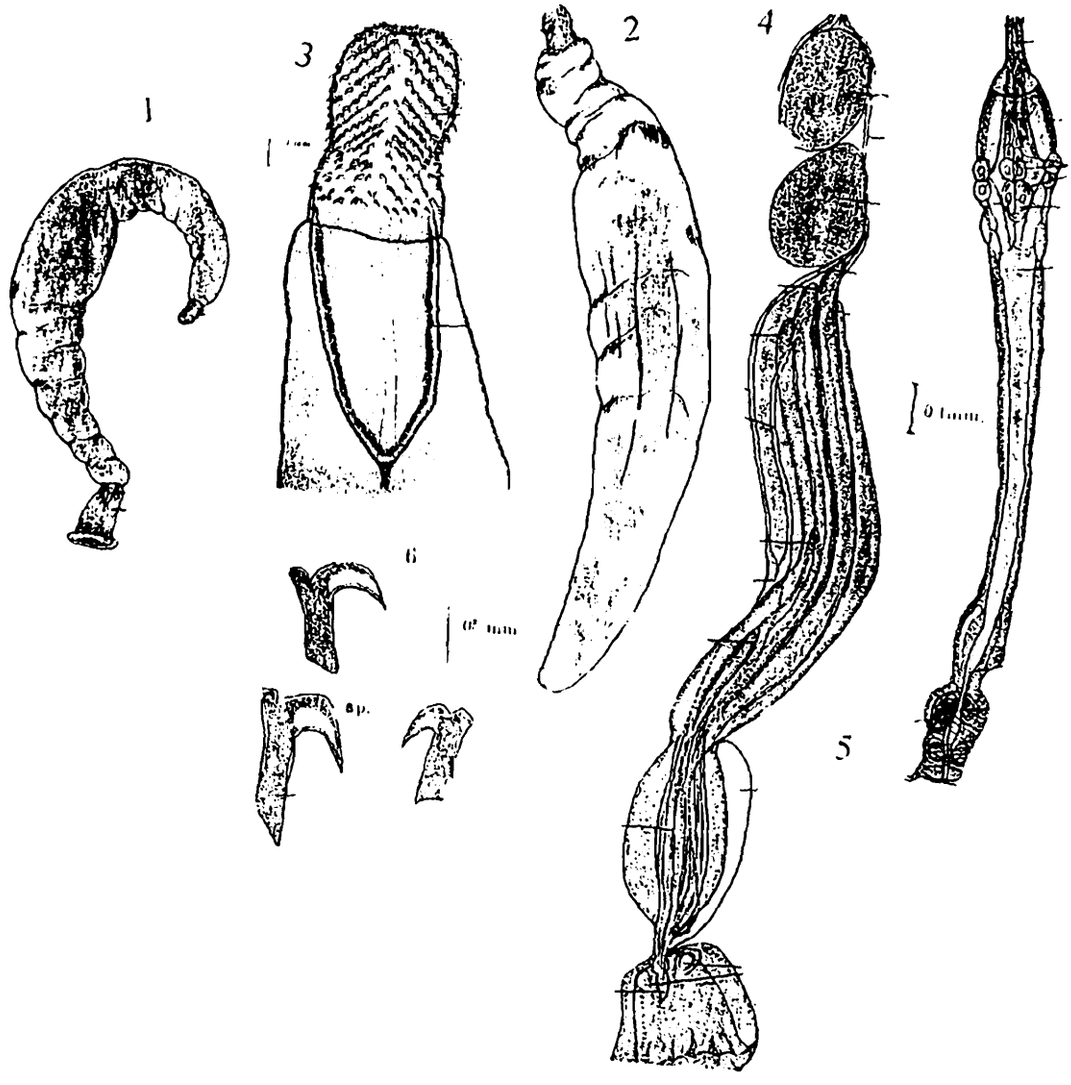


Fig. 203. *Sphaerirostris robustus* (Datta, 1928) Golvan, 1994. 1. Male, 2. Female, 3. Proboscis enlarged, 4. Male genitalia, 5. Female genitalia, 6. Posterior hooks enlarged (after Datta, 1928).

0.92-1.25 × 0.3-0.4 mm in male, in female 1.40-0.44 × 0.37-0.39 mm. with retractor muscles attached to its posterior end and their distal end attached to body wall. Lemnisci 5.0-5.8 × 0.3-0.5 mm. Testes 2, about equal in size, ovoid, lie one behind other in anterior third of body behind lemnisci, anterior testis 1.7-1.8 × 0.7-1.0 mm, posterior testis 1,5-1.8 × 0.7-1.0 mm. From testes arise vasa efferentia and they unite into a thick vas deferens 1.6-2.5 mm long, with a constriction in middle and ends in muscular penis. Cement glands rod-shaped closely attached to one another, 6.0-9.5 × 0.5-1.0 mm and open ventrally into vas deferens, just in front of seminal vesicle. Seminal vesicle pear-shaped, 1.6-2.5 × 0.2-0.3 mm anteriorly and 0.2 mm wide posteriorly, opens on right side near end of vas deferens at the origin of conical, muscular penis. Bursa funnel shaped lies retracted in body cavity, 1.0-1.5 × 0.6-1.5 mm. Penis conical, 0.17-0.25 mm long hangs at the top of bursa. Uterime bell 0.53-0.6 × 0.20.24 mm. Uterus 0.73-1.25 × 0.07-0.12 mm. Vagina 0.58-0.82 × 0.10-0.13 mm. Ova elliptical 0.042-0.63 × 0.025-0.028 mm.

Host : *Corvus coraxi, C. splendens* (Vieillot)., *Schizothorax* sp.

Location : Intestine.

Locality : Allahabad (Uttar Pradesh); Dal lake, Srinagar (Jammu & Kashmir).

Distribution : Known only from Indian subcontinent.

Note : This species is included in incerti sedis by Amin (1985).

229. ***Sphaerirostris saxicoloides*** (Nama & Rathore, 1984) Golvan, 1994 (Fig. 204)

Centrorhynchus saxicoloides Nama & Rathore, 1984 : 146-147, Fig. 4-6;
Sphaerirostris saxicoloides Golvan, 1994 : 179.
Centrorhynchus saxicoloides Bhattacharya, 2007 : 193, Pl. 34, Fig. 187 a-c.

Type locality : Jodhpur, Rajasthan, India.

Description : Male 3.23 × 0.78 mm, female 2.80 × 0.58 mm. Proboscis cylindrical, 0.67 × 0.32 mm in male, in female 0.57 × 0.33 mm, with 22-24 longitudinal rows of 12-14 hooks each with poorly developed roots, similar in both sexes. Anterior hooks 0.030-0.037 mm, middle hooks 0.37-0.040 mm and posterior hooks 0.025-0.027 mm long. Proboscis receptacle 0.85 × 0.32 mm in male, in female 0.71 × 0.28 mm. Trunk cylindrical and elongated posteriorly. Lemnisci long, slender and subequal 0.80-0.85 mm long in male, in female 0.65-0.70 mm long. Anterior testis 1.187 × 0.137 mm; posterior 0.242 × 0.192 mm. Cement glands.three, 0.47 mm long. Genital sheath 0.33 × 0.13 mm. Bursa 0.60 × 0.23 mm. Vagina 0.12 × 0.04 mm wide. Ova immature, 0.012 × 0.010 mm. Gonopore terminal.

Host : *Saxicoloides fulicata* (Indian robin); *Schizothorax* sp., *Corvus splendens* (Vieillot), *C. coraxi.*

Location : Rectum.

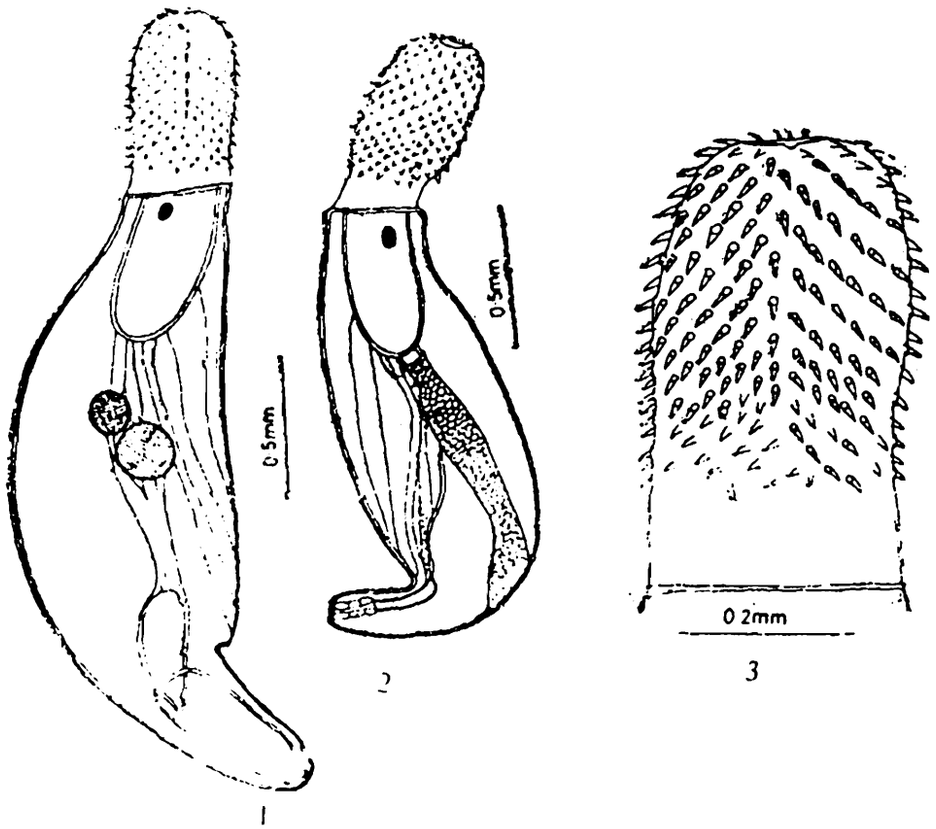


Fig. 204. *Sphaerirostris saxicoloides* (Nama & Rathore, 1984) Golvan 1994. 1. Male, 2. Female, 3. Proboscis enlarged (after Nama & Rathore, 1984).

Locality : Jodhpur (Rajasthan).

Distribution : Known only from type locality.

230. ***Sphaerirostris splendi*** (Gupta, S. P. & Gupta, K., 1970) Golvan, 1994 (Fig. 205)

Centrorhynchus splendi Gupta, S.P. & Gupta, K., 1970 : 407-410; 1971 : 101-104; Gupta, N.K. & Jain, 1973b: 555; Gupta, N.K. & Jain, 1973b : 555; Jain, 1980 : 25; Duggal, Solomon & Ambardar, 1987 : 27: Chowhan & Khera, 1988 : 192;

Sphaerirostris splendi Golvan, 1994 : 179.

Centrorhynchus splendi Bhattacharya, 2007 : 174.

Type locality : Chandigarh, North India.

Description : Female 16.7x 1.82 mm. Proboscis globular anteriorly of 0.51 × 0.43 mm, posterior part cylindrical of 0.30 × 0.45 mm, with 28 longitudinal rows of 9-10 hooks each Proboscis receptacle anteriorly inserted almost up to middle of proboscis, 1.26 × 0.4 mm. Neck 0.12 × 0.52 mm. Lemnisci equal 1.95 × 0.3 mm. Uterine bell oval, 1.2 × 0.75 mm. Uterus 1.2 × 0.75 mm. Vagina 0.24 × 0.1 mm, anterior vaginal sphincter 0.1-0.15 mm long, posterior 0.12 × 0.13 mm. Male not known.

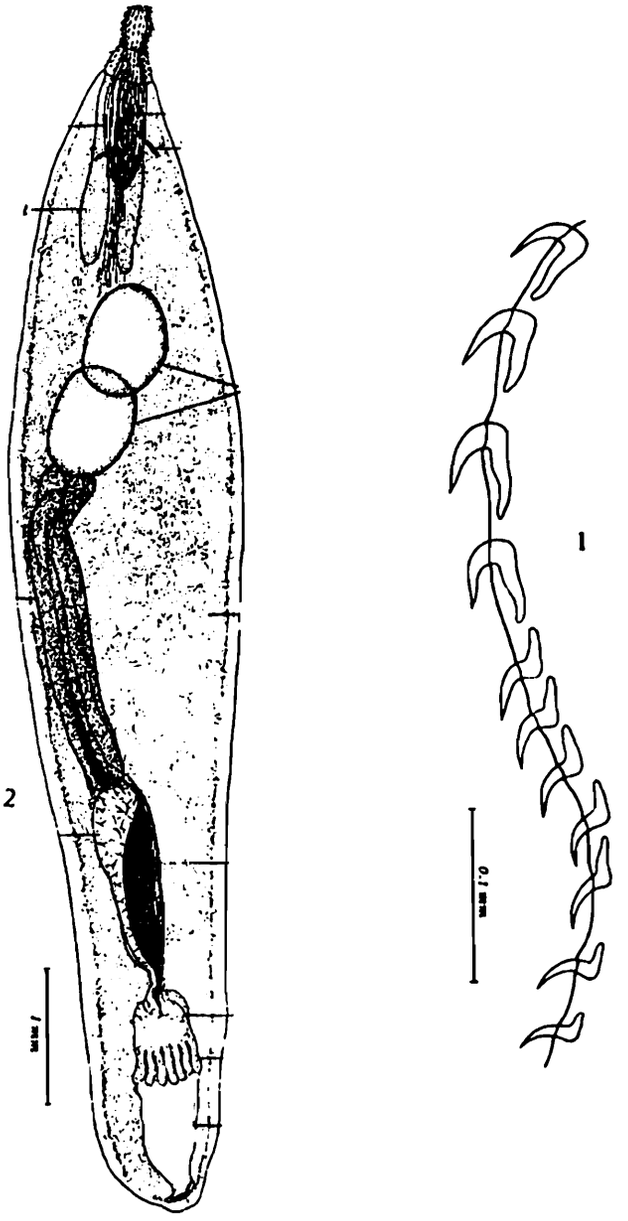


Fig. 205. *Sphaerirostris splendi* (Gupta, N.K & Gupta, K. 1970) Golvan, 1994. 1. Male, 2. Row of proboscis hooks (after Gupta, N.K. & Gupta, K. 1970).

Host : *Corvus spendens* (Vieillot), *Hierococcyx varius* (Vahl);

Intermediate host : *Porcillionides pruinosus* (Crustacea), *Rana tigrina* Daudin, Reservoir hosts: *Hemidactylus brooki* (wall lizard), *Calotes* sp. (garden lizard), *Bungarus caeruleus, Boiga trigonata, Natrix stolata* and *Tropidonotus* sp. (snakes) and *Herpestes edwardsi* (mongoose) from body cavity. *Saxicoloides fulicata* (Indian robin). *Schizothorax* sp., *C. coraxi.*

Location : Intestine; juveniles encysted in peritoneum.

Locality : Chandigarh; Punjab.

Distribution : Known only from India.

231. ***Sphaerirostris turdi*** (Yamaguti, 1939) Golvan, 1956
(Fig. 206)

Centrorhynchus turdi Yamaguti, 1939 : 1939 : 331-332 Pl. 43, Fig. 13, 14, Pl. 49, Fig. 43; 1963 : 127, Pl. 79, Fig. 802, 802;

Sphaerirostris turdi Golvan, 1956 : 741-742;

Centrorhynchus turdi Petrotschenko, 1958 : 234-235, Fig. 119;

Sphaerirostris turdi Schmidt & Kuntz, 1969 : 333;

Centrorhynchus turdi Gupta, N.K. & Jain, 1973b : 555; Jain & Gupta, N.K. 1984 : 16-17, Duggal, Soloman & Ambardar, 1987 : 26;

Sphaerirostris turdi Golvan, 1994 : 179.

Centrorhynchus turdi Bhattacharya, 2000 : 156; 2007 : 173, Pl. 30, Fig. 161 a, b.

Type locality : Japan.

Description : Male 7.2-11.5 × 1.52-2.40 mm, female 6.08-9.60 × 1.43-2.35 mm. Proboscis anterior part globular, 0.45-0.50 × 0.32-0.38 mm, posterior part cylindrical 0.18-0.30x

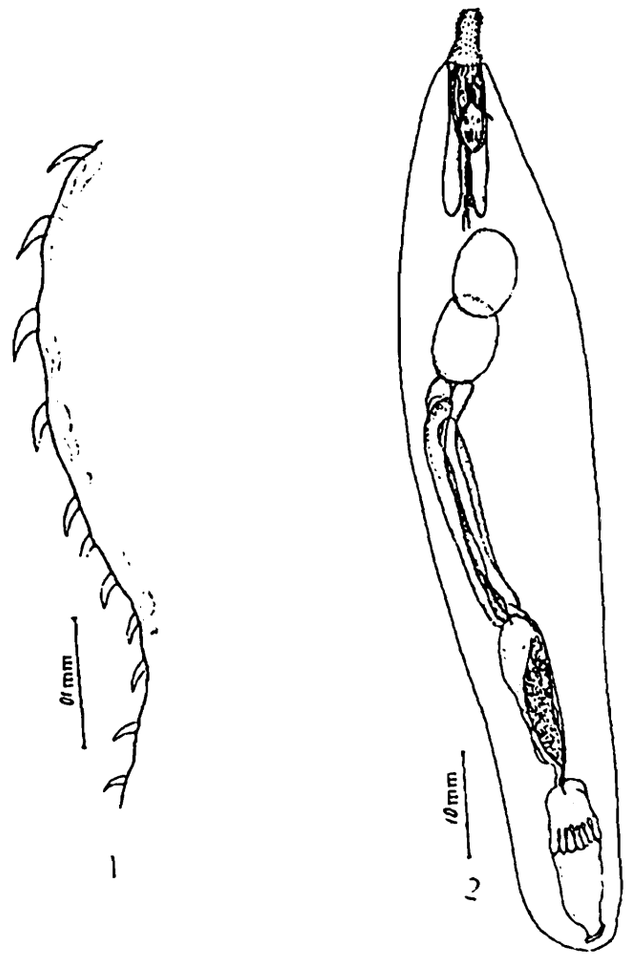


Fig. 206. *Sphaerirostris turdi* (Yamaguti, 1939) Golvan, 1956. 1. Row of proboscis hooks lateral view, 2. Male (after Yamaguti, 1930).

0.29-0.54 mm in male; in female globular part 0.45-0.53 × 0.36-0.41 mm and cylindrical part 0.18-0.3 × 0.3-0.51 mm, with 26-29 longitudinal rows of 11-13 hooks each, hooks of anterior part large, rooted, 0.03-0.038 × 0.012-0.015 mm in male, in female 0.03-0.039 × 0.012-0.015 mm, hooks of posterior part small, rootless, 0.01-0.032 × 0.007-0.0075 mm in male, in female 0.01-0.03 × 0.007-0.0075 mm. Neck slightly enlarged posteriorly, 0.13-0.14 × 0.36-0.54 mm in male, in female 0.12-0.15 × 0.37-0.54 mm. Proboscis receptacle 1.08-1.26 × 0.31-0.45 mm in male, in female 0.97-1.35 × 0.2-0.45 mm, with ganglion elliptical 0.10-0.18 × 0.045-0.046 mm at its middle. Trunk smooth, subcylindrical to spindle-shaped, widest at middle of anterior half of trunk. Hypodermic nuclei numerous and small. Lacunar system reticular with a pair of subcentral stems. Lemnisci equal, 1.28-1.58 × 0.21-0.42 mm in male, in female 1.44-2.70 × 0.18-0.30 mm. Testes elliptical, anterior 0.83-1.2 × 0.57-0.90 mm, posterior 0.90-0.97 × 0.60-0.82 mm. Cement glands four, 2.77-3.68 × 0.29-0.48 mm. Genital sheath 0.66-1.65 × 0.39-0.60 mm. Bursa 0.53-1.8 × 0.45-0.60 mm. Uterine bell 0.20-0.32 mm long. Uterus 0.38-1.9 mm long. Anterior vaginal sphincter 0.070-0.11 mm, posterior sphincter 0.10 mm in diameter. Vaginal bulb 0.060-0.10 mm diameter. Eggs elliptical, three-membraned 0.078-0.090 × 0.024-0.027 mm, embryos 0.053-0.060 × 0.014-0.018 mm. Vulva terminal.

Host : *Corvus splendens* (Vieillot), *Acridotheres tristis* (Linnaeus), *Centropus* sp. *Corvus spendens* (Vieillot), *Hierococcyx varius* (Vahl); *Dendrocitta* sp. (Tree pie).

Intermediate host : *Porcillionides pruinosus* (Crustacea), *Rana tigrina* Daudin, Reservoir hosts: *Hemidactylus brooki* (wall lizard), *Calotes* sp. (garden lizard), *Bungarus caeruleus, Boiga trigonata, Natrix stolata* and *Tropidonotus* sp. (snakes) and *Herpestes edwardsi* (mongoose) from body cavity *Saxicoloides fulicata* (Indian robin). *Schizothorax* sp., *Corvus splendens* (Vieillot), *C. coraxi.*

Location : Intestine.

Locality : Chandigah; Punjab; Sikkim; Tripura.

Distribution : China, Taiwan; Japan.

15. Family PLAGIORHYNCHIDAE Golvan, 1960

Plagiorhynchidae Golvan, 1960 : 573-693; Yamaguti, 1963 : 87-88; Bhattacharya, 2007 : 152.

Diagnosis : Polymorphida. Proboscis cylindrical or somewhat bulbous, usually short, with more or less uniform hooks, though basal hooks smaller. Trunk aspinose, fusiform or cylindrical. Lemnisci may be extremely long, with or without distinct central canal. Cement glands tubular or reniform, may be very long and slender. Eggs oval, with polar prolongation of middle shell. Parasites of birds, occasionally in reptiles.

Type genus : *Plagiorhynchus* Lühe, 1911.

Includes two subfamilies, 1. Plagiorhynchinae Meyer, 1931 and 2. Porrorchinae Golvan, 1956 both subfamilies occur in this subcontinent.

Key to Indian subfamilies of family PLAGIORHYNCHIDAE

- Proboscis cylindrical, its hooks similar with posteriorly directed roots except in one or more rows of rootless basal spines-. Parasites of birds. ..... PLAGIORHYNCHINAE
- Proboscis ovoid to spheroidal, its posterior hooks numerous, diminish in size apically and posteriorly; manubria directed anteriorly. Cement glands 2-4. Parasites of of birds and mammals ..... PORRORCHINAE

Subfamily PLAGIORHYNCHINAE Meyer, 1931

Plagiorhynchinae Meyer, 1931c : 53-108; 1932 : 123; Petrotschenko, 1958 132-133; Yamaguti, 1963 : 88; Bhattacharya, 2007 : 152.

Diagnosis : Plagiorhynchidae. Proboscis cylindrical or bulbous, with numerous hooks. Trunk massive, fusiform or cylindrical, without spines. Lemnisci slender, without central canal. Cement glands tubular or reniform. Eggs oval, with polar prolongations of middle shell. Parasites of birds.

Type genus : *Plagiorhynchus* Lühe, 1911.

Incudes three genus 1. *Plagiorhynchus* Lühe, 1911, 2. *Prosthorhynchus* Kostylew, 1915 and 3. *Sphaerechinorhynchus* Amin, Wongsawad, Sacheong, Suwattanacoynot & Sey, 1998, of which first two genera occur in this subcontinent.

Key to Indian genera of subfamily PLAGIORHYNCHINAE

- Eggs with polar prolongations of the middle shell, cement glands with 3-6 giant nuclei ..... *Plagiorhynchus*
- Eggs without polar prolongations of middle shell, cement gland with 5-6 giant nuclei ..... *Prosthorhynchus*

44. Genus ***Plagiorhynchus*** Lühe, 1911

Plagiorhynchus Lühe, 1911 : 1-115; Meyer, 1932 : 128; 1933 : 131; Petrotschenko, 1958 : 134; Yamaguti, 1963 : 89; Schmidt & Kuntz, 1966: 521; Golvan, 1994 : 171.

Plagiorhynchus (*Plagiorhynchus*) Bhattacharya, 2007 : 153.

Diagnosis : Plagiorhynchidae, Plagiorgynchinae. Proboscis cylindrical, subcylindrical, fairly long, directed ventrad, with very numerous hooks, which are small at its base. Hooks similar, simple with backwardly directed roots except one or more rootless hooks usually present basally. Proboscis receptacle cylindrical, double-walled inserted at base of proboscis, ganglion middle third of receptacle. Trunk cylindrical or slightly ovoid, aspinose, with numerous hypodermal nuclei. Lacunar system with reticular anastomoses. Lemniaci tubular usually long, slender, occasionally branched. Testes in middle to anterior third of trunk. Cement glands 3-6, long tubular or reniform. Eggs oval or elongate, outer shell

sculptured or not, with polar prolongations of middle shell. Gonopore terminal or subterminal. Parasites of aquatic arthropods which become adults in limicole birds, rarely mammals.

Type species : *Plagiorhynchus crassicolle* (Villot, 1875) Lühe, 1911.

Includes seveteen species, 1. *Plagiorhynchus charidri* (Yamaguti, 1939) Van Cleave, 1951, 2. *P. charadriicola* (Dollfus, 1953) Golvan, 1956, 3. *P. crassicollis* (Villot, 1875) Lühe, 1911, 4. *P. freitasi* Vincente, 1977, 5. *P. lemnisalis* Belopolskaja, 1959, 6. *P. limnobaeni* (Tubangui, 1933) Golvan, 1956; 7. *P. linearis* (Westrumb, 1821) Golvan, 1956, 8. *P. menurae* (Johnston, 1912) Golvan, 1956, 9. *P. odhneri* Lundstrom, 1942, 10. *P. paulus* Van Cleave & Williams, 1951, 11. *P. ponticus* Lisitsyna, 1992, 12. *P. pupa* (Linstow, 1905) Golvan, 1994; 13. *P. rectus* (Linton, 1892) Van Cleave, 1918; 14. *P. reticulatus* (Westrumb, 1821) Golvan, 1956, 15. *P. spiralis* (Rudolphi, 1809) Golvan, 1956, 16. *P. totani* (Porta, 1910) Golvan, 1956 and 17. *P. urichi* (Cameron, 1936) Golvan, 1956, of which first one occur in India.

232. ***Plagiorhynchus charidrii*** (Yamaguti, 1939) Van Cleave, 1951 (Fig. 207)

Prosthorhynchus charidrii Yamaguti, 1939 : 334-335, Pl. 44, Fig. 18, 19;

Plagiorhynchus (*Plagiorhynchus*) *charidrii* Van Cleave & Williams, 1951 : 156;

Prosthorhynchus charidrii Petrotschenko, 1958 : 178, Fig. 89;

Plagiorhynchus (*Plagiorhynchus*) *charadrii* Schmidt & Kuntz, 1966 : 526-527, Fig. 4, 5;

Prosthorhynchus charidrii Soota, Srivastava & Ghosh, 1969 : 504; 1971 : 25-28, Textfig. 5 A-C;

Plagiorhynchus charidrii (Yamaguti, 1939) Golvan, 1994 : 171;

Plagiorhynchus (*Plagiorhynchus*) *charidrii*, Amin *et al.*, 1999 : 128-129.

Plagiorhynchus (plagiorhynchus) *charidrii* Bhattacharya, 2007 : 153-154, Pl. 24, Fig. 137 a-d.

Type locality : Japan.

Description : Male 8.0-10.0 × 1.0-1.3 mm, female 9.0-11.5 × 1.0-1.5 mm. Proboscis cylindrical in male 0.85-0.93 × 0.20-0.23 mm; in female 0.87-1.0 × 0.23-0.27 mm, with 16-20 longitudinal rows of 15-19 hooks each. Basal 3 or 4 hooks in each row simple, without roots. Apical and second hook in each row with blade 0.006 mm long. Hook size similar in both sexes; apical hook 0.048-0.052 mm long, medial 0.054-0.060 mm long, basal 0.053-0.060 mm long, increasing in stoutness from front to rear, except for rootless delicate spines. Roots stout and simple. Proboscis receptacle nearly cylindrical, double-walled, 1.60-1.75 × 0.25-0.35 mm in male; in female 1.70-1.95 × 0.25-0.35 mm; with ganglion 0.13 × 0.045 mm in middle in both sexes. Trunk cylindrical or fusiform, attenuated at ends. Neck short. Trunk subcylindrical, smooth, curved ventrally at its anterior end, and small nodular projections behind vulva. Lemnisci somewhat variable, from 1.25-2.50 times length of proboscis receptacle, commonly bipartite. Testes oval to round, equal, 0.50-0.75 × 0.37-0.60 mm. Cement glands 6, tubular, 2.9-4.5 × 0.080-0.15 mm, usually one or two reaching anterior testis, rest near rear of posterior testis. Seminal vesicle 0.075

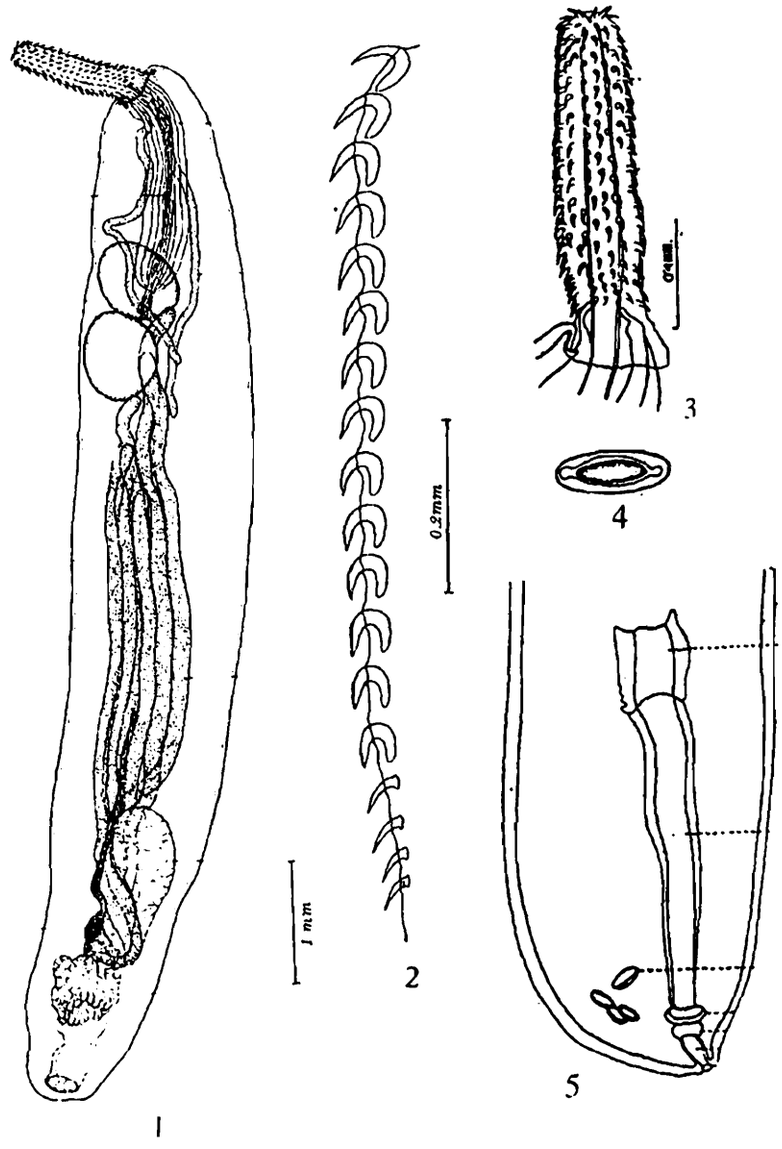


Fig. 207. *Plagyarhynchus charidrii* (Yamaguti, 1939) Van Cleave, 1951. 1. Male lateral view, 2. Row of proboscis hooks enlarged, 3. Proboscis enlarged, 4. Egg enlarged, 5. Posterior part of female (after Yamaguti, 1939).

mm wide, ventral to Saefftigen's pouch. Bursa with anterior diverticula, and about 16 rays. Uterine bell to gonopore 1.15-1.26 mm. Vaginal sphincter forming double bulb 0.094 × 0.090 mm. Free ovarian balls elliptic, up to 0.25 mm long. Eggs fusiform, 0.10-0.12 × 0.030-0.045 mm, middle shell with polar prolongations, inner shell delicate. Shelled embryos 0.060-0.066 × 0.015-0.023 mm, with visible aclid organ spines. Gonopore terminal in male and female, sometimes at base of small papilla in female.

Host : Golden plover.

Location : Intestine.

Locality : Campbell Bay in Great Nicobar island (Andaman & Nicobar Islands).

Distribution : China, Taivan, Japan; Prescadores Islands; Far East; Russia; Hawaii, Australia, Tasmania

Note : This species is not recognizable by Schmidt & Kuntz, 1977. p. 74).

45. Genus ***Prosthorhynchus*** Kostylew, 1915

Prosthorhynchus Kostylew, 1915 : 389-394; Southwell & Macfie, 1925 : 175; Meyer, 1932 : 123; Petrotschenko, 1958 : 175; Yamaguti, 1963 : 149-150; Golvan, 1994 : 174.

Plagiorhynchus (*Prosthorhynchus*) Bhattacharya, 2007 : 154.

Diagnosis : Plagiorhynhchinae. Proboscis cylindrical, with 14-30 longitudinal rows of 7-22 hooks each, anterior hooks with backwardly directed root, posterior hooks rootless. Proboscis receptacle double-walled, inserted at base of proboscis, with ganglion in its middle third. Trunk cylindrical, aspinose, hypodermal nuclei numerous, rounded. Lemnisci tubular, moderately long. Testes often contiguous, in anterior third of trunk. Cement glands long, 5-6. Female genital pore subterminal. Eggs oval or elliptical, middle shell very thick, without polar prolongations. Parasites of terrestrial arthropods and become adults in terrestrial birds, occasionally mammals.

Type species : *Prosthorhynchus scolopacidis* Kostylew, 1915.

Includes twenty eight species, 1. *Prosthorhynchus asturi* (Gupta, N.K. & Lata, 1967) Golvan, 1994; 2. *P. deysarkari* Bhattacharya, 2002, 3. *P. kuntzi* (Gupta, V. & Fatma, 1987) Bhattacharya, 2007, 4. *P. nicobariensis* Soota & Kansal, 1970, 5. *P. angerense* Travassos, 1926, 6.. *P. asymetricus* Belopolskaja, 1983, 7. *P. bullocki* (Schmidt & Kuntz, 1966) Golvan, 1994, 8. *P. cylindraceus* (Goeze, 1982) Golvan, 1956, 9. *P. formosus* (Van Cleave, 1918) Travassos, 1920, 10. *P. gallinagi* Schachtachtinskaja, 1953, 11. *P. genitopapillosus* Lundstrom,1942, 12. *P. golvani* (Schmidt & Kumtz, 1966) Golvan, 1994, 13. *P. gracilis* Petrochenko, 1958, 14. *P. longirostris* Travassos, 1926, 15. *P. luehei* Travassos, 1916, 16. *P. malayensis* Tubangui, 1935, 17. *P. ogatai* (Fukui & Morisita, 1936) Golvan, 1994, 18. *P. pigmentatus* (de Marval, 1902) Meyer, 1932, 19. *P. pittarum* Tubangui, 1935, 20. *P. rheae* (de Marval, 1902) Travassos 1926, 21. *P. rossicus* Kostylew, 1915, 22. *P. rostratum* (de Marval, 1902) Meyer, 1932, 23. *P. russelli* (Tadros, 1970) Golvan, 1994, 24. *P. schmidti* Golvan, 1994, 25. *P. scolopacidis* Kostylew, 1915, 26. *P. taiwanensis* (Schmidt & Kuntz, 1966) Golvan, 1994, 27. *P. transversus* (Ridolphi, 1819) Travassos, 1926, and 28. *P. varispinus* Wang Pu Qin, 1966, of which first four occur in India.

Key to Indian species of genus *Prosthorhynchus*

1. Proboscis with 8 longitudinal rows of 24-25 hooks each in female ..... *Prosthorhynchus asturi*

– Proboscis with more than 8 longitudinal rows of hooks 2

2. Proboscis with 14 longitudinal rows of 14 hooks each ..... *Prosthorhynchus deysarkari*

– Proboscis with 14-15 longitudinal rows of 14-15 hooks each in male, in female 16 rows 14-15 hooks each ..... *Prosthorhynchus nicobzriensis*

Proboscis with 16-17 longitudinal rows of 13-14 hooks each .... *Prosthorhynchus kuntzi*

233. ***Prosthorhynchus asturi*** (Gupta, N.K. & Lata, 1967) Golvan, 1994 (Fig. 208)

Rhadinorhynchus asturi Gupta, N.K. & Lata, 1968a : 263-264, Fig. 14-16; Golvan, 1969 : 86, Fig. 56, 57;

Prosthorhynchus asturi, Golvan, 1994 : 174.

Type locality : Hoshiarpur, Punjab, India.

Description : Female 8.5 × 0.42 mm. Proboscis long, cylindrical, forming an angle to main body axis, 0.85 × 0.14 mm, with 8 longitudinal rows of 24-25 hooks each; hooks vary in size, apical hooks 0.032-0.036 mm long with well developed roots, subapical hooks 0.42-0.006 mm long with poorly developed roots, basal hooks 0.012 × 0.002 mm. Proboscis receptacle elongated, cylindrical, double-walled, 2.47 × 0.25 mm, gradually tapering posteriorly, which measures 0.098 mm wide. Trunk cylindrical and spinose, spines small, more closely set anteriorly and widely spaced posteriorly, posterior-most part aspinose. Lacunar system not well developed with only two main longitudinal channels. Lamnisci paired, tubular, shorter than receptacle, 1.62 mm long. Ovary burst and liberated eggs.

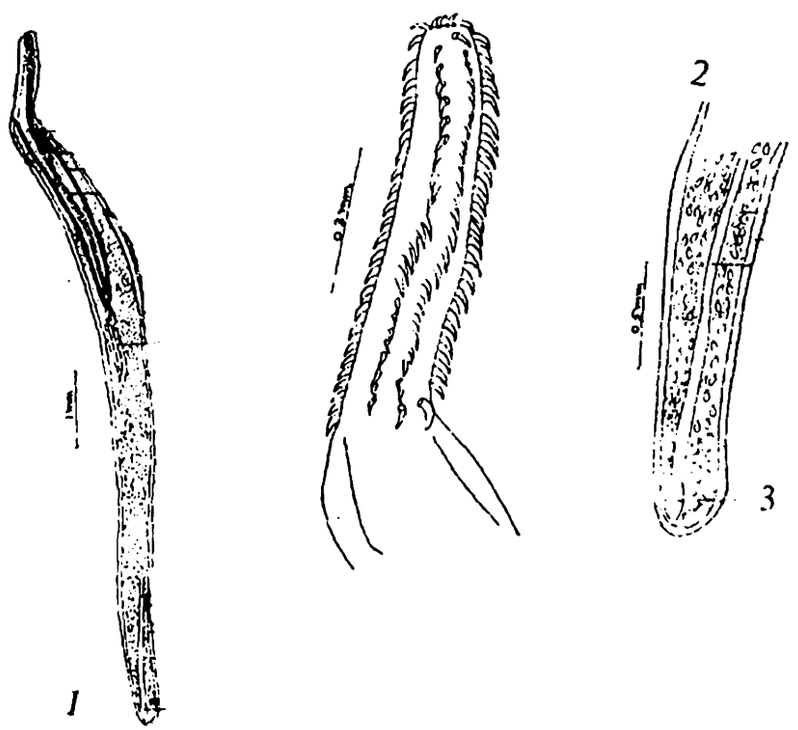


Fig. 208. *Prosthorhynchus asturi* (Gupta, N.K. & Lata, 1967) Golvan, 1994. 1. Female, 2. Proboscis enlarged, 3. Posterior part of female (after Gupta, N.K. & Lata, 1967).

Uterus elongated tubular, 1.66 × 0.04 mm, leading into small vagina 0.14 × 0.08 mm. Embryos spindle-shaped 0.04-0.05 × 0.010 mm. Male not known.

Host : *Astur badius* (Gmelin).

Location : Intestine.

Locality : Hoshiarpur (Punjab).

Distribution : Known only from type locality.

234. ***Prosthorhynchus deysarkari*** Bhattacharya, 2002 (Fig. 209)

Plagiorhynchus (*Prosthorhynchus*) *deysarkari* Bhattacharya, 2000 : 148-151, Fig. 3, 4 a-c; 2002: 141-162; 2007 : 154-156, Pl. 25, Fig. 138 1-f.

Type locality : Ambasa in North district, Tripura, India.

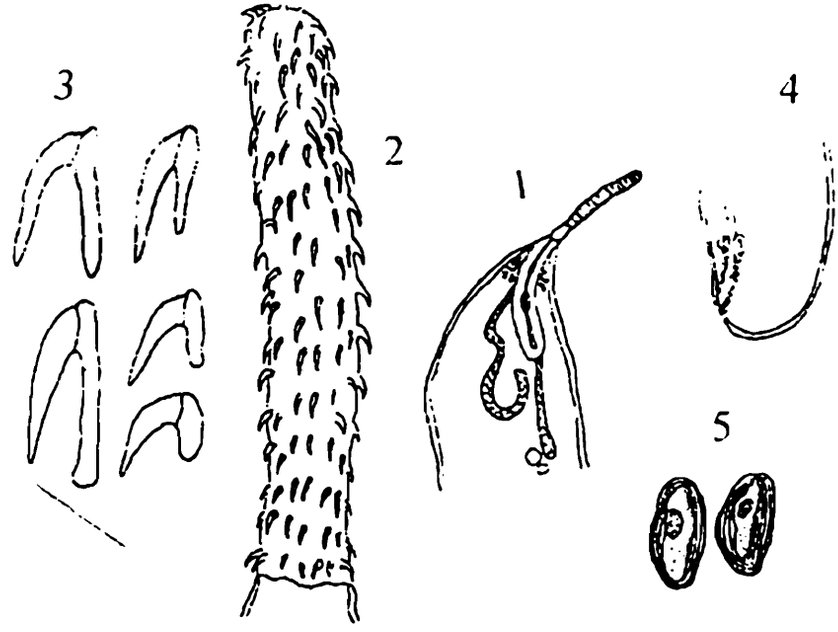


Fig. 209. *Prosthorhynchus deysarkari* Bhattacharya, 2002. 1. Anterior part of male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged, 4. Posterior part of female, 5. Ova (after Bhattacharya, 2007).

Description : Worms plump, Male 7.625 × 1.625 mm. Female 11.125 × 1.875 mm. Proboscis cylindrical, 0.5 × 0.225 mm, with 14 longitudinal rows of 14 hooks each, basal hooks smaller than apical hooks, all hooks rooted except last two of each row, anterior hooks points 0.054-0.064 mm, roots 0.052-0.094 mm long. Proboscis receptacle 1.5 × 0.5 mm, double-walled, with central ganglion. Hypodermal nuclei present. Lemnisci long, slender, coiled. Testes1.425 × 0.625 mm, overlapping. Cement glands 4. Eggs 0.041-0.074 × 0.024-0.033 mm. Gonopore terminal in male and subterminal in female.

Host : *Sturnus malabaricus.*

Location : Intestine.

Locality : Ambasa in North Tripura district (Tripura).

Distribution : Known only from type locality.

235. ***Prosthorhynchus kuntzi*** (Gupta, V. & Fatma, 1988) Bhattacharya, 2007 (Fig. 210)

Plagiorhynchus kuntzi Gupta, V. & Fatma, 1988 : 128-142; Golvan, 1994 : 171.

Plagiorhynchus (*Prosthorhynchus*) *kuntzi* Bhattacharya, 2007 : 156, Pl. 26, Fig. 140 a-c.

Type locality : Lucknow, Uttar Pradesh, India.

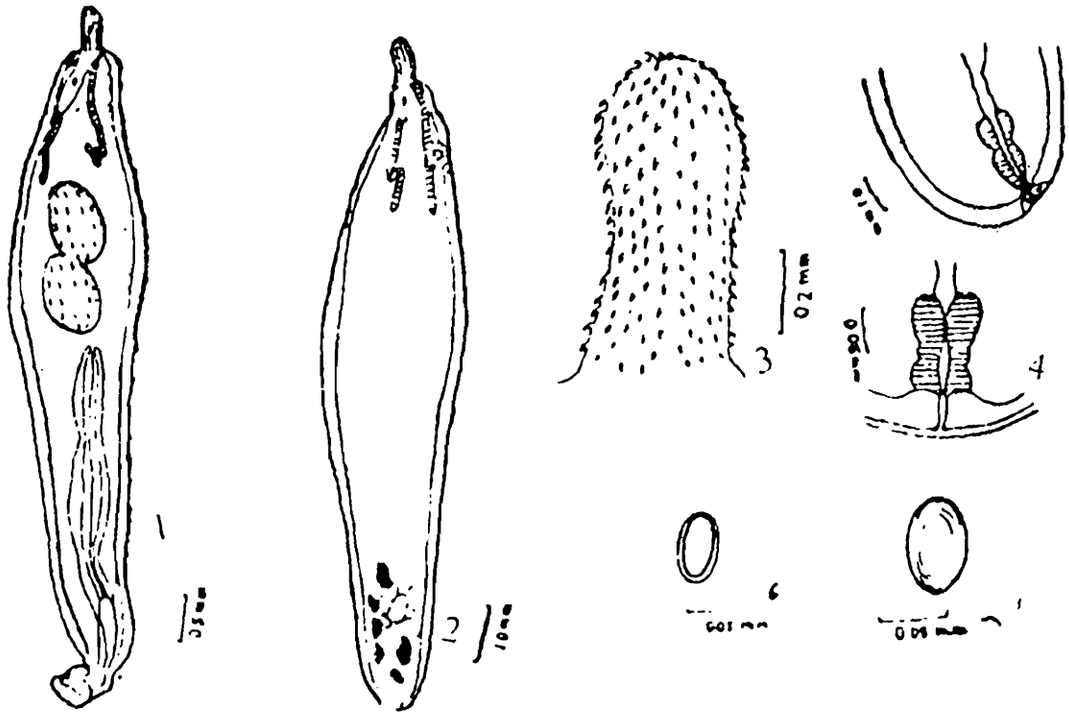


Fig. 210. *Prosthorhynchus kuntzi* Gupta, V. & Fatma, 1988. 1. Male, 2. Female, 3. Proboscis enlarged, 4. Prosterior part of female with terminal gonopore, 5. Posterior end of female with subterminal gonopore, 6. Eggs enlarged (after Gupta, V. & Fatma, 1988).

Description : Male 7.55 × 1.55 mm, female 11.70-12.55 × 0.65-0.80 mm. Proboscis cylindrical, 0.46 × 0.20 mm in male, in female 0.50-0.55 × 0.25-0.28 mm with 16-17 longitudinal rows of 13-14 hooks each, hooks more or less uniform but basal hooks smaller in size. Basal one or two hooks rootless, remaining hooks similar in shape with backwardly directed roots. First 2 hooks of each row delicate increasing in stoutness to rootless spines in both sexes, 0.040-0.042 mm long, average hooks 0.03-0.046 mm long in male; in females 0.040-0.052 mm long, Proboscis receptacle cylindrical, double-walled with ganglion about its middle. Neck 0.056 × 0.15 mm in male. Trunk elliptical or slightly

cylindrical, more or less flattened dorsally. Hypodermal nuclei numerous, evenly distributed. Lacunar system with reticular anastomoses. Lemnisci long, slender, subequal, simple 2 to 3 times longer than receptacle, shorter lemniscus 0.88 mm long, longer 1.22 mm long in male; in female shorter lemniscus 0.45-0.46 mm long, longer 0.50-0.56 mm long. Tested ovoid, in tandem, equal, contiguous, pre-equatorial, anterior 0.85 × 0.60 mm posterior 0.85 × 0.63 mm. Cement glands four, 1.32-1.50 × 0.25-0.35 mm, opening into bursa. Seminal vesicle pear-shaped, 0.65 × 0.17 mm, opening through a narrow duct into bursa. Bursa eversible, 0.50 × 0.40 mm. Uterine bell 0.50-0.56 × 0.35-0.38 mm. Ovarian balls 0.35-0.38 mm long. Eggs oval 0.060-0.065 × 0.035-0.038 mm, with or without polar prolongations of middle shell. Gonopore terminal in male, terminal or subterminal in female.

Host : Great hornbill, *Dichocerca bicornis* (Linnaeus).

Location : Intestine.

Locality : Tamil Nadu; Lucknow (Uttar Pradesh).

Distribution : Known only from India.

Note : Amin, Canaris & Kinsella (1999) consider that it cannot be assigned to either *Plagiorhynchus* or *Prosthorhynchus*. Transfer of this species from *Plagiorhynchus* to *Prosthorhynchus* on the basis of the position of female gonopore and absence of polar prolongations of middle shell membrane made by Bhattacharys (2007) is correct.

236. ***Prosthorhynchus nicobariensis*** Soota & Kansal, 1972 (Fig. 211)

Prosthorhynchus nicobariensis Soota & Kansal, 1972 : 450; 1972: 304-306, Textfig. 2 a-c; Gupta, P. D. & Ghosh, 1979 : 315;

Plagiorhynchus nicobariensis Zafar & Farooqi, 1981 : 179-180, Fig. 1, 2.

Prosthorhynchus nicobariensis Golvan, 1994 : 174

Plagiorhynchus (*Prosthorhynchus*) *nicobariensis* Bhattacharya, 2007: 156, Pl. 26, Fig. 139 a-e.

Type locality : Car Nicobar, Andaman and Nicobar Islands, India.

Description : Male 8-10 × 1.5-2.0 mm, female 7.0-8.5 × 1.1-1.5 mm, maximum width at level of anterior 1/3 of fore trunk. Proboscis cylindrical, 0.85-1.1 × 0.2-0.3 mm in male, with 18-20 longitudinal rows of 16 hooks each in male, in female 1.1 × 0.3 mm, with 14-16 longitudinal rows of 14-15 hooks each. Anterior hooks larger, each about 0.075 mm long, gradually decreasing in size posteriorly and basal hooks of each longitudinal row arcuate and spiniform and rootless, each about 0.04 mm long in male; in female anterior hooks rooted with roots directed posteriorly, but posterior hooks rootless and of lesser number. Proboscis receptacle cylindrical, double-walled, 1.62-0.65 × 0.3 mm in male; in female 1.62 × 0.3 mm, with ganglion elliptical, located in its middle. Neck short, truncate, conical, smooth, 0.2 × 0.35 mm wide at base. Trunk elongated, fusiform. Lemnisci 2, elongated, slender, subequal, 2.0-2.65 0.10 mm and 2.75 mm long in male; in female 2.0

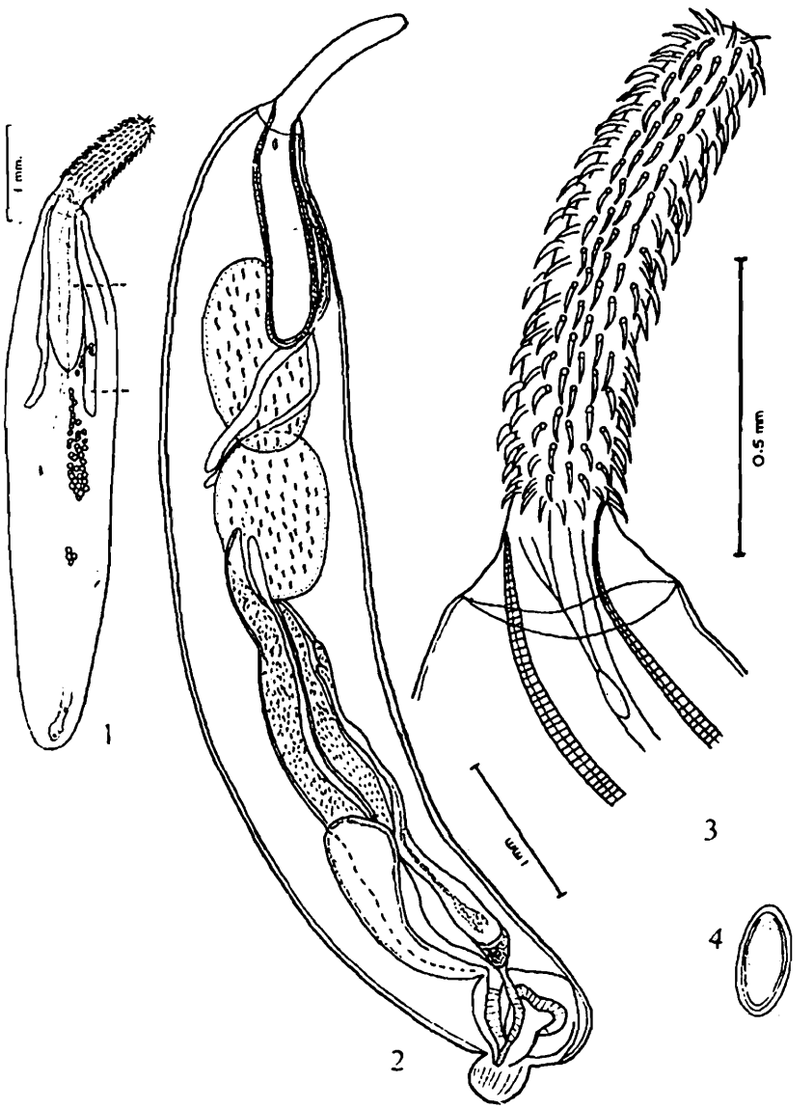


Fig. 211. *Prosthorhynchus nicobariensis* Soota & Kansal, 1972. 1. Female, 2. Male, 3. Proboscis enlarged, 4. Ovum enlarged (1-3 after Zafar & Farooqi and 4 after Soota & Kansal, 1972).

× 0.1 mm. Testes oval, in tandem, partly overlapping, situated in anterior third of trunk, anterior 1.27 × 0.65 mm, posterior 1.1 × 0.75 mm. Cement glands 4 in 2 pairs, elongated, tubular, 3.65 mm total length. Vas deferens proximally swollen and ampullate, 3.5 mm long, distal ampullae paired. Saefftigen's pouch large, pyriform, 1.5 mm long. Bursa 9.30-0.36 mm long. Eggs elliptical 0.07 × 0.035 mm, with middle shell thick with polar prolongations.

Host : *Zoothera citrina* (Latham), Ground thrush *Turdoides canadus* (Dumont).

Location : Small intestine.

Locality : Alligarh (Uttar Pradesh); Car Nicobar (Andaman & Nicobar Islands).

Distribution : Known only from India.

Subfamily PORRORCHINAE Golvan, 1956

Porrorchinae Golvan, 1956 : 351-384; Bhattacharya, 2007 : 157.

Diagnosis : Plagiorhynchidae. Proboscis ovoid to spheroid. Anterior proboscis hooks strong with posteriorly directed roots, posterior hooks uniform and rootless but usually with manubria, hooks numerous, diminish in size apically and posteriorly; manubria directed anteriorly, roots and manubria may branch. Cement glands 2-4. Parasites of birds and mammals.

Type genus : *Porrorchis* Fukui, 1929.

Includes six genera, 1. *Lueheia* Travassos, 1920, 2. *Owifordia* Schmidt & Kuntz, 1967, 3. *Porrorchis* Fukui, 1929, 4. *Pseudolueheia* Schmidt & Kuntz, 1967, 5. *Oligoterorhynchus* Monticelli, 1914 and 6. *Pseudogordiorhynchus* Golvan, 1957, of which first four genera occur in this subcontinent.

Key to Indian genera of subfamily PORRORCHINAE

1. Proboscis with 20-30 longitudinal rows of 8-10 hooks each ..... *Lueheia*
– Proboscis with numerous longitudinal rows of hooks each 2
2. Proboscis hooks with delicate lateral wings ..... *Owifordia*
– Proboscis hooks without delicate lateral wings 3
3. Proboscis receptacle with ganglion at middle ..... *Porrorchis*
– Proboscis receptacle with ganglion at base ..... *Pseudolueheia*

46. Genus ***Lueheia*** Travassos, 1920

Lueheia Travassos, 1920 : 8; Meyer, 1932 : 135; Van Cleave, 1942 : 210; Yamaguti, 1963 : 90; Golvan, 1994 : 161.

Diagnosis : Plagiorhynchidae, Porrorchinae. Proboscis subglobular, with 20-30 longitudinal rows of 8-10 hooks each; hooks largest in middle of proboscis, smaller towards apex and base of proboscis. Proboscis receptacle claviform, double-walled, with its ganglion. Trunk small, somewhat fusiform. Lemnisci 4-6, tubular, long. Testes contiguous, in anterior half of trunk. Cement glands 4, tubular. Eggs elliptical with polar prolongations of middle shell. Parasites of birds.

Type species : *Lueheia lueheia* Travassos, 1920.

Includes five species, 1. *Lueheia karachiensis* Khan, Bilqees & Mati-ur-Rahman, 2005, 2. *L. adlueheia* (Werby, 1938) Van Cleave, 1942, 3. *L. cajabambensis* Machado Filho & Ibanez, 1967, 4. *L. inscripta* (Westrumb, 1821) Travassos, 1920 and 5. *L. lueheia* Travassos, 1920, of which first one occurs in Pakistan.

237. ***Lueheia karachiensis*** Khan, Bilqees & Mati-ur-Rahma, 2005 (Fig. 212)

Lueheia karachiensis Khan, Bilqees & Mati-ur-Rahman, 2005 : 113, Fig. 1 A-D.

Type locality : Karachi, Sindh, Pakistan.

Description : Male 13.60-18.40 × 0.72-1.04 mm. Proboscis short, subglobular with 20-40 rows of 10-14 hooks each. Hooks 0.030-0.053 × 0.0076-0.0098 mm, largest at middle of proboscis. Proboscis receptacle claviform, double-walled, 1.04-1.72 × 0.400.72 mm, with ganglion in middle. Trunk elongate. Lemnisci 4, unequal, 2.40-3.40 × 0.10-0.40 mm. Testes in anterior half of trunk, anterior 0.84-2.48 × 0.40-1.0 mm, posterior 0.84-2.0 × 0.28-1.04 mm. Cement glands 4, tubular. Bursa 1.33-1.60 × 0.33-0.63 mm. Female not known.

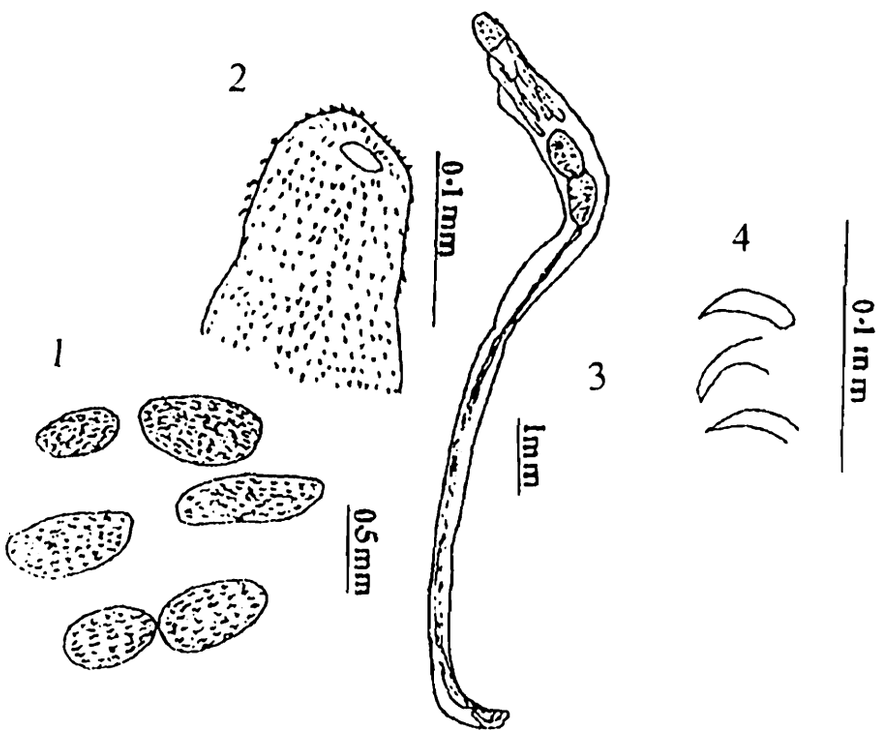


Fig. 212. *Lueheia karachiensis* Khan, Bilqees & Mati-ur-Rahma, 2005. 1. Testes of different shapes, 2. Proboscis enlarged, 3. Male, 4. Proboscis hooks enlarged (after Khan, Bilqees & Mati-ur-Rahaman, 2005).

Host : *Accipiter badius cenchroides* (Serertzov).

Location : Small intestine;

Locality : Karachi, Sindh (Pakistan);

Distribution : Known only from type locality.

47. Genus ***Owifordia*** Schmidt & Kuntz, 1967

Owifordia Schmidt & Kuntz, 1967 : 136; Golvan, 1994 : 169; Bhattacharya, 2007 : 165-166.

Diagnosis : Plagiorhynchidae Porrorchinae. Proboscis ovoid with numerous longitudinal rows of two types of hooks. First few hooks in each row strong with slender roots, each with delicate lateral wings. Remaining spines strong rootless, each with anteriorly directed blade. Blade on at least in most anterior spines in each row split into two horn-like processes. Sensory pit not associated with papilla, locayed on each side of neck, quite close to last spines. Apical organ prominent. Proboscis receptacle double-walled inserted at base of proboscis, with ganglion at its middle. Trunk elongate, cylindrical, approximately equal in diameter throughout its length except for distal end in some females, which is swollen into terminal digitiform process. Internal pseudometamerism indistinct. Hypodermal nuclei numerous, distributed evenly throughout length of trunk except extreme distal end. Lacunar system with both channels lateral vessels. Lemnisci slender, flat, quite long and not bound to body wall by ligaments. Testes oval, in tandem, well separated in anterior third of body. Cement glands 4-6, tubular, long. Eggs oval symmetrical or elongate and flattened on one side, with or without polar swellings; outer shell sculptured especially towards poles. Gonopore terminal in both sexes. Parasites of birds and mammals.

Type species : *Owifordia olseni* Schmidt & Kuntz, 1967.

Includes 3 species, 1. *Owifordia schmidti* Gupta, V. & Fatma, 1988, 2. *O. teliger* (Van Cleave, 1949) Schmidt & Kuntz, 1967 and 3. *O. olseni* Schmidt & Kuntz, 1967, of which first two occur in India.

Key to Indian species of genus *Owifordia*

– Proboscis with 10-12 hooks per row ..... *Owifordia schmidti*

– Proboscis with 8-10 hooks per row ..... *Owifordia teliger*

238. ***Owifordia schmidti*** Gupta, V. & Fatma, 1988
(Fig. 213)

Owifordia schmidti Gupta, V. & Fatma, 1988 : 138-140, Pl. 3, Fig. 1-6; Golvan, 1994 : 169; Bhattacharya, 2007 : 166.

Type locality : Chinhat near Lucknow, Uttar Pradesh, India.

Description : Male 8.52-13.0 × 0.55-0.85 mm; female 20.0-26.85 × 0.50-0.58 mm. Proboscis ovoid with 26 longitudinal rows of 10-12 hooks each, anterior 4-5 hooks strong with slender roots, each with delicate lateral wings, 0.050-0.065 mm long, middle hooks 0.052-0.055 mm long, basal spines 0.04-0.05 mm long, each with anteriorly directed bladeo.025-0.039 mm long. Proboscis receptacle double-walled 1.25-4.85 × 0.46-0.66 mm in male; in female 1.25-4.85 × 0.45-0.66 mm, with ganglion at about its middle. Neck short 1.2-1.8 × 0.16-0.19 mm wide, with sensory pit on each side. Trunk elongated, cylindrical, approximately equal in diameter throughout its length except at distal end. Internal pseudo-segmentation not distinct. Hypodermal nuclei numerous, evenly distributed throughout trunk except extreme distal end. Lacunar system with main lacular channels. Lemnisci 2, subequal, slender, flat, shorter 1.25-4.85 × 0.45-0.66 mm, longer

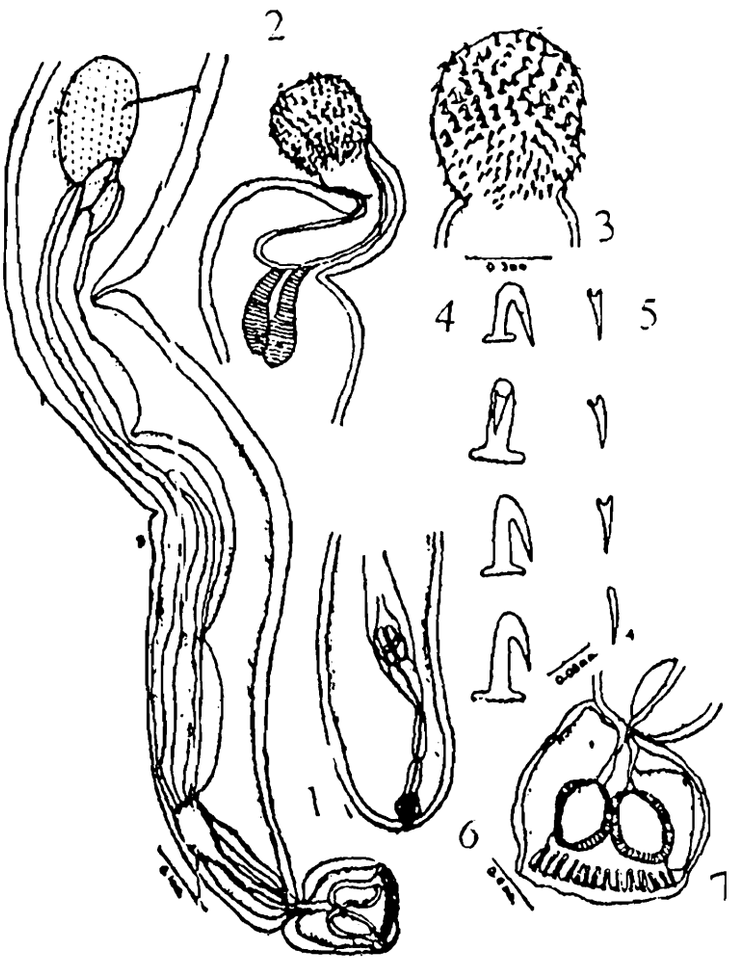


Fig. 213. *Owifordia schmidti* Gupta, V. & Fatma, 1988. 1. Posterior part of male, 2. Anterior part of worm, 3. Proboscis enlarged, 4. Row of proboscis hooks enlarged, 5. Row of trunk spines enlarged, 6. Posterior part of female, 7. Bursa enlarged (after Gupta & Fatma, 1988).

3.15-5.5 mm long in male; in female shorter lemniscus 6.05-6.10 mm long, longer 7.0-7.55 mm long. Testes ovoid, in tandem, subequal in anterior third of trunk, anterior 0.23-0.46 × 0.32-0.90 mm, posterior 0.20-0.45 × 0.32-0.70 mm. Cement glands 4, long, tubular, massed together just behind posterior testis.2.5-3.5 × 0.10-0.12 mm. Seminal vesicle pyriform 0.25-0.40 × 0.20-0.22 mm. Bursa elongated 0.72-1.50 × 0.15-0.40 mm with about15 branching rays. Uterine bell narrow, elongated 0.95-1.25 mm long. Eggs ovoid, 0.060-0.065 × 0.035-0.045 mm, without polar prolongations of middle shell. Gonopore terminal in both sexes.

Host : *Herpestes auropunctatus* (Hodgson).

Location : Intestine.

Locality : Chinhat, Lucknow (Uttar Pradesh); Tamil Nadu.

Distribution : Known only from India.

239. ***Owifordia teliger*** (Van Cleave, 1949) Schmidt & Kuntz, 1967 (Fig. 214)

Owifordia teliger Schmidt & Kuntz, 1967 : 136;

Pseudoporrorchis teliger Sen & Chouhan, 1973 : 43-44, Textfig. 3;

Owifordia teliger Golvan, 1994 : 169.

Type locality : Java, Indonesia.

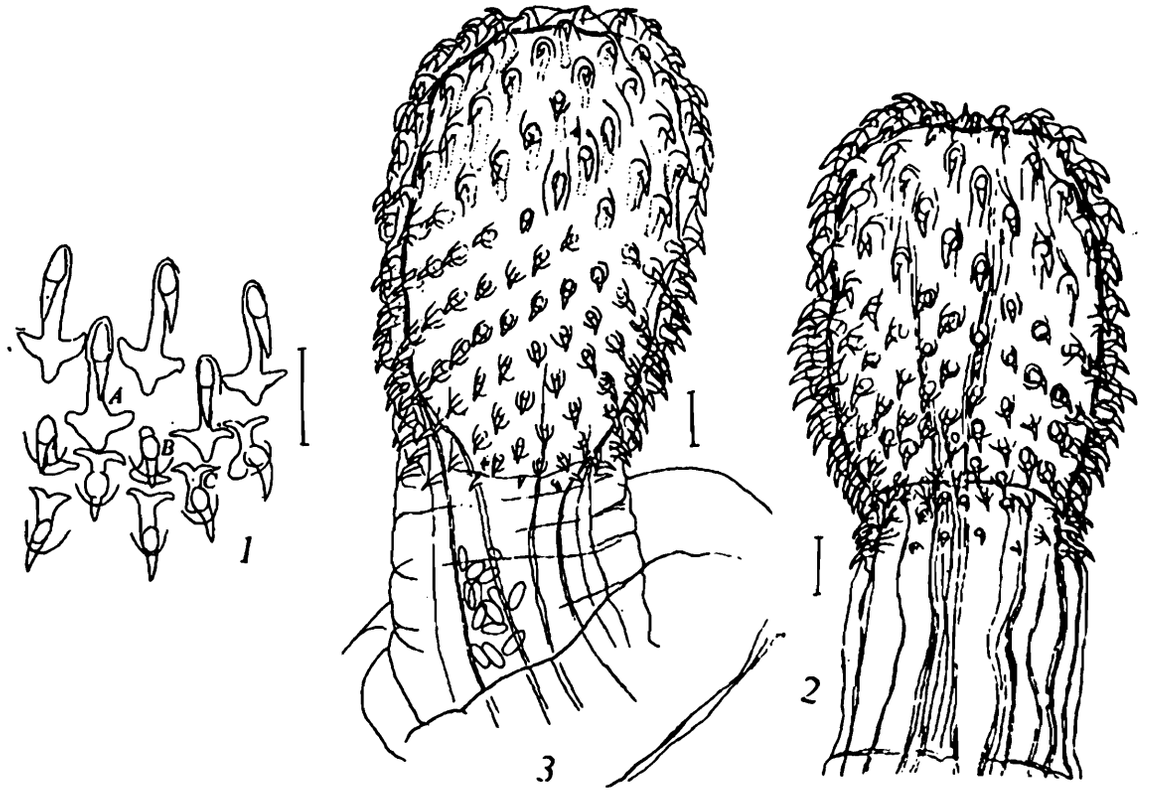


Fig. 214. *Owifordia teliger* (Van Cleave & Lincicome, 1949) Schmidt & Kuntz, 1967. 1. Arrangement of proboscis hooks, 2. Proboscis enlarged, 3. Praesoma and anterior part of trunk (after Van Cleave & Lincicome, 1949).

Description : Males 36 × 1.78 mm; females up to 38 × 2.0 mm. Proboscis short, clavate or cylindrical, with ovoidal distal end, larger than base, approximately 0.75-0.86 × 0.48-0.60 mm in male, in female 0.84 × 0.83 mm, with 24-28 approximately longitudinal rows of 10-12 hooks each, largest hooks with sickle-shaped blade with very narrow long root. Second and third hook of each row with a pair of triangular wings near its posterior end. Largest hooks with a sickle-shaped blade with very long, narrow root, which in second and third member of each longitudinal row often bear a pair of a pair of triangular wings near its posterior end. Largest hooks 0,084-0.095 × 0.030 mm. Hooks immediately behind to those with winged roots have peculiarly modified roots of two distinct types. In half of longitudinal rows, fourth hook with much shortened, simply expanded posterior process, resembling blade of an axe. In alternating rows, adjacent to these, roots with unique

appearance. Root process on this type of hook chiefly anterior to base of thorn while anteriorly this projection bifurcated into two laterally spreading horns. Basal hooks possess a small, simple, disc-like root surrounded base of its thorn. Proboscis receptacle short, cylindrical, double-walled, 1.92 × 0.52 mm in male, in female 1.81 × 0.52 mm with central ganglion,. Neck truncated cone 0.34 mm long. Trunk long, cylindrical, widest at anterior third. Lacunar system with main longitudinal channels and reticular anastomoses. Lemnisci lomger than receptacle. Testes elongate, ellipsoidal, separated from each other, post-equatorial, anterior 1.6 × 0.62 mm, posterior 1.57 × 0.71 mm. Cement glands 6, elongated, tubular, massed together, 1.82 × 0.41 mm. Bursa protruded and digitiform. Gonopore terminal. Uterine bell 1.04 × 0.17 mm. Uterus and vagina together 1.26 mm long. Mature eggs oval, within ligament sacs, with thin membrane, 0.053-0.0.059 × 0.020-0.027 mm.

Host : *Herpestes* sp.

Location : Intestine.

Locality : Allahabad (Uttar Pradesh).

Distribution : Java; North America.

48. Genus ***Porrorchis*** Fukui, 1929

Porrorchis Fukui, 1929 : -225-270; Meyer, 1932 : 131;

Pseudoporrorchis Petrochenko, 1958 : 192;

Porrorchis Petrotschenko, 1958 : 190; Yamaguti, 1963 : 153;

Pseudoporrorchis Yamaguti, 1963 : 153-154;

Porrorchis Schmidt & Kuntz, 1967 : 131; Golvan, 1994 : 173; Bhattacharya, 2007 : 157-158.

Diagnosis : Plagiorhynchidae, Porrorchinae. Proboscis ovoid, with numerous longitudinal rows of hooks. First few hooks in each row strong, with well developed simple roots, remaining hooks rootless but with delicate simple, anteriorly directed blade. Proboscis receptacle double-walled, inserted at base of proboscis, with ganglion about its middle. Trunk elongate, cylindrical, slightly swollen near anterior end in both sexes and at posterior end in females. Terminal digitiform process sometimes present on gravid females. Internal pseudo-segmentation due to circular muscle bands usually quite distinct. Hypodermal nuclei small, moderately numerous, distributed only at anterior swelling. Lacunar system with main lateral channels. Lemnisci long, flat bound to body wall by ligaments. Testes oval, in tandem, well separated or close together in anterior third of trunk. Cement glands 4-6, long, tubular in both sexes. Eggs oval, without polar swellings, outer shell sculptured especially towards poles. Gonopore terminal or subterminal in both sexes. Parasites of birds.

Type species : *Porrorchis elongatus* Fukui, 1929.

Includes ninehteen species, 1. *Porrorchis breviacanthus* (Das, 1949) Golvan, 1994, 2. *P. chauhani* Gupta, V. Fatma, 1986, 3. *P. crocidurai* Gupta, V. & Fatma, 1986, 4. *P. herpistes* Bhattacharya, 2007, 5. *P. hylae* (Johnston, 1914) Schmidt & Kuntz, 1967, 6. *P. indicus* (Das, 1957) Schmidt & Kuntz, 1967, 7. *P. keralensis* George & Nadakal, 1984,

8. *Porrorchis leibyi* Schmidt & Kuntz, 1967, 9. *P. rotundatus* (Linstow, 1897) Schmidt & Kuntz, 1967, 10. *P. bazae* (Southwell & Macfie, 1925) Schmidt & Kuntz, 1967, 11. *P. centropi* (Porta, 1910) Schmidt & Kuntz, 1967, 12. *P. centropusi* (Tubangui, 1933) Petrotschenko, 1958, 13. *P. elongates* Fukui, 1929, 14. *P. houdemeri* (Joyeux & Baer, 1935) Schmidt & Kuntz, 1967, 15. *P. hydromuris* (Edmonds, 1957) Schmidt & Kuntz, 1967, 16. *P. leibyi* Schmidt & Kuntz, 1967, 17. *P. maxvachoni* (Golvan & Brygoo, 1965) Schmidt & Kuntz, 1967, and 18. P. *nickoli* Salgado-Maldanove & Cruz-Reyes2002, 19. *P. oti* Yamaguti, 1939 of which first nine species occur in India.

Key to Indian species of genus *Porrorchis*

1. Proboscis hooks 5 in each of 30 longitudinal rows ..... *Porrorchis rotundatus*
– Proboscis hooks more than 5 in each longitudinal row 2
2. Proboscis with30-37 longitudinal rows of 8-129 hooks each..... *Porrorchis leibyi.*
– Proboscis with30-32 longitudinal rows of 9 hooks each 3
3. Proboscis with30-32 longitudinal rows of 9 hooks each.... *Porrorchis breviacanthus*
– Proboscis with 30-32 longitudinal rows of 10-12 hooks each ... *Porrorchis herpistes*
– Proboscis with less than 30 longitudinal rows of hooks 4
4. Cement glands six ..... *Porrorchis crocidurai*
– Cement glands four 5
5. Proboscis with 10-12 hooks in each of 26-28 longitudinal rows .... *Porrorchis chauhani*
– Proboscis with 10 or less hooks in longitudinal rows 6
6. Lemnisci long and digitiform, eggs with two shells ..... *Porrorchis indicus*
– Lemnisci flat, eggs three shelled 7
6. Eggs with polar prolongations of middle shell ..... *Porrorchis keralensis*
– Eggs without polar prolongations of middle shell ..... *Porrorchis hylae*

240. ***Porrorchis breviacanthus*** (Das, 1950) Golvan, 1994
(Fig. 215)

Centrorhynchus breviacanthus Das, 1950b : 298-300, Textfig. 4 a-d; Yamaguti, 1963 : 121; Anantaraman, M. & Anantaraman, S., 1970 : 6;

Porrorchis breviacnthus Gupta, P.D. & Ghosh, 1979 : 313; Golvan, 1994 : 173; Bhattacharya, 2007 : 158.

Type locality : Nagpur, Maharastra, India.

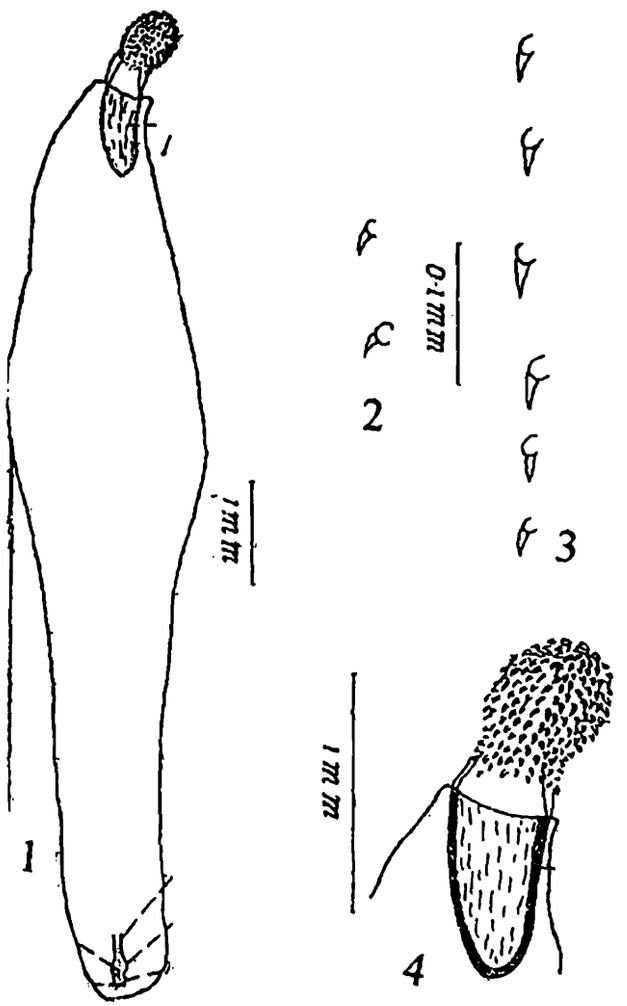


Fig. 215. *Porrorchis breviacanthus* (Das, 1950) Golvan, 1994. 1. Female, 2. Neck spines, 2. Proboscis hooks, 4. Proboscis enlarged (after Das, 1950).

Description : Female 8.59 mm long, 0.51 mm wide at its anterior end, 1.7 mm in middle, posterior end rounded 0.85 mm wide. Proboscis knob-like with neck, 0.98 × 0.45 mm, with 30-32 longitudinal rows of 9 hooks each on proboscis and 2 spines each on neck. Hooks on proboscis and neck similar. Hooks each, 0.038 × 0.030 mm. Neck 0.51 mm long. Proboscis receptacle double-walled, 0.98 × 0.45 mm. Retractor muscles of proboscis seem to come down and bend over themselves for some distance and finally attach the body wall musculature on each side. Trunk spindle-shaped with blunt tail end. Lemnisci thin, coiled, 0.55 mm and 0.48 mm long. Genital ligament arises from posterior end of proboscis, proceeds posteriorly in body cavity enclosing genitalia of which a single testis visible. Cement gland single, large, coiled filling posterior half of trunk. Ejaculatory duct and bursa supported by muscular bands attached to body wall. Female with tubular uterine bell, followed by funnel-shaped uterus with anterior and posterior sphincter muscles, enter tubular vagina which opens to exterior by vulva. Male not known.

Host : *Temenuchus pagodarum* (Gmelin).

Location : Intestine.

Locality : Nagpur (Maharastra).

Distribution : Known only from type locality.

241. ***Porrorchis chauhani*** Gupta, V. & Fatma, 1986 (Fig. 216)

Porrorchis chauhani Gupta, V. & Fatma, 1986a : 141-144, Pl. 2, Fig. 1-3; Golvan, 1994 : 173; Bhattacharya, 2007 : 159

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 14.0 × 2.5 mm; female 10.9-15.0 × 1.8-2.0 mm. Proboscis ovoid with 26-28 longitudinal rows of 10-12 hooks each, 1.8 × 0.45 mm in male; in female 0.55-0.60 × 0.45-0.55 mm, anterior 4-5 hooks of each row with long well developed simple roots, 0.058-0.060 mm long, rest rootless spines, with well developed anteriorly directed blade, 0.042-0.048 mm long. Proboscis receptacle cylindrical, double-walled, rounded at its distal end with ganglion at its middle, 1.8 × 0.45 mm in male; in female 1.2-1.5 × 0.34-

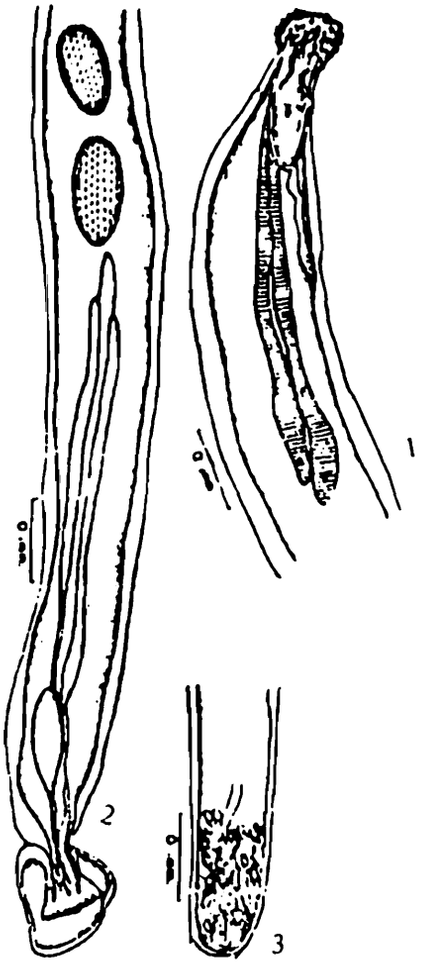


Fig. 216. *Porrorchis chauhani* Gupta, V. & Fatma, 1986. 1. Anterior part of male, 2. Posterior part of female, 3. Posterior part of female (after Gupta, V. & Fatma, 1986).

0.45 mm. Neck short, aspinose. Trunk large, cylindrical, elongated, slightly swollen near anterior end. Hypodermal nuclei small, numerous confined to anterior end. Lacunar system with two main longitudinal channels and reticular anastomoses. Internal pseudo-segmentation distinct. Lemnisci flat, wide, equal extending far above anterior testis, 3.75-4.0 mm long in male; in female 4.0-4.5 mm long. Testes ovoid, in tandem, almost equal, wide apart, equatorial, anterior 0.70 × 0.32 mm, posterior testis 0.72 × 0.38 mm. Cement glands 4, long, tubular 4.42-4.95 × 0.05-0.06 mm. Seminal vesicle elongated, 0.70 × 0.26 mm, opening through narrow duct into bursa. Bursa well developed, with two diverticula anteriorly, 0.45-0.55 × 0.20-0.38 mm with 8-10 bursal rays. Vagina thick, muscular, 0.25-0.28 × 0.12-0.18 mm. Ovarian balls 0.085-0.095 × 0.028-0.035 mm. Gonopore terminal in both sexes.

Host : *Crocidura perrotteti* (Dunernay).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

242. ***Porrorchis crocidurai*** Gupta, V. & Fatma, 1986 (Fig. 217)

Porrorchis crocidurai Gupta, V. & Fatma, 1986a: 137-141, Pl. 1, Fig. 1-5; Golvan, 1994 : 173; Bhattacharya, 2007 : 159

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 8.5-9.0 × 0.7-0.85 mm; female 10.0-12.85 × 1.0-1.8 mm. Proboscis ovoid, with 20-24 longitudinal rows of 8-9 hooks each, 0.55-0.60 × 0.40-0.50 mm in male; in female 0.60-0.65 × 0.40-0.50 mm.. Anterior 3-4 hooks of each row with long well developed simple roots, 0.06-0.062 mm long, remaining spines rootless, with well developed anteriorly directed blade, 0.050-0.055 mm long. Proboscis receptacle cylindrical, double-walled, rounded at distal end with ganglion at its middle, 0.62-0.65 × 0.15-0.18 mm in male; in female 1.3-1.6 × 0.40-0.50 mm. Neck short, aspinose. Trunk fairly large, elongated, aspinose, slightly swollen near anterior end. Internal pseudo-segmentation distinct in both sexes. Hypodermal nuclei small, numerous confined to anterior part. Lacunar system with two main longitudinal channels and reticular anastomoses. Lemnisci flat, subequal, extending far above anterior testis, smaller lemniscus 1.50-1.60 mm long, longer 1.88-1.90 mm long in male; in female shorter lemniscus 1.30-1.32 mm long, longer 1.42-1.45 mm long. Testes ovoid, in tandem, subequal, separated from each other, post-equatorial, anterior 0.40-0.45 × 0.25-0.30 × 0.30-0.32 mm, posterior testis 0.45-0.48 × 0.30-0.32 mm. Cement glands 6, elongated, tubular just behind posterior testis, 2.0-2.5 mm long. Seminal vesicle elongated, 0.80-0.86 × 0.14-0.15 mm. Bursa well developed, with 10-12 thin branching rays, anterior part with two diverticula, 0.65-0.72 × 0.25-0.32 mm with 8-10 muscular bursal rays. Gonopore terminal. Vagina thick, muscular, 0.25-

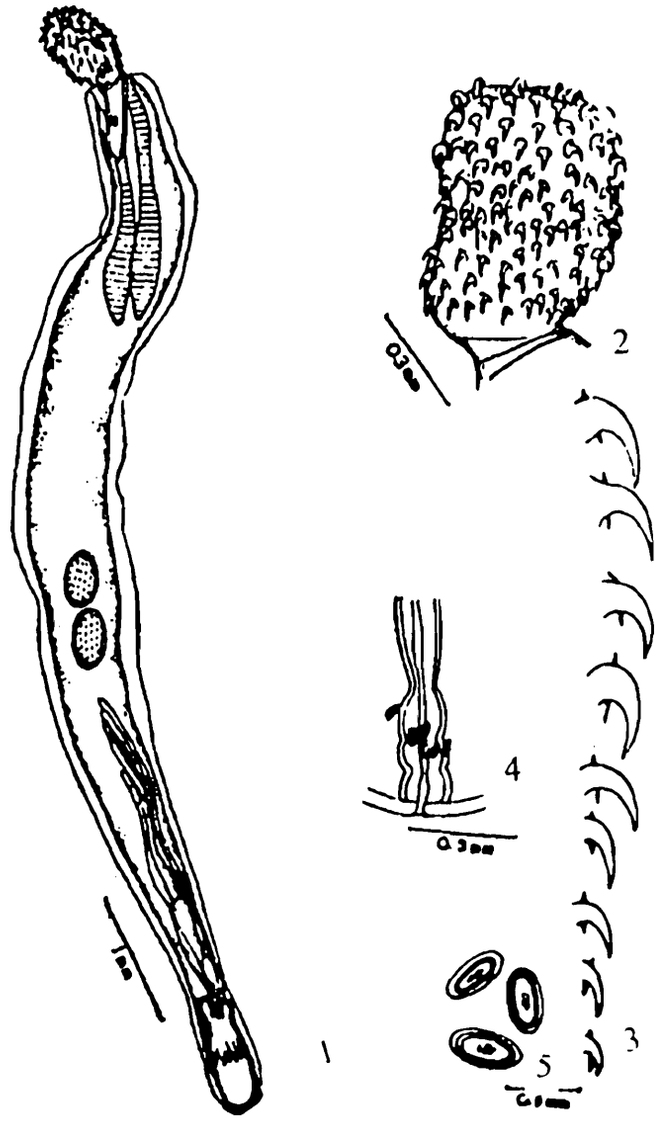


Fig. 217. *Porrorchis crocidurai* Gupta, V. & Fatma, 1986. 1. Male, 2. Posterior part of female, 3. Row of proboscis enlarged, 4. Row of proboscis hooks enlarged, 5. Ova enlarged (after Gupta, V. & Fatma, 1986).

0.27 × 0.12-0.15 mm, opening terminally outside body. Eggs oval 0.040-0.042 × 0.026-0.030 mm with polar prolongations of middle shell.

Host : *Crocidura perrotteti* (Dunernay).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

243. ***Porrorchis herpistes*** Bhattacharya, 2007
(Fig. 218)

Porrorchis herpistes Bhattacharya, 2007 : 159-161, Pl. 26. Fig. 143 a-g.

Type locality : Satpurs, Madhya Pradesh, India.

Description : Male 25.0-29.5 × 1.00-2.37 mm. Female 42.5-44.00 × 1.00-2.5 mm. Proboscis ovoid, 0.65-0.75 × 0.60-0.70 mm, with 30-32 longitudinal rows of 10-12 hooks each, anterior hooks with strong roots, posterior hooks rootless, roots 2nd, 3rd and 4th hooks of each row very long, 0.0104-0.116 mm long. Points of hooks 0.064-.0.07 mm long, rootless hooks at base 0.05-0.06 mm long. Neck truncate 0.575 × 0.625 mm. Proboscis receptacle narrow, cylindrical, double-walled, 2.00x 0.375 mm with central ganglion. Lemnisci longer than receptacle, 5.625-6.00 mm and 6.00-6.125 × 0.575 mm. Testes elliptical, one after other, anterior testis 2.00-2.06 × 0.90-0.95 mm and posterior 2.00-2.08 × 0.74-0.80 mm. Cement glands 4, long and tubular, 9.30-0.375 mm long. Eggs 0.05-0.06 × 0.02-0.026 mm. Gonopore terminal.

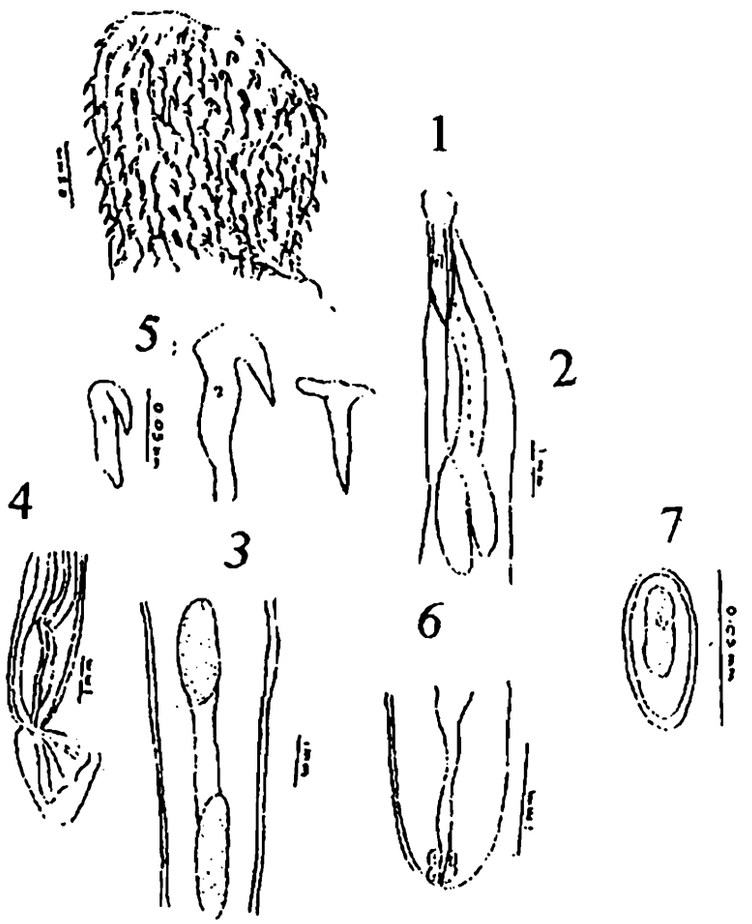


Fig. 218. *Porrorchis herpistes* (Bhattacharya, 2007). 1. Proboscis enlarged, 2. Anterior part of male, 3. Midtrunk region, 4. Posterior part of male, 5. Proboscis hooks enlarged, 6. Posterior part of female, 7. Ovum (after Bhattacharya, 2007).

Host : *Herpestes auropunctatus.*

Location : Intestine.

Locality : Satpura (Madhya Pradesh).

Distribution : Known from type locality.

244. ***Porrorchis hylae*** (Johnston, 1914) Schmidt & Kuntz, 1967 (Fig. 219)

Echinorhynchus hylae Johnston, 1914 : 63-91; Meyer, 1932 : 252;

Pseudoporrorchis hylae (Johnston), Yamaguti, 1963 : 154;

Porrorchis hylae Schmidt & Kuntz, 1967b: 133-135, Fig. 8-9; Gupta, N. K. & Jain, ?1973c: 385-386, Fig. 2 i, j; Golvan, 1994: 173; Bhattacharya, 2000: 151; 2007: 161 Pl. 26-27, Fig. 144 a-e.

Type locality : Queensland, Australia.

Description : Male 20-30 × 1.0-1.5 mm; female 33-58 × 1.4-2.0 mm. Proboscis ovoid, nearly spherical 0.5 × 0.39-0.44 mm in male; in female 0.45-0.54 × 0.45-0.58 mm, with 24-28 longitudinal rows of 8-10 hooks each, hooks similar in both sexes except for size. First 5 hooks with long well developed, simple root, rest rootless but each with well developed anteriorly directed blade. Each hook surrounded at its base by definite theca of

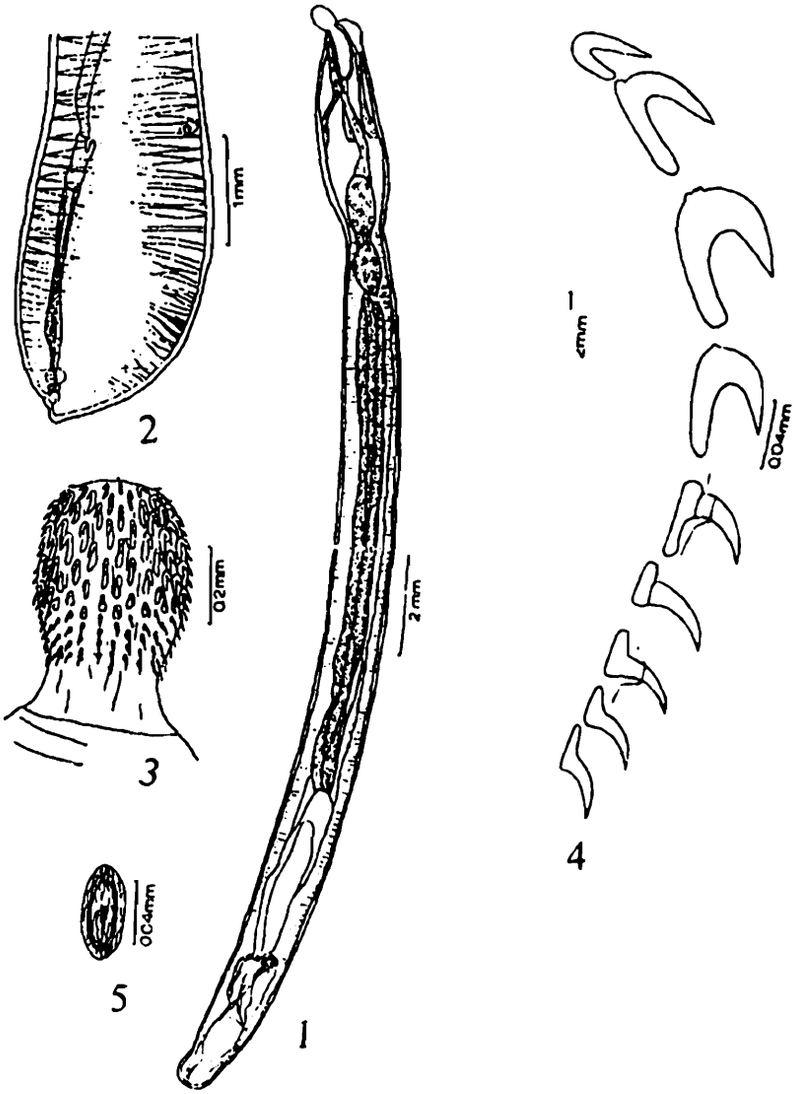


Fig. 219. *Porrorchis hylae* (Johnston, 1914) Schmidt & Kuntz, 1967. 1. Male, 2. Posterior part of female, 3. Proboscis enlarged, 4. Row of proboscis hooks, 5. Ovum enlarged (after Schmidt & Kuntz, 1967).

proboscis cuticle. Anterior hooks 0.04-0.05 mm long, middle hooks 0.056-0.059 mm long, basal spines 0.030-0.044 mm long in male; in female anterior hooks 0.038-0.053 mm long, middle hooks 0.065-0.071 mm long, basal spines 0.055-0.059 mm long. Neck similar in both sexes Trunk elongate, cylindrical, swollen at anterior one-fourth, antero-dorsal swelling sometimes overhanging neck. Conspicuous internal pseudo-segmentation present. Lacunar system with inconspicuous main channels. Lemnisci flat, widest near distal end, 2.0-2.5 mm long with a few small fragments of nuclei in male; in female 2.9-3.4 mm long. Testes in tandem, close together, sometimes overlapping, slightly, equal in size, 0.9-1.2 × 0.50-0.68 mm. Cement glands 4, tubular. Bursa complex with 14 wide rays, and with inner muscular cap. Uterine bell to subterminal gonopore 2.0-2.5 mm. Eggs oval, 0.059-0.065 × 0.027-0.029 mm, outer shell sculptured, especially towards poles. Thick middle shell without polar swellings.

Host : *Bioga trigonata* Fitzinger; *Glaucidiun cucudoiders* (Spotted owl).

Location : Mesentery.

Locality : Chandigarh.

Distribution : Taiwan, China; Philippine islands, Australia;

245. ***Porrorchis indicus*** (Das, 1957) Schmidt & Kuntz, 1967 (Fig. 220)

Pseudoporrorchis indicus Das, 1957b : 659-663, Pl. 1, 2; Yamaguti, 1963 : 154;

Pseudoporrorchis indicus Anantaraman, M. & Anantraman, S., 1970: 8; Soota & Kansal, 1970: 450; Srivastava & Pande, 1971: 107-111, Fig. 1-8;

Porrorchis indicus Srivastava, 1971: 92;

Pseudoporrorchis indicus Soota & Kansal, 1972: 306-307; Gupta N. K. & Jain, 1973a: 555;

Porrorchis indicus Gupta, N. K. & Jain. 1973a: 381-385, Fig. 1 A-H; Rengaraju, 1979: 60-61, Fig. 1-4; Duggal, Solomon & Ambardar, 1987: 23; Golvan, 1994: 173; Bhattacharya, 1999: 178-179, 2007: 162 Pl. 34-35, Fig. 192 ac, 197 a-e.

Type locality : Amraoti, Nagpur, Maharastra, India.

Description : Male 29.75-34.20 × 1.55-1.72 mm; female 32.82 × 1.84 mm. Proboscis small, spherical 0.45-0.54 × 0.39-0.45 mm in male, in female 0.72-0.74 × 0.30-0.32 mm, with 20-24 longitudinal rows of 8-10 hooks each. Anterior five hooks of each row larger and slender than posterior hooks 0.037-0.058 × 0.008-0.017 mm at base of blade. Posterior hooks smaller 0.021-0.025 mm long. Anterior 4 hooks with well developed posteriorly directed roots, larger in size than their blades, 0.037-0.062 mm long. Root of 5th hook reduced, base of blade located in middle of it so that with anteriorly directed blade. Posterior hooks with anteriorly directed blades. Proboscis receptacle elongated, cylindrical double-walled, with ellipsoid posterior end, 1.20-1.46 × 0.50-0.53 mm in male, in female 1.44 × 0.27 mm, with elongated ganglion 0.15 × 0.05 mm located near its middle. Neck small 0.14 × 0.27 mm. Trunk large, cylindrical with an anterior dorsal swelling overhanging neck,

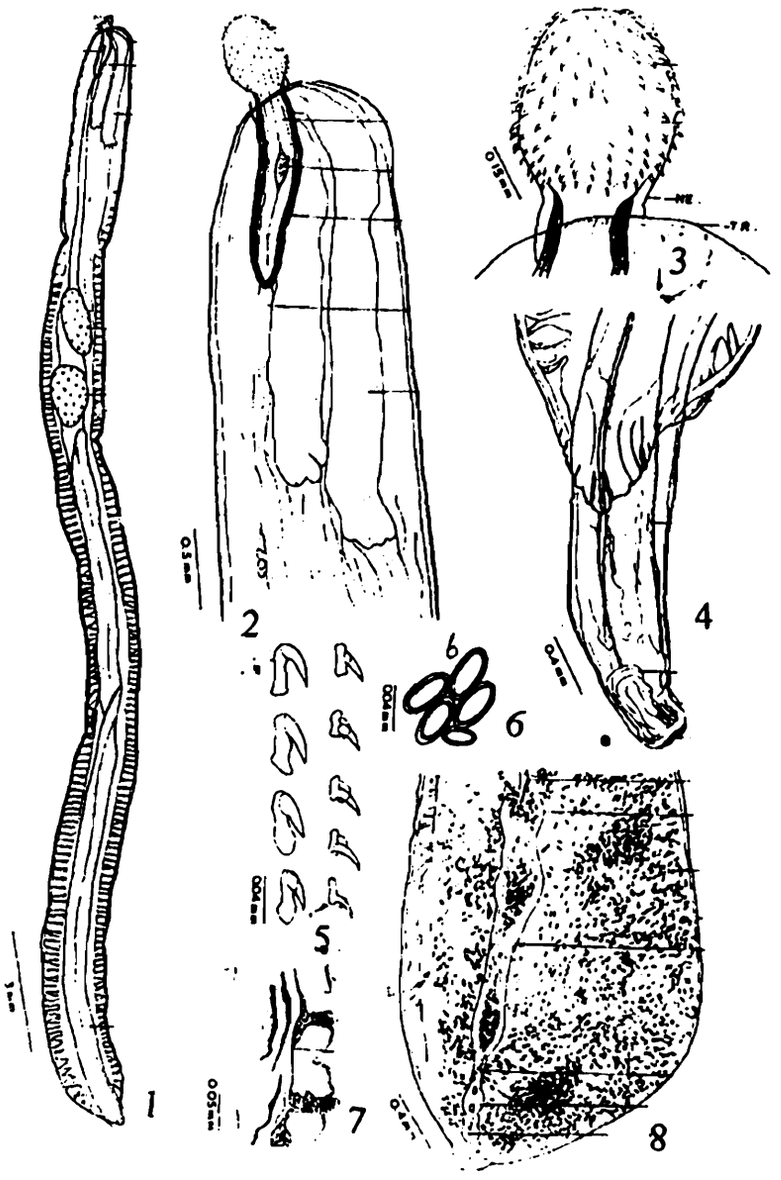


Fig. 220. *Porrorchis indicus* (Das, 1957) Schmidt & Kuntz, 1967. 1. Male, 2. Anterior part of worm, 3. Proboscis and neck enlarged, 4. Posterior part of male, 5. Proboscis hooks enlarged, 6. Ova enlarged, 7. T.S. of Proboscis wall showing attachment of hooks, 8. Posterior end of female (after Schmidt & Kuntz, 1967).

posterior end of female slightly swollen. Lacunar system poorly developed with lateral longitudinal channels. Lemnisci long, digitiform, small, nucleated 2.38-2.83 × 0.37 mm their posterior ends almost touch testes. Testes oval, in tandem, anterior 1.20-1.58 × 0.54-0.65 mm, posterior 1.54 × 0.84 mm. Cement glands 4, tubular, long, post-testicular, 12.16 × 0.48 mm, with many nuclei in each gland. Four main cement ducts pour into a common tubular reservoir, 4.16 × 0.48 mm, connected with bursa open into muscular cap of bursa. Bursal cap 0.53 × 0.21 mm. Mature ovary disintegrate into ovarian balls and numerous eggs. Uterine bell cup-shaped 0.29 × 0.48 mm, its base with selector apparatus of several cells. Uterus simple, tubular 1.21 × 0.28 mm. Vagina 0.56 × 0.065 mm with two sphincters 0.14-0.23 × 0.13-0.17 mm. Female gonopore subterminal. Mature eggs ovoidal, double-walled. 0.053-0.072 × 0.030-0.034 mm. Fertilised eggs acquire an additional membrane.

Host : *Centropus sinensis* (Stephens), *C. castonopterus, C. andamanensis, Centropus* sp., *Bubo bubo bengalensis, Tyto alba javanicus, Milvus migrans govinda, domestic poultry and ducks.* Juvinile in *Lycodon* sp.

Location : Intestine.

Locality : Amraoti, Nagpur (Maharastra); Chandigah; Punjab; Garo Hills (Meghalaya); Port Blair (Andaman & Nicobar Islands).

Distribution : Known only from India.

246. ***Porrorchis keralensis*** George & Nadakal, 1984
(Fig. 221)

Porrorchis keralensis George & Nadakal, 1984: 101-103, Fig. 3 a-d; 1992 : 287; 1993 : 404-406; Golvan, 1994: 173; Bhattacharya, 2007: 162 Pl. 27, Fig. 145 a-e.

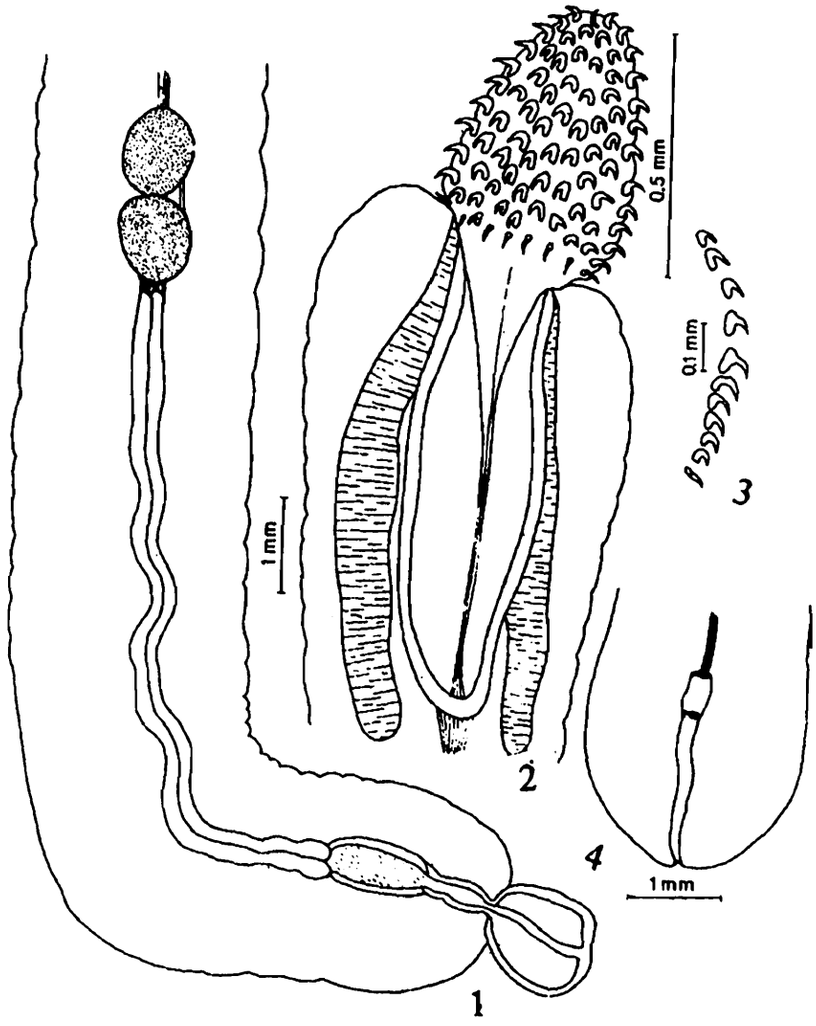


Fig. 221. *Porrorchis keralensis* George & Nadakal, 1984. 1. Posterior part of female, 2. Anterior part of male, 3. Row of proboscis hooks, 4. Posterior part of female (after George & Nadakal, 1984).

Type locality : Channapetta, Bethany hills, Kerala, India.

Description : Male 30-35 × 0.5-2.0 mm; female 32-42 × 0.54-3.0 mm. Proboscis globular or spherical 0.60-0.80 mm long in male, in female0.70-0.90 × 0.15-0.20 mm, with 22-26 lo ıgitudinal rows of 8-10 hooks each in both sexes. Anterior 4 hooks of each row with true roots, directed backwards. Hooks of first and second rows 0.02-0.03 × 0.037-0.040 mm and of third and fourth rows 0.047-0.050 mm long, and of remaining rows 0.034-0.038 mm long.-Roots 0.02-0.03 × 0.003-0.008 mm. Each hook surrounded at base by a circular covering. Proboscis receptacle cylindrical, double-walled, 1.0-1.15 × 0.37-0.38 mm in male; in female 1.35-1.40 × 0.38-0.41 mm. Neck short. Trunk cylindrical aspinose, somewhat overhanging neck. Pseudo-segmentation conspicuous. Lemnisci 2, flat, equal, extending beyond receptacle, 1.0-1.6 × 0.15-0.16 mm in male; in female1.7-1.8 × 0.15 mm. Testes unequal, oval, pre-equatorial, in tandem, closely placed or sometimes slightly overlapping and in contact with lemnisci, anterior 0.9-1.2 × 0.07-0.08 mm, posterior 0.82-0.90 × 0.07-0.08 mm. Cement glands 4, long, tubular, closely placed, 8-14 × 0.15-0.17 mm, its ducts open into cement reservoir 1.0-1.5 × 0.20-0.35 mm and continue as ejaculatory duct ending in bursa. Bursa spherical with muscular cap, 1.0-1.1 × 1.0-1.2 mm. Uterine bell pre-equatorial, narrow, 0.30-0.50 × 0.50-0.70 mm. Uterus 1.0-1.3 × 0.20-0.25 mm. Vagina 0.50-0.70 × 0.50-0.70 mm. Eggs oval 0.05-0.06 × 0.025-0.035 mm, with outer shell with sculptured poles and middle without polar prolongations. Embryos with anterior dorsal hooks. Female gonopore subterminal.

Host : *Centropus sinensis* (Stephens); juveniles in cysts of mesenteries of amphibians and reptiles.

Location : Small intestine.

Locality : Channapatta, Bethany hills (Kerala).

Distribution : Known only from type locality.

247. ***Porrorchis leibyi*** Schmidt & Kuntz, 1967

Porrorchis leibyi Schmidt & Kuntz, 1967 : 75-76; 135-136, Fig. 10-13; Bhattaacharya, 2003 : 75-76.

Type locality : Taiwan and Palawan.

Description : Male35-42 × 1.0-1.8 mm; female 42-50 × 1.5-1.8 mm. wide at anterior swelling. Proboscis ovoid,0.49-0.55 mm long, 0.41-0.53mm in maximum width, with 30-37 longitudinal rows of 8-12 hooks each. In both sexes. First four or five hooks in each with long, well developed simple roots, remaining spines rootless but each with anteriorly directed blade. Anterior hooks 0.039-0.059 mm long, middle hooks 0.079-0.093 mm long, basal spines 0.050-0.072 mm long in both sexes. Cuticular theca surround base of each hook. Proboscis receptacle 1.1-1.35 × 0.40-0.60 mm. Lemnisci wide, flat 0.30-.040 mm long not reaching anterior testis. Testes oval, in tandem, slightly separated 1.3-1.8 mm × 0.480.80 mm Cement glands 2,-3 varying from worm to worm. Genital pore nearly terminal. Bursa nor observes. In female posterior end swollen and pointed but without finger like process.

Uterine bell to subterminal gonopore 2.5 mm. Eggs 0.065-0.070 × 0.020-0.034mm, outer shell thin, sculptured towards poles. Middle shell without polar prolongations.

Host : Qwl.

Location : Intestine.

Locality : Rhenock (Sikkim).

Distribution : Taiwan and Palawah.

248. ***Porrorchis rotundatus*** (von Linstow, 1897) Schmidt & Kuntz, 1967 (Fig. 222)

Echinorhynchus rotundatus von Linstow, 1897 : 27-34; Shipley, 1904 : 52; Meyer, 1933 : 136; *Pseudoporrorchis rotundatus*. Petrotschenko, 1958 194-195; Yamaguti, 1963 : 155; Pl. 73, Fig. 751-753; *Porrorchis rotundatus* (Linstow, 1897) Schmidt & Kuntz, 1967b : 140; Golvan, 1994 : 173.

Type locality : Madagascar, Africa.

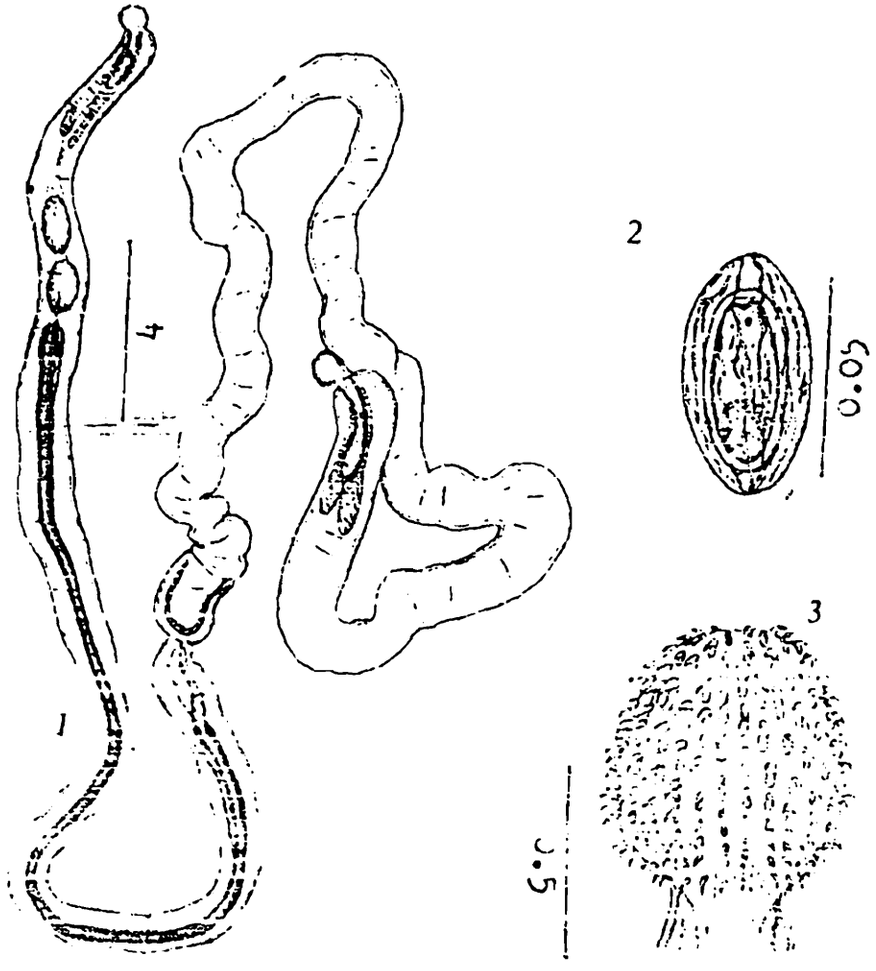


Fig. 222. *Porrorchis rotundatus* (von Linstow, 1897) Schmidt & Kuntz, 1967. 1. Male and female in copulation, 2. Ovum enlarged, 3. Proboscis enlarged (after Yamaguti, 1963).

Description : Worms 38 × 0.95 mm. Proboscis ovoid, with 30 longitudinal rows of 5 hooks each. Anterior hooks with 0.084 mm long mucros, posterior ones with 0.035 mm long, with roots, last without roots. Proboscis receptacle double-walled with ganglion at its middle. Trunk cylindrical, elongated, aspinose, trunk widening posteriorly in males. Hypodermal nuclei small, moderately numerous. Lacunar system with main lateral longitudinal channels. Lemnisci long, flat, longer than receptacle. Testes ovoid, in tandem. Cement glands elongate, tubular. Eggs oval, 0.06 × 0.031 mm, with 2 membranes with thick and striated at surface and without polar prolongations of middle shell.

Host : *Centropus sinensis* (Stephens).

Location : Intestine.

Locality : Sri Lanka;

Distribution : Madagascar (Africa).

49. Genus ***Pseudolueheia*** Schmidt & Kuntz, 1967

Pseudolueheia Schmidt & Kuntz, 1967: 138-139; Golvan, 1994 : 176; Bhattacharya, 2007 : 162-163.

Diagnosis : Plagiorhynchidae, Porrorchinae. Proboscis spherical or ovoid with numerous longitudinal rows of hooks with well developed roots except rootless basal hooks. Proboscis receptacle double walled, attached at base of proboscis, in its middle third. Trunk aspinose. Lacunar system with irregular main lateral channels with regular anastomosis. Hyppodermal nuclei small, numerous and evenly distributed. Lemnisci two, flat, wide bound to trunk wall by ligaments at their free ends. Testes in anterior half of trunk, in tandem or nearly so. Cement glands 4, long, tubular. Gonopore nearly terminal in male and subterminal in female. EFggs ovoid to elliptical, thick middle shell with or without polar swellings, outer shell thin sculptured more towards poles. Parasites of birds.

Type species : *Pseudolueheia pittae* Schmidt & Kuntz, 1967.

Includes four species, 1. *Psedolueheia arunachalensis* Bhattacharya, 2007, 2. *P. korathai* Gupta, V. & Fatma, 1988, 3. *P. boreotis* (Van Cleave, & Williams, 1951) Schmidt & Kuntz, 1967, 4. *P. pittae* Schmidt & Kuntz, 1967, of which first two occurs in India.

Key to Indian species of Genus *Pseudolueheia*

- Proboscis with 26-28 longitudinal rows of 8-10 hooks each .... *Pseudolueheia arunachalensis*
- Proboscis with 22 longitudinal rows of 11 hooks each ..... *Pseudolueheia kprathai*

249. ***Psedolueheia arunachalensis*** Bhattacharya, 2007 (Fig. 223)

Psedolueheia arunachalensis Bhattacharya, 2007 : 163-165, Pl. 27, a-f.

Type locality : Tirup, Arunachal Pradesh, India.

Description : Worms of medium size, plumpy, ventrally curved, Male 10.625 × 2.0 mm. Female 16.125-18.775 × 3.00-3.25 mm. Proboscis ovoid, 0.475x 0.475 mm in male, in female 0.50-0.52 × 0.45-0.48 mm, with 26-28 longitudinal rows of 8-10 hooks each in both sexes, apical hooks smaller than hooks of mid-proboscis, roots 1st, 2nd and 3rd hooks of each row longer than points of hooks; basal hooks rootless, points of apical hooks 0.033-0.035 × 0.0083 mm, points of hooks of mid-proboscis 0.040-0.0415 × 0.0166 mm, points of basal hooks 0.0.03-0.033 × 0.0083 mm; roots of apical hooks 0.045-0.049 mm long, roots of midproboscis hooks 0.070-0.0749 mm long; roots of hooks near base 0.038-0.0415 mm long. Nexk short, wide than long, 0.25 × 0.525 mm. Proboscis receptacle double-walled, with central ganglion, 1.125 × 0.04 mm. Lemnisci nearly equal, leaf-like, distal tips bound to body wall by ligaments, 1.175 × 0.5 mm and 1.625 × 0.3 mm, Testes two, oval, one behind other, near to lemnisci, posterior testis ruptured, anterior testis 1.375 × 0.625 mm. Cement glands 4, long, tubular, average length 4.30 mm long. Uterus

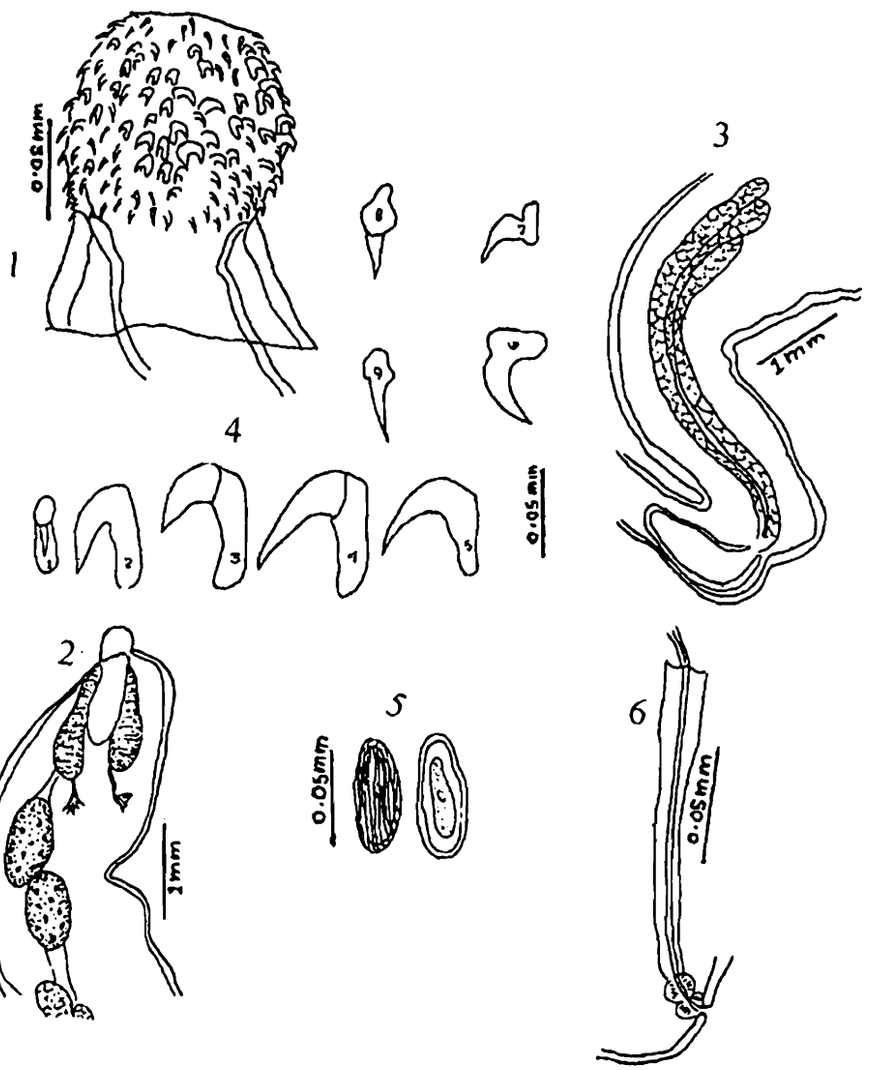


Fig. 223. *Psedolueheia arunachalensis* Bhattacharya, 2007. 1. Proboscis enlarged, 2. Anterior part of male, 3. Posterior part of male, 4. Proboscis hooks enlarged, 5. Ova, 6. Posterior part of female (after Bhattacharya, 2007).

1.25-1.50 mm long, vagina 0.5-0.55 mm long with sphincter muscle. Immature eggs 0,024-0.034 × 0.006-0.008 mm, mature eggs 0.055-0.006 × 0.0115-0.018 mm, with polar prolongations of middle shell.

Host : *Pitta nepalensis.*

Location : Intestine.

Locality : Tirup in Gandigram district (Arunachal Pradesh).

Distribution : Known only from type locality.

250. ***Pseudolueheia korathai*** Gupta, V. & Fatma, 1988 (Fig. 224)

Pseudolueheia korathai Gupta, V. & Fatma, 1988 : 132-134, Pl. 2, Fig. 1-3; Golvan, 1994 : 176; Bhattacharya, 2007 : 163. Pl. 27, Fig. 146 a-c.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 12.7 × 1.8 mm; female 12.2 × 2.0 mm. Proboscis subcylindrical 0.75 × 0.45 mm in male; in female 0.95 × 0.60 mm, with 22 longitudinal rows of 11 hooks each,

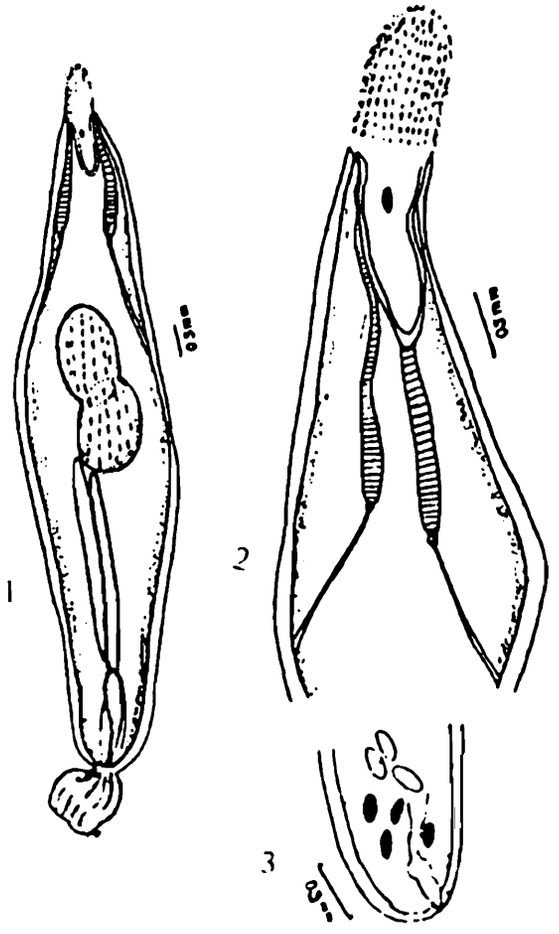


Fig. 224. *Psedolueheia korathai* Gupta, V. & Fatma, 1988. 1. Male, 2. Anterior part of worm, 3. Posterior end of female (after Gupta, V. & Fatma, 1988).

hooks with well developed root. First 1 or 2 hooks in each row delicate, 0.030-0.032 mm long, remaining rooted hooks stronger 0.035 -0.040 mm long, basal rootless spines 0.025-0.028 mm long in males; in females first 1 or 2 hooks delicate 0.030-0.032 mm long, remaining rooted hooks stronger, 0.032-0.038 mm long, rootless spines strong, 0.025-0.030 mm long. Proboscis receptacle double-walled with ganglion at about its middle, 1.0 × 0.37 mm in males; in females 1.8 × 0.45 mm. Trunk elongated, fusiform, wide in middle, rounded posteriorly. Lacunar system with main lateral channels and reticular anastomoses. Hypodermal nuclei small, numerous evenly distributed. Lemnisci 2, simple, unequal, flat, wider near distal end, containing nucleus at tip, extending far above anterior testis, shorter lemniscus 2.2 mm long, longer 2.4 mm long in males; in females shorter lemniscus 3.0 × 0.2 mm, longer 3.5 × 0.22 mm. Testes ovoid, in tandem, subequal, overlapping, pre-equatorial, anterior 1.7 × 0.9 mm; posterior 2.5 × 0.25 mm. Cement glands 4, tubular, elongated, just behind posterior testis, 5.0-5.4 × 0.25 mm. Bursa simple without musculature, 1.02 × 0.65 mm. Uterine bell elongated, 0.38 × 0.25 mm. Eggs 0.030-0.035 × 0.020-0.022 mm, outer shell thin, heavily sculptured towards poles, middle shell without polar prolongations. Gonopore terminal in male.

Host : *Lobivanellus indicus* (Boddaert).

Location : Intestine.

Locality : Tamil Nadu; Prince of Wales Zoological gardens, Lucknow (Uttar Pradesh).

Distribution : Known only from India.

16. Family POLYMORPHIDAE Meyer, 1931

Polymorphidae Meyer, 1931c : 53-108; 1932 : 62;
Polymorphinae Van Cleave, 1953 : 26;
Polymorphidae Petrochenko, 1956 : 354;
Filicollidae Petrotschenko, ? 1956, I : 153;
Polymorphidae Yamaguti, 1963 : 69;
Arhythmrhynchidae Lühe, 1911 : 47.
Polymorphinae Bhattacharya, 2007 : 147.

Diagnosis : Polymorphida. Proboscis or trunk may be bulbous. Proboscis receptacle double-walled, with ganglion near its middle. Trunk bulbous, spinose. Hypodermal nuclei small and numerous. Lemnisci long, often flattened near their middle. Cement glands 2-6, exceptionally 8, usually tubular. Parasites of vertebrates, especially birds and mammals.

Type genus : *Polymorphus* Lühe, 1911.

Includes eight genera, 1. *Arhythmorhynchus* Lühe, 1911, 2. *Bolbosoma* Porta, 1908, 3. *Filicollis* Lühe, 1911, 4. *Polymorphus* Lühe, 1911, 5. *Southwellina* Witenberg, 1932, 6. *Androcantha* Schmidt, 1975, 7. *Corynosoma* Lühe, 1911 and 8. *Diplospinifer* Fukui, 1919, of which first five genera occur in this subcontinent.

Key to Indian genera of family POLYMORPHIDAE

1. Proboscis globose with radially arranged hooks at its apex ..... *Filicollis*
– Proboscis not globose 2
2. Cement glands 2 ..... *Bolbosoma*
– Cement glands more than 2 3
3. Proboscis hooks in 13-36 longitudinal rows of 8-22 hooks each ..... *Arhythmorhynchus*
– Proboscis hooks in 12-22 longitudinal rows of 6-16 hooks each ..... *Polymorphus*

50. Genus ***Arhythmorhynchus*** Lühe, 1911

Arhythmorhynchus Lühe, 1911 : 47; Southwell & Macfie, 1925 : 160; Meyer, 1932 : 91-93; Yamaguti, 1935 : 273; Petrotschenko, 1958 : 74-75; Yamaguti, 1963 : 74;

Skrjabinorhynchus Petrochenko, 1958: 72;

Arhythmorhynchus Yamaguti, 1963 : 74-75; Golvan, 1994 : 139.

Diagnosis : Polymorphidae, Polymorphinae Proboscis short, always swollen towards middle, with 13-36 longitudinal rows of 8-22 hooks each, hooks larger at level of swollen part of proboscis, ventral hooks larger than dorsal hooks, with difference varying in different species, sometimes without appreciable difference. Proboscis receptacle cylindrical, double-walled, with ganglion about its middle. Neck short or long, unarmed. Trunk long, slender, spinose at somewhat swollen anterior part, behind which swollen again and provided with large hypodermic nuclei; slender posterior part of trunk almost completely devoid of nuclei, may be invaginated into anterior part. Lemnisci slender or clavate. Testes in tandem in swollen part posterior to spinose region. Cement glands 2-4 (usually 2) very long. Ova elliptical, with polar prolongations of middle shell. Parasites of piscivorous birds. First intermediate hosts aquatic arthropods, second intermediate hosts fishes, amphibians and reptiles.

Type species : *Arhythmorhynchus fressoni* (Molin, 1858) Lühe, 1911.

Includes twenty seven species, 1. *Arhythmorhynchus platystomi* George & Nadakal, 1985, 2. *A. brevis* Van Cleave, 1916, 3. *A. capellae* (Yamaguti, 1935), 4. *A. comptus* Van Cleave & Rausch, 1950, 5. *A. distinctus* Baer, 1956, 6. *A. ducocinctus* (Chandler, 1935), 7. *A. eroliae* (Yamaguti, 1939) Schmidt, 1973, 8. *A. fressoni* (Molin, 1858) Lühe, 1911, 9. *A. frontospinosus* (Tubangui, 1936) Yamaguti, 1963, 11. *A. jeffreyi* Schmidt, 1973, 11. *A. johnstoni* Golvan, 1960, 12. *A. limosae* Edmonds, 1971, 13. *A. macracanthus* (Ward & Winter, 1952), 14. *A. petrotschenkoi* (Schmidt, 1969) Atrashkevich, 1979, 15. *A. plicatus* (Linstow, 1883) Meyer, 1932, 16. *A. pumiliorostris* Van Cleave, 1916, 17. *A. roseus* (Molin, 1858) Meyer, 1932, 18. A. *rubicundus* (Molin, 1859) Meyer, 1932, 19. *A. siluricola* Dollfus, 1929, 20. *A. suecicus* Lundstrom, 1942, 21.*A. teres* Van Cleave, 1920, 22. *A. trichocephalus* (Leuckart, 1876) Lühe, 1911, 23. *A. tringi* Gubanov, 1952, 24. *A. turbidus* (Van Cleave,

1939) Golvan, 1994, 25. *A. uncinatus* (Kaiser, 1893) Lühe, 1911, 26.*A. villoti* Golvan, 1994 and 27. *A. xeni* Atrashkewitch, 1978, of which first one occurs in India.

251. ***Arhythmorhynchus platystomi*** George & Nadakal, 1985 (Fig. 225)

Arhythmorhynchus platystomi George & Nadakal, 1985b : 138-140, Fig. 1, 2; Golvan, 1994: 139.

Type locality : Trivandrum, Kerala, India.

Description : Worms orange coloured in life. Everted male juvenile 3-4 × 1.0-1.5 mm. Proboscis long, swollen at middle, 0.50-0.70 × 0.15-0.30 mm, with 24-26 longitudinal rows of 16-18 hooks each. Hooks of 8th, 9th and 10th of midventral longitudinal rows large and wide, anterior hooks 0.025-0.030 × 0.010-0.014 mm, of middle 0.034-0.036 × 0.012-0.020 mm, of posterior 0.016-0.020 × 0.008-0.012 mm. Proboscis receptacle cylindrical, double-walled, 0.54-0.62 × 0.12-0.15 mm. Neck 0.12-0.25 × 0.15-0.17 mm.

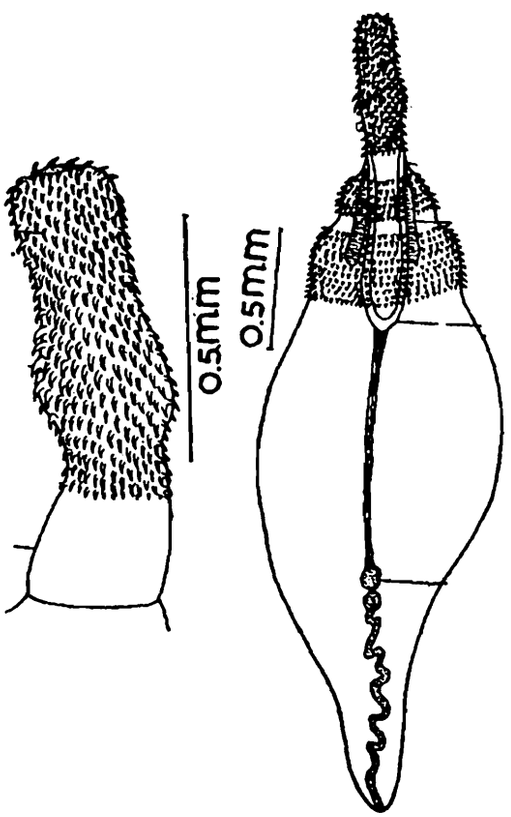


Fig. 225. *Arhythmorhynchus platystomi* George & Nadakal, 1985. 1. Male, 2. Proboscis enlarged (after George & Nadakal, 1985).

Trunk barrel-shaped and swollen at middle, 2.0-3.0 × 1.0-1.5 mm, with spines restricted in two bands at anterior part, separated by a short aspinose part anteriorly, first group with 30-40 longitudinal rows of 6- 8 spines each, and second group with 40-46 longitudinal rows of 8-12 spines each. Caudal region non-spiny and invaginable into trunk. Lemnisci 2, swollen at distal end, extend up to base of receptacle. Testes equatorial, ovoid, equal,

in tandem and placed distantly. Cement glands 2-4, long, tubular. Genital ducts rudimentary both in male and female worms. Ovarian cells in clusters and attached to proboscis receptacle by ligaments. Gonopore terminal. Female not known.

Host : *Arius platystomus* (Day), *Channa striatus* (Bloch), *Megalops cyprinoids* (Swainson), *Anabas scandens* (Day).

Location : Cysts in mesenteries.

Locality : Trivandrum (Kerala).

Distribution : Known only from type locality.

51. Genus ***Southwellina*** Witenberg, 1932 redefined Schmidt, 1972

Southwellina Witenberg, 1932: 253-256; Bhattacharya, 3007 : 150.

Diagnosis : Polymorphida, Polymorphidae. Proboscis cylindrical with or without swelling, with numerous longitudinal rows of hooks. Neck inconspicuous. Proboscis receptacle double-walled inserted at base of proboscis. Anterior part of trunk swollen, posterior part slender. Hypodermal nuclei confined anterior trunk. Anterior trunk with 2 fields of spines on at least one sex. Anterior fields may be incomplete dorsally. Lemnisci not bound to trunk wall at distal ends. Testes at pre-equatorial. Cement glands 4, tubular. Parasites of birds.

Type species : *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932.

This genus includes seven species, 1. *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932, 2. *S. sacra* Bhattacharya *et al.*, 2002, 3. *S, ardeae* (Belopolskaja, 1958) Folvan, 1994, 4. S. *dimorpha* Schmidt, 1973, 5. *S. duocincta* Chandler, 1935, 6. *S. macracantha* (Ward & Winter, 1952) Schmidt, 1973 and 7. *S, pontica* (Petrotschenko & Smogorjevskaja, 1952) Golvan, 1994, of which first two occur in this country.

Key to Indian species of genus *Southwellina*

– Proboscis with 17-24 longitudinal rows of 14-17 hooks each .... *Southwellina hispida*

– Proboscis with 14 longitudinal rows of 15 hooks each ..... *Southwellina sacra*

252. ***Southwellina sacra*** Bhattacharya, Pande & Srivastava, 2002 (Fig. 226)

Southwellina sacra Bhattacharya, Pande & Srivastava, 2002 : 72-83; 2007 : 151-152, Pl. 25, Fig. 136 a-e.

Type locality : Port Blair Andaman & Nicobar Islands, India.

Description : Male anterior part 4.875 × 0.75 mm; posterior part 0.27 mm wide; female 4.55-5.5 × 1.00-1.75 mm. Proboscis 0.675-0696 × 0.20 mm, with14 longitudinal rows of 15 hooks each. Hook tips 0.030-035 × 0,004-0.01 mm, middle hooks 0.036 0.042

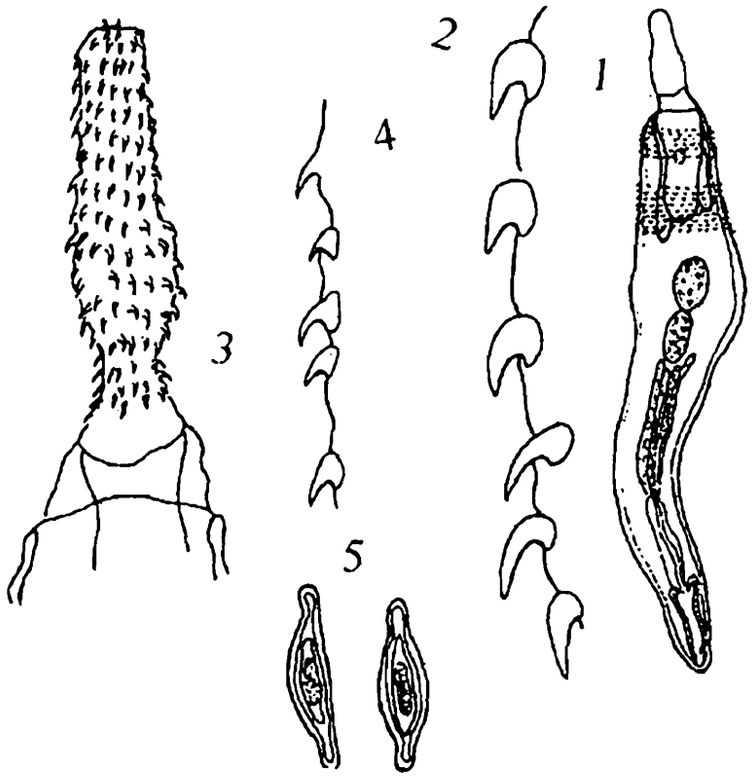


Fig. 226. *Southwellina sacra* Bhattacharya, 2002. 1. Male, 2. Row of proboscis hooks enlarged, 3. Proboscis enlarged, 4. Row of trunk spines enlarged, 5. Ova (after Bhattacharya, 2007).

× 0.018 mm; basal hooks 0.0360.052 × 0.01-0.012 mm, Hypodermic nuclei restricted to anterior trunk. Trunk spines in two fields at wide anterior trunk, first field 0.166-0.18 wide with 8-10 rows of spines, second field 0.248-0.289 mm wide with 8-12 rows of spines. Proboscis receptacle 0.85 × 0.225 mm with central ganglion. Lemnisci 0.75 × 0.125 mm and 1.05 × 0.25 mm long. Anterior testis 0.375 × 0.25 mm, posterior testis 0.347 × 0. 207 mm. Cement glands for, 0.375 mm long. Eggs 0.083-1.00 × 0.024- 0.033 mm with polar prolongations of middle shell membrane. Proboscis receptacle thick, muscular, double-walled, 1.3 × 0.3 mm with ganglion situated about its middle. Trunk barrel-shaped, 2.3 × 0.8 mm, its anterior part of 0.12 mm wide part beset with 40-44 longitudinal rows of 5-6 small spines each; middle part of trunk 1.6 × 0.8 mm with longitudinal rows of 7-8 spines each. Interval between rows 0.5 mm. Lacunar system with a network of branching canals. Lemnisci long, one 1.75 × 0.215 mm long other 1.0 × 0.225 mm long. Testes 2, equal, held in position by genital ligaments,anterior 0.374 × 0.25 mm, posterior 0.0347 × 0.207 mm .Cement glands long and tubular. Bursa occupies near hind end of trunk. Female not known.

Host : *Egretta sacra.*

Location : Intestine.

Locality : Port Blair (Andaman & Nicobar Islandso.

Distribution : Known only from type locality.

253. ***Southwellina hispida*** (Van Cleave, 1925) Witenberg, 1932

Arhythmorhynchus hispidus Van Cleave, 1925 : 149-156; Schmidt & Kuntz, 1967a : 809;

Arhythmorhynchus tigrinus Moghe & Das, 1953 : 211-216; Fig. 1-6; Das, 1954 : 41-49, Pl. 6-9;

Arhythmorhynchus sp. Datta, 1954 : 39-50. Pl. 7, Fog. 1-6;

Arhythmorhynchus tigrinus Yamaguti, 1963 : 77; Anantaraman, M. & Anantaraman, S., 1970 : 5; George & Nadakal, 1992 : 287; Golvan, 1994 : 139.

Southwellina hispida (Van Cleave, 1925) Witenberg, 1932, Bhattacharya, 2002 : 63-82; 2007 : 150-161, Pl. 25, Fig. 135 a-c.

Type locality : Amraoti, Maharastra, India.

Description : Worms orange pink in colour in life. Juvenile male 3.4 × 0.8 mm. Proboscis 0.5-0.7 mm long, 0.15-0.19 mm wide at both ends, but its middle part 0.25 mm wide with 17-18 longitudinal rows of 15-18 hooks each. Hooks vary in size, those in mid-proboscis largest with pronounced shoe-shaped roots, roots 0.05-0.06 mm long, blade 0.04 mm long in middle part. Hooks of anterior part slightly smaller, root 0.4 mm long and blade 0.035 mm. Hooks of posterior part decrease in size, root measure 0.02 mm long, blade 0.03 mm long. Neck long, aspinose, cone-shaped 0.45 mm long, 0.2 mm wide at anterior end and 0.53 mm wide at basal end. Proboscis receptacle thick, muscular, double-walled, 1.3 × 0.3 mm with ganglion situated about its middle. Trunk barrel-shaped, 2.3 × 0.8 mm, its anterior part of 0.12 mm wide part beset with 40-44 longitudinal rows of 5-6 small spines each; middle part of trunk 1.6 × 0.8 mm with longitudinal rows of 7-8 spines each. Interval between rows 0.5 mm. Lacunar system with a network of branching canals. Lemnisci long, 1.0 × 0.15 mm, interspersed with lacunar spaces and nuclei, closely surrounded by compressor muscles. 1.3 × 0.3 mm. Testes 2, equal, held in position by genital ligaments, 0.15 × 0.1 mm. Cement glands long and tubular. Bursa occupies near hind end of trunk. Female not known.

Host : *Nicticorax nicticorax, Haliaster indus*; *Rana tigrina* Daudin, *Tropidonotus piscator.*

Location : Intestine.

Locality : Chilka lake (Orissa), Madhya Pradesh.

Distribution : Known only from India.

52. Genus ***Bolbosma*** Porta, 1908

Bolbosoma Porta, 1908 : 268-282; Southwell & Macfie, 1925 : 168; Van Cleave, 1953 : 97; Petrotschenko, 1958 : 119; Yamaguti, 1963 : 85; Golvan, 1994 : 140.

Diagnosis : Polymorphida, Polymorphidae, Proboscis claviform or conical with 12-26 longitudinal rows of 5-9 hooks each. Proboscis receptacle cylindrical, double-walled. Neck short. Trunk of medium size about 10 mm long, to very large over 200 mm long. Anterior

part of trunk swollen in form of inflated bulb or slightly expanded in width which may be divided into three parts, anterior, intermediate and posterior parts. Posterior part may be attenuated, sometimes filiform. Lacunar system with main lateral channels and annular commissures, alternating with circular musculature. Lemnisci slender, narrowly cylindrical, occasionally lobe-like, variable in length. Testes rounded, in tandem, usually in middle third of body. Cement glands 2, after Golvan 3, tubular, long. Eggs large, elongate, with polar prolongations of middle shell. First intermediate host crustaceans, second intermediate host fishes. Parasites of marine mammals.

Type species : *Bolbosoma balaenae* (Gmelin, 1790) Porta, 1908.

Includes fifteen species, 1. *Bolbosoma vasculosum* (Rudolphi, 1819) Porta, 1908, 2. *B. australis* Skrjabin, 1972, 3. *B. balaenae* (Gmelin, 1790) Porta, 1908, 4. *B. bobrovoi* Krotov & Delamure, 1952, 5. *B. brevicolle* (Malan, 1967) Porta, 1908, 6. *B. caenoforme* (Heitz, 1920) Porta, 1908, 7. *B. capitatum* (Linstow, 1880) Porta, 1908, 8. *B. hamiltoni* Baylis, 1929, 9. *B. heteraanthe* (Heintz, 1920) Meyer, 1932 10. *B. nipponicum* Yamaguti, 1939, 11. *B. physeteris* Gabanov, 1952, 12. *B. scromberomori* Wang, 1980, 13. *B. thunni* Harada, 1935, 14. *B. tuberculata* Skrjabin, 1970, and 15. *B. turbinella turbinella* (Diesing, 1851) Porta, 1908, of which first one occurs in India.

254. ***Bolbosoma vasculosum*** (Rudolphi, 1819) Porta, 1908
(Fig. 227)

Echinorhynchus vasculosum Rudolphi, 1819 : 1-81;

Bolbosoma vasculosum Porta, 1908 : 268-282; Van Cleave, 1953 : 87, Pl., Fig. 370, 371; Petrotschenko, 1958 : 131; Yamaguti, 1963 : 87, Pl. Fig. 370, 371; Murugesh, 1994: 421, Fig. 8, 9; Golvan, 1994 : 140.

Description : Body 12-15 × 0.5-0.8 mm. Proboscis subcylindrical, 0.76-1.0 × 0.40-0.47 mm, with slight enlargement near its middle, with 18-20 longitudinal rows of 8-9 hooks each. Largest hooks heavy about 1.10 × about 0.040-0.045 mm. Basal hooks about 0.079 × 0.016 mm. Neck conical 0.75-1.0 mm long. Trunk bulb long, not conspicuously developed, about 1 × 1 mm, shaped like an enlarged band rather than a definite bulb. Trunk spines in two separate collars or spine fields, one longest part of bulb about 0.048 × about 0,02 mm, those of anterior field shorter and narrower. Lemnisci about 1.5 mm long.

Host : *Scomberomorus commersoni* (Lecepede); *Euthynnus affinis* (Cantor).

Location : Intestine.

Locality : Visakhapatnam coast, Bay of Bengal (Andhra Pradesh).

Distribution : North Atlantic; Mediterranean Sea, Japan.

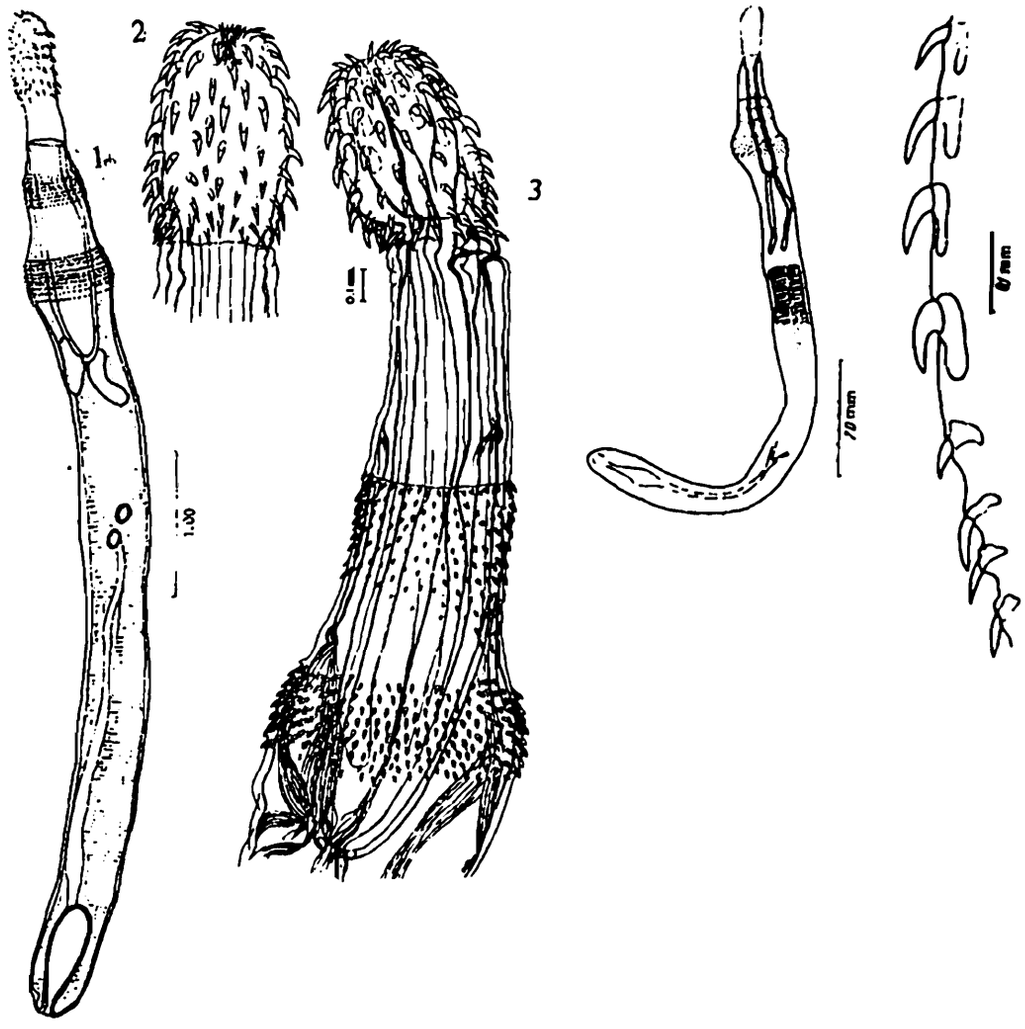


Fig. 227. *Bolbosoma vasculosum* (Rudolphi, 1819) Porta, 1908. 1. Male, 2. Proboscis enlarged, 3. Praesoma enlarged, 4. Female, 5. Row of proboscis hooks enlarged (after Murugesh, 1994).

53. Genus ***Filicollis*** Lühe, 1911

Filicollis Lühe, 1911 : 30; Southwell & Macfie, 1925 : 170; Meyer, 1932 : 73; Petrotschenko, 1958 : 154;
Parafilicollis Petrotschenko, 1958 : 154;
Filicollis Yamaguti, 1963 : 63-64; Golvan, 1994 : 157.

Diagnosis : Polymorphidae. Sexual dimorphism distinct. In females only or in both sexes, proboscis globose bulb, on apex of which hooks arranged radially. Trunk rather plump, with thick integument, spinose anteriorly in male only. Constriction of trunk present or absent. Hypodermal nuclei small, numerous. Lacunar system reticular. Neck long, slender, conspicuous. Proboscis receptacle double-walled, usually long, narrow, with ganglion moderately anterior to its base. Lemnisci very long, slender, occasionally digitiform. Testes contiguous or not, usually in midtrunk. Cement glands 4 or 6, pyriform to tubular. Eggs elliptical, without or with polar prolongations of middle shell. Parasites of aquatic birds.

Type species : *Filicollis anatis* (Schrank, 1788) Lühe, 1911.

Includes 2 species, 1. *Filicollis anatis* (Schrank, 1788) Lühe, 1911, and 2. *F. trophimenkoi* Atrashkevich, 1982, of which first one occurs in India

255. ***Filicollis anatis*** (Schrank, 1788) Lühe, 1911
(Fig. 228)

Echinorhynchus anatis Schrank, 1788 : 1-116;

Filicollis anatis Lühe, 1911 : 1-144; Meyer, 1932 : 73-75, Fig. 50, 51; Petrotschenko, 1958 : 154-157, Fig. 78, 79; Yamaguti, 1963 : 64, Fig. 242-244; Farooqi & Zafar, 1980 : 175-177, Fig. 1 a, b; Golvan, 1994 : 157.

Description : Worms of medium size; Males 10-12 × 0.5 mm; females 10-15 mm long, 2.5 mm in maximum width in mid metasomal region. Proboscis short oval 0.30-0.36 × 0.15 mm in male, in female characteristically provided with a slender neck, about 1.5 × 0.25 mm with a large, bulbous proboscis 0.25-0.5 mm in diameter, subsequently becoming inflated and spherical after acquiring deep penetration in host's mucosa and sub-mucosa. Proboscis armature radial star-shaped pattern of hooks, in longitudinal rows of 10-11 hooks each. Due to its inflated and bulbous nature, hooks initially situated in linear rows become disposed in radial pattern. Only in females post-eqatorial half of proboscis bulb fortified by an accessory cushion-like structure with about 40 continuous digitate muscular

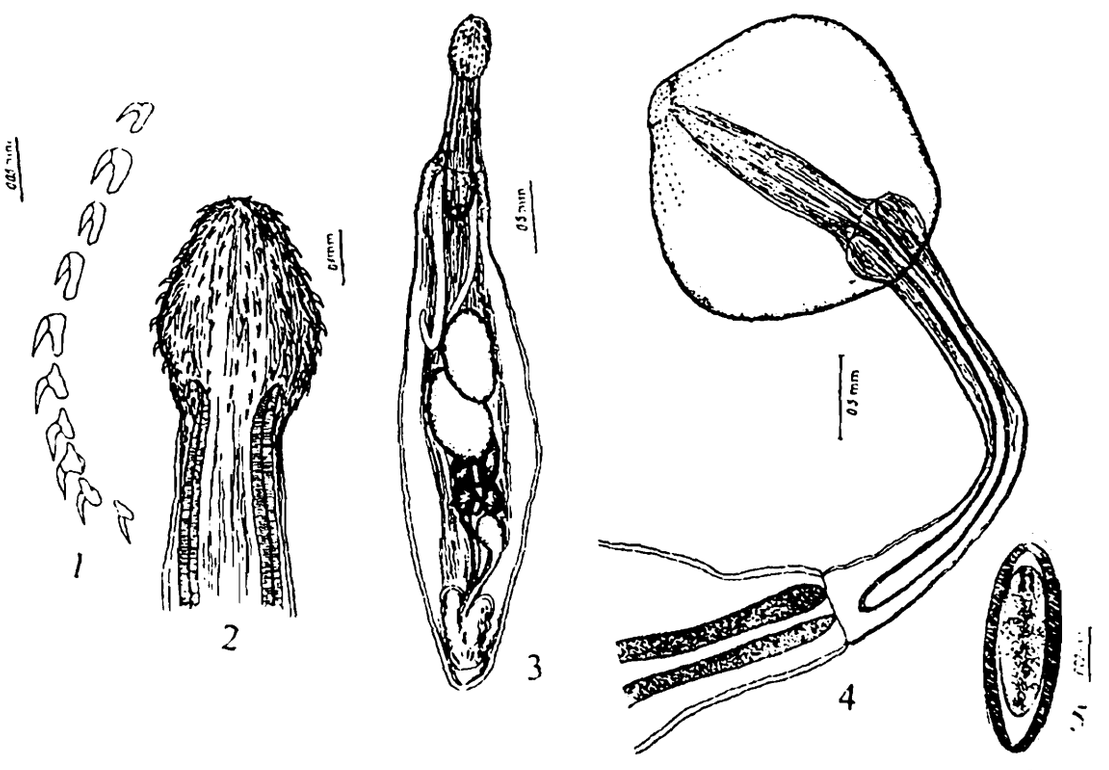


Fig. 228. *Filicollis anatis* (Schrank, 1788) Lühe, 1911. 1. Row of proboscis hooks enlarged, 2. Proboscis enlarged, 3. Male, 4. Anterior end of female, 5. Egg enlarged (after Petrochenko, 1958).

cripts, forming a compact basal corolla. Neck small conical truncate in males. Trunk plump, spinose in male only. Lemnisci digitiform longer than receptacle. Testis ovoid, in tandem in midtrunk.

Location : Intestine.

Distribution : Europe; Nigeria, Holaectic region.

54. Genus ***Polymorphus*** Lühe, 1911

Polymorphus Lühe, 1911 : 28; Souhwell & Macfie, 1925 : 168;
Profilicollis Meyer, 1932 : 73;
Polymorphus Meyer, 1933 : 7;
Hexaglandula Petrotschenko, 1950? : 98;
Parafilicollis Petrotschenko, 1956;
Polymorphus Petrotschenko, 1958 : 69;
Polymorphus Yamaguti, 1963 : 70-71;
Hexaglandula Yamaguti, 1963 : 77;
Polymorphus Amin, 1992 : 117-118; Golvan, 1994 : 172; Bhattacharya, 2007 : 148.

Diagnosis : Polymorphidae, Polymorphinae. Proboscis cylindrical, ovoid, spindle- or pear-shaped with short and long neck, or spheroid with very long neck, with variable number of longitudinal rows, which gradually decrease in size towards both ends. Roots of anterior hooks simple and well developed, those of posterior hooks reduced, rudimentary or absent. Proboscis receptacle double-walled and inserted at base of proboscis; with ganglion near its base or middle. Trunk small, plump, and anteriorly expanded with pronounced, shallow or without constriction, or cylindrical or pyriform. Anterior part of trunk with spines which may occasionally extend ventrally farther than dorsally. Lacunar system with main lateral longitudinal channels and reticular anastomoses. Lemnisci digitiform or clavate. Testes usually spheroid, contiguous, in tandem, oblique or opposite and in anterior half of trunk. Cement glands 4-6, usually tubular, occasionally clavate. Eggs fusiform with variably pronounced polar prolongations of middle shell or ovoid with membranes concentric without any prolongations. Gonopore terminal in both sexes, not spined. Parasites of aquatic and shore birds or occasionally of aquatic mammals and fish.

Type species : *Polymorphus minutus* (Goeze, 1782) Lühe, 1911.

Subgenus ***Polymorphus*** Lühe, 1911

Polymorphus Lühe, 1911 : 1-144; Amin, 1992 : 120;

Diagnosis : Polymorphidae, Polymorphinae. Trunk usually anteriorly expanded, sometimes elongate, with one or occasionally two or on constriction. Proboscis cylindrical, ovoid to ovoid-elongate, pyriform or spindle-shaped. Neck long or short. Trunk usually anteriorly expanded, sometimes elongate, with one, or occasionally two or no constrictions. Cement glands 4 or 6. Mature eggs usually with polar prolongations of middle membrane.

Type species : *Polymorphus* (*Polymorphus*) *minutus* (Goeze, 1783) Lühe, 1911.

Includes forty eight species, 1. *Polymorphus* (*Polymorphus*) *ariusis* (Bilqees, 1971) Amin, 1992, 2. *Polymorphus boschadis* (Schrank, 1788) Railliet, 1919, 3. *P.* (*P.*) *karachiensis* (Bilqeesm 1971) Amin, 1992, 4. *P.* (*P.*) *minutus* (Goeze, 1792) Luhe, 1911. .5. *P.* (*P.*) *nickoli* Khan & Bilqees, 1998, 6. *P.* (*P.*) *sindensis* Khan, Gazi & Bilqees, 2002, 7.. *P.* (P.) *actuganensis* Petrochenko, 1949, 8.. *P.* (*P.*) *acutis* Van Cleave & Starrett, 1940, 9. *P. altmmani* (Perry, 1942) Van Cleave, 1947, 10. *P. antarcticus* Zdzitowiecki, 1985, 11. *P.* (*P.*) *arcticus* (Van Cleave, 1929) Van Cleave, 1937, 12. *P.* (*P.*) *arctocephali* Smales, 1986, 13. *P.* (*P.*) *biziurae* Johnston & Edmonds, 1948, 14. *P* .(*P.*) *botulus* (Van Cleave, 1916) Witenberg, 1932, 15. *P.* (*P.*) *brevis* (Van Cleave, 1916) Travassos, 1926, 16. *P.* (*P.*) *cetaceum* (Johnston & Best, 1947) Schmidt & Dailey, 1971, 17. *P.* (*P.*) *chasmagnathi* Holeman-Spector, Nane-Carzon & Dei-Cas, 1977, 18. *P.* (*P.*) *cincli* Belopolskaja, 1959, 19. *P. contortus* (Bremser in Westrumb, 1821) Travassos, 1926, 20. *P.* (*P.*) *corynoides* Skrajabin, 1913, 21, *P.* (*P.*) *corynosoma* Travassos, 1915, 22. *P.* (*P.*) *crassus* Van Cleave, 1924, 23. *P.* (*P.*) *cucullatus* Van Cleave & Starrett, 1940, 24. *P.* (*P.*) *diploinflatus* Lundstrom, 1942, 25. *P.* (*P.*) *inermis* Travassos, 1923, 26. *P.* (*P.*) *kenti* Van Cleave 1947, 27. *P.* (P.) *kostylewi* Petrotschenko, 1949, 28. *P.* (*P.*) *magnus* Skrajabin, 1913, 29. *P.* (*P.*) *marchii* (Porta, 1910) Meyer, 1932, 30. *P. major* Lundstrom, 1942, 31. *P* (*P.*) *marilis* Van Cleave, 1939, 32. *P.* (*P.*) *mathevossianae* Petrotschenko, 1949, 33. *P.* (*P.*) *meyeri* Lundström, 1942, 34. *P.* (*P.*) *miniatus* (Linstow, 1896) Travassos, 1926, 35. *P.* (*P.*) *mutabilis* (Rudolphi, 1819) Travassos, 1926, 36. *P.* (*P.*) *obtusus* Van Cleave, 1918, 37. *P.* (*P.*) *paradoxus* Connell & Corner, 1957, 38. *P.*(*P.*) *paucihamatus* Heinze, 1936, 39. *P.* (P.) *phippsi* Kostylev, 1922, 40. *P.* (*P.*) *piriformis* (Bremser, 1811 in Rudolphi, 1819) Machalska, 1981, 41. *P.* (*P.*) *pupa* (Linstow, 1905) Kostylew, 1922, 42. *P.* (*P.*) *sphaericephalus* (Bremser in Rudolphi, 1819) Van Cleave, 1947, 43. *P.* (*P.*) *spindlatus* Amin & Heckmann, 1991, 44. *P.* (*P.*) *striatus* (Goeze, 1782) Lühe, 1911, 45. *P.* (*P.*) *strumosoides* Lundström, 1942, 46. *P.* (*P.*) *swartzi* Schmidt, 1965, 47. *P.* (*P.*) *texensis* Webster, 1948, and 48. *P.* (*P.*) *trochus* Van Cleave, 1945, of which first six species occur in this subcontinent.

Key to Indian species of subgenus *Polymorphus*

1. Proboscis hooks in 10 longitudinal rows of 16 each ..... *Polymorphus* (*Polymorphus*) *nickoli*

– Proboscis hooks in more than 10 longitudinal rows 2

2. Proboscis hooks in 14 longitudinal rows of 16 each ..... *Polymorphus*(*Polymorphus*) *sindensis*

– Proboscis hooks in 14-16 longitudinal rows of 8-9 hooks each ..... *Polymorphus* (*Polymorphus*) *minutus*

– Proboscis with 16 or more longitudinal rows of hooks 3

3. Proboscis hooks in 16 longitudinal rows ..... *Polymorphus* (*Polymorphus*) *ariusis*

– Proboscis hooks in 18 longitudinal rows ..... *Polymorphus* (*Polymorphus*) *karachiensis*

Note : *Polymorphus* (*Polymorphus*) *boschadis* is not included in the key.

256. ***Polymorphus* (*Polymorphus*) *ariusis*** (Bilqees, 1971) Amin, 1992 (Fig. 229)

Hexaglandula ariasis Bilqees. 1971 : 57-59. Fig. 1 A-D; Bilqees & Khan, 1987 : 20-21, Fig. 30 a-d; Gupta, V. & Sinha, 1990b : 55.

Polymorphus ariasis (Bilqees. 1971) Amin, 1992 : 118;

Hexaglandula ariasis Golvan, 1994 : 172.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Worms of medium size. Male 7.3-7.6 × 0.8-0.9 mm, female 7.8-8.0 mm long, wider than males. Maximum width of body at leminiscular region. Proboscis

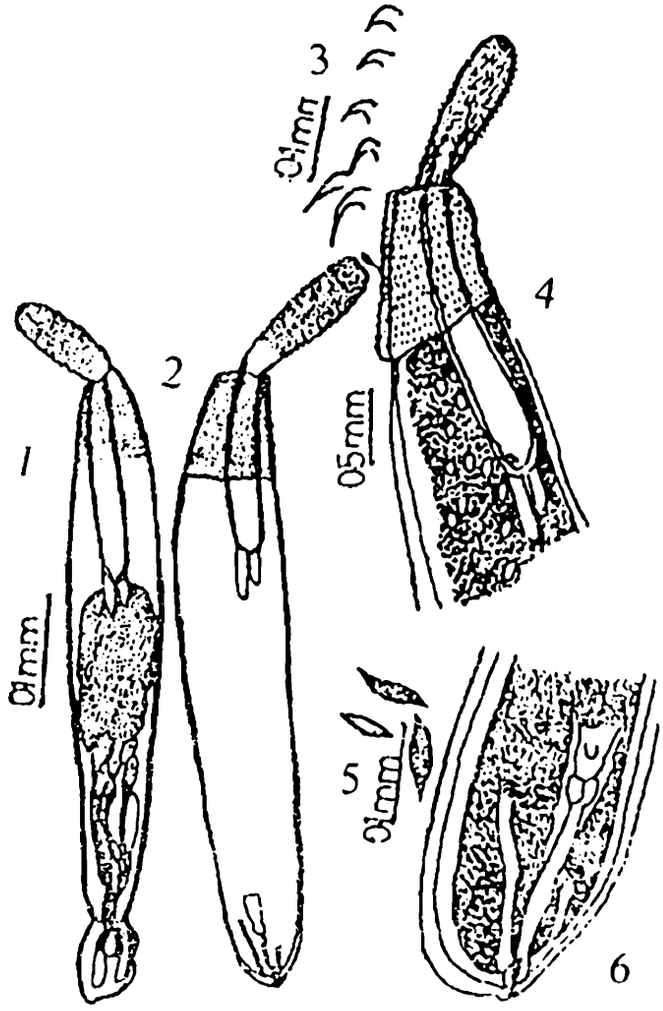


Fig. 229. *Polymorphus* (*Polymorphus*) *ariusis* Bilqees, 1971. 1. Male, 2. Female, 3. Row of proboscis hooks enlarged, 4. Anterior part of female, 4. Eggs, 5. Posterior part of female (after Bilqees, 1971).

cylindrical but swollen anteriorly, 1.0-1.4 × 0.3-0.4 mm in both sexes, with 16 longitudinal rows of hooks. Posterior hooks near neck large. Collar with 16 rows of small spines, which are distinctly marked off rest of body. Proboscis receptacle elongated, saccular, 1.8-1.9 × 0.250-0.255 mm in both sexes. Trunk elongate, fusiform. Lemnisci subequal, longer than receptacle, 1.9-2.1 mm long Testes large, unequal, located at midtrunk, 0.70-0.85 mm wide. Anterior testis larger than posterior testis. Cement glands 6, tubular, dilated anteriorly, 1.0-1.4 mm long. Bursa well developed, with three distinct parts, 0.70-0.80 × 0.55-0.58 mm. Uterine bell 0.5-0.6 mm long. Uterus and vagina located in posterior quarter of trunk with terminal gonopore. Eggs elongated with polar prolongations of middle shell, 0.05-0.08 mm long.

Host : *Arius serratus* Day.

Location : Intestine.

Locality : Karachi coast, Pakistan.

Distribution : Known only from type locality.

257. ***Polymorphus boschadis*** (Schrank, 1788) Railliet, 1919

Echinorhynchus boschadis Schrank, 1788 : 1-144;

Polymorphus boschadis (Schrank, 1788) Railliet, 1919 : 185-198; Yamaguti, 1963 : 71, Pl. 28, Fig. 282-284; Srivastava, 1971 : 92;

Description : The publication containing the description and figures of this species could not be procured.

Host : Ducks and poultry.

Location : Intestine,

Locality :

Distribution : North Eurasia.

258. ***Polymorphus (Polymorphus) karachiensis*** (Bilqees, 1971). Amin, 1992 (Fig. 230)

Hexaglandula karachiensis Bilqees, 1971 : 59-61, Fig. 2 A-D; Bilqees & Khan, 1987 : 20, Fig. 29 a-e; Gupta, V. & Sinha, 1990b: 55.

Polymorphus karachiensis (Bilqees) Amin, 1992: 118.

Hexaglandula karachiensis Golvan, 1994: 160.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Male 8.65 × 0.68 mm. Proboscis long-cylindrical, swollen posteriorly, 1.80 × 0.25 mm with 18 longitudinal rows of hooks. All hooks of same size, wider at base. Collar with 16 rows of pointed almost conical spines. Proboscis receptacle elongated 2.6

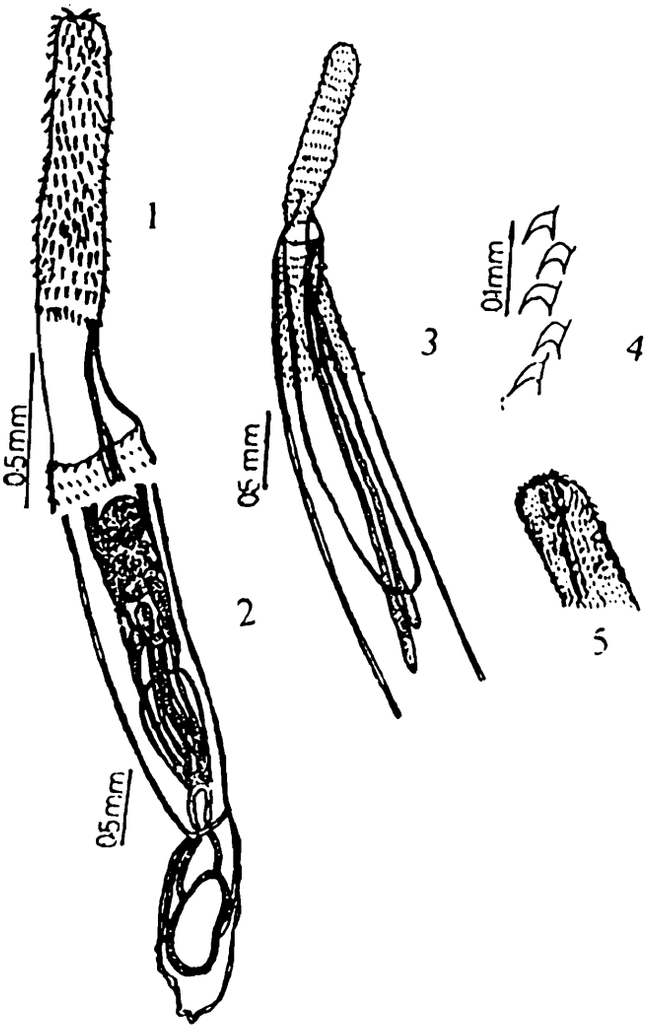


Fig. 230. *Polymorphus* (*Polymorphus*) *karachiensis* (Bilqees, 1971) Amin, 1992. 1. Anterior part of male, 2. Posterior part of male, 3. Anterior part of worm, 4. Proboscis hooks enlarged, 5. Proboscis (after Bilqees, 1971).

× 0.40 mm. Trunk elongated cylindrical. Lemnisci unequal, slender, shorter lemniscus 2.80 mm long, longer lemniscus 3.20 mm long. Testes rounded 0.30 × 0.35 mm. Cement glands 6, tubular anteriorly expanded, 1.25-1.50 mm long. Bursa well developed, 1.25 × 0.55 mm. Female not known.

Host : *Arius serratus* Day.

Location : Intestine.

Locality : Karachi coast, Pakistan.

Distribution : Known only from type locality.

259. ***Polymorphus* (*Polymorphus*) *minutus*** (Goeze, 1782) Luhe, 1911 (Fig. 231)

Polymorphus minutus Fotedar & Dhar, 1973 : 55-56; Bhattacharya, 2003 : 87-91; 2007 : 148-150, Pl. 24, Fig. 134 a-e.

Type locality : Tierra del Fuego.

Description : Male small, fusiform, 5.875 × 1.125 mm. Female 8. 125-8.30 × 1.70-1.75 mm. Proboscis 0.55 × 0.32 mm with 14-16 longitudinal rows of 8-9 hooks each; anterior 4 hooks in each row large and with prominent roots; size of hooks 0.0.0415-0.0585 × 0.0166-0.0249 mm. Proboscis receptacle double-walled, 1.25-0.375 mm long with ganglion near centre. Lemnisci longer than proboscis receptacle, 1.625 × 0.20 mm. Testes contiguous, anterior 2.25 × 0.425 mm, posterior 2.125 × 0.425 mm. Cement glands 4. Eggs elliptical, 0.058-0/17 × 0.0166 mm with polar prolongations of middle shell.

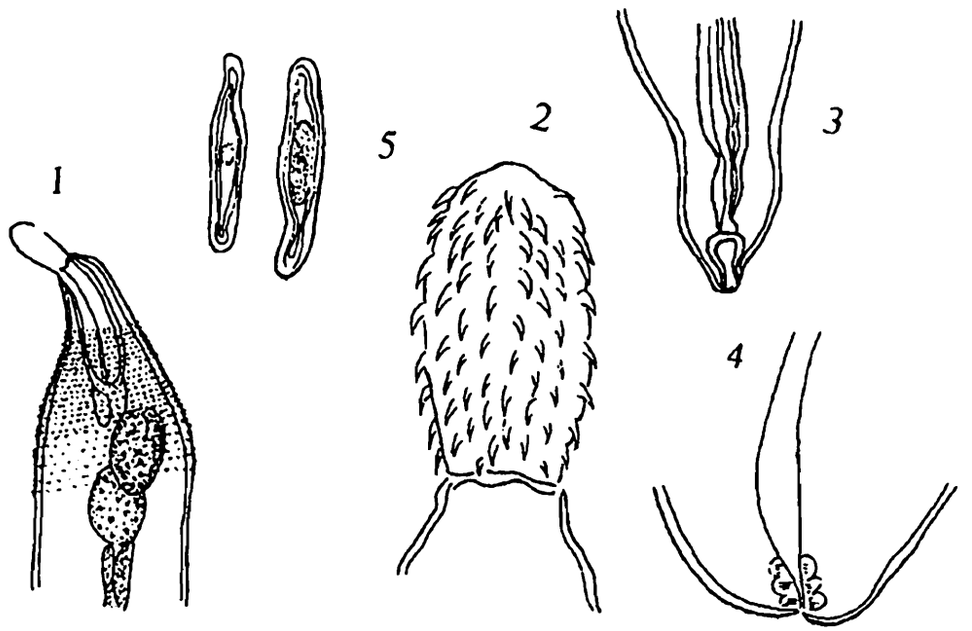


Fig. 231. *Polymorphus* (*Polymorphus*) *mintus* (Goeze, 1782) Lühe, 1911. 1. Anterior part of male, 2. Posterior enlarged, 3. Posterior part of male, 4. Posterior part of female, 5. Ovaum enlarged (after Bhattacharya, 2007).

Host : *Anas quercudula,* juvenile in *Rana cynophylictis,* Garganey teal.

Location : Intestine.

Locality : Allahabad (Uttar Pradesh); Kashmir,

Distribution : Tierra del Fuego.

260. ***Polymorphus (Polymorphus) nickoli*** Khan & Bilqees, 1998 (Fig. 232)

Polymorphus nickoli Khan & Bilqees, 1998: 35-37, Fig. 1 A-C.

Type locality : Oderolal Station, Sindh, Pakistan.

Description : Worms white in color in life. Male 10.12-10.16 × 1.22-1.26 mm, female 8.47-11.93 × 1.24-2.18 mm. Proboscis small, ovoid, 0.26-0.46 × 0.21-0.32 mm in male; in

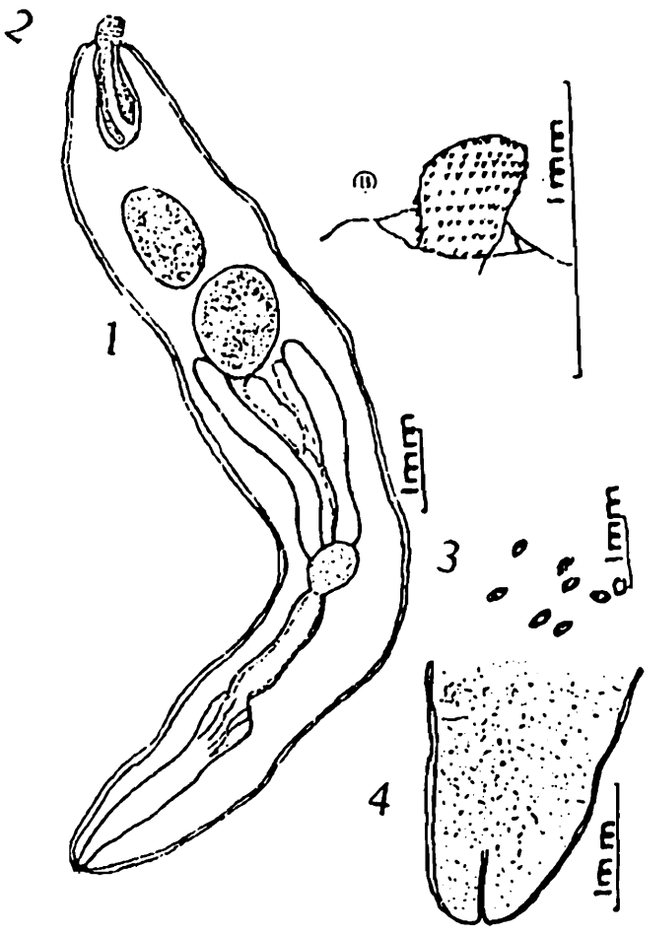


Fig. 232. *Polymorphus* (*Polymorphus*) *nickoli* Khan & Bilqees, 1998. 1. Male, 2. Proboscis enlarged, 3. Eggs, 4. Posterior part of female (after Khan & Bilqees, 1998).

female 0.26-0.46 × 0.24-0.32 mm, with 10 rows of 16 hooks each in both sexes. Anterior rows with smaller hooks, middle rows with larger hooks and posterior hooks with smaller hooks. Number and size of hooks similar in both sexes. Hooks 0.024-0.037 × 0.011-0.014 mm. Proboscis receptacle double-walled, arise from base of proboscis, 0.86-0.98 × 0.34-0.36 mm in male; in female 0.88-0.98 × 0.34-0.38 mm. Neck distinct, short, 0.075-0.22 × 0.21-0.42 mm in male; in female 0.078-0.22 × 0.21-0.42 mm. Lemnisci small, short, 0.70-0.84 × 0.12-0.13 mm in male; in female 0.67-0.88 × 0.12-0.13 mm. Testes unequal in anterior half of trunk, both measuring 1.04-1.144 × 0.52-0.67 mm. Cement glands 4, tubular, beginning immediately behind posterior testis, 1.32-2.38 × 0.34-0.446 mm, its reservoir elongated, 1.09-1.44 × 0.27-0.35 mm. Bursa prominent with a bursal cap, 1.64-2.29 × 0.32-0.344 mm. Eggs numerous 0.033-0.037 × 0.012-0.014 mm with polar prolongations of middle shell. Gonopore terminal.

Host : *Corvus splendens* (Vieillot).

Location : Small intestine.

Locality : Oderolal station, Sindh (Pakistan).

Distribution : Known only from type locality.

261. ***Polymorphus (Polymorphus) sindensis*** Khan, Gazi & Bilqees, 2002 (Fig. 233)

Polymorphus sindensis Khan, Gazi & Bilqees, 2002 : 145, Fig. 4 A-DC, 5-8.

Type locality : Oderolal Station, Sindh, Pakistan.

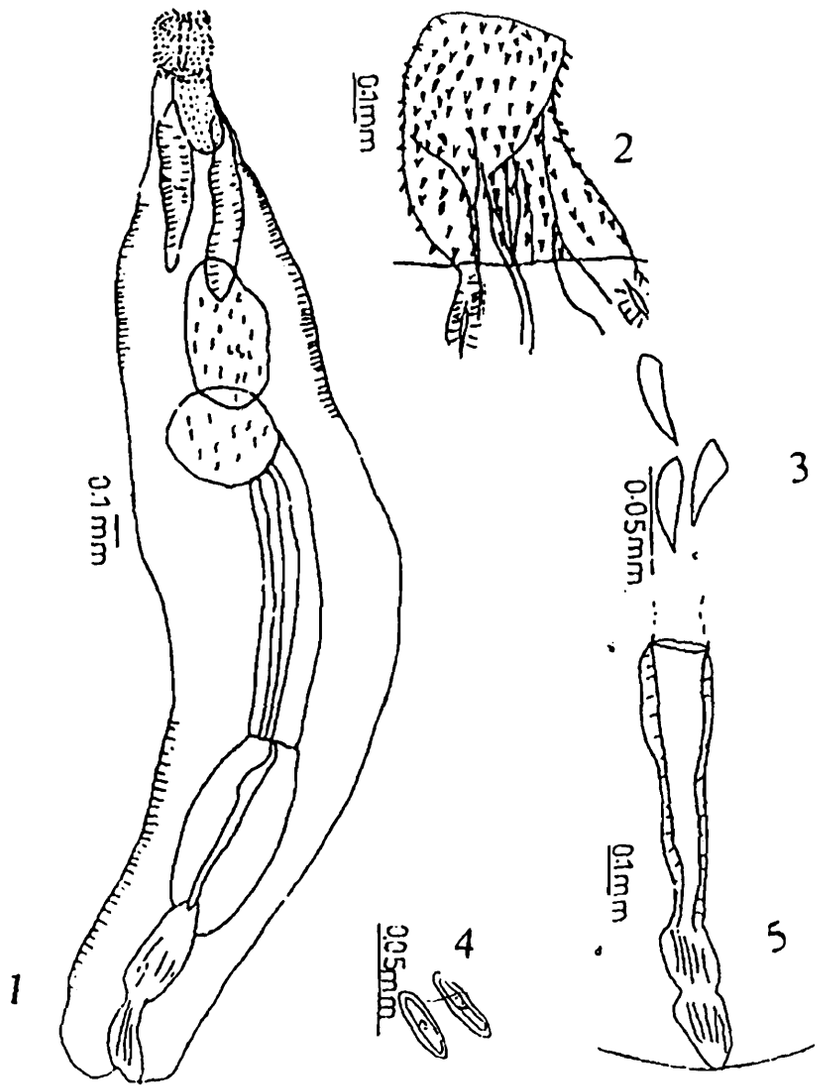


Fig. 233. *Polymorphus* (*Polymorphus*) *sindensis*. 1. Male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged, 4. Eggs enlarged, 5. Female genitalia (after Khan, Gazi & Bilqees, 2002).

Description : Male 5.48 × 1.28 mm, female 16.44 × 2.88 mm. Proboscis small, 0.33 × 0.24 mm in male, in female 1.08 × 0.48 mm, with 14 longitudinal rows of 16 hooks each in both sexes. Hooks 0.038-0.039 × 0.011-0.012 mm. in male; in female 0.038-0.040 × 0.010-0.011 mm. Hooks with simple roots. Neck short, 0.015 × 0.027 mm in male; in female 0.24 × 0.92 mm. Proboscis receptacle double-walled, inserted at base of proboscis, 0.81 × 0.21 mm in male, in female 2.76 × 0.72 mm; with central ganglion. Trunk elongate. Lemnisci subequal, longer than receptacle 0.99 × 0.16 mm; right one 1.2 × 0.18 mm in

male, in female left one 3.2 × 0.84 mm, right one 4.2 × 0.80 mm. Testes ovoid, somewhat contiguous at a distance of 0.075 mm from proboscis receptacle, anterior testis 0.54 × 0.42 mm, posterior 0.52 × 0.46 mm. Cement glands 4, tubular, 0.9 × 0.43 mm. Bursa 1.02 × 0.39 mm. Ovarian balls numerous, 0.40-0.44 × 0.20-0.24 mm. Anterior edge of uterus to genital pore measure 1.57 × 0.12 mm. Eggs oval, 0.039-0.041 × 0.011-0.013 mm.

Host : *Corvus splendens* (Vieillot).

Location : Small intestine.

Locality : Oderolal station, Sindh (Pakistan).

Distribution : Known only from type locality.

C. Class EOACANTHOCEPHALA Van Cleave, 1936

Eoacanthocephala Van Cleave, 1936b : 294-295; Yamaguti, 1963 : 2, 30; Bhattacharya, 2007 : 41.

Diagnosis : Proboscis hooks radially arranged without pronounced asymmetry on various surfaces. Hook formula constant for most species. Proboscis receptacle single-walled. Embryos ellipsoidal, membranes not heavy. Lacunar system with dorsal and ventral longitudinal channels. Body covering with or without cuticular spines. Subcuticula with a few ovoidal or amoeboid giant nuclei. Ligament sacs of females usually distinct, one dorsal and one ventral. Specialised protonephridia absent. Cement gland of male single, syncytial mass containing giant nuclei. Embryos ellipsoidal, membranes not heavy. All definitive hosts aquatic and with exception of one species (*Neoechinorhynchus emydis*) parasites of digestive tract of fishes. Cosmopolitan in distribution.

This class includes two orders, Gyracanthocephala Van Cleave, 1936 and Neoacanthocephala, both occur in this subcontinent.

Key to orders of class EOACANTHOCEPHALA

– Eoacanthocephala without trunk spines ..... Order GYRACANTHOCEPHALA

– Eoacanthocephala with trunk spines ..... Order NEOACANTHOCEPHALA

Order GYRACANTHOCEPHALA Van Cleave, 1936

Gyracanthocephala Van Cleave, 1936b : 297; Yamaguti, 1963 : 2; Bhattacharya, 2007 : 41.

Diagnosis : Eoacanthocephala with tgenerally small or medium size, covered to greater or lesser degree with spines. Hypodermal nuclei giant, circular or ramified, rarely with numerous nuclear fragments. Lacunar system reticulate, without clearly expressed main channels. Proboscis receptacle sacciform, single-walled. Cement glands syncytial with a certain number of nuclei. Eggs small, oval, without protrusions of membranes at poles. Embryo oval, without hooks or spines. Parasites of freshwater and marine fishes.

Type family : Quadrigyridae Van Cleave, 1920.

Includes single family Quadrigyridae Van Cleave, 1920, which occurs in this subcontinent.

17. Family QUADRIGYRIDAE Van Cleave, 1920

Diagnosis : Gyracanthocephala. Proboscis globular or elongate with a few spiral rows of hooks. Proboscis receptacle single-walled with basal ganglion. Trunk small, delicate, covered with spines, generally in anterior region, or may extend to midtrunk. Hypoderamal nuclei large and few or small and numerous. Lacunar system with or without main channels, reticular or not. Lemnisci long, filiform, short or saccate, or claviform. Cement gland syncytial. Eggs small, rounded or elliptical. Parasites of fresh water and marine fishes.

Type genus : Quadrigyrus Van Cleave, 120.

Includes two subfamilies Pallisentinae and Quadrigyrinae, both occur in this subcontinent.

Key to subfamily of family QUADRIGYRIDAE

– Anterior trunk with circles of spines, usually incomplete dorsally ..... QUADRIGYRINAE

– Anterior trunk with complete circles of spines, in one or two zones separated by aspinose gaps, spines of second zone may extend over rest of trunk in circles or longitudinal rows ..... PALLOSENTINAE

Subfamily PALLISENTINAE Amin, 1985

Key to the genera of subfamily PALLISENTINAE

1. Proboscis with 3 circular rows of hooks 2

– Proboscis with 4 circular rows of hooks 3

2. Trunk spines divided into two separate groups, anterior group in circular rows and posterior group in longitudinal rows ..... *Acanthogyrus*

– Trunk spines closely set in anterior part and wide apart posteriorly ..... *Acanthosentis*

3. Anterior trunk with close set spines followed by widely set spine extending to posterior end ..... *Pallisentis*

– Anterior trunk with 16-17 circular rows of rose-thorn like spines ..... *Raosentis*

55. Genus ***Acanthogyrus*** Thapar, 1927 emend Farooqi, 1989

Acanthogyrus Thapar, 1927 : 112-113; Petrotschenko, 1956 : 236; Yamaguti, 1963 : 28; Rai, 1967 : 28-29; Anantaraman, M. & Anantaraman, S., 1970 : 2; Verma, 1975 : 177-178; Farooqi, 1989 : 158; Golvan, 1994 : 137; Bhattacharya, 2007 : 54.

Diagnosis : Quadrigyridae, Pallisentinae. Proboscis oval or oblong, with 3 circles of 4-8 hooks each, apicals largest, size gradually decreasing in length antero-posteriorly. Trunk slender, spinose, trunk spines extending posteriorly up to gonopore. Lacunar system with regular circular vessels. Lemnisci spatulate or digitiform, longer than proboscis receptacle. Testes in tandem, in posterior half of trunk. Cement glands single, syncytial with a few large nuclei, its reservoir with single efferent duct. Seminal vesicle usually with a paired accessory distal pyriform ampullae. Bursal rays rudimentary. Uterine bell goblet-shaped. Female gonopore subterminal. Parasites in fresh water fishes.

Type species : *Acanthogyrus acanthogyrus* Thapar, 1927.

Note : Farooqi (1989) synonumized *Acanthogyrus tripathii* Rai, 1967 and *A. guptai* Gupta & Verma, 1976 with A. *acanthogyrus* Thapar, 1927.

Includes single species, *Acanthogyrus acanthogyrus* Thapar, 1927 which occurs in the subcontinent.

262. ***Acanthogyrus acanthogyrus*** Thapar, 1927 (Fig. 234)

Acanthogyrus acanthogyrus Thapar, 1927 : 110-113; Fig. 1-6; Datta & Poddar, 1935 :

Acanthogyrus (Acanthogyrus) tripathii Deo, 1950 : 244; Sarkar, 1956 : 359-362;

Acanthogyrus acanthogyrus Yamaguti, 1963 : 28, Pl. 8, Fig. 68-71;

Acanthogyrus (Acanthogyrus) tripathii Rai, 1967 : 29-32, Fig. 1-7;

Anantaraman, M. & Anantaraman, S. 1970: 2; Rai, 1971 : 127; 231-233, Textfig. 1-3, Pl. 5, Fig. 1-3;

Acanthogyrus guptai Gupta. S. P. & Verma. 1976 : ——

Acanthogyrus acanthogyrus Ahmed & Begum, 1978; 52; Ahmed & Rauf, 1981 : 17; Ahmed, 1981 : 230; Gupta, V. & Fatma, 1986a : 148, Pl. 3, Fig. 1-4; Golvan, 1994 : 137.

Acanthogyrus acanthogyrus Farooqi, 1989 : 158-161, Fig. 1-7;

Acanthogyrus (Acanthogyrus) acanthogyrus, Gupta, V. & Sinha, 1990b : 46;

Acanthogyrus (Acanthogyrus) tripathii Gupta, V. & Sinha, 1990b : 46;

Acanthogyrus (Acanthogyrus) acanthogyrus, Arthur & Ahmed, 2002 : 39.

Acanthogyrus acanthogyrus Bhattacharya, 2007 : 55, Pl. 10, Fig. 40 a-d.

Acanthogyrus tripathii Bhattacharya, 2007 : 55-56, Fig. 41 a-e.

Acanthogyrus guptai Bhattacharya, 2007 : 57, Pl. 10, Fig. 42 a-c.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 6.0-12 × 1.5-2.0 mm. Female 12.0-12.50 × 2.0-2.5 mm. Proboscis short, oblong, often withdrawn into body, 0.12-0.15 × 0.10 mm, with 3 circles of 6-8 hooks

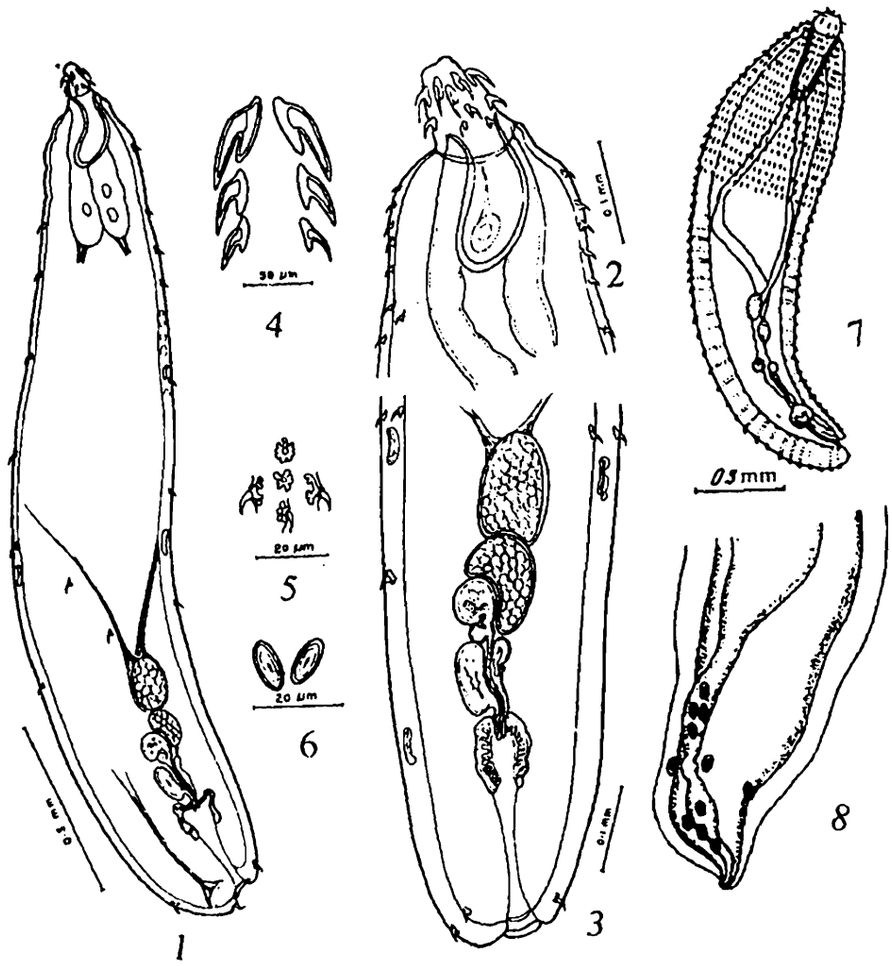


Fig. 234. *Acanthogyrus acanthogyrus* Thapar, 1927. 1. Male, 2. Anterior part of male, 3. Posterior part of male, 4. Proboscis hooks enlarged, 5. Trunk spines, 6. Ova, 7. Female, 8. Posterior part of female (1-6 after Farooqi, 1987, 7,8 after Thapar, 1927).

each. Hooks of first row 0.060.065 mm long, of second row 0.040-0.045 mm long, of third row 0.040-0.042 mm long in male; in female I, II and III rows with 0.060-0.075 mm with root 0.040-0.05 mm, 0.04-0.05 mm with root 0.030 mm long, and 0.03-0.045 mm with root 0.04 mm long respectively. Proboscis receptacle cylindrical, single-walled, muscular sac, extending into trunk pseudocoel, with ganglion near its base, 0.60 × 0.25 mm in male; in female 0.75 × 0.15 mm, ganglion sends out fine branches, retinacula to body wall. Neck short, conical, wider at base 0.10 × 0.10-0.25 mm, Trunk club-shaped and swollen anteriorly, armed with regular rows of minute curved spines, and stellate bases, each spines 0.020 mm long, disposed in two successive zones of circular rows, anterior with 8-12 complete rows of 32-40 spines each, followed after a short gap, by 20-24 rows of about 48 minute spines each in midtrunk region, thence gradually becoming sparse posteriorly, only a few extending up to genital pore in both sexes. Lacunar system with main lateral longitudinal channels and reticular anastomoses. Lemnisci long, narrow, unequal, shorter 1.25-1.5 mm long, larger 1.70-1.75 × 0.10-0.12 mm in male; in female shorter lemniscus 1.0-1.06 × 0.40-0.45 mm, each with a large nucleus in male. Testes

subequal, overlapping, occupying posterior part of trunk, anterior 0.75-0.80 × 0.55-0.60 mm, posterior 0.62-0.65 × 0.55-0.62 mm. Vasa efferentia from testes unite to form vas deferens and terminates at base of rudimentary penis. Duct from sac-like seminal vesicle joins vas deferens. Cement glands 2, oval or spherical, unequal, smaller gland 0.20-0.22 × 0.08-0.085 mm, larger gland 0.25-0.26 × 0.19-0.20 mm with 6-8 large nuclei. Cement reservoir oval or pyriform, 0.4 × 0.45 mm with single duct 0.65 m long end at base of penis. Saefftigen's pouch pyriform, 0.45-0.49 × 0.27-0.35 mm. Seminal vesicle bean-shaped, 0.30-0.32 × 0.16-0.20 mm. Bursa eversible, muscular, 0.25-0.40 × 0.35-0.38 mm. Uterine bell goblet-shaped, 0.5 × 0.1 mm, opening into thick, muscular uterus with a pair of flask shaped cells at its posterior end, and a big nucleus in its wall. Vagina funnel-shaped, short, thick-set with sphincter of 0.07 mm in diameter end in subterminal, sinistral with antero-dorsal and antero-ventral genital spines. Eggs ovoidal, 0.040-0.050 × 0.020-0.025 mm.

Host : *Labeo rohita* (Hamilton); *L. bata* (Hamilton), *Catla catla* Hamilton-Buchanan, *Cirrhina* sp.

Location : Intestine.

Locality : Lucknow, Bareilly (Uttar Pradesh), Kolkata (West Bengal); Dhaka (Bangladesh).

Distribution : Known only from Indian suncontinent.

Remarks : Farooqi (1989) synonymized *Acanthogyrus guptai* Gupta & Verma, 1977 and *Acanthogyrus tripathii* Rai, 1967 with *Acanthogyrus acanthogyrus* Thapar, 1927.

56. Genus ***Acanthosentis*** Verma & Datta, 1929

Acanthosentis Verma & Datta, 1929 : 483-484; Textfig. 1, 2; Meyer, 1932 : 35; Petrotschenko, 1956 : 246-247; Yamaguti, 1963 : 32-33; Rai, 1967 : 35-37; Gupta, V. & Fatma, 1986 : 157; Golvan, 1994 : 138; Bhattacharya, 2007 : 45.

Diagnosis : Quadrigyridae, Pallisentinae. Proboscis short, globular to cylindrical with 3 circular rows of 6 single-rooted hooks each. Proboscis receptacle cylindrical, single-walled, muscular with ganglion close to its base. Trunk small, curved ventrad, with 20-31 rings of closely set spines on anterior 2/5 of its length, but wide apart as they proceed backwards; posterior trunk usually aspinose, especially in mature specimens. Hypodermal nuclei few, oval or branched, exclusively median. Lacunar system reticular with prominent transverse vessels. Lemnisci slender, cylindrical to claviform, longer than receptacle. Testes nearly rounded, in tandem, contiguous in posterior part of trunk. Cement gland round, syncytial, with several nuclei. Uterine bell with ventral anterior opening. Uterus with 6-8 short diverticula. Vagina narrow with 2 glands. Eggs elongate with 3 concentric membranes. Gonopore of female ventro-terminal. Adults parasitic in fishes.

Type species : *Acanthosentis antespinus* Verma & Datta, 1929.

Includes forty two species, 1. *Acanthogyrus antespinus* Verma & Datta, 1929, 2. *A. arii* Bilqees, 1971, 3. *A. bacalai* Verma, 1973, 4. *A. betwai* Tripathi, 1959, 5. *A. bilaspurensis* Chowhan, Gupta, N.K & Khera, 1988, 6. *A. cammersoni* Gupta, N.K. & Kajaji, 1969, 7. *A. cotai* Agarwal & Kajaji, 1986. 8. *A. dattai* Poddar, 1938, 9. *A. giuris* Soota & Sen, 1956, 10. *A. gobindi* Chowhan, Gupta, N.K. & Khera, 1987, 11. *A. golvani* Gupta, N.K. & Jain, 1980, 12. *A. heterospinus* Khan & Bilqees, 1990, 13. *A. hilsai* Pal, 1963, 14. *A. holospinus* Sen, 1938, 15. *A. indicus* Tripathi, 1959, 16. *A. oligospinus* Anantaraman, 1980, 17. *A. putitorae* Chowhan, Gupta, N.K. & Khera, 1988, 18. *A. seenghalae* Chowhan, Gupta, N.K. & Khera, 1988, 19. *A. shuklai* Agarwal & Singh, 1982, 20. *A. sircari* Poddar, 1941, 21. *A. thapari* Prasad, Sahay & Nath, 1969, 22. *A. tilapiae* Baylis, 1948, 1956, 23. *A. vancleavei* Gupta, V. & Fatma, 1986, 24. *A. vittatusi* Verma, 1978, 25. *A. acanthuri* Cable & Quick, 1954, 26. *A. alternatspinus* Amin, 2005, 27. *A. anguillae* Wang, 1981, 28. *A. intermedius* Achmerov & Dombreskaja-Achmerova, 1941, 29. *A. lizae* Wang, 1963, 30. *A. maroccanus* Dollfus, 1951, 31. *A. malawiensis* Amin & Hendrix, 1999, 32. *A. multispinus* Wang, 1966, 33. *A. nigeriensis* Dollfus & Golvan, 1956, 34. *A. papilo* Troncy & Vassilliades, 1974, 35. *A. pararecptaclis* Amin, 2005, 36. *A. partispinus* Furtudo, 1963, 37. *A. paucispinus* Wang Pu Qin, 1966, 38. *A. periophthalmi* Wang, 1980, 39. *A. scromberomori* Wang, 1980, 40. *A. shashiensis* Tso, Chen & Chien, 1974. 41. *A. siamensis* Farooqi & Srikanchana, 1987 and 42. *A. similis* Wang, 1980, of which first twenty four species occur in this subcontinent.

Key to Indian species of genus *Acanthosentis*

1. Spines comb-like covering whole trunk. ..... *Acanhtosentis arii*

– Trunk spines not comb-like 2

2. Hooks in posterior circle larger than middle circle ..... *Acantosentis heterospinus*

– Hooks in 2 or 3 circles equal in length 3

– Hooks increase in length from anterior to posterior circle 4

3. Hook length in I : 0.050, in II : 0.040, in III : 0.040 mm. spines large, rose-thorn like with discoid base ..... *Acanthosentis oligospinus*

– Hook length in I : 0.033, in II : 0.024-0.028, in III : 0.028 mm in males, in females I : 0.032-0.036, in II : 0.024-0.028, in III : 0.024-0.028 mm ..... *Acanthosentis bilaspurensis*

4 Proboscis hooks in anterior 2 circles smaller than 0.032 mm long 5

– Proboscis hooks in anterior circles larger than 0.041 mm long. 6

5. Proboscis 0.10-0.18 × 0.10-0.12 mm. Hooks in I: 0.029, in II : 0.029, in III : 0.020 mm long. Trunk spines in 10-15 circles ..... *Acantosentis hilsai*

– Proboscis 0.08-0.15 × 0.07-0.08 mm. Hooks in I : 0.021-0.031, in II : 0.020-0.031, in III : 0.015-0.020 mm long. Trunk spines in 22-26 circles ..... *Acantosentis baicalai*

6. Vagina with 1 pair of prominent club-shaped glands distally. Spines covering whole trunk 7

– Vaginal glands absent, other characters vary 8

7. Giant hypodermal nuclei 1 dorsal, 1 ventral. Uterus with prominent coil near uterine bell ..... *Acanthosentis thapari*

– Giant hypodermal nuclei 4-6 dorsal, 2 ventral. Uterus not coiled .....
Acanhtosentis dattai

8. Spines covering entire or almost entire trunk 9

– Spines restricted to anterior half of trunk 10

9. Posterior most spines near posterior tip of female trunk, Proboscis 0.20 × 0.18 mm, Lemnisci miniscule, narrow, shorter than receptacle ..... *Acanthosentis shuklai*

– Posteriormost spines near posterior tip of male trunk. Proboscis small. Lemnisci longer than receptacle 12

10. Proboscis 0.127-0.138 × 0.127 mm. worms large, 9 mm long. Trunk spines in 30-43 circle ..... *Acanthosentis betwai*

– Proboscis up to 0.10 × 0.05 mm. Worms 3.9-5.6 × 1.2 mm in males, in females 6.03-7.12 × 1.27-1.60 mm. Anterior hooks 0.050 mm long ..... *Acanthosentis holospinus*

11. Trunk with up to 10 circles at anterior end 14

– Trunk spines with 10-13 circles of spines in anterior third to half 15

– Trunk spines in 7-8 circles anteriorly. Giant hypodermal nuclei 10-12 dorsal, 3-4 ventral ..... *Acanthosentis gobindi*

– Trunk spines in 7-10 circles anteriorly. Giant hypodermal nuclei 6-8 dorsal, 2-3 ventral .....
Acantosentis putitorae

12. Proboscis as long as wide. Trunk spines in 12-14 circles. Lemnisci baloon-shaped. Cement glands with 6-11 giant nuclei ..... *Acanthosentis seenghalae*

– Proboscis not as long as as wide. Circles of trunk spines variable. Lemnisci not balloon shaped. Cement glands with up to 8 giant nuclei 16

13. Trunk with 23 circles of spines ..... *Acanthosentis giuris*

– Spines in 51-54 circles in male, 59 circles in female covering all over trunk closely set anteriorly ..... *Acanthosentis golvani*

– Circles of trunk spines variable 17

14. Lemnisci unequal 18

– Lemnisci equal or subequal 19

15. Proboscis cone-shaped, widest at base. Proboscis hooks not decreasing much in size posteriorly, hooks of I: 0.055, of II: 0.050, of III: 0.040 mm long in males, in females 0.060- 0.061, 0.045-0.060, 0.030-0.035 mm long ..... *Acanthosentis vancleavei*

– Proboscis ovoid, 0.138 × 0.115. Proboscis hooks decreasing abruptly in size, hooks in I : 0.055, in II: 0.048, in III: 0.015 mm long. Lemnisci with 3 giant nuclei .... *Acanthosentis sircari*

16. Proboscis hooks large, anterior 0.072, middle 0.054, posterior 0.048 mm long, Trunk spines in 20-21 circles ..... *Acanthosentis antespinus*

– Proboscis hooks smaller, length of hooks smaller. Trunk spines in 0-12 circles .. 20

17. Giant hypodermal nuclei many, up to 9 dorsal, 6 ventral, in groups of 2-4 adjacent nuclei. Cement glands small ..... *Acanthosentis vittatusi*

– Giant hypodermal nuclei fewer, 2-8 not clustered in groups. Cement gland markedly longer 21

18. Giant hypodermal nuclei, 1-2 dorsal, 1 ventral. Cement gland 0.13-0.36 × 0.10-0.32 mm ..... *Acanthosentis camerooni*

– Giant hypodermal nuclei 6-8. Cement gland up to 0.14-0.94 × 0.09-0.55 mm 22

19. Giant hypodermal nuclei usually 5 dorsal, 2 ventral. Cement gland 0.94 × 0.55 mm *Acanthosentus indicus*

– Giant hypodermal nuclei usually 2-4 dorsal, 4-6 ventral. Cement gland 0.14–0.020 × 0.09 mm ..... *Acanthosentis tilapiae*

Note : Acanthos*entis cotoi* is not included in the key.

263. ***Acanthosentis antespinus*** Verma & Datta, 1929 (Fig. 235)

Acanthosentis antespinus Verma & Datta, 1929 : 484-495, Textfig. 1 A-C. 2; Pl. 10, Fig. 1-8, Pl. 11, Fig. 10-17; Meyer, 1932 : 35-36, Fig. 10-13;

Acanthosentis (*Acanthosentis*) *antespinus* Petrotschenko, 1956: 247, Fig. 90;

Acanthosentis antespinus Yamaguti, 1963 : 33, Pl. 10, Fig. 92-95; Gupta, V. & Sinha, 1990b : 52, 57; Jain, Devi & Rao, 1994 : 43-45; Golvan, 1994 : 138; Bhattacharya, 2007 : 46, Pl. 8, Fig. 26 a-d.

Type locality : Kolkata, West Bengal, India.

Description : Male worms white and gravid female brownish in life. Male 1.0-1.25 × 0.20-0.25 mm, female 2.0-3.0 × 0.75-1.10 mm. Proboscis short, cylindrical to globular, 0.17 × 0.05 mm, with 3 circles 6 hooks each. Each hook with stout undivided root and a inconspicuous knob-like projection. Blade of hooks of apical, middle and basal circles

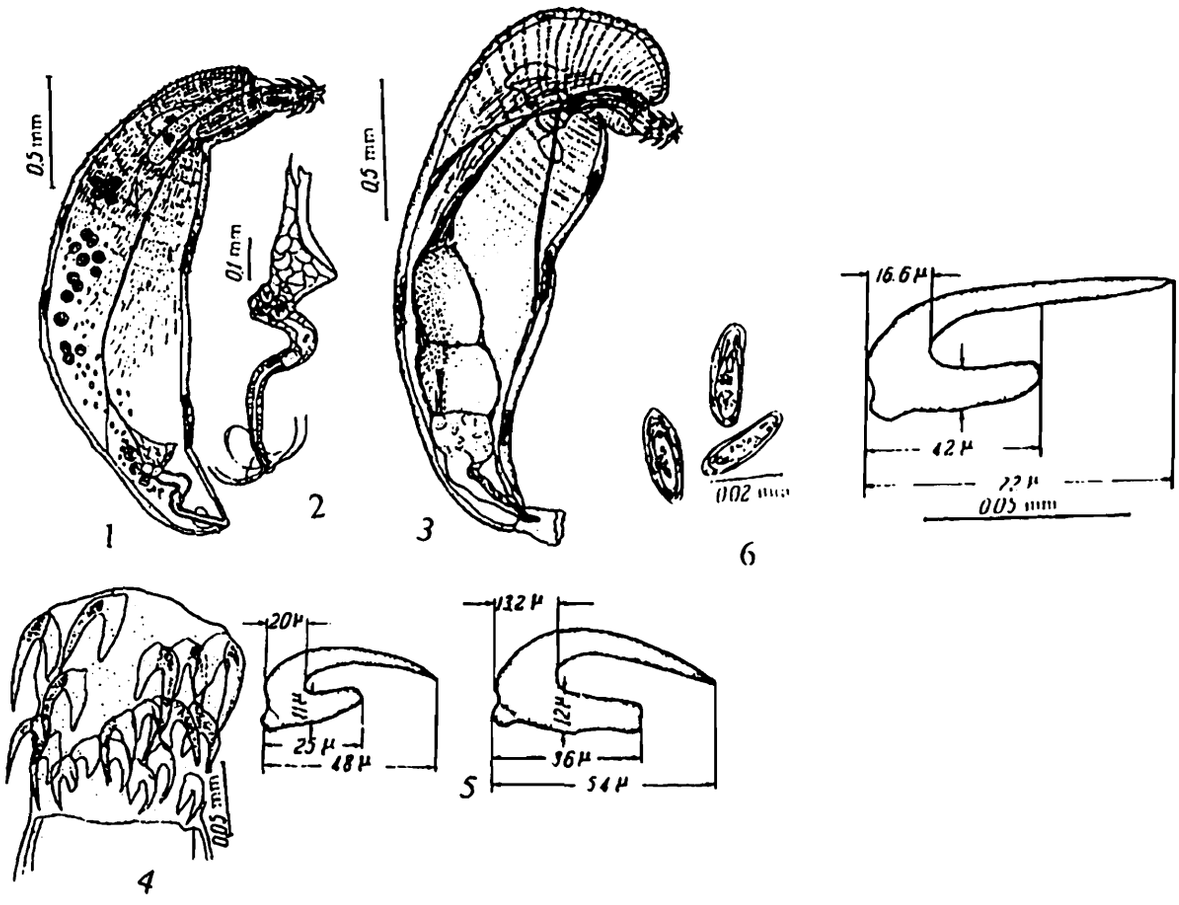


Fig. 235. *Acanthosentis antespinus* Verma & Datta, 1929. 1. Female, 2. Female genitalia, 3. Male, 4. Proboscis enlarged, 5. Proboscis hooks enlarged, 6. Ova enlarged (after Verma & Datta, 1929).

0.072 × 0.016 mm, 0.056 × 0.013 mm and 0.048 × 0.012 mm. Roots of same circles 0.042 × 0.013 mm, 0.036 × 0.012 mm and 0.025 × 0.011 mm. Proboscis receptacle single-walled 0.38 × 0.13 mm, with ganglion near its base. Neck absent. Trunk thick at middle, anterior 2/5 of trunk covered with 20-31 circles of pointed spines with flat scaly bases or platelets. Of these a few of anterior and posterior circles have a small number of spines, middle ones have 80-100 spines in each circle. Lacunar system with longitudinal channels and transverse anastomoses. Hypodermal nuclei occur dorsal, ventral and laterally. Lemnisci 2, slightly longer than receptacle, 0.04 × 0.07 mm each with a single nucleus posteriorly. Testes ellipsoidal or ovoidal, nearly equal, opposed to each other, in midtrunk, anterior 0.47 × 0.3 mm, posterior 0.34 × 0.32 mm. Efferent ducts emerge from testes runs backwards and unites with vas deferens and terminates in muscular cone-shaped penis. Cement gland rounded syncytial mass with 6-8 nuclei, 0.17 × 0.21 mm, continues as cement duct, lies alongside vas deferens and at base of penis. Seminal vesicle globular 0.13 × 0.19 mm. Bursa 0.21 × 0.13 mm. Uterine bell funnel-shaped with 6-8 diverticula leads into uterus. Uterus with thick flabby walls containing nucleated flask-shaped glands, leads into vagina through a muscular bulb, ovijector. Vagina with two single-nucleated, club-shaped glands on its wall. Gonopore of female lies in depression in postero-ventral extremity. Eggs elongated 0.026 × 0.008 mm

Host : *Mystus* (*Macrones*) *gulia* Gunther, *Mystus seenghala* (Sykes), *Labeo rohita* (Hamilton).

Location : Duodenum and Intestine.

Locality : Chilka lake (Orissa); Allahabad (Uttar Pradesh); Kolkata (West Bengal); Kalri lake, Sindh, Pakistan.

Distribution : Known only from Indian subcontinent.

264. ***Acanthosentis arii*** Bilqees, 1971
(Fig. 236)

Acanthosentis arii Bilqees, 1971: 61-64, Fig. 3 A-E;

Acanthogyrus (*Acanthosentis*) *arii*, Amin, 1985: 65;

Acanthosentis arii, Bilqees & Khan, 1987: 18-19, Fig. 28 a, b; Gupta & Sinha, 1990b: 55; Golvan, 1994 : 138.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Female 8.70-9.50 × 1.75-2.10 mm. Proboscis invaginated. Proboscis receptacle 0.9-1.0 × 0.25-0.28 mm. Female trunk stout, elongated, gradually enlarging from anterior end to middle and narrowing posteriorly, trunk spines comb-like, covering whole trunk, closely set anteriorly, but wide apart in rest of trunk and become closer

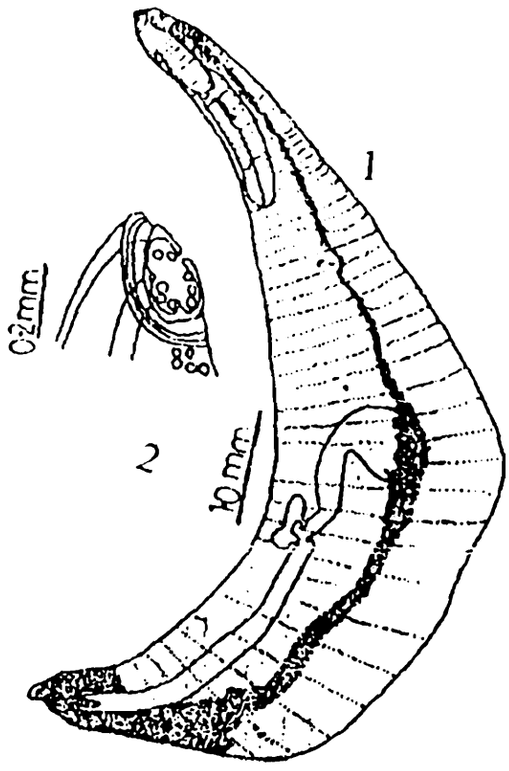


Fig. 236. *Acanthosentis arij* Bilqees 1971. 1. Female, 2. Enface view of anterior end (after Bilqees, 1971).

posteriorly. Lemnisci equal, claviform, longer than receptacle, enclosed in common sheath, 1.2-1.4 mm long, fused together at free end. Uterine bell large, funnel-shaped with ventral opening, 0.5-0.7 × 0.6-0.8 mm. Uterus long, vagina thin, muscular, surrounded by muscular sphincter and opening to exterior by ventral pore at posterior end. Eggs oval to round, 0.030-0.045 × 0.03-0.06 mm, filling whole of trunk pseudocoel. Ale not known.

Host : *Arius serratus* Day.

Location : Intestine.

Locality : Karachi coast, Sindh, Pakistan.

Distribution : Known only from type locality.

265. ***Acanthosentis bacailai*** Verma, 1973
(Fig. 237)

Acanthosentis bacailai Verma, 1973 : 166-170, Pl. 2, Fig. 1-3, Pl. 4, Fig. 4;
Acanthogyrus (*Acanthosentis*) *bacailai* Amin, 1985 : 65;
Acanthosentis bacailai Golvan, 1994 : 138; Bhattacharya, 2007 : 47, Pl. 8, Fig. 27 a-d

Type locality : Lucknow, Uttar Pradesh, India.

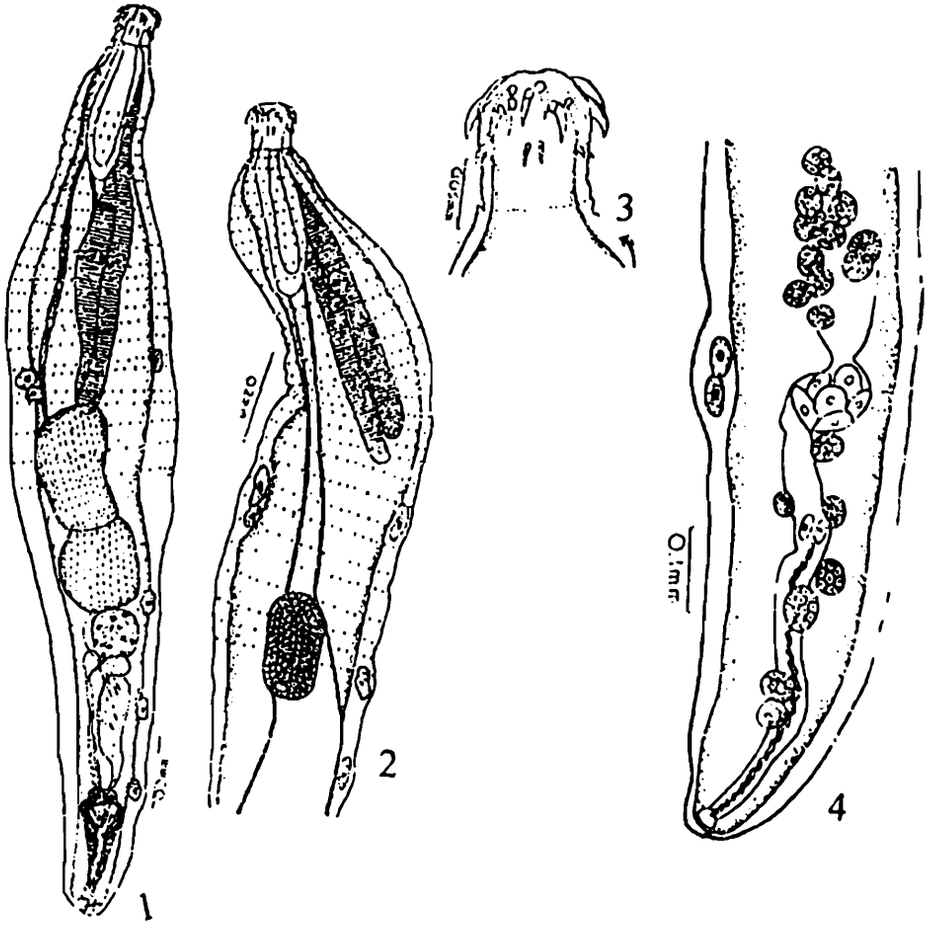


Fig. 237. *Acanthosentis bacailai* Verma, 1973. 1. Male, 2. Anterior part of female, 3. Proboscis enlarged, 4. Posterior part of female (after Verma, 1973).

Description : Male 2.05-5.6 0.35-1.05 mm, female 3.21-3.64 × 0.35-0.42 mm. Proboscis short, globular, 0.08-0.15 × 0.07-0.08 mm in male, in female0.09-0.092 × 0.08-0.091 mm, with 3 transverse rows of 6 recurved hooks each. Hooks of apical circle 0.020-0.031 mm, middle circle 0.020-0.031 mm and basal circle 0.015-0.020 mm long in male; in female hooks of apical and middle circles 0.03-0.035 mm and basal circle 0.13-0.016 mm long. Proboscis receptacle cylindrical, single-walled, muscular sac, 0.9-0.35 × 0.08-0.1 mm in male, infemale0.30-0.31 × 0.08-0.11 mm. Neck 0.023-0.06 × 0.07-0.08 mm in male, in female 0.028-0.06 × 0.03-0.09 mm. Trunk small, elongated, cylindrical with both ends attenuated, anterior half of trunk armed with 25-26 rows of spines. Lacunar system with prominent main channels and reticular anastomoses. Hypodermal nuclei present. Lemnisci slender, long, unequal, shorter lemniscus 0.78-1.5 × 0.6-0.9 mm, longer lemniscus 0.80-1.35 x0.01-0.10 mm in male, in female shorter lemniscus 0.66-0.81 × 0.05-0.06 mm. Testes elongated or oval, in tandem, subequal, pre-equatorial, overlapping or slightly touching each other, anterior 0.23-1.25 × 0.15-0.55 mm, posterior 0.21-1.1 × 0.55-0.72 mm. Cement glands single, syncytial, spherical with 12-13 nuclei, 0.10-0.82 × 0.038-0.10 mm opening by a duct into bursa. From each testis arises vas deferens runs down and enters bursa. Saefftigen's pouch 0.09-0.35 × 0.05-0.25 mm. Seminal vesicle elongated, 0.20-1.0 × 0.065-0.30 mm. Bursa eversible, muscular, 0.30-1.05 × 0.09-0.30 mm. Ovary oval, pre-equatorial, 0.23x 0.12 mm. Uterine bell 0.07-0.075 × 0.08-0.11mm opening into uterus through uterine tube. Uterine sac 0.44-0.50 × 0.03-0.04 mm. Vagina thick, muscular, 0.02-0.03 × 0.03-0.04 mm. Female gonopore postero-ventral.

Host : *Chela baicala* (Hamilton).

Location : Intestine.

Locality : River Gomti, Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

266. ***Acanthosentis betwai*** Tripathi, 1959
(Fig. 238)

Acanthosentis betwai Tripathi, 1959 : 70-73, Fig. 6 b; Yamaguti, 1963 : 33, Gupta, N.K. & Kajaji, 1969: 970; Anantaraman, M. & Anantaraman, S., 1970 : 3; Gupta, P.D. & Ghosh, 1979 : 316; Zafar & Farooqi, 1976 : 147; Khan & Bilqees, 1990: 240; Gupta, V. & Sinha, 1990b: 46; Golvan, 1994 : 138; Bhattacharya, 2007 : 47-48, Pl. 9. Fig. 28.

Type locality : River Betwa at Bhopal (Madhya Pradesh).

Description : Worms whitish, semitransparent in life, but gravid females brownish owing to brown eggs. Males 8.75 × 1.25 mm; female 8.06-9.83 × 2.08 mm. Proboscis small, globular, 0.127-0.133 × 0.127 mm in male, with 3 circular rows of 6 recurved hooks each; in female 0.095-0.103 × 0.114-0.117mm; Anterior, middle and basal hooks are 0.057-0.068mm, 0.038-0.053 mm, 0.024-0.041 mm long in male; in female hooks of same anterior, middle and basal circles 0.071-0.0946 × 0.0100.014 mm, 0.035-0.052 × 0.0057-0.0078 mm and 0.032-0.033 × 0.0047-0.0071 mm. Proboscis receptacle long, cylindrical,

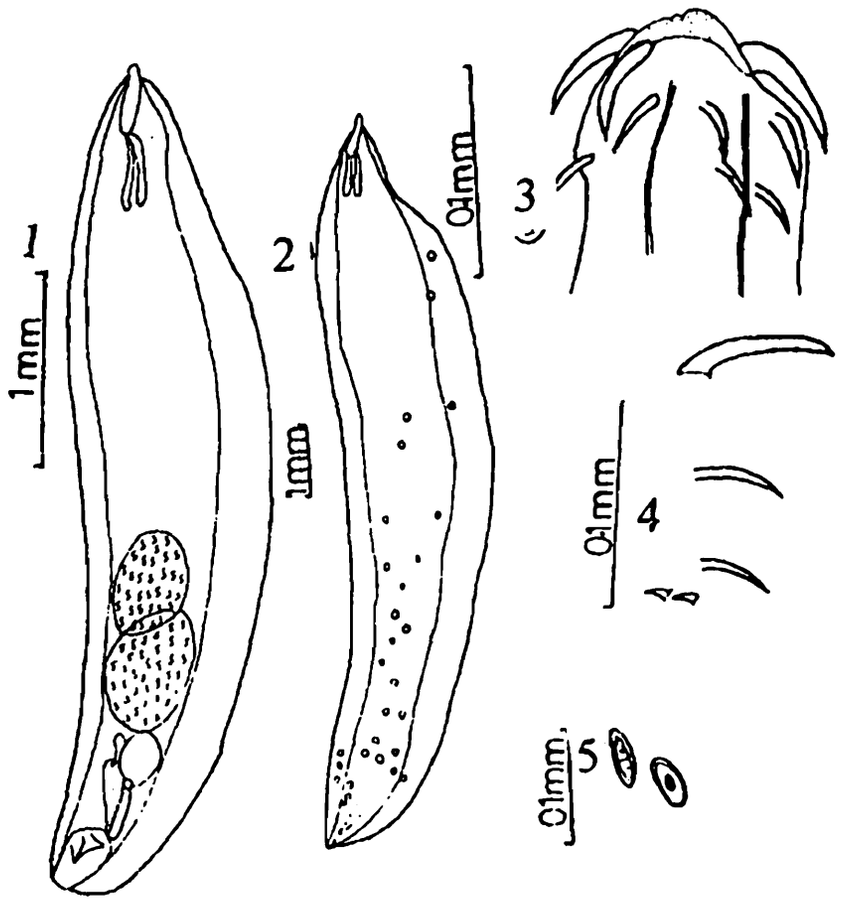


Fig. 238. *Acanthosentis betwai* Tripathi, 1959. 1. Male, 2. Female, 3. Proboscis enlarged, 4. Proboscis hook from each circle, 5. Eggs (after Khan & Bilqees, 1990).

single-walled, wider in posterior part, 0.32-0.51 × 0.12-0.16 in male; in female 0.27-0.55 × 0.100.16 mm. Neck small, smooth 0.025-0.038 × 0.116-0.129 mm in male; in female 0.052-0.053 x0.114-0.152 mm. Trunk long, thick, with 42-44 regular circles of spines extending up to posterior testis in male and nearly to end of trunk in female. Lacunar system with dorsal and ventral longitudinal channels and reticular anastomoses. Lemnisci slightly unequal, longer than receptacle, with single large nucleus, 0.72-0.93 × 0.10-0.11 mm in male, in female 0.87-1.03 × 0.11 -0.16 mm. Testes oval, unequal, lie closely apposed to each other, anterior 0.45-0.78 × 0.30-0.61 mm, posterior 0.58-0.60 × 0.45-0.59 mm. Cement gland oval, large, syncytial mass, lie close to posterior testis, 0.25-0.58 × 0.18-0.30 mm, its reservoir small 0.10-0.12 × 0.09-0.091 mm. Seminal vesicle pyriform 0.39-0.41 × 0.084-0.19 mm. Saefftigen's pouchoblong, 0.13-0.27 × 0.25-0.30 mm. Bursa bell-shaped, 0.23-0.27 mm. Uterine bell cup-shaped., with a pair of diverticula. Ovary oval, breaking up into ovarian balls spherical or oval, 0.03-0.11 × 0.030-0.059 mm. Uterus 0.26 × 0.066 mm leads into long narrow vagina 0.94 mm long, through a muscular ovijector, which controls passage of eggs. Outside vaginal wall two single nucleated, club-shaped glands communicate with vagina by a common pore close to external aperture. Eggs small, oval, 0.010-0.016 × 0.0061-0.0069 mm.

Host : *Aoria* (*Macrones*) *gulia* Gunther, *Mystus seenghala* (Sykes), *Labeo rohita* (Hamilton); *Labeo gonius* Mc Clelland.

Location : Intestine.

Locality : Chilka lake (Orissa); River Betwa at Bhopal (Madhya Pradesh); Allahabad (Uttar Pradesh); Kolkata (West Bengal); Kalrai lake, Sindh, Pakistan.

Distribution : Known only from Indian subcontinent.

267. ***Acanthosentis bilaspurensis*** Chowhan, Gupta, N.K. & Khera, 1987 (Fig. 239)

Acanthogyrus (Acanthosentis) bilaspurensis Chowhan, Gupta, N.K. & Khera, 1987 : 59-64, Fig, 1-11; *Acanthosentis bilaspurensis* Golvan, 1994 : 138; Bhattacharya, 2007 : 48, Pl. 9. Fig. 29 a-e.

Type locality : Bilaspur, West Bengal, India.

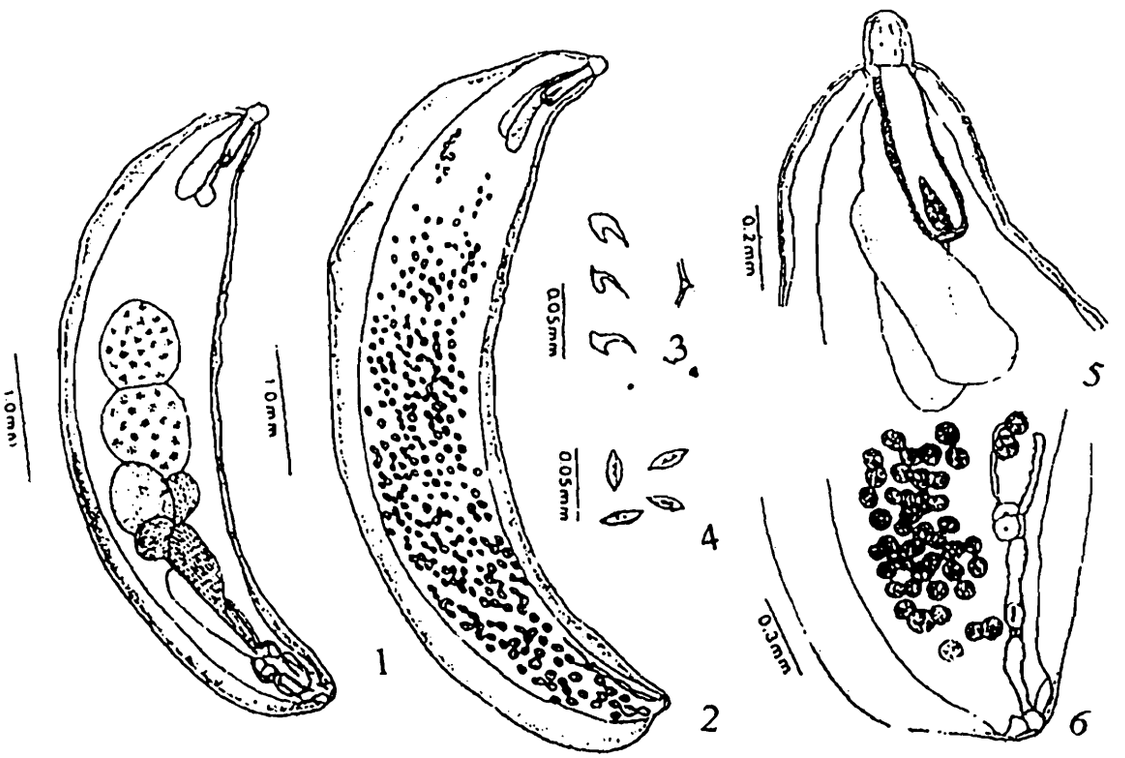


Fig. 239. *Acanthosentis bilaspurensis* Chowhan, Gupta, N.K. & Khera, 1987. 1. Male, 2. Female, 3. Proboscis hooks enlarged, 4. Ova, 5. Anterior part of worm, 6. Posterior part of female (after Chowhan, Gupta, N.K. & Khera, 1987).

Description : Male 3.9-5.6 × 1.2 mm; female 6.03-7.12 × 1.27-1.62 mm. Proboscis small, globular, with a small pit at its apex, 0.12 × 0.11 mm in male; in female 0.20-0.22 × 0.17-0.22 mm, with 3 circular rows of 6 hooks each. Hooks 0.033 × 0.008-0.010 mm, 0.024-0.028 × 0.008-0.01 mm and 0.024-0.028 × 0.005 mm in I, II and III rows respectively in males. In females 0.032-0.036 ×.0.008-0.010 mm, 0.024-0.028x 0.006 mm and 0.022-0.028 × 0.005- 0.006 mm I, II and III rows respectively. Proboscis receptacle cylindrical, 0.21-0.43 × 0.09-0.11 mm in male; in female 0.36-0.40 × 0.14-0.15

mm, with basal ganglion. Trunk curved ventrally with peg-like spines, in 20-22 circles of 22-27 spines each, spines about 0.001 mm long, not covering whole trunk. Lacunar system reticular. Lemnisci subequal, longer than receptacle, balloon-shaped 0.49-0.78 × 0.15-0.26 mm in male; in female 0.78-1.34 × 0.15-0.27 mm. Testes almost rounded, anterior 0.51-0.66 × 0.52-0.61 mm, posterior 0.52-0.70 × 0.59-0.69 mm. Cement gland oval 0.43-0.54 × 0.33-0.46 mm, its reservoir semilunar 0.41-0.93 × 0.26-0.31 mm. Saefftigen's pouch 0.36-0.71 × 0.10-0.15 mm. Copulatory bursa 0.77-0.84 × 0.33-0.36 mm, its muscular cap 0.18-0.20 × 0.26-0.28 mm. Uterine bell funnel-shaped 0.19-0.59 × 0.13-0.26 mm. Uterus 0.31-0.36 × 0.06 mm. Vagina 0.26-0.37 × 0.65-0.73 mm and without glands. Eggs 0.032 × 0.01 mm with conical polar processes of outermost layer of shell. Female gonopore a slit surrounded by cuticular folds terminally.

Host : *Cirrhinus reba* (Hamilton).

Location : Intestine.

Locality : Bilaspur, Bakra Nangal, Lathiani, Kolkata (West Bengal).

Distribution : Known only from India.

268. ***Acanthosentis cammersoni*** Gupta, N.K. & Kajaji, 1969 (Fig. 240)

Acanthosentis cameroni Gupta, N.K. & Kajaji, 1969 : 965-968, Fig 1.21;

Acanthogyrus (*Acanthosentis*) *cameroni,* Amin, 1985 : 65;

Acanthosentis cammersoni, Gupta, V. & Sinha, 1990b : 47;

Acanthosentis cammersoni Golvan, 1994 : 138.

Acanthosentis cameroni Bhattacharya, 2007: 48, Pl. 9, Fig. 30 a-d.

Type locality : River Gomti near Lucknow, Uttar Pradesh, India.

Description : Male 2.0-3.89 × 0.31-0.51 mm, female 5.48-7.9 × 0.59-0.70 mm. Proboscis short, globular 0.11-0.18 × 0.05-0.08 mm in male; in female 0.08-0.13 mm × 0.056-0.06 mm, with 3 circles of 6 recurved hooks, hooks of anterior row 0.035-0.045 mm long, middle row 0.019-0.028 mm and basal row 0.015-0.025 mm long in male; in female corresponding hooks 031-0.04 mm, 0.020-0.023 mm and 0.015-0.02 mm long. Proboscis receptacle cylindrical, single-walled, muscular 0.20-0.29 × 0.08-0.13 mm in male; in female 0.138-0.351 × 0.058-0.113 mm. Neck 0.03-0.04 × 0.06-0.11 mm in male; in female 0.026-0.03 × 0.05-0.06 mm. Trunk elongated, cylindrical, gradually enlarging from anterior end to middle and narrowing from there to posterior end. Anterior half trunk beset with10-18 circles of hooks, anterior spines closely set, rows near middle wide apart. Giant hypodermal nuclei 2 or 3, 1-2 dorsal, 1 ventral. Lacunar system reticular. Lemnisci slender, cylindrical, subequal, much longer than receptacle, with giant nuclei in each, 0.52-0.80 mm long, 0.56-0.89 mm long in male; in female 0.43-0.73 mm long, 0.58-0.77 mm long. Testes cylindrical, in tandem, subequal, overlapping or slightly touching, in middle third of trunk, anterior 0.09-1.12 × 0.22-0.42 m, posterior 0.29-0.90 × 0.20-0.40 mm. Vasa deferens

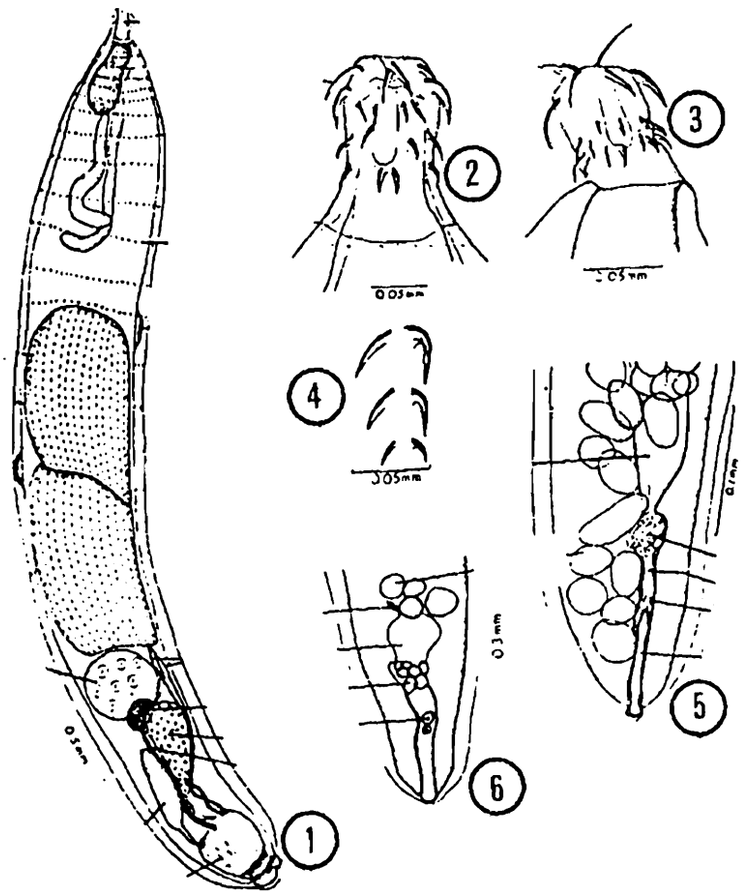


Fig. 240. *Acanthosentis cammersoni* Gupta, N.K. & Kajaji, 1969. 1. Male, 2. Proboscis of male enlarged, 3. Proboscis of female enlarged, 4. Proboscis hooks enlarged, 5 & 6 Posterior part of female enlarged (after Gupta, N.K. & Kajaji, 1969).

from each testis runs down in close association with cement gland and cement reservoir and opens into bursa. Cement gland single, syncytial, spherical mass with 8 nuclei, 0.13-0.36 × 0.10-0.31 mm, its reservoir pear-shaped 0.07-0.16 × 0.05-0.15 mm continue through its long duct up to bursal cap. Saefftigen's pouch 0.25-0.57 × 0.08-0.26 mm. Seminal vesicle club-shaped 0.200-0.399 × 0.06-0.07 mm. Bursa eversible, bell-shaped 0.10-0.39 × 0.10-0.23 mm. Uterine bell rectangular, funnel-shaped 0.12-0.31 × 0.10-0.13 mm, opens through a tube into uterus with several large guard cells. Uterus 0.12-0.22 mm long. Vagina thick, muscular with sphincters 0.215-0.315 × 0.031-0.05 mm Ovarian balls spherical or oval 0.11-0.20 × 0.07-0.08 mm. Eggs fusiform 0.025-0.039 × 0.01-0.012 mm. Gonopore postero-ventral.

Host : *Rohtee cotio* Sykes.

Location : Intestine.

Locality : Gomti River at Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

269. ***Acanthosentis cotoi*** Agarwal &Kajaji, 1986

Acanthosentis cotoi Agarwal & Kajaji, 1986 : 30 (abstact).

Type locality : Lucknow, Uttar Pradesh, India.

Description : The publication containing the description and figures of this species could nit be procured.

Host : *Rohita cotoi* (Hamilton).

Location : Intestine;

Locality : Lucknow (Uttar Pradesh);

Distribution : Known only from type locality.

270 ***Acanthosentis dattai*** Poddar, 1938
(Fig. 241)

Acanthosentis dattai Poddar, 1938 : 171-174, Fig. 1-5; Petrotschenko, 1956 : 248-250, Fig. 91; Yamaguti, 1963 : 33, Pl. 11, Fig. 107-110; Anantaraman & Anantaraman, 1970 : 3; Sharma & Wattal, 1976 : 169-173, Fig. 1-3; Gupta, P. D. & Ghosh, 1979: 316; Ahmed & Rauf, 1981 : 121; Ahmed, 1981 : ? 232; Dhar & Majdah, 1988 : ? 5-6; Gupta, V. & Sinha, 1990b : 46; Jha, Sinha & Mishra, 1992 : 5; Golvan, 1994: 138; Arthur & Ahmed, 2002: 39; Bhattacharya, 2007: 49, Pl. 9, Fig. 31 a, b.

Type locality : Salt Lake, Kolkata, West Bengal, India.

Description : Worms white in life. Males 1.34-3.34 × 0.21-0.24 mm, females 1.67-9.46 × 0.44-0.90 mm. Proboscis cylindrical 0.12 × 0.055 mm with transverse rows of 6 recurved hooks each. Hooks of apical circle 0.050 mm, middle circle 0.030 mm and basal circle 0.026 mm long. Proboscis receptacle single-walled, muscular 0.42 × 0.12 mm, with ganglion at its base. Neck almost absent. Trunk elongated, cylindrical, slightly flattened laterally and tapering towards both ends, with regular circlets of rose-thorn-like spines present all over trunk. Hypodermal giant nuclei 6-8, 4-6 dorsal and 2 ventral. Lacunar system with fine network with transverse canals. Lemnisci 2, slightly longer than receoptacle, 0.68 × 0.056 mm and 0.59 × 0.055 mm. Testes 2, almost in tandem, anterior 0.48 × 0.31 mm, posterior 0.29 × 0.275 mm. Efferent ducts from each testis unite at start of seminal vesicle to form vas deferens ending in muscular penis. Cement gland syncytial with 6-8 nuclei, 0.35 × 0.26 mm, its reservoir 0.13x 0.12 mm, its duct and duct of seminal vesicle open at base of penis, which protrudes into cavity of bell-shaped eversible bursa. Penis 0.066x 0.033 mm. Uterine bell thin, funnel-shaped, not coiled, with a few guard cells, 0.095 mm long, attached by genital ligament to base of proboscis receptacle. Uterus elongated tube, 0.29 mm long its anterior third swollen and flabby with a couple of large nuclei, leads into vagina 0.0175 mm long with glands 0.105 mm long Eggs spindle-shaped 0.026 mm long. Female gonopore postero-ventral.

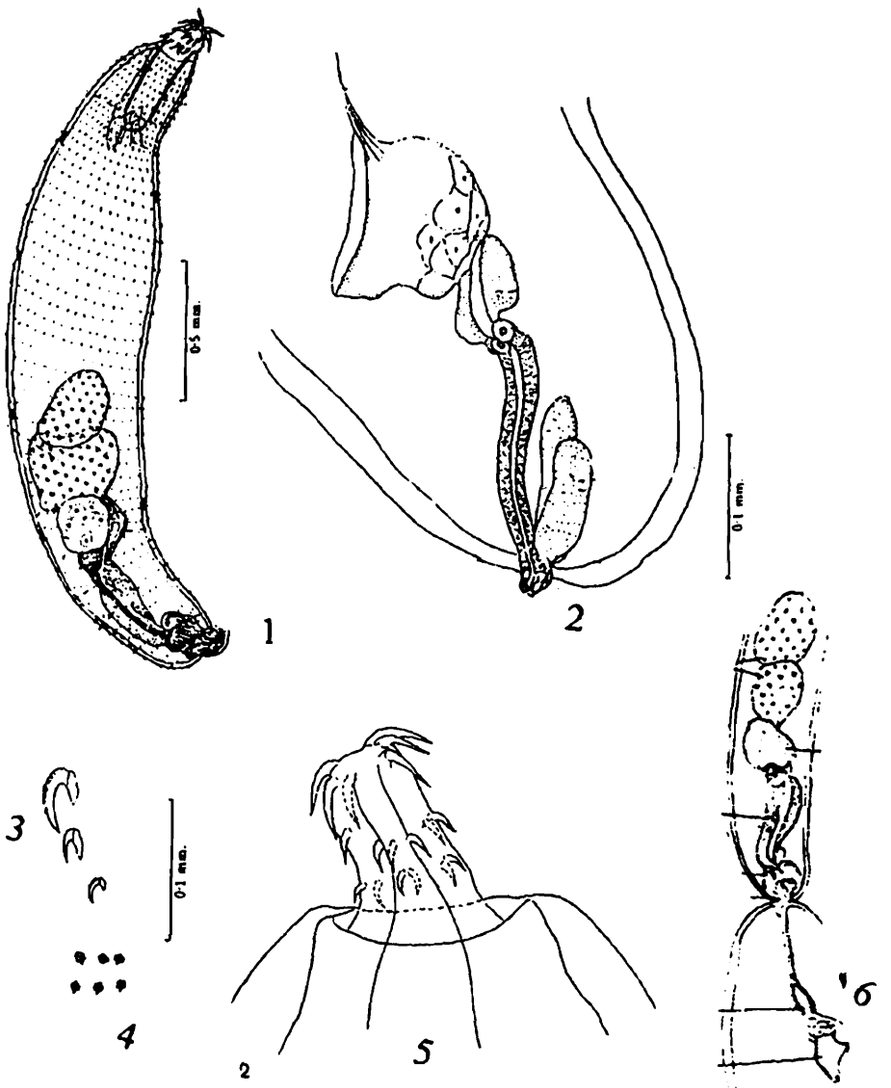


Fig. 241. *Acanthosentis dattai* Poddar, 1938. 1. Male, 2. Posterior part of female, 3. Proboscis hooks, 4. Trunk spines, 5. Proboscis enlarged, 6. Posterior part of male and female in copulation (after Poddar, 1938).

Host : *Barbus ticto* (Hamilton & Buchanan), *B. stigma* (Cuvier & Valenciennes). (Hamilton), *Puntius sophore.*

Intermediate host : *Mesocyclops leukarti* (Claus) at Delhi.

Location : Small intestine.

Locality : Muzaffarpur (Bihar); Salt lake in Kolkata (West Bengal); Dhaka (Bangladesh).

Distribution : Known only from Indian subcontinent.

Location : Intestine.

Locality : Pulta water works in 24 Paraganas district (West Bengal).

Distribution : Known only from India.

271. ***Acanthosentis giuris*** Soota & Sen, 1956
(Fig. 242)

Acanthosentis giuris Soota & Sen, 1956 : 363-365, Fig. 1;

Acanthogyrus (*Acanthosentis*) *giuris* (Soota & Sen), Dollfus & Golvan, 1956 : 65;

Acanthosentis giuris. Yamaguti, 1963 : 33, Pl. 10, Fig. 98, 99; Anantaraman, M. & Anantaraman, S., 1970 : 3;

Acanthogyrus (*Acanthosentis*) *giuris* Amin, 1985: 65;

Acanthosentis giuris Gupta, V. & Sinha, 1990b: 42; Golvan, 1994: 138; Bhattacharya, 2007: 53, Pl. 10, Fig. 38 a-d.

Type locality : Palta water works in 24 Paraganas district, West Bengal, India.

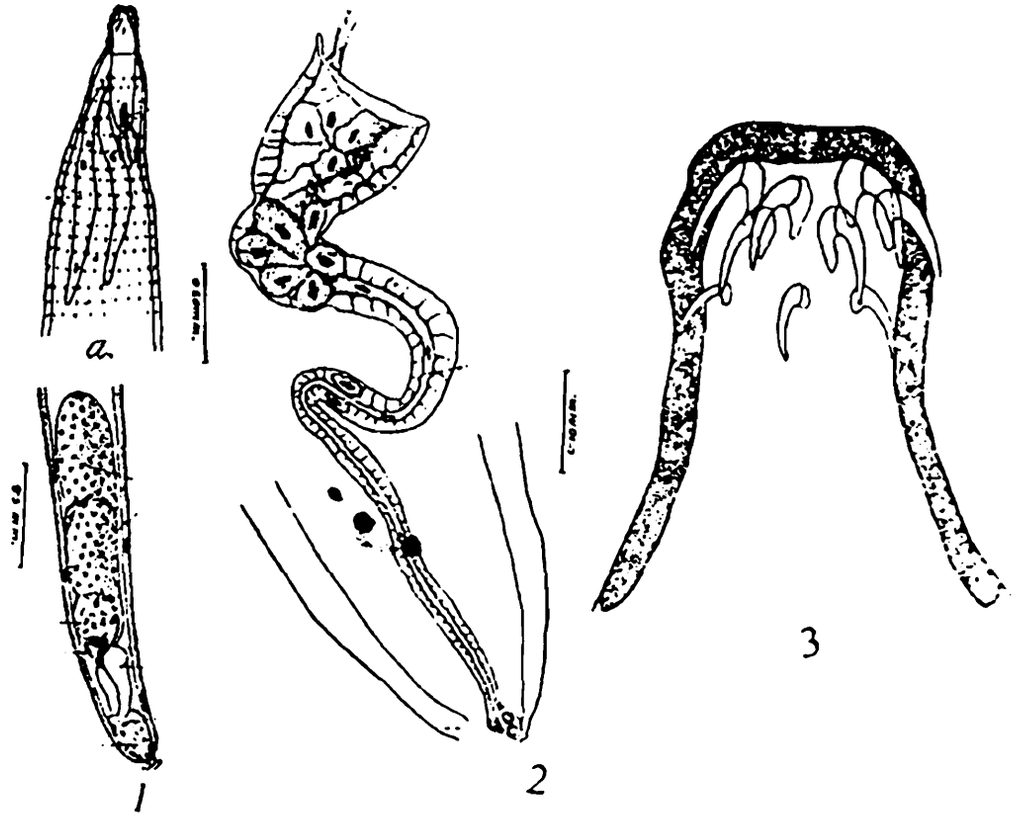


Fig. 242. *Acanthosentis giuris* Soota & Sen, 1956. 1. Anterior part of female, 2. Female genitalia, 3. Proboscis part of male, 4. Proboscis and neck enlarged (after Soota & Sen, 1956).

Description : Male 4.35 × 0.48 mm; female 5.22-6.5 × 0.55-0.63 mm. Proboscis globular, wider than long, 0.07 × 0.10 mm in male; in female 0.07-0.09 × 0.09-0.13 mm, armed with 3 circular rows of 6 hooks each, Hooks 0.04 mm, 0.03 mm and 0.02 mm long in I, II and III rows in male; in female same hooks 0.04-0.05 mm, 0.03-0.04 mm and 0.03 mm long in I, II and III rows respectively. Proboscis and prominent neck with thick cuticular layer. Proboscis receptacle single-walled, muscular, with ganglion near its base, 0.45 mm long in male, in female 0.39-0.59 mm long. Neck 0.10 × 0.14 mm in male, in female 0.09-0.13 × 0.15-0.17 mm. Trunk cylindrical, widening from anterior end to middle

and narrowing from there to posterior end, with 23 circles of spines, after spineless area. Lemnisci 2, slightly longer than receptacle, larger lemniscus with 2 nuclei and smaller with single nucleus. Testes 2, unequal, in posterior half of body, anterior 0.53 × 0.29 mm, posterior 0.50 × 0.27 mm. Cement gland syncytial with 8 nuclei, 0.26 × 0.21 mm. Seminal vesicle 0.38 mm long. Bursa 0.32 mm long. Uterine bell 0.24-0.26 mm long. Uterus along with vagina 0.45-0.75 mm long with 6 guard cells. Eggs 0.03-0.10 × 0.03-0.08 mm.

Host : *Glossogobius giuris* (Hamilton).

Location : Intestine.

Locality : Pulta waterworks in 24 Paraganas (West Bengal).

Distribution : Known only from India.

272. ***Acanthosentis gobindi*** Chowhan, Gupta, N. K. & Khera, 1987 (Fig. 243)

Acanthosentis gobindi Chowhan, Gupta, N.K. & Khera, 1987 : 62-65, Fig. 12-17; Golvan, 1994 : 138; Bhattacharya, 2007 : 53, Pl. 10, Fig. 39 a, b.

Type locality : Rivulet arising from Gobindsagar Lake, Nangal, Punjab, India.

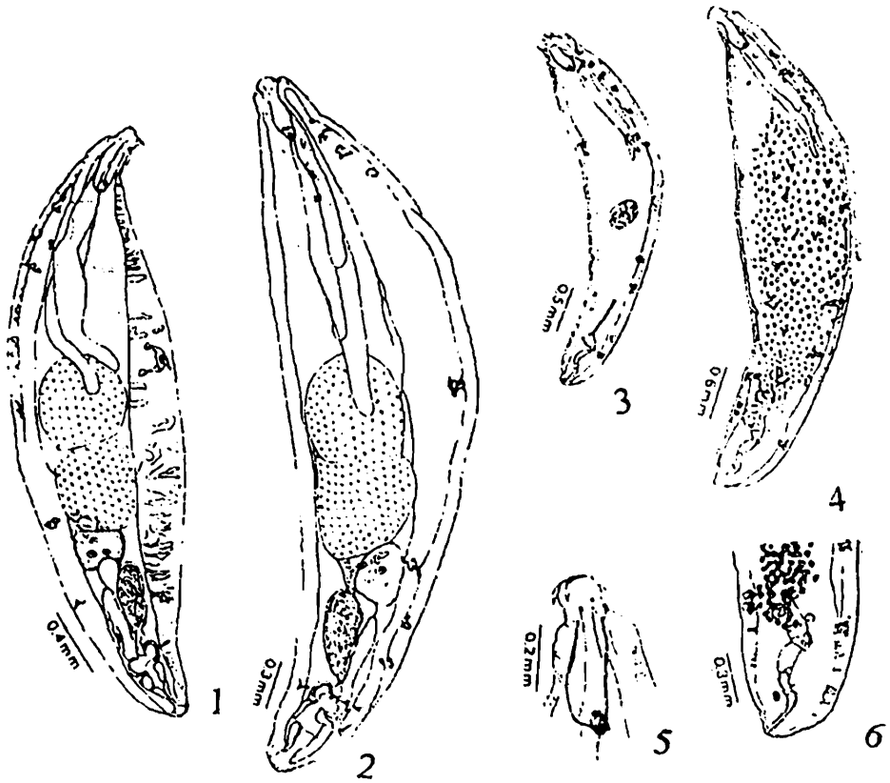


Fig. 243. *Acanthosentis gobindi* Chowhan, Gupta, N.K. & Khera, 1987. 1. Male, 2. Male with one of its lemniscus bifurcated, 3. Immature female with ovary, 4. Mature female, 5. Anterior part of worm enlarged, 6. Posterior part of female (after Chowhan, Gupta, N.K., & Khera, 1987).

Description : Male 3.32-4.38 × 0.92-1.09 mm, female 4.16-8.13 × 0.70-1.62 mm. Proboscis globular,0.12-0.13 × 0.q112-0.13 mm in male, in female 0.15-0.16 × 0.12-0.14 mm, with 3 circular of 6 hooks each. Hooks in I, II and III circles 0.057-0.061 × 0.011-0.012 mm, 0.032-0.041 × 0.006-0.008 mm and 0.028-0.040 × 0.006-0.008 mm respectively in male. In female hooks of I, II and III circles 0.066-0.074 × 0.012-0.014 mm, 0.041-0.049 × 0.006-0.008 mm and 0.037-0.045 × 0.006-0.008 mm respectively. Proboscis receptacle cylindrical, single-walled, with ganglion at its base, 0.30-0.31 × 0.12 mm in male, in female 0.35-0.39 × 0.12-0.15 mm. Hypodermal nuclei large, conspicuous, dendritic, 11-16, 10-12 dorsal and 3-4 ventral. Trunk wide at middle, slightly curved ventrally, with 7-8 circles of spines anteriorly. Lacunar system reticular. Lemnisci subequal, 1.13-1.57 × 0.09-0.16 mm in male, in female subequal 1.38 × 0.11-0.20 mm, extending almost up to level of posterior end of receptacle. Testes in tandem, anterior almost rounded 0.54-0.69 × 0.54-0.60 mm, posterior nearly oval 0.57-0.79 × 0.48-0.61 mm. Cement gland syncytial oval, directly behind posterior testis, 0.38-0.41 × 0.31 mm, its reservoir pear-shaped. 0.11-0.16 × 0.13-0.16 mm Saefftigen's pouch 0.44-0.54 × 0.08-0.10 mm. Seminal vesicle pear-shaped, broader anteriorly 0.39-0.57 × 0.13-0.21 mm. Copulatory bursa 0.43-0.54 × 0.25-0.28 mm with muscular cap 0.24-0.27 × 0.13-0.16 mm. Genital ligament 0.62-0.74 × 0.12-0.18 mm. Ovary 0.35 × 0.2 mm. Utetrine bell funnel-shaped 0.16-0.20 × 0.12-0.18 mm, uterus 0.25-0.31 × 0.07-0.12 mm, vagina 0.21-0.35 × 0.05-0.08 mm.

Host : *Labeo rohita* (Hamilton).

Location : Intestine.

Locality : Rivulet emerging from Gobindsagar lake, Nangal (Punjab).

Distribution : Known only from type locality.

273. ***Acanthosentis golvani*** Gupta, N.K. & Jain, 1980
(Fig. 244)

Acanthosentis golvani Gupta, N.K. & Jain, 1980b : 149-160; Duggal & Khera, 1986a : 141-142, Fig. 9-18;

Acanthogyrus (Acanthosentis) golvani. Amin, 1985 : 65;

Acanthosentis golvani Gupta, V. & Sinha, 1990b : 48; Golvan, 1994 : 138; Bhattacharya, 2007 : 53-54.

Type locality : Chandigarh, North India.

Description : Male 10.05-11.17 × 1.39-1.57 mm, female11.94 × 1.2 mm. Proboscis small, globular, 2.12 × 0.10 mm in both sexes, with 3 circles of 6 hooks each, 0.073-0.075 × 0.018 mm (dorsal and ventral pairs) in I circle ————; in II circle 0.064 × 0.014 mm, in III circle 0.058 × 0.014 mm. Hooks of I circle at two levels, lateral pair smaller, 0.053 × 0.011 mm, and a little posteriorly placed and hooks of posterior circle are evenly placed. Proboscis receptacle 0.125-0.127 × 0.06 mm in male, in female 0.14 × 0.07 mm with

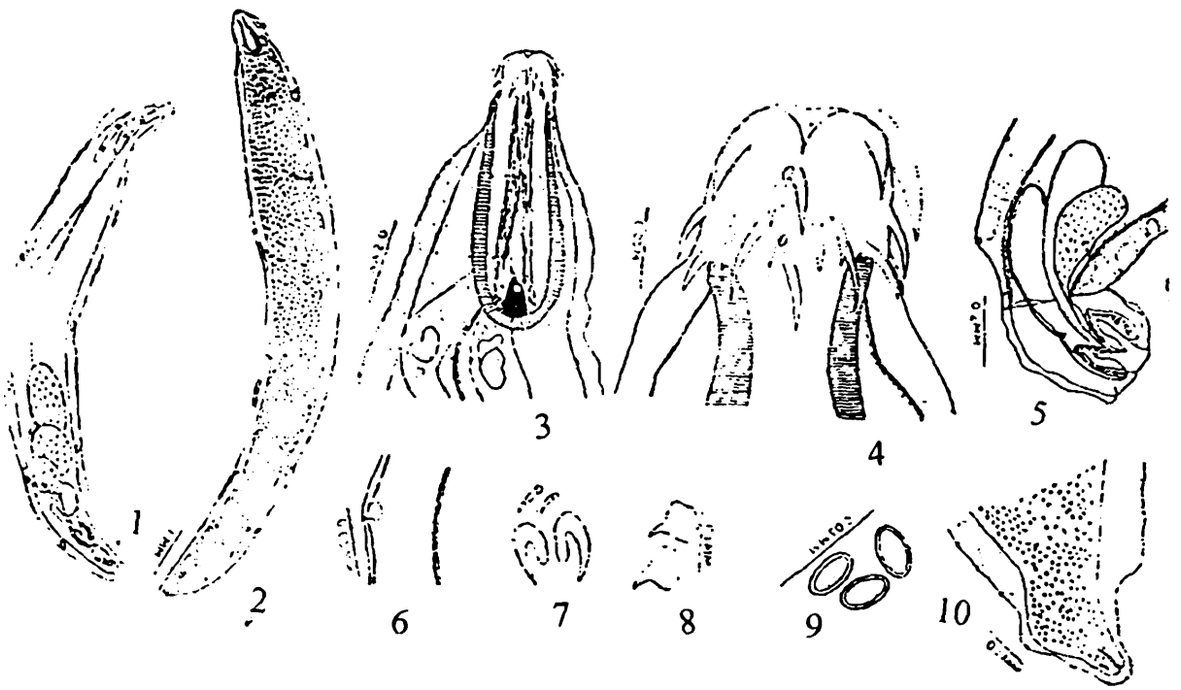


Fig. 244. *Acanthosentis golvani* Gupta, N.K. & Jain, 1980. 1. Male, 2. Female, 3. Anterior part of worm, 4. Proboscis enlarged, 5. Posterior part of male, 6. Row of proboscis hooks, 7. Proboscis hooks, 8. Trunk spines, 9. Ova, 10. Posterior part of female (after Chowhan, Gupta, N.K. & Khera, 1987).

ganglion at its base. Neck small 0.06-0.075 × 0.09-0.12 mm in male, in female 0.06 × 0.12 mm. Trunk small, fusiform, with minute spines all over forming 51-54 circles in male, in female 59 circles, closely set anteriorly or slightly raised areas of trunk wall and 0.015-0.016 mm in male, in female 0.016-0.018 mm long, each with oval root and pointing protruding blade and posterior tip with 5-6 closely set last circles of spines. Hypodermal nuclei large, oval, 5 dorsal and 2-3 ventral. Lacunar system reticular with dorsal and ventral channels. Lemnisci unequal, 0.9-0.92 × 0.16-0.19 mm and 1.35-1.45 × 0.16-0.17 mm in male; in female 1.55 × 1.5 mm and 1.44 × 0.10 mm, shorter with one and longer with two nuclei. Testes in tandem, post-equatorial, anterior 1.08-1.27 × 0.69-0.84 mm, posterior 0.97-1.05 × 0.76-0.79 mm, which slightly overlap anterior testis. Cement glands syncytial, oval with 6 nuclei, 0.67-0.93 × 0.49-0.51 mm, its reservoir 0.24-0.28 × 0.21-0.27 mm, its duct 0.69-0.85 mm long. Saefftigen's pouch 0.69-0.82 × 0.15-0.18 mm. Seminal vesicle 0.63-0.87 × 0.33-0.45 mm. Bursal cap 0.33-0.46 × 0.36-0.39 mm. Everted copulatory bursa 0.82 × 0.60 mm. In female genital tube 1.05 mm long. Eggs 0.013 × 0.007 mm.

Host : *Mystus seenghala* (Sykes) Hamilton, *Labeo rohita* (Hamilton).

Location : Intestine.

Locality : Chandigarh; Amrister (Punjab),

Distribution : Known only from India.

274. ***Acanthosentis heterospinus*** Khan & Bilqees, 1990 (Fig. 245)

Acanthosentis heterospinus Khan & Bilqees, 1990 : 237-242, Fig. 2 A-F, 3 A, B, 4: Golvan, 1994 : 138.

Type locality : Kalri lake, Sindh, Pakistan.

Description : Male 2.62-4.49 × 0.70-1.09 mm, female 5.47-5.81 × 0.98-1.12 mm. Proboscis small, globular, eversible, 0.075-0.097 × 0.09-0.12 mm in male, in female 0.10-0.12 × 0.11-0.12 mm, with 3 transverse rows of 6 hooks each. Hooks of apical, middle and basal rows, 0.0552-0.059 × each, hooks wide base and pointed tips. Hooks of apical row 0.055-0.0099-0.011 mm and 0.037 × 0.0062-0.0066 mm, of basal row 0.040-0.041 × 0.0067 mm in male; in female same 0.064-0.066 × 0.011-0.015 mm, 0.038-0.043 × 0.006-0.007 mm and 0.044-0.046 × 0.0075-0.0085 mm. Proboscis receptacle cylindrical, single-walled, 0.30-0.33 × 0.12-0.14 mm 015 mm wide. Neck short, smooth 0.030-0.064 × 0.075-0.12 mm in male, in female 0.056-0.058 × 0.12-0.14 mm. Trunk elongate, cylindrical, with rows of 30-36 spines throughout trunk, of 0.016-0.018 mm in male; in female in 38-41 transverse rows throughout trunk, of 0.017-0.018 mm long. Lacunar system with main longitudinal channels and reticular anastomoses. Lemnisci longer than receptacle, subequal, slender, right 0.76-0.96 × 0.14-0.15 mm, left 0.90-1.09 × 0.14-0.15

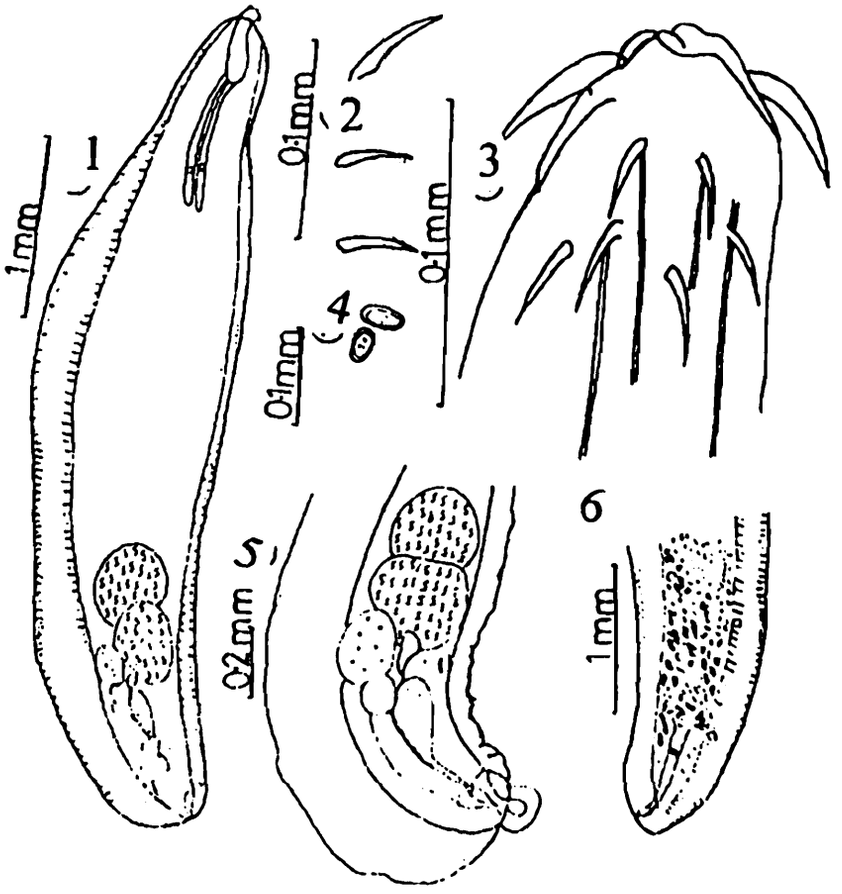


Fig. 245. *Acanthosentis heterospinus* Khan & Bilqees, 1990. 1. Male, 2. Proboscis hooks enlarged, 3. Proboscis enlarged, 4. Eggs, 5. Posterior part of male, 6. Posterior part of female (after Khan & Bilqees, 1990).

mm in male, in female right 0.62-0.91 × 0.11-0.14 mm, left 0.67-0.93 × 0.12-0.14 mm, each with a giant nucleus. Anterior testis 0.26-0.45 × 0.31-0.40 mm, posterior 0.27-0.45 × 0.30-0.34 mm. Cement gland syncytial 0.11-0.15 × 0.12 mm, with many nuclei, its reservoir small, 0.11-0.15 × 0.12 mm. Vas deferens 0.18-0.22 × 0.074-0.077 mm. Cement duct 0.22-0.29 mm long. Seminal vesicle elongated 0.25-0.36 × 0.070-0.074 mm. Saefftigen's pouch muscular, located behind vas deferens, 0.33-0.42 × 0.14-0.22 mm wide. Bursa 0.33-0.42 × 0.14-0.22 mm. Uterine bell 0.25-0.28 × 0.11-0.12 mm, opening into uterus 0.18-0.22 × 0.037-0.060 mm. Vagina 0.050-0.060 × 0.060-0.067 mm. Eggs small, oval, 0.011-0.012 × 0.007-0.0074 mm. Female gonopore terminal.

Host : *Catla catla* (Hamilton).

Location : Intestine.

Locality : Kalri lake, Sindh, Pakistan.

Distribution : Known only from type locality.

275. ***Acanthosentis hilsai*** Pal, 1963
(Fig. 246)

Acanthogyrus hilsai Pal, 1963a : 96-98, Fig. 1; Pal, 1963b : 120-121; Anantaraman, M. & Anantaraman, S., 1970 : 4; Gupta, V. & Sinha, 1990b : 47, 48; Golvan, 1994 : 138.

Type locality : Ganges River, Uttar Pradesh, India.

Description : Worms whitish in life. Male 1.2-2.63 × 0.37-0.90 mm; female 3.27 × 0.47 mm. Proboscis small, globular, 0.1-0.18 × 0.1-0.12 mm in male; in female 0.10-0.12 × 0.11-0.12 mm. Hooks of anterior row 1.5 times larger than basal hooks. Hooks of apical, middle and basal rows 0.055-0.059 × 0.009-0.011 mm, 0.037 × 0.0062-0.0066 mm and 0.040-0.041 × 0.0067 mm in male; in female same 0.064-0.066 × 0.011-0.015 mm, 0.038-0.043 × 0.0062-0.0074 mm and 0.044-0.046 × 0.0075-0.0085 mm. Proboscis receptacle cylindrical, single-walled 0.24-0.39 × 0.10-0.14 mm in both sexes, with ganglion at its base. Neck short, smooth 0.030-0.064 × 0.075-0.12 mm in male; in female 0.056-0.058 × 0.12-0.14mm. Trunk elongate, cylindrical, with posterior end slightly recurved, widest near middle of anterior half and tapers towards posterior blunt end, anterior end armed with 10-15 circles of spines. Hypodermal nuclei

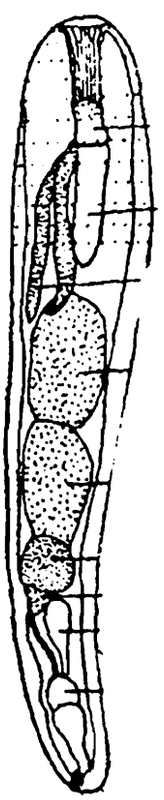


Fig. 246. *Acanthosentis hilsai* Pal, 1963. Male (after Pal, 1963).

present. Lacunar system with longitudinal channels and reticular anastomoses. Lemnisci long, slender, about equal, reach anterior testis, 0.63 × 0.06-0.08 mm. Testes ovoid, overlapping, anterior 0.16-0.39 × 0.14-0.27 mm long. Testes ovoid, overlapping, anterior 0.16-0.39 × 0.14-0.27 mm, posterior 0.16-0.39 × 0.14-0.27 mm. Cement gland spherical, syncytial mass 0.1-0.2 × 0.1-0.2 mm, with many nuclei. Cement reservoir small 0.11-0.15 × 0.12 mm. Vas deferens 0.18-0.22 × 0.074-0.077 mm. Seminal vesicle club-shaped 0.10-0.29 × 0.01-0.02 mm. Bursa funnel-shaped. Ovary 0.43 × 0.2 mm Uterine gland 0.06 × 0.04, with guard cells which form a globular syncytial mass. Uterus long 0.29 × 0.04 mm leads into thick, muscular vagina.0.04 × 0.02 mm. Eggs small, oval, numerous 0.011-0.017 × 0.007-0.0074 mm.

Host : *Hilsa ilisha* (Hamilton).

Location : Intestine.

Locality : Ganges river (Uttar Pradesh).

Distribution : Known only from type locality.

276. ***Acanthosentis holospinus*** Sen, 1938
(Fig. 247)

Acanthosentis holospinus Sen, 1938 : 41-45, Fig. 1-4; Yamaguti, 1963 : 33; Anantaraman, M. & Anantaraman, S., 1970 : 3; Gupta, P.D. & Gupta, R.K., 1979: 316;

Acanthogyrus (*Acanthosentis*) *holospinus* Amin, 1985 : 85;

Acanthosentis holospinus Gupta, V. & Sinha, 1990b : 46; Golvan, 1994 : 138.

Type locality : Salt lake near Kolkata, West Bengal, India.

Description : Worms whitish or creamy in life. Male 0.9-2.4 × 0.2-0.4 mm, female 1.6-9.4 × 0.2-0.7 mm. Proboscis short, cylindrical 0.1 × 0.05 mm with 3 rows of 6 single-rooted hooks. Hooks of anterior row much stronger and larger in size than those of basal row, about 0.05 mm long Proboscis receptacle single-walled, muscular, 0.30 × 0.08 mm, with ganglion near its base. Trunk spinose with about 38 circular rows of 34 spines each in middle of trunk. Circles of spines crowded anteriorly but in posterior 4/5 they are widely separated. Hypodermal giant nuclei oval or round, 4 dorsal, 2 ventral. Lacunar system well developed with channels and canaliculi spread all over body wall. Lemnisci 2, very slender, muscular, slightly longer than receptacle, about 0.3 mm long. Testes ovoid about equal in size, touching each other, from each vas efferens arises, and two of then unite to form vas deferens and opens into penis. Cement gland syncytial lies just behind testes with 4-6 large nuclei, its reservoir overlying wide seminal vesicle, from which a short cement duct emerges, continues posteriorly touching vas deferens and terminates in penis. Uterine bell thin, funnel-shaped followed by guard cells. Uterus long, wide anteriorly, and narrow towards its base with a pair of large cells. Vagina narrow with a pair of glands. Embryos elliptical, 0.10 × 0.073 mm. Female gonopore terminal.

Host : *Barbus stigma* (Cuvier & Valencielles) Hamilton.

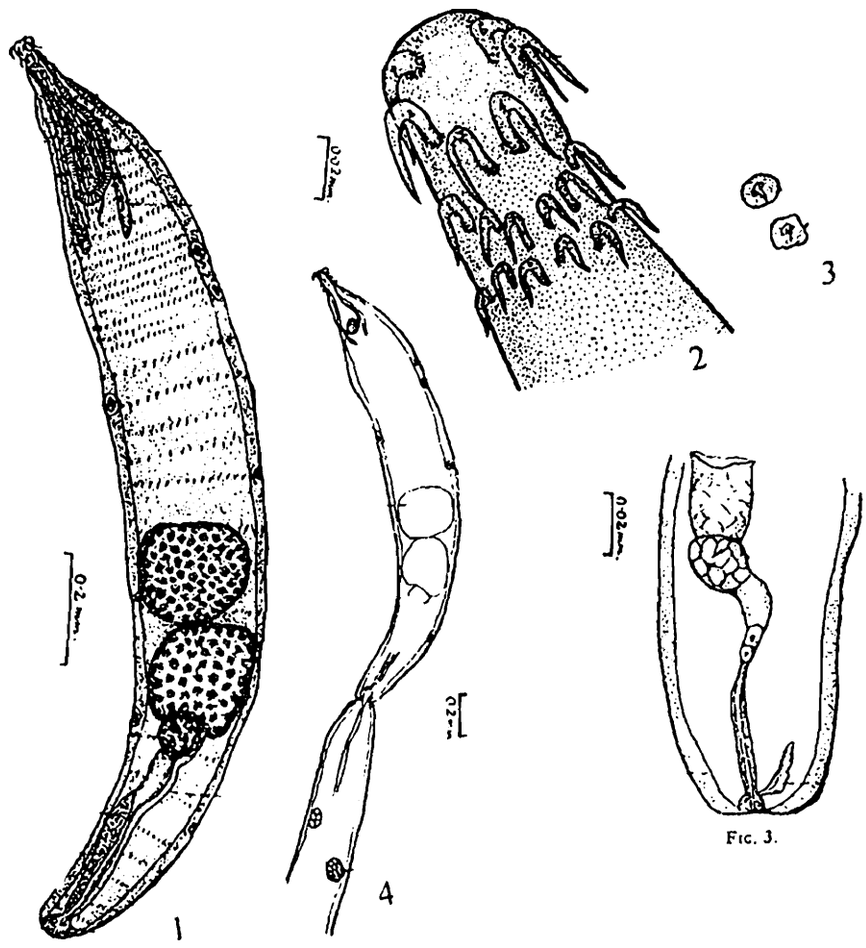


Fig. 247. *Acanthosentis holospinus* Sen, 1938. 1. Male, 2. Proboscis enlarged, 3. Trunk spines, 4. Posterior part of male and in copulation, 5. Posterior part of female (after Sen, 1937).

Location : Intestine.

Locality : Salt lake near Kolkata (West Bengal).

Distribution : Known only from India.

277. ***Acanthosentis indicus*** Tripathi, 1959
(Fig. 248)

Acanthosentis indica Tripathi, 1959 : 70, Textfig. 6 a; Pal, 1963 : 120-121; Yamaguti, 1963 : 33, Pl. 8, Fig. 76; Rai, 1967 : 36-38, Fig. 13-20; Prasad, Sahay & Sinha, 1969 : 279-283, Fig. 1-6; Sahay, Sinha & Narayanan, 1967:18-19, Fig. 1-3; Anantaraman, M. & Anantaraman, S., 1970 : 3;

Ahmed & Rauf, 1981 : ?124; Ahmed, 1981 : ?235;

Acanthogyrus (*Acanthosentis*) *indicus* Amin, 1985 : 65;

Acanthosentis indicus Gupta, V. & Sinha, 1990b : 47, 48;

Acanthogyrus (*Acanthosentis*) *indicus*, Arthur & Ahned, 2002 : 39.

Acanthosentis indica Golvan, 1994 : 138; Bhattacharya, 2007 : 49, Pl. 9, Fig. 32 a, b.

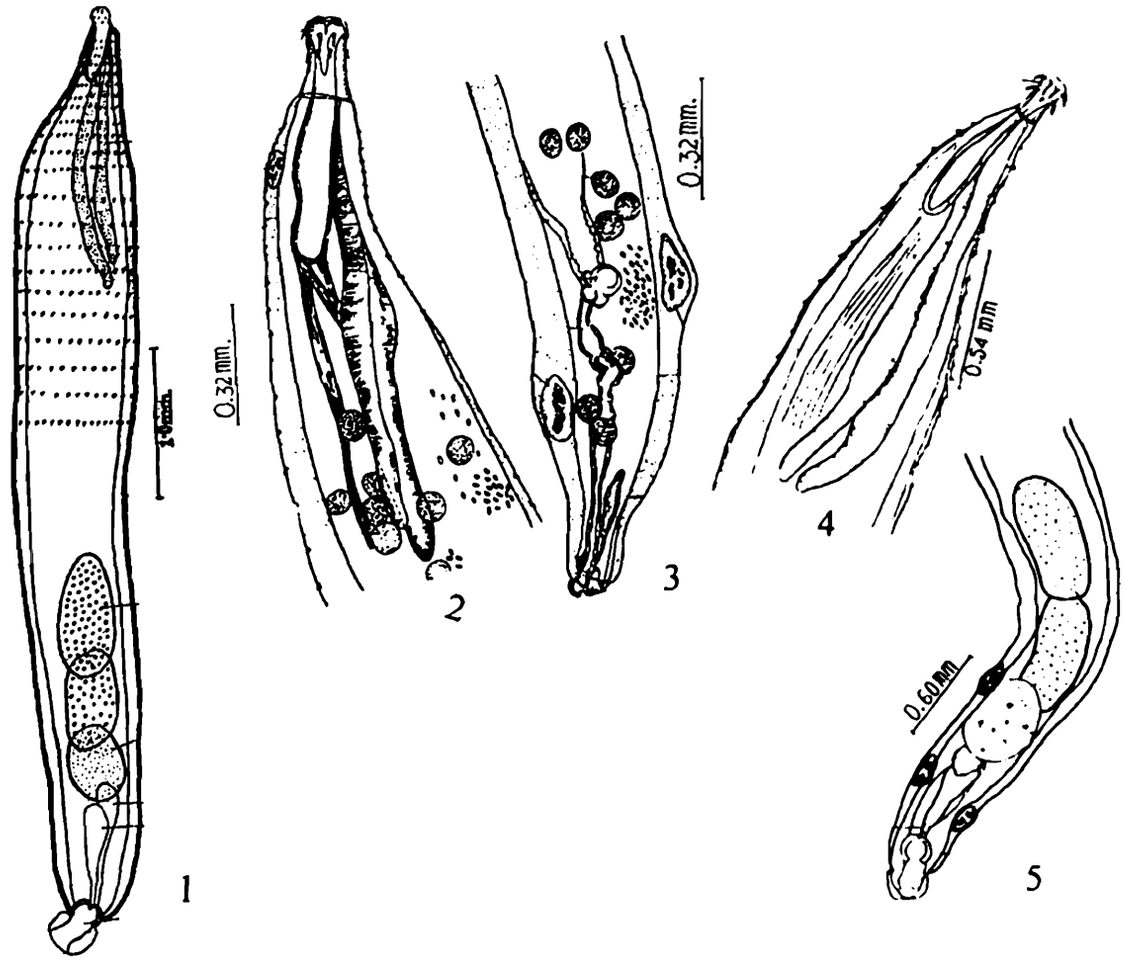


Fig. 248. *Acanthosentis indicus* Tripathi, 1959. 1. Male, 2. Anterior part of female, 3. Posterior part of female, 4. Anterior part of male, 5. Posterior part of male (1 after Tripathi, 2-5 after Sahay, Sinha & Narayan, 1967).

Type locality : Chilka lake, Orissa, India.

Description : Males 7.48-8.26 × 1.01mm, females 7.26-8.55 × 0.76-0.89 mm. Proboscis larger, cylindrical, 0.145-0.217 × 0.08-0.11 mm, with 3 rows of 6 hooks each. Hooks in I, II and III circles 0.041-0.045 mm, 0.038 and 0.031-0.036 mm long in male; in female 0.05-0.06 mm, 0.045-0.05 mm and 0.025-0.03 mm long. Proboscis receptacle long, single-walled 0.525-0.587 mm long in male, in female 0.59-0.66 mm long, with ganglion near its base. Trunk elongated, almost cylindrical, slightly flattened laterally and tapering towards both ends, anterior part with 19-20 circles of short, recurved spines. Spines of anterior circles bigger than in posterior ones. Giant hypodermal nuclei 5 dorsal and 2 ventral. Lacunar system with fine net wok of more prominent transverse canals. Lemnisci long, narrow, slightly unequal but not reaching anterior testis, 1.36-1.98 × 0.11-0.21 mm. Testes oval, overlapping, in posterior half of body, anterior testis 1.08 × 0.58 mm, posterior testis 0.87 × 0.45 mm. An efferent duct from each testis, run posteriorly and joins its fellow to form vas deferens which ends in muscular penis. Cement gland single, spherical, syncytial mass 0.94 × 0.55 mm, with 6-8 nuclei, its reservoir club-shaped, 0.175-0.25 × 0.162-0.212 mm. Seminal vesicle pyriform 0.14 mm long. Bursa 0.7 × 0.43 mm. Uterine bell triangular,

funnel-shaped, 0.18 mm long, with a few guard cells at posterior end. Uterus long, muscular, 0.55-0.72 mm long, and vagina muscular 0.55-0.72 mm long with club-shaped vaginal glands, 0.15 mm long near its opening. Eggs elliptical with three shells, 0.024-0.032 × 0.010-0.018 mm. Female gonopore postero-ventral.

Host : *Setipinna phasa* (Hamilton), *Hilsa ilisha* (Hamilton); *Mystus seenghala* (Sykes) Hamilton, *Macrones gulia* (Gunther).

Location : Intestine.

Locality : Chilka lake (Orissa); River Ganges at Buxar (Uttar Pradesh); Ganga River at Bakor (Bihar); Hooghly, Malta River (West Bengal); Barisal, Dhaka (Bangladesh).

Distribution : Known only from Indian subcontinent.

278. ***Acanthosentis oligospinus*** Anantaraman, S., 1980 (Fig. 249)

Acanthosentis oligospinus Anantaraman, S. 1969 : 21-23, Fig. 1-5; Fig. 1-5; 1969 : 1629-1632; Anantaraman, S & Anantaraman, M, 1974 : 140-144, Fig. 1-7; Anantaraman, S., 1980a : 876; 1980b: 21-23, Fig. 1-5; Najib, 1983: 223-224; 1985 : 152-157; 1986 :

Acanthogyrus (*Acanthosentis*) *oligospinus* Amin, 1985 : 65;

Acanthosentis oligospinus Najib, 1986 : 1-6; 1990 : 1-3; 190 : 1-5; Golvan, 1994 : 138.

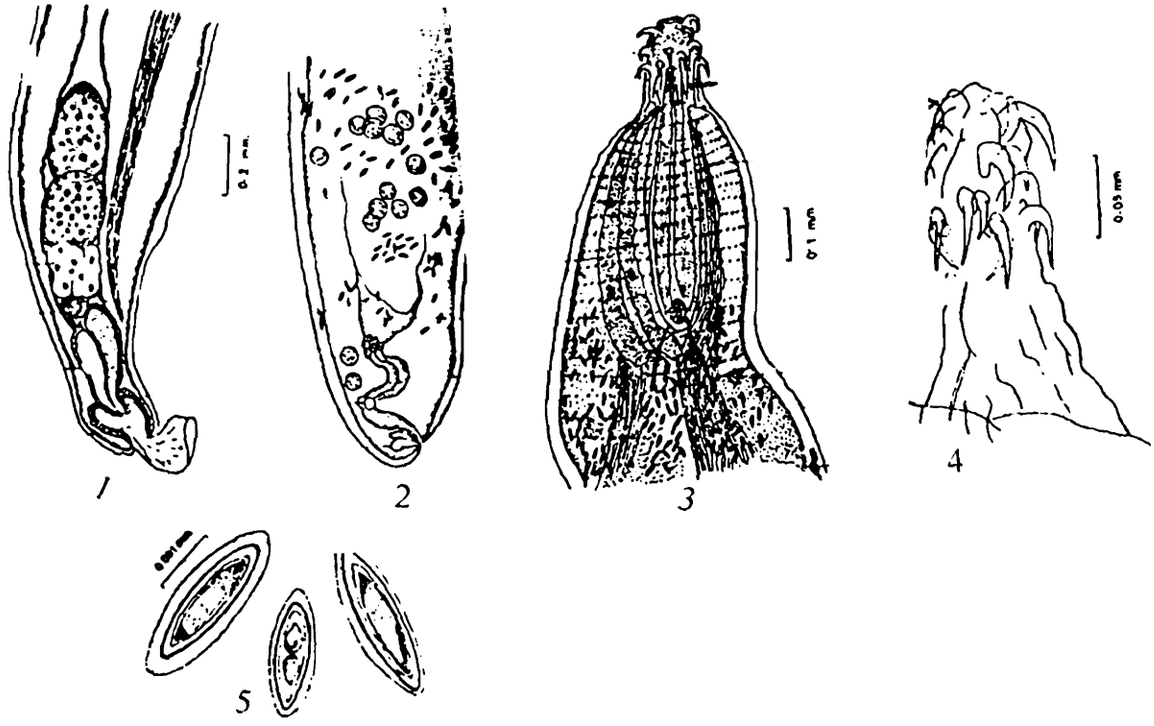


Fig. 249. *Acanthosentis oligospinus* Anantaraman, S., 1980. 1. Posterior part of male, 2. Posterior part of female, 3. Anterior part of worm, 4. Proboscis enlarged, 5. Ova enlarged (after Anantaraman, S., 1980).

Type locality : Chennai, Tamil Nadu, India.

Description : Males 4.0 × 0.89 mm; female 4.5 × 1.07 mm. Proboscis cylindrical, short 0.15 × 0.07 mm with 3 circles of 6 hooks each. Hook roots blunt, without prominence. Anterior most hooks 0.05 mm long, middle and basal hooks 0.04 mm long. Proboscis receptacle 0.40 × 0.09 mm with ganglion at its base. Neck short, unarmed. Trunk cylindrical, with discoid base, in 16-18 circles of 50-60 large, rose-thorn-like spines each in anterior region, 17^{th} and 18^{th} circles visible only in lateral regions. Each spine with a scale-like body and a fine prominence. Hypodetrmal nuclei dendritic, 5 or 6 pairs. Lemnisci ribbon shaped. Testes one behind other, anterior oval, larger 0.38 × 0.23 mm, posterior spherical 0.26 × 0.23 mm, two vasa efferentia run posteriorly below or one side of cement gland. Cement gland syncytial 0.22 × 0.20 mm, its reservoir 0.15 × 0.09 mm. Seminal vesicle 0.06 × 0.05 mm leading into a wide vas deferens 0.45 × 0.10 mm. Saefftigen's pouch and vas deferens covered in muscular sheath lead into a bell-shaped copulatory bursa 0.25 × 0.12 mm. Penis projects from its top into its cavity as a short protuberance. Ovarian balls 0.04 mm in diameter freely float in body cavity. Uterine bell funnel-shaped, thin-walled 0.10 × 0.16 mm followed by 6 guard cells. Uterus 0.18 × 0.05 mm continues as bulbous ovijector. Vagina tubular 0.22 × 0.25 mm with 1 pair of saccular vaginal glands 0.08 × 0.10 mm, open outside through a subterminal pore. Eggs oval 0.035 × 0.012 mm.

Host : *Mystus* (*Macrones*) *gulio* (Gunther).

Location : Intestine.

Locality : Chennai (Tamil Nadu).

Distribution : Known only from type locality.

279. ***Acanthosentis putitorae*** Chowhan, Gupta, N.K. & Khera, 1988 (Fig. 250)

Acanthosentis putitorae Chowhan, Gupta, N. K. & Khera, 1988a : 197-200, Fig. 1-11; Golvan, 1994: 138; Bhattacharya, 2007: 50, Pl. 9, Fig. 33 a-e.

Type locality : Sutlej river at Nangal and Ropar, Punjab, India.

Description : Male 0.72-3.4 × 0.48-0.67 mm; female 5.08-6.04 × 0.80-0.93 mm. Proboscis small, globular, with apical pit, which corresponds with terminus of apical gland located interiorly, 0.12 × 0.08-0.12 mm in male; in female 0.13 × 0.13 mm, with 3 circles of 6 hooks each. Two lateral hooks of anterior circle placed somewhat posteriorly. Hooks of I, II and III circles 0.057-0.078 × 0.010-0.016 mm, 0.041-0.058 × 0.07 mm and 0.033-0.041 × 0.07 mm respectively in male; in female hooks of corresponding circles 0.061-0.074 × 0.016 mm, 0.041-0.049 × 0.08 mm and 0.37-0.041 × 0.07-0.08 mm respectively. Proboscis receptacle cylindrical 0.26-0.3 × 0.12-0.15 mm in male; in female 0.35 × 0.13-0.15 mm. Hypodermal giant nuclei 8-11, 6-8 dorsal, 2-3 ventral. Trunk ventrally curves, armed with 7-10 circles of 20-27 spines each, 6 anterior circles forming complete circles and posterior ones incomplete dorsally. Size of spines decrease posteriorly. Lacunar system

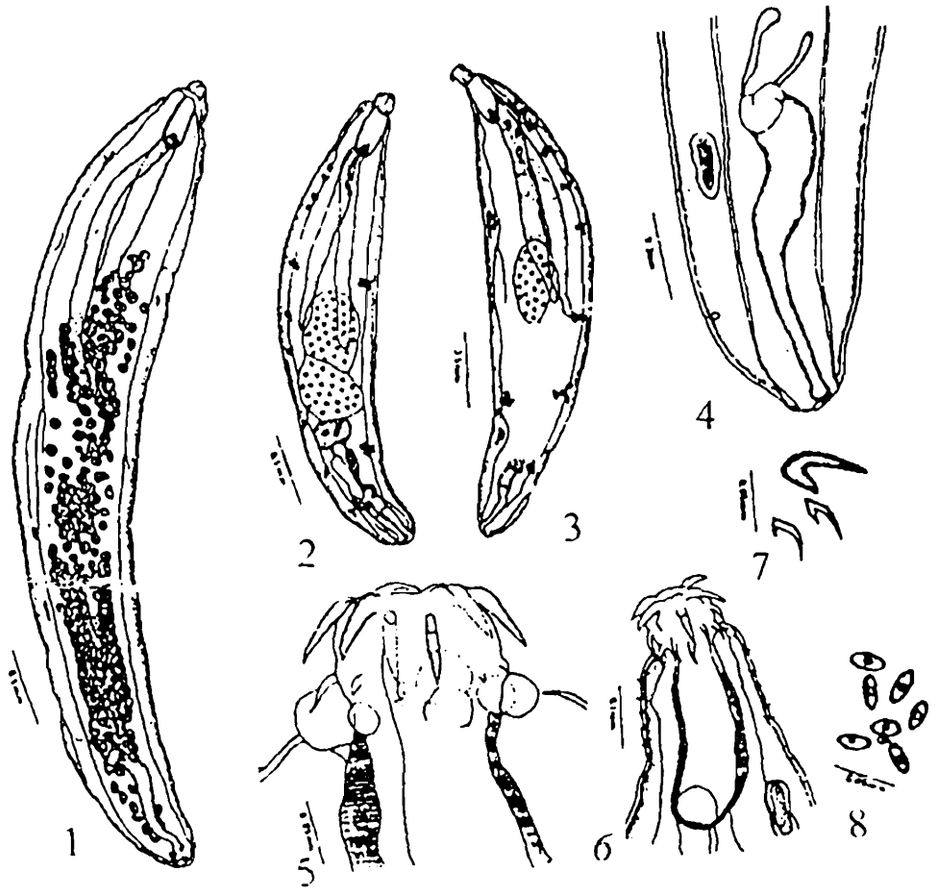


Fig. 250. *Acanthosentis putatorae* Chawhan, Gupta, N.K. & Khera, 1988. 1. Gravid female, 2. Male, 3. Immature female, 4. Posterior part of female, 5. Proboscis enlarged, 6. Anterior part of worm, 7. Proboscis hooks enlarged, 8. Ova (after Chowan, Gupta & Khera, 1988).

reticular. Lemnisci elongated, subequal 1.06-1.74 × 0.09-0.13 mm in male; in female equal 1.75-2.34 × 0.13-0.16 mm. Anterior testis oval 0.36-0.57 × 0.33-0.38 mm, posterior testis slightly rounded 0.31-0.45 × 0.33-0.39 mm. Cement gland rounded, syncytial 0.20-0.35 × 0.20-0.26 mm, its reservoir 0.08-0.12 × 0.08-0.12 mm. Seminal vesicle pear-shaped 0.23-0.36 × 0.07-0.08 mm. Saefftigen's pouch 0.21-0.35 × 0.08-0.10 mm. Copulatory bursa 0.44-0.48 × 0.17-0.23 mm, its muscular cap 0.10-0.13 × 0.17-0.23 mm. Male gonopore large surrounded by radial folds. Uterus 0.26-0.43 × 0.07-0.12 mm. Vagina 0.26-0.35 × 0.07-0.08 mm. Vaginal pore slit like situated on a small elevated area surrounded by large circular cuticular folds. Ovary oval 0.17-0.55 × 0.12-0.26 mm. Egg oval 0.028 × 0.014 mm.

Host : *Tor putitora* (Hamilton).

Location : Intestine.

Locality : Sutlej river at Nangal and Ropar (Punjab).

Distribution : Known only from type locality.

280. ***Acanthosentis seenghalae*** Chowhan, Gupta, N.K. & Khera, 1988 (Fig. 251)

Acanthosentis seenghalae Chowhan, Gupta, N.K. & Khera, 1988a : 201-203, Fig. 12-15; Golvan, 1994 : 138; Bhattacharya, 2007 : 52, Pl. 10, Fig. 37 a-c.

Type locality : Nangal, Punjab, India.

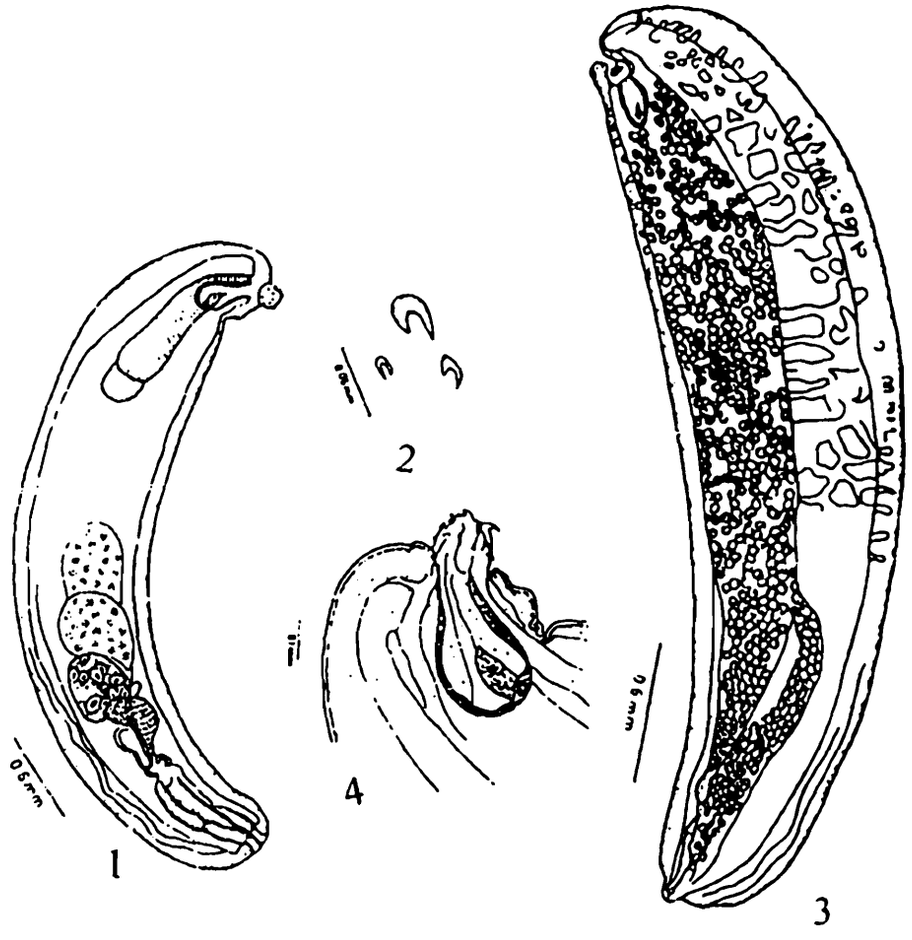


Fig. 251. *Acanthosentis seenghalae* Chowhan, Gupta, N.K. & Khera, 1988. 1. Male, 2. Proboscis hooks, 3. Female, 4. Anterior part of worm enlarged (after Chowhan, Gupta, N.K. & Khera, 1988).

Description : Male 2.8-3.18 × 0.72-1.0 mm; female 2.87-4.35 × 0.70-0.98 mm. Proboscis as long as wide, 0.06-0.08 × 0.07-0.08 mm .with 3 circles of 6 spines each. Hooks of I, II and III circles 0.029-0.030 × 0.006-0.008 mm, 0.020-0.027 × 0.003-0.004 mm and 0.016-0.024 × 0.002-0.004 mm in male; in female hooks of corresponding circles 0.041-0.045 × 0.012-0.016 mm, 0.028-0.033 × 0.004-0.006 mm and 0.028-0.033 × 0.004-0.006 mm respectively. Proboscis receptacle flask-shaped, 0.25-0.26 × 0.10-0.14 mm. Trunk ventrally curved, with spines restricted to 1/3, in 12-14 circles of 20-21 spines each. Lemnisci subequal, balloon-shaped, 0.59-0.91 × 0.12-0.18 mm in male; in female lemnisci not clear. Testes in tandem, anterior oval 0.38-0.45 × 0.26-0.30 mm, posterior rounded 0.39-0.43 × 0.30-0.41 mm. Cement gland syncytial rounded 0.21-0.31 × 0.18-0.28 mm

with 6-11 giant nuclei, its reservoir pyriform 0.12-0.13 × 0.10-0.11 mm. Saefftigen's pouch 0.16-0.23 × 0.07-0.10 mm. Seminal vesicle pear-shaped 0.25-0.30 × 0.10-0.12 mm. Copulatory bursa 0.49-0.54 × 0.10-0.15 mm, its muscular cap 0.07-0.11 × 0.10-0.15 mm. Uterine bell 0.08-0.15 × 0.06-0.08 mm. Uterus 0.17-0.20-0.05-0.06 mm. Vagina 0.16-0.20 × 0.04-0.05 mm. Ovarian balls fill body cavity. Female gonopore with a small papilla-like protruberance.

Host : *Mystus seenghala* (Sykes).

Location : Intestine.

Locality : Nangal (Punjab).

Distribution : Known only from type locality.

281. ***Acanthosentis shuklai*** Agarwal & Singh, 1982
(Fig. 252)

Acanthosentis shuklai Agarwal & Singh, 1982 : 85-87,Fig. 1-3; Bhattacharya, 2007: 50, Pl. 9, Fig. 34 a-c.

Type locality : Gorakhpur, Uttar Pradesh, India.

Description : Male 16 × 2 mm, female 14 × 2 mm. Proboscis short 0.20 × 0.18 mm with 3 circles of 3 hooks each. Hooks broad based with pointed tips. Proboscis receptacle saccular, 0.55 × 0.03 mm. Neck short, unarmed, 0.03 mm long. Trunk spines small of same size and shape. In female posterior most spines on posterior tip of trunk. Lemnisci very small, narrow, shorter than proboscis receptacle. Genital organs located in posterior third of trunk. Testes in tandem, anterior 0.9-× 1.1 mm, posterior 1.1 × 1.3 mm. Cement gland syncytial, 1.1 × 0.8 mm with 5 nuclei, its reservoir 0.4 mm diameter. Seminal vesicle 0.77 × 0.3 mm. Penis along with ejaculatory duct clothed in muscular sheath lead into

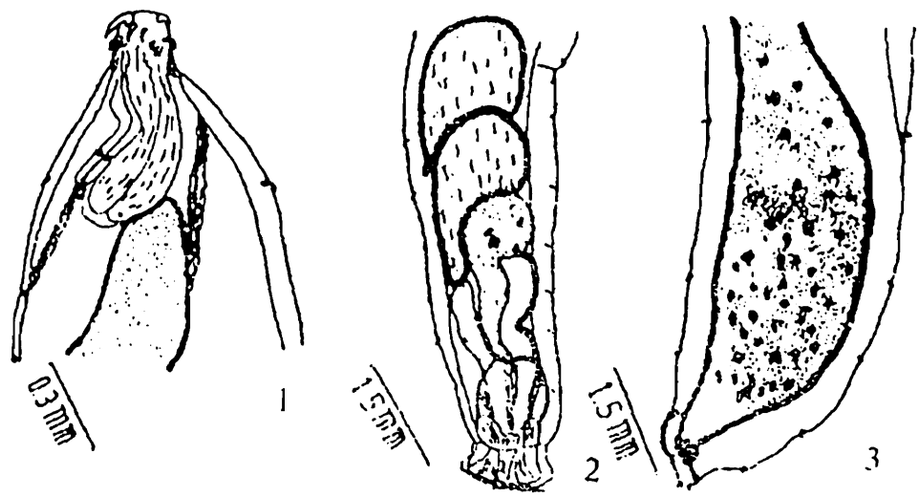


Fig. 252. *Acanthosentis shuklai* Agarwal & Singh, 1982. 1. Anterior part of worm, 2. Posterior part of male, 3. Posterior part of female (after Agarwal & Singh, 1982).

copulatory bursa, on a short protuberance which measures 1.8 × 0.25 mm. Saefftigen's pouch absent. Ovarian balls fill trunk cavity, each measure 0.1 mm in diameter. Uterine bell thin, conical, 0.2 × 0.3 mm guarded by 18 guard cells. Uterus short, bulbous, 0.3 × 0.4 mm. Vagina tubular, 0.2 × 0.1 mm with a pair of glands. Eggs 0.15 × 0.09 mm.

Host : *Labeo rohita* (Hamilton).

Location : Intestine.

Locality : Gorakhpur (Uttar Pradesh).

Distribution : Known only from type locality.

282. ***Acanthosentis sircari*** Poddar, 1941
(Fig. 253)

Acanthosentis sircari Poddar, 1941 : 137-142, Fig. 1-4; Petrotschenko, 1956 : 250-251, Fig. 92; Yamaguti, 1963 : 34; Anantaraman, M. & Anantaraman, S., 1970 : 3;

Acanthogyrus (*Acanthosentis*) *sircari* Amin, 1985: 65;

Acanthosentis sircari Gupta, V. & Sinha, 1990b : 47; Golvan, 1994 : 138; Bhattacharya, 2007 : 50-52, Pl. 9, Fig. 35 a-c.

Type locality : Kolkata, West Bengal, India.

Description : Worms creamy white in life. Males 3.11-4.26 × 0.48-0.67 mm; females 2.94-11.89 × 0.39-1.01 mm. Proboscis globular 0.138 × 0.115 mm, with 3 circular rows of 6 hooks each. Hooks of posterior circle decreasing in size abruptly. Hooks of I. II and III circles 0.055 mm, 0.048 mm, 0.018 mm long. Proboscis receptacle single-walled, muscular, 0.26 × 0.15 mm hanging down from middle part of proboscis with ganglion situated at its base. Neck very short. Trunk cylindrical with wide anterior end while posterior part tapers slightly towards posterior end, with 14 circles of spines. Subcuticular nuclei, 5 dorsal and 2 ventral, some branched nuclei present. Lacunar system with transverse canals. Lemnisci short 0.92 × 0.10 mm with 3 giant nuclei, and 1.93 × 0.16 mm with 2 giant nuclei. Testes ovoid, closely apposed to each other, anterior testis 0.39 × 0.34 mm, posterior testis 0.38 × 0.32 mm. Vasa efferentia from testes unite near cement reservoir to form a thick elongated vas deferens ending in penis. Cement gland syncytial mass with 6-8 nuclei, lying close behind posterior testis, 0.253 × 0.207 mm, its reservoir rounded 0.16 × 0.10 mm, continues as narrow cement duct 0.598 mm long opens at base of penis. Penis conical, muscular at top of eversible funnel-shaped bursa. Seminal vesicle long, balloon-shaped sac opens near opening of vas deferens in penis. Bursa funnel-shaped 0.437 mm long. Uterine bell thin-walled 0.115 mm long leads into tubular uterus, at their junction 5-6 giant cells, guard cells control passage of mature eggs into uterus At junction of anterior and posterior parts two giant cells are situated within uterine wall. Uterus tubular, 0.133 mm long leads into thick muscular vagina situated postero-ventral end of worm. Vagina 0.16 mm long. Eggs not liberated.

Host : *Rasbora elongata* (Hamilton).

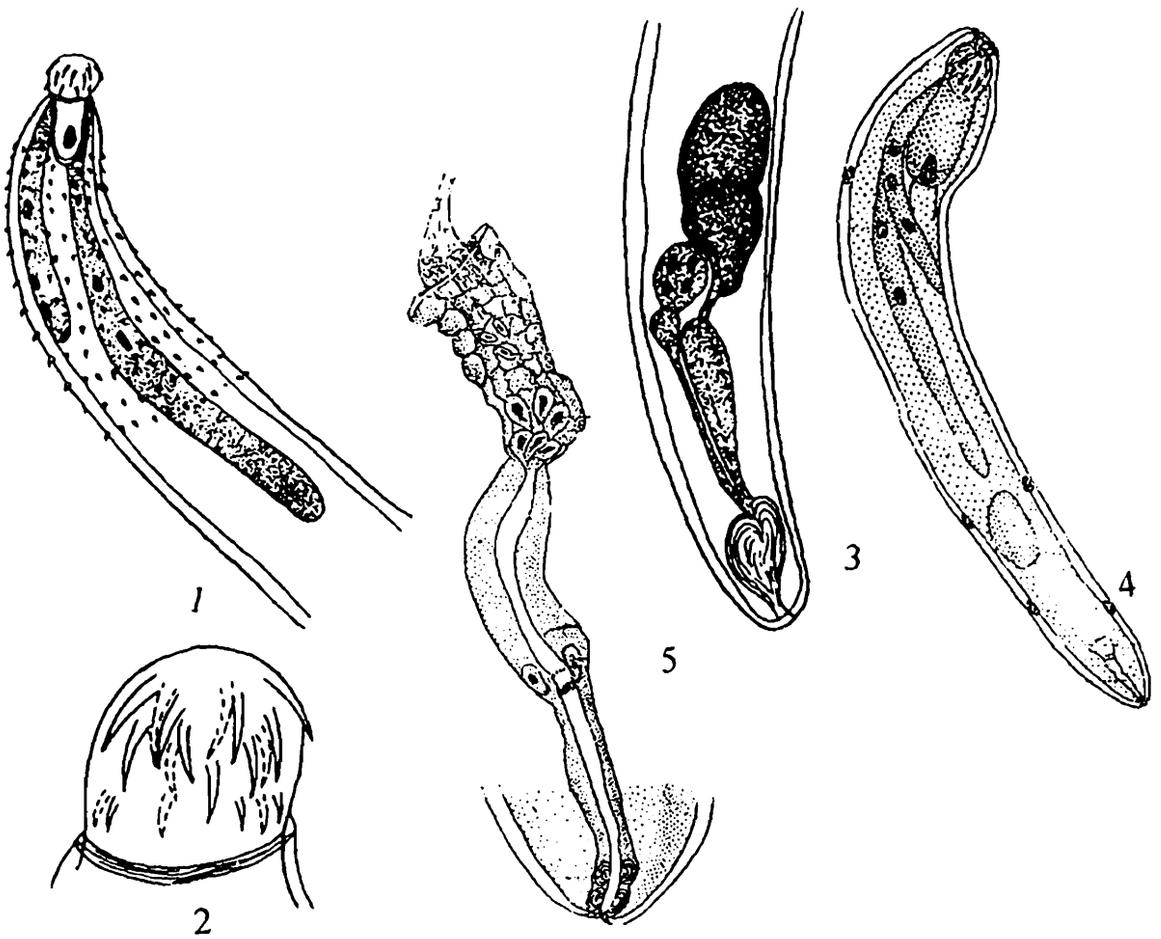


Fig. 253. *Acanthosentis sircari* Poddar, 1941. 1. Anterior part of female, 2. Proboscis enlarged, 3. Posterior part of male, 4. Female, 5. Female genitalia (after Poddar, 1941).

Location : Intestine.

Locality : Kolkata (West Bengal).

Distribution : Known only from type locality.

283. ***Acanthosentis thapari*** Prasad, Sahay & Shambunath, 1969 (Fig. 254)

Acanthosentis thapari Prasad, Sahay & Shambunath, 1969 : 279-283. Fig. 1-6;

Acanthogyrus (*Acanthosentis*) *thapari* Amin, 1985 : 66;

Acanthosentis thapari Gupta, V. & Sinha, 1990b : 48; Golvan, 1994 : 138; Bhattacharya, 2007: 54, Pl. 9, Fig. 30 a-d.

Type locality : Patna, Bihar, India.

Description : Male 3.35-3.85 × 0.37-0.45 mm; female 3.35-4.9 mm long, 0.26-0.5 mm wide. Proboscis nearly cylindrical 0.185-0.190 × 0.11-0 mm in male and in female 0.175-

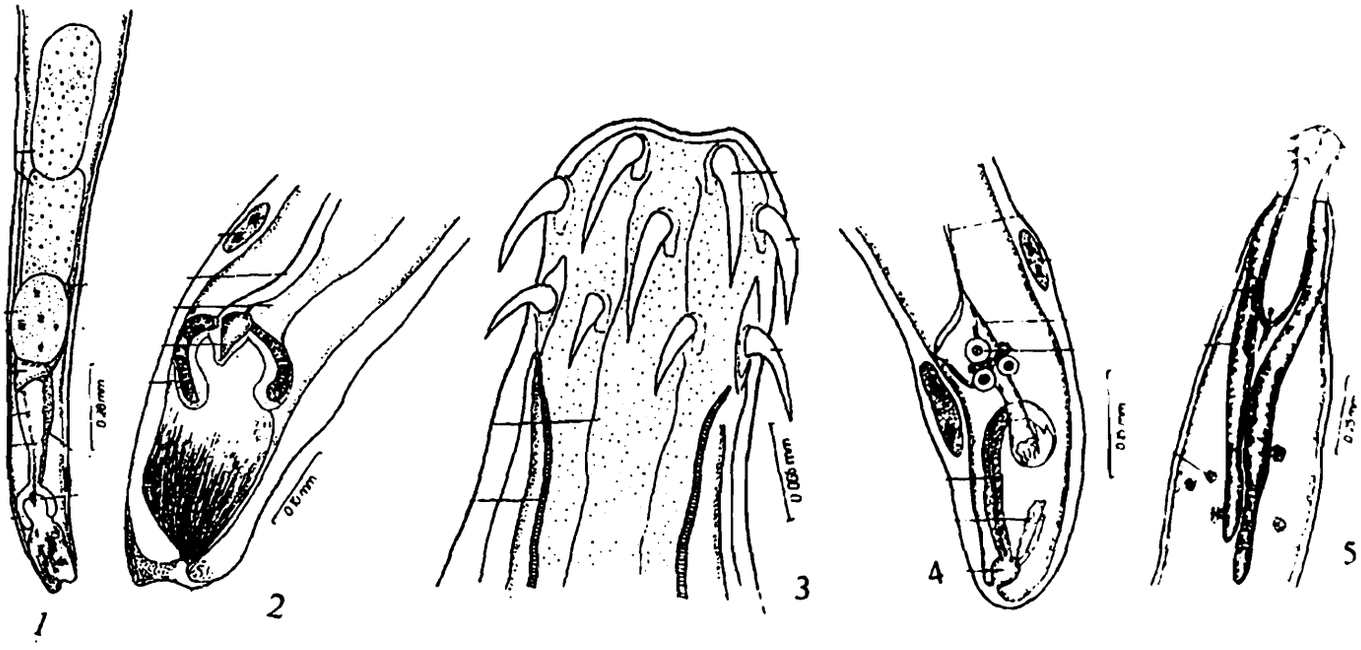


Fig. 254. *Acanthosentis thapari* Prasad, Sahay & Nath, 1969. 1. Posterior part of male, 2. Posterior part of male, 3. Proboscis and neck enlarged, 4. Posterior part of female, 5. Anterior part of female (after Prasad, Sahay & Nath, 1969).

0.205 × 0.1250.162 mm, with 3 transverse rows of 6 hooks each. Hooks 0.048 mm, 0.040-0.044 mm and 0.028-0.036 mm long in anterior, middle and posterior rows respectively. Proboscis receptacle single-walled, 0.54-0.615 mm long in male, and in female 0.63 mm long, with ganglion embedded in wall at its posterior end. Trunk elongated, almost cylindrical, flattened laterally and tapering to both ends, spinose with regular circles of spines all over but exact number could not be determined as spines on posterior half of trunk were very small. These spines closely set anteriorly but wide apart posteriorly. Giant hypodermal nuclei, 1 dorsal and 2 ventral. Lacunar system with transverse anastomoses. Lemnisci 2, longer than receptacle, 0.75-1.05 mm long in males, in females 0.90-1.2 mm long. Right lemniscus 1.01-1.22mm and left 0.935-1.028 mm long. Testes 2, one behind other, in close approximation, anterior 0.43-0.60 × 0.22-0.31 mm, posterior 0.43-0.57 × 0.225-0.312 mm. Efferent ducts from each testis run posteriorly and unite at commencement of seminal vesicle to form vas deferens ending in muscular penis. Cement gland syncytial 0.24-0.30 × 0.10-0.22 mm with 6-8 nuclei, its reservoir 0.11-0.15 × 0.06-0.125 mm. Cement ducts and seminal vesicle open at base of penis. Seminal vesicle 0.33-0.45 mm long. Bursa 0.120-0.125 × 0.11-0.135 mm. Penis 0.075-0.080 mm long. Uterine bell thin funnel-shaped, 0.11 mm long, its posterior end with two guard cells. Uterus muscular, elongated tube, 0.05 × 0.02-0.03 mm, with prominent coil near uterine bell, opening into vagina. Vagina with glands near its opening. Female gonopore postero-ventral.

Host : *Hilsa ilisha* Hamilton.

Location : Intestine.

Locality : Patna, Murzafarpur (Bihar).

284. ***Acanthosentis tilapiae*** Baylis, 1947
(Fig. 255)

Acanthosentis tilapiae Baylis, 1947:861-868; Petrotschenko, 1956 : 251; Ahmed & Rauf, 1981 : 125; Ahmed, 1981 : 236;

Acanthogyrus (Acanthosentis) tilapiae Amin, 1985 : 66;

Acanthosentis tilapiae Golvan, 1994 : 138; Arthur & Ahmed, 2002 : 39-40.

Type locality : Tanzania, Africa.

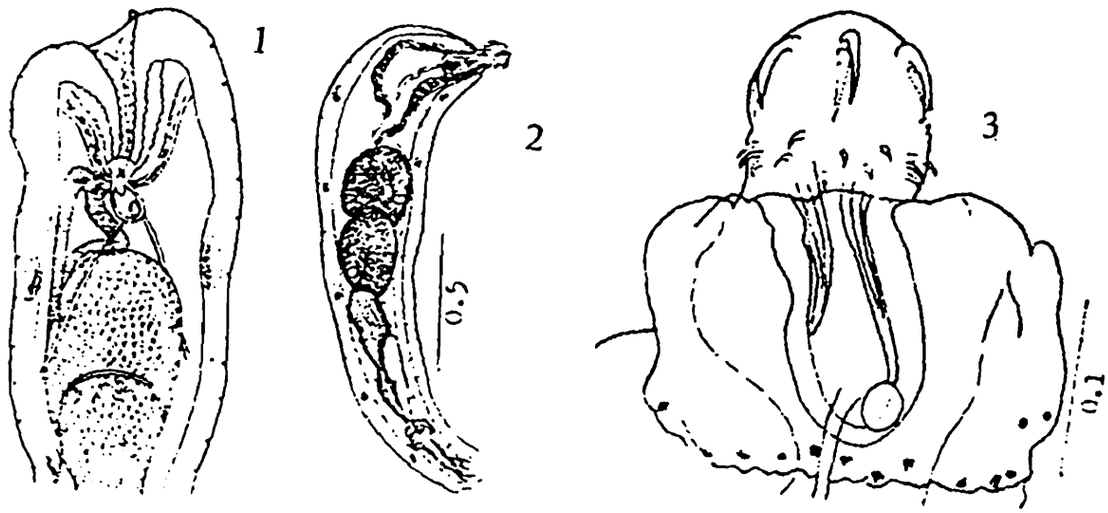


Fig. 255. *Acanthosentis tilapiae* (Baylis, 1948), Dollfus & Golvan, 1956. 1. Anterior half of male with Proboscis retreated, 2. Male, 3. Anterior part of worm.

Description : Male 1.12-2.12 x0.33-0.66 mm, female 1.30-3.03 × 0.60-0.61 mm. Proboscis 0.065-0.11 × 0.06-0.10 mm. Hooks in I, II and III circles 0.036-0.048 mm, 0.01-0.02 mm and 0.01-0.018 mm long in males; in females 0.045-0.058 mm, 0.012-0.022 mm and 0.010-0.016 mm long. Giant hypodermal nuclei usually 8, 2-4 dorsal, 4-6 ventral. Cement gland syncytial 0.14-0.20 × 0.09 mm.

Host : *Channa striatus* (Bloch), *Clarias batracus* (Linnaeus).

Location : Intestine.

Lacality : ?Bihar; Ganga River, Hooghly, Malta River (West Bengal), Barisal (Bangladesh).

Distribution : Africa.

285. ***Acanthosentis vancleavei*** Gupta, V. & Fatma, 1986
(Fig. 256)

Acanthosentis vancleavei Gupta, V. & Fatma, 1986c : 153-157, Pl. 2, Fig. 1-3; Golvan, 1994 : 138; Bhattacharya, 2007 : 54, Pl. 34, Fig. 189 a-d.

Type locality : Lucknow, Uttar Pradesh, India.

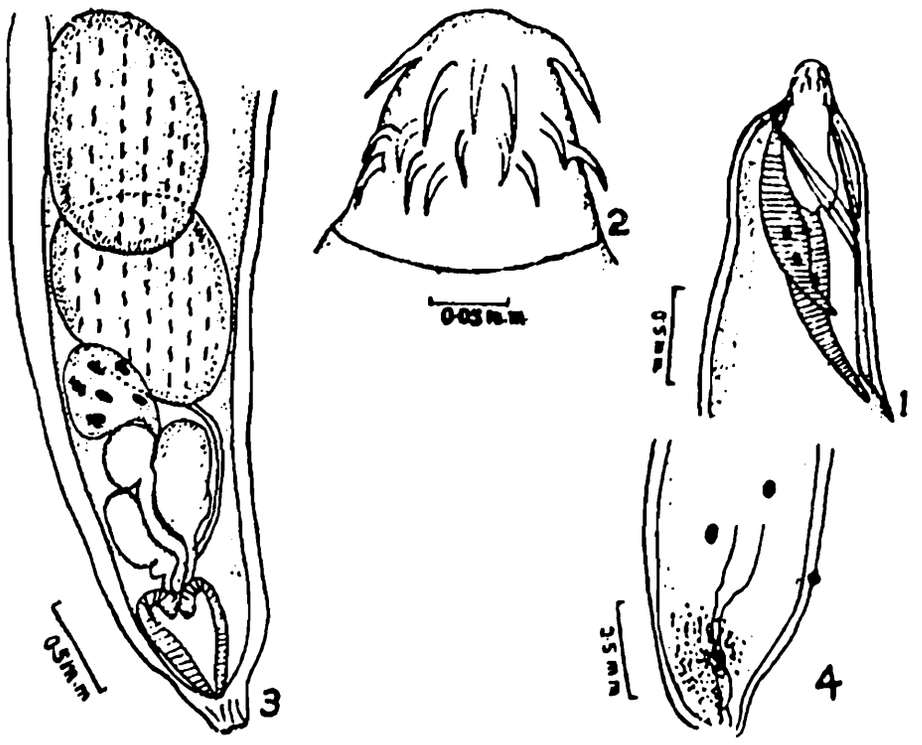


Fig. 256. *Acanthosentis vancleavei* Gupta, V. & Fatma, 1986. 1. Posterior part of male, 2. Proboscis enlarged, 3. Anterior part of worm, 4. Posterior part of female (after Gupta, V. & Fatma, 1986).

Description : Male 10.25 × 1.4 mm; female12.4-12.96 × 0.92-0.96mm. Proboscis short, globose, widest at base, 0.15 × 0.12 mm in male, in female 0.15-0.16 × 0.12-0.15 mm, with 3 transverse rows recurved hooks, similar in shape but different in size. Hooks of anterior 0.055 mm, middle 0.06 mm and basal circles 0.04 mm long in male; in female corresponding rows with 0.06-0.061 mm, 0.045-0.05 mm and 0.03-0.035 mm long. Proboscis receptacle cylindrical, single-walled, muscular sac with ganglion at its base, in male 0.55 × 0.18 mm; in female 0.50-0.55 × 0.30-0.35 mm. Neck 0.06 × 0.21 mm in male, in female 0.050-0.055 mm long. Trunk elongate, cylindrical, gradually widening from anterior end to middle, thence narrowing to posterior end. Anterior half of trunk with 18-20 circles of spines, closely set anteriorly and wide apart up to midtrunk. Lacunar system reticular. Lemnisci cylindrical, slender, unequal, longer than receptacle, with 2 nuclei each, smaller lemniscus 1.12 mm long, longer 1.40 × 0.45 mm long. Testes ovoid, subequal, contiguous, overlapping, post-equatorial, anterior 1.15 × 0.74 mm, posterior smaller, 1.05 × 0.78 mm. Cement gland ovoid, syncytial with 6 nuclei, 0.44 × 0.35 mm, its reservoir bean-shaped, 0.31 × 0.25 mm continuing up to bursal level through narrow duct. Saefftigen's pouch 0.56 × 0.25 mm Bursa bell-shaped 0.50 × 0.37 mm. Uterine bell rectangular 0.30-0.35 × 0.10-0.11 mm opening into uterus through a tube with several guard cells. Eggs elongated 0.01-0.011 × 0.010-0.012 mm. Gonopore terminal in both sexes.

Host : *Labeo rohita* (Hamilton) Gunther.

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

286. ***Acanthosentis vittatusi*** Verma, 1973
(Fig. 257)

Acanthosentis vittatusi Verma, 1973 : 265-271, Pl. 1, Fig. 1-4;

Acanthogyrus (*Acanthosentis*) *vittatusi* Amin, 1985 : 66;

Acanthosentis vittatusi Golvan, 1994 : 138; Bhattacharya, 2007 : 52, Pl. 9-10, Fig. 36 a-d.

Type locality : Allahabad, Uttar Pradesh, India.

Description : Male 1.15-1.32 × 0.25-0.28 mm; female1.49-1.85 × 0.22-0.30 mm. Proboscis short, globular, 0.06-0.15 × 0.07-0.10 mm in males, in females 0.08-0.14 × 0.04-0.08 mm, with 3 circles of 8 recurved hooks each. Hooks of apical, middle and basal rows 0.037-0.05 mm, 0.032-0.039 mm and 0.020.03 mm in males; in females same hooks 0.04-0.048 mm, 0.035-0.039 mm and 0.028-0.031 mm long. Proboscis receptacle cylindrical, single-walled, muscular sac 0.14-0.20 × 0.06-0.07 mm in male; in female 0.21-0.27 × 0.05-0.062 mm, with ganglion at its base. Trunk small, elongated, cylindrical, with ends attenuated, anterior trunk armed with 17-19 rows of spines. Lacunar system

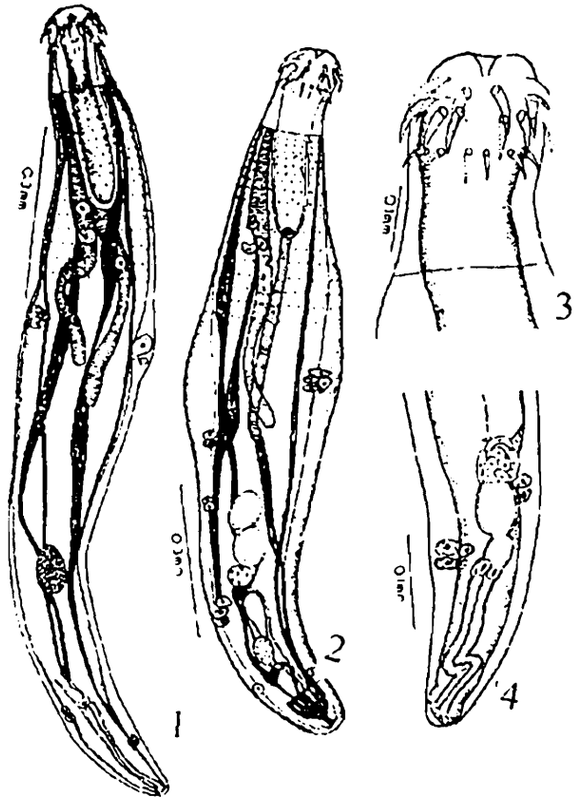


Fig. 257. *Acanthosentis vittatusi* Verma, 1973. 1. Female, 2. Male, 3. Proboscis enlarged, 4. Posterior part of female (after Verma, 1973).

with prominent main channels and reticular anastomoses. Giant hypodermic nuclei many, 8-15; up to 9 dorsal and 6 ventral, in groups of 2-4 adjacent nuclei Lemniscus long, slender, unequal, extend up to midtrunk, shorter lemniscus 0.40-0.505 × 0.35-0.5 mm, longer 0.44-0.56 × 0.02-0.05 mm in male, in female shorter lemniscus 0.51-0.64 × 0.27-0.30 mm, longer 0.54-0.59 × 0.0320.07 mm. Testes, oval, in tandem, subequal, pre-equatorial, overlapping or slightly touching each other, anterior 0.077-0.09 × 0.06-0.075 mm, posterior 0.81-0.092 × 0.065-0.078 mm. Cement gland single, syncytial, spherical with 6 nuclei, 0.040-0.041 × 0.05-0.052 mm, its reservoir 0.03-0.04 × 0.029-0.035 mm, opening by a duct into bursa. Saefftigen's pouch 0.11-0.115 × 0.03-0.042 mm. Bursa muscular, eversible, 0.075-0.10 × 0.05-0.65 mm. Ovary oval, post-equatorial 0.08-0.18 mm × 0.032-0.07 mm. Uterine bell 0.03-0.048 0.025-0.042 mm opening into uterus through uterine tube with guard cells. Uterus along with vagina 0.13-0.52 mm long. Female gonopore postero-ventral.

Host : *Mystus vittatus* (Bloch).

Location : Intestine.

Locality : Allahabad (Uttar Pradesh).

Distribution : Known only from type locality.

57. Genus ***Pallisentis*** Van Cleave, 1928

Neosentis Van Cleave, 1928 : 148;

Pallisentis Van Cleave, 1928 : 147-149

Farzandia Thapar, 1930 : 362; 1931: 76; Meyer, 1933: 34;

Pallisentis Meyer, 1932 : 34;

Farzandia Meyer, 1933 : 30;

Farzandia Petrochenko, 1956 : 239;

Pallisentis Petrotschenko, 1956 : 245; Yamaguti, 1963 : 34;

Devendrosentis Sahay, Sinha & Ghosh, 1971 : 79;

Pallisentis Golvan, 1994 : 169; Amin, Richard, Heckman, Pham Van Luc, 2000 : 41; Bhattacharya, 2007 : 59-60.

Diagnosis : Quadrgyridae, Pallisentinae. Proboscis short, cylindrical to spheroid with 4 circles of 6-12 hooks each. Proboscis receptacle single-walled with large ganglion near its base. Trunk slender, small-medium in length, with an anterior set of collar spines and a posterior set of trunk spines separated by region without spines. Collar spines arranged in a few closely set circles, circles of trunk spines more widely spaced and may extend to posterior end of males or females. Giant hypodermal nuclei may be present. Lemnisci cylindrical, long, equal or unequal. Testes ovoid-cylindrical, contiguous. Cement gland syncytial medium-long with few to many giant nuclei. Cement reservoir present. Saefftigen's pouch present or absent. Parasites of fresh water fishes of Asia.

Type species : *Pallisentis umbellatus* Van Cleave, 1928.

This genus subdivided in to 3 subgenera *Demidueterospinus* Amin *et al.*, 2000, *Brevitritospinus* Amin *et al.*, and *Pallisentis* Van Cleave, 1928 all occur in Indian subcontinent..

Key to subgenera of genus *Pallisentis*

1. Proboscis hooks in second or third circle declining abruptly in size, cement gland usually small, with a few giant nuclei 2

– Proboscis hooks gradually declining in size posteriorly, cement gland usually l long with many giant nuclei ..... Subgenus *Pallisentis* Van Cleave, 1928

2. Proboscis hooks in second circle about half as long as hooks in first circle .... Subgenus *Demidueterspinus* Amin 2000

Proboscis hooks in third circle about half as long as hooks of second circle .... Subgenus *Brevitritospinus* Amin, *et al.*, 2000

Subgenus *Brevitritospinus* Amin *et al.*, 2000

Brevitritospinus Amin *et al.*, 2000 : 41-43.

Diagnosis : With characters of the genus *Pallisentis* provided herein. Proboscis hooks in circle 3 about half as long as hooks in circle 2. Cement gland usually small with a few giant nuclei.

Type species : *Pallisentis* (*Brevitritospinus*) *allahabadi* Agarwal, 1958.

Includes seven species, 1. *Pallisentis* (*Brevitotritispinus*) *allahabadi* Agarwal, 1958, 2. *P.* (*B.*) *cavasii* Gupta, S.P. & Verma, 1981, 3. *P.* (*B.*) *croftoni* Mital & Lal, 1981, 4. *P.* (*B.*) *fasciati* Gupta, S. P. Verma, 1980, 5. *P.* (*B.*) *indicus* Mital & Lal, 1981, 6. *P.* (*B.*) *mehrai* Gupta, V. & Fatima, 1986 and 7. *P.* (*B.*) *vietnamensis* Amin, Hackmann, Nguyen Van Ha & Pham Van, 2000, of which first 6 species occur in the subcontinrnt.

Key to Indian species of *Brevitritospinus*

1. Proboscis with conspicuous apical organ ... *Pallisentis* (*Brevitritospinus*) *allahabadi*

– Proboscis without apical organ 2

2. Cement gland with 608 giant nuclei ..... *Pallisentis* (*Brevitritospinus*) *cavasiii*

– Cement gland with more than 8 giant nuclei 3

3. Proboscis armed with 4 circles of 6-10 hooks each .... *Pallisentis* (*Brevitritospinus*) *fasciatus*

– Proboscis armed with 4 circles of 10-12 hooks each .... *Pallisentis* (*Brevitritospinus*) *mehtai*

Note : *Pallisentis* (*Brevitritospinus*) *crftoni* Mital & Lal, 1981 and *Pallisentis* (*Brevitritospinus*) *indicus* Mital & Lal, 1981 are not included in the key.

287. ***Pallisentis (Brevitritospinus) allahabadi*** Agarwal, 1958
(Fig. 258)

Pallisentis allahabadi Agarwal, 1958 : 107; Yamaguti, 1963 : 34; Anantaraman, M. & Anantaraman, S., 1970 : 4; Jain & Gupta, N.K., 1979 : 174-175, Fig. 9-29; Gupta, V. & Sinha, 1990 : 43; Chowhan, Gupta, N.K. & Khera, 1987b : 23, Fig 7-9, 11, 12; 1991: 159-167; Chaubey, 1996:

Pallisentis buckleyi Tadros, 1966 : 155-160, Fig. 1-8; Anantaraman, M. & Anantaraman, S., 1970 : 4;

Pallisentis allahabadi Ahmed & Rauf, 1981 : 124; Ahmed, 1981 : 235; Gupta, V. & Sinha, 1990b : 43; Chowhan, Gupta, N.K. & Khera, 1991 : 159;

Pallisentis (Pallisentis) allahabadi Golvan, 1994 : 169;

Pallisentis (Brevitritospinus) allahabadi Amin *et al.*, 2000 : 43; Arthur & Ahmed, 2002 : 40.

Pallisentis allahabadi Bhattacharya, 2007 : 61-62, Pl. 11, Fig. 47 a-d.

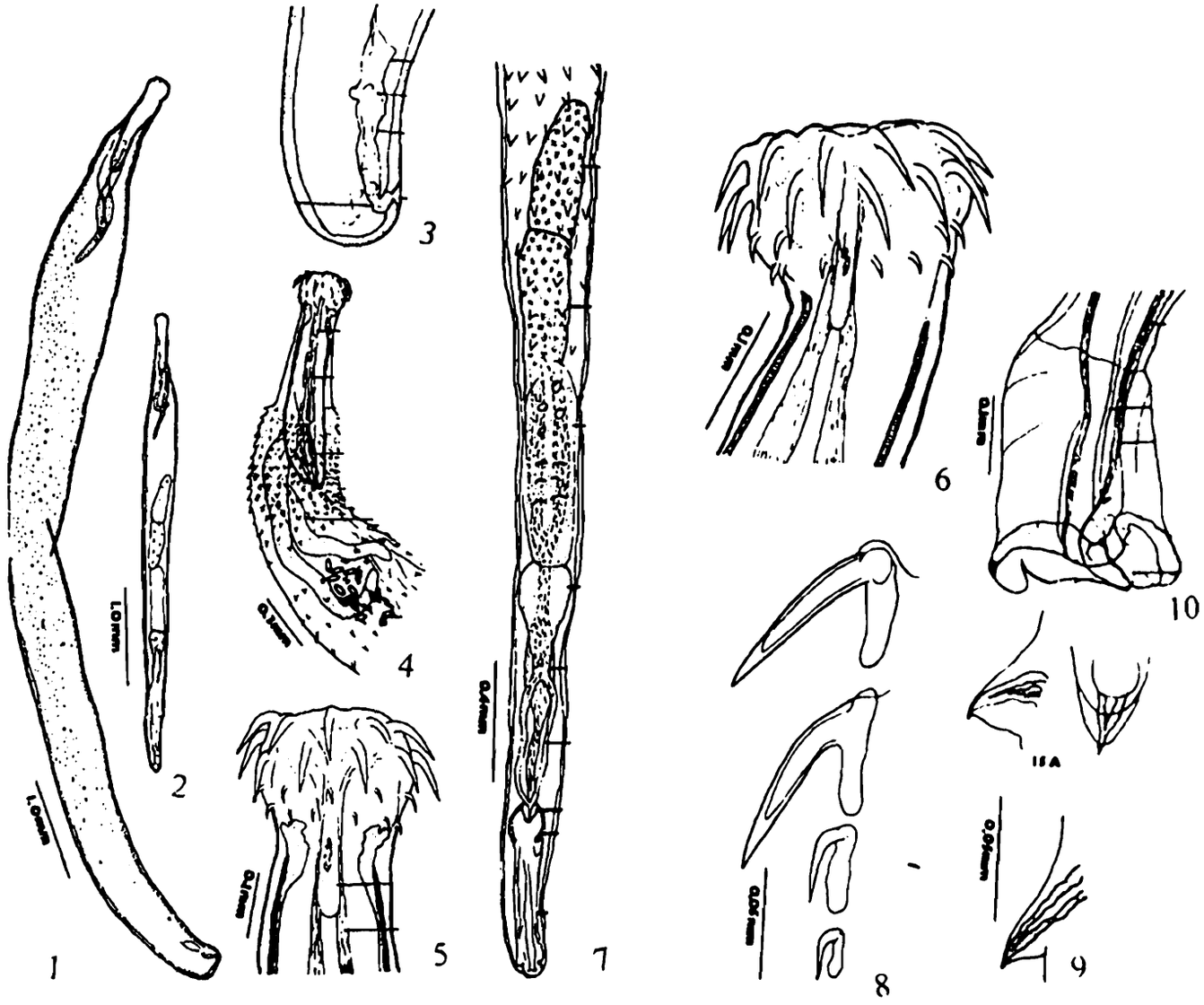


Fig. 258. *Pallisentis (Brevitritospinus) allahabadi* Agarwal, 1958. 1. Female, 2. Male, 3. Posterior part of female, 4. Anterior part of worm, Posterior part of male, 5,6. Proboscis and neck enlarged, 7. Posterior part of male, 8. Proboscis hooks enlarged, 9. Trunk spines enlarged, 10. Posterior part of male (after Gupta, V. & Verma, 1980).

Type locality : Allahabad, Uttar Pradesh, India.

Description : Male 2.85-5.97 × 0.28-0.42 mm, female 5.8-16.34 × 0.41-0.95 mm. Proboscis small, globular, with conspicuous apical organ, with 4 circles of 8-10 hooks, arranged radially alternating, each hook 0.02-0.10 mm long, 0.10-0.29 × 0.11-0.34 mm in male; in female 0.138-0.175 × 0.216-0.256 mm. Hooks in I, II, III and IV circles 0.061-0.073 × 0.008-0.012 mm, 0.057-0.069 × 0.008-0.010 mm, 0.024-0.029 × 0.004-0.006 mm and 0.016-0.025 × 0.004 mm in male; in female in same circles 0.085-0.106 × 0.015-0.017mm, 0.081-0.9 × 0.005-0.008 mm in male; in female hooks of same circles 0.085-0.106 × 0.0150.017 mm, 0.081-0.086 × 0.015-0.017 mm, 0.028-0.041 × 0.005-0.008mm and 0.020-0.029 × 0.005-0.008 mm. Proboscis receptacle cylindrical, tapering posteriorly, single-walled, inserted at base of proboscis 0.375-0.5.87 × 0.081-0.13 mm in male; in female 0.749-1.60 × 0.022-0.48 mm. Neck long, cylindrical 0.179-0.293 × 0.073-0.13 mm in male, in female 0.392-0.489 × 0.212-0.271 mm. Collar spines in 15-16 circles of 12-16 spines each 0.020-0.029 × 0.012-0.020 mm, with distance between circles 0.016-0.041 mm, non-spined area following collar spines 0.154-0.191 m long in male; in female collar spines in 11-16 circles of 19-30 spines each 0.040-0.053 × 0.024-0.039 mm, circles of spines 0.02-0.041 mm apart, distance between last circle of collar spines and first trunk spines 0.077-0.142 mm. Trunk long, narrow, cylindrical, curved, with rounded posterior end in both sexes, in 21-25 circles of 1-12 spines each, 0.038-0.064 mm long in male; in female 32-36 circles of 1-18 spines each. Their number more in anterior circles than in posteror circles, last 1 or 2 circles with 1 or 2 spines each. Lemnisci digitiform, equal or subequal, longer 0.652-1.141 × 0.041-0.065 mm, smaller 0.587-1.141 × 0.041-0.073 mm in male; in female longer lemniscus 0.847-2.054 × 0.088-0.14 mm and smaller 0.734-1.858 × 0.073-0.098 mm. Testes oblong, in tandem, contiguous, anterior 0.44-0.96 × 0.146-0.212 mm, posterior 0.244-0.463 × 0.163-0.228 mm. Cement gland syncytial, elongated, cylindrical 0.138-0.187 × 0.146-0.22 mm with 10-12 giant nuclei. Cement reservoir pear-shaped 0.293-0.554 × 0.146-0.22 mm with 2 ducts. Seminal vesicle 0.326-0.489 × 0.081-0.114 mm. Saefftigen's pouch 0.31 × 0.456 × 0.049-0.065 mm. Bursa 0.34-0.66 × 0.11-0.17 mm. Copulatory bursa 0.518-0.831 × 0.098-0.16 mm, when everted 0.293-0.456 × 0.195-0.226 mm.. In female genital tube 0.652-0.782 mm long. Eggs elliptical, 0.057-0.082 × 0.02-0.037 mm, without polar prolongations.

Host : *Channa punctata* (Bloch); *C. marulius*; Unidentified fish.

Location : Body cavity, intestine and stomach.

Locality : Allahabad (Uttar Pradesh); Ottu (Haryana); Cherrapunji (Meghalaya), Barisal, Dhaka (Bangladesh).

Distribution : Known only from the subcontinent.

288. ***Pallisentis (Brevitritospinus) cavasii*** Gupta, S. P. & Verma, 1980 (Fig. 259)

Pallisentis cavasii Gupta, S. P. & Verma, 1980: 269-272, Fig. 1-4; Soota & Bhattacharya, 1982 : 161-165, Textfig. 2, 3; Gupta, V. & Sinha, 1990b : 48;

Pallisentis (*Pallisentis*) *cavasii* Golvan, 1994 : 169

Pallisentis (*Brevitritospinus*) *cavasii*, Amin, *et al.*, 2000: 43;

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 2.05-2.95 × 0.20- 0.25 mm wide; female 2.92-3.8 × 0.5-0.51 mm. Proboscis globose with four circles of 6-10 recurved hooks, similar in shape but differ in size, 0.05-0.82 × 0.021-0.09 mm in male; in female 0.135 × 0.22 mm. Proboscis hooks of first, second, third and fourth circles 0.045-0.07 mm, 0.041-0.065 mm, 0.025-0.030 mm and 0.020-0.022 mm long in male; in female proboscis hooks of same circles 0.082-0.092 mm, 0.076-0.080 mm, 0.032-0.039 mm and 0.029-0.030 mm long. Each hook with a

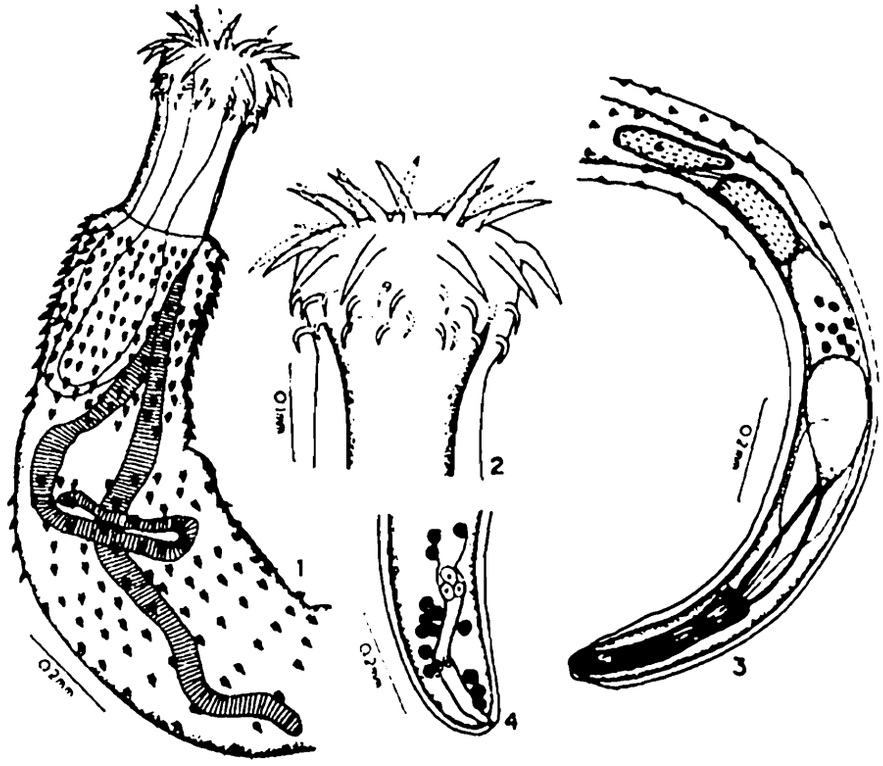


Fig. 259. *Pallisentis* (*Brevitritospinus*) *cavasii* Gupta, V. & Verma, 1980. 1. Anterior part of male, 2. Proboscis of female enlarged, 3. Posterior part of male, 4. Posterior part of female (after Gupta, V. & Verma, 1980).

recurved blade, a horizontally directed root, handle sunk in proboscis wall and posteriorly directed guard also embedded in proboscis wall. Proboscis receptacle cylindrical, single-layered muscular sac 0.012-0.016 × 0.04-0.10 mm in male; in female 0.36-0.60 × 0.11-0.16 mm, with ganglion at its base from which fibers run posteriorly and anteriorly. Trunk small, cylindrical, spinose, with anterior and posterior ends slightly attenuated. Body spination consists of collar and trunk spines. Collar spines start from little posterior to proboscis, having 15 transverse circlets of 8-16 spines each in male; in female 8-16 circlets of 10-18 spines each. Distance between collar spines 0.01-0.025 mm in male and in female 0.01-0.035 mm. Spines measure 0.018-0.023 mm long in male and in female 0.015-0.035

mm long. Trunk spines start after a short non-spiny area, 0.062-0.08 mm with 18-23 circlets of 10-20 spines each in male; in female 0.12-0.13 mm with 30-32 circlets of 12-20 spines each. Distance trunk spines 0.015-0.04 mm in male and in female 0.01-0.045 mm. Trunk spines measure 0.02-0.029 mm long in male and in female 0.02-0.035 mm long. Intervals between each circlet in trunk spination wider posteriorly and number decreases in last row until remain 1 or 2. Trunk spines in female specimens extend up to 2/3 of body length while in male up to anterior end of cement gland. Each spine consists of a proximal forked part and a distal spiny part. Lacunar system reticular with prominent main channels. Lemnisci a pair, long, unequal, 0.53-0.52mm and 0.068-0.10 × 0.025-0.035 mm in male; in female 1.04-1.12 × 0.05-0.06 mm and 1.10-1.15 × 0.04-0.05 mm. Testis cylindrical, in tandem, subequal and post-equatorial, anterior testis 0.16-0.225 × 0.06- 0.07 mm; posterior testis 0.16-0.20 × 0.06-0.07 mm. Cement gland single, cylindrical, syncytial mass with 6 to 8 nuclei lying just behind testis, 0.2-0.23 × 0.052-0.09 mm, its reservoir pear-shaped, 0.14-0.25 × 0.05-0.12 mm opening by a pair of duct 0.26 mm long into bursa. From each testis a vas deferens runs down in close association with cement gland and cement reservoir and joins bursa. Saefftigen's pouch elongated, 0.18-0.25 × 0.025-0.10 mm opening by a narrow tubular duct, 0.13 mm long which runs down and opens into bursa at about point where ducts of cement reservoir open. Bursa eversible muscular, 0.25- 0.25 × 0.04-0.06 mm. Ovarian balls spherical or oval, 0.02-0.03 × 0.015-0.028 mm. Uterine bell funnel-shaped 0.05-0.07 × 0.039-0.05 mm opening into uterus through uterine tube with guard cells. Uterine sac 0.14-0.2 × 0.031-0.04 mm. Vagina thick, muscular, surrounded by muscle sphincter, 0.2 to 0.25 × 0.025-0.03 mm. Gonopore ventro-terminal in female.

Host : *Mystus cavasius* (Hamilton).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from India.

289. ***Pallisentis (Brevitritospinus) croftoni*** Mital & Lal, 1981

Pallisentis croftoni Mital & Lal, 1981 : 165-175;

Pallisentis (*Brevitritospinus*) *croftoni* (Mital & Lal), Amin *et al.*, 2000 : 43;

Pallisentis croftoni Bhattacharya, 2007: 71.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Channa* sp.

Location : Intestine.

Distribution : Known only from type locality.

290. ***Pallisentis (Brevitritospinus) fasciatus*** Gupta, S. P. & Verma, 1980 (Fig. 260)

Pallisentis fasciatus Gupta, S.P. & Verma, 1980 : 272-275, Pl. 2, Fig. 1-4; Gupta, V. & Sinha, 1990b : 44;

Pallisentis (*Pallisentis*) *fasciatus* Golvan, 1994 : 169;

Pallisentis (*Brevitritospinus*) *fasciatus* Amin *et al.*, 2000 : 43.

Pallisentis fasciati Bhattacharya, 2007 : 71.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 2.85-4.1 × 0.30- 0.35 mm, female 4.0-4.6 × 0.45-0.50 mm. Proboscis globular 0.25-0.40 × 0.12-0.15 mm in male, in female 0.25-0.40 × 0.16-0.24 mm, with 4circles of recurved hooks similar in shape but differs in size, with 6-10 hooks each. Each hook with a recurved blade and a horizontally directed root. Proboscis hooks of first, second, third and fourth rows 0.06-0.07 mm, 0.06-0.064 mm, 0.02-0.03 mm and 0.02-0.022 mm long in male; in female proboscis hooks of same circles 0.09-0.10 mm, 0.08-

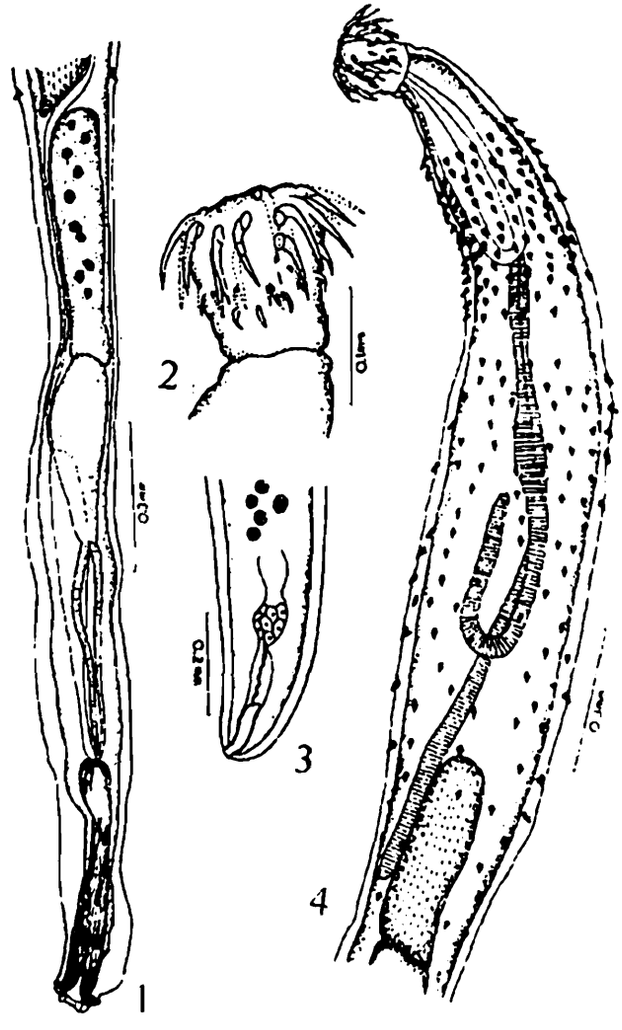


Fig. 260. *Pallisentis* (*Brevitritospinus*) *fasciatus* Gupta, S.P. & Verma, 1980. 1. Posterior part of male, 2. Proboscis and neck enlarged, 3. Posterior part of female, 4. Anterior part of female (after Gupta, S.P. & Verma, 1980).

0.085 mm, 0.026-0.030 mm and 0.02-0.025 mm long. Proboscis receptacle cylindrical, single-walled muscular sac, 0.23-0.44 × 0.09-0.10 mm in male, in female 0.275-0.36 × 0.11-0.15 mm, with ganglion at its base from which fibers run posteriorly and anteriorly. Trunk small, cylindrical, spinose with both ends slightly attenuated. Body spination consists of collar and trunk spines. Collar spines start from a little posterior to proboscis armed with15-16 circlets of 8-16 spines each in male, and in female 14-16 circles of 8-20 each. Distance between collar spines 0.01-0.05 mm in male and in female 0.01-0.03 mm. Trunk spines measure 0.02-0.03 mm long in male, in female 0.019-0.03 mm long. Trunk spines start after a short non-spiny area, 0.08-0.12 mm in male and 0.135 -0.18 mm in female, with 20-26 circlets of 10-24 spines each in male and 29-32 circlets of 10-26 spines each in female. Distance between trunk spines 0.03-0.08 mm in male and jn female 0.04-0.07 mm. Intervals between each circlet in trunk spination becomes wider posteriorly and number of spines decreases in last row to 1 to 2. Spines consist of a proximal forked part and distal spiny part. Lacunar system reticular with prominent main channels. Lemnisci long, slender, cylindrical, unequal with giant nucleus projection, 1.10-1.46 × 0.04-0.05 mm, and 1.2-1.84 × 0.04-0.07 mm in male, in female 1.3- 1.37 × 0.06-0.061 mm and 1.4-1.44 × 0.04-0.05 mm. Testis cylindrical, subequal, in tandem and pre-equatoiral, anterior testis 0.20-0.50 × 0.10-0.15 mm, posterior testis 0.2-0.44 × 0.09-0.15 mm. Cement gland single, cylindrical, syncytial mass with 10-8 nuclei, 0.2-0.54 × 0.1-0.15 mm, its reservoir 0.20-0.40 × 0.09-0.12 mm opening by a pair of ducts, 0.4-0.45 mm long into bursa. Ovarian balls spherical or oval, 0.035-0.05 × 0.03-0.04 mm. Uterine bell elongated, oval, 0.05-0.06 × 0.04-0.07 mm, opening into uterus through uterine tube which consists of guard cell. Uterine sac 0.13-0.29 × 0.03-0.06 mm. Vagina thick, muscular, surrounded by muscle sphincter, 0.03-0.04 × 0.03-0.035 mm. Gonopore ventro-terminal.

Host : *Trichogaster fasciatus* (Bloch & Schneider).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

291. ***Pallisentis (Brevitritospinus) indicus*** Mital & Lal, 1981

Pallisentis indica Mital & Lal, 1981 : 165-175; Gupta, V. & Sinha, 1990b : 44;
Pallisentis (*Brevitritospinus*) *indica* (Mital & Lal), Amin *et al.*, 2000 : 43;
Pallisentis indica Bhattacharya, 2007 : 71.

Description : The publication containing the description and figures of this species could not be procured.

Host : *Channa* sp. *Arius serratus* Day.

Location : Intestine.

Distribution : Known only from type locality.

292. ***Pallisentis (Brevitritospinus) mehrai*** Gupta, V. & Fatma, 1986 (Fig. 261)

Pallisentis mehrai Gupta, V. & Fatma, 1986c : 167-170, Pl. 4, Fig. 1-7;

Pallisentis (Pallisentis) mehrai Golvan, 1994 : 169;

Pallisentis (Brevitritospinus) mehrai Amin *et al.*, 2000 : 43.

Pallisentis mehrai Bhattacharya, 2007 : 66, Pl. 12, Fig. 54 a-d.

Type locality : Mandapam, Tamil Nadu, India.

Description : Males smaller, 5.72-6.68 × 0.50-0.56 mm, than females 8.6-10.5 × 0.45-0.58 mm. Proboscis globular, 0.18-0.26 × 0.32-0.45 mm in male, in female 0.16-0.20 × 0.30-0.32 mm, with 4 circles of 10-12 recurved hooks each in both sexes, each similar in shape but different in size. Hooks of I, II, III and IV circles 0.10-0.128 mm, 0.10-0.12 mm, 0.052-0.065 mm, and 0.040-0.045 mm long in males; in females corresponding circles 0.120-0.125 mm, 0.080-0.085 mm, 0.052-0.055 mm and 0.042-0.045 mm long

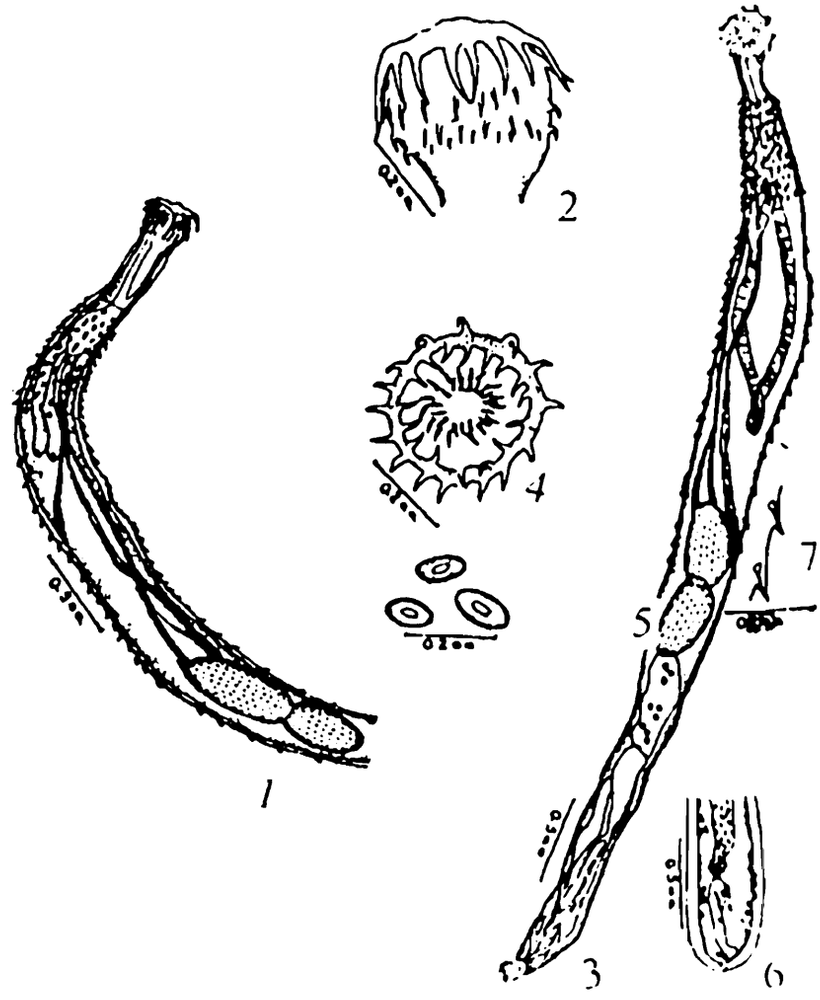


Fig. 261. *Pallisentis (Brevitritospinus) mehrai* Gupta, V. & Fatma, 1986. 1. Anterior part of male, 2. Proboscis enlarged, 3. Male, 4. End on view of proboscis enlarged, 5. Ova enlarged, 6. Posterior part of male, 7. Trunk spines (after Gupta, V. & Fatma, 1986).

respectively. Each hook with a recurved blade, a horizontally directed root, a handle and posteriorly directed guards sunk in proboscis wall. Proboscis receptacle cylindrical, single-walled, muscular, 0.70-0.75 × 0.20-0.25 mm in male; in female 0.87-1.20 × 0.10-0.12 mm, with ganglion near its base. Neck small, 0.35-0.40 × 0.15-0.18 mm. Collar with 10-12 circles of 10-12 spines each of 0.018-0.02 mm long in male and in female 13-14 circles with 10-18 spines of 0.18-0.025 mm long in female. Distance between collar spines 0.012-0.02 mm in male and 0.012-0.02 mm in female. Trunk elongated, cylindrical, with both ends slightly curved, spines start after a short gap of 0.12-0.15 mm in male and 0.22-0.25 mm in female, with 20-30 circles of 11-12 spines each of 0.018-0.023 mm long in males and 30-40 circles of 15-20 spines each, of 0.02-0.026 mm long each in female, extending up to posterior end of body. Distance between trunk spines 0.03-0.065 mm in male and 0.04-0.05 mm in female. Interval between trunk spination becomes wider posteriorly and number of spines decreases in last circle until it reaches 2-4. Each spine with a prominent proximal part and distal spiny forked part. Lacunar system reticular with prominent main channels. Lemnisci equal, long, slender with giant nuclei, 1.5-2.0 x0.10-0.12 mm in male; in female1.5-1.8 x0.10-0.12 mm. Testes ovoid, subequal, in tandem, post-equatorial, anterior 0.60-0.65 × 0.10-0.15 mm, posterior 0.62-0.68 × 0.10-0.15 mm. Cement gland elongated, cylindrical, syncytial 0.60-0.68 × 0.15-0.16 mm, with 10-15 nuclei, its reservoir pyriform 0.32-0.38 × 0.18-0.25 mm opening by a pair of ducts 0.45-0.55 mm long into bursa. Saefftigen's pouch elongated 0.50-0.65 × 0.18-0.20 mm opening by a narrow tubular duct, 0.22-0.30 mm long, runs down and opens into bursa. Bursa eversible, muscular, 0.27-0.62 × 0.12-0.25 mm. Body cavity filled with spherical or oval ovarian balls, 0.018-0.22 × 0.009-0.01 mm. Uterine bell funnel-shaped, 0.22-0.28 × 0.01-0.015 mm, opening into uterus through uterine tube with guard cells. Uterus saccular 0.20–0.25 × 0.10-0.12 mm. Vagina muscular surrounded by sphincter muscles, 0.06 × 0.04-0.045 mm. Eggs 0.055-0.07 × 0.030-0.035 mm. Genital pore terminal in both sexes.

Host : *Caranx kalla* (Cuvier & Valenciennes).

Location : Intestine.

Locality : Mandapam (Tamil Nadu); Uttar Pradesh.

Distribution : Known only from India.

Subgenus ***Demidueterospinus*** Amin *et al.*, 2000

Demidueterospinus Amin *et al.*, 2000 : 41;

Diagnosis : With characters of genus *Pallisentis*. Proboscis hooks in circle 2 about half as long as hooks in circle 1. Cement gland usually small with a few giant nuclei.

Type species : *Pallisentis* (*Demidueteospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.

Includes three species, 1. *Pallisentis* (*Demidueterospinus*) *basiri* Farooqi, 1958, Amin *et al.*, 2000, 2. *P.* (*D.*) *ophiocephali* (Thapar, 1927) Baylis 1933, Amin *et al.*, 2000., 3. *P. (D.) pandei* Rai, 1967, Amin *et al.*, 2000, all of which occur in the subcontinent.

Key to Indian species of subgenus *Demidueterospinus*

– Collar with 8-10 circles of 10-14 spines each ..... *Pallisentis (Demidueterospinus) basiri*

– Collar with 13-15 circles of 14-24 spines each ..... *Pallisentis (Demidueterospinus) ophiocephali*

– Collar with 14-16 circles of 16 spines each ..... *Pallisentis (Demidueterospinus) pandei*

293. ***Pallisentis (Demidueterospinus) basiri*** Farooqi, 1958 (Fig. 262)

Pallisentis basiri Farooqi, 1958: 458-462, Fig. 1-6; 1958: 457; Hasan & Quasim, 1960 : 152-156, Fig. 1; Yamaguti, 1963 : 34; Anantaraman, M. & Anantraman, S., 1970 : 4; Gupta, V. & Fatma, 1986c : 171-174, Pl. 5, Fig. 1-7; Guta, V. & Sinha, 1990b : 43;

Pallisentis (Pallisentis) basiri Golvan, 1994: 169;

Pallisentis (Demidueterospinus) basiri Amin *et al.*, 2000 : 41.

Pallisentis basiri Bhattacharya, 2007 : 62-64, Pl.11, Fig. 486 a-g.

Type locality : Alligarh, Lucknow, Uttar Pradesh, India.

Description : Male 6.0-8.28 × 0.24 mm; female 5.5-10.0 × 0.4-0.5 mm. Proboscis globular 1.95 × 0.14 mm in male; in female 1.1 × 0.3 mm, with a knob with 4 circles of 8-10 recurved hooks each. Apical hooks largest 0.016 mm long, of II, III and IV circles 0.040-0.050 mm, 0.020-0.025 mm and 0.015-0.016 mm long respectively in male. In female hooks corresponding circles 0.065-0.068 mm, 0.062-0.064 mm, 0.050-0.055 mm and 0.040-0.045 mm. Arrangement of hooks alternate. Apical hooks beset radially at an obtuse angle to longitudinal axis of proboscis, and of remaining circles at an acute angle. Neck small, 0.27 × 0.14 mm. Proboscis receptacle cylindrical, single-walled, muscular sac, 0.60-0.85 × 0.22-0.25 mm in male, in female 0.40-0.42 × 0.12-0.15 mm, with ganglion at its base. Collar spines in 8-10 circles of 10-14 spines each in male; in female 10-12 circles of 10-16 spines each. Each spine 0.032 mm long. Trunk cylindrical, anterior end slightly curved and tapering, spines start after a slight gap, in 13-18 circles of 10-15 spines in male, in female 20-22 circles of 10-20 spines each. Spines 0.015-0.020 mm long in male, in female 0.015-0.025 mm long. Interval between each circle of trunk spines become wider posteriotly and number of spines decreases in last circle until reaching 1-2 spines. Trunk spines extend up to level of middle of posterior testis in male and in female 2/3 of trunk length. Spines consist of a proximal forked part and distal spiny part. Lacunar system with prominent main longitudinal channels and reticular anastomoses. Hypodermal nuclei of two types, oval-shaped in anterior part at about level of receptacle, of 0.014 mm long, and elongated dumb-bell-shaped giant nuclei in posterior part, of 0.071 mm long. Lemnisci long, slender, of uniform width, unequal, shorter 1.80-1.95 mm, longer 2.60-2.65 mm long in male; in female shorter 1.05-1.10 mm, longer 2.15-2.20 mm long. Testes

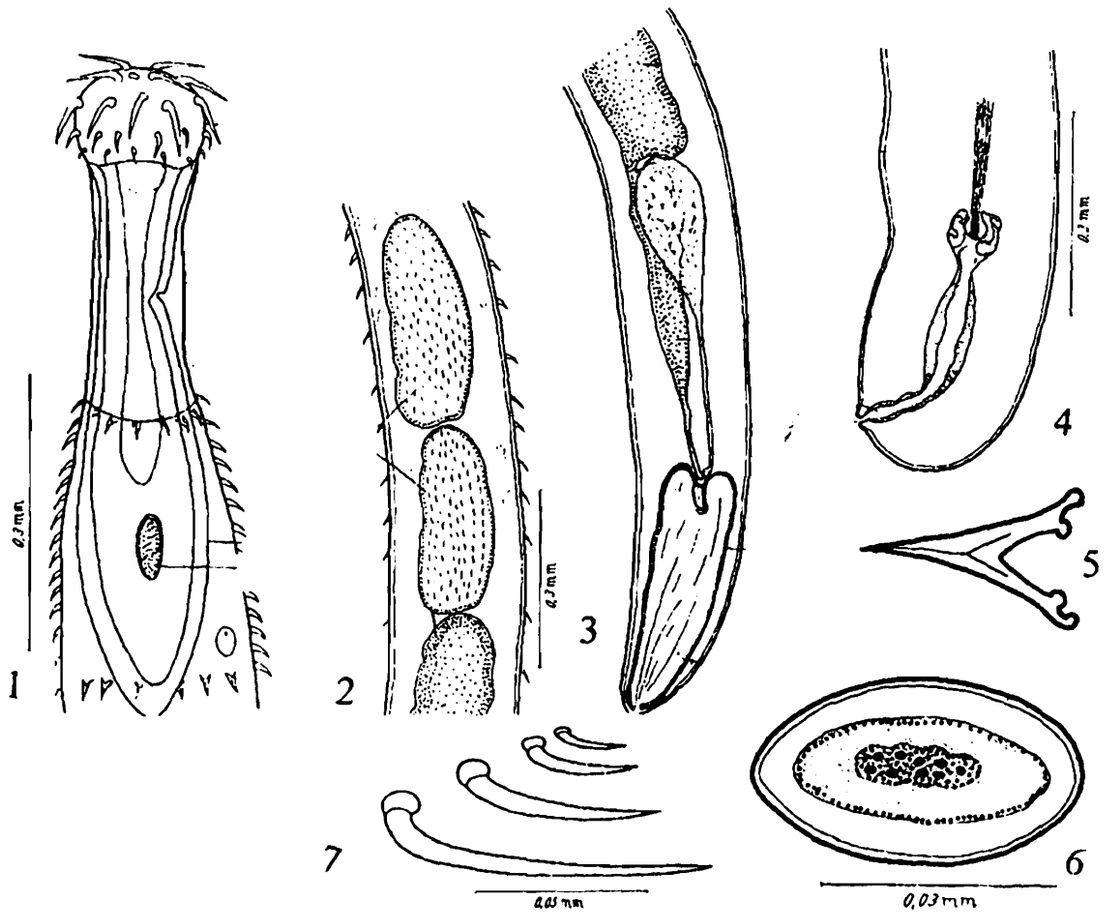


Fig. 262. *Pallisentis* (*Demidueterospinus*) *basiri* Farooqi, 1958. 1. Anterior part of male, 2. Mid trunk of male, 3. Posterior part of male, 4. Posterior part of female, 5. Trunk spine, 6. Ovum, 7. Proboscis enlarged (after Farooqi, 1956).

2, elongated, cylindrical, subequal, pre-equatorial, in tandem, anterior 0.70-0.75 × 0.20-0.25 mm posterior 0.70-0.72 × 0.30-0.38 mm. Cement gland elongated, sybcytial mass, 1.02-1.05 × 0.31-0.35 mm with 10-12 nuclei, its reservoir 0.50-0.55 × 0.30-0.35 mm opening by a pair of ducts, 0.50-0.55 mm long into bursa. Vas deferens runs down in close association with cement gland reservoir and enters bursa. Saefftigen's pouch pyriform, 0.62-0.65 × 0.09-0.10 mm. Seminal vesicle pyriform 0.52-0.55 × 0.12-0.15 mm. Bursa elongated, muscular, eversible, 0.32-0.45 × 0.50-0.55 mm. Ovarian balls 0.025-0.050 mm long. Uterine bell elongated, 0.05-0.055 mm long. Uterus 0.15-0.16 mm long. Vagina thick 0.10-0.12 mm long with 2 sphincter muscles. Eggs 0.020-0.022 × 0.005-0.008 mm, without polar prolongation of middle shell. Gonopore terminal in both sexes.

Host : *Rhyncobdella aculeata, Channa striatus* (Bloch), *Trichogaster chunni.*

Location : Intestine, liver.

Locality : Aligarh, Lucknow (Uttar Pradesh);

Distribution : Known only from India.

Remarks : Soota & Bhattacharya (1982) synonymised *Pallisentis basiri* and *P. pandei* with *P. colisai*, which Khan & Bilqees (1982) and Amin *et al.* (2000) do not agree with their contenton and consider them to be distinct species. This the present author accepts.

294. ***Pallisentis (Demidueterospinus) ophiocephali*** (Thapar, 1931) Baylis, 1933 (Fig. 263)

Farzandia ophiocephali Thapar, 1931a : 362; 1931b: 77-80, Fig. 1-3; Bhalerao, 1931: 569; Meyer.1932: 30-31, Fig. 6; Sarkar, 1953: 193; Petrotschenko, 1956: 239, Fig. 85; Yamaguti, 1963: 35, Pl. 11, Fig. 105, 106;

Pallisentis ophiocephali Gupta, N.K. & Lata, 1968c : 340, Fig. 24-26;

Pallisentis (Farzandia) ophiocephali Anantaramam, M. & Anantaraman, S., 1970: 4;

Pallisentis ophiocephali Saeed & Bilqees, 1973 : 83-86,, Fig. 1; Bilqees, 1976 : 110; Rahman & Ali, 1977 : 277; Jha, Sinha & Mishra, 1979 : 5; Soota & Bhattacharya, 1982 : 158-161, Textfig. 1; Hossain, Haque, Chowdhury & Islam, 1982 : 131; Huq, Hossain, Amin & Islam, 1983: 68; Firdaus, 1984 : 290; Chandra, 1985 : 48; 1985 : ?136; Hussain & Ali, 1986 : 111; Firdaus, 1986: 216-217; Chandra & Golder, 1987: 333-334; Golder, Chandra & Rahman, 1987: 37-38; Bilqees & Khan, 1987 : 16, Fig. 20 a-f; Chandra & Rahman, 1988 : 37; Dhar & Majdah, 1988 : 5, 6, 7' Rahman, 1989 : ?365; Akhtar, Chowdhury, Latif & Nahar, 1989: 38; Akhtar, Sufi & Nahar, 1990 : 174;

Pallisentis ophiocephali Gupta, V. & Sinha, 1990b : 43; 54; Jha, Sinha & Mishra, 1992: 3, 4, 5, 6; Sinha, 1993: 199-200;

Pallisentis (Neosentis) ophiocephali Golvan, 1994: 169;

Pallisentis (Demidueterospinus) ophiocephali Amin, et al., 2000 : 41; Arthur & Ahmed, 2002 : 41.

Farzandia ophiocephali Bhattacharya, 2000 : 143; 2007: 67, Pl..12, Fig. 55 a-b.

Type locality : Lucknow, Uttar Pradesh, India.

Descriptiom : Worms creamy white in life. Male 9.06-11.88 × 0.44-0.55 mm; female 8.03-24.86 × 0.475-0.715 mm. Proboscis short, globular 0.19-0.22 × 0.22-0.26 mm in male; in female 0.22-0.27 × 0.22-0.30 mm, with 4 circles of 8 hooks each. Hooks of different dimensions, marginal hooks 0.05 × 0.01 mm, largest hooks 0.024 × 0.01 mm and smallest hooks 0.018 × 0.004 mm, with 4 circles of 8 or 10 hooks each; hooks of I, II, III and IV circles 0.068-0.085 mm, 0.068-0.073 mm, 0.051-0.06 mm and 0.025-0.042 mm long in both sexes. Base of proboscis with a pair of papillae. Lacunar system not very well developed. Proboscis receptacle cylindrical, single-walled 0.50-0.80 × 0.19-0.27 mm in male; in female 0.77-0.88 × 0.165-0.22 mm. Neck 0.22-0.33 × 0.22-0.24 mm in male; in female 0.165-0.33 × 0.22-0.27 mm. Collar with 13-15 closely set rings with 14-24 spines each. Trunk slender, tubular, pseudo-segmented, with widely spaced 25-35 rings with 10-20 spines each in male; in female with 30-72 rings of 10-24 spines each. Trunk spines very minute 0.032 × 0.016 mm, embedded in cuticle. Lemnisci 1.04-2.36 mm and 0.99-2.42 mm long. Testes anterior 0.385-1.10 mm, posterior 0.33-1.04 mm long. Cement gland cylindrical, syncytial 0.55-2.01 × 0.05-2.42 mm with number of nuclei, its reservoir 0.253-0.66 × 0.132-0.33 mm. Seminal vesicle 0.275-0.55 × 0.55-0.198 mm. Uterus elongated, tubular, 0.35 × 0.07 mm. Vagina small, 0.11 × 0.05 mm. Eggs oval, 0.060-0.085 × 0.038-0.042 mm.

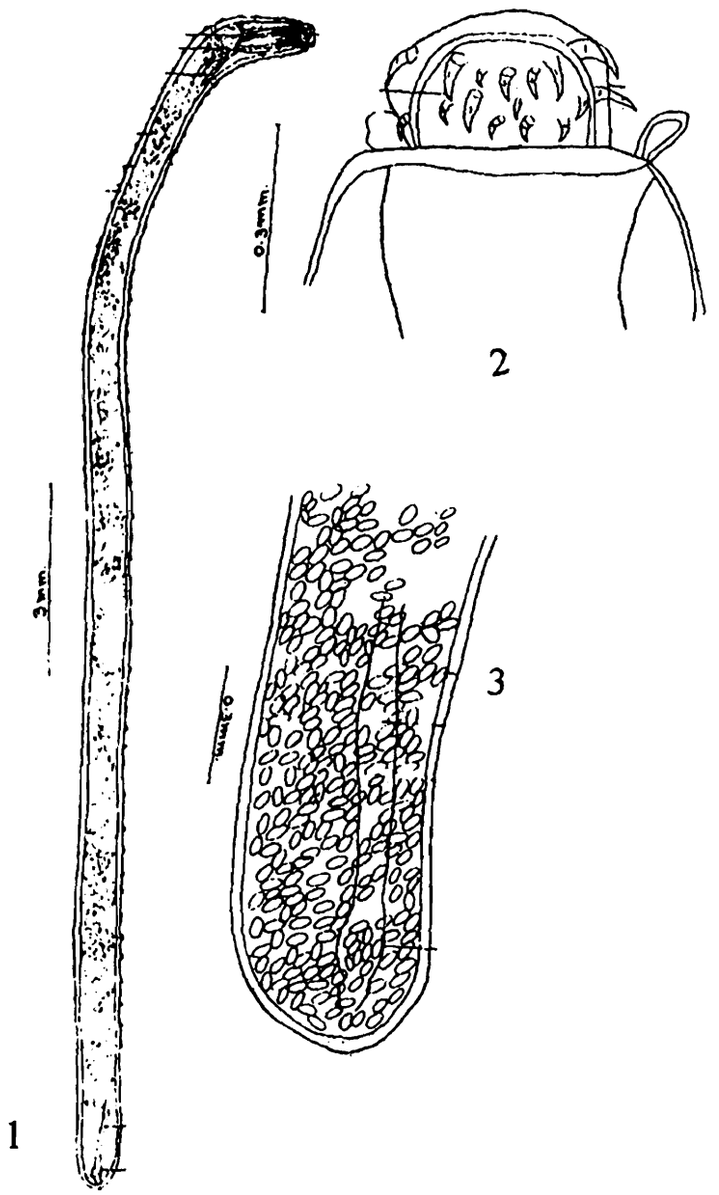


Fig. 263. *Pallisentis* (*Demidueterospinus*) *ophiocephali* (Thapar, 1927) Amin *et al.*, 2000. 1. Female, 2. Proboscis trunk enlarged, 3. Posterior part of female (after Thapar, 1931).

Host : *Channa marulius* (Hamilton), *C. striatus* (Bloch), *C. punctata* (Bloch), Channa ophiocephalus, *Nandus nandus* (Hamilton-Buchanan), *Grihiria* (*Cirrihina*) *cupla*, *Ompok pabda* (Hamilton), *Xenentodon cancila* (Hamilton); *Rana tigrina* (Daudin).

Location : Intestine.

Locality : Cochin (Kerala); Karaikal (Podicherry); Chandbeli Konark (Orissa); Lucknow (Uttar Pradesh); Sikandarpur Reservoir, Muzaffarpur (Bihar); Jamshadpur; Diamond harbour, Bishnupur, Kolkata, Siliguri, Kurseong, (West Bengal); Shillong (Meghalaya), Chandpur, Chittagong, Dhaka, Mymensingh (Bangladesh); Kalri lake, Sindh (Pakistan).

Distribution : Known only from Indian subcontinent.

295. ***Pallisentis (Demidueterospinus) pandei*** Rai, 1967
(Fig. 264)

Pallisentis pandei Rai, 1967: 39-42, Fig. 21-29; 1971 : 127; Anantaraman, M. & Anantaraman, S., 1970 : 4; Rai, 1971: 127; Gupta, V. & Sinha, 1990b : 43;

Pallisentis (Pallisentis) pandei Golvan, 1994 : 170;

Pallisentis (Demidueterospinus) pandei Amin *et al.*, 2000 : 41.

Pallisentis pandei Bhattacharya, 2007: 69, Pl..12, Fig. 57 a-e.

Type locality : Raya, Uttar Pradesh, India.

Description : Male 5.07-6.00 × 0.30-0.35 mm. Female 6.1-13.24 × 0.61-0.76 mm. Proboscis 0.14-0.16 × 0.14-0.17 mm, with 4 circles of 10 hooks each, hooks of apical circle larger than others. Hooks in 4 circles measured 0.07-0.08 mm, 0.031-0.039 mm, 0.02-0.031 mm and 0.02-0.03 mm long in both sexes. Proboscis receptacle single-walled, 0.35-0.46 × 0.13-0.15 mm, with ganglion near its base. Collar spines in 14-16 circles of 16 spines each. Trunk cylindrical with rounded anterior end and narrower posterior end. Trunk spines separated by a gap 0.11-0.19 mm in males and 0.18-0.23 mm in females, in

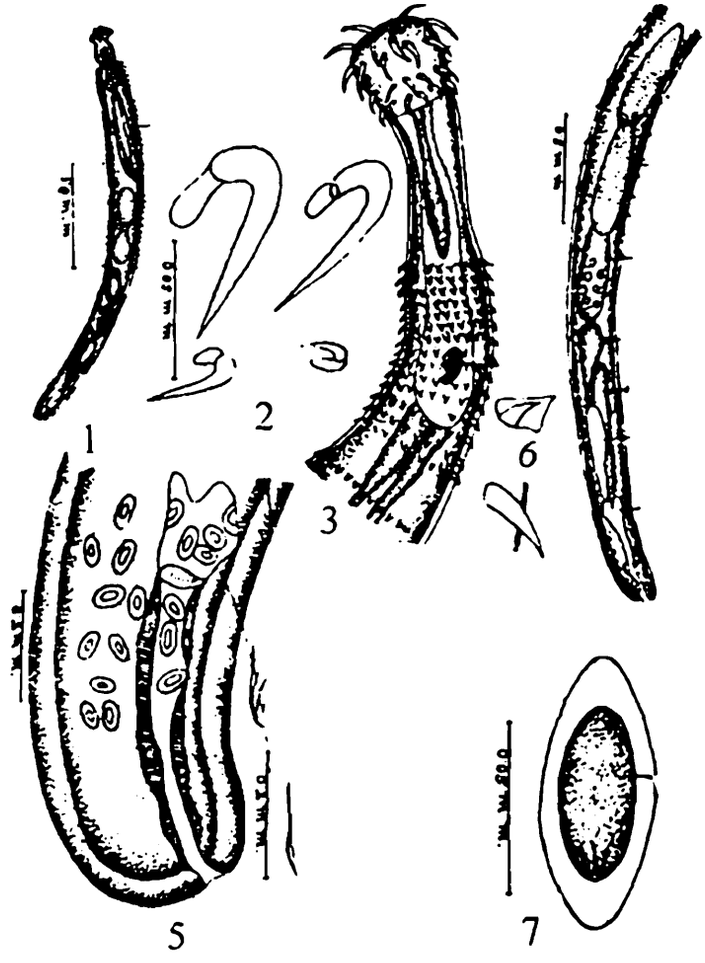


Fig. 264. *Pallisentis (Demidueterospinus) panadei* Rai, 1967. 1. Male, 2. Proboscis hooks enlarged, 3. Anterior part of worm, 4. Posterior part of male, 5. Posterior part of male, 6. Trunk spines, 7. Ovum (after Rai, 1967).

20-28 circles, last row extending to anterior border of cement gland. These two groups of spines dissimilar in form. Collar spines scale-like with a central part and lateral wings, trunk spines straight but without lateral wings. Lemnisci long, slender, equal extended beyond receptacle to anterior testis. Hypodermal nuclei in two pairs dorsal and two pairs ventral. Testes elongated, in tandem, in midtrunk, anterior 0.58-0.62 × 0.13-0.15 mm, posterior 0.51-0.56 × 0.13-0.14 mm. Cement gland syncytial elongated, linearly placed, directly behind testes, 0.47-0.63 × 0.12-0.14 mm, with 8 nuclei, followed by elongated sac-like cement reservoir lying below gland and continuing posteriorly into bursal cap. Saefftigen's pouch elongated, pear-shaped, 0.32-0.43 mm long. Seminal vesicle 0.32-0.39 mm long. Three terminal ducts from these open into anterior part of bursa. Bursa 0.22-0.39 × 0.08-0.09 mm. Uterus 0.27-0.39 mm long. Vagina 0.31-0.47 mm long. Eggs delicate, irregularly shaped, flattened with membranous outer shell with filamentous character at one pole, 0.21-0.24 × 0.13-0.15 mm, with elongated oval egg with two shells, 0.08-0.10 × 0.04-0.049 mm, embryo 0.047-0.06 × 0.032-0.040 mm with characteristic hooklets.

Host : *Mystus armatus, M. vittatus* (Bloch), *Catla catla* (Hamilton), *Channa punctatus* (Bloch), *Hilsa ilisha* Hamilton (Hamilton).

Location : Intestine.

Locality : Raya (Uttar Pradesh).

Distribution : Known only from type locality.

Subgenus ***Pallisentis (Pallisentis)*** Amin *et al.*, 2000

Pallisentis Pallisentis Amin *et al.*, 2000 : 41, 43.

Diagnosis : With characters of genus *Pallisentis*. Proboscis hooks gradually decreasing in size posteriorly. Cement gland usually long with many giant nuclei.

Type species : *Pallisentis (Pallisentis) umbellatus* Van Cleave, 1928.

Includes twenty one species, 1. *Pallisentis (Pallisentis) clupei* Gupta, S.P. & Gupta, R. C. 1979, 2. *P. (P.) colisai* Sarkar, 1954, 3. *P. (P.) fotedari* Gupta, V. & Sinha, 1991, 4. *P. (P.) gaboes* (Mac Cullum, 1918) Van Cleave, 1928; 5. *P. (P.) garuei* (Sahay, Sinha & Ghosh, 1971) Jain & Gupta, N.K. 1979, 6. *P. (P.) gomtii* Gupta, S.P. & Verma, 1980, 7. *P. (P.) guntei* Gupta, V. & Fatima, 1986, 8. *P. (P.) guptai* Gupta, V. Fatima, 1986, 9. *P. (P.) jagani* Koul. Raina, Bambroo & Koul, 1991, 10. *P. (P.) kalrii* Khan & Bilqees, 1985, 11. *P. (P.) magnum* Saeed & Bilqees, 1971, 12. *P. (P.) nagpurensis* (Bhalerao, 1931 Baylis, 1931, 13. *P. (P.) nandai* Sarkar, 1953, 14. *P. (P.) sindensis* Khan & Bilqees, 1987, 15. *P. (P.) celatus* (Van Cleave, 1928) Baylis 1933, 16. *P. (P.) changgungensis* Liu & Zhang, 1992, 17. *P. (P.) cholodowsky* (Kostylew, 1928) Amin, 1985, 18. *P. (P.) golvani* Troncy & Vassilliades, 1973, 19. *P. (P.) pesteri* (Tadeos, 1966) Chowhan, Gupta, N.K. & Khera, 1987, 20. *P. (P.) rexus* Amin, Taraschewsi, 2003, 21. *P. (P.) singaporensis* Khan & Ip, 1989 of which first 14 species occur in Indian subcontinent.

Key to Indian species of subgenus *Pallisentis*

1. Worms small below 6 mm long ..... *Pallisentis* (*Pallisentis*) *gumtei*
– Worms larger than 6 mm 2
1. Proboscis pyriform ..... *Pallisentis* (*Pallisentis*) *nandai*
– Proboscis short, globular 3
3. Proboscis hooks 4-6 in 8-9 spiral rows ..... *Pallisentis* (*Pallisentis*) *nagpurensis*
– Proboscis hooks 6 in each of 4 circles ..... *Pallisentis* (*Pallisentis*) *garuai*
– Proboscis hooks 8 in each of 4 circles 4
4. Collar with 12-13 circles of 8-10 spines each in male; and 14-15 circles of 13-14 circles of 14-20 spines each ..... *Pallisentis* (*Pallisentis*) *clupei*
– Collar with 13-14 circles of 8-10 spines each in male; and 14-15 circles of 12-16 spines each in female ..... *Pallisentis* (*Pallisentis*) *guptai*
– Collar with 13-16 more circles of spines each in 5
5. Collar with 13-16 circles of 18-20 spines each ..... *Pallisentis* (*Pallisentis*) *sindensis*
– Collar with 15 circles of 20 spines each ..... *Pallisentis* (*Pallisentis*) *magnum*
– Collar with 16 circles of 10-12 spines each ..... *Pallisentis* (*Pallisentis*) *jagani*
6. Proboscis hooks 8-10 in 4 circles ..... *Pallisentis* (*Pallisentis*) *gomti*
– Proboscis hooks 10 or more in each circle 7
7. Proboscis hooks 10 in each circle 8
– Proboscis hooks 10-12 in each circle 9
8. Collar with 6-10 circles in male and 13 circles in female ..... *Pallisentis* (*Pallisentis*) *fotedari*
– Collar with 16-17 circles of 12-14 spines each in males, 15-17 circles of 12-16 spines each in female ..... *Pallisentis* (*Pallisentis*) *colisai*
– Collar with 15 circles of 20 spines ..... *Pallisentis* (*Pallisentis*) *kalriai*

296. ***Pallisentis* (*Pallisentis*) *clupei*** Gupta, S.P. & Gupta, R.C. 1977 (Fig. 265)

Pallisentis clupei Gupta, S.P. & Gupta, R.C., 1977 : 226; 1980 : 135-139, Pl. 1, Fig. 1-3; Gupta, V. & Sinha, 1990b : 54;

Pallisentis (*Pallisentis*) *clupei* Amin *et al.*, 2000 : 43.

Pallisentis clupei Bhattacharya, 2007 : 64, Pl. 11, Fig. 49 a-c.

Type locality : Quilon, Kerala, India.

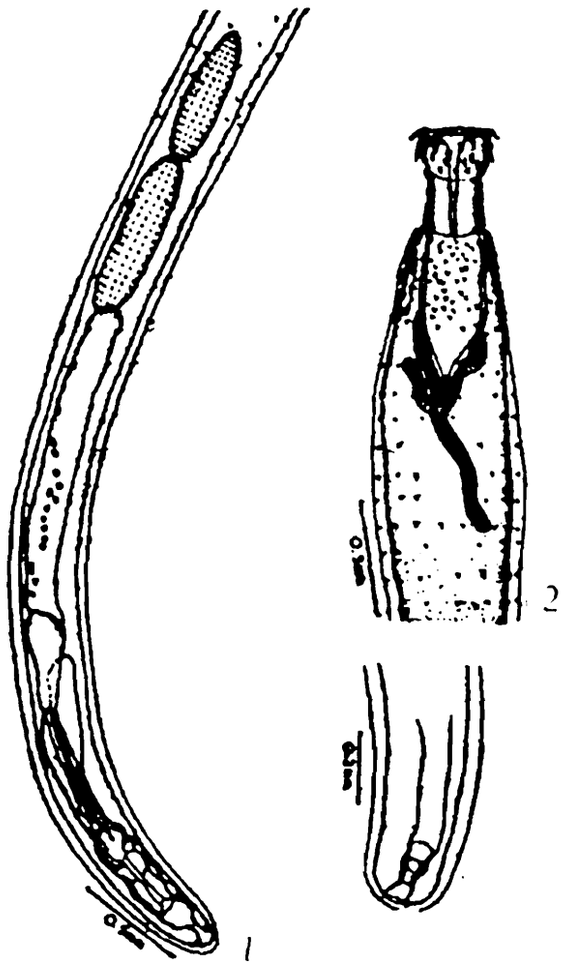


Fig. 265. *Pallisentis (Pallisentis) clupei* Gupta, S.P. & Gupta, R.C. 1977. 1. Posterior part of male, 2. Anterior part of male, 3. Posterior part of female (after Gupta, S.P. & Gupta, R.C., 1977).

Description : Male 8.27-8.64 × 0.60-0.63 mm, female 11.3 × 0.7 mm. Proboscis globular with 4 circles of 8 recurved hooks, hooks of I circles 0.11-0.15 mm, II circle 0.07-0.09 mm, III circle 0.055-0.070 mm and Iv circle 0.03-0.04 mm long in male; in female in corresponding circles 0.095-0.10 mm, 0.08-0.085 mm, 0.05-0.06 mm and 0.038-0.04 mm long. Proboscis receptacle cylindrical, single-walled, muscular, with ganglion at its base, 0.81-0.88 × 0.20-0.28 mm in male; in female 0.9 × 0.3 mm. Collar spines in 12-13 circles in males and 13-14 in females, each circle with 14-20 spines, measuring 0.025-0.026 mm long in both sexes. Trunk elongate, cylindrical, with both ends slightly attenuated, spines start after short aspinose area 0.17-19 mm long with 28-30 circles of 8-16 spines each in male, 0.14-0.17 mm long in females with 61 circles of 10-16 spines each. Trunk spines extend up to posterior end of anterior testis in males, in females up to posterior end. Spines 0.02-0.03 mm long in both sexes. Lemnisci long, cylindrical, unequal, shorter lemniscus 0.95-0.96 × 0.07-0.08 mm, longer 1.25-2.07 × 0.07-0.08 mm in male; in female shorter lemniscus 1.24 × 0.06 mm, longer 1.28 × 0.06 mm. Lacunar system with prominent main longitudinal channels and reticular anastomoses. Testes cylindrical, subequal, in tandem, post-equatorial, anterior 0.61-0.74 × 0.18-0.20 mm, posterior 0.71-0.75 × 0.18-0.19 mm. Cement gland

single, cylindrical, syncytial mass with 9-16 nuclei, 1.39-1.5 × 0.16-0.20 mm, its reservoir 0.46-0.50 × 0.17-0.18 mm opening by a pair of ducts 0.57-0.58 mm long into genital atrium. From each testis vas deferens runs down in close association with cement reservoir and enters genital atrium. Seminal vesicle 0.51-0.72 × 0.12-0.17 mm, opening by a duct into genital atrium. Saefftigen's pouch 0.58-0.60 × 0.11-0.16 mm, opening into genital atrium. Genital atrium 0.18-0.30 × 0.16-0.17 mm followed by a muscular elongate, eversible bursa, 0.45-0.52 × 0.14-0.15 mm. Ovarian balls scattered in body cavity. Uterine bell leads into tubular uterus, which in turn leads into thick vagina with muscular sphincter, 0.125 × 0.08 mm ending in vulva 0.03 × 0.065 mm at posterior end.

Host : *Clupea longiceps* (Gunther).

Location : Intestine.

Locality : Quilon (Kerala).

Distribution : Known only from type locality.

297. ***Pallisentis (Pallisentis) colisai*** Sarkar, 1954
(Fig. 266)

Pallisentis colisai Sarkar, 1956 : 192-193; 1956 : 351-359, Textfig. 1 a, b; Yamaguti, 1963 : 35, Pl. 9, Fig. 87, 88;

Pallisentis buckleyi Tadros, 1966 : 155-160, Fig. 1-8; Sahay, Nath & Sinha, 1967 : 348;

Anantaraman, M. & Anantaraman, S., 1970 : 4;

Pallisentis colisai Anantaraman, M. & Anantaraman, S., 1970 : 4; Rai, 1971: 127; Soota & Bhattacharya, 1982 : 161-165, Textfig. 2 a-e, 3 a-c; Gupta, V. & Sinha, 1990b: 47;

Pallisentis (Pallisentis) colisai Golvan, 1994 : 169;

Pallisentis (Pallisentis) colisai Amin *et al.*, 2000 : 43.

Pallisentis colisai Bhattacharya, 2000 : 143-144; 2007 : 62-64, Pl. 11, Fig. 50 a-c.

Type locality : Delhi, India.

Description : Male 3.5-8.5 × 0.34-0.36 mm, female 5.4-12.9 × 0.61-0.62 mm. Proboscis 0.12-0.19 ×, 0.15-0.28 mm, with 4 equidistant circles of 10-12 hooks each. Hooks of apical circle longer than others. Hooks in I, II, III and IV circles 0.76-0.08 mm, 0.68-0.07 mm, 0.05 mm, 0.04 mm long in males; in females in I, II, III and IV circles 0.093-0.10 mm , 0.076-0.093 mm, 0.034-0.037 mm, 0.025-0.030 mm long resepectively. Proboscis receptacle ovoid, single-walled, muscular sac, 0.28-0.68 × 0.14-0.28 mm in males; in females 0.49-0.77 × 0.13-0.22 mm, with big oval ganglion at its base. Ganglion gives out a few nerve fibers to body wall. Collar spines in 15-17 rows with 12-14 spines each in males; in females in 15-17 circular rows with12-16 spines each. Collar spines 0.02 mm long. Trunk long, cylindrical, anterior part with 21-67 equidistant circles of 16-20 each in males; in females 33-35 rows of 15-18 spines each. Behind spiny part of trunk lies a short spineless region, followed by a part covered with 21-67 regular circles with 16-20 spines each, varying in number according to sex, separated from one another by wide spineless

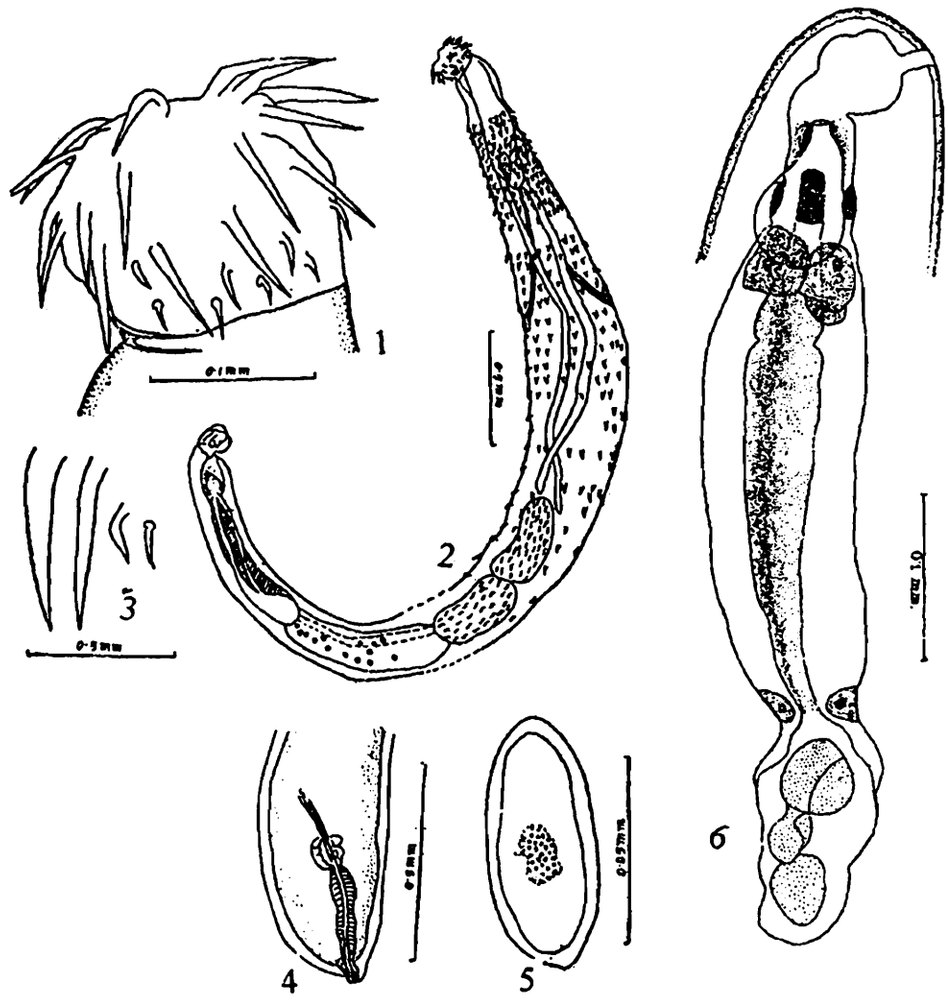


Fig. 266. *Pallisentis (Pallisentis) colisai* Sarkar, 1954. 1. Proboscis enlarged, 2. Male, 3. Proboscis hooks and trunk spines enlarged, 4. Posterior part of female, 5. Ovum, 6. Female genitalia (after Sarkar, 1954).

spaces. Trunk spines 0.02 mm long. Sexual dimorphism distinct in respect of number of circles of spines over trunk, in male range of variation of number of circles very little, 21-22, while in female it is fixed at 67 circles. In male nearly half of trunk covered with circles of spines and in female nearly 5/6 of trunk covered by circles of spines. Lemnisci elongated, nearly equal, 1.06-2.40 × 0.04-0.07 mm in males; in females 1.98 × 0.55 mm wide Testes elliptical, elongated, one behind other, anterior 0.34-0.38 × 0.11-0.16 mm, posterior 0.31-0.35 × 0.12-0.18 mm. Vas efferens from each testis runs down and unite into vas deferens and opens at base of seminal vesicle. Cement gland single, syncytial, elongated 0.28-0.42 × 0.12-0.17 mm, with 12-14 nuclei, opening into pyriform cement reservoir 0.25-0.45 × 0.11-0.12 mm. Seminal vesicle 0.29-0.45 × 0.08-0.12 mm. Bursa 0.18-0.21 × 0.09 mm. Penis with ducts open into bursa. Uterine bell elongated, oval, with 2 constrictions, one in anterior part other in middle part, with guard cells below it. Uterus long, flabby tube with frilled longitudinal muscles and transverse muscular bands. Four flask-shaped cells lie at posterior end of uterus, below which uterus passes into tubular

vagina with 2 sets of strong muscular bands, vaginal sphincters. Pyriform vaginal gland situated on vaginal wall. Vulva small, tubular placed postero-ventrally. Eggs 0.051-0.068 × 0.025-0.03 mm.

Host : Eel; *Channa punctata* (Bloch), *Channa* sp.; *Labeo rohita* (Hamilton) Gunther, *Colisa fasciatus* (Bloch & Schinder); unidentified fish.

Location : Intestine.

Locality : Delhi; Aligarh (Uttar Pradesh); Rajgir, Patna (Bihar); Ankhola (West Bengal); South of Tripura;.

Distribution : Known only from India.

298. ***Pallisentis (Pallisentis) fotedari*** Gupta, V. & Sinha, 1991 (Fig. 267)

Pallisentis fotedari Gupta, V. & Sinha, 1991 : 19-23, Fig. 1-6; Bhattacharya, 2007 : 69-70, Pl. 12-13, Fig. 58 a-d.

Type locality : Puri coast, Orissa, India.

Description : Male 12.48-12.60 × 0.55-0.66 mm, female 13.3-14.6 × 0.55-0.64 mm. Proboscis globular with 4 circles of 10 recurved hooks each; hooks of I, II, III and IV circles 0.11-0.12 mm, 0.090-0.98 mm, 0.04-0.05 mm and 0.04-0.05 mm long in males; in females in same hooks 0.12-0.13 mm, 0.07-0.09 mm, e 0.05-0.06 mm and 0.008-0.0095 mm long. Each hook with a recurved blade, a horizontally directed root and a handle sunk in proboscis wall. Proboscis receptacle cylindrical, single-walled, muscular 0.70-0.90 × 0.26-0.30 mm. Body spination with collar spines and trunk spines. Collar spines or anterior girdle start a little posterior to proboscis, in 6-10 transverse circles in male; in female10-13 circles. Trunk elongated, cylindrical, with both ends slightly curved. Trunk spines start after a non-spiny area of 0.06-0.068 mm in male, in females 0.88 mm. Trunk spines extend up to middle to posterior end of trunk, in 19-27 circles of 8-16 spines each in male, in female 23-28 circles of 8-16 spines each. Interval between each trunk spination becomes wider posteriorly and number reduced to 2-4 in last row. Each spine with a proximal forked part and distal spiny part. Lemnisci 2, long, slender, cylindrical, subequal, shorter lemniscus 2.20 mm long, longer 2.75 mm long in male; in female shorter lemniscus 2.90-3.55 mm long, longer 3.25-3.65 mm long. Testes subequal, elongated, over-lapping, contiguous, equatorial, anterior 1.40-1.75 × 0.30-0.35 mm, posterior smaller 1.05-1.35 × 0.30-0.40 mm. Cement gland single syncytial. Cement reservoir elongated, subequal, 0.60-0.95 mm long, open by a pair of ducts in bursa. Saefftigen's pouch elongated, pyriform, 0.45-0.90 × 0.15-0.30 mm. Seminal vesicle 0.70-0.85 mm long. Bursa retractile 1.10-1.30 mm long. Ovarian balls 0.025-0.032 mm long. Uterine bell opens through a tube into uterus with guard cells. Uterus saccular, 0.9-1.0 mm long. Vagina thick, muscular, surrounded by muscle sphincter. Eggs oval to spherical, 0.032-0.078 × 0.030-0.068 mm, without polar prolongations of middle shell. Gonopore terminal.

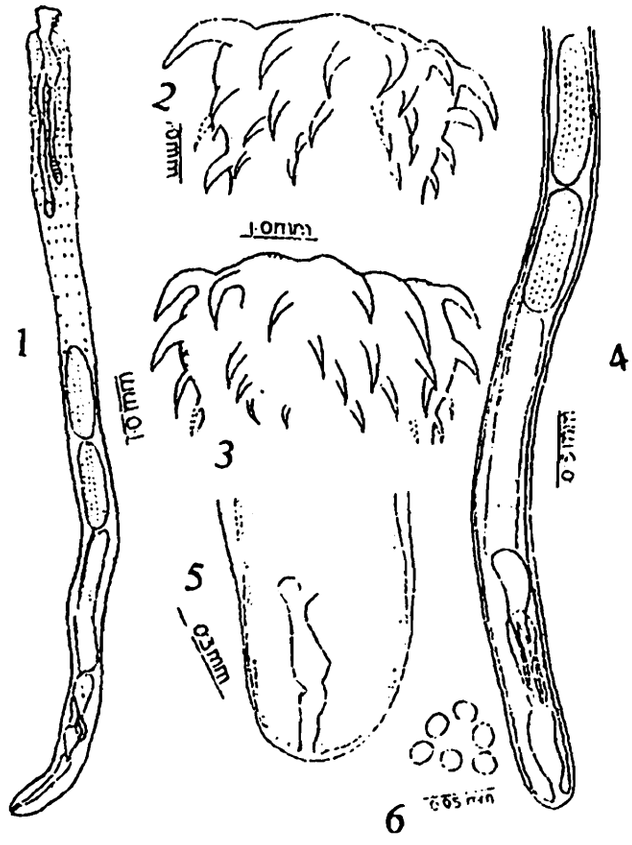


Fig. 267. *Pallisentis (Pallisentis) fotedari* Gupta, V. & Sinha, 1991. 1. Male, 2,3. Proboscis enlarged, 4. Posterior part of male, 5. Posterior end of female, 6. Ova (after Gupta, V. & Sinha, 1991).

Host : *Clupea longicep* Gunther.

Location : Intestine.

Locality : Puri coast, Bay of Bengal (Orissa).

Distribution : Known only from type locality.

299. ***Pallisentis (Pallisentis) garuai*** (Sahay, Sinha & Ghosh, 1971) Jain & Gupta, N.K. 1979 (Fig. 268)

Devendrasentiss garuai Sahay, Sinha & Ghosh, 1971 : 70-79, Fig. 1-5; Jain & Gupta, N.K. 1979c : 70-79, Fig. 1-5; Ahmed & Rauf, 1981 : 120; Ahmed, 1981 : 229; Gupta, V. & Fatma, 1986c : 166;

Pallisentis (Pallisentis) garuai Golvan, 1994 : 169;

Pallisentis garuai Ahmed & Ezaz, 1997 : 160;

Pallisentis (Pallisentis) garuei Amin et al;. 2000 : 43; Arthur & Ahmed, 2000 : 40.

Pallisentis garuai Bhattacharya, 2007 : 70-71, Pl..13, Fig. 60 a-f.

Type locality : Patna, Bihar, India.

Description : Male 8.97-10.9 × 0.58-0.78 mm; female14.02-28,72 × 0.43-0.57 mm. Proboscis globular, with 4 circles of 6 hooks each 0.187-0.243 mm long in male and 0.224-0.261 mm long in female. Hooks of anterior two circles stouter and longer 0.08-0.10 mm, 0.06-0.08 mm long, of III and IV circles 0.04-0.06 mm, 0.032-0.05 mm long. Proboscis receptacle single-walled, 0.83-0.86 mm long in males and 0.84-0.91 mm long in females. Neck unarmed, 0.187-0.223 mm long in male and 0.187-0.29 mm long in female. Trunk large cylindrical, with distinct ventral flexure. Trunk anteriorly with 13-15 rows of close set spines in males and 12-17 rows in females, followed by a aspinose area after which regular rows of widely placed thinner spines, in 28-32 spines in males and 36-76 spines in female. Lemnisci cylindrical, three times as long as receptacle. Testes 2, cigar-shaped, one behind other, anterior 0.73-0.095-0.20 mm, posterior 0.85-0.84 × 0.093-0.29 mm, from each testis vas efferens runs a short distance along cement gland and join to form vas deferens opening at base of penis. Cement glands syncytial, 1.68-2.47 × 0.13-0.34 mm. Uterine bell thin, funnel-shaped opens into vagina provided with sphincter muscles. In mature females ovary bursts liberating spherical; ovarian balls which float in body cavity. Eggs elliptical 0.05-0.07 × 0.016-0.018 mm with polar prolongation of middle shell.

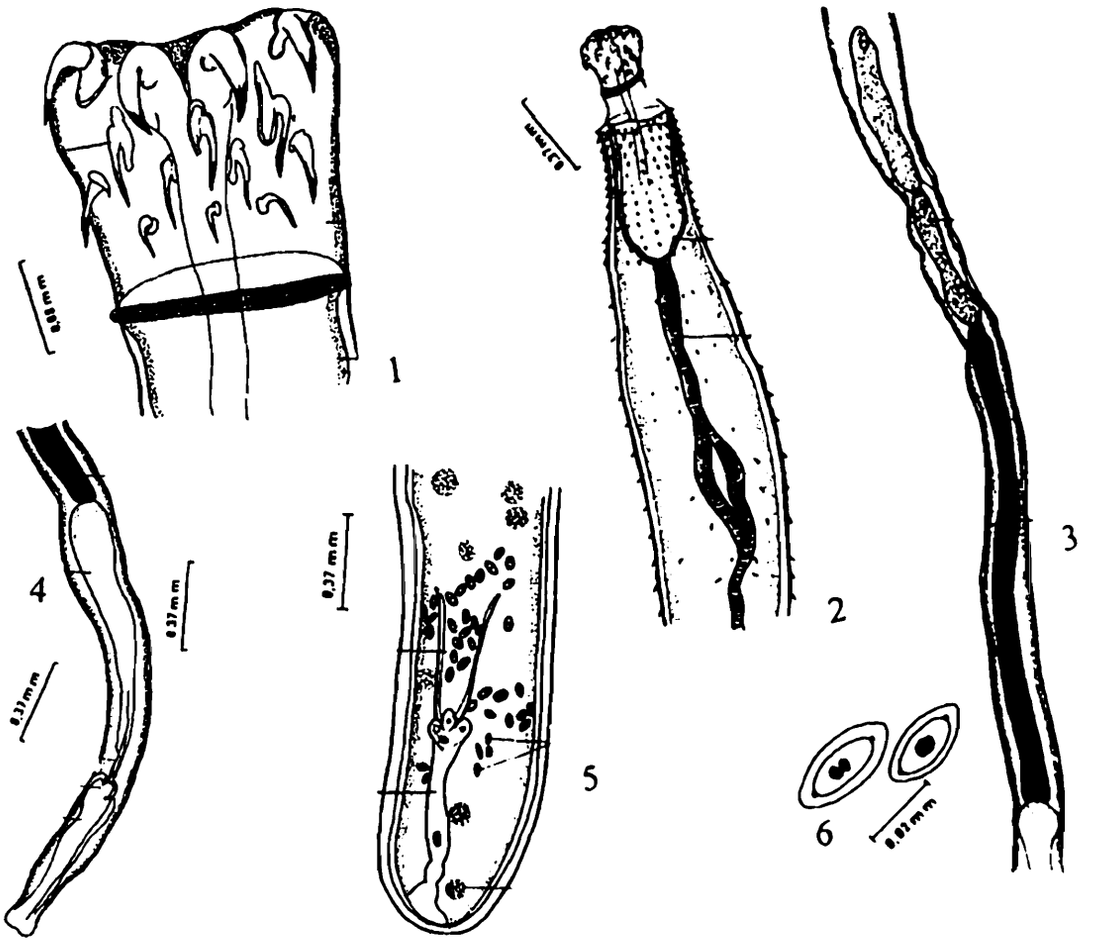


Fig. 268. *Pallisentis (Pallisentis) garuai* (Sahay, Sinha & Ghosh, 1971) Jain & Gupta, N.K. 1979. 1. Proboscis enlarged, 2. Anterior part of female, 3. Midtrunk of male, 4. Posterior part of male, 5. Posterior part of female, 6. Ova (after Sahay, Sinha & Ghosh, 1979).

Host : *Clupisoma garua* (Hamilton).

Location : Intestine.

Locality : Patna (Bihar); Barisal, Dhaka (Bangladesh).

Distribution : Known only from Indian subcontinent.

300. ***Pallisentis (Pallisentis) gomtii*** Gupta, S.P. & Verma, 1980 (Fig. 269)

Pallisentis gomtii Gupta, S.P. & Verma, 1980 : 275-280, Pl. 3, Fig. 1-4; Gupta, V. & Sinha, 1990b : 42;

Pallisentis (*Pallisentis*) *gomtii* Golvan, 1994 : 169;

Pallisentis (*Pallisentis*) *gomtii* Amin, *et al.*, 2000 : 43.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Male 4.01-6.9 × 0.45-0.46 mm; female 4.8-13.55 × 0.25-0.47 mm. Proboscis short globular, with 4 circles of recurved hooks, 8-10 hooks each, 0.215-0.250 × 0.20-0.212 mm in male, in female 0.20-0.28 × 0.25- mm. Each hook consists of recurved blade, a horizontally directed root, a handle embedded and a guard also embedded in proboscis wall. Proboscis hooks of first, second, third and fourth circles 0.03-0,07 mm, 0.025-0.05 mm, 0.021-0.041 mm and of 0.02-0.031 mm long. In female hooks of same circles 0.06-0.10 mm, 0.06-0.089 mm, 0.03-0.06 mm and 0.03-0.04 mm long. Proboscis receptacle cylindrical, single-walled, muscular sac, with ganglion at its base, in male 0.63-0.64 × 0.14-0.15 mm; in female 0.45-1.14 × 0.13- 0.19 mm. Lacunar system reticular with prominent main channels. Collar spines start from little posterior to proboscis with 15 circles of 8-10 spines each in male and in female 14-15 circlets of 8-16 spines each. Distance between collar spines 0.011-0.06 mm in male and in female 0.01-0.04 mm. Spines measure 0.011-0.039 mm in female. Trunk elongated, cylindrical with both ends slightly attenuated, spines start after a short non-spiny area 0.15-0.20 mm in male and in female 0.08-0.16 mm. Each row having 6-12 spines of 0.03-0.12 mm in male, and 8-14 spines of 0.01-0.04 mm. Distance between trunk spines 0.03-0.12 mm in male and in female 0.01-0.04 mm. Trunk spines measure 0.015-0.03 mm long in male and in female 0.02-0.04 mm long. Intervals between each circlet in trunk spination becomes wider posteriorly and number of spines decreases in last row reduced 1 or 2. Trunk spines in female extend up to little anterior to posterior end of body while in male up to middle or posterior testis. Lemnisci a pair of long, slender, cylindrical, subequal, shorter lemniscus 1.04-1.73 × 0.05-0.06 mm and longer 1.16-2.3 × 0.05-0.06 mm in male; in female shorter lemniscus 1.11-1.98 × 0.05- 0.13 mm, and longer lemniscus 1.50-2.13 × 0.05-0.08 mm. Testes elongated, in tandem, subequal and post-equatorial, anterior 0.35-3.83 mm long, posterior testis 0.38-0.46 × 0.061-0.10 mm. Cement gland, single, cylindrical, syncytial mass with numerous nuclei lying behind testes, 0.088-0.11 × 0.082-0.13 mm, its reservoir 0.34-0.48 × 0.07-0.15 mm opening by a pair of duct 0.34-0.52 mm long into bursa. From each testis

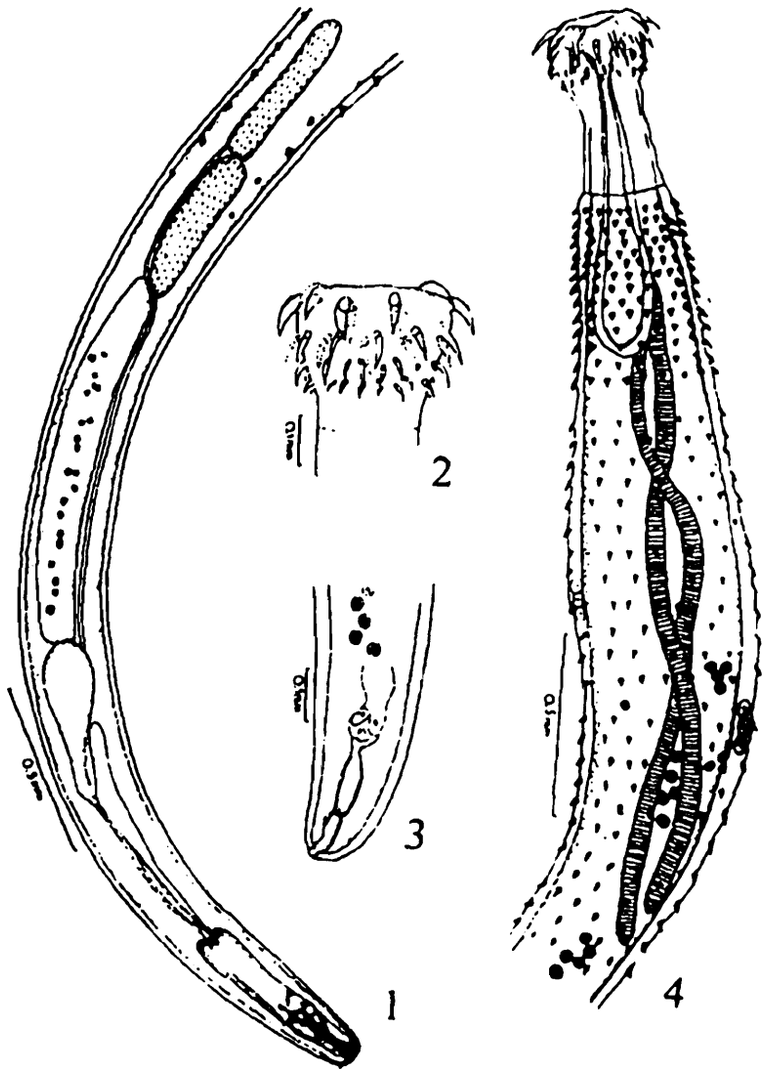


Fig. 269. *Pallisentis (Pallisentis) gomti* Gupta, S.P. & Verma, 1980. 1. Posterior part of male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Anterior part of female (after Gupta, S.P. & Verma, 1980).

a vas deferens runs down in close association with cement gland and cement reservoir and joins bursa. Saefftigen's pouch elongated 0.31-0.38 × 0.06-0.08 mm opening by a narrow tubular duct 0.23-0.30 mm long into bursa. Bursa muscular, eversible, 0.37-0.49 × 0.06-0.062 mm. Uterine bell 0.09-0.15 × 0.06-0.12 mm, opening into uterus through uterine tube with guard cells. Uterine sac 0.22-0.35 × 0.05-0.12 mm. Vagina thick, muscular, surrounded by muscle sphincter, 0.1-0.12 × 0.02-0.05 mm. Gonopore lying ventro-terminal in female.

Host : *Nandus nandus* (Hamilton-Buchanan).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

301. ***Pallisentis (Pallisentis) guntei*** Sahay, Nath & Sinha, 1967 (Fig. 270)

Pallisentis guntei Sahay, Nath & Sinha, 1967 : 349-351, Fig. 1-5 Gupta, V. & Sinha, 1990b : 47,

Pallisentis (Pallisentis) guntei Golvan, 1994 : 169;

Pallisentis (Pallisentis) guntei Amin *et al.*, 2000 : 43.

Pallisentis guntei Bhattacharya, 2007 : 65, Pl. 12, Fig. 52 a-d.

Type locality : Ranchi, Chittasgarh, India.

Description : Worms small. Male 1.75-1.95 mm long, female 4.15-4.6 mm long. Proboscis nearly globular 0.135-0.15 mm long in male, in female 0.23-0.28 mm long, with 4 rows of 8-10 hooks each, hooks of 1st and 2nd rows 0.085 mm long, while those of 3rd and 4th rows 0.03-0.045 mm long respectively. Proboscis receptacle single-walled, cylindrical, 0.16-0.18 mm long in male. Neck 0.33-0.35 mm long in fe6male without armature. Trunk cylindrical, with a distinct ventral flexure behind midtrunk, throwing it into a loop, with

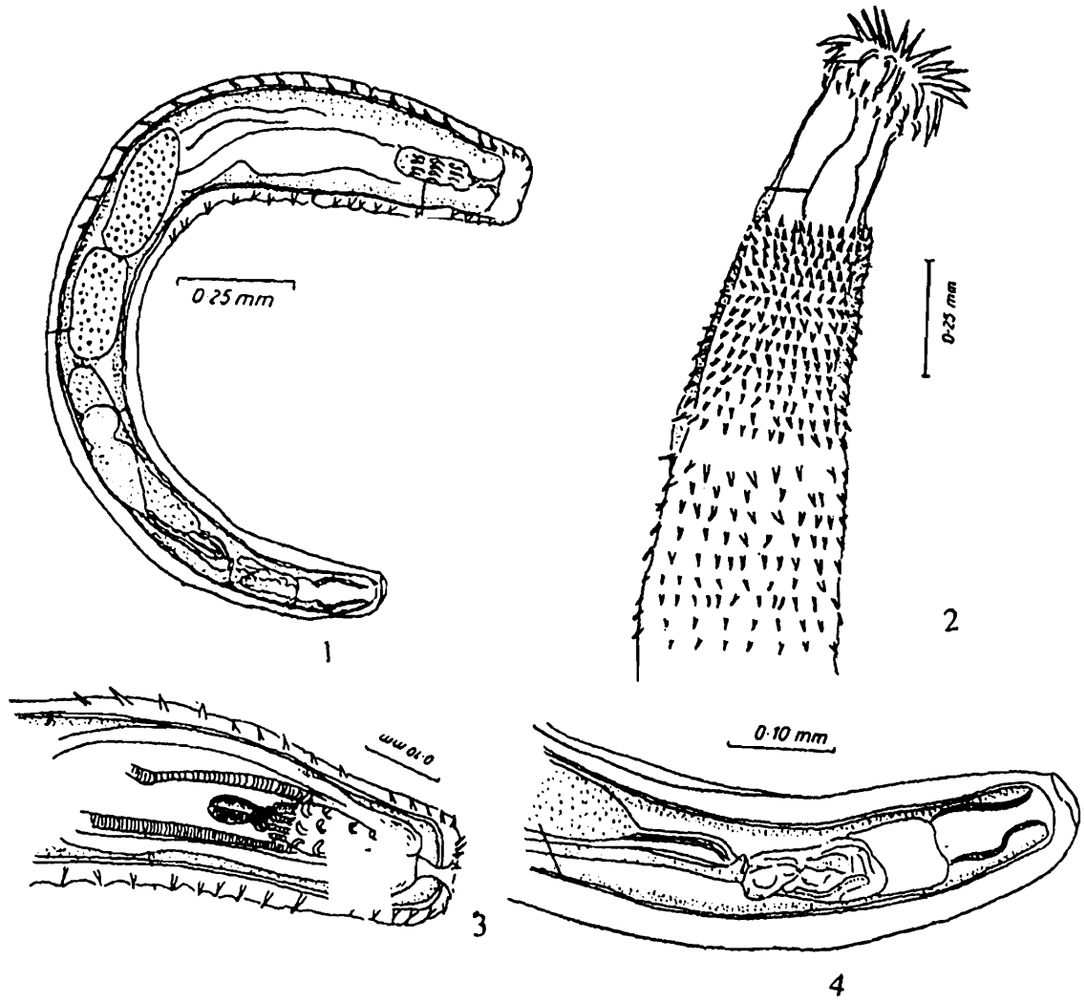


Fig. 270. *Pallisentis (Pallisentis) guntei* Sahay, Nath & Sinha, 1967. 1. Male, 2. Anterior part of worm enlarged, 3. Anterior part of worm with introverted proboscis, 4. Posterior part of male (after Sahay, Nath & Sinha, 1967).

16-17 rows of close set hooks followed by a spineless portion, after which again with regular rows of widely placed hooks. Testes elongated, one behind other, anterior testis 0.2-0.3 mm long,, 0.10-0.11 mm wide, posterior testis 0.175-0.20 mm long, 0.10-0.11 mm wide. From testes arise vasa efferentia run a short distance along cement glands, join to form vas deferens, which opens at base of penis. Seminal vesicle elongated, 0.35-0.475 mm long, 0.075-0.09 mm wide, its ducts join vas deferens before latter open into penis. Cement gland bilobed 0.125-.18 mm long with nuclei, its duct opening separately at base of penis. Bursa funnel shaped 0.04-0.5 mm long and eversible. In female ovary, uterine, uterus, vagina and vulva. In mature worms ovary bursts liberating ovarian balls, which float in body cavity. Uterine bell thin, funnel shaped attached at one end by thin genital ligament to base of proboscis sheath. Uterus long and muscular 0.16-0.18 mm long, leading into elongated vagina. Vulva slit-like placed postetro-ventally.

Host : *Lepidocephalichthys guntea* Hamilton, *Nandus nandus* (Hamilton-Buchanan). *Location* : Intestine, peritoneal cysts.

Locality : Ranchi (Bihar). Lucknow (Uttar Pradesh);

Distribution : Known only from India.

302. ***Pallisentis (Pallisentis) guptai*** Gupta, V. & Fatma, 1986 (Fig. 271)

Pallisentis guptai Gupta, V. & Fatma, 1986c : 159-162, Pl. 3, Fig. 1-7;

Pallisentis (*Pallisentis*) *guptai* Golvan, 1994 : 169; Amin et al., 2000 : 43.

Pallisentis guptai Bhattacharya, 2007 : 66, Pl. 12, Fig. 53 a-d.

Type locality : Lucknow, Uttar Pradesh, India.

Description : Males 5.64-6.85 × 0.50-0.55 mm, females 14.26-20.50 × 0.45-0.66 mm. Proboscis globular 0.25-0.30 × 0.22-0.28 mm in male, in female 0.26-0.30 × 0.30-0.32 mm, with 4 circles of 8 recurved hooks each. Hooks of I, II, III and IV first circle 0.06-0.08 mm, second 0.052-0.058 mm, third 0.04-0.045 mm and fourth 0.03-0.04 mm long in males; in females hooks of same circles 0.09-0.10 mm, 0.06-0.07 mm, 0.045-0.05 mm and 0.020-0.025 mm long. Each hook with a recurved blade and horizontally directed root, a handle sunk in wall of proboscis. Proboscis receptacle cylindrical, single-walled, muscular sac, with ganglion at its base, 0.80-0.85 x0.20-0.25 mm in male; in female 0.88-0.90 × 0.20-0.22 mm. Collar spines in 13-14 transverse rows of 8-10 spines each in males; in females 14-15 circles of 12-16 spines each. Distance between collar spines 0.012-0.2 mm in male, in female 0.015-0.025 mm. Spines 0.015-0.022 mm long in males; in females 0.016-0.020 mm long. Neck small separated from proboscis by a transverse muscular band, 0.04-0.045 × 0.16-0.20 mm in male; in female 0.45-0.50 × 0.20-0.25 mm. Trunk elongate, cylindrical with both ends slightly curved, spines start after a non-spiny area, 0.55-0.068 mm with 12-18 hooks each in males, in females 0.08-0.12 mm, 25-30 circles of 12-18 hooks each. Distance between trunk spines 0.015-0.35 mm in male; in female 0.015-0.040 mm. Trunk spines 0.022-0.025 mm long in males and 0.022-0.030

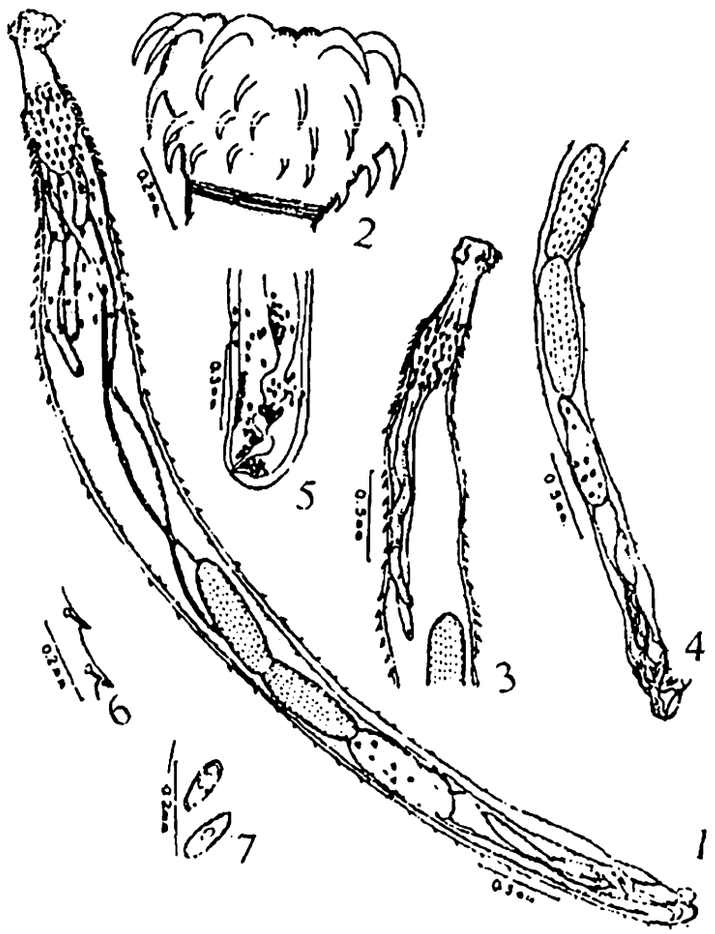


Fig. 271. *Pallisentis (Pallisentis) guptai* Gupta, V. & Fatma, 1986. 1. Male, 2. Proboscis enlarged, 3. Anterior part of male, 4. Posterior part of male, 5. Posterior part of female, 6. Trunk spines, 6. Ova (after Gupta, V. & Fatma, 1986).

mm long in females. Interval between each circlet in trunk spination becomes wider posteriorly and number spines decrease in last circle until it reaches 2.4. Each spine with a proximal forked part and distal spiny part. Lacunar system with prominent main longitudinal channels and reticular anastomoses.Lemnisci unequal, shorter lemniscus 1.2-1.6 × 0.10-0.15 mm, longer 1.4-1.8 × 0.10-0,12 mm in males; in females about 3 times as long as receptacle, shorter lemniscus 1.5-1.8 x0.10-0.11 mm, longer 1.4-2.0 × 0.10-0.12 mm. Testes elongated, cylindrical, subequal, overlapping, post-equatorial, anterior 0.48-0.50 × 0.20-0.28 mm at 4.25-5.0 mm from anterior end; posterior smaller 0.54-0.60 × 0.20-0.25 mm at 2.0-2.6 mm from posterior end. Cement gland elongated, syncytial, overlapping posterior testis, 0.50-0.58 × 0.20-0.26 mm, with 10-12 nuclei, its reservoir 0.50-0.56 × 0.18-0.25 mm, opening by a pair of ducts, 0.50-0.65 mm long into bursa. Saefftigen's pouch elongated, pyriform 0.65-0.75 × 0.15-0.18 mm, opening by narrow ducts, 0.25-0.35 mm long, run down and open into bursa. Seminal vesicle 0.18-0.22 × 0.12-0.15 mm. Bursa eversible, muscular, 0.18-0.22 × 0.18-0.20 mm. Ovarian balls oval, 0.25-0.32 × 0.12-0.26 mm. Uterine bell funnel-shaped, 0.25-0.30 × 0.09-0.12 mm, opening into uterus through a tube with guard cells. Uterus saccular 0.25-0.32 × 0.18-0,02 mm.

Vagina thick, muscular, surrounded by sphincter muscles, 0.6-0.75 × 0.04-0.045 mm. Eggs oval 0.055-0.057 × 0.03-0.031 mm without polar prolongation of middle shell. Gonpore terminal.

Host : *Nandus nandus* (Hamilton-Buchanan).

Location : Intestine.

Locality : Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

303. ***Pallisentis (Pallisentis) jagani*** Koul, Raina, Bambroo & Koul, 1991 (Fig. 272)

Pallisentis jagani Koul, Raina, Bambroo & Koul, 1991 : 124-127, Fig. 1-7; 1999 : 43-50; Bhattacharya, 2007 : 70, Pl.13, Fig. 59 a-e.

Type locality : Sai R. S. Para, Jammu, Jammu and Kashmir, India.

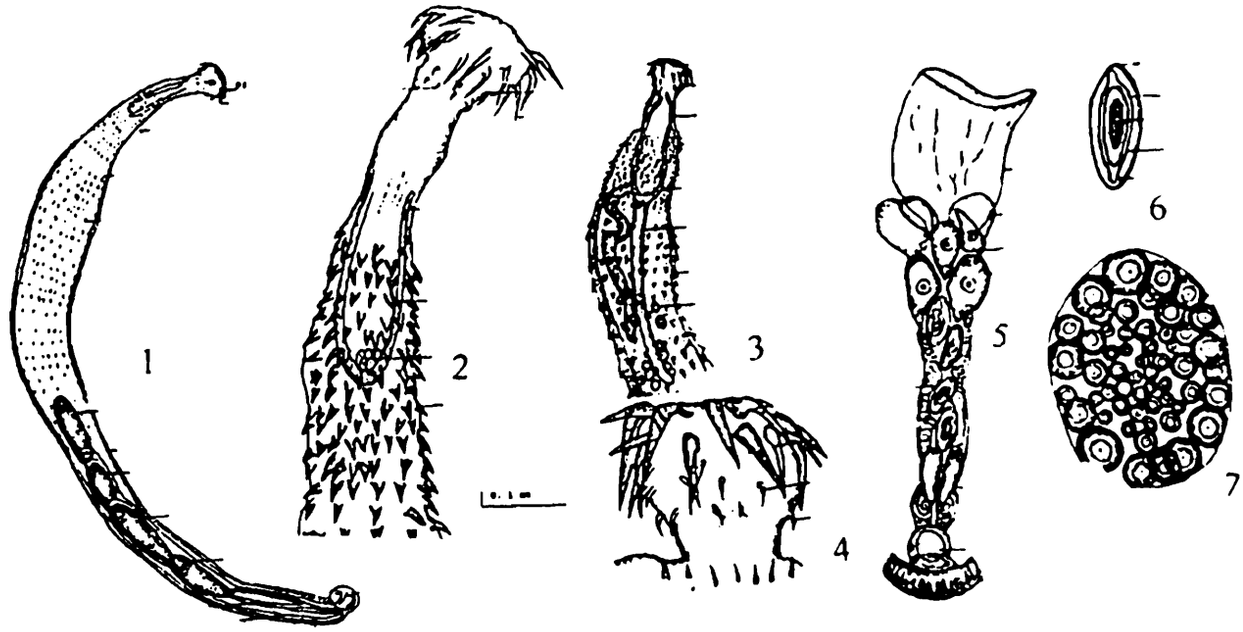


Fig. 272. *Pallisentis (Pallisentis) jagani* Koul, Raina, Bambroo & Koul, 1991. 1. Male, 2. Anterior part of male, 3. Anterior part of female, 4. Proboscis enlarged, 5. Female genitalia, 6. Ovum enlarged, 7. Ovarian ball (after Koul, Raina, Bambroo & Koul, 1991).

Description : Males 3.153 × 0.246 mm, females 5.2 × 0.54 mm. Proboscis bluntly rounded with 4 circles of hooks, hooks of I circles 0.046-0.061 mm, II circle 0.046-0.056 mm, III circle 0.012-0.014 mm and IV circle 0.012-0.013 mm long in male; in female in circles I 0.056-0.084 mm, II 0.050-0.079 mm, III 0.018-0.21 mm and IV 0.014-0.021 mm long. Proboscis receptacle small 0.338 × 0.03 mm in males and in females 0.415 × 0.12 mm. Neck small without spines, 0.26 × 0.07 mm in male, in female 0.176 × 0.253 mm.

Collar with 16 circles of 10-12 spines each. Trunk cylindrical, tapering towards posterior end, anterior trunk spines extending up to 0.33 mm in males and 0.26 in females, in 15-16 circles with 8-15 spines in each in males; in females 36-37 circles of 8-19 spines each. Spines 0.020-0.025 × 0.01 mm. Anterior aspinose region extends up to 0.07-0.076 mm. Posterior spinose region longer than anterior aspinose region, with 22-24 rows of 8-11 spines each in males and 36-37 rows of 8-19 spines each in females. Spine size almost same as in anterior spines. Posterior aspinose region longer 1.4 mm long in males and 2.3 mm long in females. Lemnisci 2. Testes 0.276 × 0.076 mm and 0.184 × 0.076 mm. Cement gland with 6 giant nuclei, an average of 0.277 × 0.092 mm, its reservoir with 2 cement ducts. Seminal vesicle small, 0.26 × 0.338 mm. Saefftigen's pouch 0.346 × 0.38 mm. Bursa small 0.163 × 0.158 mm. Uterine bell 0.14 × 0.12 mm with guiding cells 0.06-0.07 × 0.03-0.04 mm. Uterus tubular. Vagina small, 0.8-0.09 × 0.05-0.06 mm. Utero-vaginal valve well developed. Vagina small 0.05-0.08 × 0.05-0.06 mm. Ovarian balls spherical to oval, 0.051-0.067 mm in size. Eggs oval 0.045-0.047 × 0.015-0.017 mm with polar prolongation of middle shell.

Host : *Channa striatus* (Bloch), *Schizothorax sinuatus.*

Location : Intestine.

Locality : Sai R. S. Para, Jammu (Jammu & Kashmir).

Distribution : Known only from type locality.

304. ***Pallisentis (Pallisentis) kalriai*** Khan & Bilqees, 1985 (Fig. 273)

Pallisentis kalriai Khan & Bilqees, 1985a : 103-104, Fig. 1-10; Bilqees & Khan, 1987 : 16-17, Fig. 21 a, b, 22 a-c, 23 a, b, 24 a, b;

Pallisentis (*Pallisentis*) *kalriai* Golvan, 1994 : 169; Amin *et al.*, 2000 : 43.

Type locality : Kalri lake, Sindh, Pakistan.

Description : Worms medium sizes, elongate, creamy white in life. Male 8.90-10.57 × 0.57-0.58 mm, female 12.03-12.31 × 0.52-0.53 mm. Proboscis short, invaginable, 0.99-0.116 × 0.23-0.27 mm in male and 0.16-0.21 × 0.16-0.33 mm in female, with 4 rows of 10 hooks each, hooks 0.076-0.091 × 0.012-0.26 mm, all hooks wider at base and pointed at tip and slightly curved ventrally. Anterior most row of hooks Large, while second, third and fourth rows become progressively smaller. Neck short, smooth 0.265-0.315 × 0.232-0.238 mm, with cuticular folds. Collar with 15 circular rows with 20 spines each, 0.0384-0.390 × 0.15-0.019 mm, provided with cuticular thickenings at base giving comb-like appearance. Spines on trunk conical in shape and larger than in collar spines, becoming progressively smaller towards posterior end. Spine arrangement similar in both sexes. Lemnisci long, slender, 1.228-1.90-6 × 0.060-0.065 mm. Testes cylindrical, 1.17-1.19 × 0.26-0.27 mm. Cement gland long, syncytial, 1.66-2.58 × 0.19-0.23 mm, its reservoir

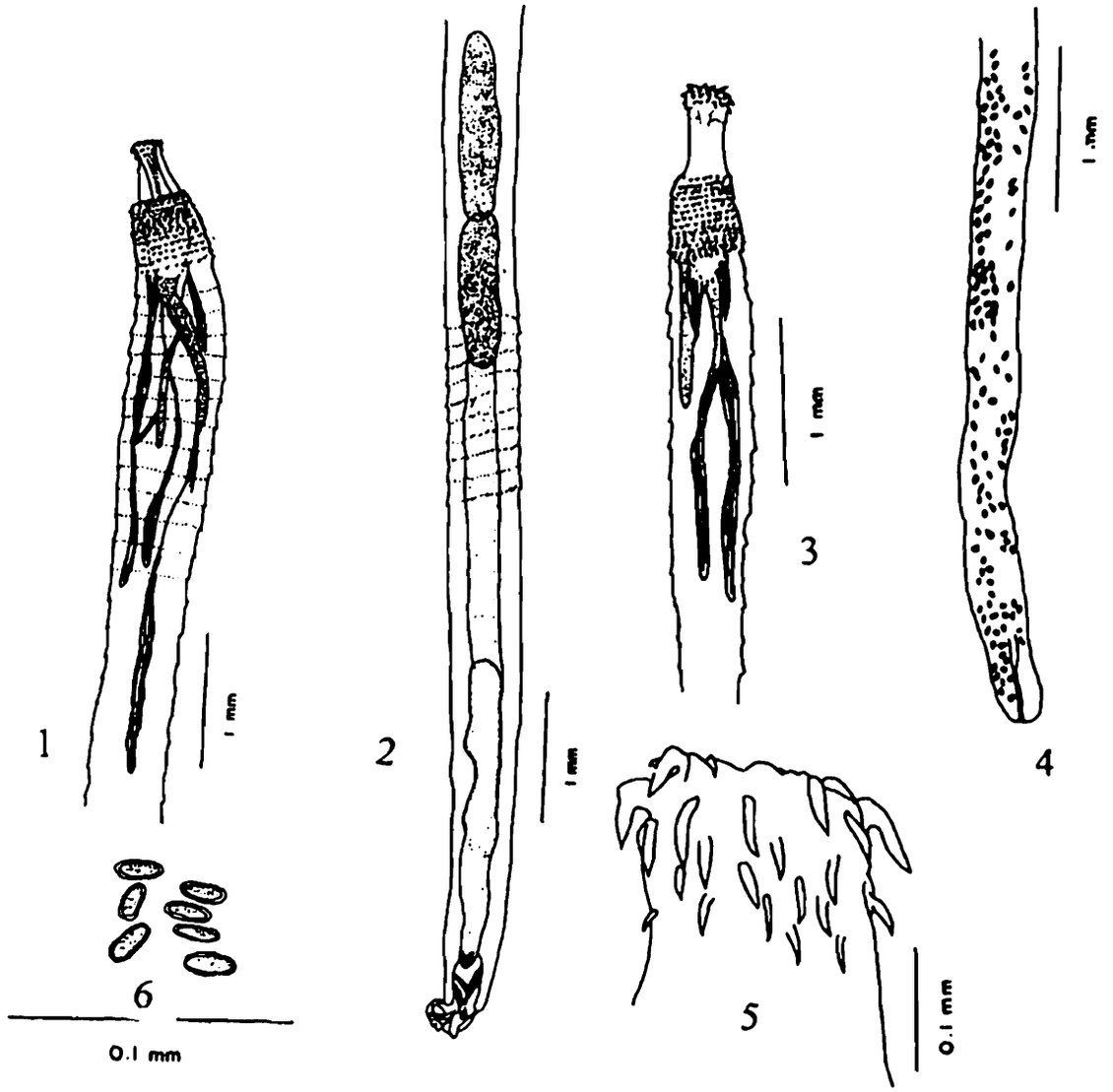


Fig. 273. *Pallisentis* (*Pallisentis*) *Kalriai* Khan & Bilqees, 1985. 1. Anterior part of female, 2. Posterior part of male, 3. Anterior part of male, 4. Posterior part of male, 5. Proboscis enlarged, 6. Ova (Khan & Bilqees, 1985).

elongated, 1.07-1.85 × 0.14-0.31 mm. Seminal vesicle 0.89-1.17 × 0.23-0.27 mm. Saefftigen' pouch 0.39-0.70 × 0.23-0.39 mm. Copulatory bursa 0.27-0.54 × 0.23-0.50 mm with 5-6 rays and delicate muscle fibers. Uterine bell present, not clearly distinguishable. Eggs numerous, thin-walled, oval, 0.032-0.036 ×, 0.012-0.016 mm. Posterior end of body rounded with terminal gonopore.

Host : *Labeo rohita* (Hamilton).

Location : Small intestine.

Locality : Kalri lake, Sindh (Pakistan).

Distribution : Known only from type locality.

305. ***Pallisentis (Pallisentis) magnum*** Saeed & Bilqees, 1971
(Fig. 274)

Pallisentis magnum Saeed & Bilqees, 1971 : 221-223, Fig. 1; Bilqees, 1976 : 110; Khan & Bilqees, 1985b : 281; 1986 : 14-15, Fig. 17 a-d; Gupta, V. & Sinha, 1990b : 55;

Pallisentis (Pallisentis) magnum Golvan, 1994 : 169.

Type locality : Kalri lake, Sindh, Pakistan.

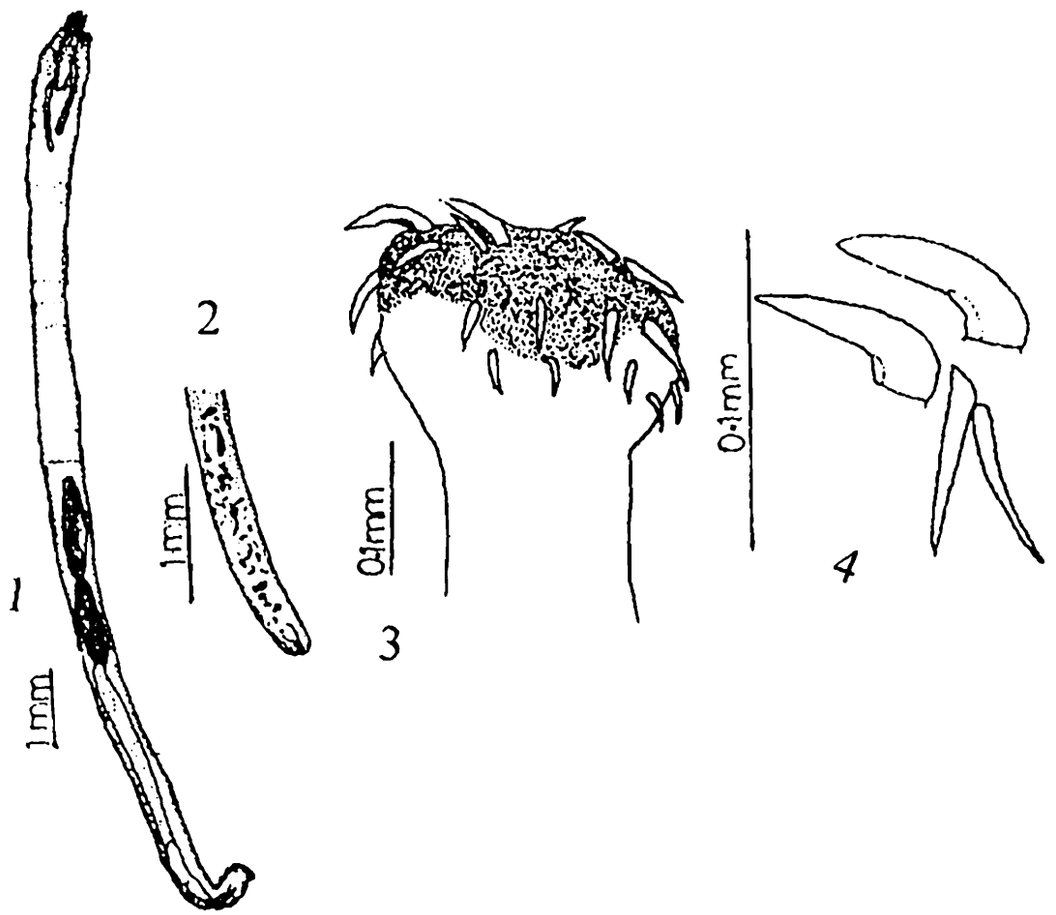


Fig. 274. *Pallisentis (Pallisentis) magnum* Saeed & Bilqees, 1971. 1. Male, 2. Posterior part of female, 3. Proboscis and neck enlarged, 4. Proboscis hooks enlarged (Saeed & Bilqees, 1971).

Description : Worms creamy white in life. Male 9.78-20-82 × 0.78-1.05 mm, female 11.73-12.94 × 0.70-0.74 mm. Proboscis short, globular, wider at apex and gradually narrowing towards base, apex with a muscular pad to which base of hooks attached. Proboscis 0.21-0.25 × 0.33-0.39 mm with 4 rows of 8 hooks each; hooks of first row large, curved ventrally with pointed ends, 0.063-0.082 × 0.012-0.02 mm, base of hook with a swelling. Hooks of second, third and fourth rows smaller, 0.0576-0.0612 × 0.0072-0.0108 mm; 0.0432-0.0504 x0.00468-0.0072 mm, and 0.032-0.039 × 0.0054-0.0068 mm respectively in both sexes. Proboscis receptacle cylindrical, single-walled, 0.66-1.44 × 0.33-0.50 mm in male; in female 0.54-0.78 × 0.23-0.35 mm. Neck smooth 0.21-0.23 × 0.27-

0.33 mm in male; in female 0.38-0.39 × 0.23-0.29 mm. Collar with 15 rows of 20 spines each, which are small, pointed and wide at base, 0.027-0.039 × 0.010-0.014 mm. Trunk large, slender and tubular with ends slightly attenuated. Anterior half of trunk with rows of 14-16 spines each, smaller than collar spines. Lacunar system with prominent main channels and reticular vessels. Lemnisci 1.24-1.59 × 0.077-0.079 mm. Testes oval, anterior 0.68-1.62 × 0.17-0.43 mm, posterior 0.66-1.30 × 0.20-0.43 mm. Cement gland elongate, large, pear shaped 0.92-3.35 × 0.13-0.36 mm, its reservoir 0.44-0.98 × 0.17-0.34 mm. Saefftigen's pouch 0.44-1.18 × 0.052-0.13 mm. Seminal vesicle 0.42-0.97 × 0.052-013 mm. Bursa variable in shape and size, 0.06-0.36 × 0.11-0.42 mm, provided with depressor, dilator and retractor muscles which help during copulation. Ovaran masses 0.025-0.051 × 0.025-0.038 mm. Uterine bell 0.72-0.081 × 0.076 mm. Vagina 0.038-0.048 × 0.028-0.038 mm. Posterior end of female rounded, with terminal gonopore.

Host : *Wallago attu* (Bloch & Schneider).

Location : Small intestine.

Locality : Kalri lake, Sindh, Pakistan.

Distribution : Known only from type locality.

306. ***Pallisentis (Pallisentis) nagpurensis*** (Bhalerao, 1931) Bayis, 1933 (Fig. 275)

Farzandia nagpurensis Bhalerao, 1931 : 569-573, Fig. 1-4;

Pallisentis nagpurensis Baylis, 1933 : 444-447, Datta & Poddar, 1935 : 234-235; Textfig. 4, Pl. 5, Fig. 4, 5; Subramanian, 1937a : 311-315; Textfig. 1-4; 1937b : 111-112, Fig. 1-3;

Pallisentis nagpurensis Fernando & Furtudo, 1963 : 151-152, Fig. 3 a-f; Yamaguti, 1963 : 35; Fernando & Furtudo, 1969 : 90; Ravindranath & Nadakal, 1971, 1-5, Fig. 1, 2; George & Nadakal, 1973 : 31-42, Fig. 1-7;

Pallisentis nagpurensis Bhasheerulla, 1973 : 74. 79;

Pallisentis nagpurensis Jain & Gupta, N. K. 1979 : 173-174, Fig. 1-8;

Pallisentis nagpurensis Kennedy, 1981 : 1847-1850, Fig. 1-4; Ahmed & Rauf, 1981 : 121; Ahmed, 1981 : 234; Soota & Bhattacharya, 1982 : 158-161, Textfig. 1 a-d; George & Nadakal, 1983 : 387-390; Firdaus, 1984 : 290; Chawhan, Gupta, N. K. & Khera, 1987b : 2, Fig. 1-6; George & Nadakal, 1987 : 75, 76, Fig. 3; Firdaus, 1988 : 216; Chandra & Rahman, 1988 : 37-38; Gupta, V. & Sinha, 1990b : 43; George & Nadakal, 1992 : 287; Khanum, Zaman & Shamin, 1993 : 96;

Pallisentis (*Farzandia*) *nagpurensis* Golvan, 1994 : 170;

Pallisentis nagpurensis Brijkumar, 1996 : 115-124; Madhavi, Jhansilaksmibai & Murugam 1996 : 350; Koul, Raina & Zutshi, 1999 : 51-59; Rathabai & Ramalingam, 2001 : 65-72;

Pallisentis (*Pallisentis*) *nagpurensis*, Arthur & Ahmed, 2002 : 40.

Pallisentis nagpurensis Bhattacharya, 2007 : 67, Pl..12, Fig. 56 a-d.

Type locality : Nagpur, Maharastra, India.

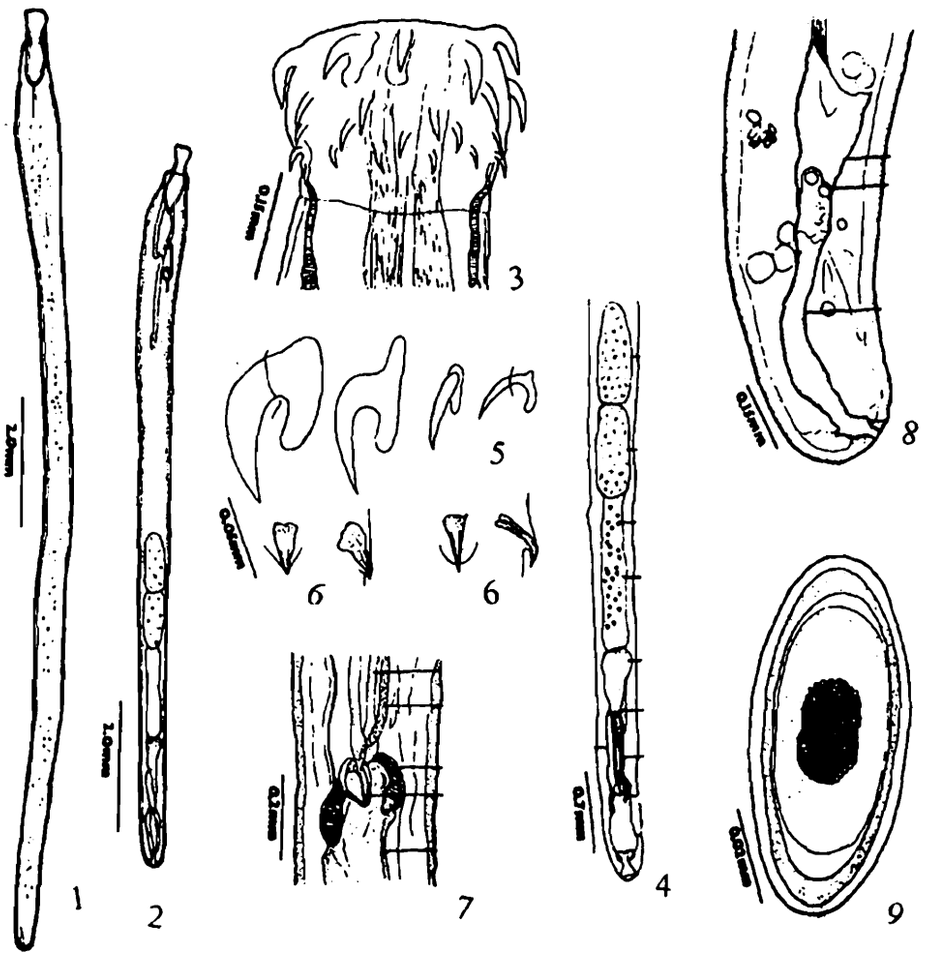


Fig. 275. *Pallisentis* (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Baylis, 1931. 1. Female, 2. Male, 3. Proboscis enlarged, 4. Posterior part male, 5. Proboscis hooks enlarged, 6. Trunk spines enlarged, 7. Mid trunk showing some male genitalia, 8. Posterior part of female, 9. Ovum enlarged (after Kennedy, 1981).

Description : Male 7.82-12.18 × 0.43-0.44 mm; Female 0.26-22.92 × 0.39-0.63 mm. Proboscis short, globular 0.14-0.16 × 0.19-0.21 mm in males; in females 0.13-020 × 0.20-0.25 mm, with 8-9 spiral rows of 4-6 hooks each. Hooks decrease in size posteriorly. Hook of I, II, III and IV rows, 0.059-0.076 mm, 0.050-0.65 mm, 0.033-0.046 mm, 0.020-0.033 mm long in males; and in females same rows 0.66-0.074 mm, 0.057-0.063 mm, 0.036-0.048 mm and 0.023-0.033 mm long respectively. Root length of above hooks 0.041-0.050 mm, 0.031-0.041 mm, 0.021-0.25 mm and 0.017-0.021 mm long in males and in females 0.052-0.065 mm. 0.041-0.048 mm, 0.22-0.33 mm and 0.025-0.026 mm long. Proboscis receptacle single-walled 0.59-0.62 × 0.15-0.17 mm in males and in female 0.54-0.78 × 0.15-0.22 mm in females. Trunk elongated, slightly wider in anterior half, narrowing at level of anterior testis. Trunk spines at anterior end forming two groups; 11-14 horizontal rows of collar spines and 19-25 rows of trunk spines. Lemnisci long, filiform 2.79 × 0.28 mm in males and in females 3.4-4.41 × 0.68-0.78 mm. Testes elongate, contiguous, anterior 0.77-1.09 × 0.13-0.22 mm, posterior 0.61-0.94 × 0.15-0.24 mm. Cement gland syncytial, bilobed, elongated with 17-22 large nuclei, its ducts two from gland unite and open at base

of minute penis. Uterine bell funnel-shaped, eversible present. In mature female ovary bursts liberating ovarian balls floating in body cavity., they contain eggs in all stages of development. Uterine bell funnel-shaped attached on one side to genital ligament at base of proboscis. Base of uterine bell with a few guard cells which sort out eggs and allow only mature eggs into uterus. Uterus thin-walled, long tube leads into elongated vagina. Vagina with two bands of strong muscles at both ends, which allows eggs to pass out in single file. Vulva placed postero-ventrally. Shelled acanthors 0.068-0.091 × 0.028-0.040 mm.

Host : *Channa striatus* (Bloch), *C. marulius* (Hamilton), *C. punctatus* (Bloch); *C. gachua* (Hamilton & Buchanan), *Channa* sp., *Glossogobius giurus* (Hamilton), *Nandus nandus* (Hamilton-Buchanan), *Etroplus suratensis* (Bloch), *E. maculates* (Bloch), *Cirrhina cupla; Wallago attu* (Bloch & Schneider).

Location : Intestine. {George & Nadakal (1983) found worms encapsulated in mesenteries of *Wallago attu* (Bloch & Schneider), *Heteropneustes fossilis* (Bloch), *Channa gachua* and *Rana tigrina* (Daudin), and encapsulated worms in liver of *Macropodus cupanus*, *Aplocheilus melastigma* (Mc Clelland) and *Barbus* sp; and encapsulated worms in process degeneration in mesenteries of *Rana tigrina* (Daudin) and *Channa gachua*].

Locality : Trivandrum, Cochin (Kerala); Karaikal (Pondichrry); Visakhapatnam (Andhra Pradesh); Nagpur (Maharastra); Konark, Chandbeli (Orissa); Luckmow (Uttar Pradesh); Gobinsagar lake; Ludhiana (Punjab); Darjeeling, Kurseong, Siliguri Bishnupur, Diamond Harbour, Kolkata, Kiddapur, Uttarbagh (West Bengal); Barisal, Dhaka, Sylhet (Bangladesh); Kalrai lake, Sindh (Pakistan);Rangoon (Burma); Sri Lanka.

Distribution : Known only from Indian subcontinent.

307. ***Pallisentis (Pallisentis) nandai*** Sarkar, 1953
(Fig. 276)

Pallisentis nandai Sarkar, 1953a : 192-193; 1953b : 139-143, Textfig.1-3; Yamaguti, 1963 : 35, Pl. 9, Fig. 83; Rehman & Ali, 1969 : 276-278, Fig. 1-3; Anantaraman, M. & Anantaraman, S., 1970 : 4; Gupta, P. D. & Gupta, R. K. 1979 : 317; Basheerullah, 1973 : 65; Gupta, P. D. & Ghosh, 1979 : 317; Ahmed & Rauf, 1981 : 120;

Pallisentis (*Pallisentis*) *nandai* Golvan, 1994 : 170; Amin et al., 2000 : 43; Arthur & Ahmed, 2002 : 40-41.

Pallisentis nandai Bhattacharya, 2007 : 62-64, Pl..11, Fig. 50 a-c.

Type locality : Aligarh, Uttar Pradesh, India.

Description : Male 5.6-9.9 × 0.37-0.63 mm; female 6.3-10.4 × 0.39-0.56 mm. Proboscis pyriform, anteriorly wider than posterior 0.17-0.48 × 0.19-0.32 mm, hook in I, II, III and IV circles 0.09 mm, 0.08 mm, 0.06 mm and 0.03 mm long. Proboscis receptacle thin, ovoid, single-walled sac, 0.44-0.84 × 0.12-0.25 mm, with oval ganglion in its posterior half, from which nerve retinacula emerge and pass out to trunk wall. Rings of spines appear to correspond to transverse lacunar canals. Collar with 13-14 circular rows of 18-20 short, close-set spines each, measuring 0.027 mm long, following which short spineless area. Trunk cylindrical with wide anterior and a blunt posterior end. Portion behind this

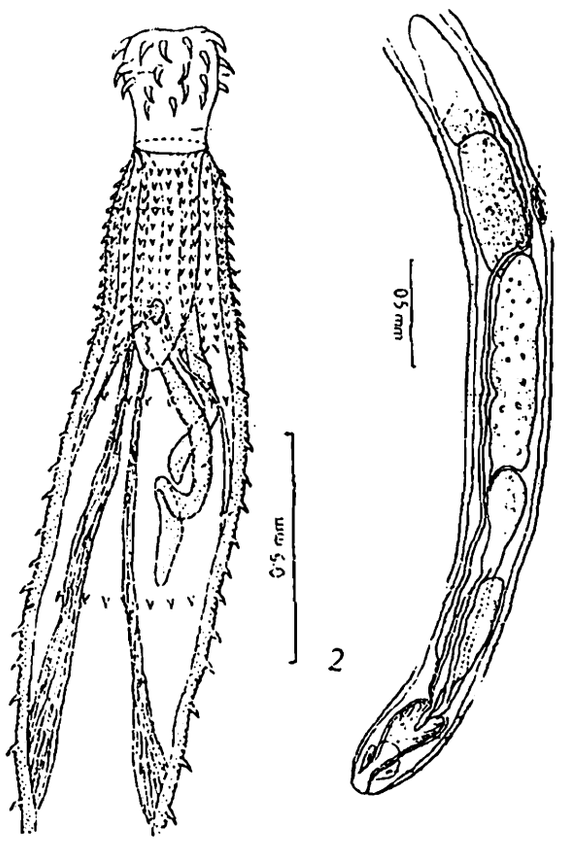


Fig. 276. *Pallisentis* (*Pallisentis*) *nandai* Sarkar, 1953. 1. Anterior part of worm, 2. Posterior part of male (after Sarkar, 1959).

with 28-55 regular circles with 16-20 arrow-shaped spines each, separated from one another by wide aspinose spaces. Trunk spines measure 0.018 mm long. Lacunar system well developed with two lateral longitudinal channels and transverse canals at regular intervals giving segmental appearance. Lemnisci long, 1.1-1.8 × 0.04 mm, shorter 0.72 × 1.3 × 0.04 mm. Testes elongated elliptical, one behind other, anterior 0.43-0.56 × 0.14-0.16 mm, posterior 0.37-0.53 × 0.14-0.16 mm, from which emerge vasa efferentia and unite into vas deferens near anterior tip of cement gland. Cement gland single, elongated, lobulated with 23-25 nuclei, 0.77-1.4 × 0.14-0.22 mm, its reservoir 0.29-0.48 × 0.12-0.21 mm, with two ducts open at base of seminal vesicle. Seminal vesicle large, thin-walled 0.24-0.89 × 0.130.9 mm, opening at base of penis. Copulatory bursa funnel-shaped, with glandular structures, 0.43-0.51 mm long. Ovary seen in immature specimens and in mature worms ovarian balls present. Uterine bell funnel-shaped with 4-6 guard cells. Uterus thick-walled, long and opens into vagina with two muscle bands. Vulva located postero-ventrally.

Host : *Nandus nandus* (Hamilton-Buchanan); *Glossigobius giuris* (Hamilton), unidentified fish.

Location : Intestine.

Locality : Aligarh (Uttar Pradesh); Kolkata (West Bengal). Barisal, Chittagong, Dhaka, Sylhet (Bangladesh); Chandpur (Pakistan).

Distribution : Known only from Indian subcontinent.

308. ***Pallisentis (Pallisentis) sindensis*** Khan & Bilqees, 1987
(Fig. 277)

Pallisentis sindensis Khan & Bilqees, 1987 : 263-268, Fig. 1 A-D; Bilqees & Khan, 1987 : 17-18, Fig. 25 a, b, 26 a, b;

Pallisentis sindensis Golvan, 1994 : 170;

Pallisentis (Pallisentis) sindensis Amin *et al.*, 2000 : 43.

Type locality : Kalri (Kinjar) lake, Sindh, Pakistan.

Description : Worms creamy white in life, Male 9.08-11.08 × 0.54-1.05 mm; female 10.11-31.1 × 0.52-0.81 mm. Proboscis slightly globular, 0.14-0.20 × 0.21-0.23 mm in male; in female 0.14-0.20 × 0.21-0.22 mm, with 4 circles of 8 ventrally curved hooks each, similar in both sexes. Apical hooks largest, 0.072-0.082 × 0.018-0.025 mm, hooks of second, third and fourth circles smaller, 0.070-0.072 × 0.009-0.010 mm, 0.045-0.050 × 0.0072-0.0074 mm, and 0.036-0.039 × 0.0043-0.0068 mm respectively. Proboscis receptacle elliptical, single-walled, 0.51 × 0.027 mm in male; in female 0.58 × 0.26-0.299 mm. Neck aspinose behind proboscis, 0.10-0.44 × 0.23-0.25 mm in male, in female 0.21-0.44 × 0.21-0.25 mm. Collar 0.038 × 0.019 mm with spines in 13-16 rows of 18-20 spines

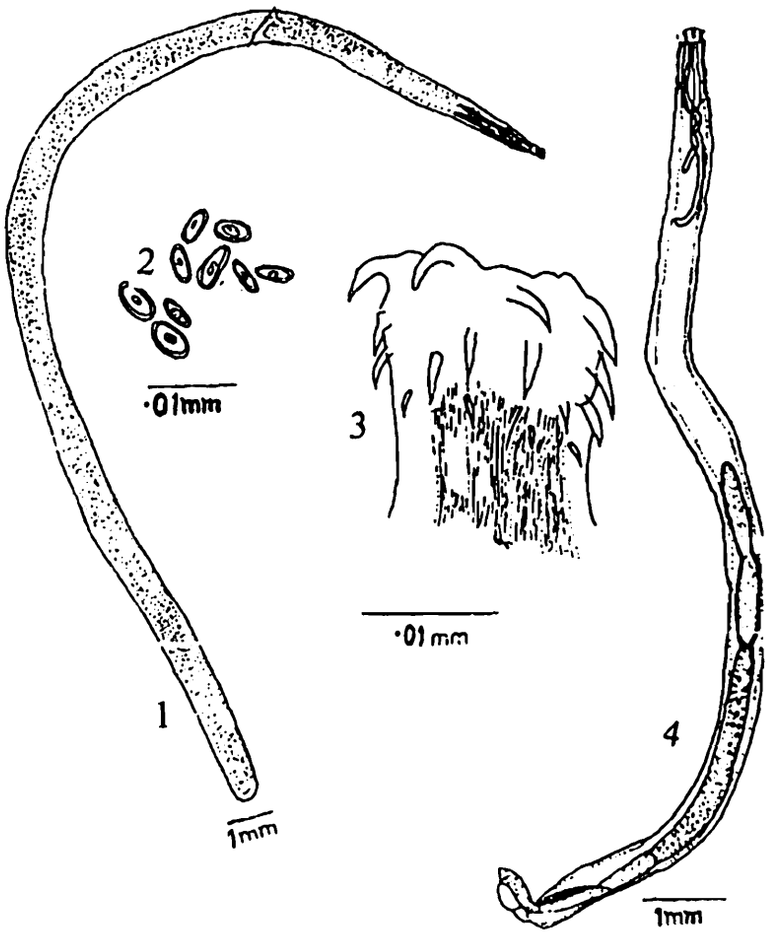


Fig. 277. *Pallisentis (Pallisentis) sindensis* Khan & Bilqees, 1987. 1. Female, 2. Eggs enlarged, 3. Proboscis enlarged, 4. Male (after Khan & Bilqees, 1987).

each, 0.038 × 0.019 mm Trunk cylindrical, elongated, vermiform, with pseudo-segmentation. Anterior third of trunk with rows of spines at a distance of 0.17-0.38 mm. These spines smaller than collar spines, 0.0378 × 0.0064 mm. Trunk spination similar in both sexes. Lemnisci long, slender, nearly equal, 1.75-3.08 × 0.052-0.068 mm. Testes oval,contiguous, unequal, anterior 1.08-1.66 × 0.23-0.44 mm, posterior 1.00-1.24 × 0.23-0.40 mm. Cement gland single, elongate, syncytial, 2.21-3.00 × 0.27-0.34 mm with distinct nuclei of 0.079 × 0.079 mm. Cement reservoir 0.44-0.81 × 0.21-0.30 mm, followed by seminal vesicle of 0.47-1.36 × 0.10-0.13 mm. Saefftigen's pouch elongated, 0.47-1.32 × 0.10-0.21 mm. Bursa retractile, 0.26-0.66 × 0.28-0.34 mm. Uterine bell 0.52 × 0.091 mm. Eggs oval, numerous, 0.054-0.075 × 0.025-0.032 mm.

Host : *Channa* (*Ohiocephalus*) *striatus* Bloch.

Location : Small intestine.

Locality : Kalri (Kinjar) lake, Sindh, Pakistan.

Distribution : Known only from type locality

58. Genus ***Raosentis*** Datta, 1947

Raosentis Datta, 1947 : 363; Petrotschenko, 1956 : 253; Yamaguti, 1963 : 35; Gupta, V. Fatma, 1986 : 178; Yamaguti, 1963 : 35; Golvan, 1994 : 177; Bhattacharya, 2007 : 57.

Diagnosis : Quadrigyridae, Pallisentinae. Proboscis globular or slightly elongated with 4 circles of hooks, hooks of anterior 2 circles stouter and longer than those of posterior circles, with a free zone devoid of spines between second and third circle. Proboscis receptacle single-walled, with ganglion at its base. Hypodermic nuclei small, 4 or 5 pairs, 1 or 2 pairs ventrally. Lacunar system with dorsal and ventral longitudinal main channels, connected by transverse anastomoses. Lemnisci longer than receptacle. Trunk small, fusiform. Anterior part of trunk with 16-17 circles of numerous rose-thorn-like spines. Testes contiguous, in tandem, near posterior end. Cement gland syncytial, with 8-10 nuclei. Uterine bell leading into a long tubular uterus which in turn leads into a narrow vagina with two sphincters. Eggs elliptical, small. Parasites in intestine of fishes.

Type species : *Raosentis poddari* Datta, 1947.

Includes four species, 1. *Raosentis dattai* Gupta, V. & Fatma, 1986, 2. *R. ivaniosi* George & Nadakal, 1978, 3. *R. poddari* Datta, 1947 and 4. R. *thapari* Rai, 1967, all occur in Indian subcontinent.

Key to Indian species of genus *Raosentis*

1. Proboscis hooks in 4 circles of 6, 6, 8. 8 each 2
– Proboscis hooks arranged otherwise 3
2. Trunk spines in 9 circles of rose-thorn-like ..... *Raosentis thapari*
– Trunk spines in 16-20 circles of rose-thorn-like ..... *Raosentis dattai*

3. Proboscis hooks in 4 circles of 7 each ..... *Raosentis poddari*

– Proboscis hooks in 4 circles of 8-10 each ..... *Raosentis ivaniosi*

309. ***Raosentis dattai*** Gupta, V. & Fatma, 1986
(Fig. 278)

Raosentis dattai Gupta, V. & Fatma, 1986c : 175-178, Pl. 6, Fig. 1-3; Golvan, 1994 : 177; Bhattacharya, 2007 : 58, Pl. 11, Fig. 43 a, b..

Type locality : River Gomti, Lucknow, Uttar Pradesh, India.

Description : Male 2.68 × 0.7 mm; female 1.54-2.74 × 0.45-0.90 mm. Proboscis globular, slightly elongated with 4 circles of 6, 6, 8, 8 hooks each, 0.24 × 0.18 mm in male, in females 0.25-0.30 × 0.10-0.15 mm. Hooks of anterior two circles larger and stouter than posterior two circles, with a of spineless gap of 0.04-0.05 mm long between second and third circles. Hooks of I, II, III and IV circles 0.060-0.065 mm, 0.055-0.058 mm, 0.020-0.025 mm and 0.010-0.015 mm long in male; in female corresponding hooks 0.062-0.065 mm, 0.055-0.060 mm, 0.025-0.030 mm, and 0.015-0.018 mm long. Proboscis receptacle

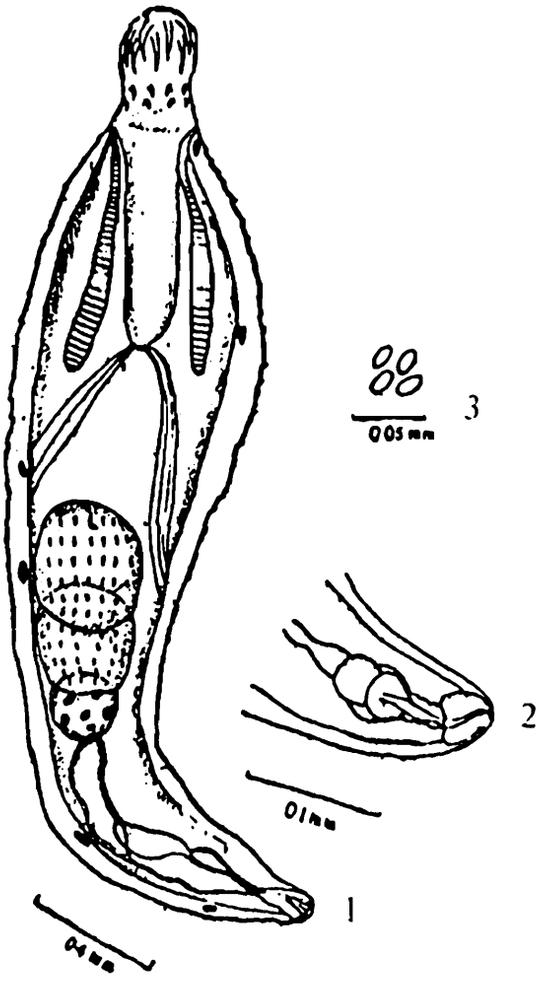


Fig. 278. *Raosentis dattai* Gupta, V. & Fatma, 1986. 1. Male, 2. Posterior part of female, 3. Ova (after Gupta, V. & Fatma, 1986).

single-walled with ganglion at its base, in male 0.61 × 0.15 mm, in female 0.52-0.60 × 0.14-0.16 mm. Lacunar system with dorsal and ventral main longitudinal channels and transverse anastomoses. Hypodermal nuclei small, 4-5 pairs dorsally and 2-3 pairs ventrally. Trunk small, fusiform, curved posteriorly, anterior trunk with 16-20 circles of rose-thorn-shaped spines with semilunar base, in male spines 0.005-0.008 mm long extending up to anterior testis; in female 0.005-0.006 mm long extending up to anterior half of trunk. Lemnisci subequal, tubular, longer than receptacle, shorter 0.70 × 0.10 mm, longer 0.75 × 0.08 mm. Testes ovoid, contiguous, overlapping, post-equatorial, anterior 0.34 × 0.32 mm, posterior smaller 0.32 × 0.28 mm. Cement gland ovoid, syncytial 0.21-0.25 × 0.18-0.20 mm with 6 nuclei, opening into bursa through its narrow tubular duct. Seminal vesicle pear-shaped 0.45 × 0.08 mm. Bursa muscular, bell-shaped, 0.25 × 0.20 mm. Uterine bell cylindrical 0.22-0.25 × 0.09-0.095 mm. Uterus short bulbous 0.12-0.15 × 0.08-0.09 mm, opening into vagina through uterine tube with two sphincters, 0.10-0.15 × 0.12-0.15 mm. Vagina 0.15-0.17 mm long opening outside through terminal gonopore. Eggs oval 0.040-0.045 × 0.02-0.022 mm, without polar prolongation of middle shell.

Host : *Eutropichthys vacha* (Hamilton).

Location : Intestine.

Locality : River Gomti, Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

310. ***Raosentis ivaniosi*** George & Nadakal, 1978
(Fig. 279)

Raosentis ivaniosi George & Nadakal, 1978b : 82-84, Fig. 5-7; 1992 : 287; Bhattacharya, 2007 : 59, Pl. 11, Fig. 46 a - c.

Type locality : Veli lake, Kerala, India.

Description : Males 1.5-5.0 × 0.3-0.67 mm. Females 2-7 × 0.85-2.0 mm. Proboscis globular 0.11-0.16 × 0.04-0.075 mm in male, in female 0.20-0.23 × 0.08-0.12 mm, with 4 circles, with 8-10 hook each, First and second rows of hooks larger and stouter than other hooks. Hookless gap found between second and third circles. Hooks of third and fourth rows small. Hooks of I, II, III and IV rows 0.06-0.09 mm, 0.004-0.008 mm, 0.050-0.058 × 0.004-0.007 mm, 0.030-0.040 × 0.003-0.005 mm and 0.024-0.035 × 0.002-0.003 mm long. First and second rows of hooks with well developed roots of 0.016-0.018 mm long. Proboscis receptacle cylindrical, single-walled, 0.18-0.20 × 0.080-0.095 mm in male, in female 0.226-0.30 × 0.10-0.12 mm, with ganglion at its base. Neck short, 0.08-0.10 × 0.07-0.13 mm in male, in female 0.20-0.225 × 0.15-0.18 mm. Trunk cylindrical and wide at middle, with indistinct pseudo-segmentation, anterior part armed with 20-30 circles of 24-25 minute spines each, extending to midtrunk. Trunk spinose posteriorly on ventral surface. Lemnisci unequal, with swollen ends, longer than receptacle, 0.37-0.38 × 0.02-0.03 mm and 0.30-0.35 × 0.30-0.50 mm in male; in female 0.425-0.47 × 0.030-0.050 mm and 0.30-0.40 × 0.025-0.040 mm. Testes ovoid, post-equatorial, in tandem,

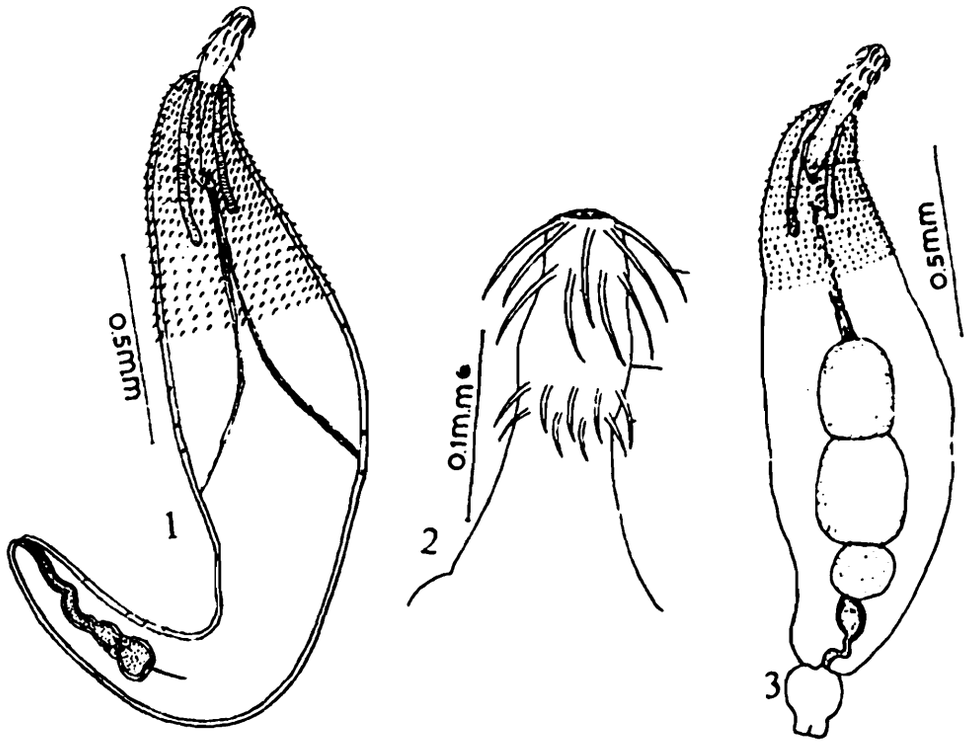


Fig. 279. *Raosentis ivaniosi* George & Nadakal, 1978. 1. Female, 2. Proboscis and neck enlarged, 3. Male (after George & Nadakal, 1978).

contiguous, unequal, anterior 0.20-0.26 × 0.175-0.250 mm, posterior 0.30-0.35 × 0.20-0.30 mm. Cement gland syncytial, 0.12-0.20 × 0.20-0.25 mm, its reservoir 0.10-0.125 × 0.070-0.125 mm, lies behind posterior testis. Uterine bell post-equatorial, 0.13-0.16 × 0.070-0.084 mm, surrounded at its base by 6-8 uterine pockets on each side. Uterus narrow, long, 0.06-0.07 × 0.03-0.05 mm. Vagina 0.030-0.035 × 0.03-0.04 mm. Eggs oval 0.04-0.06 × 0.02-0.03 mm, with three shells without polar prolongation. Embryos with central nuclear mass, 0.030-0.045 × 0.015-0.025 mm.

Host : *Arius platystomus* (Day) Griffith.

Location : Small intestine;

Locality : Veli lake, Puvar and Vellayam (Kerala).

Distribution : Known only from India.

311. ***Raosentis poddari*** Datta, 1947, 1946
(Fig. 280)

Raosentis poddari Datta, 1947 : 363-367, Textfig. 1 a-e; Petrotschenko, 1976 : Yamaguti, 1963 : 35; Pl. 11, Fig. 103, 104; Rai, 1967 : 32; Anantaraman, M. & Anantaraman, S., 1970 : 4; Gupta, P. D. & Ghosh, 1979 : 317; Gupta, V. & Sinha, 1990b : 48; Satyanarayana & Venkatachalam, 1993 :170; Golvan, 1994 : 177; Bhattacharya, 2007 : 58, Pl. 11, Fig. 44 a, b.

Type locality : Kolkata, West Bengal, India.

Description : Worms of small size, spindle shaped, whitish in colour. Male 0.67-2.37 × 0.27-0.53 mm; female 1.31-2.53 × 0.42-0.64 mm. Proboscis globular, sometimes slightly elongated, 0.14-0.25 × 0.12-0.18 mm, with 4 circles, anterior two circles with 6 hooks each and posterior two circles with 7 hooks each. Hooks of anterior two circles stouter and longer than other two circles with a gap of spineless space between second and third circles. Hooks of circle 0.085-0.115 mm, II circle 0.070-0.095 mm, III circle 0.025-0.035 mm and IV circle 0.025-0.030 mm long. Proboscis receptacle single-walled, 0.16-0.37 × 0.05-0.14 mm, with small, elongated ganglion with nerve retinacula located at its base. Anterior end of trunk with 16 or 17 circles of 32-34 rose-thorn-like spines each, basal plates of these embedded in body wall. Hypodermal nuclei 4 or 5 pairs on dorsal surface and 1 or 2 pairs on ventral surface of body wall. Lacunar system with two main dorsal and ventral longitudinal channels and transverse canals, giving segmental appearance Lemnisci 2, slightly longer than

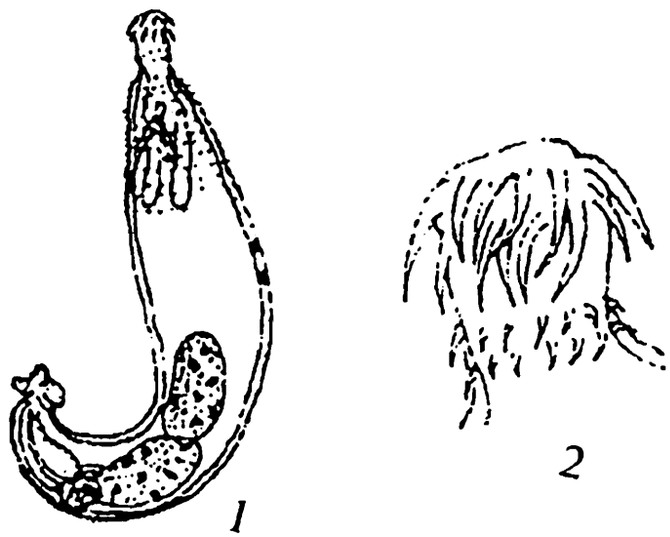


Fig. 280. *Raosentis poddari* Datta, 1947. 1. Row of proboscis hooks and trunk spines enlarged, 2. Ova enlarged, 3. Proboscis enlarged, 4. Female, 5. Male (after Datta, 1947).

receptacle, 0.28-0.60 × 0.05-0.07 mm. Testes ovoid, in tandem, close to each other, anterior 0.506 × 0.242 mm, posterior 0.460 × 0.184 mm, from which two vasa efferentia emerge and run backwards and unite to form vas deferens below cement gland before opening into seminal vesicle. Cement gland rounded syncytial mass, 0.184 mm long, behind posterior testis with 8-10 nuclei, from which a cement duct emerges and opens into seminal vesicle near its posterior end. Seminal vesicle thin-walled muscular sac, 0.368 mm long, opens into a thick muscular, conical penis hanging at top of eversible bursa. Bursa 0.138 mm long. In some cases a pair of glandular structures present on top of bursa, on sides of seminal vesicle. Uterine bell with guard cells, leads into a large tubular uterus, which in turn leads into a narrow vagina with a pair of vaginal glands on both sides which opens at posterior end of body through vulva. Eggs elliptical, 0.05 × 0.01 mm.

Host : *Mystus cavasius* (Hamilton), *M. vittatus* (Bloch), *M. armatus, Mastacembalus armatus.*

Location : Intestine.

Locality : Tamil Nadu; Gorakhpur (Uttar Pradesh); Kolkata (West Bengal).

Distribution : Known only from India.

312. ***Raosentis thapari*** Rai, 1967
(Fig. 281)

Raosentis thapari Rai, 1967 : 32-35, Fig. 8-12; 1971 : 127; Anantaraman, M, & Anantaraman, S., 1970 : 4; Rai, 1971 : 127, Fig. 8-12; Gupta, V. & Sinha, 1990b : 43, 48; Golvan, 1994 : 177; Bhattacharya, 2007 : 58-59, Pl. 11, Fig. 53 a-c.

Type locality : Mathura, Gorakhpur, Uttar Pradesh, India.

Description : Worms grayish-brown in life, small, spindle shaped, 1.7-2.37 × 0.57-0.68 mm. Proboscis nearly elongated, 0.14-0.24 × 0.11-0.16 mm, with 4 circular rows, anterior 2 rows with 6 hooks each, posterior 2 rows with 8 hooks each. Gap of 0.058-0.078 mm between 2nd and 3rd circles of hooks. Hooks of I, II, III and IV circles 0.085 mm, 0.058 mm, 0.028 mm and 0.020 mm. Proboscis receptacle single-walled, 0.39-0.56 × 0.097-0.11 mm, wi7th ganglion near its base. Anterior part of trunk with 9 circles of 25-30 rose-thorn- like spines, extend to near middle of proboscis receptacle, with 9 rows of 25-30 spines each. Hypodermal nuclei 3 pairs each on dorsal and ventral surfaces. Lemnisci 2, longer than receptacle, equal in size, 0.55-0.75 mm long. Testes nearly spherical, in tandem, in anterior half of trunk, anterior smaller, 0.25-0.27 × 0.27-0.50 mm, posterior larger, 0.26-0.33 × 0.31-0.35 mm. Cement gland nearly spherical, syncytial, lie behind posterior

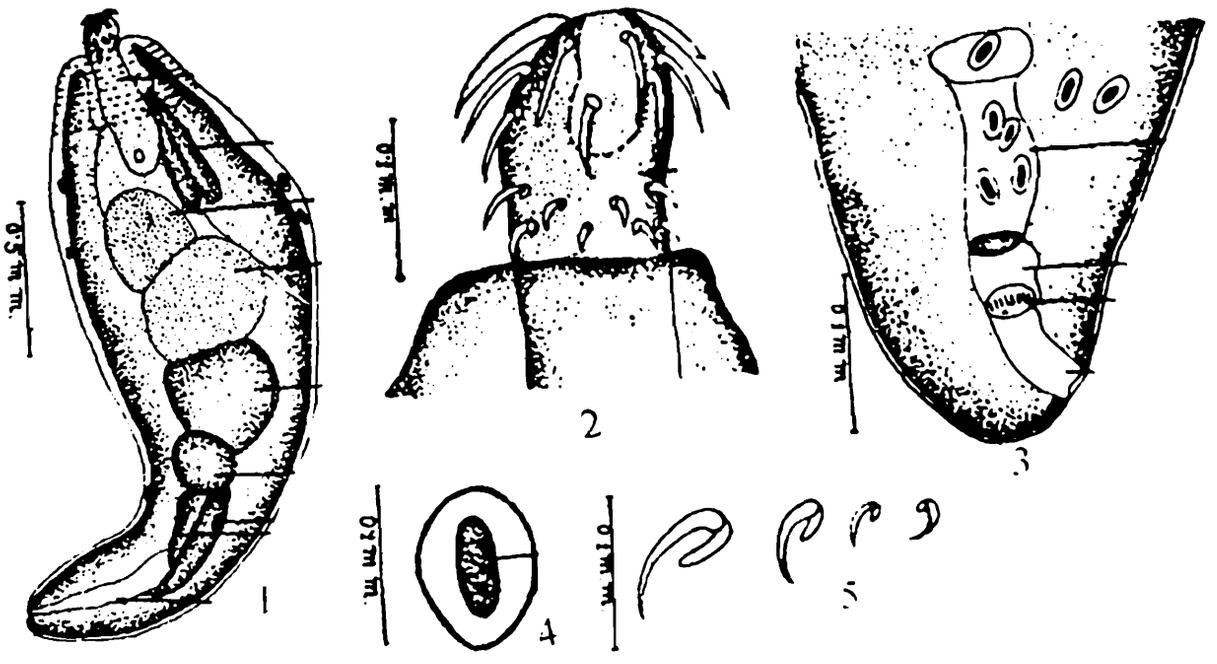


Fig. 281. *Raosentis thapari* Rai, 1967. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Ovum enlarged, 5. Proboscis hooks (after Rai, 1967).

testis, 0.39-0.40 × 0.31-0.35 mm, its reservoir rounded 0.14-0.19 × 0.14-0.18 mm, continue into duct and passing along seminal vesicle towards anterior part of elongated bursa. In female ovary disintegrates and liberates embryonated eggs. Uterus with two sphincters. Eggs 0.039-0.040 × 0.02-0.22 mm.

Host : *Mastacembelus armatus* Cuvier & Valencielles, *Mystus vittatus* (Bloch), *M. cavasius* (Hamilton), *Catla catla* (Hamilton), *Channa punctatus* (Bloch), *Hilsa ilisha* (Hamilton),

Location : Intestine.

Locality : Mathura, Gorakhpur (Uttar Pradesh); Kolkata (West Bengal);

Distribution : Known only from India.

Subfamily QUADRIGYRINAE Van Cleave, 1920

Quadrigyrinae Van Cleave, 1920 : 334; Petrotschenko, 1956 : 240; Bhattacharya, 2007 : 42.

Diagnosis : Proboscis globular to elongate, with few hooks in spiral rows. Proboscis receptacle single-walled, with ganglion near its base. Trunk small to medium in size. Trunk spines in circular rows, limited to its anterior third, may reach midtrunk region or beyond. Hypodermic giant nuclei few, or divided into numerous fragments. Lacunar system reticular or not, with or without prominent main channels. Lemnisci long and filiform, short and saccate, or claviform. Testes contiguous or separate. Cement glands syncytial. Eggs small, rounded or elliptical. Parasites of fresh water and marine fishes.

Type genus : *Quadrigyrus* Van Cleave, 1920.

Includes four genera, 1. *Quadrigyrus* Van Cleave, 1920, 2. *Deltacanthus* Diaz-Ungria & Garcia-Rodrigo, 1958, 3. *Machadosentis* Noronha, 1992 and 4.*Pararaosentis* Amin, Hackman, Ha, Luc & Doanh, 2000, of which first genus occurs in India.

59. Genus ***Quadrigyrus*** Van Cleave, 1920

Quadrigyrus Van Cleave, 1920 : 334 Southwell & Macfie, 1925 : 151; Petrotschenko, 1956 : 241; Yamaguti, 1963 : 31; Gupta, V. & Sinha, 1992 : 111; Golvan, 1994 : 177.; Bhattacharya, 2007 : 42.

Diagnosis : Quadrigyridae. Quadrigyrinae. Medium sized worms. Proboscis with 3-4 circular rows of hooks. Hypodermal nuclei of two types, anterior nuclei mid-dorsal and mid-ventral, others usually lateral and strongly branched. Proboscis receptacle single-walled, thick, muscular with ganglion close to its base. Anterior trunk usually with 4-10 circular rows of spines, which may be interrupted dorsally. Lemnisci claviform to elliptical or fusiform, may be wide apart from each other, with a giant nucleus. Cement gland a compact or elongate mass with several nuclei. Gonopore of female ventro-terminal. Eggs oval. Parasites of fishes.

Type species : *Quadrigyrus torquatus* Van Cleave, 1920.

Includes nine species, 1. *Quadrigyrus guptai* Gupta, V. & Sinha, 1991, 2. *Q. sinhai* Gupta, V. & Fatima, 1986, 3. *Q. brasiliensis* Machado Filho, 1941, 4. *Q. chinensis* Mao, 1979, 5. *Q. machadoi* Fabio, 1983, 6. *Q. nickoli* Schmidt & Huggins, 1973, 7. *Q. polyspinosus* Li Minmin, 1984, 8. *Q. rhodei* Wang, 1980 and 9. *Q. torquatus* Van Cleave, 1920, of which first two occur in India.

Key to Indian species of genus *Quadrigyrus*

- Proboscis with 4 circles of 6 hooks each; anterior trunk with 13 circles of 14 spines each ..... *Quadrigyrus guptai*
- Proboscis with 4 circles of 5 hooks each; anterior trunk with 8-10 circles of 18-20 spines each ..... *Quadrigyrus sinhai*

313. ***Quadrgyrus guptai*** Gupta, V. & Sinha, 1992
(Fig. 282)

Quadrgyrus guptai Gupta, V. & Sinha, 1992 : 108-110, Pl. 1, Fig. 1-6; Golvan, 1994 : 177; Bhattacharya, 2007 : 43. Pl. 8, Fig. 24 a-e.

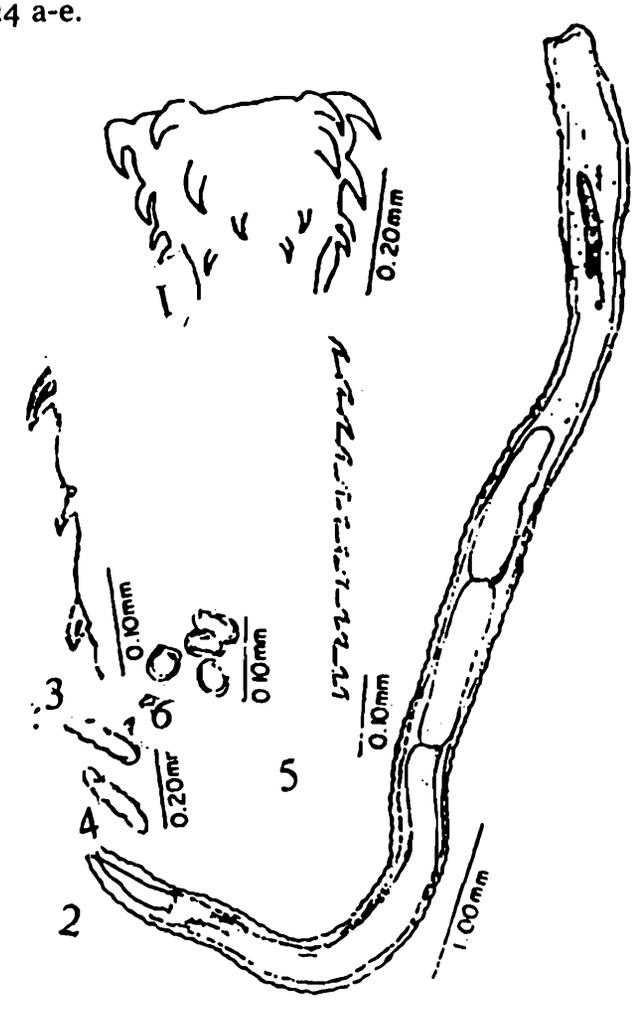


Fig. 282. *Quadrgyrus guptai* Gupta, V. & Sinha, 1992. 1. Proboscis enlarged, 2. Male with proboscis inverted, 3. Row of proboscis hooks, 4. Branched giant nuclei, 5. Row of collar spines, 6. Egg enlarged (after Gupta, V. & Sinha, 1992).

Type locality : Puri coast, Bay of Bengal, Orissa, India.

Description : Males 14.3 × 0.55 mm; females 20.7 × 0.65 mm. Proboscis globose, wider than long, 0.19 × 0.23 mm in males, in females 0.56 × 0.66 mm, with 4 circles of 6 hooks each, Hooks of first, second, third and basal circles 0.11-0.12 × 0.030-0.032 mm, 0.07-0.074 × 0.022-0.024 mm, 0.040-0.042 × 0.012-0.14 mm and 0.036-0.038 × 0.008-0.010 mm in females. Proboscis receptacle single-walled, short with ganglion at its base, 0.6 × 0.2 mm in males; in females 0.9 × 0.23 mm. Giant nuclei 2, not highly branched, placed laterally in receptacle. Neck very short, 0.18 × 0.16 mm in male; in female 0.20 × 0.26 mm. Trunk elongate, cylindrical, pseudo-segmented, slightly wide anteriorly and tapering posteriorly, 20.3 × 0.65 mm in females. Anterior trunk with 13 circles of 8-14 closely set spines each with feeble roots, 0.040-0.042 × 0.012-0.016 mm in females. Lemnisci long, tubular, equal or subequal, longer than receptacle, extending far above anterior testis, shorter 2.6 × 0.12 mm, longer 2.7 × 0.12 mm in females. Testes elliptical, contiguous, subequal, pre-equatorial, one behind other, anterior 1.9 × 0.38 mm, posterior 1.95 × 0.38 mm. Cement gland cylindrical, elongated syncytial with several nuclei, 2.6 × 0.36 mm, its reservoir pyriform, just behind cement gland 0.98 × 0.38 mm. Saefftigen's pouch 1.0 × 0.3 mm opening into bursa through its duct, 1.2 × 0.12 mm. Bursa 1.15 × 0.3 mm, opening subterminally to out side. Uterus along with vagina, opening to outside through terminal gonopore. Eggs 0.048-0.52 × 0.036-0.038 mm.

Host : *Caranx kalla* Cuvier & Valenciennes (Cuvier & Valenciennes).

Location : Intestine.

Locality : Puri coast, Bay of Bengal (Orissa).

Distribution : Known only from type locality.

314. ***Quadrgyrus sinhai*** Gupta, V. & Fatma, 1986 (Fig. 283)

Quadrgyrus sinhai Gupta, V. & Fatma, 1986c : 150-152, Pl. 1, Fig. 1-5; Golvan, 1994 : 177; Bhattacharya, 2007 : 43-46. Pl. 8, Fig. 25 a-e.

Type locality : Ghagra river, Uttar Pradesh, India.

Description : Male 8.6 × 0.54 mm. Proboscis globular, wider than long, 0.19 × 0.23 mm, with 4 circles of 5 hooks each. Hooks of first, second, third and fourth circles 0.07-0.072 mm, 0.06-0.061 mm, 0.038-0.044 mm and 0.032-0.035 mm long. Proboscis receptacle single-walled, short, muscular longer than proboscis, 0.80 × 0.18 mm with basal ganglion. Neck 0.32 × 0.22 mm with sensory pit on each side at base of last circle of hooks. Trunk elongated, cylindrical, slightly wide anteriorly and tapering posteriorly, anterior trunk with 8-10 circles of 18-20 spines each, 0.035-0.040 mm long with extensive dendritic roots interrupted dorsally. Hypodermal giant nuclei of two types, anterior nuclei mid-dorsal and mid-ventral and ovoid, posterior nuclei lateral, 1-3 highly branched posteriorly. Testes elliptical, contiguous, subequal, equatorial, anterior 0.95 × 0.25 mm, posterior smaller,

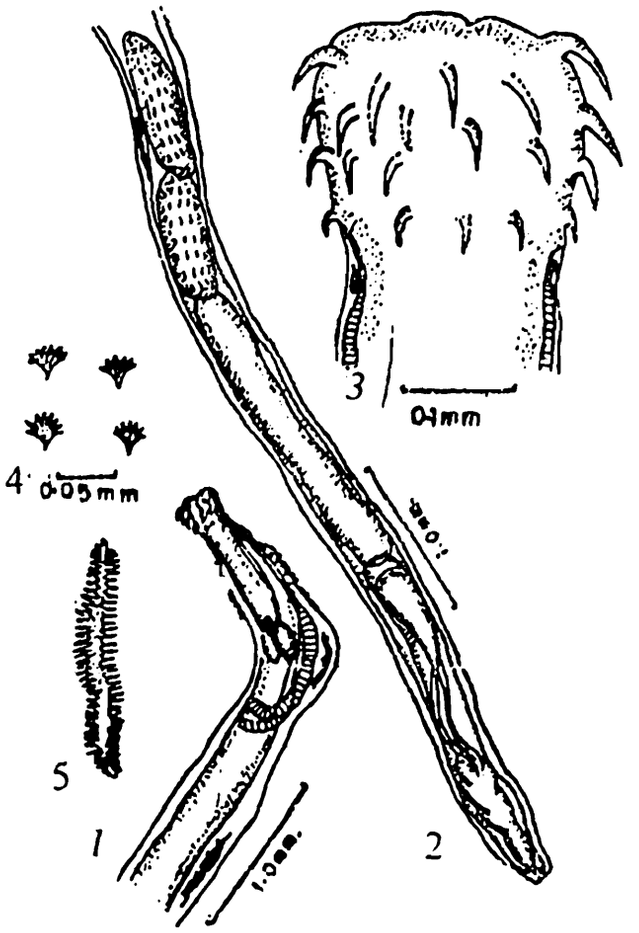


Fig. 283. *Quadrgyrus sinhai* Gupta, V. & Fatma, 1986. 1. Anterior part of male, 2. Posterior part of male, 3. Proboscis enlarged, 4. Collar spines enlarged, 5. Branched giant nuclei (after Gupta, V. & Fatma, 1986).

0.81 × 0.25 mm. Cement gland elongated, cylindrical, syncytial with 10-12 giant nuclei 2.05 × 0.25 mm,. its reservoir pyriform, just behind cement gland, 0.75 × 0.22 mm. Saefftigen's pouch pyriform, 0.56 × 0.25 mm opening into bursa through its duct, 0.80 × 0.10 mm. Bursa elongated 0.85 × 0.25 mm, opening terminally. Female not known.

Host : *Barbus stigma* (Hamilton).

Location : Intestine.

Locality : Ghagra River, Rudauli, Lucknow (Uttar Pradesh).

Distribution : Known only from type locality.

8. Order NEOECHINORHYNCHIDA Southwel & Macfie, 1925

Neoechinorhynchide Southwel & Macfie, 1925 : 147; Petrotschenko, 1956 : 183; Yamaguti, 1963 : 15.

Diagnosis : Worms usually small. Proboscis invaginable, provided usually with comparatively small number of hooks. Trunk spinose or not. Hypodermal nuclei few, large, amoeboid or fragmented. Proboscis receptacle single-walled. Protonephridia absent.

Cement glands syncytial, rarely divided into two lobes. Eggs elliptical, usually without polar prolongations of middle shell. Embryo unarmed. Parasites as adults in fishes, as larva in body cavity of insects.

Includes three families, 1. Neoechinorgynchidae Ward, 1917, 2. Tenuisentidae Van Cleave, 1936 and 3. Dendronucleatidae Sokolovskaia, 1962, of which first one occur in this subcontinent.

18. Family NEOECHINORHYNCHIDAE Ward, 1917

Neoechinorhynchinae Travassos, 1926b : 34;

Neoechinorhynchidae Van Cleave, 1916 : 228; Van Cleave, 1919a : 240-241; Travassos, 1917b : 10; Southwell & Macfie, 1925 : 147-148; Meyer, 1933 : 168; Petrotschenko, 1956 : 185; Yamaguti, 1963 : 15; Bhattacharya, 2007 : 71.

Diagnosis : Neoechinorhynchida. Proboscis variable in shape, with hooks in longitudinal, spiral or transverse rows. Proboscis receptacle inserted at base of proboscis, with single-walled. Trunk aspinose; hypodermal nuclei large, few in number, mainly in median line. Lemnisci 2, short or long. Testes oval to elliptical, rarely more elongate. Cement gland syncytial with cement reservoir. Eggs elliptical without polar prolongations of middle shell. Parasites of marine and fresh water fishes.

Type genus : *Neoechinorhynchus* Hamann, 1892.

Includes four subfamilies, 1. Gracilisentinae Petrotschenko, 1956, 2. Neoechinorhynchinae Travassos, 1926, 3. Eocollinae Petrotschenko, 1956 and 4. Atactorhynchinae Petrotschenko, 1956, of which first two subfamilies occur in this subcontinent.

Key to Indian subfamilies of family NEOECHINORHYNCHIDAE

– Proboscis small, rounded with a small number of spiral rows of hooks .... NEOECHIMOHYNCHINAE

– Proboscis short, cylindrical with few circular rows of hooks..... GRACILISENTINAE

Subfamily GRACILISENTINAE Petrotschenko, 1956

Gracilisentinae Petrotschenko, 1956 : 224; Yamaguti, 1963 : 25;

Diagnosis : Neoechinorhynchida, Neoechinorhynchidae with circular rows of proboscis hooks. Parasites of fishes.

Type genus : *Gracilisentis* Van Cleave, 1919.

Includes single genus *Gracilisentis* Van Cleave, 1919, which occurs in this subcontinent.

60. Genus ***Gracilisentis*** Van Cleave, 1919

Gracilisentis Van Cleave, 1919a : 245; Meyer, 1932 : 169; Southwell & Macfie, 1925 : 150; Petrotschenko, 1956 : 224; Yamaguti, 1963 : 25; Golvan, 1994 : 159; Bhattacharya, 2007 : 72.

Diagnosis : Neoechinorhynchidae, Gracilisentinae. Worms small. Proboscis short, cylindrical, with slight constriction above basal row of hooks, with 12 longitudinal rows of 3 hooks each (or 3 transverse rows of 12 hooks each); basal row wide apart from second row than latter from first row; each hook with a narrow root than that of other two rows. Proboscis receptacle subcylindrical, with ganglion near its base. Trunk small. Lacunar system with two main longitudinal channels and transverse anastomoses. Hypodermal giant nuclei mainly in mid-dorsal line. Lemnisci slender, longer than receptacle. Testes continuous, nearer to posterior end than to anterior end. Cement glands syncytial, with several nuclei, or 12 as given by Van Cleave. Eggs elliptical, with delicate shell. Parasites of fishes.

Type species : *Gracilisentis gracilisentis* (Van Cleave, 1013) Van Cleave, 1919.

Includes three species, 1. *Gracilisentis mugilis* Gupta, N.K. & Lata, 1967, 2. *G. gracilisentis* (Van Cleave, 1913) Van Cleave, 1919 and 3. *G. variabilis* (Diesing, 1856) Travassos, Artiges & Pereira, 1928, of which first one occur in India.

315. ***Gracilisentis mugilis*** Gupta, N.K. & Lata, 1968
(Fig. 284)

Gracilisentis mugilis Gupta, N.K. & Lata, 1968a : 254-256, Fig. 3-5; Gupta, V. & Sinha, 1990b : 52; Golvan, 1994 : 159 ; Bhattacharya, 2007 : 72-73, Pl.13, Fig. 61 a-c.

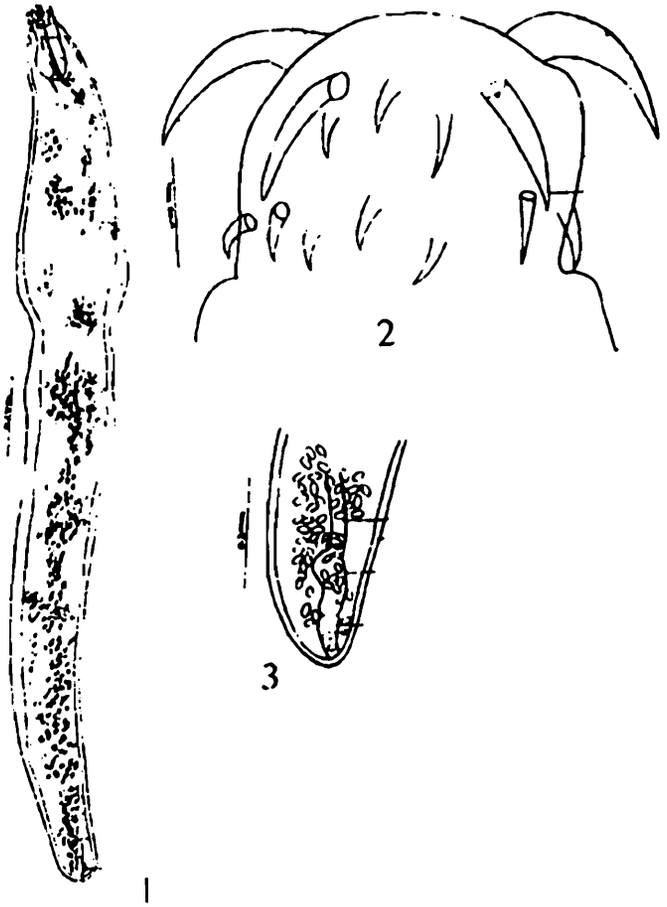


Fig. 284. *Gracilisentis mugilis* Gupta, N.K. & Lata, 1968. 1. Female, 2. Proboscis enlarged, 3. Posterior part of female (after Gupta, N.K. & Lata, 1968).

Type locality : Chandigah, North India, India.

Description : Female 5.5 mm long, 0.61 mm maximum width and 0.28 mm wide at its minimum width at level of uterus, gradually tapering posteriorly. Proboscis short, globular, 0.12 × 0.14 mm with 12 longitudinal rows of 2 hooks each. Large hooks 0.054 × 0.010 mm, median hooks 0.07 × 0.010 mm, small hooks 0.02 × 0.004 mm. Proboscis receptacle cylindrical, single-walled 0.36 × 0.15 mm, lies at base of proboscis. Trunk fusiform, aspinose. Lacunar system well developed with two main longitudinal channels and transverse anastomoses. Ovary disintegrate into a number of eggs scattered throughout body cavity. Uterus small, 0.18 × 0.07 mm, anteriorly attached to suspensory ligament. Vagina 0.14 × 0.02 mm. Eggs oval, 0.036-0.049 × 0.024-0.039 mm. Male not known.

Host : *Mugil* sp.

Location : Intestine.

Locality : Kerala; Chandigarh;

Distribution : Known only from India.

Subfamily NEOECHINORHYNCHINAE Travassos, 1926 emend. Yamaguti, 1963

Neoechinorhynchinae Travassos, 1926b : 34;

Neoechinorhynchidae Meyer, 1932 : 168;

Neoechinorhynchinae Petrotschenko, 1956 : 186; Yamaguti, 1963 : 16; Bhattacharya, 2007 : 73.

Diagnosis : Neoechinorhynchinae. Body delicate. Proboscis small, rounded, with spiral rows of hooks. Neck short. Eggs oval, without polar prolongations of middle shell. Parasites of fishes.

Type genus : *Neoechinotrhynchus* Stiles & Hassall, 1905.

Includes nine genera 1. *Dispiron* Bilqees, 1971, 2. *Neoechinorhynchus* Stiles & Hassall, 1905, 3. *Octospinifer* Van Cleave, 1919, 4. *Paraechinorhynchus* Bilqees & Khan, 1983, 5. *Zeylonechinorhynchus* Fernando & Furtudo, 1963, 6. *Hexaspiron* Dollfus & Golvan, 1956, 7. *Microsentis* Martin & Multani,1966, 8. *Octospiniferoides* Bullock, 1957, 9. *Paulisentis* Van Cleave & Bangham, 1949, of which first five genera occur in this subcontinent.

Key to Indian genera of subfamily NEOECHINORHYNCHINAE

1. Proboscis with 2 spiral rows of hooks ..... *Dispiron*
– Proboscis with more than 2 rows of hooks 2
2. Proboscis with 3 spiral rows of hooks 3
– Proboscis with more than 3 rows of hooks 4
3. Proboscis with 3 spiral rows of 6 hooks each ..... *Neoechinorhynchus*
– Proboscis with 3 spiral rows of 4, 6, 8 hooks each ..... *Paraechinorhynchus*

4. Proboscis with 7 oblique rows of 4 hooks each ..... *Zeylonechinorhynchus*

– Proboscis with 8-10 spiral rows of 3 hooks each ..... *Octospinifer*

61. Genus ***Dispiron*** Bilqees, 1970

Dispiron Bilqees, 1970 : 104; Golvan, 1994 : 145.

Diagnosis : Neoechinorhynchida, Neoechinorhynchinae. Worms with 2 lemnisci, elliptical testes, small rounded proboscis with 2 spiral rows of 6-12 hooks each, and subspherical to ovoid eggs without polar prolongations of middle shell.

Type species : *Dispiron mugilis* Bilqees, 1970.

Includes three species, 1. *Dispiron catla* Bilqees, 1970, 2. *D. heteranthus* Khan & Bilqees, 1986 and 3. *D. mugilis* Bilqees, 1970, all of which occur in Pakistan.

Key to Pakistan species of genus *Dispiron*

1. Proboscis hooks in 2 rows of 6 each ..... *Dispiron catla*

– Proboscis hooks in 2 rows of more than 6 each 2

2. Proboscis hooks in 3 rows of 6 in I row and 8 in II row..... *Dispiron heteracanthus*

– Proboscis hooks in 2 rows of 12 each ..... *Dispiron mugilis*

316. ***Dispiron catla*** Khan & Bilqees, 1987
(Fig. 285)

Dispiron catla Khan & Bilqees, 1987 : 268-271, Fig. 2 A-D.; 1987b : 13, Fig. 14 a-c; Golvan, 1994 : 145.

Type locality : Kalri (Kinjar) lake, Sindh. Pakistan.

Description : Worms creamy white in colour in life. Male 2.44-4.18 × 0.57-0.83 mm; female 2.31-5.76 × 0.64-1.61 mm. Proboscis small, rounded, 0.049-0.099 × 0.056-0.098 mm in male; in female 0.066-0.068 × 0.074-0.079 mm. Proboscis with an apical disc with two rows of 6 hooks each in both sexes. Hooks of first row larger, 0.039-0.041 × 0.0072-0.0079 mm, second row 0.025-0.032 × 0.0054-0.0061 mm in both sexes. Proboscis receptacle single-walled, 0.21-0.24 × 0.082-0.083 mm in male; in female 0.091-0.21 × 0.043-0.093 mm. Neck short, 0.016 × 0.096 mm in male; in female 0.021-0.045 × 0.075-0.079 mm. Lacunar system well developed. Trunk delicate, anterior end attenuated, widening from base of proboscis receptacle, posterior end slightly flattened and narrow. Lemnisci digitiform, 0.66-0.74 × 0.099-0.14 mm in male; in female 0.25-0.83 × 0.068-0.16 mm. Testes oval, syncytial, anterior 0.25-0.49 × 0.11-0.24 mm, posterior 0.29-0.33 × 0.14-0.25 mm. Cement gland large, round, 0.046-0.072 × 0.043-0.072 mm. Saefftigen's pouch oblong, 0.25-0.34 × 0.030-0.068 mm. Seminal vesicle elongated, 0.25-0.30 × 0.054-0.075 mm. Bursa varies in shape, 0.21-0.27 × 0.08-0.14 mm. Uterine bell elongated, 0.097-0.18 × 0.036-0.039 mm, sphincter 0.014-0.032 × 0.021-0.025 mm, followed by

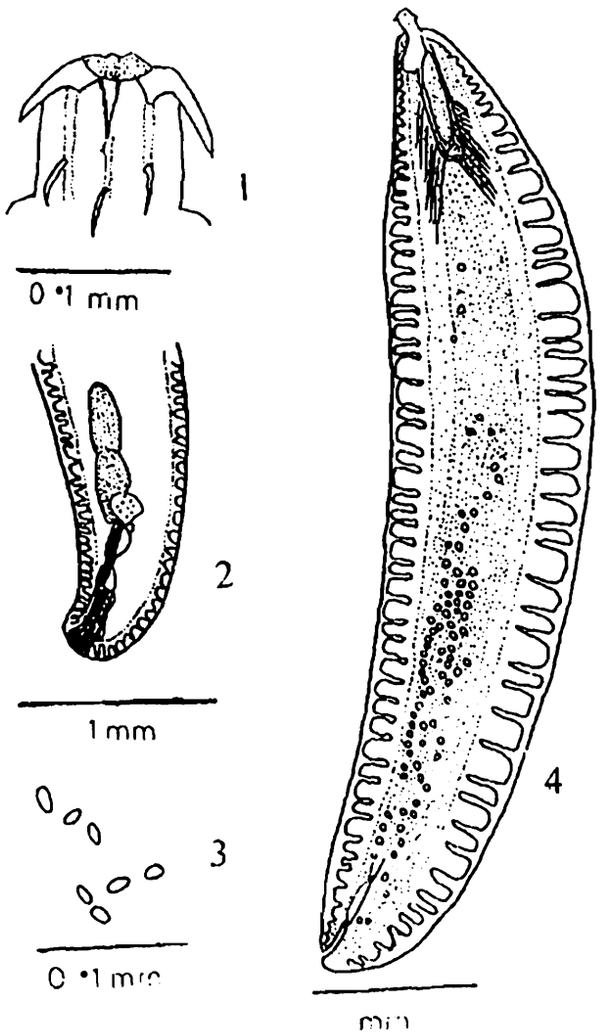


Fig. 285. *Dispiron catla* Khan & Bilqees, 1987. 1. Proboscis enlarged, 3. Posterior of male, 3. Eggs, 4. Female (after Khan & Bilqees, 1987).

vagina, 0.097-0.16 × 0.014-0.025 mm, opening into vulva. Vulva 0.021-0.032 × 0.014-0.032 mm. Ovarian masses numerous, 0.049-0.83 × 0.049-0.058 mm. Eggs oval, without polar prolongations of middle shell, 0.0072-0.010 × 0.0072-0.0080 mm.

Host : *Catla catla* (Hamilton).

Location : Small intestine.

Locality : Kalri (Kinjar) lake, Sindh (Pakistan).

Distribution : Known only from type locality.

317. ***Dispiron heteracanthus*** Khan & Bilqees, 1985 (Fig. 286)

Dispiron heteracanthus Khan & Bilqees, 1985c : 11-13, Fig. 3, 4, 8; Bilqees & Khan, 1987 : 12, Fig. 12 a-c, 13 a, b; Golvan, 1994 : 145.

Type locality : Kalri lake, Sindh, Pakistan.

Description : Worms creamy white in life. Male 6.22-6.86 × 1.32-1.35 mm; female 5.35-9.86 × 0.99-1.54 mm. Proboscis short, rounded, 0.140-0.153 × 0.128-0.156 mm in male; in female 0.12-0.13 × 0.084-0.10 mm, with 2 spiral rows, first row with 6 and second row with 8 hooks. Hooks of first row different in size, those of sides, 0.057-0.061 × 0.0090-0.0099 mm, while those of in center smaller, 0.043-0.054 mm long. Hooks of second row smaller 0.031-0.033 × 0.0054-0.0072 mm in both sexes. Proboscis receptacle 0.38-0.51 × 0.140-0.166 mm in male; in female 0.26-0.34 × 0.10-0.18 mm. Neck short 0.153-0.58 × 0.281-0.285 mm in male; in female 0.025-0.03 × 0.12-0.18 mm. Trunk medium sized and cylindrical, slightly flattened dorso-ventrally. Lemnisci short, stout, hang in pseudocoel, 0.76-0.99 × 0.132-0.137 mm in female. Testes large, oval, 0.46-0.91 × 0.51-0.61 mm. Cement gland large, rounded with prominent nuclei, 0.44-0.52 × 0.37-0.38 mm, its reservoir small, 0.17-0.20 × 0.10- 0.17 mm. Seminal vesicle elongated, 1.05-1.36 × 0.20-0.23 mm. Saefftigen's pouch 0.74-1.22 × 0.10-0.20 mm. Bursal cap 0.11-0.49 × 0.12-0.26 mm. Bursa supported by 6-7 very fine rays, 0.49-0.56 × 0.26-0.28 mm. Uterine bell 0.52-0.72 × 0.05-0.11 mm. Eggs without polar prolongations of middle shell, 0.051 × 0.018 mm wide.

Host : *Labeo rohita* (Hamilton).

Location : Small intestine.

Locality : Kalri lake, Sindh, Pakistan.

Distribution : Known only from type locality.

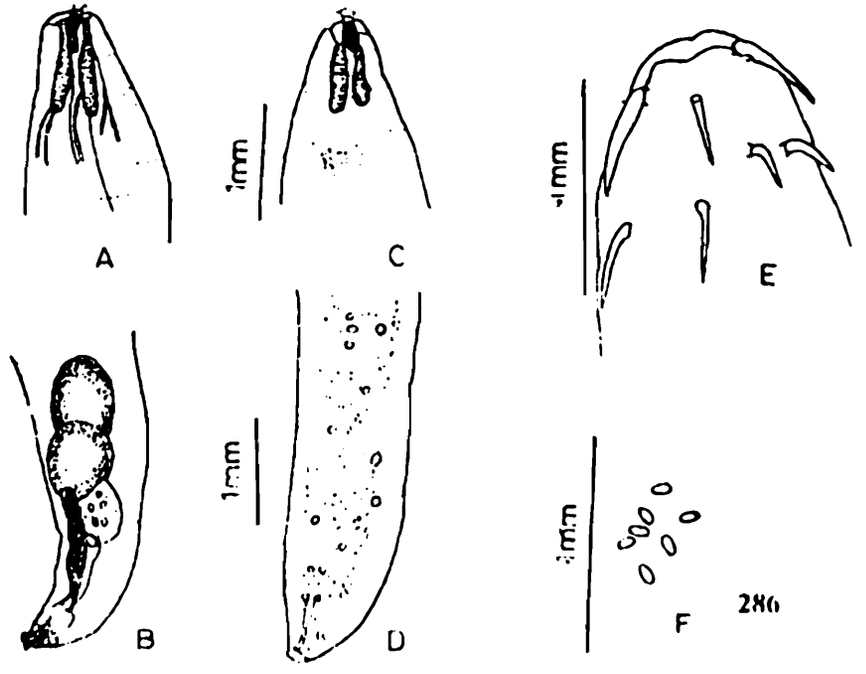


Fig. 286. *Dispiron heteracanthus* Khan & Bilqees, 1986. A. Anterior part of male, B. Posterior part of male, C. Anterior part of Female, D. Posterior part of female, E. Proboscis enlarged, F. Eggs (after Khan & Bilqees, 1986).

318. ***Dispiron mugilis*** Bilqees, 1970
(Fig. 287)

Dispiron mugilis Bilqees, 1970 : 103-105, Fig. 3, 4, 8; Bilqees & Khan, 1987 : 11-12, Fig. 11a, b; Gupta, V. & Sinha, 1990b : 55; Golvan, 1994 : 145.

Type locality : Keti Bunder, Sindh, Pakistan.

Description : Worms small, creamy white. Males 3.75 mm long; females 5.0 mm long. Proboscis small with 12 hooks in two spiral rows. In anterior part of body retractor muscles and lacunar system obvious. In females pseudo-segmentation of cuticle prominent in fore body. Trunk cylindrical, flattened dorso-ventrally. Lemnisci and retractor muscles visible. Cement gland well developed and syncytial. In anterior part of body retractor muscles and lacunar system present. Bursa well developed. Most of body cavity filled uterus and eggs. Eggs oval to subspherical 0.03-0.04 × 0.025-0.04 mm.

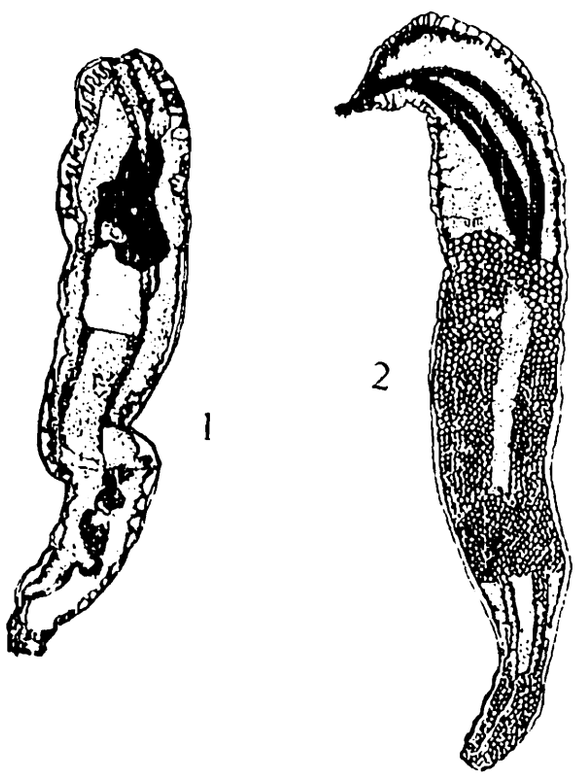


Fig. 287. *Dispiron mugilis* Bilqees, 1970. 1. Male, 2. Female (after Bilqees, 1970).

Host : Mugil buchanan Bloch,

Location : Intestine.

Locality : Keti Bunder, Sindh, Pakistan.

Distribution : Known only from type locality.

62. Genus ***Neoechinorhynchus*** Haman, 1892 in Stiles & Hassal, 1905

Neorhynchus Hamann, 1892 :

Eorhynchus Hamann, 1892 :

Neoechinorhynchus Stiles & Hassall, 1905 : 1-150; Van Cleave, 1919a : 241-242; Southwell & Macfie, 1925 : 148;

Eosentis Van Cleave, 1928 : 147;

Neoechinorhynchus Meyer, 1932 : 171-172;

Eosentis Meyer, 1933 : 176;

Neoechinorhynchus Datta, 1936 : 222; Petrotschenko, 1956 : 187; Yamaguti, 1963 : 16-17; Golvan, 1994 : 164; Amin, 2000 : 6; Bhattacharya, 2007 : 73-74.

Diagnosis : Neoechinorhynchidae, Neoechinorhynchinae. Proboscis short, usually globular or subglobular, occasionally cylindrical. Proboscis hooks in 3 circles of 6 hooks each. Anterior hooks large with heavy roots, middle and posterior hooks smaller, may be rooted. Proboscis receptacle short, simple, single-walled sac with cerebral ganglion at or near its base. Lacunar channels median (dorsal and ventral) connected by circular anastomoses. Few giant nuclei present in body-wall, often with 4-5 dorsally and 1-2 ventrally, in lemnisci 1-3 each and cement gland several, or not apparent in body-wall. Trunk aspinose, usually cylindrical, occasionally fusiform or spindle-shaped, straight or curved ventrally, often small. Lemnisci digitiform, filiform or elongate-oblong, equal or unequal, short or long. Testes spherical to oblong, contiguous or not, equatorial or post-equatorial. Cement gland syncytial; cement reservoir rounded or ovoid. Saefftigen's pouch may be present. Genital pore terminal in both sexes or subterminal in females. Eggs oval, elliptical or elongate with concentric shells or with polar prolongations of fertilization membrane. Parasites in marine, freshwater or estuarine fishes, amphibians and reptiles.

Type species : *Neoechinorhynchus rutili* (Müller, 1780) Stiles & Hassall, 1905.

Includes two subgenera, *Hebesoma* Van Cleave, 1928 and *Neoechinorhynchus* Hamann, 1892 in Stiles & Hassall, 1905, both occur in this subcontinent.

Key to subgenera of genus *Neoechinorhynchus*

– Eggs ovoid, elliptical or elongate with polar prolongations of fertilization membrane— ..... subgenus *Hebesoma*

– Eggs spheroidal, ovoid or elliptical, with concentric egg membranes..... ..... subgenus *Neoechinorhynchus*

Subgenus ***Hebesoma*** Van Cleave, 1928

Hebesoma Van Cleave, 1928 : 147-148; Meyer, 1932 : 175; Yamaguti, 1935 : 345; Petrotschenko, 1956 : 227-228; Yamaguti, 1963 : 30; Golvan, 1994 : 159;

Neoechinorhynchus (*Hebesoma*) Amin, 2002 : 6.

Diagnosis : Neoechinorhynchidae, Neoechinorhynchinae. With characters of genus Neoechinorhynchus. Eggs spheroidal, ovòid or elliptical with concentric shells without polar prolongations of fertilization membrane. Parasites of fishes.

Type species : *Neoechinorhynchus* (*Hebesoma*) *violentum* (Van Cleave, 1928) Salgado-Maldonado, 1978.

Includes eleven species, 1. *Neoechinorhynchus* (*Hebesoma*) *agilis* (Rudolphi, 1819) Van Cleave, 1916; 2. *N.* (*H.*) *manasbalensis* Kaw, 1951; 3. *N.* (*H.*) *carinatus* Buckner & Buchner, 1993, 4. *N.* (*H.*) *crysemiydis* Cable & Hopp, 1954,. 5. *N.* (*H.*) *didelphis* Amin, 2001, 6. *N.* (*H.*) *doryphorus* Van Cleave & Bangham, 1949, 7. *N.* (*H.*) *idahoensis* Amin & Heckmann, 1992, 8. *N.* (*H.*) *lingulatus* Nockol & Ernest, 1987, 9. *N.* (*H.*) *pungitius* Dechtiar, 1971, 10. *N.* (*H.*) *rostratus* Amin & Bullock, 1998, 11. *N.* (*H.*) *violentum* (Van Cleave, 1928) Salgado-Maldonado. 1979. of which first two occur in the subcontinent.

Key to Indian species of subgenus *Hebesoma*

- Giant hypodermic nuclei 6 dorsal and 2 ventral; eggs spimdle-shaped with polar prolongations at both ends ..... *Neoechinorhynchus* (*Hebesoma*) *agilis*
- Giant hypodermic nuclei 5-10 dorsal and 2-3 ventral; eggs fusiform with polar prolongation at one end and rounded at other end ..... *Neoechinorhynchus* (*Hebesoma*) *manasbalensis*

319. ***Neoechinorhynchus* (*Hebesoma*) *agilis*** (Rudolphi, 1819) Van Cleave, 1916 (Fig. 288)

Ehinorhynchus agilis Rudolphi, 1819 : 1-8

Neoechinorhynchus (*Hebesoma*) *agilis* Amin, 2000 : 7.

Neoechinorhynchus agilis Bhattacharya, 2005 : 123-157; 2007 : 75.

Type locality : Japan.

Description : Body 7.0-22.0 × 0.6-1.0 mm. Proboscis short, stout 0.13-0.15 mm long, with 3 circles of 6 hooks each. All proboscis hooks rooted, 0.084-0.14 mm, 0.039-0.081 mm and 0.036-0.060 mm in each circle in males and females. A conspicuous muscular ring just behind origin of proboscis receptacle present. Proboscis receptacle 0.55-0.70 × 0.13-0.24 mm, with thick wall of circular muscle fibers and a fairly large mass of ganglion at its base. Short retinaculum and long retractor of receptacle arise on either side of receptacle near its posterior end. Giant hypodermal nuclei 8, 6 dorsal and 2 ventral. Lemnisci equal, very long extend backwards to posterior end of anterior testis. Testes elongate oval lie one behind other with flat contact surfaces, in middle third of trunk, 0.65-1.82 × 0.37-0.56 mm. Each vas deferens forms an elongate club-shaped vesicle 1.0 × 0.25 mm joins seminal vesicle, and lies close side by side on dorsal surface of syncytial cement gland, of 1.8 × 0.53 mm, with giant nuclei. Cement reservoir up to 0.53 × 0.28 mm gives rise to a slender duct on either side of its posterior end. Saefftigen's pouch cylindrical 1.0 mm long. Bursal cap muscular

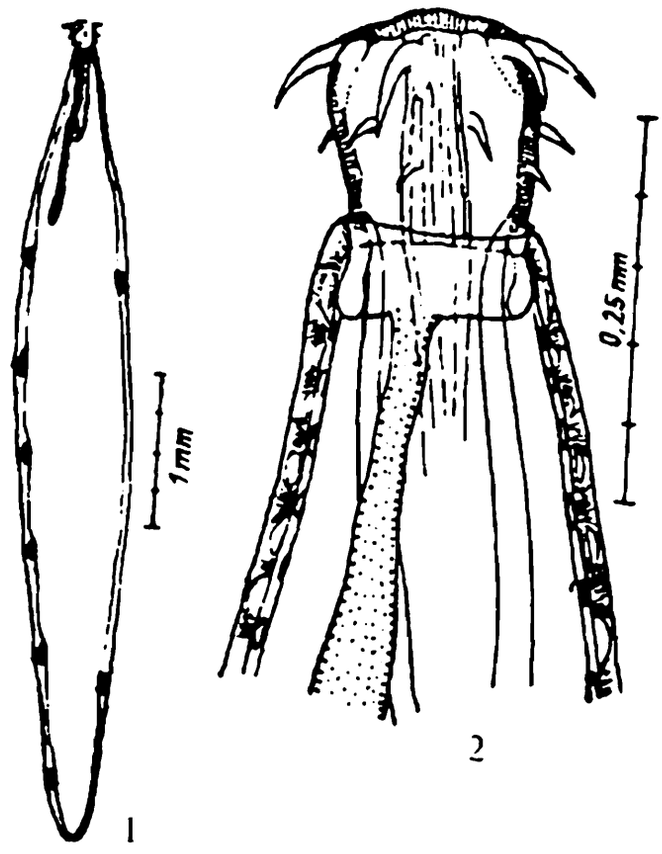


Fig. 288. *Neoechinorhynchus* (*Hebesoma*) *agilis* (Rudolphi, 1819) Van Cleave, 1916. 1. Outline of Female, 2. Anterior part of worm.

without diverticula or rays. Bursa 1.4 mm long. Terminal male genital pore 0.2 mm in maximum width. Spindle-shaped, outer egg shell, 0.035-0.42 × 0.009-0.012 mm, middle shell prolongations at two poles, 0.031-0.033 × 0.008-0.010 mm. Embryo 0.024-0.027 × 0.007-0.008 mm. Gonopore about 0.2 mm in maximum width.

Host : *Mugil cephalus* Linnaeus.

Location : Intestine.

Locality : Machilipatnam (Andhra Pradesh); Chilka lake (Orissa).

Distribution : Fiji; Mediterranean, Atlantic, Pacific; Missisippi, North America; Uruguay.

320. ***Neoechinorhynchus (Hebesoma) manasbalensis*** Kaw, 1951 (Fig. 289)

Neoechinorhynchus manasbalensis Kaw, 1951 : 126-129, Fig. 3 a-g; Yamaguti, 1963 : 19, Pl. 7, Fig. 59-62; Anantaraman, M. & Anantaraman, S., 1970 : 3; Raina, Koul, Koul & Raina, 1984 : 71-78; Dhar & Majdah, 1988 : 149-151; Pl. 3, Fig. 34-41; Dhar & Pererzada, 1994 : 86-89; Koul, Raina, Koul & Bambroo, 1994 : 124-127; Fig. 1-12; Khan & Rashid, 1994 : 71; Gupta, V. & Sinha, 1990b : 45; Bhattacharya, 2007 : 72-73, Pl.13, Fig. 61 a-c.

Neoechinorhynchus (*Hebesoma*) *manasbalensis* Amin, 2000 : 8.

Neoechinorhynchus manasbalensis Bhattacharya, 2007 : 80, Pl. 14, 68 a-c.

Type locality : A stream leading from Manasbal lake, Jammu and Kashmir, India.

Description : Male 4.37-7.7 × 0.75-1.183 mm; females 5.45-12.27 × 0.54-1.54 mm. Proboscis short, globose, 0.089-0.107 × 0.095-0.13 mm with 3 circular rows of 6 hooks each. Apical hooks blade 0.044-0.046 mm long, root 0.037-0.05 mm long, blade of middle row 0.03-0.038 mm long, root 0.02 mm long, blade of basal row 0.028-0.034 mm long, root very small. Proboscis receptacle single-walled 0.22-0.37 × 0.088-0.14 mm, with ganglion near its base. Trunk subcylindrical, fusiform, arched. Giant hypodermal nuclei 5-10 dorsal and 2-3 ventral. Lacunar system with two main longitudinal channels and intervening network of transverse canals. Lemnisci 2, filiform 1.33-1.96 × 0.09-0.18 mm and 1.1-1.77 × 0.09-0.2 mm, longer one with 3 nuclei and shorter one with 2 nuclei. Testes ovoid, in tandem, nearly globular, slightly unequal, anterior 0.535-0.945 × 0.228-0.714 mm, posterior 0.571-0.982 × 0.393-0.625 mm. Two vasa efferentia from testes run on ventral surface of cement gland and unite to form vas deferens. Cement gland syncytial oval mass 0.30 × 0.23 mm, with 6 nuclei. Seminal vesicle pear-shaped, 0.535 × 0.17 mm. Vas deferens seminal vesicle cement duct open at base of cone-shaped cirrus 0.09 × 0.036 mm lies in copulatory bursa 0.3 × 0.2 mm. Ovarian balls numerous, spherical 0.068-0.148 × 0.044-0.112 mm packed with ova. Uterine bell 0.214-0.357 × 0.14 mm with several guard cells at its base. Uterus tubular and 0.04 mm wide at proximal end, with a pair of guard cells at its base. Vagina short, muscular 0.041 × 0.05 mm opening by female gonopore subterminally on ventral surface. Eggs fusiform with unipolar fertilization membrane on one side, with other side rounded, 0.024-0.036 × 0.008-0.012 mm.

Host : *Oreinus sinuatus* Haeckel, *Schizothorax esocinus* Haeckel, *S. niger* Haeckel, *Nemachilus kashmirensis*.

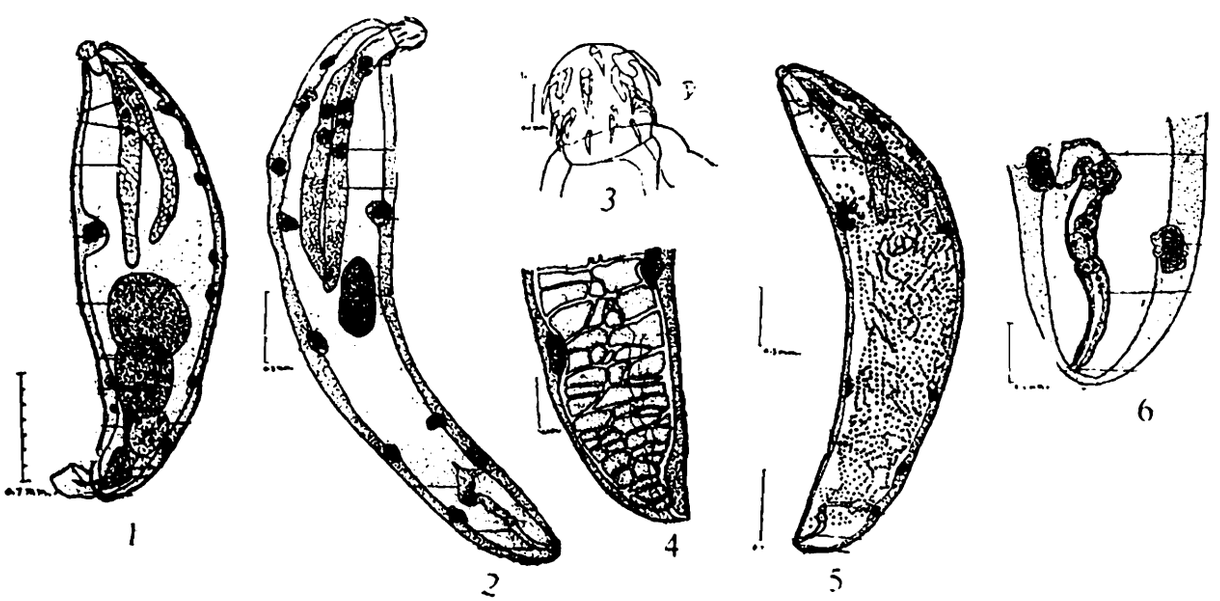


Fig. 289. *Neoechinorhynchus* (*Hebesoma*) *manasbalensis* Kaw, 1951. 1. Male, 2. Young female, 3. Proboscis enlarged, 4. Posterior part showing lacunar system, 5. Gravid female, 6. Posterior part of female (after Kaw, 1951).

Location : Intestine.

Locality : A stream leading from Manasbal lake into Jhelum river, Wular lake (Jammu & Kashmir). Shillong (Meghalaya).

Distribution : Known only from India.

Subgenus ***Neoechinorhynchus*** Hamann, 1892 in Stiles & Hassal, 1905.

Neoechinorhynchus Stiles & Hassall, 1905 : 1-150;

Eosentis Van Cleave 1928 : 147;

Neoechinorhynchus Golvan, 1994 : 164;

Neoechinorhynchus (*Neoechinorhynchus*) Amin, 2000 : 6.

Diagnosis : Neoechinorhynchidae, Neoechinorhynchinae. With characters of genus *Neoechinorhynchus*. Eggs spheroidal, ovoidal or elliptical with concentric shells, without polar prolongations of fertilization membrane.

Type species : *Neoechinorhynchus* (*Neoechinorhynchus*) *rutili* (Müller, 1780) Stiles & Hassall, 1905.

Includes ninety three species, of which following 32 species occur in this subcontinent, 1. *Neoechinorhynchus aminulhaquei* Chandra, 1983, 2. *N.* (*N.*) *argentatus* Chandra, Rao & Shyamasundarim 1986, 3. *N.* (*N.*) *bangoni* Tripathi, 1959, 4. *N.* (*N.*) *chilkaensis* Poddar, 1937, 5. *N.* (*N.*) *cirrhiniae* Gupta, N. K. & Jain, 1979, 6. *N.* (*N.*) *cyanophlyctis* Kaw, 1951, 7. *N.* (*N.*) *dattai* Golvan, 1994, 8. *N.* (*N.*) *devdevi* Datta, 1936, 9. *N.* (*N.*) *elongatus* Tripathi, 1959, 10. *N.* (*N.*) *formosanus* (Harada, 1938) Kaw, 1951, 11. *N.* (*N.*) *gibsoni* Khan & Bilqees, 1989, 12. *N.* (*N.*) *glyptosternomi* Fotedar & Kharoo, 1984, 13. *N.* (*N.*) *hutchinsoni* Datta, 1936, 14. *N.* (*N.*) *johnii* Yamaguti, 1939, 15. *N.* (*N.*) *kallarensis* George & Nadakal, 1978, 16. *N.* (*N.*) *karachiensis* Bilqees,1972, 17. *N.* (*N.*) *nematolosi* Tripathi, 1959, 18. *N.* (*N.*) *nikoli* Khan & Bilqees, Noor-ur-Nissa, Ghazi & Ata-ur-Rahim, 1999, 19. *N.* (*N.*) *oreini* Fotedar, 1968, 20. *N.* (*N.*) *ovalis* Tripathi, 1959, 21. *N.* (*N.*) *sootai* Bgattacharya,1999, 22. *N.* (*N.*) *rigidus* Van Cleave, 1928, 23. *N.* (*N.*) *roonwali* Datta & Soota, 1961, 24 *N.* (*N.*) *topseyi* Poddar, 1937, 25. *N.* (*N.*) *tylosuri* Yamaguti, 1939, 26. *N.* (*N.*) *afghanus* Moravec & Amin, 1978, 27. *N.* (*N.*) *africanus* Troncy 1969, 28. *N.* (*N.*) *aldrichettae* Edmonds, 1971, 29. *N.* (*N.*) *armeniacus* Mikailov, 1975, 30. *N.* (*N.*) *asymetricus* Belouse 1952, 31. *N.* (*N.*) *australis* Van Cleave, 1931, 32. *N.* (*N.*) *butternae* Golvan, 1956, 33. *N.* (*N.*) *carassi* Roitman, 1961, 34. *N.* (*N.*) *carinatus* Buckner & Buckner, 1993, 35. *N.* (*N.*) *carpiodi* Dechtiar, 1968, 36. *N.* (*N.*) *chelenos* Schmidt, Esch & Gilbons, 1970, 37. *N.* (*N.*) *coiliae* Yamaguti, 1939, 38. *N.* (*N.*) *constrictus* Little & Hopkins, 1968, 39. *N.* (*N.*) *crassus* Van Cleave, 1919, 40. *N.* (*N.*) *cristatus* Lynch, 1936, 41. *N.* (*N.*) *curemei* Noronha, 1973, 42. *N.* (*N.*) *cylindratus* (Van Cleave, 1914) Van Cleave, 1919, 43. *N.* (*N.*) *dimorphospinus* Amin & Sey, 1996, 44. *N.* (*N.*) *distractus* Van Cleave, 1949, 45 *N.* (*N.*) *dorsovaginatus* Amin & Christison, 2005, 46. *N.* (*N.*) *edmondsi* (Edmonds, 1982) Golvan, 1994, 47. *N.* (*N.*) *emydis* (Leidy, 1851) Van Cleave, 1919, 48. *N.* (*N.*) *emyditoides* Fisher, 1960, 49. *N.* (*N.*) *golvani* Salgado-Maldonado. 1978, 50. *N.* (*N.*) *ichthyobori* El Naffar & Abu Sinna, 1974, 51. *N.* (*N.*)

idahoensis Amin &, Heckman, 1992, 52. *N.* (*N.*) *iraqensis* Amin, Al-Sady, Mhaisen & Bassat, 2001, 53. *N.* (*N.*) *limi* Muzzall & Buckner, 1982, 54. *N.* (*N.*) *longilemnisci* Yamaguti, 1954, 55. *N.* (*N.*) *macronucleatus* Machado, 1954, 56. *N.* (*N.*) *macrospinosus* Amin & Nahhas, 1994, 57. *N.* (*N.*) *magnapapillatus* Johnson, 1969, 58. *N.* (*N*9. *magnus* Southwell & Macfie, 1926, 59. *N.* (*N.*) *nigeriensis* Farooqi, 1981, 60. (*N.*) *ningalooensis* Pichlin & Cribb, 2001, 61. *N.* (*N.*) *notemigoni* Dechter, 1967, 62. *N.* (*N.*) *octonucleatus* Tubangui, 1933, 63. *N.* (*N.*) *paraguayensis* Machado, 1959, 64. *N.* (*N.*) *paucihamatus* (Leidy, 1891) Petrotschenko, 1956, 65. *N.* (*N.*) *pimelodi* Brasil-Sato & Pavanelli, 1998, 66. *N.* (*N.*) *plagiognathopitis* Wang & Zhang, 1987, 67. *N.* (*N.*) *prchilodorum* Nickol & Thatcher, 1971,68. *N.* (*N.*) *prolixoides* Bullock, 1963, 69. *N.* (*N.*) *prolixus* Van Cleave & Timmons, 1952, 70. *N.* (*N.*) *pseudemydis* Cable & Hopp, 1954, 71. *N.* (*N.*) *pterodoritis* Thatcher, 1981, 72. *N.* (*N.*) *quatarensis* Amin, Saoud & Alkuwari, 2002, 73. *N.* (*N.*) *quinghaiensis* Liu, Yang & Yang, 1981, 74. *N.* (*N.*) *rigidus* Van Cleave, 1928, 75. *N.* (*N.*) *robertbaueri* Amin, 1985, 76. *N.* (*N.*) *roseus* Salgado-Mqldonado, 1978, 77. *N.* (*N.*) *rostratum* Amin & Bullock, 1998, 78. *N.* (*N.*) *rutili* (Müller, 1780) Stiles & Hassall, 1905; 79. *N.* (*N.*) *saginatus* Van Cleave & Bangham, 1949, 80. *N.* (*N.*) *salmonis* Ching, 1984, 81. *N.* (*N.*) *saurogobi* Yu Yi & Wu, 1989, 82. *N.* (*N.*) *simansularis* Roitman, 1961, 83. *N.* (*N.*) *sinicus* Wang, 1966, 84. *N.* (*N.*) *strigosus* Van Cleave, 1949, 85. *N.* (*N.*) *stunkardi* Cable & Fisher, 961, 86. *N.* (*N.*) *tenellus* (Van Cleave, 1914) Van Cleave, 1919, 87. *N.* (*N.*) *tsintaoensis* Morisita, 1937, 88. *N.* (*N.*) *tumidus* Van Cleave & Bangham, 1949, 89. *N.* (*N.*) *venustus* Lynch, 1936, 90. *N.* (*N.*) *valloldoi* Vizcaino, 1992, 91. *N.* (*N.*) *wuyiensis* Wang, 1981, 92. *N.* (*N.*) *zacconis* Yamaguti, 1935 and 93. *N.* (*N.*) *zabensis* Amin, Shamall, Abdulla & Mhaisen, 2003, of which first 25 species occur in this subcontinent.

Key to Indian species of subgenus *Neoechinorhynchus*

1. Proboscis hooks equal in length in 2 or 3 circles 2

– Proboscis hooks in each circle different from hooks of other circles 7

3. Proboscis hooks equal in all 3 circles, 0.014-0.025 mm long, roots up to 0.033 mm long (in Amphibia) ..... *Neoechinorhynchus* (*Neoechinorhynchus) cyanophlyctis*

– Proboscis hooks equal only in 2 circles 3

3. Male trunk constricted above testes. Proboscis hooks, anterior 0.050, middle 0.037, posterior 0.035 mm long. Eggs large, 0.154 × 0.05 mm ..... *Neoechinorhynchus* (*N.*) *hutchinsoni*

– Trunk not contricted in males and females. Proboscis hooks larger or smaller. Eggs smaller 4

4. Males above 20 mm, females 35-65 mm long 5

– Males and females between 10-20 mm long 6

– Males and females less than 10 mm long 7

5. Males 22-28 mm, females 40-63 mm long. Trunk with 2 lateral cuticular folds ..... *Neoechinorhynchus (N.) johnii*

– Males 28-30 mm, females 35-60 mm, long. Trunk without lateral cuticular folds .... *Neoechinorhynchus (N.) topseyi*

6. Worms 9-20 mm long. Lemnisci markedly unerqual. Proboscis hooks small, anterior0.026- 0.038 mm, middle 0.019-0.023 mm, posterior 0.019-0.021 mm long ..... *Neoechinorhynchus (N.) bangoni*

– (Males not known). Females 19.2 mm long. Lemnisci equal. Proboscis hooks, anterior 0.09 mm, middle 0.018 mm, posterior 0.018 mm long ..... *Neoechinorhynchus (N.) argentatus*

7. Males and females less than 1 mm long 8

– Males between 4-8 mm long 9

– Males and females between 1-3 mm long 11

8. Males 0.72 × 0.21 mm, females 0.65 × 0.20 mm. Proboscis hooks, 0.060-0.068, 0.053 mm long in both sexes ..... *Neoechinorhynchus (N.) ovalis*

– Males 0.86 × 0.30 mm long (females not known). Posterior proboscis hooks larger than middle hooks, hooks very small, anterior 0.034, middle 0.021, posterior 0.023 mm long. Trunk blunt, more robust anteriorly ... *Neoechinorhynchus (N.) cirrhinae*

9. Apical hooks 0.026-0.027 mm long ..... *Neoechinorhynchus (N.) nikoli*

– Apical hooks 0.05- 0.07 mm long 10

10. Trunk bulky in the middle and sharply attenuated in anterior third ..... *Neoechinorhynchus (N.) glyptosternomi*

– Trunk cylindrical not bulky in the middle .... *Neoechinorhynchus (N.) kashmirensis*

11. Trunk cylindrical, wide at middle 12

– Trunk not wide at middle 13

12. Proboscis hooks, anterior 0.06-0.1, middle 0.03-0.04, posterior 0.015-0.02 mm long. Testes unequal. Eggs large, 0.07-0.08 × 0.0290.032 mm ..... *Neoechinorhynchus nematalosi*

– Proboscis hooks anterior 0.075-0.083, middle 0.038-0.044, posterior 0.026-0.030 mm long Testes unequal. Eggs small 0.019-0.026 × 0.0057 mm ..... *Neoechinorhynchus (N.) kallariensis*

– Proboscis hooks, anterior 0.049, middle 0.030, posterior : 0.019 mm Long, testes equal, eggs large, 0.11 × 0.026 mm. ..... *Neoechinorhynchus (N.) elongatus*

13. Giant hypodermal nuclei not known or indistinct 14

– Giant hypodermal nuclei present 15

9. Giant hypodermal nuclei present only ventrally ..... *Neoechinorhynchus* (*N.*) *aminulhaquae*

– Giant hypodermal nuclei present dorsally and ventrally 15

15. Giant hypodermal nuclei more than 8 dorsally, up to 6 ventrally 16

– Giant hypodermal nuclei 8 or less dorsally, less than 6 ventrally 17

16. Giant hypodermal nuclei, 9-10 dorsal, 2 ventral ..... *Neoechinorhynchus* (*N.*) *roonwali*

– Giant hypodermal nuclei, 10 dorsal, 4 ventral ..... *Neoechinorhynchus* (*N.*) *rigidus*

– Giant hypodermal nuclei, 8-9 dorsal, 1-3 ventral ..... *Neoechinorhychus* (*N.*) *devdevi*

– Giant hypodermal nuclei, 5-8 dorsal, 3-5 ventral ..... *Neoechinorhynchus* (*N.*) *chilkaensis*

– Giant hypodermal nuclei less than 7 dorsally, less than 3 ventrally 18

18. Giant hypodermal nuclei, 5-7 mid-dorsally, 2 mid-ventrally ..... *Neoechinorhynchus* (*N.*) *oreini*

– Giant hypodermal nuclei, 5 or less dorsally, 1 or more ventrally 19

19. Giant hypodermal nuclei, 5 mid-dorsal, 1 mid-ventral ..... *Neoechinorhynchus* (*N.*) *dattai*

– Giant hypodermal nuclei, less than 5 dorsally, 1 ventrally or different in number in both sexes 20

20. Giant hypodermal nuclei, 3-4 dorsal, 1 ventral ..... *Neoechinorhynchus* (*N.*) *formosanus*

– Giant hypodermal nuclei vermiform 3 in male, 6 in female ..... *Neoechinorhynchus* (*N.*) *tylosuri*

321. ***Neoechinorhynchus* (*Neoechinorhynchus*) *aminulhaquei*** Chandra, 1983 (Fig. 290)

Neoechinorhynchus aminulhaquei Chandra, 1983a : 132-134, Fig. 1-3; Arthur & Ahmes, 2002 : 41.
Neoechinorhynchus (*Neoechinorhynchus*) *aminulhaquei* Amin, 2002 : 7.

Type locality : Dhaka, Bangladesh.

Description : Male 2.70-3.88 × 0.99-1.08 mm; female 4.90-4.96 × 1.36 mm. Proboscis globular to cylindrical, 0.13-0.16 × 0.08-0.11 mm in male, in female 0.115 × 0.055 mm, with 3 circular rows of 6-8 hooks each, hooks of anterior row slightly larger, stouter, 0.040-0.045 mm long, of middle row 0.035-0.040 mm long, of basal row 0.035 mm long. Proboscis receptacle thin, single-walled, muscular sac attached to base of proboscis, with ganglion with a few nerve fibers located in its wall near base, 0.40-0.45 × 0.09-0.10 mm.

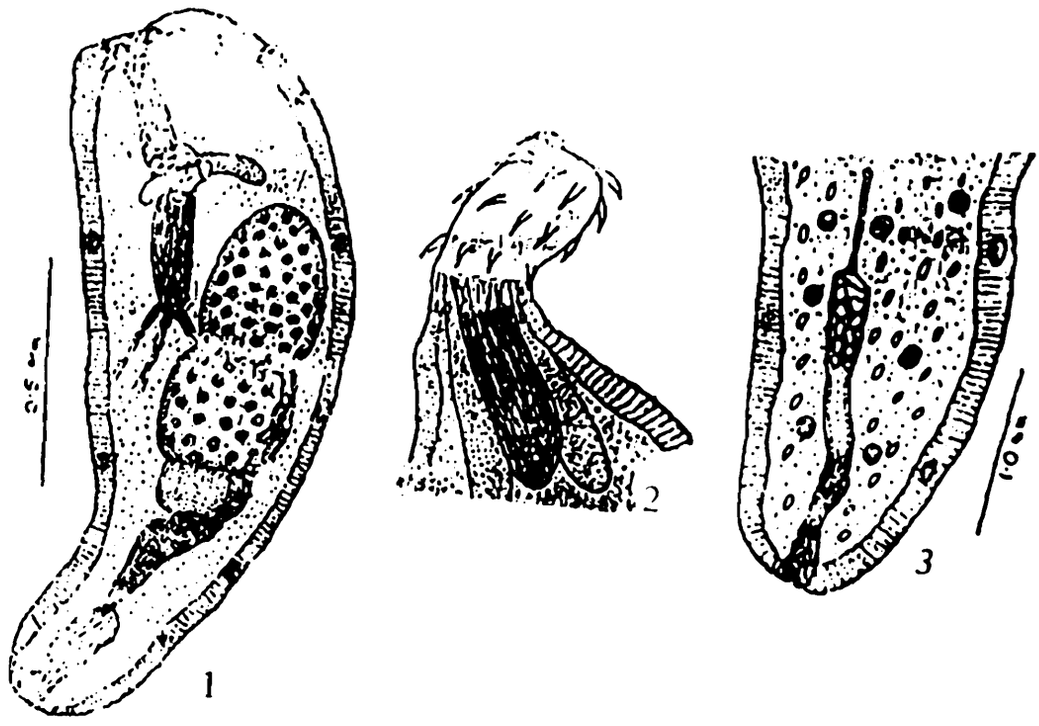


Fig. 290. *Neoechinorhynchus* (*Neoechinorhynchus*) *aminulhaquei* Chandra, 1983. 1. Male with introverted proboscis, 2. Anterior part of worm, 3. Posterior part of female (after Chandra, 1983).

Neck short. Hypodermal nuclei present on ventral surface. Trunk short, fusiform, tapering posteriorly, aspinose, with thick layer of cuticula, with subcuticular nuclei 5-6 on dorsal surface and 2 on ventral surface. Lemnisci short, cylindrical, equal, 0.70 × 0.05 mm in male, in female 0.75 × 0.05 mm. Testes ovoid or subspherical, almost equal, one behind other, anterior 0.40-0.47 × 0.28-0.40 mm, posterior 0.33-0.40 × 0.30-0.42 mm, each giving out vas efferens, runs beside cement gland and unite into thick vas deferens, opening with opening of seminal vesicle at base of penis. Cement gland single, syncytial mass, 0.20-0.39 × 0.19-0.39 mm, opens into a thick cement reservoir. Seminal vesicle thick-walled sac opening near base of penis. Penis short, thick, muscular cone-shaped hangs at top of funnel-shaped inverted bursa. Bursa eversible, 0.16-0.30 × 0.09-0.15 mm. Uterine bell kept in position by genital ligament. Uterus flabby, short. Vagina short, thick-walled muscular tube guarded by two bands of strong muscles, which control exit of ova in a single file through vulva. Ovarian balls 0.10-0.16 × 0.10-0.14 mm, and fertilized eggs 0.02 × 0.005-0.007 mm.

Host : *Mystus vittatus* (Bloch).

Location : Intestine.

Locality : Dhaka, Mymensingh (Bangladesh).

Distribution : Known only from Bangladesh.

Note : Amin (2002) invalidated this species as hooks are shown in figure in vertical, not alternating or spitral rows.

322. ***Neoechinorhynchus (Neoechinorhynchus) argentatus*** Chandra, Rao & Shyamasundari, 1987
(Fig. 291)

Neoechinorhynchus argentatus Chandra, Rao & Shyamasundari, 1987 : 49-52, Fig. 1-3; Golvan, 1994 : 164;

Neoechinorhynchus (Neoechinorhynchus) argentatus Amin, 2002 : 9.

Neoechinorhynchus argentatus Bhattacharya, 2007 : 82, Pl. 14, Fig. 72 a-e.

Type locality : Visakhapatnam, Andhra Pradesh, India.

Description : Worms creamy white in life. Female 19.2 × 0.30 mm. Proboscis short, round 0.123 mm long, 0.099 mm wide at tip, and 0.078 mm wide at base, with 3 rows of 6 hooks each, hooks of anterior most row much larger than other two rows, strongly recurved at their bases and 0.096 mm long with backward pointed blade and those of posterior circle smallest 0.012 mm long. Hooks of middle circle longer than those of posterior circle, 0.018 mm long. Proboscis receptacle cylindrical, thin, single-walled, inserted at base of proboscis, 0.21 × 0.084 mm, with ganglion 0.069 × 0.039 mm at its base. Trunk long, filiform with slight curvature towards ventral surface, aspinose. Lacunar system not visible. Lemnisci 2, equal, elongated 1.092 × 0.036 mm. Ovarian balls 0.066-0.105 mm in diameter. Uterine bell with 3 guard cells at its posterior end, which functions

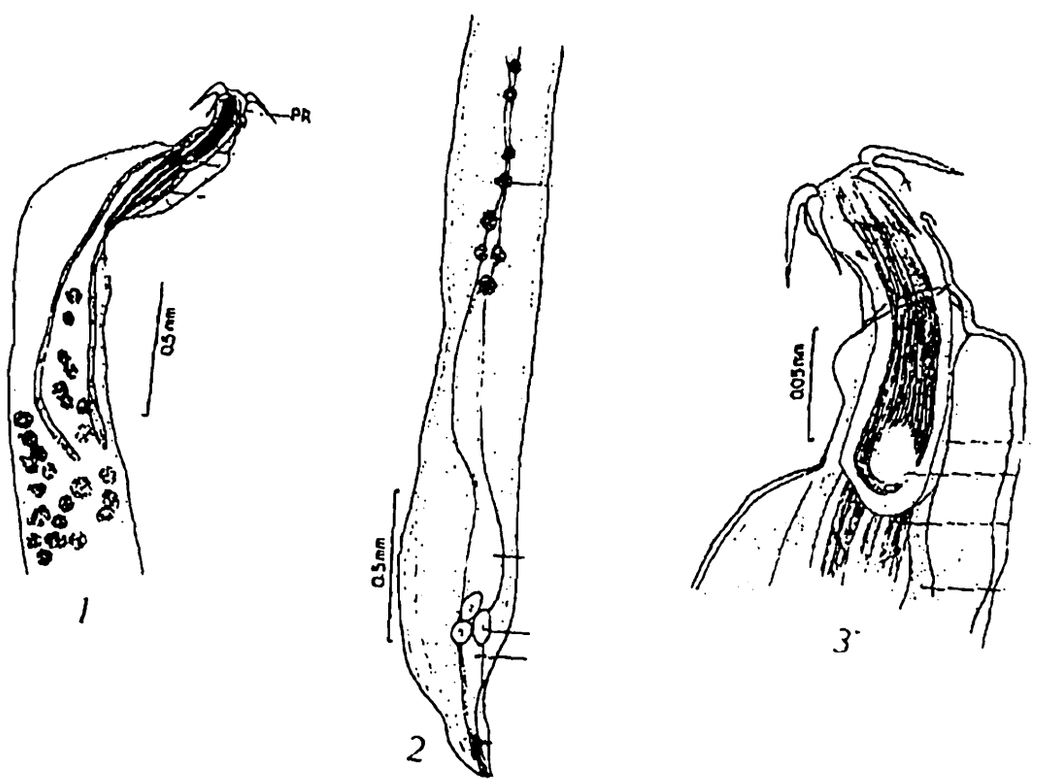


Fig. 291. *Neoechinorhynchus (Neoechinorhynchus) argentatus* Chandra, Rao & Shyamasundari, 1987. 1. Anterior part of female, 2. Posterior part of female, 3. Anterior part of worm (after Chandra, Rao & Shyamasundari, 1987).

as selector apparatus. Uterus thick-walled tube opens into vagina with sphincters and opens terminally to outside. Male not known.

Host : *Pennahia argentea* (Houttuyn).

Location : Intestine.

Locality : Visakhapatnam (Andhra Pradesh).

Distribution : Known only from type locality.

Note : Amin (2002) invalidated this specis as eggs and egg membranes are not reported.

323. ***Neoechinorhynchus (Neoechinorhynchus) bangoni*** Tripathi, 1959 (Fig. 292)

Neoechinorhynchus bangoni Tripathi, 1959 : 65-67, Fig. 3 A, B; Yamaguti, 1963 : 18; Anantataraman, M. & Anantaraman, S., 1970 : 2; Gupta, V. & Sinha, 1990b : 51; Golvan, 1994 : 165;

Neoechinorhynchus (*Neoechinorhynchus*) *bangoni* Amin, 2002 : 9.

Neoechinorhynchus bangoni Bhattacharya, 2007 : 83, Pl. 14, Fig. 74 a, b.

Type locality : Guttiyan Sharif near Kolkata, West Bengal, India.

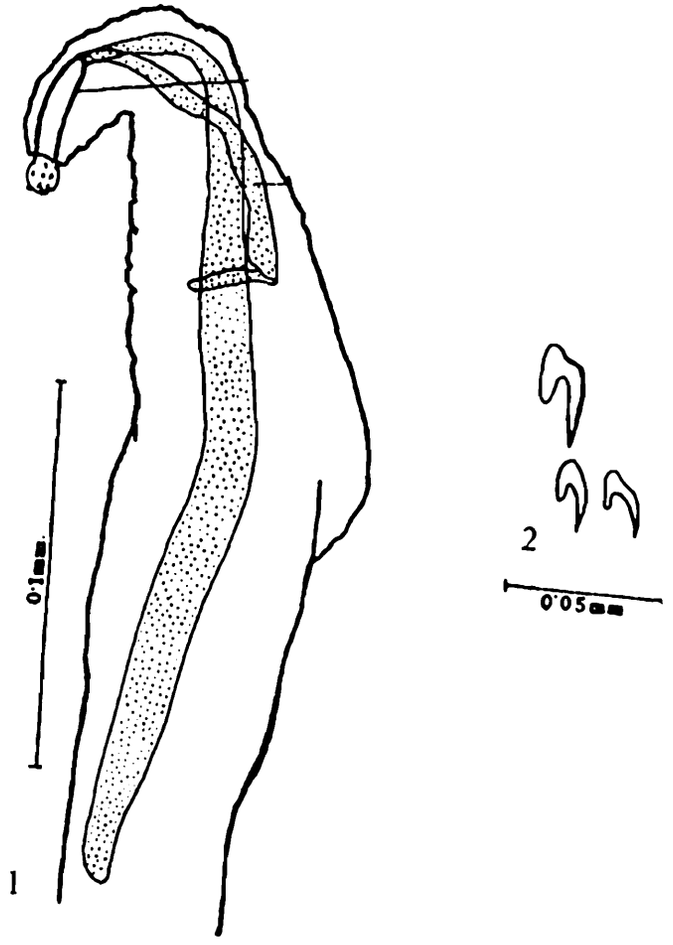


Fig. 292. *Neoechinorhynchus* (*Neoechinorhynchus*) *bangoni* Tripathi, 1959. 1. Anterior part of worm, 2. Proboscis hooks enlarged (after Tripathi, 1959).

Description : Males 9-12.× 0.72-0.94 mm; females 15-20 × 0.65-0.94 mm. Proboscis short, globular, 0.076-0.118 × 0.089-0.106 mm with 3 circular rows of 6 hooks each. Hooks of anterior row longer than those of other two rows. Hooks of first row 0.026-0.038 mm, of second and third rows 0.019-0.0231 mm long. Proboscis receptacle single-walled, 0.391-0.71 × 0.101-0.162 mm. Lemnisci unequal, 1.45-2.07 × 0.059-0.072 mm and 2.08-3.99 × 0.101-0.162 mm. Testes 2, elongate-oval, anterior 0.94-1.45 × 0.21-0.36 mm, posterior 0.87-1.30 × 0.21-0.36 mm. Cement glands oval, syncytial, 0.65-1.88 × 0.26-0.53 mm, its reservoir and seminal vesicle pyriform. Male genitalia in posterior half of trunk. Female genitalia obscured by elliptical eggs of 0.034-0.038 × 0.007-0.013 mm.

Host : *Mugil tada* Forsskal.

Location : Intestine.

Locality : Fish farm at Ghutiyan Sharif near Kolkata (West Bengal).

Distribution : Known only from type locality.

324. ***Neoechinorhynchus (Neoechinorhynchus) chilkaensis*** Poddar, 1937 (Fig. 293)

Neoechinorhynchus chilkaensis Poddar, 1937a : 129-131, Fig.1 A, B; Chandra, Rekha, Rao & Shyamasundari, 1982 : 293-294; Gupta, N. K. & Jain, 1983 : 413-414, Fig. 3 a-g; Duggal & Kaur, 1986b : 151-152, Fig. 1-8; Chowhan & Khera, 1988 : 191; Gupta, V. & Sinha, 1990b : 43; Chandra, 1992 : 404, 406; 1993 : 648; Golvan, 1994 : 165; Arthur & Ahmed, 2002 : 41.

Neoechinorhynchus (Neoechinorhynchus) chilkaensis Amin, 2002 : 8.

Neoechinorhynchus chilkaensis Bhattacharya, 2007 : 75-77, Pl.13, Fig. 62 a, b.

Type locality : Chilka lake, Orissa, India.

Description : Male 7.86-13.67 × 1.11-1.305 mm; female 11.515-15.27 × 1.83-2.25 mm. Proboscis small, globular, 0.105-0.164 × 0.12-0.16 mm in male, In female 0.125-0.15 × 0.135-0.15 mm, with 3 circles of 6 hooks each, anterior hooks rooted. Hooks of anterior, middle and basal circles, 0.065-0.70 mm, 0.035-0.045 mm, and 0.026-0.030 mm long in males; in females hooks of same circles 0.068-0.078 mm, 0.033-0.040 mm and 0.030-0.035 mm long. Proboscis receptacle elongated, single-walled, muscular, attached to base of proboscis, 0.225-0.435 × 0325. 25. .135-0.150 mm in male; in females 0.315-0.375 × 0.127-0.15 mm, with large ganglion at its base, its nerve fibers supply body wall. Neck short, 0.015-0.017 × 0.018-0.11 mm in male; in female 0.018-0.021 × 0.12 mm. Trunk small, cylindrical, fusiform, aspinose. Hypodermal giant nuclei large, conspicuous 3-5 ventral and 5-8 dorsal in male; in female 3-4 ventral and 7-8 dorsal. Lacunar system with median longitudinal channels and numerous transverse canals very prominent giving body appearance of pseudo-segmentation. Lemnisci long, subequal, fusiform, each with 2-3 giant nuclei, 2.10-2.50 × 0.225 mm and 2.79-4.46 × 0.165-0.18 mm in male; in female 2.35-4.31 × 0.22 mm and 2.79-4.46 × 0.23-0.24 mm. Testes oval, contiguous, in tandem, anterior 0.84-1.86 × 0.885-0.945 mm, posterior 0.945-1.33 × 0.795-0.85 mm. Cement gland large, oval, syncytial, 1.17-1.41 × 0.72-0.825 mm with 5-6 nuclei. Cement reservoir

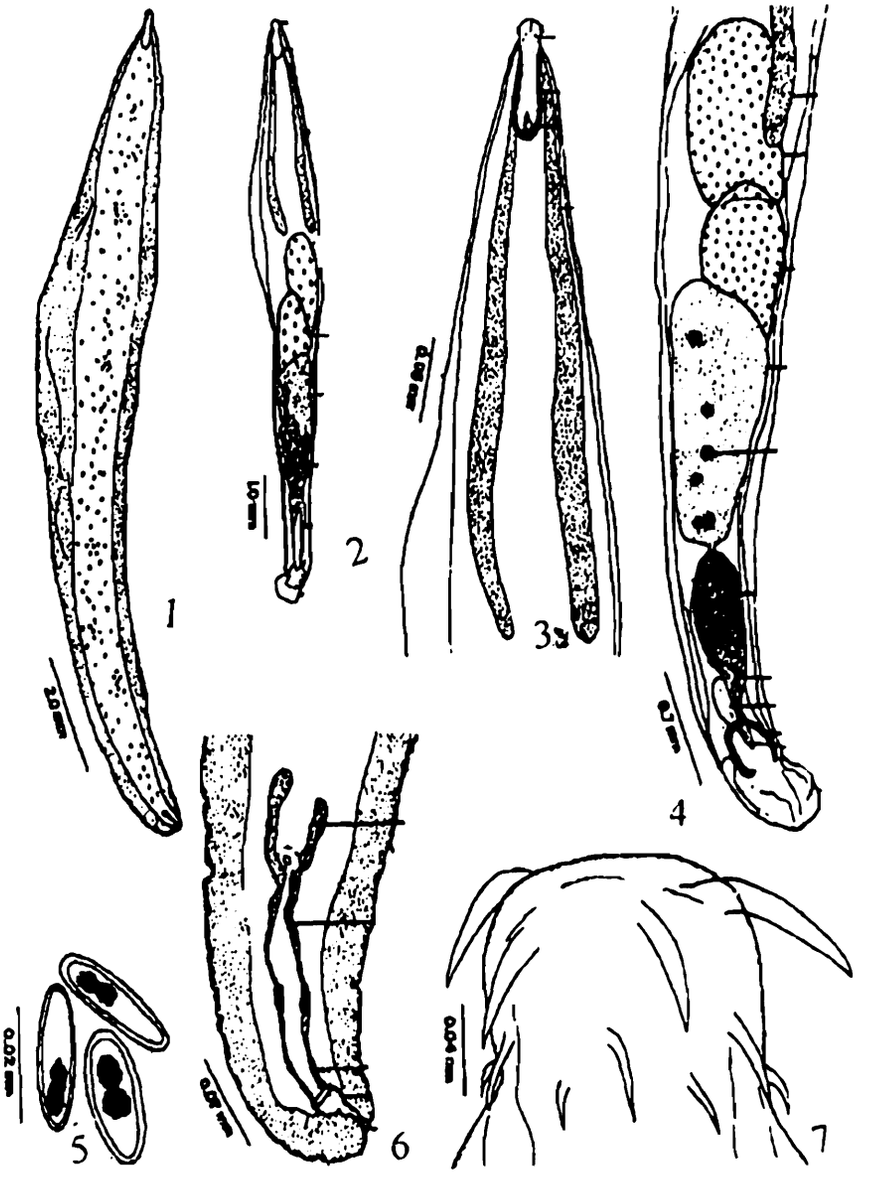


Fig. 293. *Neoechinorhynchus* (*Neoechinorhynchus*) *chilkaensis* Poddar, 1937. 1. Female, 2. Male, 3. Anterior part of worm, 4. Posterior part of male, 5. Ova enlarged, 6. Posterior part of female, 7. Proboscis enlarged (after Gupta, N.K. & Jain, 1937).

pyriform, 0.75-1.035 × 0.195-0.30 mm. Seminal vesicle 0.90-0.97 × 0.15-0.24 mm. Saefftigen's pouch 0.78-0.84 × 0.10-0.13 mm. Bursal cap 0.165-0.225 × 0.30-0.345 mm. Copulatory bursa retracted 0.625-0.93 × 0.36-0.45 mm, everted 0.615 × 0.645 mm. Uterine bell 0.285-0.375 × 0.09-0.195 mm. Uterus 0.25-0.37 × 0.082-0.135 mm, vagina 0.34-0.43 × 0.06-0.097 mm. Eggs oval to elliptical with concentric shells, 0.018-0.019 × 0.012-0.013 mm.

Host : *Mugil cepahalus* (Linnaeus), m. Cirrahanus, C..alegolepis, *M. parsia* (Hamilton), *Liza microlepis*; *Barbus ticto* (Hamilton & Buchanan), *Sigonus vermiculatus* (Cuvier & Valenciennes).

Location : Small intestine.

Locality : Vasco-de-Gama and Panaji (Goa); Visakhapatnam (Andhra Pradesh); Tamil Nadu ; Chilka lake (Orissa); Ropar (Punjab); Chittagong, Cox Bazar, Taknaf (Bangladesh).

Distribution : Known only from India.

Note : Poddar (1937).reported Male 4.2-7.8 × 0.20-1.03 mm; female 5.0-18.70 × 0.31-1.08 mm. Proboscis small, globular, 0.121 × 0.11 mm. Hooks of anterior, middle and basal circles 0.07mm, 0.03mm, and 0.027 mm long in males; Proboscis receptacle 0.46 × 0.14 mm. Lemnisci 1.85 × 0.11 mm and 1.61 × 0.11 mm. Testes anterior 0.84-1.86 × 0.885-0.945 mm, posterior 0.945-1.33 × 0.795-0.85 mm. Cement gland 1.09 × 0.66 mm its reservoir 0.44 × 0.26 mm. Vas deferens 1.14 × 0.20 mm. Penis 0 0.04 mm. Bursal 0.68 × 0.57 mm. Uterine bell 0.1119 mm long. Uterus 0.21 mm, vagina 0.06 mm. Eggs 0.023 mm.

325. ***Neoechinorhynchus (Neoechinochynchus) cirrhinae***
Gupta, N. K. & Jain, 1979
(Fig. 294)

Neoechinorhynchus cirrhinae Gupta, N. K. & Jain, 1973b : 555; 1979a : 141-150, Fig. 1-4; Gupta, V. & Sinha, 1990b : 46; Golvan, 1994 : 165;

Neoechinorhynchus (*Neoechinorhynchus*) *cirrhinae* Amin, 2002 : 9.

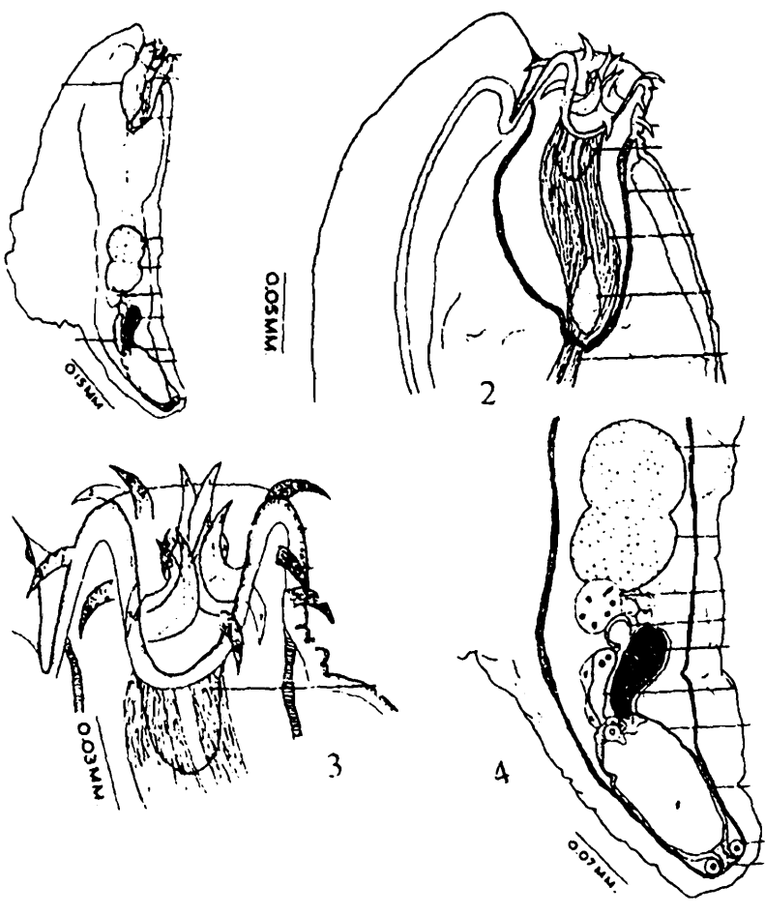


Fig. 294. *Neoechinorshynchus* (*Neoechinorhynchus*) *cirrhinae* Gupta, N.K. & Jain, 1979. 1. Male with proboscis partly inverted, 2. Anterior part of worm, 3. Proboscis and neck enlarged, 4. Posterior part of male (after Gupta, N.K. & Jain, 1979).

Type locality : Ghaggar river near Chandigarh, India.

Description : Male 0.86 × 0.36 mm. Proboscis globular, 0.074 × 0.074 mm, partly invaginated and armed with 3 circles of 6 hooks each. Hooks in anterior, middle and basal circles 0.034 mm, 0.021 mm, and 0.023 mm long. From apex of proboscis hangs in its cavity a small apical organ. Proboscis receptacle single-walled, cylindrical, inserted at base of proboscis, 0.182 × 0.085 mm, with a slight protuberance at its free posterior end where proboscis inverters leave it and continue backwards as dorsal and ventral receptacle retractors. Ganglion large, 0.044 × 0.024 mm, wedged in proboscis inverters at base of receptacle. Trunk short 0.86 × 0.36 mm, with a slight curvature towards ventral surface, robust anteriorly, with a great dilatation behind middle. Lemnisci not observed. Testes spherical, continuous, situated just behind midtrunk, anterior 0.086 × 0.083 mm; posterior 0.063 × 0.086 mm. Cement gland single, syncytial with 6 giant nuclei, 0.049 × 0.038 mm, its reservoir oval, 0.026 × 0.017 mm, lies behind cement gland. Two cement ducts from reservoir run posteriorly along with seminal vesicle. Seminal vesicle elongated, 0.084 × 0.035 mm. Copulatory bursa 0.11 × 0.077 mm, provided with muscular cap, 0.034 × 0.068 mm. Saefftigen's pouch 0.073 × 0.023 mm, situated behind cement reservoir to side of seminal vesicle. Gonopore terminal, guarded by a genital sphincter. Female not known.

Host : *Cirrihina* sp.

Location : Intestine.

Locality : Ghaggar river near Chandigarh.

Distribution : Known only from type locality.

Note : Amin (2002) synonomised *Neoechinorhynchus yalei* Datta, 1936 with *N. devdevi* Datta, 1938, as main anatomy tallies with *N. devdev*, except in measurements and number of subcuticular nuclei and both species were collected from the same genus of host and in same locality and variation in measurements and number giant nuclei fall within the usual intraspecific range. He has not assigned this species as no females were reported.

326. ***Neoechinorhynchus (Neoechinorhynchus) cynophlyctis*** Kaw, 1951 (Fig. 295)

Neoechinorhynchus cynophlyctis Kaw, 1951 : 130-131, Fig. 4 A, B; Yamaguti, 1963 : 21; Anantaraman,M. & Anantaraman, S., 1970 : 3; Golvan, 1994 : 165;

Neoechinorhynchus (Neoechinorhynchus) cyanophylictis Amin, 2002 : 9.

Neoechinorhynchus cynophlyctis Bhattacharya, 2007 : 77, Pl..13, Fig. 63 a, b.

Type locality : Dal lake, Srinagar, Jammu and Kashmir, India.

Description : Male 2.46 × 0.55 mm. Proboscis cylindrical 0.13 × 0.07 mm, with 3 circular rows of 6 hooks each, 0.014-0.025 mm long with root up to 0.033 mm long in all circles. Proboscis receptacle single-walled, 0.18 × 0.10 mm. Trunk subcylindrical, more or less sickle-shaped, aspinose. Lacunar system well developed with main longitudinal

channels and intervening network of transverse canals. Lemnisci 0.36 × 0.05 mm and 0.23 × 0.07 mm. Testes nearly equal, subspherical, partly overlap each other, anterior 0.22 × 0.25 mm, posterior 0.20 × 0.21 mm, vasa efferrntia from testes unite to form vas deferens. Cement gland oval, syncytial mass, 0.15 × 0.08 mm. Seminal vesicle pear-shaped, lying on dorsal surface of cement gland, 0.35 × 0.2 mm. Penis thick, cone-shaped 0.076 × 0.036 mm. Copulatory bursa everted 0.24 × 0.15 mm. Female not known.

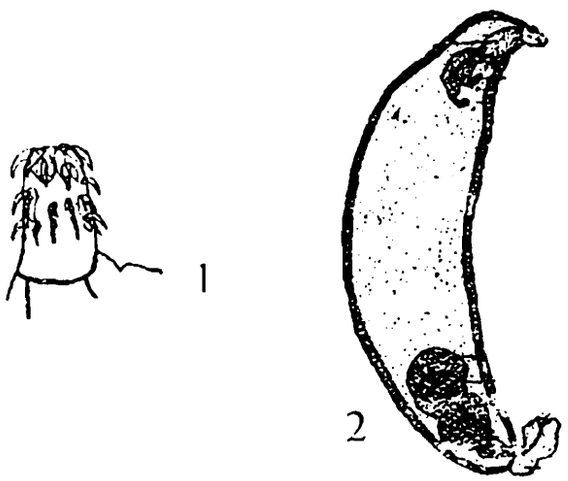


Fig. 295. *Neoechinorhynchus* (*Neoechinorhynchus*) *cynophlyctis* Kaw, 1951. 1. Proboscis enlarged, 2. Male (after Kaw, 1951).

Host : *Rana cyanophlyctis.*

Location : Intestine.

Locality : Ganga River, Bihar; Dal lake, Srinagar (Jammu & Kashmir).

Distribution : Known only from India.

Note : Amin (2002) has unassigned this species as no females were reported.

327. ***Neoechinorhynchus (Neoechinorhynchus) dattai*** Golvan, 1994 (Fig. 296)

Neoechinorhyncus rutili Datta, 1936 : 217-219, Textfig. 3; Anantaraman, & Anantaraman, S. 1970 : 2;
Neoechinorhynchus dattai Golvan, 1994 : 165;
Neoechinorhynchus (*Neoechinorhynchus*) *dattai* Amin, 2002 : 7.
Neoechinorhynchus dattai Bhattacharya, 2007 : 77-78, Pl. 28, Fig. 149 a-c.

Type locality : Walur lake, Jammu and Kashmir, India.

Description : Males 3.0-4.2 × 0.50-0.80 mm. Female 7.50-8.80 × 0.60-1050 mm. Proboscis globular, with 6 spiral rows of 3 hooks each. 0.132 × 0.097-0.143 mm. Apical hooks 0.08 mm, middle 0.04, basal 0.037 mm long. Proboscis receptacle single-walled muscular sac, 0.242 × 0.175 mm. with basal ganglion with few nerves in its wall, Neck

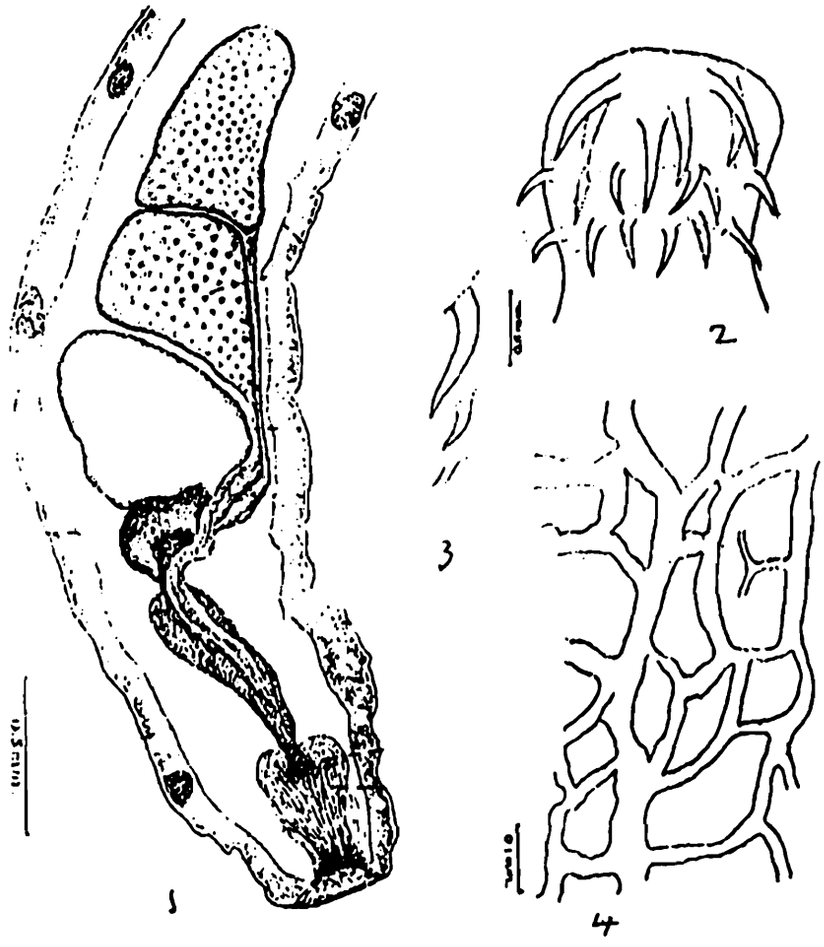


Fig. 296. *Neoechinorhynchus* (*Neoechinorhynchus*) *dattai* Golvan, 1994. 1. Posterior part of male, 2. Proboscis enlarged, 3. Proboscis hooks enlarged, 4. Part of trunk showing lacunar system (after Datta, 1936).

short, truncated cone. Trunk fusiform, aspinose, arched with anterior and posterior ends gradually bent ventrally. Hypodermal giant nuclei 5 mid-dorsally and single mid-ventrally. Lemnisci very long, sometimes reaching up to testes slightly unequal, longer lemniscus 1.58 × 0.088 mm with two nuclei, shorter 1.27 × 0.088 mm with one nucleus. Testes ovoid, closely one behind other, anterior larger, 1.10 × 0.55 mm, posterior shorter 0.77 × 0.37 mm. Two vasa efferentia from testes run short distance, then swells a little before uniting to form short vas deferens runs a short distance alongside seminal vesicle and then opens at base of muscular cone-like penis, which hangs near top of eversible bursa. Cement gland single, syncytial mass, its anterior end touches posterior testes, from which a duct leads into cement reservoir near base of penis. Copulatory bursa 0.374 × 0.176 mm. Uterine funnel opens directly into ventral ligament sac. Posterior end of female obliquely truncated with gonopore near ventral margin. Eggs oval, with three membranes, outer membrane very transparent, middle membrane thick, shiny, refracting light well. Eggs about 0.05 × 0.013 mm. Embryos 0.030-0.040 × 0.014-0.024 mm.

Host : *Nemachilus stoliezkie* Steindacher, *N. vittatus* (Heckel).

Location : Intestine.

Locality : Canal to Dal lake, Srinagar, channel toWalur Lake, Ladhak, channel to Manasbal lake, Canal to Dal lake,

Distribution : Europe; North America.

Note : Amin (2002) invalidated this species as no egg membranes were reported.

328. ***Neoechinorhynchus (Neoechinorhynchus) devdevi*** (Datta, 1936) Kaw, 1951 (Fig. 297)

Eosentis devdevi Datta, 1 936 : 211;

Eosentis yalei Datta, 1936 : 225; Datta, 1936 : 222-223, Textfig. 5 a, b; Kaw, 1951 : 126 ;

Neoechinorhynchus yalei (Datta), Kaw, 1951 : 130-131, Fig. 4 a, b; Yamaguti, 1963 : 20;

Neoechinorhynchus (*Eosentis*) *yalei* Anantaraman, M. & Anantaraman, S., 1970 : 3;

Neoechinorhynchus devdevi Fotedar & Dhar, 1977a : 26-37; Golvan, 1994 : 164;

Eosentis devdevi Gupta, P. D. & Ghosh, 1979 : 316;

Neoechinorhynchus yalei Gupta, V. & Sinha, 1990b : 45; Golvan, 1994 : 166;

Neoechinorhynchus (*Neoechinorhynchus*) *yalei* Amin, 2002 : 7.

Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* Amin, 2002 : 9.

Neoechinorhynchus devdevi Bhattacharya, 2007 : 78, Pl.13, Fig. 64 a-c.

Neoechinorhynchus yalei Bhattacharya, 2000 : 144-145; 52007 : 83.

Type locality : Srinagar, Jammu and Kashmir, India.

Description : Male 2.29-3.30 × 0.73-1.08 mm; female 2.97-7.59 × 0.616-1.276 mm. Proboscis short, globular, 0.132 × 0.099 mm, with 3 circles of 6 hooks each. Apical hooks much longer and stouter 0.09 mm long, middle hooks 0.045 mm long, basal hooks 0.04 mm long. Proboscis in most cases found tucked in proboscis receptacle. Proboscis receptacle short, thin, single-walled, muscular, 0.264 × 0.132 mm, with ganglion at its base, from which nerves supply trunk wall. Trunk fusiform, tapering moderately towards posterior end, aspinose. External body wall slightly furrowed giving it annulated appearance. Hypodermic giant nuclei 8-9 dorsal and 1-3 ventral. Lacunar system of reticular anastomoses. Lemnisci 2, long, filamentous, unequal, longer 1.87 × 0.132 mm, shorter 1.78 × 0.13 mm, with 3 giant nuclei each. Testes ovoid, subequal, one behind other, anterior 0.704 × 0.44 mm, posterior 0.616 × 0.44 mm, from each testis emerge vas efferens, two of them run by side of cement gland unite into vas deferens, opening with opening of seminal vesicle at base of penis. Cement gland single, syncytial mass 0.44 × 0.31 mm, opens into thick cement reservoir, from which cement duct runs backwards and ends at base of penis. Seminal vesicle thick-walled sac 0.374 × 0.198 mm, opens at base of penis. Penis short, thick muscular, cone-shaped, hanging at top of funnel-shaped inverted bursa. Uterine bell funnel-shaped, 0.415 × 0.07 mm, with large guard cells at its base. Uterus short, flabby 0.25 × 0.035 mm with two flask-shaped cells near its posterior end, where it opens into vagina. Vagina short, thick-walled, muscular tube 0.50 × 0.04 mm guarded by two bands of strong muscles, controlling exit of eggs in a single fine through vulva. Eggs 0.02 × 0.005 mm. Female gonopore at postero-ventral.

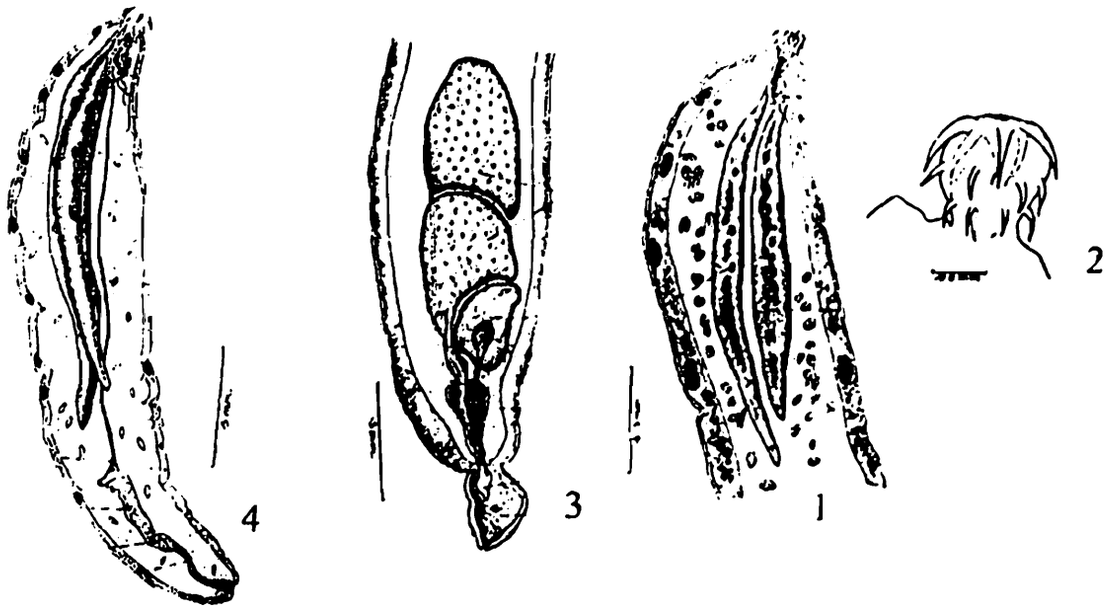


Fig. 297. *Neoechinorhynchus* (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951. 1. Anterior part of female, 2. Proboscis enlarged, 3. Posterior part of male, 4. Male (after Datta, 1936).

Host : *Schizothorax esocinus* Haeckel, *S. planifrons*, ,*Synaptura orientalis*, *Tor tor* Hamilton, *Labeo rohita* (Hamilton), *Ptychatalus rattanis*, *Mystus* sp., *Rana cyanophyctis*.

Location : Intestine.

Locality : : Trivandrum (Kerala); Jhelum river, Srinagar. Canal to Dal lake, channel to Manasbal lake, Srinagar (Jammu & Kashmir), Garo Hills (Meghalaya),

Distribution : Known only from India.

Note : Amin (2002)synonymised *Neoechinorhynchus yalei* Datta, 1936 with *N. devdevi* Datta, 1936 as the main anatomy tallies with *N. devdevi*, except in measurements and in the number of subcuticular nuclei and both species were collected from the same genus of host in the same locality and variations in measurements and giant nuclei number fall within the usual intraspecific range. He also has not assigned this species as egg morphology was not discussed.

329. ***Neoechinorhynchus* (*Neoechinorhynchus*) *elongatus*** Tripathi, 1959 (Fig. 298)

Neoechinorhynchus elongatus Tripathi, 1959 : 67, Textfig. 4; Yamaguti, 1963 : 19; Anantaraman, M. & Anantaraman, S., 1970 : 3; Gupta, V. & Sinha, 1990b : 43; 51; Golvan, 1994 : 165;

Neoechinorhynchus (*Neoechinorhynchus*) *elongatus* Amin, 2002 : 9.

Neoechinorhynchus elongatus Bhattacharya, 2005 : 78, Pl.13, Fig. 65; ; 2007 : 78, Pl.13, Fig. 65.

Type locality : Chilka lake, Orissa, India.

Description : Males 5.3-7.1 × 0.75-0.87 mm; female 9.0-13.2 × 1.45-1.6 mm. Proboscis small, globular, 0.116 × 0.087-0.101 mm in males; and 0.145 × 0.116 mm in females, with

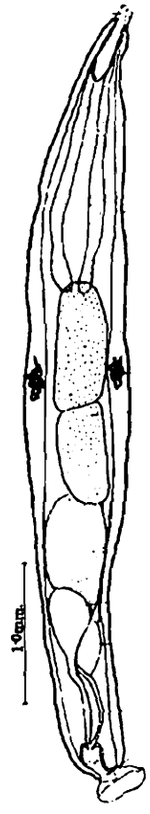


Fig. 298. *Neoechinorhynchus (Neoechinorhynchus) elongatus* Tripathi, 1959. Female (after Tripathi, 1959).

3 circles of hooks. Hooks unequal in size, anterior 0.049 mm, middle 0.03 mm and posterior 0.019 mm long. Proboscis receptacle more than 3 times as long as proboscis, 0.337-0.435 × 0.101-0.116 mm in males and 0.651 × 0.145 mm in females. Trunk elongate and tapering to posterior end in both sexes. Giant hypodermal nuclei not known. Lemnisci 2, equal, 1.45-1.49 × 0.087-0.101 mm. Testes ovoid placed about midtrunk, 0.58-0.72 × 0.333-0.348 mm. Cement gland syncytial 0.652-0.797 × 0.406 mm, its reservoir pyriform, 0.507 × 0.29 mm. Seminal vesicle long, 0.174-0.188 mm long. Eggs elliptical, 0.11 × 0.026 mm.

Host : *Mugil subviridis* Cuvier & Valenciennes, *M. dussumieri* Cuvier & Valenciennes, *Mugil* sp.

Location : Intestine.

Locality : Chennai (Tamil Nadu); Kakinada (Andhra Pradesh); Chilka lake (Orissa); West Bengal.

Distribution : Known only from India.

Note : Amin (2002) has not assigned this species as egg membranes are not reported.

330. *Neoechinorhynchus (Neoechinorhynchus) formosanus* (Harada, 1938) Kaw, 1951
(Fig. 299)

Eosentis formosanus Harada, 1938 : 419-427; Saeed & Bilqees, 1973 : 85, Fig. 2-7;

Neoechinorhynchus formosus (Harada), Petrotschenko, 1956 : 206-207, Fig. 66; Yamaguti, 1963 : 19, Pl. 2, Fig. 12; Bilqees, 1972 : 55; Bilqees & Khan, 1987 : 11, Fig. 10 a-f; Gupta, V. & Sinha, 1990b : 54; Golvan, 1994 : 165;

Neoechinorhynchus (Neoechinorhynchus) formosanus Amin, 2000 : 14.

Type locality : Formosa, China.

Description : Worms of medium size, in life orange yellow and flat. Male 8.26-9.31 × 1.03-1.8 mm. Female 8.79 × 1.03-1.8 mm. Proboscis short, spherical 0.14-0.17 × 0.006-0.013 mm with 3 spiral rows of 6 hooks each. Proboscis hooks anterior 0.07 mm long, middle hooks 0.04 mm long, posterior hooks 0.028 mm long. Proboscis receptacle short, sub-cylindrical single-walled, 0.31-0.34 × 0.13-0.15 mm with ganglion at its base. Neck very short. Trunk elongated, curved ventrally, aspinose. Giant hypodermal amoeboidally

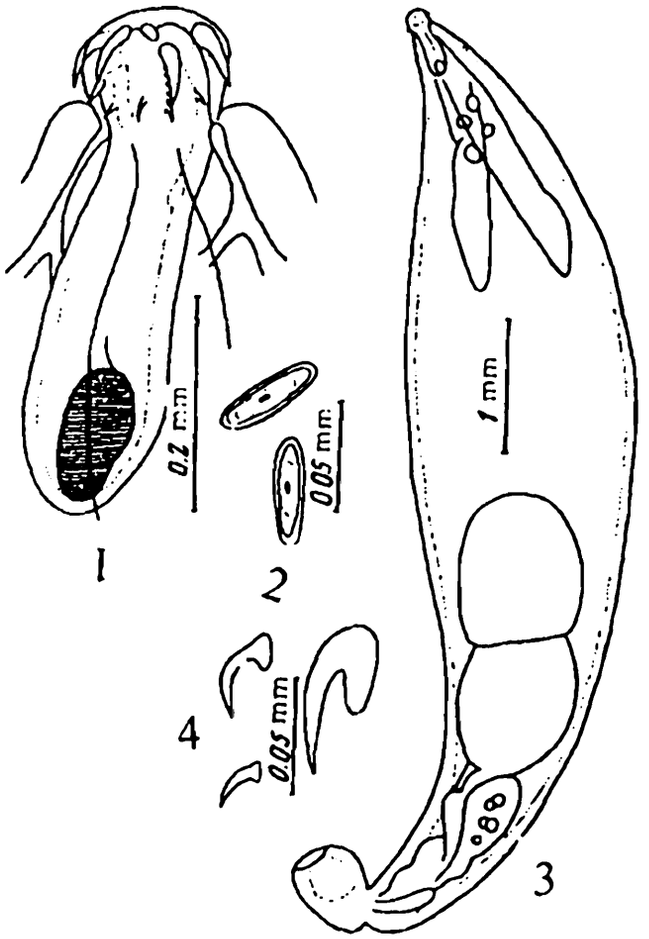


Fig. 299. *Neoechinorhynchus (Neoechinorhynchus) formosanus* (Harada, 1938) Kaw, 1951. 1. Proboscis and proboscis receptcle enlarged, 2. Ova enlarged, 3. Male, 4. Proboscis hooks enlarged (after Harada, 1938).

branching nuclei 3-4 dorsal and 1 ventral nuclei. Lemnisci filiform, equal, flat 1.02-1.03 × 0.31-0.35 mm with 20 giant nuclei. Testes in anterior half of body, contiguous, elongate, anterior 1.1 × 0.9 mm, posterior circular 0.9 mm wide. Cement gland syncytial, rounded, 1.26-1.27 × 0.34-0.54 mm, its reservoir rounded, 0.34-0.54 × 0.17-0.27 mm. Seminal vesicle 0.14 × 0.17 mm. Bursa 0.13-0.17 × 0.17-0.34 mm. Uterine bell funnel-shaped, about 1.6 mm long. Vagina thick 0.10-0.012 mm long..

Host : *Labeo rohita* (Hamilton), *Mugil spergielaris* Bloch.

Location : Intestine.

Locality : Kalri lake, Sindh (Pakistan).

Distribution : Formosa; China; Japan.

331. ***Neoechinorhynchus (Neoechinorhynchus) gibsoni*** Khan & Bilqees, 1989 (Fig. 300)

Neoechinorhynchus gibsoni Khan & Bilqees, 1989 : 259-263, Fig. 1-5; Golvan, 1994 : 165; *Neoechinorhynchus (Neoechinorhynchus) gibsoni* Amin, 2002 : 7.

Type locality : Kalri lake, Sindh, Pakistan.

Description : Male 4.30-4.33 × 0.65-0.67 mm, female 13.4-13.6 × 2.25-2.28 mm. Proboscis small, globular, 0.14-0.15 × 0.14-0.15 mm in male; in female 0.148 × 0.0096 mm, with 3 circles of six hooks each. Hooks of apical, middle and basal circles 0.056 × 0.012 mm, 0.048 × 0.0096 mm, 0.046 × 0.0073 mm in male, in female hooks of same circles 0.064 × 0.017 mm, 0.056 × 0.0099 mm, 0.052 × 0.0096 mm. Hooks at base widest and pointed at tip. Proboscis receptacle single-walled, with ganglion at base, 0.14 × 0.12-0.15 mm in male; in female 0.15 × 0.14 mm. Neck 0.05 × 0.164 mm in female. Trunk elongate, curved ventrally. Lemnisci 0.56-0.58 × 0.10 mm in both sexes. Testes contiguous in posterior half of trunk, anterior smaller 0.42-0.44 × 0.30-0.32 mm, posterior 0.47-0.49 × 0.28-0.29 mm. Cement gland single, large, syncytial, 0.25-0.26 × 0.15 mm, its reservoir small, 0.091-0.093 × 0.051-0.053 mm. Seminal vesicle 0.35-0.37 × 0.40-0.42 mm. Saefftigen's pouch 0.31-0.32 mm long. Bursa 0.26-0.27 × 0.23 mm. Ovarian balls 0.057-0.096 × 0.064-0.083 mm. Vagina 0.075 × 0.037 mm. Eggs small, oval, 0.021-0.022 × 0.010-0.013 mm.

Host : *Labeo rohita* (Hamilton).

Location : Intestine.

Locality : Kalri lake, Sindh, Pakistan.

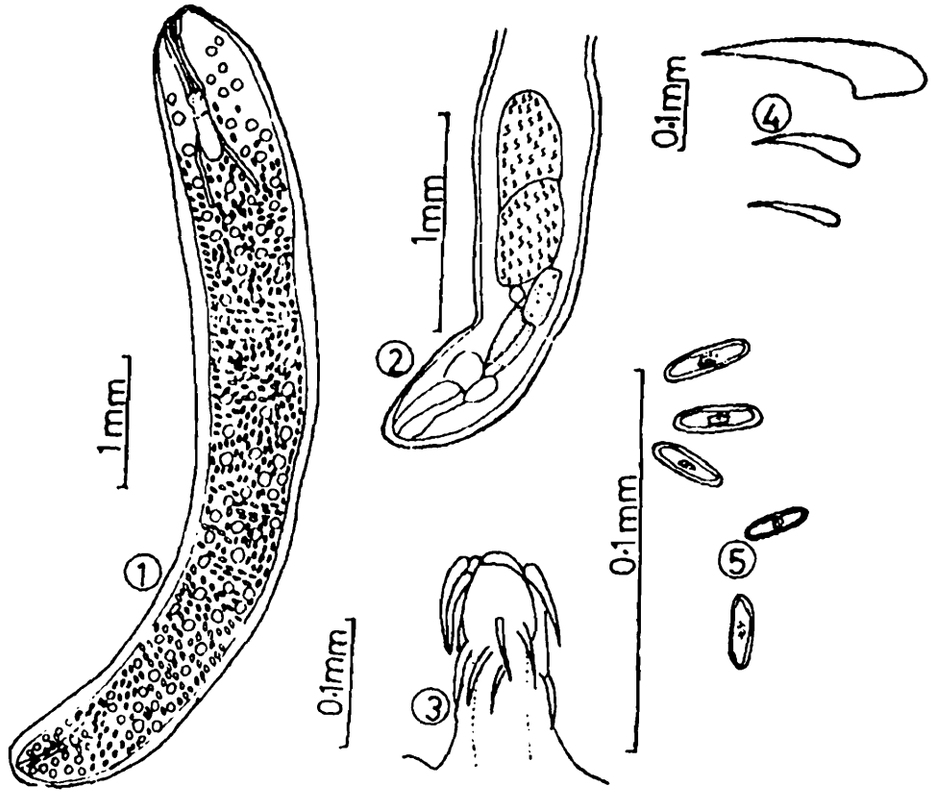


Fig. 300. *Neoechinorhynchus* (*Neoechinorhynchus*) *gibsoni* Khan & Bilqees, 1989. 1. Female, 2. Posterior part of male, 3. Proboscis enlarged, 4. Proboscis hooks enlarged, 5. Eggs enlarged (after Khan & Bilqees, 1989).

Distribution : Known only from type locality.

Note : Amin (2002) considers this species questionable as measurements are confusing, seem to be in error and do not agree with the scale in the figures.

332. *Neoechinorhynchus (Neoechinorhynchus) glyptosternumi* Fotedar & Dhar, 1977 (Fig. 301)

Neoechinorhynchus glyptosternumi Fotedar & Dhar, 1977a : 26-37; Fotedar & Kharoo, 1985 : 36-39, Fig. 1-3; Gupta, V. & Sinha, 1990b : 53; Golvan, 1994 : 165;

Neoechinorhynchus (Neoechinorhynchus) glyptosternumi Amin, 2002 : 9.

Neoechinorhynchus glyptosternumi Bhattacharya, 2007 : 78-79, Pl. 28, Fig. 150 a-c.

Type locality : River Jheelum near Baramulla, Jammu and Kashmir, India.

Description : Male 5.05 × 0.82 mm; female 4.3 × 0.46 mm. Proboscis small 0.11 × 0.07 mm, with 3 rows of 6 hooks each, of these terminal hooks largest, 0.07 mm, middle hooks 0.06 mm and basal hooks 0.028 mm, hook roots very small. Proboscis receptacle single-walled 0.16 × 0.09 mm. Trunk long, bulky in middle and sharply attenuated in anterior

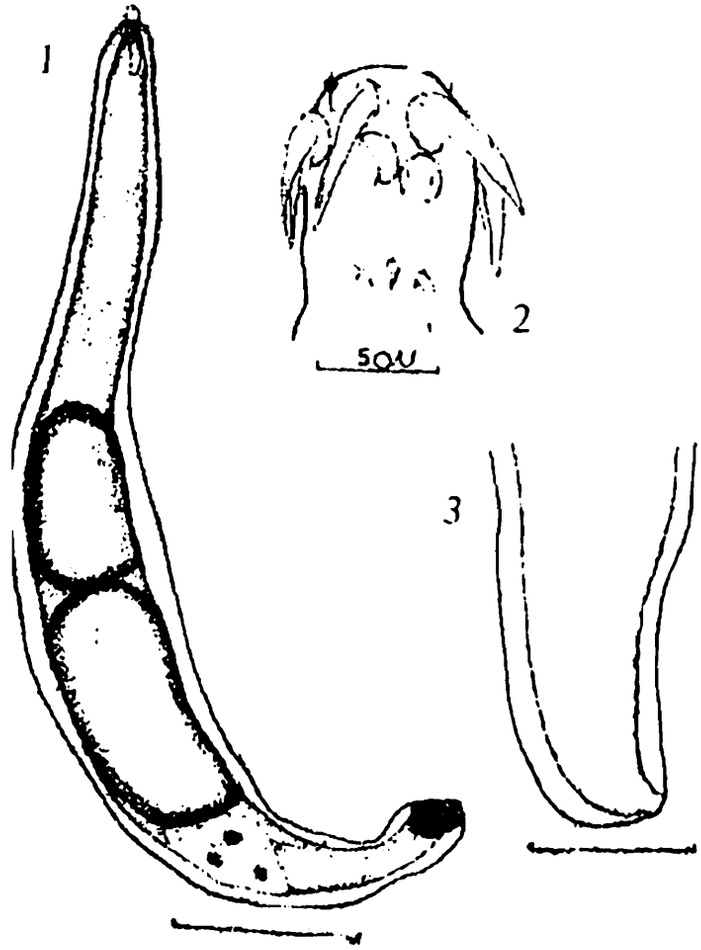


Fig. 301. *Neoechinorhynchus (Neoechinorhynchus) glyptosternumi* Fotedar & Dhar, 1977. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female (after Fotedar & Kharoo, 1985).

third. Giant hypodermal nuclei not detected. Lemnisci 2, equal, small 2.22 mm long. Testes in tandem, anterior 0.98 × 0.55 mm, posterior 1.47 × 0.78 mm. Cement gland oval with 3-4 large nuclei, its reservoir small. Seminal vesicle small. Everted bursa 0.45 × 0.38 mm.

Host : *Glyptosternum* sp.

Location : Intestine.

Locality : Ladhak; River Jhelum near Baramulla (Jannu & Kashmir).

Distribution : Known only from India.

Note : Amin (2002) has not assigned this species to subgenus as morphology and measurements of egg were not reported.

333. ***Neoechinorhynchus (Neoechinorhynchus) hutchinsoni*** Datta, 1936 (Fig. 302)

Neoechinorhynchus hutchinsoni Datta, 1936 : 219-224, Textfig. 4; Yamaguti, 1963 : 19; Anantaraman, M. & Anantaraman, S., 1970 : 3; Gupta, P.D & Gupta, R.K. 1979 : 316; Gupta, V. & Sinha, 1990b : 46;

Neoechinorhynchus (*Neoechinorhynchus*) *hutchinsoni* Amin, 2002 : 9.

Neoechinorhynchus hutchinsoni Bhattacharya, 2007 : 79, Pl. 13, Fig. 66.

Type locality : Leh, Jammu and Kasmir, India.

Description : Males 7.8-8.2 × 0.8-1.0 mm; females 18.9 × 1.3 mm. Proboscis oval, 0.77-1.0 × 0.099-1.0 mm, wider than long, with 3 circular rows of 6 hooks each, hooks of apical row longer and much stouter than those of middle and basal rows. Proboscis hooks apical 0.05 mm, middle 0.037 mm and basal 0.035 mm long respectively. Proboscis receptacle single-walled, muscular 0.26 × 0.099 mm, with ganglion in its posterior part, sending out nerve retinacula to body wall. Trunk cylindrical with tapering ends, male trunk constricted above testes. Hypodermal nuclei 5 in mid-dorsal line and 2 in mid-ventral line. Lemnisci 2, filamentous, unequal, longer lemniscus 2.73 × 0.176 mm, shorter lemniscus 2.5 × 0.176 mm. Testes elliptical, closely apposed one behind other, anterior 1.19 × 0.484 mm, posterior 1.122 × 0.484 mm. Cement gland syncytial mass 0.9 × 0.35 mm, lie behind posterior testis, its reservoir spherical with cement duct opening at base of muscular, cone-like penis.

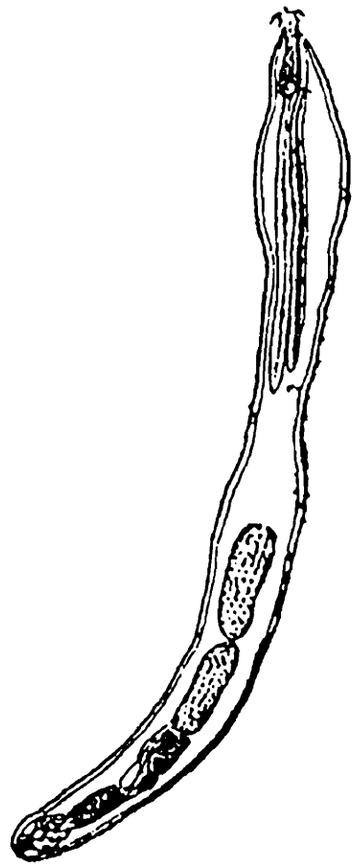


Fig. 302. *Neoechinorhynchus* (*Neoechinorhynchus*) *hutchinsoni* Datta, 1936. Male (after Datta, 1936).

Penis attached at top of inverted bell-shaped bursa 0.68 mm long. Vas deferens opens into seminal vesicle 0.484 mm long. Eggs 0.154 × 0.055 mm.

Host : *Diptychus maculatus* (Steindachner).

Location : Intestine.

Locality : Leh, at altitude of 11,500 feet (Jammu & Kashnir),

Distribution : Known only from India.

Note : Amin (2002) has not assigned this species to subgenus as egg morphology was not reported.

334. ***Neoechinorhynchus (Neoechinorhynchus) johnii*** Yamaguti, 1939 (Fig. 303)

Neoechinorhynchus johnii Yamaguti, 1939 : 346-347, Pl. 48, Fig. 37, 38; Petrotschenko, 1956 : 207-208, Fig. 67; Yamaguti, 1963 : 19, Pl. 83, Fig. 836, 837; Bilqees, 1972b : 96-97, Fig. 9-16; Bilqees & Khan, 1978 : 10-11, Fig. 9 a-e; Gupta, N. K. & Jain, 1983 : 409-413, Fig. 2 a-h, Pl. 1, Fig. 1-3; Gupta, V. & Sinha, 1990b : 55; Golvan, 1994 : 165;

Neoechinorhynchus (Neoechinorhynchus) johnii Amin, 2000 : 13.

Neoechinorhynchus johnii hattacharya, 2007 : 79, Pl. 35, Fig.6961 a-d.

Type locality : Japan.

Description : Male 21.70-26.97 × 0.55-0.65 mm; in female 40-63 × 0.7-1.21 mm. Proboscis globular, small, with 3 circles of 6 hooks each, 0.10-0.142 × 0.13-0.19 mm in males; in females 0.08-0.16 × 0.09-0.16 mm. Hooks of anterior circles 0.089-0.093 × 0.012 mm, and of middle and posterior circles 0.020-0.024 × 0.004 mm in males; in females hooks of anterior row largest and curved at base, 0.08-0.09 mm. of middle row hooks 0.05-0.06 mm long, and of posterior row hooks 0.019-0.020 mm long. Proboscis receptacle saccular, single-walled, with rounded ganglion at its base, 0.406-0.536 × 0.13-0.163 mm in males; in females 0.38 mm long. Trunk long, slender, with 2 lateral cuticular folds. Lemnisci equal, or subequal, slender, 1.82-2.92 × 0.08-0.11 mm in males; in females 2.7-3.5 mm long. Testes elongated, tubular, in tandem, contiguous, anterior slightly smaller, 1.95-3.44 × 0.22-0.44 mm and posterior 2.11-4.27 × 0.21-0.42 mm. Cement gland long, tubular, syncytial, 3.22-4.83 × 0.19-0.34 mm with 12-13 giant nuclei. Cement reservoir pyriform, 0.40-0.50 × 0.19-0.29 mm. Seminal vesicle, 0.52-1.0 × 0.14-0.22 mm. Duct from cement gland and sperm duct open into small papillated bursa 0.05 × 01 mm. Saefftigen's pouch 0.601-0.78 × 0.081-0.146 mm. Copulatory bursa 0.32-0.86 × 0.16-0.55 mm with its muscular cap 0.12-0.22 × 0.12-0.18 mm. Uterine bell 0.14-0.17 × 0.1-0.16 mm. Uterus fusiform 0.3-0.4 mm long. Vagina tubular, 0.2-0.25 mm long with sphincter 0.08-0.1 mm in diameter. Selector apparatus well developed with 4 nucleated cells at base of uterine bell. Vulva thick-walled, folded inwards with wide subterminal aperture. Ovarian balls 0.06-0.08 × 0.06-0.09 mm. Eggs elongate 0.033-0.038 × 0.02-0.022 mm.

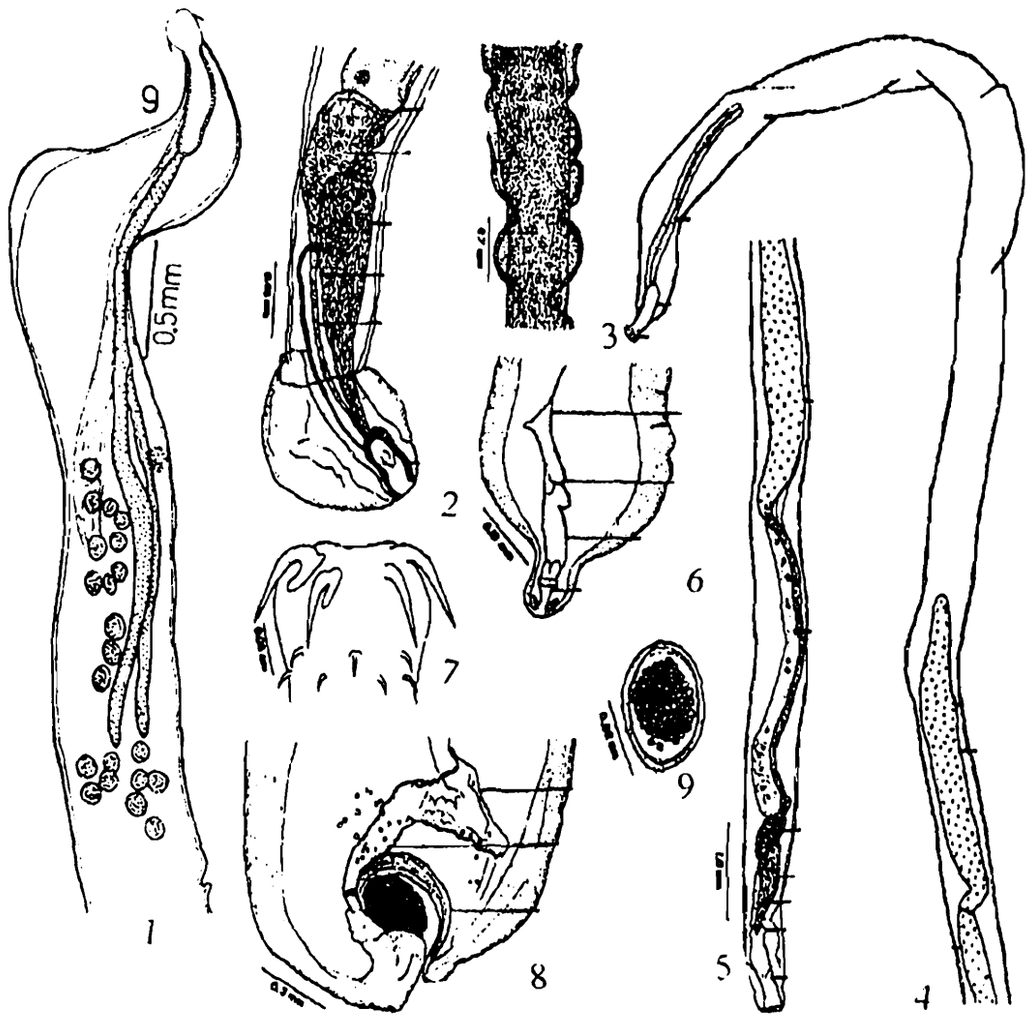


Fig. 303. *Neoechinorhynchus (Neoechinorhynchus) johnii* Yamaguti, 1939. 1. Anterior part of female, 2. Posterior part of male, 3. Midtrunk region, 4,5. Anterior and posterior part of male, 6. Posterior part of immature female, 6. Proboscis enlarged, 7. Posterior part of female, 8. Posterior end of female, 9. Ovum (after Yamaguti, 1939).

Host : *Pseudosciaena diacanthus* Lac.

Location : Intestine.

Locality : Panaji (Goa); Mumbai (Maharastra); Karachi coast (Pakistan).

Distribution : East China Sea; Japan.

335. ***Neoechinorhynchus (Neoechinorhynchus) kallarensis*** George & Nadakal, 1978 (Fig. 304)

Neoechinorhynchus kallarensis George & Nadakal, 1978b : 80-82, Fig. 1-3, 1992 : 287; Golvan, 1994 : 165;

Neoechinorhynchus kallarensis Bhattacharya, 2007 : 72-73, Pl.13-14, Fig. 67 a-c.

Type locality : Kallar dam, Kerala, India.

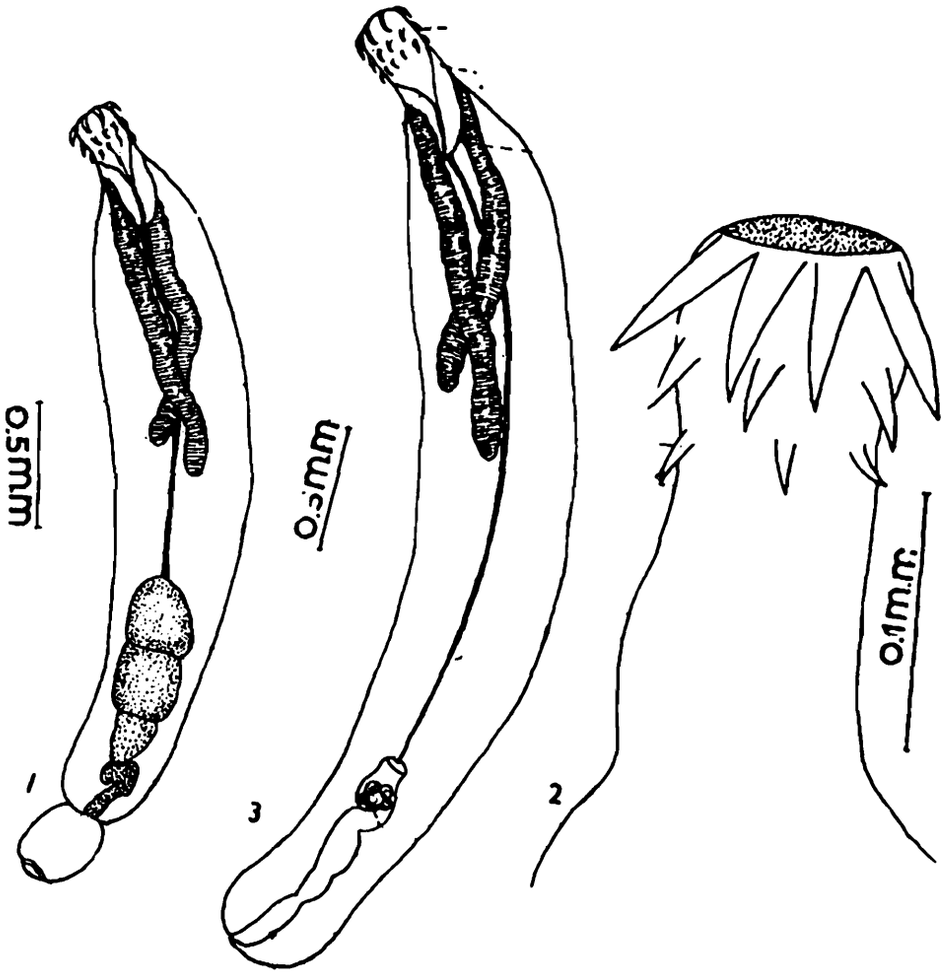


Fig. 304. *Neoechinorhynchus* (*Neoechinorhynchus*) *kallarensis* George & Nadakal, 1978. 1. Male, 2. Female, 3. Proboscis and neck enlarged (after George & Nadakal, 1978).

Description : Males 2-4 × 0.37-0.8 mm; females 3-7 × 0.4-0.9 mm. Proboscis with 3 circular rows of 6-8 hooks each in both sexes, 0.14-0.18 × 0.07-0.15 mm in male, in female 0,22-0.35bx 0.15-0,25 mm. Hooks of first row 0.06-0,1 × 0.015-0.02 mm, of second row 0.03-0.04 × 0.010-0.013 mm, of third row 0.015-0.020 × 0.006-0.01 mm. First and second row hooks with well developed roots, but third hooks without roots. Proboscis receptacle subcylindrical, single-walled with ganglion lying at its base, 0.18-0.2 × 0.14-0.21 mm in males; in females 0.22-0.25 × 0.14-0.15 mm. Neck short. Trunk cylindrical and wide in middle, spinose. Pseudo-segmentation indistinct in both sexes. Lemnisci subequal, saccular, extending to middle of trunk, 1.25-1.32 × 0.06-0.12 mm in males; in females 1.5-1.63 × 0.1-0.15 mm. Testes ovoid, in tandem, post-equatorial, equal, contiguous, 0.30-0.32 × 0.28-0.31 mm. Cement glands ovoid, syncytial, lying just behind posterior testis. Bursa spherical, double-walled. 0.20-0.23 × 0.12-0.15 mm Uterine bell 0.21-0.24 × 0.08-0.15 mm, with 6 rounded uterine pockets on each side. Gonopore terminal. Uterus 0.43-0.50 × 0.10-0.12 mm. Vagina 0.30-0.35 × 0.60 mm. Eggs oval elliptical 0.07-0.085 × 0.029-0.032 mm.

Host : *Lanbuea dadybergeri* (Hamilton & Buchanan), *Rasbora rasbora* (Hamilton & Buchanan).

Location : Intestine.

Locality : Kallar dam (Kerala).

Distribution : Known only from type locality.

336. ***Neoechinorhynchus (Neoechinorhynchus) karachiensis*** Bilqees, 1972 (Fig. 305)

Neoechinorhynchus karachiensis Bilqees, 1972b : 94-96, Fig. 1-8; Bilqees & Khan, 1987 : 9-10, Fig. 8 a-d; Golvan, 1994 : 165;

Neoechinorhynchus (Neoechinorhynchus) karachiensis Amin, 2002 : 9.

Type locality : Karachi coast, Sindh, Pakistan.

Description : Worms creamy white and opaque. Males 6.02–8.98 × 0.77-0.93 mm, females 7.28-20.05 × 0.56-1.44 mm. Proboscis 0.12-0.13 × 0.11-0.13 mm in males, in

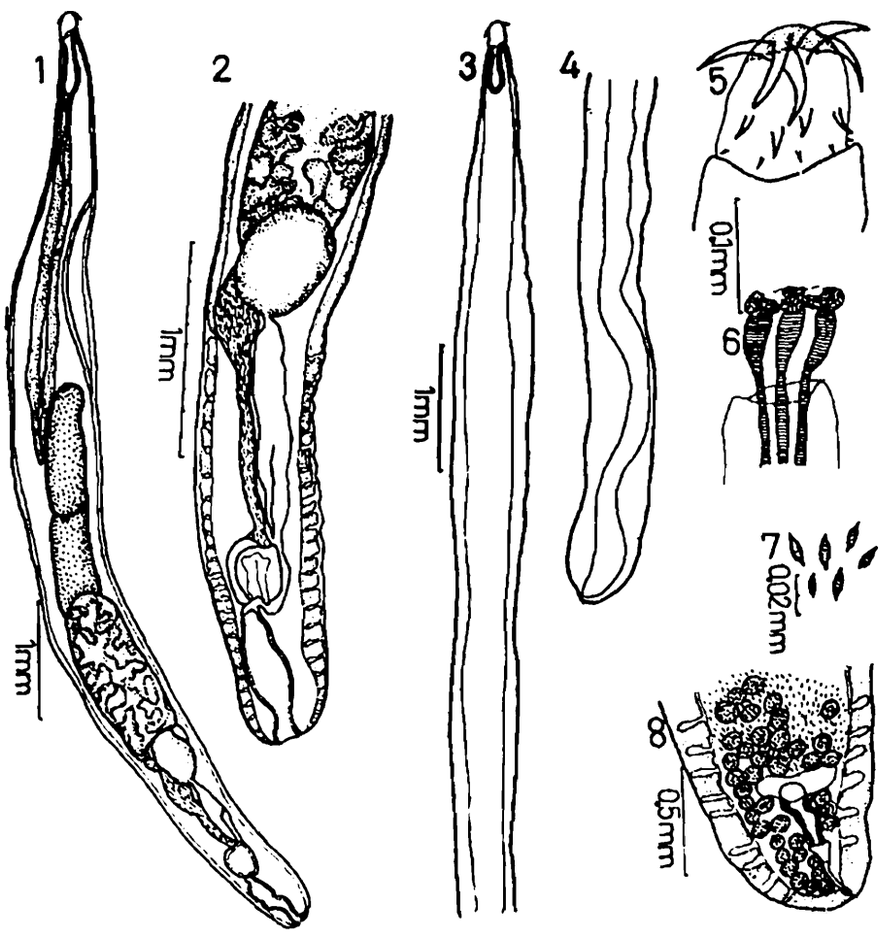


Fig. 305. *Neoechinorhynchus (Neoechinorhynchus) karachiensis* Bilqees, 1972. 1. Male, 2. Posterior part of male, 3,4. Outline of anterior and posterior parts of female, 5. Proboscis enlarged, 6. Proboscis musculature, 7. Ova, 8. Posterior part of female (after Bilqees, 1972).

females 0.10-0.15 × 0.12-0.14 mm, with 3 circular rows of 6 hooks each; anterior hooks largest, smallest hooks at base. Hooks of apical, middle and basal circles 0.05-0.06 mm, 0.039-0.040 mm, 0.010-0.011 mm long in males; in females hooks of same circles 0.06-0.07 mm, 0.04-0.05 mm and 0.009-0.011 mm long. Each anterior large hook with a muscular pad 0.02-0.025 mm in diameter. Proboscis receptacle with ganglion near its base, 0.40-0.52 mm long in males, in females 0.40-0.49 mm long. Trunk cylindrical. Lemnisci tubular 5-8 times as long as receptacle, always equal in length, 3.20-3.78 × 0.04-0.05 mm in both sexes. Testes elongated, directly in tandem, 1.0-1.2 × 0.04-0.045 mm. Cement gland larger than both testes, 1.3-1.44 × 0.50-0.58 mm with its rounded reservoir. Seminal vesicle 0.50-0.55 × 0.40-0.42 mm. Saefftigen's pouch elongated,0.75-0.79 × 0.15-0.17 mm. Bursal cap 0.40-0.42 × 0.3-0.31 mm without digitiform posterior rays. Bursa elongated, 0.70-0.72 × 0.20-0.22 mm. Floating ovarian balls numerous 0.07 mm in diameter. Uterine bell 0.03-0.04 mm wide. Uterus short, tubular, 0.023-0.027 mm long with muscular wall. Vagina tubular, 0.019-0.02 mm long with sphincter of 0.01-0.011 mm in diameter. Eggs small, elongated 0.01-0.02 × 0.005-0.01 mm.

Host : *Mugil spegieleri* (Bloch).

Location : Intestine.

Locality : Karachi coast (Pakistan).

Distribution : Known only from type locality.

Note : Amin (2002) has not assigned this species as egg membranes were not described.

337. ***Neoechinorhynchus (Neoechinorhynchus) nematalosi*** Tripathi, 1959 (Fig. 306)

Neoechinorhynchus nematalosi Tripathi, 1959 : 64-65, Textfig. 2 a, b; Yamaguti, 1963 : 19; Anantaraman. M. & Anantaraman, S., 1970 : 3; Golvan, 1994 : 165;

Neoechinorhynchus (*Neoechinorhynchus*) *nematalosi* Amin, 2002 : 10.

Neoechinorhynchus nematalosi Bhattacharya, 2007 : 80, Pl.13, Fig. 69 a, b.

Type locality : Chilka lake, Orissa, India.

Description : Male 2.33 × 0.24 mm, female 3.25-7.0 × 0.29-0.68 mm. Proboscis globular 0.145 × 0.145 mm with 3 longitudinal rows of unequal hooks. Hooks of anterior row 0.075-0.083 mm, middle row 0.038-0.044 mm, posterior row 0.026-0.030 mm long. Proboscis receptacle 0.20-0.21 × 0.13-0.14 mm. Trunk long with anterior part thinner and followed by a slight swelling of dorsal wall of and thin posterior part. Lemnisci very long with slightly swollen ends, 1.45-2.17 mm long in male. Testis anterior 0.22 × 0.17 mm, posterior 0.29 × 0.17 mm. Cement gland 0.22 × 0.145 mm. Uterine bell and uterus confined to posterior part of female. Eggs 0.019-0.026 × 0.0057 mm.

Host : *Nematalosa nasus.*

Location : Intestine.

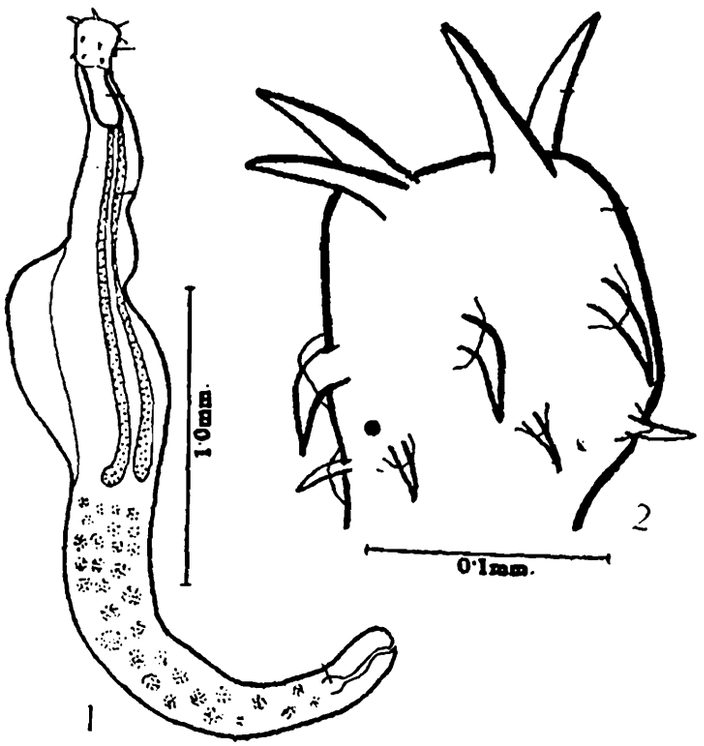


Fig. 306. *Neoechinorhynchus* (*Neoechinorhynchus*) *nematalosi* Tripathi, 1959. 1. Female, 2. Proboscis enlarged (after Tripathi, 1959).

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality.

Note : Amin (2002) has not assigned this species to subgenus as egg membranes were not discussed.

338. ***Neoechinorhynchus (Neoechinorhynchus) nickoli*** Khan, Bilqees, Noor-ur-Nissa, Ghazi & At-ur-Rahim, 1999 (Fig. 307)

Neoechinorhynchus nickoli Khan, Bilqees, Noor-ur-Nissa, Ghazi & At-ur-Rahim, 1999 : 241-243, Fig. 1 a-e, 2;

Neoechinorhynchus (*Neoechinorhynchus*) *nickoli* Amin, 2002 : 6.

Type locality : Hasan Abdal Punjab, Pakistan.

Description : Worms small. Male 4.02-5.07 × 0.64-0.70 mm. Female 6.20-7.24 × 0.79-1.36 mm. Proboscis small, globular, 0.110-0.112 × 0.096-0.098 mm in male, in female 0.098-0.10 × 0.07-0.10 mm, with 3 circles of 6 hooks each. Hooks of apical circle 0.025-0.027 × 0.0061-0.0068 mm, of middle circle 0.0176-0.021 × 0.0034-0.0040 mm, of basal circle 0.0153-0.020 × 0.0030-0.0034 mm in both sexes. Hook roots simple. Proboscis receptacle single-walled 0.23-0.30 × 0.12-0.14 mm in both sexes, with ganglion at its hind end. Neck small, short 0.028-0.035 × 0.24-0.28 mm in male, in female 0.07 × 0.24 mm.

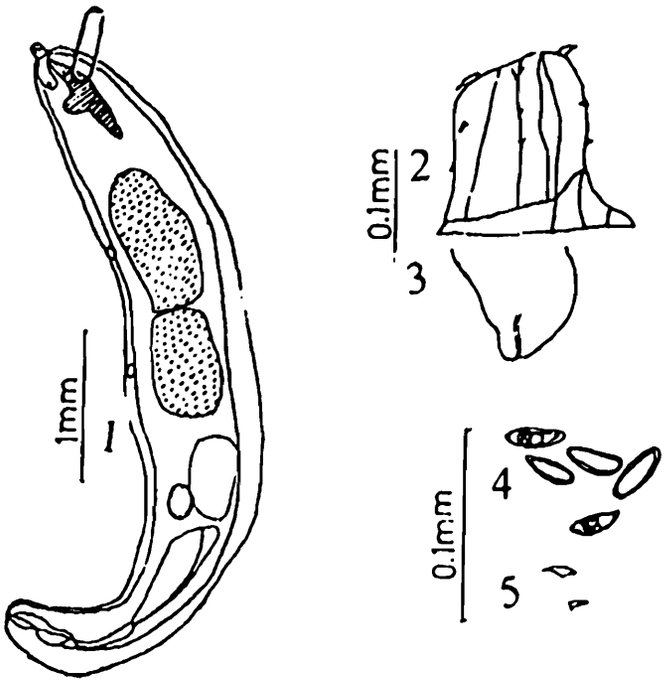


Fig. 307. *Neoechinorhynchus* (*Neoechinorhynchus*) *nickoli* Khan, Bilqees, Noor-ur-Nissa, Ghazi & At-ur-Rahim, 1999. 1. Male, 2. Proboscis enlarged, 3. Posterior part of female, 4. Eggs enlarged, 5. One proboscis hook from each side (after Khan *et al.*, 1999).

Giant hypodermal nuclei conspicuous. Trunk cylindrical, widest at level of anterior testis. Lemnisci unequal approximately 0.40-0.68 × 0.098-0.11 mm in male, in female 0.61-0.68 × 0.098-0.11 mm, one lemniscus curled in most specimens. Testes cylindrical, elongated, anterior 0.84-0.92 × 0.36-0.40 mm, posterior 0.70-0.75 × 0.35-0.36 mm. Cement gland single 0.38-0.51 × 0.26-0.28 mm, its reservoir small 0.084-0.14 × 0.084-0.18 mm. Seminal vesicle 0.40-0.42 × 0.15-0.22 mm. Saefftigen's pouch 0.21-0.23 × 0.16-0.18 mm. Bursa well developed 0.57 × 0.16-0.2 mm. Ovarian balls numerous, 0.054-0.056 × 0.056 mm. Vaginal tubular long. Eggs oval to elongate, 0.039-0.042 × 0.014-0.015 mm.

Host : *Labeo boga* (Hamilton).

Location : Intestine.

Locality : Hasan Abdal Punjab (Pakistan).

Distribution : Known only from type locality.

Note : Amin (2002) considers the assignment of this species to *Neoechinorhynchus* questioinable on the basis of vertical proboscis hooks, not spiral or alternating rows and egg structure questionable, different in drawing and photograph.

339 ***Neoechinorhynchus (Neoechinorhynchus) oreini*** Fotedar, 1968 (Fig. 308)

Neoechinorhynchus oreini Fotedar, 1968 : 147-152, Fig. 1, 2; Gupta, V. & Sinha, 1990b : 45; Golvan, 1994 : 165;

Neoechinorhynchus (*Neoechinorhynchus*) *oreini* Amin, 2002 : 7

Neoechinorhynchus oreini Bhattacharya, 2007 : 89, Pl.14, Fig. 701 a, b.

Type locality : Arapat stream near Anantnag, Jammu and Kashmir, India.

Description : Worms cylindrical with arched lanceolate body. Males 8.0-11.75 × 0.9-1.45 mm, females 11.5-16.8 × 1.2-1.7 mm. Proboscis small, 0.13-0.18 × 0.1-0.16 mm with 3 rows of 6 hooks each. Hooks of apical and middle rows nearly equal and distinctly larger than basal row of hooks. Roots of hooks in first two rows 0.030-0.035 mm long, those of basal row 0.015 mm long. Hooks in first two rows 0.075-0.088 mm long and 0.073-0.085 mm long, those of basal row 0.048-0.053 mm long. Proboscis receptacle single-walled, muscular sac, 0.30-0.38 × 0.085-0.17 mm, with ganglion with nerve fibers located in hinder part of its wall. Inner layer of body wall with transverse and longitudinal muscle fibres and 5-7 subcuticular nuclei located along mid-dorsal and only 2 small nuclei along mid-ventral surface of body wall. Some nuclei are irregular in outline. Lemnisci 2, long, subequal, 1.59-2.9 mm and 1.32-2.68 mm long, with 1 and 2 nuclei. Testes ovoid, in tandem, one behind other in second half of trunk, anterior 0.8-1.5 × 0.56-0.78 mm,

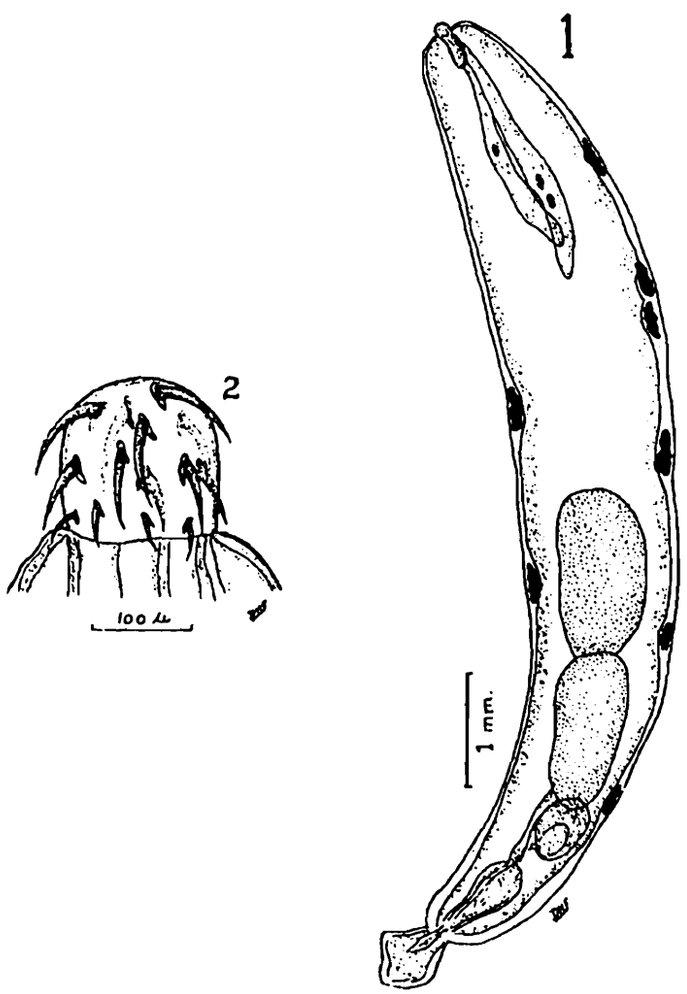


Fig. 308. *Neoechinorhynchus* (*Neoechinorhynchus*) *oreini* Fotedar, 1968. 1. Male 2. Proboscis enlarged (after Fotedar, 1968).

posterior 0.69-1.4 × 0.49-0.6 mm. In some specimens one large testis with slight demarcation in middle, indicating union of two testes. Cement gland ovoid, syncytial, 0.6-0.8 × 0.48-0.7 mm. Seminal vesicle well developed, 0.48-0.75 × 0.20-0.35 mm. Penis 0.3 × 0.08 mm. Copulatory bursa 0.59-0.80 × 0.35-0.54 mm. Fully mature filled with spherical ovarian balls, 0.078-0.20 mm in diameter. Uterine bell 0.58 × 0.28 mm; uterus 0.2 mm long. Vagina 0.06 × 0.05 mm, opens ventrally near posterior end of trunk. Eggs in gravid females 0.030-0.042 × 0.012-0.015 mm.

Host : *Oreinus sinuatus* Haeckel.

Location : Intestine.

Locality : Arapat stream near Anantnag (Jammu & Kashmir).

Distribution : Known only from type locality.

Note : Amin (2000) has not assigned this species to subgenus as egg morphology was not reported.

340. ***Neoechinorhynchus (Neoechinorhynchus) ovalis*** Tripathi, 1959 (Fig. 309)

Neoechinorhynchus ovalis Tripathi, 1959 : 63-64, Textfig. 1; Yamaguti, 1963 : 19; Anantaraman, M. & Anantaraman, S., 1970 : 3; Gupta, V. & Sinha, 1990b : 48; Golvan, 1994 : 165;

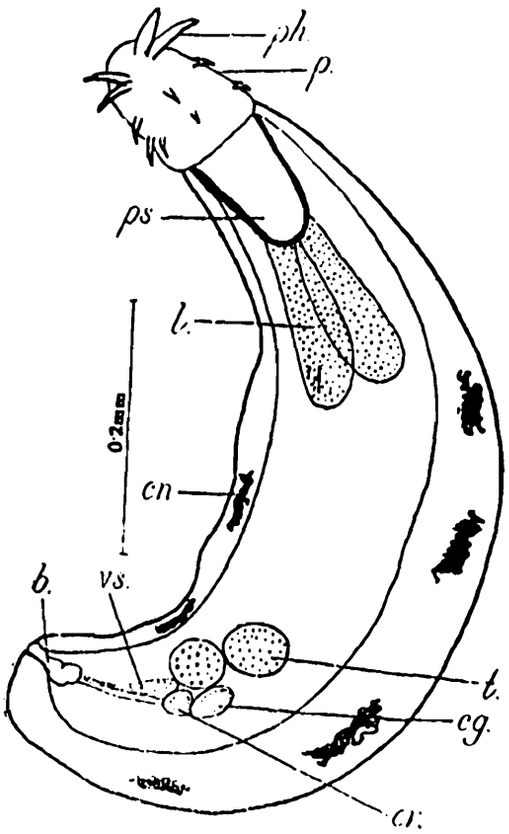


Fig. 309. *Neoechinorhynchus* (*Neoechinorhynchus*) *ovalis* Tripathi, 1959. 1. Male (after Tripathi, 1959).

Neoechinorhynchus (*Neoechinorhynchus*) *ovalis* Amin, 2002 : 10.

Neoechinorhynchus ovalis Bhattacharya, 2007 : 81, Pl. 14, Fig. 75 a, b.

Type locality : Chilka lake, Orissa, India.

Description : Male 0.72 × 0.21 mm; female 0.65 × 0.20 mm. Proboscis 0.114 × 0.091 mm, with 3 circular rows of hooks, hooks of first row 0.06-0.068 mm long, of second and third rows 0.053 mm long. Proboscis receptacle 0.098 × 0.06 mm. Trunk short, plump, oval, with anterior part tapered in region of receptacle, but swollen posteriorly. Hypoderamal nuclei amoeboid, 4 dorsal, 3 ventral. Lemnisci equal 0.247 × 0.045-0.049 mm not reaching testes. Testes spherical, in tandem, in posterior quarter of body. Cement gland pyriform, its reservoir rounded. Seminal vesicle elongated and tapered. Bursa small, about diameter of cement reservoir. Uterine bell, uterus and vagina combined 0.152 mm long. Eggs not developed.

Host : *Elops saurus* Linnaeus.

Location : Intestine.

Locality : Chilka lake (Orissa).

Distribution : Known only from type locality.

Note : Amin (2002) has not assigned this species to subgenus as egg and reproductive organs are not reported and one illustrated male appeared immature.

341. ***Neoechinorhynchus*** (***Neoechinorhynchus***) ***rigidus*** (Van Cleave, 1928) Kaw, 1951 (Fig. 310)

Eosentis rigidus Van Cleave, 1928 : 147-148, Textfig. 1, 2; Datta, 1937 : 303-304;

Neoechinorhynchus rigidus (Van Cleave) Kaw, 1951 : 369-378 : Petrotschenko, 1956 : 210; *Neoechinorhynchus rigidus* Yamaguti, 1963 : 20;

Neoechinorhynchus (*Eosentis*) *rigidus* Anantaraman, M. & Anantraman, S., 1970 : 3;

Neoechinorhynchus rigidus Gupta, V. & Sinha, 1990b : 45; Golvan, 1994 : 166;

Neoechinorhynchus (*Neoechinorhynchus*) *rigidus* Amin, 2000 : 15.

Neoechinorhynchus rigidus Bhattacharya, 2007 : 81, Pl. 15, Fig. 75 a, c.

Type locality : Kashmir, Jammu & Kashmir, India.

Description : Male about 2.4-7.5 × 0.65-0.92 mm; females 4.8-12.0 × 0.7-1.5 mm. Proboscis short, globular 1.21 × 1.10 mm, with 3 circular rows of 6 hooks each, hooks all rooted, anterior hooks 0.13 mm, middle hooks 0.05 mm and basal hooks 0.045 mm long. Proboscis receptacle single-walled, thick, muscular, with ganglion near its base, 0.35 × 0.22 mm. Trunk slightly crescentic in form. Hypodermal nuclei 8-14, up to 10 dorsally and up to 4 ventrally. Lemnisci 2, filiform reaching up to anterior end of posterior testis, with 3 nuclei each, 4.31 × 0.24 mm and 3.92 × 0.24 mm. Testes oval, one behind other, closely apposed, anterior 1.12 × 0.65 mm, posterior 1.10-1.7 × 0.7 mm. Efferent ducts of testes unite to form vas deferens near cement gland and end in a muscular cone-shaped penis.

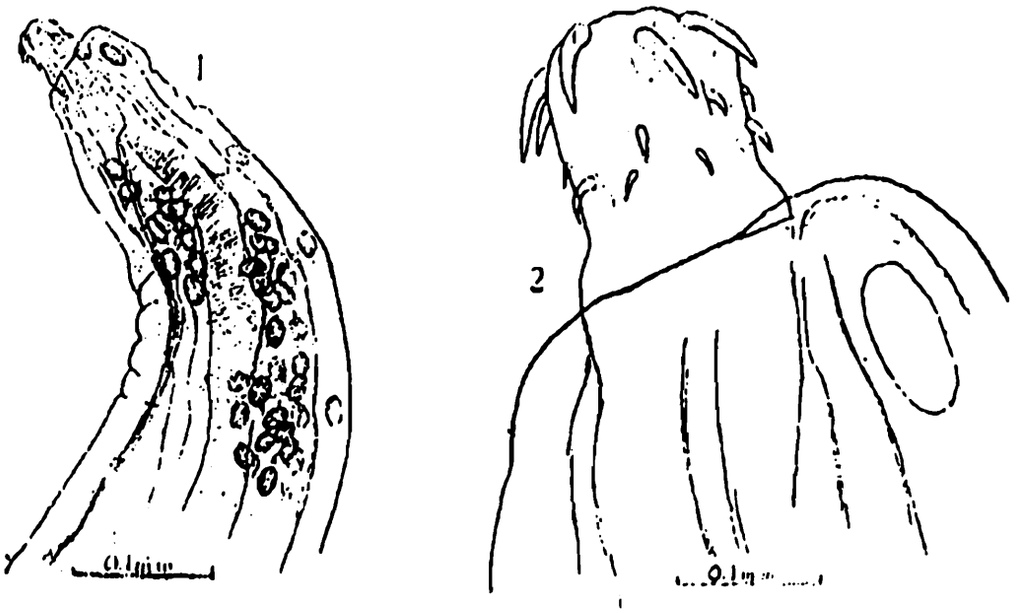


Fig. 310. *Neoechinorhynchus* (*Neoechinorhynchus*) *rigidus* (Van Cleave, 1928) Kaw, 1951. 1. Anterior part of female, 2. Proboscis enlarged (all from Cleave, 1928).

Cement gland single, syncytial mass, 0.79 × 0.40 mm, with 6-8 nuclei, leads into cement reservoir, 0.24 × 0.15 mm which continues as cement duct leading to base of penis. Seminal vesicle balloon-shaped, thin-walled, 0.62 × 0.22 mm. Bursa 0.88 × 0.4 mm. Eggs 0.027-0.030 × 0.012-0.015 mm.

Host : *Schizothorax zarudnyi* (Nikolsky).

Location : Intestine.

Locality : (Jammu & Kashmir).

Distribution : Seistan.

342. ***Neoechinorhynchus* (*Neoechinorhynchus*) *roonwali*** Datta & Soota, 1963 (Fig. 311)

Neoechinorhynchus roonwali Datta & Soota, 1963 : 36-39, Textfig. 1 a-c; Gupta, P. D & Ghosh, 1979 : 316; Golvan, 1994 : 166

Neoechinorhynchus (*Neoechinorhynchus*) *roonwali* Amin, 2002 : 10.

Type locality : Kabul, Afghanistan.

Description : Male 3-8 × 0.6-1.0 mm. al. Proboscis 0.09-0.12 mm long with 3 circles of 6 hooks each. Hooks of first circle largest, 0.044-0.052 mm, of middle circle 0.040-0.044 mm and basal circle 0.036 mm long. Proboscis receptacle nearly 0.37-0.48 mm long. Giant hypodermic nuclei 9-10 dorsal and 2 ventral. Lemnisci equal or subequal, overlapping 2.0-3.8 mm long with 4-6 nuclei. Testes slightly unequal, anterior larger about 0.5-1.0 × 0.3-0.6 mm, posterior smaller about 0.4-0.9 × 0.3-0.6 mm. Cement gland

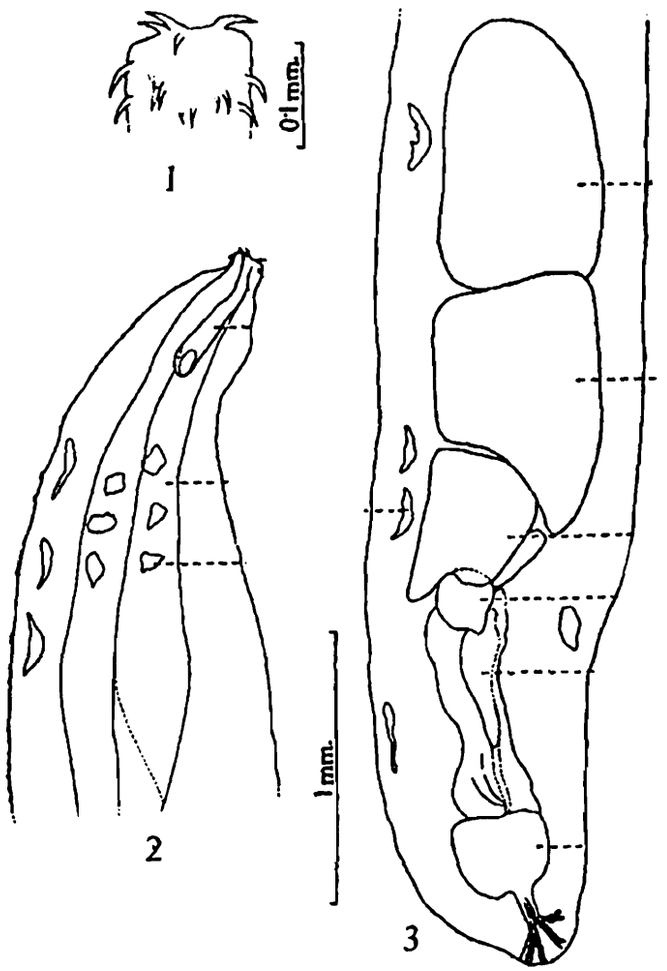


Fig. 311. *Neoechinorhynchus* (*Neoechinorhynchus*) *roonwali* Datta & Soota, 1963. 1. Proboscis enlarged, 2. Anterior part of worm, 3. Posterior part of male (after Datta & Soota, 1963).

nearly 0.2-0.65 mm long its reservoir nearly 0.09-0.2 mm long. Seminal vesicle and bursa 0.8-1.35 mm long. Female not known.

Host : *Oreinus* sp.

Location : Intestine.

Locality : Kabul (Afghanistan).

Distribution : Known only from type locality.

Note : Amin (2002) has not assigned this species to subgenus as no females were reported.

343. ***Neoechinorhynchus (Neoechinorhynchus) sootai*** Bhattacharya, 1999 (Fig. 312)

Neoechinorhynchus sootai Bhattacharya, 1999 : 352-392; 2007 : 81-82 Pl. 35, Fig. 193 a-c.

Type locality : Shillong, Meghalaya, India.

Description : Male 2.328 × 0.389 mm. Female 2.204 × 0.331 mm. Eggs 0.012-0.016 × 0.006 mm. Giant hypodermal nuclei 2 dorsal and 2 ventral. Proboscis 0.0415 × 0.0249 mm, with 6 spiral rows of 3 hooks each, apical hooks 0.03 × 0.008 mm, subapical hooks 0.016 × 0.004 mm, basals 0.016 × 0.004 mm. Proboscis receptacle 0.207 × 0.041 mm. Lemnisci 0;.439 × 0.058 mm. Anterior testis 0.331 × 0.264, posterior testis 0.248 × 0.223 mm. Cement gland syncytial, 0. 231 × 0.166 mm with 6-7 nuclei, its receptacle 0.248 mm long.

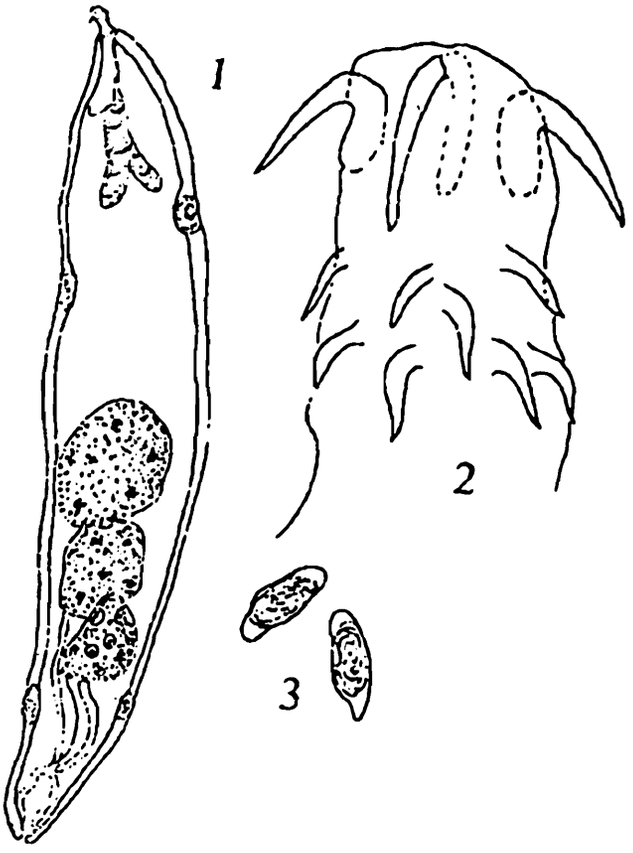


Fig. 312. *Neoechinorhynchus* (*Neoechinorhynchus*) *sootai* Bhattacharya, 1999. 1. Male, 2. Proboscis enlarged, 3. Eggs (after Bhattacharya, 1999).

Host : *Puntius* sp.

Location : Intestine.

Locality : Shillong (Meghalaya).

Distribution : Known only from type locality.

344. ***Neoechinorhynchus (Neoechinorhynchus) topseyi*** Poddar, 1937 (Fig. 313)

Neoechinorhynchus topseyi Poddar, 1937b : 365-368, Fig. 1-3; Petrotschenko, 1956 : 213, Fig. 70; Tripathi, 1959 : 67-68, Textfig. 5 a-c; Yamaguti, 1963 : 20;

Neoechinorhynchus (*Eosentis*) *topseyi* Anantaraman, M. & Anantaraman, S., 1979 : 3;

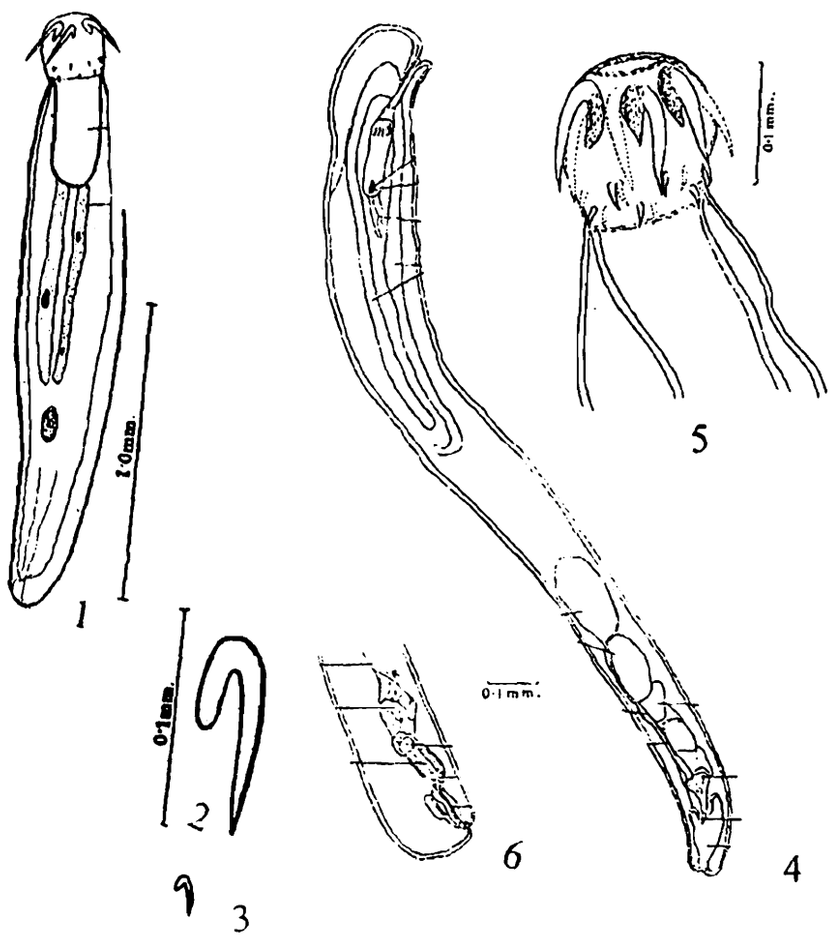


Fig. 311. *Neoechinorhynchus* (*Neoechinorhynchus*) *topseyi* Poddar, 1936. 1. Female, 2,3,. Proboscis hook and trunk spines enlarged, 4. Male, 5. Proboscis and neck enlarged, 6. Posterior part of female (1,2,3 after Tripathi, 1959; after Poddar, 1937).

Neoechinorhynchus topseyi Gupta, P.D. & Ghosh, 1979 : 316; Ahmed & Rauf, 1981 : 119; Ahmed, 1981 : 230; Gupta, N.K. & Jain, 1983 : 407-412, Fig. 1 a-e; Gupta, V. Sinha, 1990b : 49; Golvan, 1994 : 166;

Neoechinorhynchus (*Neoechinorhynchus*) *topseyi* Amin, 2002 : 10;

Neoechinorhynchus topseyi Arthur & Ahmed, 2002 : 41.

Neoechinorhynchus topseyi Bhattacharya, 2007 : 82, Pl. 14, Fig. 73 a-d.

Type locality : Kolkata, West Bengal, India.

Description : Worms creamy white in life. Male 28-30 × 0.439-0.71 mm. Female 35-60 × 0.34-0.504 mm. Proboscis globular, 0.15 × 0.14 mm in male; with 3 spiral rows of 6 hooks each. Hooks of anterior, middle and basal circles 0.081-0.087 ×, 0.012-0.015 mm, 0.026-0.028 × 0.003-0.005 mm and 0.021-0.024 × 0.003-0.005 mm in male; in female same 0.085-0.093 × 0.012 mm, 0.028-0.030 × 0.004 mm, 0.024-0.028 × 0.004 mm. Proboscis receptacle single-walled, cylindrical, with ganglion at its base, 0.374 × 0.162 mm and ganglion 0.081-0.089 × 0.061 mm in male; in female 0.325-0.438 × 0.097-0.162 mm and ganglion 0.11 × 0.04 mm. Neck almost as long as proboscis, 0.10 × 0.162 mm in

male; in female 0.17 × 0.17 mm. Trunk elongated, cylindrical, aspinose. Lacunar system with distinct network channels and vessels. Lemnisci, long, equal or subequal, 1.495-2.247 × 0.081 mm and 1.495-2.178 × 0.081 mm. Testes elongated-oval, in tandem, contiguous in midtrunk, anterior smaller 2.208-3.841 × 0.368-0.414 mm, posterior larger, 5.198-5.658 × 0.414-0.46 mm, with a pair of vasa efferentia run a short distance and unite to form vas deferens Cement gland very long, cylindrical, syncytial mass, 6.44-6.946 × 0.174-0.19 mm. Cement reservoir elongated, pyriform 0.553 × 0.211-0.244 mm. Saefftigen's pouch 0.65-0.764 × 0.041-0.081 mm. Seminal vesicle, thin-walled, narrowing posteriorly and opens into penis. Vas deferens also opens into penis along with duct of seminal vesicle. Copulatory bursa funnel shaped, eversible, 0.487-0.60 × 0.276-0.439 mm, its muscular cap 0.21-0.227 × 0.114 mm. Penis 0.154 × 0.099 mm. Uterine bell thin, infundibular, 0.276-0.325 × 0.121-0.183 mm with an oblique opening, dorsal lip extending farther anteriorly and attached to suspensory ligament and ventral lip attached to ventro-lateral body wall. Uterus with anterior flabby part, 0.145-0.162 × 0.069-0.102 mm and posterior muscular part with sphincter at its middle, 0.121-0.171 × 0.056-0.061 mm. Vagina broader than uterus, 0.140-0.406 × 0.101-0.276 mm. Vaginal glands elongated, 0.174-0.183 × 0.0240.028 mm occur along lateral sides of vagina. Only ovarian balls present. Female gonopore subterminal.

Host : *Polynemus heptadactylus* (Cuvier & Valenciennes,), *P. paradiseus*, *Cynoglossus lingua* Hamilton, *Pseudosclaena diacanthus* Lac.

Location : Intestine.

Locality : Panaji (Goa); Mumbai (Maharastra); Kolkata, estuary of Malta river at Canning, Kolkata (West Bengal); Dhaka (Bangladesh).

Distribution : Known only from Indian subcontinent.

Note : Amin (2002) has not assigned this species as only females with ovarian balls reported.

Note : Poddar (1937) reports : Male 1.30-28.5 x0.17-1.10 mm, female 7.0-69.0 × 0.50-1.5 mm. Proboscis 0.15x 0.14 mm. Hooks (1) 0.095 mm, (2) 0.025 mm, (3) 0.024 mm. Subcuticular nuclei 5 dorsal, 2 ventral. Lemnisci 0.99 × 0.066 mm, 0.836 × 0.066 mm. Anterior testes 4.861 × 0.22 mm, posterior 4.275 × 0.22 mm. Cement gland 1.10 × 0.154 mm, reservoir 0.416 × 0.176 mm. Penis 0.154 × 0.099 mm.

345. ***Neoechinorhynchus* (*Neoechinorhynchus*) *tylosuri*** Yamaguti, 1939 (Fig. 314)

Neoechinorhynchus tylosuri Yamaguti, 1939 : 347-348, Pl 54, 25, Pl. 57, Fig. 35, Pl. 49, Fig. 49-50; Petrotschenko, 1956 : 217-218, Fig. 72; Yamaguti, 1963 : 20, Pl. 83, Fig. 829, 830; Gupta, N.K. & Gupta, K. 1972c : 117-118, Fig. 1-4; Golvan, 1994 : 166;

Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Amin, 2000 : 13.

Neoechinorhynchus tylosuri Bhattacharya, 2007 : 82, Pl. 14, Fig. 72 a-e.

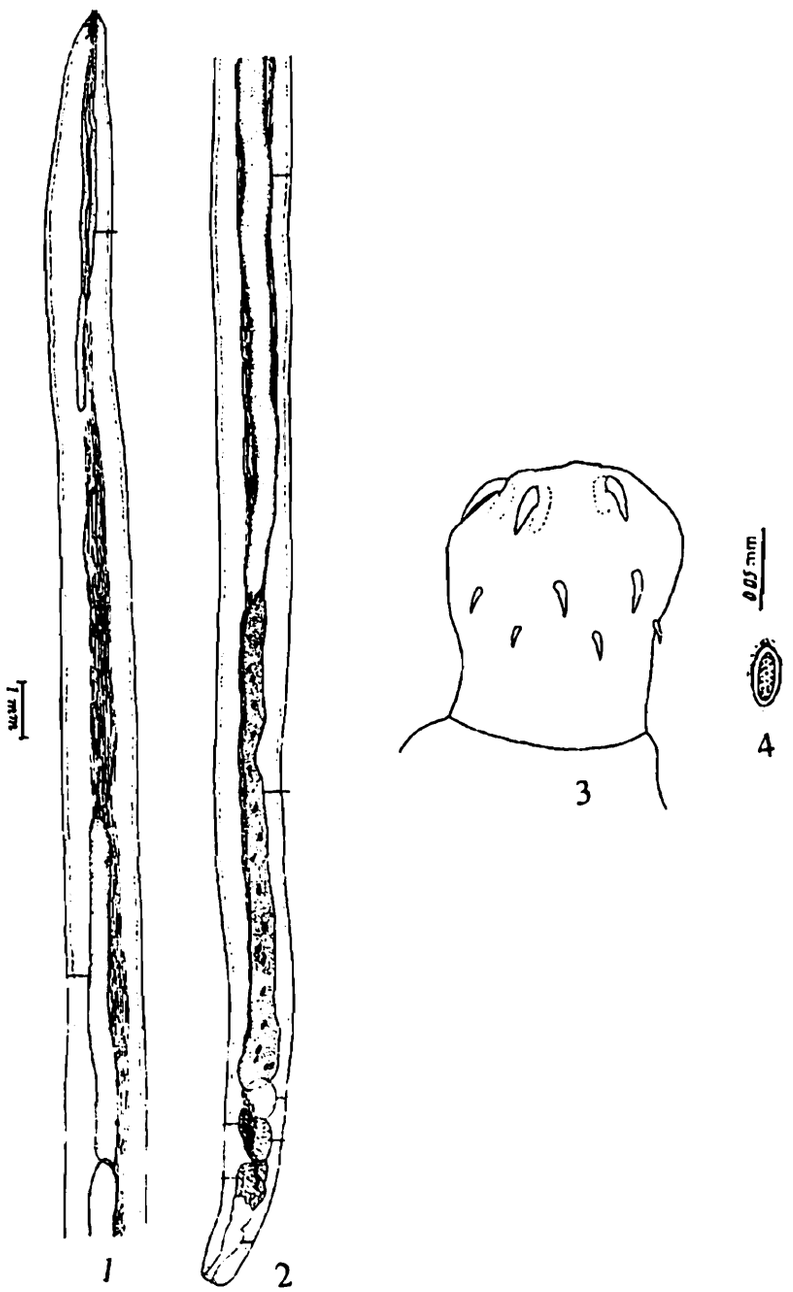


Fig. 314. *Neoechinorhynchus* (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939. 1,2. Anterior and posterior parts of female, 3. Proboscis enlarged, 4. Egg (after Yamaguti, 1939).

Type locality : Hamana lake (Koti), Japan.

Description : Male 12-60-19.80 × 0.8-1.5 mm. Female cylindrical, 21-70-29.58 × 0.55-2.0 mm. Proboscis short, globular, 0.090-0144 × 0.108-0.144 mm truncate in front, with 3 spiral rows of 6 hooks each. Of anterior hooks lateral ones are largest hooks of anterior circle 0.090-0.10 × 0.01-0.015 mm, of middle circle 0.065-0.09 × 0.01-0.015 mm, of basal circle 0.025-0.035 × 0.005-0.007 mm. All hooks well developed with backwardly directed roots. Proboscis receptacle short, subcylindrical, saccular, single-walled, 0.318-0.558 × 0.12-0.18 mm with ganglion at its base. From ganglion arises a pair of antero-median

supplying proboscis. Neck short, conical, aspinose, 0.108-0.198 × 0.126-0.165 mm. Trunk long, slender, nearly cylindrical, aspinose, 0.27-0.81 mm wide, some what narrowed at both ends. Hypodermic nuclei 3 large vermiform in male, 6 nuclei in female. Lemnisci elongated and filiform, 1.53-2.89 × 0.054-0.11 mm. Testes paired elongated, elliptical to cylindrical, directly in tandem, anterior 1.36-2.70 × 0.21-0.27 mm, posterior 1.53-2.79 × 0.16-0.198 mm, usually tapering posteriorly. Sperm ducts two present. Cement gland syncytial, very much elongated, 1.89-2.28 × 0.11-0.14 mm, tapering anteriorly and usually overlapping attenuated posterior end of posterior testis, with 20-22 giant nuclei. Cement reservoir rounded, 0.36-0.39 × 0.198-0.27 mm. Seminal vesicle tubular 0.57-0.93 × 0.14-0.16 mm. Saefftigen's pouch oblong 0.46 × 0.07-0.12 mm. Both seminal vesicle and Saefftigen's pouch terminate in cap of bursa. Bursal cap 0.18 × 0.144-0.162 mm leads into bursa. Inverted bursa 0.43-0.594 × 0.12-0.25 mm opens to outside by male gonopore. Floating ovarian balls numerous, rounded 0.05-0.06 mm in diameter in some specimen of 48 mm long, and of 18 × 0.08-010 mm, in largest mature worm of 70 mm long. Uterine bell cup-shaped 0.2-0.32 × 0.25-0.39 mm, with nuclei at its posterior end. Uterus spindle-shaped 0.27-0.39 × 0.09-0.13 mm, slightly tapering posteriorly. Vaginal small 0.105-0.135 × 0.065-0.075 mm, with a single sphincter posteriorly, opens to outside through subterminal female gonopore. Vaginal duct 0.030-0.042 mm wide, twisted at its anterior end. Posterior vaginal bulb 0.07-0.12 mm wide. Vulva subterminal. Mature eggs oval 0.045 × 0.018 mm.

Host : *Polynemus heptadactylus* (Cuvier & Valenciennes), *P. paradiseus*, *P. sexfilics* *Cynoglossus lingua* Hamilton, *Pseudosciaena diacanthus* Lac., *Tylosurus schismatorgynchus* (Bleeker), *Otolithus branneus*,

Location : Intestine.

Locality : Ernakulam (Kerala), Mumbai (Maharastra).

Distribution : Japan; Russia.

Note : Indian specimens are smaller than Japanese specimens of Yamaguti (1939).

63. Genus ***Paraechinorhynchus*** Bilqees & Khan, 1983

Paraechinorhynchus Bilqees & Khan, 1983 : 117; Golvan, 1994 : 170.

Diagnosis : Neoechinorhynchidae, Neoechinorhymnchinae. Proboscis short, its hooks 18 in 3 spiral rows of varying number. Proboscis receptacle single-walled. Lemnisci digitiform with or without nuclei. Trunk small, cylindrical and slightly curved ventrally. Lacunar system well developed. Giant hypodermal nuclei present. Testes contiguous, oval to elongate. Cement gland syncytial with nuclei, its reservoir small. Eggs small, without polar prolongations of middle shell.

Type species : *Paraechinorhynchus kalraiai* Bilqees & Khan, 1983.

Includes single species *Paraechinorhynchus kalriai* Bilqees & Khan, 1983, which occurs in Pakistan.

346. ***Paraechinorhynchus kalriai*** Bilqees & Khan, 1983 (Fig. 315)

Paraechinorhynchus kalriai Bilqees & Khan, 1983 : 117-119, 1 A-E; 1987 : 14, Fig. 15 a, b, 16 a, b; Golvan, 1994 : 170.

Type locality : Kalri lake, Sinsh, Pakistan.

Description : Worms creamy white in life. Male 7.15-8.87 × 1.29-1.30 mm; female 16.68 × 2.21 mm. Proboscis very short, 0.110-0.112 × 0.089-0.10 mm in male; in female 0.089 × 0.092 mm. Proboscis hooks 18 in 3 spiral rows of 4, 6 and 8, unequal in size; hooks of first row large, 0.068-0.068-0.070 × 0.014-0.018 mm, second and third rows, 0.043-0.046 × 0.0072-0.010 mm in both sexes. Proboscis receptacle single-walled, 0.42-0.46 × 0.10-0.34 mm. Neck short, 0.038-0.051 × 0.13-0.21 mm in male; in female short, 0.025 × 0.115 mm. Trunk cylindrical, wide in middle and narrowing towards both ends, maximum width at one third from anterior end. Lacunar system well developed.

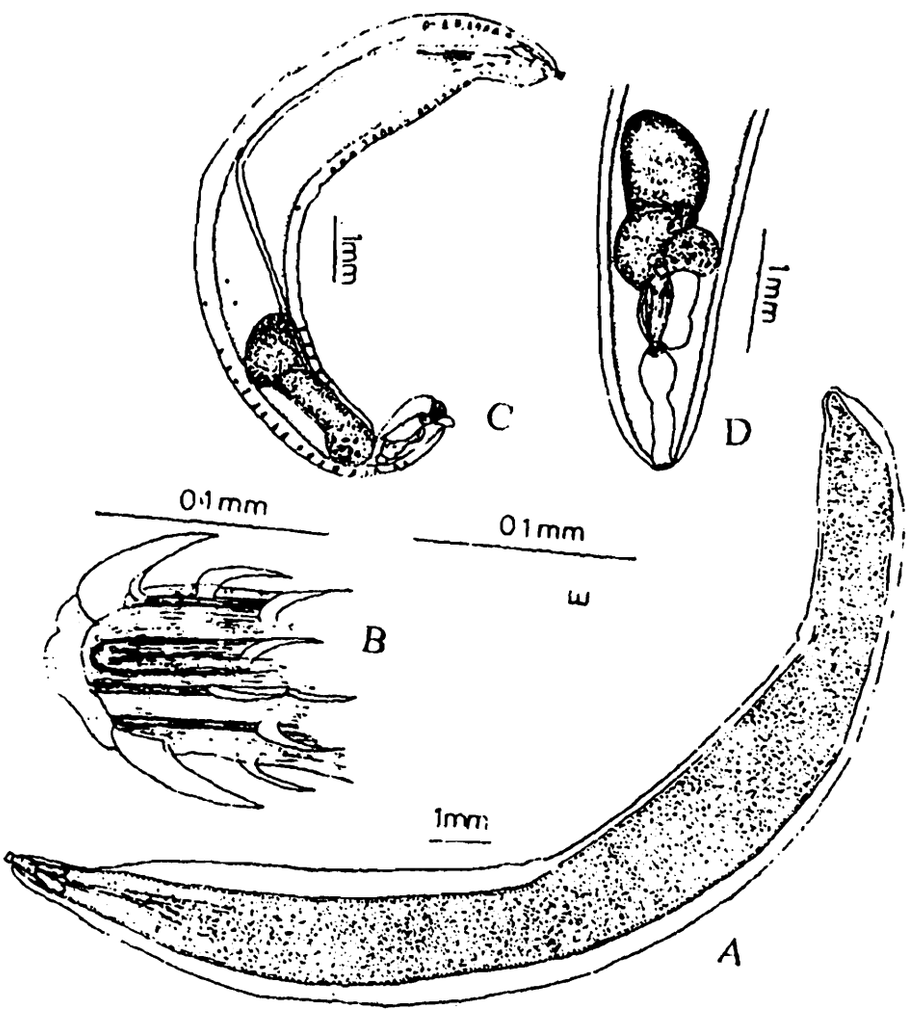


Fig. 315. *Paraechinorhynchus kalriai* Bilqees & Khan, 1983. A. Female, B. Proboscis enlarged, C. Male, D. Posterior part of male (after Bilqees & Khan, 1983).

Hypodermal nuclei present. Lemnisci short, slightly swollen, 0.64-0.72 × 0.14-0.15 mm. Testes anterior slightly flattened and posterior oval to elongate 0.68-1.24 × 0.55-1.08 mm. Cement gland large, syncytial with several nuclei, 0.38-0.73 × 0.43-0.50 mm, its reservoir small, 0.10-0.18 × 0.09-0.13 mm. Saefftigen's pouch oblong, 0.42-0.66 × 0.23-0.29 mm. Seminal vesicle, 0.63-0.68 × 0.21-0.26 mm. Bursal cap small, 0.10-0.13 × 0.10-0.11 mm. Bursa variable in shape, 0.88-0.89 × 0.29-0.33 mm. Eggs oval, 0.010-0.012 × 0.0070-0.0072 mm, without polar prolongations of middle shell,

Host : *Labeo rohita* (Hamilton).

Location : Small intestine.

Locality : Kalri lake, Sindh, Pakistan.

Distribution : Known only from type locality.

64. Genus ***Octospinifer*** Van Cleave, 1919

Octospinifer Van Cleave, 1919 : 244; Southwell & Macfie, 1925 : 149; Meyer, 1932 : 170; Petrotschenko, 1956 : 220; Yamaguti, 1963 : 22; Golvan, 1994 : 167.

Diagnosis : Neoecinarhynchidae, Neoechinorhynchinae. Proboscis globular, wider than long, with 8-10 spiral rows of 3 hooks each. Proboscis receptacle subcylindrical, short, with ganglion at its base. Trunk almost cylindrical, tapering posteriorly, with giant hypodermal nuclei mainly in middorsal line. Lacunar system with prominent mid-dorsal longitudinal channels and reticular anastomoses. Lemnisci tubular, moderately long, with a few giant nuclei. Testes contiguous, in middle third of body. Cement gland syncytial, with several nuclei, well apart from testes. Eggs elliptical, with delicate shell. Parasites of fishes.

Type species : *Octospinifer macilentus* Van Cleave, 1919.

Includes four species 1. *Octospinifer rohitai* Zuberi & Farooqi, 1976, 2. *O. macilentus* Van Cleave, 1919, 3. *O. torosus* Van Cleave & Haderlie, 1950 and 4. *O. variabilis* (Diesing, 1851) von Kritscher, 1976, of which first one occurs in Pakistan.

347. ***Octospinifer rohitae*** Zuberi & Farooqi, 1976 (Fig. 316)

Octospinifer rohitae Zuberi & Farooqi, 1976 : 43-46, Fig. 1-4; Bilqees & Khan, 1987 : 19, Fig. 27 a-d; Golvan, 19948 167.

Type locality : Kinjar lake (Kalri lake) Sindh, Pakistan.

Description : Worms small, yellowish white in life. Male 2.36 × 0.6 mm, female 7.94 × 2.02 mm. Proboscis globular, 0.16 × 0.15 mm in male, in female 0.1 × 0.1 mm, with 8 spiral rows of 3 hooks each, 0.10-0.13 × 0.01-0.02 mm in male; in female 0.08-0.10 × 0.01-0.02 mm. Proboscis receptacle short, subcylindrical, 0.21 × 0.1 mm in male, in female 0.15 × 0.01 mm. Trunk short, cylindrical, aspinose tapering posteriorly in both sexes. Lemnisci short, 0.58 × 0.04 mm in male, in female long, tubular 1.4 × 0.1 mm. Testes 2, close together,

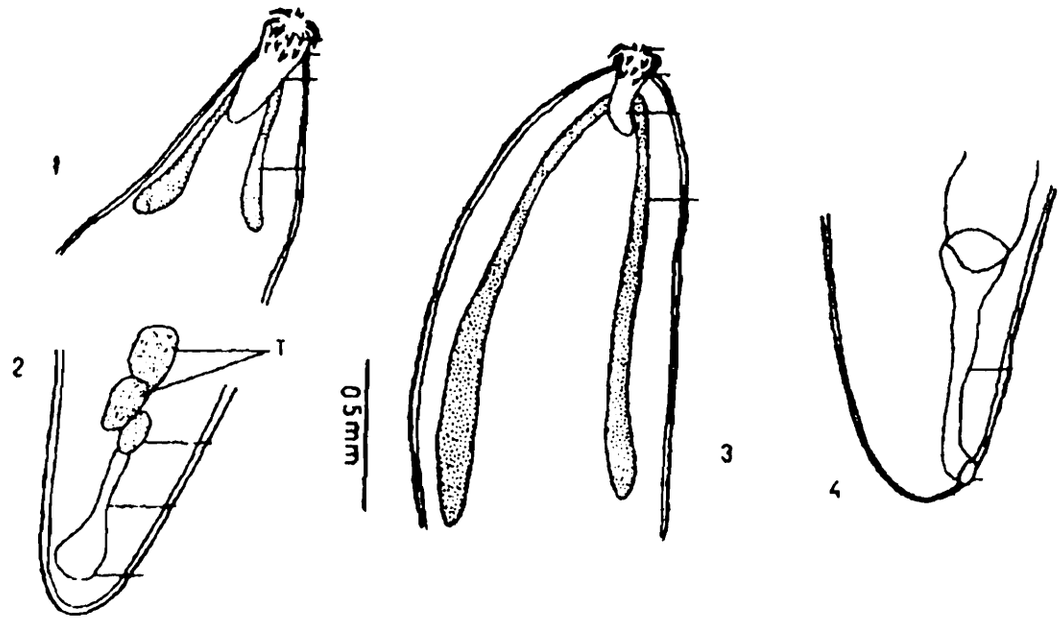


Fig. 316. *Octospinifer rohitae* Zuberi & Farooqi, 1976. 1. Anterior part of male, 2. Posterior part of male, 3. Anterior part of female, 4. Posterior part of female (after Zuberi & Farooqi, 1976).

anterior 0.2 × 0.05 mm, posterior 0.2 × 0.02 mm. Cement gland single, 0.05 × 0.04 mm, its reservoir tubular, 0.25 × 0.04 mm. Bursa rounded at its hind end 0.2 × 0.18 mm, without rays. Vagina long, 0.4 × 0.05 mm. Vulva situated at 0.2 mm from hind end.

Host : *Labeo rohita* (Hamilton).

Location : Intestine.

Locality : Kinjar Lake (Kalri lake) Sind (Pakistan).

Distribution : Known only from type locality.

65. Genus ***Zeylanechinorhynchus*** Fernando & Furtudo, 1963

Zeylanechinorhynchus Fernando & Furtudo, 1963 : 150; Golvan, 1994 : 180.

Diagnosis : Neoechinorhynchidae, Neoechinorhynchinae. Proboscis long with 7 oblique rows of 4 hooks each. Anterior 2 circles of hooks larger and separated from posterior 2 circles by a wide gap. Hooks of anterior circle slightly curved at base and pointed at apex; those of posterior circles more markedly curved at base. Proboscis receptacle well developed. Neck long. Lemnisci narrow and long. Testes large and subequal. Cement gland and reservoir well developed. Saefftigen's pouch flask-shaped. Copulatory bursa bulbous. Uterus bulbous Vagina and sphincters well developed. Gonopore with terminal sphincter. Parasites of fresh water fishes in Asia.

Type species : *Zeylonechinorhynchus longinuchalis* Fernando & Furtudo, 1963.

Includes single species, *Zeylonechinorhynchus longinuchalis* Fernando & Furtudo, 1963 which occurs in Sri Lanka.

348. ***Zeylonechinorhynchus longinuchalis*** Fernando & Furtudo, 1963 (Fig. 317)

Zeylonechinorhynchus longinuchalis Fernando & Furtudo, 1963 : 148-150, Fig. 3 c-f., Golvan, 1994 : 180.

Type locality : Munnereiya, North Central Province, Sri Lanka.

Description : Male 4.15 mm long, 0.48 mm in maximum width; female 3.9-7.5 mm long, 0.25-0.48 mm in maximum width. Proboscis oval, 0.15 × 0.08 mm in male; in female 0.21-0.28 × 0.11-0.14 mm, with 7 oblique rows of 4 hooks each. Two anterior hooks in each row large, and followed at a distance by other two smaller posterior hooks. Larger hooks similar in size and average 0.088 mm long, smaller hooks 0.022 mm long in males; in females larger hooks average 0.108 mm long, smaller 0.035 mm long. Proboscis receptacle 0.22 × 0.11 mm in male; in female 0.28-0.40 × 0.11-0.15 mm. Neck long and cylindrical 0.13 × 0.08 mm. Hypodermal nuclei distinct. Trunk unarmed, stout and usually curls up when fixed. Lemnisci narrow, equal, reach anterior testis, they measure 1.48 mm long. Anterior testis 0.40 × 0.21 mm, posterior testis 0.42 × 0.18 mm. Cement gland large, 0.56 × 0.21 mm, its reservoir somewhat bean-shaped, 0.27 × 0.12 mm. Saefftigen's pouch 0.50 × 0.09 mm. Cirrus sac 0.18 × 0.14 mm. Uterine bell prominent with well developed sorting apparatus. Uterus bulbous. Vagina muscular with prominent sphincter. Eggs elongate average 0.030 × 0.009 mm. Gonopore terminal in both sexes.

Host : *Macrones vittatus* (Bloch).

Location : Small intestine.

Locality : Minneriya, North Central Province (Sri Lanka).

Distribution : Known only from type locality.

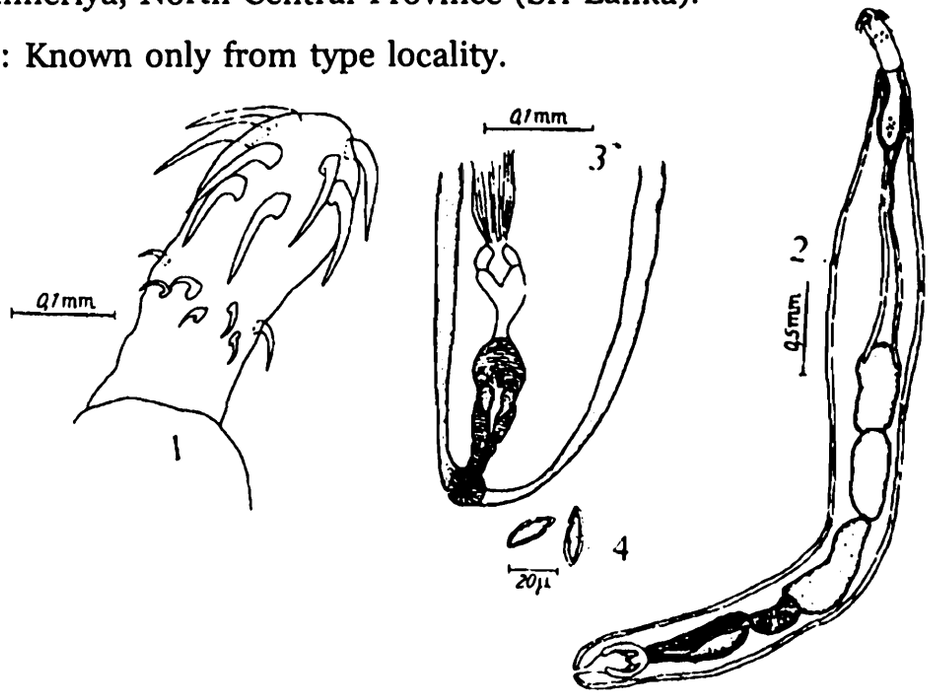


Fig. 317. *Zeylonechinorhynchus longinuchalis* Fernando & Furtudo, 1963. 1. Proboscis and neck enlarged, 2. Male, 3. Posterior part of female, 4. Eggs (after Fernando & Furtudo, 1963).

HOSTS AND PARASITES

Indian hosts and their parasites are arranged alphabetically.

Crustacea

Mesocyclops leukarti (Claus).

Acanthosentis dattai Poddar, 1938.

Mediorhynchus nickoli Khan, Bilqees & Mati-ur-Rehman, 2004.

Spherrirostris lancea (Westrumb, 1821) Golvan, 1956.

Porcillanides pruinosus; (Crustacea).

Centrorhynchus batrachus Das, 1952.

Longicollum lutiani Jain & Gupta, N.K., 1980.

Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.

Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.

Insecta

Periplaneta americana.

Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.

Phyllodromia germanica. Juvinile in

Moniliformis kalahariensis Meyer, 1931 (Juvenile).

Pseudoacanthocephalus crawfordi Baylis, 1933 :

Pisces

Ablennis hians

Rhadinorhynchus hiansi Soota & Bhattacharya, 1981.

Acanthurus strigosus.

Cavisoma magnum (Southwell, 1927) Van Cleave, 1931.

Alectis indica.

Raorhynchus polynemi Tripathi, 1959.

Anabas scandens (Day).

Arhythmorhynchus platystomi George & Nadakal, 1985.

Aoria (*Macrones*) *gulia* Gunther.

Acanthosentis betwai Tripathi, 1959.

Aplocheilus melastigma (Mc Clelland)

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Arioides dussameiri (Cuvier & Valenciennes).

Pseudorhadinorhynchus dussamicitatum Gupta, N.K. & Gupta, K. 1972.

Arius arius (Bleeker).

Cleaeius fotedari (Gupta, S.P. & Naqvi) Kumar, 1992

Diplosentis manteri Gupta, V. & Fatma, 1979.

Arius gagor (Hamilton).

Cleaveius secundus (Tripathi, 1959) Golvan, 1969.

Arius jella Russell.

Indorhynchus indicus (Tripathi, 1959) Golvan, 1969.

Arius platystomus

Micracanthorhynchina golvani Gupta, V. & Sinha, 1992

Metarhadinorhynchus thapari Gupta, R.C. & Gupta, S. P. 1975.

Arhythmorhynchus platystomi George & Nadakal, 1985.

Rhadinorhynchus trivandricus George & Nadakal, 1978.

Raosentis ivaniosi George & Nadakal, 1978.

Arius serratus Day.

Acanthosentis arii Bilqees, 1971.

Filisoma indicum Van Cleave, 1928.

Pallisentis (*Brevitritospinus*) *indicus* Mital & Lal, 1981.

Polymorphus (*Polymorphus*) *ariusis* Bilqees, 1971. Amin, 1992.

Polymorphus (*Polymorphus*) *karachiensis* (Bilqees, 1971). Amin, 1992.

Serrasentis sagittifer (Linton, 1889) Linton, 1932.

Auxis thazard.

Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985

Barbus sp.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Barbus stigma (Cuvier & Valenciennes)

Acanthosentis dattai Poddar, 1938.

Acanthosentis holospinus Sen, 1938.

Quadrgyrus sinhai Gupta, V. & Fatma, 1986.

Barbus ticto (Hamilton & Buchanan).

Acanthosentis dattai Poddar, 1938.

Neoechinorhynchus (*Neoechinorhynchus*) *chilkaensis* Poddar, 1937.

Belone choram (Ruppell).

Longicollum quiloni Gupta, S.P. & Naqvi, 1984.

Caranx kalla (Cuvier & Valenciennes).

Neogorgorhynchoides cablei Gupta, V. & Fatma, 1987.

Pallisentis (Brevitritospinus) mehrai Gupta, V. & Fatma, 1986.

Quadrgyrus guptai Gupta, V. & Sinha, 1992.

Serrasentis nadakali George & Nadakal, 1978.

Caranx malabaricus (Cuvier & Valenciennes).

*Gorgorhynchoides valiyathurae (*Nadakal, John & Jacob, 1990) Bhattacharya, 2007.

Pseudorhadinorhynchus cinereus Gupta, S.P. & Naqvi, 1983.

Pseudorhhadinorhyncus cochinensis Gupta, S.P. & Naqvi, 1081.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Caranx nigripinnis (Russel).

*Gorgorhynchoides valiyathurae (*Nadakal, John & Jacob, 1990) Bhattacharya, 2007.

Catfish

*Paracanthocephaloides tripathi i*Golvan, 1959,

Catla catla Hamilton-Buchanan.

Acanthogyrus acanthogyrus Thapar, 1927.

Acanthosentis heterospinus Khan & Bilqees, 1990.

Pallisentis (Demidueterospinus) pandei Rai, 1967.

Raosentis thapari Rai, 1967.

Dispiron catla Khan & Bilqees, 1987.

Channa gachua (Hamilton & Buchanan),

Pallisentis (Pallisentis) nagpurensis (Bhalerao, 1931) Bayis, 1933.

Channa marulius (Bloch).

Pallisentis (Brevitritospinus) allahabadi Agarwal, 1958.

Pallisentis (Demidueterospinus) ophiocephali (Thapar, 1931) Baylis, 1933.

Pallisentis (Pallisentis) nagpurensis (Bhalerao, 1931) Bayis, 1933.

Channa punctata (Bloch).

Pallisentis (Brevitritospinus) allahabadi Agarwal, 1958.

Pallisentis (Demidueterospinus) ophiocephali (Thapar, 1931) Baylis, 1933.

Pallisentis (Demidueterospinus) pandei Rai, 1967.

Pallisentis (Pallisentis) colisai Sarkar, 1954.

Pallisentis (Pallisentis) nagpurensis (Bhalerao, 1931) Bayis, 1933.

Raosentis thapari Rai, 1967.

Channa sp.

Centrorhynchs brevicaudatus Das, 1950.

Pallisentis (Brevitritospinus) croftoni Mital & Lal, 1981.

Pallisentis (Brevitritospinus) indicus Mital & Lal, 1981.

Pallisentis (*Pallisentis*) *colisai* Sarkar, 1954.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Channa striatus (Bloch).

Acanthosentis tilapiae Baylis, 1947.

Arhythmorhynchus platystomi George & Nadakal, 1985.

Pallisentis (*Demidueterospinus*) *basiri* Farooqi, 1958.

Pallisentis jagani Koul, Raina, Bambroo & Koul, 1991.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Pallisentis (*Pallisentis*) *sindensis* Khan & Bilqees, 1987.

Pomphorynchus bulbocolli Linkins in Van Cleave, 1919.

Saccosentis ophoiocephali Jain & Gupta, N.K. 1979.

Charadrius dubius curonicus.

Mediorhynchus micracanthus (Rudolphi, 1819) Meyer, 1932.

Chela baicala (Hamilton).

Acanthosentis bacailai Verma, 1973.

Chorinemus moadetta (Cuvier & Valenciennes).

Euzetacanthus chorinemusi Gupta, S.P. & Naqvi, 1984.

Cirrhina cupla.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Cirrhinus reba (Hamilton).

Acanthosentis bilaspurensis Chowhan, Gupta, N.K. & Khera, 1987.

Cirrhina sp.

Acanthogyrus acanthogyrus Thapar, 1927.

Neoechinorhynchus (*Neoechinochynchus*) *cirrhinae* Gupta, N. K. & Jain, 1979.

Clarias batracus (Jerdon).

Acanthosentis tilapiae Baylis, 1947.

Arhythmacanthus zdzitowieckii Kumar, 1992.

Hypochinorhynchus golvani Gupta, P.C. & Kumar, 1988.

Cleaveius durdanae Kumar, 1992.

Centrorhynchus bethaniae George & Nadakal, 1987.

Pallisentis (*Pallisentis*) *clupei* Gupta, S.P. & Gupta, R. C. 1977.

Pallisentis (*Pallisentis*) *fotedari* Gupta, V. & Sinha, 1991.

Tenuiproboscis clupei Gupta, V. & Sinha, 1992.

Clupea longiceps (Gunther).

Pallisentis clupei Gupta, S.P. & Gupta, R. C., 1977.

Tenuiproboscis clupei Gupta, V. & Sinha, 1992.

Clupisoma garua (Hamilton).
Pallisentis (*Pallientis*) *garuai* (Sahay, Sinha & Ghosh, 1971) Jain & Gupta, N.K. 1979.
Colisa fasciatus (Bloch & Schinder).
Pallisentis (*Pallisentis*) *colisai* Sarkar, 1954.
Cybium guttatum (Lacepede).
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Cynoglossus lingua Hamilton.
Neoechinorhynchus (*Neoechinorhynchus*) *topseyi* Poddar, 1937.
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Rhadinorhynchus stunkardi Gupta, V. & Fatma, 1987.
Cynoglossus lingua (Hamilton & Buchanon).
Serrasentis nadakali George & Nadakal, 1978.
Diptychus maculatus (Steindachner).
Neoechinorhynchus (*Neoechinorhynchus*) *hutchinsoni* Datta, 1936.
Echeneis naucrates (Day).
Rhadinorhynchus echeneisi Gupta, S.P. & Gupta, R.C. 1981.

Eel

Pallisentis (*Pallisentis*) *colisai* Sarkar, 1954.
Elacate nigra.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Elops saurus Linnaeus.
Arhythmacanthus thapari (Gupta, V. & Fatima, (1969) Amin, 1985.
Neoechinorhynchus (*Neoechinorhynchus*) *ovalis* Tripathi, 1959.
Serrasentis indicus Singh, Agarwal & Laksmi, 1988.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Engraulis malabaricus Cuvier & Valenciennes.
Longicollum engralisi Gupta, V. & Fatma, 1985.
Pseudorhadinorhynchus longicollum Gupta, S. P. & Naqvi, 1986.
Pseudorhadinorhynchus machidai Kumar, 1992.
Serrasentis engralisi Gupta, S.P. & Gupta, R.C. 1980.
Epinephelus chlorostigma.
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Etroplus maculates (Bloch).
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Etroplus suratensis (Bloch).
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Euthynnus affinis (Cantor).
Bolbosoma vasculosum (Rudolphi, 1819) Porta, 1908.
Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985.
Eutropichthys vacha (Hamilton).
Raosentis dattai Gupta, V. & Fatma, 1986.
Gagata batasio (Hamilton).
Yamagutisentis nickoli Kumar, 1992.
Gagata cenia (Hamilton).
Pseudorhadinorhynchus machidai Kumar, 1992.
Gerres abreveatus
Gorgothynchoides indicus Bhattacharya & Banerjee, 2003.
Gerres filamentosus,
Longicollum lutiani Jain & Gupta, N.K., 1980.
Gerres setifer (Hamilton).
Cleaveius indicus Saxena, 2004.
Longicollum cadenati Gupta, S.P. & Naqvi, 1984.
Tenuiproboscis guptai Gupta, V. & Sinha, 1990.
Glossogobius giuris (Hamilton).
Acanthosentis giuris Soota & Sen, 1956.
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Pallisentis (*Pallisentis*) *nandai* Sarkar, 1953.
Metechinorhynchus kushiroensis (Fujita, 1921) Golvan, 1969.
Glyptosternum sp.
Neoechinorhynchus (*Neoechinorhynchus*) *glyptosternumi* Fotedar & Dhar, 1977.
Grihiria (*Cirrihina*) *cupla.*
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.
Gomphorus coeruleus.
Serrasentis mujibi Bilqees, 1972.
Harpodon nehereus (Hamilton-Buchanon).
Paracanthocephaloides golvani Chandra, Rao & Shyamasundari, 1984.
Harpodon sp.
Raorhynchus polynemi Tripathi, 1959.
Hemirhamphus marginatus (Bleeker).

Micracanthorhynchina chandrai Bhattacharya, 2007.
Heteropneustes fossilis (Bloch).
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Hilsa ilisha Hamilton.
Acanthogyrus hilsai Pal, 1963.
Raosentis thapari Rai, 1967.
Acanthosentis indica Tripathi, 1959.
Acanthosentis thapari Prasad, Sahay & Shambunath, 1969.
Pallisentis (*Demidueterospinus*) *pandei* Rai, 1967.
Istiophorus gladius.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Johnius areus Bloch.
Gorgorhynchoidess golvani(Chandra, Rao & Shyamasundari, 1984) Bhattacharya, 2007.
Johnius axillaris (Cuvier & Valenciennes).
Serrasentis nadakali George & Nadakal, 1978.
Johnius dussamieri,
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Kaloula palora.
Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.
Yamagutisentis cochinensis (Gupta, S.P. & Naqvi, 1984) Kumar, 1992.
Kathala axillaris (Cuvier).
Gorgorhynchoides golvani (Chandra, Rao & Shyamasundari, 1984)Bhattacharya, 2007.
Katsuwonus pelamis.
Rhadinorhynchus pristis (Rudolphi, 1802) Lühe, 1911.
Labeo bata (Hamilton).
Acanthogyrus acanthogyrus Thapar, 1927.
Labeo boga (Hamilton).
Neoechinorhynchus (*Neoechinorhynchus*) *nickoli* Khan, Bilqees, Noor-ur-Nissa, Ghazi & At-ur-Rahim, 1999.
Labeo gonius Mc Clelland.
Acanthosentis betwai Tripathi, 1959.
Labeo rohita (Hamilton) Gunther.
Acanthohogyrus acanthogyrus Thapar, 1927.
Acanthosentis antespinus Verma & Datta, 1929.
Acanthosentis betwai Tripathi, 1959.

Acanthosentis gobindi Chowhan, Gupta, N.K. & Khera, 1987.
Acanthosentis golvani Gupta, N.K. & Jain, 1980.
Acanthosentis shuklai Agarwal & Singh, 1982
Acanthosentis vancleavei Gupta, V. & Fatma, 1986.
Dispiron heteracanthus Khan & Bilqees, 1985.
Neoechinorhynchus (Neoechinorhynchus) formosanus (Harada, 1938) Kaw, 1951.
Neoechinorhynchus (Neoechinorhynchus) gibsoni Khan & Bilqees, 1989.
Pallisentis (Pallisentis) colisai Sarkar, 1954.
Pallisentis (Pallisentis) kalriai Khan & Bilqees, 1985.
Neoechinorhynchus (Neoechinorhynchus) devdevi (Datta, 1936) Kaw, 1951.
Octospinifer rohitae Zuberi & Farooqi, 1976.
Paraechinorhynchus kalriai Bilqees & Khan, 1983.
Lanbuea dadybergeri (Hamilton & Buchanan).
Neoechinorhynchus (Neoechinorhynchus) kallarensis George & Nadakal, 1978.
Leiognathus equualus (Forskaal).
Bullockrhynchus indicus Chandra, Rao & Shyamasundari, 1985.
Raorhynchus schmidti George & Nadakal, 1978.
Leiognathus splendens (Cuvier).
Cleaveius leiognathi Jain & Gupta, N.K., 1980.
Cleaveius portblarensis Jain & Gupta, N. K.1980.
Leiognathus (= *Equula*) *splendens* (Cuvier).
Goacanthus panajiensis Gupta, N.K. & Jain, 1980.
Lepidocephalichthys guntea Hamilton
Pallisentis (Pallisentis) guntei Sahay, Nath & Sinha, 1967.
Leptacanthus savala (Cuvier).
Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985.
Lethrinus reticulatus.
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Liza microlepis.
Neoechinorhynchus (Neoechinorhynchus) chilkaensis Poddar, 1937.
Lobates surinamensis.
Longicollum indicum Gupta, N.K. & Gupta, K., 1970
Lutjanus calcarifer (Bloch).
Serrasentis sagittifer (Linton, 1889) Linton, 1932.

Lutianus fulbiflama

Gorgorhynchoides indicus Bhattacharya & Banerjee, 2003.

Lutianus johnii (Bloch).

Longicollum lutiani Jain & Gupta, N.K., 1980.

Serrasentis sagittifer (Linton, 1889) Linton, 1932.

Telosentis mizellei Gupta, V. & Fatma, 1988.

Lutianus leiglossus

Telosentis lutianus Gupta, V.C. & Gupta, P.C. 1989.

Lutjanus sp

Serrasentis sagittifer (Linton, 1889) Linton, 1932.

Macrones gulia (Gunther).

Acanthosentis indica Tripathi, 1959.

Macrones vittatus (Bloch).

Zeylonechinorhynchus longinuchalis Fernando & Furtudo, 1963.

Macropodus cupanus.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.

Mastacembalus armatus Cuvier & Valencielles.

Raosentis poddari Datta, 1947.

Raosentis thapari Rai, 1967.

Megalops cyprinoids (Swainson).

Arhythmorhynchus platystomi George & Nadakal, 1985.

Megalopsis cordyla

Gorgorhynchoides indicus Bhattacharya & Banerjee, 2003.

Mesocyclops leukarti (Claus).

Acanthosentis dattai Poddar, 1938.

Mediorhynchus nickoli Khan, Bilqees & Mati-ur-Rehman, 2004.

Spherirostris lancea (Westeumb, 1821) Golvan, 1956.

Mugil cunchanni Bloch.

Dispiron mugilis Bilqees, 1970.

Mugil cephalus Linnaeus.

Cleaveius thapari (Gupta, S.P. & Naqvi, 1980) Kumar, 1992.

Neoechinorhynchus (*Neoechinorhynchus*) *chilkaensis* Poddar, 1937.

Neoechinorhynchus (*Hebesoma*) *agilis* (Rudolphi, 1819) Van Cleave, 1916.

Pseudorhadinorhynchus srivastavai Gupta, V. & Fatma, 1986.

Mugil dussamieri Cuvier & Valenciennes.

Neoechinorhynchus (*Neoechinorhynchus*) *elongatus* Tripathi, 1959.
Serrasentis golvani Gupta, P.C. & Kumar, 1989.
Mugil parsia (Hamilton).
Neoechinorhynchus (*Neoechinorhynchus*) *chilkaensis* Poddar, 1937.
Mugil spergielaris Bloch.
Neoechinorhynchus (*Neoechinorhynchus*) *formosanus* (Harada, 1938) Kaw, 1951.
Neoechinorhynchus (*Neoechinorhynchus*) *karachiensis* Bilqees, 1972.
Mugil sp.
Centrorhynchus sharmai (Gupta, N.K. & Lata, 1966) Gupta. V & Fatma, 1967.
Centrorhynchus sholapurensis Rengaraju & Das, 1977. *G*
Gracilisentis mugilis Gupta, N.K. & Lata, 1968.
Mugil subviridis Cuvier & Valenciennes.
Neoechinorhynchus (*Neoechinorhynchus*) *elongatus* Tripathi, 1959.
Pseudorhadinorhynchus orissi Gupta, V. & Fatma, 1986.
Mugil tada Forsskal.
Neoechinorhynchus (*Neoechinorhynchus*) *bangoni* Tripathi, 1959,
Cleaveius inglisi (Gupta, V. & Fatma), Kumar, 1992.
Mystus armatus
Pallisentis (*Demidueterospinus*) *pandei* Rai, 1967.
Raosentis poddari Datta, 1947.
Mystus cavasius (Hamilton).
Pallisentis (*Brevitritospinus*) *cavasii* Gupta, S.P. &Verma, 1980.
Raosentis poddari Datta, 1947.
Raosentis thapari Rai, 1967.
Mystus (*Macrones*) *gulia* Gunther.
Acanthosentis antespinus Verma & Datta, 1929.
Acanthosentis betwai Tripathi, 1959.
Acanthosentis indica Tripathi, 1959.
Acanthosentis oligospinus Anantaraman, S., 1980.
Mystus seenghala (Sykes) Hamilton.
Acanthosentis antespinus Verma & Datta, 1929.
Acanthosentis golvani Gupta, N.K. & Jain, 1980.
Acanthosentis indica Tripathi, 1959.
Acanthosentis seenghalae Chowhan, Gupta, N.K. & Khera, 1988.
Cleaveius mysti (Sahay & Sinha) Amin, 1985.

Mystus vittatus (Bloch).
Acanthosentis vittatusi Verma, 1973.
Pallisentis (*Demidueterospinus*) *pandei* Rai, 1967.
Raosentis poddari Datta, 1947.
Raosentis thapari Rai, 1967.
Neoechinorhynchus (*Neoechinorhynchus*) *aminulhaquei* Chandra, 1983.
Nandus nandus (Hamilton-Buchanan).
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.
Pallisentis (*Pallisentis*) *gomtii* Gupta, S.P. & Verma, 1980.
Pallisentis (*Pallisentis*) *guntei* Sahay, Nath & Sinha, 1967.
Pallisentis (*Pallisentis*) *guptai* Gupta, V. & Fatma, 1986.
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Pallisentis (*Pallisentis*) *nandai* Sarkar, 1953.
Pseudorhadinorhynchus nandai Gupta, V. & Sinha, 1993.
Nemachilus kashmirensis.
Pomphorhynchus kashmirensis Kaw, 1941.
Nemachilus stoliezkie Steindacher.
Neoechinorhynchus (*Neoechinorhynchus*) *dattai* Golvan, 1994.
Nemachilus vittatus (Heckel).
Neoechinorhynchus (*Neoechinorhynchus*) *dattai* Golvan, 1994.
Nematolosia nausus (Bloch.).
Neoechinorhynchus (*Neoechinorhynchus*) *nematalosi* Tripathi, 1959.
Raorhynchus thaari Gupta, V. & Fatma, 1981.
Nemipterus japonicus (Bloch).
Serrasentis nadakali George & Nadakal, 1978.
Nemipterus sp.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Ompok pabda (Hamilton).
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933);
Oreinus plagyostomus Mc Lelland.
Pomphorhynchus jammuensis Fotedar & Dhar, 1974.
Oreinus sinuatus Haeckel.
Nephridiacanthus oreinus (Fotedar, 1968) Golvan, 1994.
Neoechinorhynchus (*Hebesoma*) *manasbalensis* Kaw, 1951.
Neoechinorhynchus (*Neoechinorhynchus*) *oreini* Fotedar, 1968.

Oreinus sp.

Neoechinorhynchus (*Neoechinorhynchus*) *roonwali* Datta & Soota, 1963.

Pomphorhynchus kashmirensis Kaw, 1941.

Oreinus striatus Haeckel.

Pomphorhynchus oreini Fotedar & Dhar, 1974.

Osteogeniosus militaris (Linnaeus) Bleeker.

Cleaveius secundus (Tripathi, 1959) Golvan, 1969.

Cleaveius singhai (Gupta, V. & Fatma, (1987) 1989 Kumar, 1992.

Indorhynchus indicus (Tripathi, 1959) Golvan, 1969.

Otolithus branneus.

Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.

Pama pama (Hamilton-Buchanon).

Cleaveius secundus (Tripathi, 1959) Golvan, 1969.

Pangasius pangasius (Hamilton).

Cleaveius prashadi (Datta, 1940) Golvan, 1969.

Pelamys chilensis Cuvier & Valenciennes.

Pseudorhadinorhynchus deeghai Saxena, 2004.

Rhadinorhynchus dollfusi Gupta, V. & Fatma, 1988.

Rhadinorhynchus pelamysi Gupta, S.P. & Gupta, R.C., 1980.

Pelamys sarda (Linnaeus).

Raorhynchus terebra (Rudolphi, 1819) Tripathi, 1959.

Pennahia argentea (Houttuyn).

Neoechinorhynchus (*Neoechinorhynchus*) *argentatus* Chandra, Rao & Shyamasundari, 1987.

Paracanthocephaloides golvani Chandra, Rao & Shyamasundari, 198

Pennahia macrophthalmus.

Longicollum indicum Gupta, N.K. & Gupta, K., 1970.

Plotossus anguilliaris Linnaeus.

Paracanthocephaloides tripathii Golvan, 1969.

Plotosus canius Hamilton-Buchanan.

Cleaveius secundus (Tripathi, 1959) Golvan, 1969.

Paracanthocephaloides tripathii Golvan, 1969.

Arhythmacanthus septacanthus (Sita, 1949) Amin, 1985;

Polydactylus indicus (Bloch).

Rhadinorhynchus keralensis Gupta, V. & Fatma, 1989.

Polynemus chilensis Cuvier & Valenciennes.
Rhadinorhynchus polynemi Gupta, N.K. & Lata, 1968.
Polynemus heptadactylus Cuvier & Valenciennes.
Neoechinorhynchus (*Neoechinorhynchus*) *topseyi* Poddar, 1937.
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Rhadinorhynchus polynemi Gupta, N.K. & Lata, 1968.
Polynemus paradiseus Linnaeus.
Heterosentis caballeroi Gupta, V. & Fatma, 1985
Neoechinorhynchus (*Neoechinorhynchus*) *topseyi* Poddar, 1937
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Polynemus plebius.
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Raorhynchus polynemi Tripathi, 1959.
Polynemus sexfilics.
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Polynemus sexfilus (Bloch & Schneider).
Raorhynchus polynemi Tripathi, 1959.
Rhadinorhynchus polynemi Gupta, N.K. & Lata, 1968.
Polynemus sextarius.
Raorhynchus guptai Gupta, P.C. & Kumar, 1987.
Polynemus sp.
Raorhynchus polynemi Tripathi, 1959.
Pomadasys maculatus (Bloch).
Echinorhynchus indicus Chandra, Rao & Shyamasundari, 1982.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Pristipoma hasta
Acanthocephalus goaensis Jain & Gupta. 1982.
Pristipoma quoraka (Cuvier & Valenciennes).
Paralongicollum sergenti (Choquette & Gayot, 1952) Amin, Bauer & Sidorov, 1991.
Protonibea diacanthus.
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Psenes indicus (Day).
Serrasentis psenesi Gupta, S.P. & Gupta, R.C. 1980.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Psettodes erumei (Bloch & Schneider

Longicollum psettodai Gupta, S.P. & Gupta, K. 1979.
Rhadinorhynchus erumei (Gupta, V. & Fatma, 1981) Amin, 1985.
Serrasentis fotedari Gupta, V. & Fatma, 1980.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Pseudorhombus triocellatus (Gunther).
Raorhynchus schmidti George & Nadakal, 1978.
Serrasentis nadakali George & Nadakal, 1978.
Pseudorhombus arseus
Circinatechnorhynchus pseudorhombi Bhattacharya, 2007.
Pseudorhombus sp.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Pseudosciaena diacanthus Lac.
Neoechinorhynchus (*Neoechinorhynchus*) *johnii* Yamaguti, 1939.
Neoechinorhynchus (*Neoechinorhynchus*) *topseyi* Poddar, 1937.
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Pterois miles (Bonnett).
Serrasentis nadakali George & Nadakal, 1978.
Pterolithus maculatus (Cuvier),
Paracanthocephaloides golvani Chandra, Rao & Shyamasundari, 1984
Ptychatalus rattanis.
Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.
Pomadasys hasta (Bl.och).
Acanthocephalus goanensis Jain & Gupta, N.K. 1981.
Acanthocephalus hastae Baylis, 1944.
Pomadasys maculatus.
Acanthocephalus hastae Baylis, 1944.
Puntius sophore.
Acanthosentis dattai Poddar, 1938.
Puntius sp.
Neoechinorhynchus (*Neoechinorhynchus*) *sootai* Bhattacharya, 1999.
Rachycentrum canadus (Linnaeus).
Serrasentis nadakali George & Nadakal, 1978.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Rasbora elongata (Hamilton).
Acanthosentis sircari Poddar, 1941.

Acanthosentis thapari Prasad, Sahay & Shambunath, 1969.
Serrasentis nadakali George & Nadakal, 1978.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Rasbora rasbora (Hamilton & Buchanan).
Neoechinorhynchus (*Neoechinorhynchus*) *kallarensis* George & Nadakal, 1978.
Rhinobates djaddensis (Forskall) (.=*Raja djeddensis*).
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Rhinoplagusia japonica (Temmenick. & Schleg).
Yamagutisentis rhinoplagusiae (Yamaguti, 1935) Golvan, 1969.
Rhyncobdella aculeata.
Pallisentis (*Demidueterospinus*) *basiri* Farooqi, 1958.
Rohita cotoi (Hamilton).
Acanthosentis cotoi Agarwal &Kajaji, 1986.
Rohtee cotio Sykes.
Acanthosentis cammersoni Gupta, N.K. & Kajaji, 1969.
Salmo trutta fario.
Neoechinorhynchus (*Hebesoma*) *manasbalensis* Kaw, 1951.
Pomphorhynchus jammuensis Fotedar & Dhar, 1974.
Pomphorhynchus kashmirensis Kaw, 1941.
Saurida tumbil (Bloch).
Paracanthocephaloides golvani Chandra, Rao & Shyamasundari, 1984.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992
Saurida undosquamis (Richardson).
Filisoma inglisi Gupta, S.P. & Naqvi, 1984.
Saurus myops (Cuvier).
Filisoma inglisi Gupta, S.P & Naqvi, 1982.
Scatophagus argus (Cuvier & Valenciennes).
Filisoma indicum Van Cleave, 1928.
Filisoma scatophagus Datta & Soota, 1960
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Tenuiproboscis clupei Gupta, V. & Sinha, 1992.
Tenuiproboscis ernakulensis Gupta, S.P. & Naqvi, 1992.
Schizothorax esocinus Haeckel.
Neoechinorhynchus (*Hebesoma*) *manasbalensis* Kaw, 1951.
Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.

Pomphorhynchus kashmirensis Kaw, 1941.
Schizothorax niger Haeckel.
Neoechinorhynchus (*Hebesoma*) *manasbalensis* Kaw, 1951.
Pomphorynchus bulbocolli Linkins in Van Cleave, 1919.
Pomphorhynchus kashmirensis Kaw, 1941.
Pomphorhynchus orientalis Fotedar & Dhar, 1974.
Schizothorax planifrons.
Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.
Schizothorax sinuatus.
Pallisentis (*Pallisentis*) *jagani* Koul, Raina, Bambroo & Koul, 1991.
Schizothorax sp.
Echinorhynchus orientalis Kaw, 1951.
Sphaerirostris saxicoloides (Nama & Rathore, 1984) Golvan, 1994.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Schizothorax zarudnyi (Nikolsky).
Neoechinorhynchus (*Neoechinorhynchus*) *rigidus* (Van Cleave, 1928) Kaw, 1951.
Sciaena dussamieri Cuvier & Valenciennes.
Serrasentis sciaenus Bilqees, 1972
Scomber japoiocus.
Raorhynchus meyeri (Heinze, 1934) Golvan, 1969.
Scomber pelamys Linnaeus.
Raorhynchus meyeri (Heinze, 1934) Golvan, 1969.
Scomberomorus commeronianus Lacepede.
Bolbosoma vasculosum (Rudolphi, 1819) Porta, 1908.
Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985.
Scomberomorus guttatus (Bloch & Schnider).
Rhadinorhynchus ganapatii Chandra, Rao & Shyamasundari, 1985.
Serranus sp.
Cavisoma magnum (Southwell, 1927) Van Cleave, 1931.
Setipinna phasa (Hamilton).
Acanthosentis indica Tripathi, 1959.
Siganus vermiculatuus (Cuvier & Valenciennes).
Filisoma indicum Van Cleave, 1928.

Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Neoechinorhynchus (*Neoechinorhynchus*) *chilkaensis* Poddar, 1937.
Scianeoides microdon Bleeker.
Pseudorhadinorhynchus guptai Gupta, V. & Sinha, 1993.
Tenuiproboscis edmondsi Gupta, S.P. & Naqvi, 1992.
Silago sihama (Rupp.).
Serrasentis nadakali George & Nadakal, 1978
Stomateus cinereus Day.
Pseudorhadinorhynchus cinereus Gupta, S.P. & Naqvi, 1983.
Rhadinorhynchus cadenati (Golvan & Houin, 1964) Golvan, 1969.
Stromateus sinensis Day.
Pseudorhadinorhynchus mnobi Gupta, S.P. & Naqvi, 1986.
Pseudorhadinorhynchus mujibi Gupta, S.P. & Naqvi, 1983.
Yamagutisentis mujibi (Gupta, S.P. & Naqvi, 1984) Kumar, 1992.
Strongylura strongylurus.
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Synaptura cornuta.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Synaptura orientalis (Bloch & Schnider).
Frilloechinorhynchus meyeri (Gupta, S. P. & Naqvi, 1986) Bhattacharya, 2007.
Echinorhynchus veli George & Nadakal, 1978.
Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Tachysurus jella (Day).
Euzetacanthus golvani Gupta, V. & Fatma, 1986
Indorhynchus indicus (Tripathi, 1959) Golvan, 1969.
Tachysurus nenga (Bleeker).
Indorhynchus bilqeesi Kumar, 1992.
Pseudorhadinorhynchus dhari Kumar, 1992.
Teuthis (*Teuthis*) *bamin.*
Pseudocavisoma chromatidis (Cable & Quick) Golvan & Houin, 1964
Therapon jarbua (Forsskal).
Pseudorhadinorhynchus dussamicitatum Gupta, N.K. & Gupta, K. 1972.
Pseudorhadinorhynchus ernakulensis Gupta, N.K. & Gupta, K., 1972.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.

Tor putatora (Hamilton).
Acanthosentis putitorae Chowhan, Gupta, N.K. & Khera, 1988.
Tor tor Hamilton.
Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.
Pomphorhynchus tori Fotedar & Dhar, 1974.
Triacanthus brevirostris (Temmenck & Schleg.).
Tenuiproboscis bilqeesi Gupta, S.P. & Naqvi, 1992.
Trichocephalus myops (Bloch & Schnider).
Filisoma inglisi Gupta, S.P. & Naqvi, 1984.
Gorgorhynchoides golvani (Chandra, Rao & Shyamasundari, 1984) Bhattacharya, 2007.
Serrasentis sagittifer (Linton, 1889) Linton, 1932.
Trichogaster chunni.
Pallisentis (*Demidueterospinus*) *basiri* Farooqi, 1958.
Trichogaster fasciatus (Bloch & Schneider).
Pallisentis (*Brevitritospinus*) *fasciatus* Gupta, S.P. & Verma, 1980.
Tylosurus schismatorhynchu (Bleeker).
Neoechinorhynchus (*Neoechinorhynchus*) *tylosuri* Yamaguti, 1939.
Tylosurus strongylarus (V. Hassell).
Longicollum indicum Gupta, N.K. & Gupta, K., 1970.
Unidentified fish.
Centrorhynchus javanicus Rengaraju & Das, 1975.
Centrorhynchus sholapurensis Rengaraju & Das, 1977.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Cleaveius circumspinifer Subramanian, 1927.
Pallisentis (*Brevitritospinus*) *allahabadi* Agarwal, 1958.
Pallisentis (*Pallisentis*) *colisai* Sarkar, 1954.
Pallisentis (*Pallisentis*) *nandai* Sarkar, 1953.
Yamagutisentis rhinoplagusiae (Yamaguti, 1935) Golvan, 1969.
Upeneus vittatus Lecepede.
Gorgorhynchoides golvani (Chandra, Rao & Shyamasundari, 1984) Bhattacharya, 2007.
Wallago attu (Bloch & Schneider).
Pallisentis (*Pallisentis*) *magnum* Saeed & Bilqees, 1971.
Pallisentis nagpurensis (Bhalerao, 1931) Bayis, 1933.
Xenentodon cancila (Hamilton).
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.

Amphibia

Bufo asper.

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Bufo melanostictus (Schneider).

Centrorhynchus magnus Fukui, 1929.

Echinopardalis bangalorensis Pujatti, 1951.

Pseudoacanthocephalus bufonis (Shipley. 1903) Petrotschenko, 1958.

Pseodacanthocephalus paratiensis Bhattacharya, 2000.

Pseodacanthocephalus shillongensus Bhattacharya, 1999.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Bufo sp.

Acanthocephalus manipurensis Bhattacharya, 2007.

Centrorhynchus batrachus Das, 1952.

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Bufo viridis Daudin.

Longicollum lutiani Jain & Gupta, N.K., 1980.

Pomphorhynchus bufonis Fotedar, Duda & Raina, 1970.

Pseudoacanthocephalus bufonicola (Kostylew, 1941) Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Rana chalconta.

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992

Rana crancvora.

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.

Rana cyanophlyctis Hamilton

Neoechinorhynchus (*Neoechinorhynchus*) *cynophlyctis* Kaw, 1951.

Neoechinorhynchus (*Neoechinorhynchus*) *devdevi* (Datta, 1936) Kaw, 1951.

Pomphorhynchus dubiuus Kaw, 1941.

Pomphorhynchus minutus (Goeze, 1782) Lühe, 1911.

Pomphorhynchus laevis (Zoega in Müller, 1776) Van Cleave, 1924

Rana erythrea.

Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.

Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Rana macrodon.
Pseudoacanthocephalus bufonis (Shipley) Petrotschenko, 1958.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992
Rana rudibanda.
Pseudoacanthocephalus bufonicola (Kostylew, 1941) Petrotschenko, 1958.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Rana sp.
Acanthocephalus kabulensis Datta & Soota, 1956
Rana tigrina Daudin.
Acanthocephalus nickoli Khan & Bilqees, 1994.
Southwellina hispida (Van Cleave, 1925) Witenberg, 1932.
Centrorhynchus amphibius Das, 1950.
Centrorhynchus batrachus Das, 1952.
Centrorhynchus bilqeesae Gazi, Khan & Noor-un-Nisa, 2005.
Centrorhynchus brevicaudatus Das, 1950.
Centrorhynchus clitoredeus (Meyer, 1931) Golvan, 1956.
Centrorhynchus magnus Fukui, 1929.
Centrorhynchus mysentri Gupta, V. & Fatma, 1983.
Longicollum lutiani Jain & Gupta, N.K., 1980.
Centrorhynchus amphibius Das, 1950.
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.
Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Pseudoacanthocephalus rauschi Gupta, V. & Fatma, 1986.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Rana tigrina regulosa.
Pseudoacanthocephalus bufonis (Shipley), Petrotschenko, 1958.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Rhacophorus cruciger eques
Acanthocephalus srilankensis Cruz & Ching, 1975.
Rhacophorus microtympanus.
Acanthocephalus srilankensis Cruz & Ching, 1975.
Pallisentis (*Demidueterospinus*) *ophiocephali* (Thapar, 1931) Baylis, 1933.

Pallisentis (*Pallisentis*) *nagpurensis* (Bhalerao, 1931) Bayis, 1933.
Pseudoacanthocephalus rauschi Gupta, V. & Fatma, 1986.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Yamagutisentis cochinensis (Gupta, S.P & Naqvi, 1984) Kumar, 1992.
Schizopygopsis stoliczkae Steindachner.
Acanthocephalus kashmirensis Datta, 1936.
Toads.
Centrorhynchus aluconis (Müller, 1780) Lühe, 1911.

Reptilia

Bioga trigonata Fitzinger.
Centrorhynchus batrachus Das, 1952.
Porrorchis hylae (Johnston, 1914) Schmidt & Kuntz, 1967.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Bungarus crocidurus (Schneider).
Centrorhynchus batrachus Das, 1952.
Centrorhynchus crocidurus Das, 1950.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Calotes sp. (garden lizard).
Centrorhynchus batrachus Das, 1952.
Longicollum lutiani Jain & Gupta, N.K., 1980.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Ceratophora stoddardi, horned lizard,
Acanthocephalus sereendibensis Cruz & Mills, 1970.
Cnemsapis kandianus kandianus (Gecko).
Acanthocephalusa sereendibenssi Cruz & Mills, 1970.
Dryophis mycterizans.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Hemidactylus brooki (wall lizard).
Centrorhynchus batrachus Das, 1952.

Longicollum lutiani Jain & Gupta, N.K., 1980.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Lycodon flavomaculatus.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Lycodon sp.
Centrorhynchus longicephalus Das, 1950.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Naja hannah.
Sphaerirostris reptans (Bhalerao, 1931) Golvan, 1956.
Naja naja (Linnaeus).
Centrorhynchus sindensis Khan, Khatoon & Bilqees, 2002.
Naja tripudianus (Laurenti).
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Natrix stolatus.
Centrorhynchus batrachus Das, 1952.
Longicollum lutiani Jain & Gupta, N.K., 1980.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Psammophis leithii.
Acanthocephalus leithii Bilqees, Muti-ur-Rehman & Khan, 2004.
Ptyas mucosus (Linnaeus).
Oligacanthorhynchus indicus Rengaraju & Das, 1981.
Centrorhynchus amphibius Das, 1950.
Centrorhynchus clitoredeus (Meyer, 1931) Golvan, 1956.
Centrorhynchus ptyasus Gupta, P.D., 1950.
Sphaerirostris lancea (Westrumb, 1821) Golvan, 1956.
Sinotes arnensis
    Centrorhynchus spinosus (Kaiser, 1893) Golvan, 1956.
Tropidonotus piscator.
Tropidonotus sp. (Snake).
    Southwellina hispida (Van cleave,1925) Witenberg, 1932.
Centrorhynchus batrachus Das, 1952.
Centrorhynchus longicephalus Das, 1950.

Longicollum lutiani Jain & Gupta, N. K., 1980.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Vipera russelli Linnaeus.
Sinotes arnensis.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Zamenis gracilis.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.

Aves

Accipiter badius (Gmelin).
Centrorhynchus bethaniae George & Nadakal, 1987.
Accipiter badius cenchroides (Serertzov).
Lueheia karachiensis Khan, Bilqees & Mati-ur-Rahman, 2005.
Acridotheres tristis (Linnaeus).(Common myna).
Mediorhynchus mariae George & Nadakal, 1984;
Mediorhynchus orientalis Belopolskata, 1853.
Sphaerirostris lancea(Westrumb, 1821) Golvan, 1956.
Sphaerirostris pinguis (Van Cleave, 1918) Golvan, 1956.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Anas querguedula
Polymorphus (Polymorphus) minutus (Goeze, 1782) Lühe, 1911.
Acanthosentis cotoi Agarwal & Kajaji, 1986.
Anastomus oscitanus (Boddaert).
Centrorhynchus buckleyi Gupta, V. & Fatma, 1981.
Astur badius (Gmelin).
Centrorhynchus clitoredeus (Meyer, 1931) Golvan, 1956.
Centrorhynchus guptai Golvan, 1969.
Centrorhynchus magnus Fukui, 1929.
Centrorhynchus milvus Ward, 1956.
Prosthorhynchus asturi (Gupta, N.K. & Lata, 1967) Gplvan, 1994.
Athene brama (Temminick).
Apororhynchus chauhani Sen, 1975.
Centrorhynchus atheni Gupta, V. & Fatma, 1983.

Centrorhynchus brama Rengaraju & Das, 1980.
Centrorhynchus conspectus Van Cleave & Pratt, 1940.
Centrorhynchus microcephalus (Bravo-Hollis, 1947) Golvan, 1956.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.

Bird

Mediorhynchus colini (Webster, 1948) Schmidt & Kuntz, 1977.
Centrorhynchus microrchis Fukui, 1929.
Pomphorhynchus kawi Fotedar, Duda & Raina, 1970.
Bubo bubo bengalensis.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Bubo sp. (Qwl)
Centropus ovali Bhattacharya, 1999.
Butastur teesa Franklin.*(* Eagle).
Mediorhynchus fatimae Khan, Bilqees & Muti-ur-Rahman, 2004.
Buteo sp.
Centrorhynchus buteonis (Goeze, 1782 in Schrank, 1788) Kostylew, 1914.
Centropus andamanensis.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Centropus castonopterus.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Centropus sinensis (Stephens).
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Porrorchis keralensis George & Nadakal, 1984.
Porrorchis rotundatus (von Linstow, 1897) Schmidt & Kuntz, 1967.
Centropus sp.
Mediorhynchus orientalis Belopolskaya, 1953.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Choriotis nigriceps (Vigors) (Great Indian bustard).
Mediorhynchus rajasthanensis Gupta, P.D., 1976.
Circus macrourus (Gmelin).
Centrorhynchus latai Golvan, 1994.
Corvus coraxi.
Sphaerirostris robustus (Datta, 1928) Golvan, 1994.

Sphaerirostris saxicoloides (Nama & Rathore, 1984) Golvan, 1994.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Corvus coronoides culminatus.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1923.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Corvus corvus interpositus Laubm.
Sphaerirostris pinguis (Van Cleave, 1918) Golvan, 1956
Centrorhynchus brevicaudatus Das, 1950.
Centrorhynchus gibsoni Khan, Gazi & Bilqees, 2002.
Centrorhynchus milvus Ward, 1956.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Corvus splendens splendens (Vieillot).
Centrorhynchus batrachus Das, 1952.
Centrorhynchus bengalensis Datta & Soota, 1958.
Centrorhynchus hargisi Gupta, V. & Fatma, 1983.
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Longicollum lutiani Jain & Gupta, N.K., 1980.
Polymorphus (Polymorphus) nickoli Khan & Bilqees, 1998.
Polymorphus (Polymorphus) sindensis Khan, Gazi & Bilqees, 2002.
Sphaerirostris corvi (Fukui, 1929) Golvan, 1956.
Sphaerirostris globuli (Nama & Rathore, 1984) Golvan, 1994.
Sphaerirostris pinguis (Van Cleave, 1918) Golvan, 1956.
Sphaerirostris robustus (Datta, 1928) Golvan, 1994.
Sphaerirostris saxicoloides (Nama & Rathore, 1984) Golvan, 1994.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Dendrocitta vagabonda (Latham) (Tree pie).
Centrorhynchus batrachus Das, 1952.
Spherrirostris lancea (Westrumb, 1821) Golvan, 1956.
Dendrocitta sp.
Centorhynchus turdi(Yamaguti, 1939) Golvan, 1956.
Dichocerca bicornis (Linnaeus) (Great hornbill).

*Prosthorhynchus kuntzi (*Gupta, V. & Fatma, 1988) Bhattacharya, 2007.
Dicrurus macrocercus (Vieillot).
Centrorhynchus opimus Travassos, 1919.
Dinopium bengalense (Linnaeus).
Mediorhynchus channapettae George & Nadakal, 1984 :
Dinopium sp. (Red backed woodpecker).
Centrorhynchus bengalensis Datta & Soota, 1958.
Domestic poultry and ducks.
Polymorphus boschadis (Schrank, 1788) Railliet, 1919.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Drongo or Racket tail drongo
Mediorhynchus robustus Van Cleave, 1016.
Eagle
Centrorhynchus sikkimensis Bhattacharya, 2003.
Egretta sacra
Southwellina sacra Bhattacharya, Pande & Srivastava, 2002.
Falco liniculatus.
Mediorhynchus armenicus Petrotchenco, 1958.
Falco (Cerchneis) tinunculus tinunculus Linnąeus.
Centrorhynchus macrorchis Das, 1950.
Falco jugger (Gray).
Centrorhynchus aluconis (Müller, 1780) Lühe, 1911.
Fly catcher
Mediorhynchus cambellensis Soota & Kansal, 1971.
Gagata batasio (Hamilton).
Yamagutisentis nickoli Kumar, 1992.
Gallus galus domesticus.
*Mediorhynchus gallinarum (*Bhalerao, 1937) Van Cleave, 1947.
Mediorhynchus indicus George, Nadakal, Vijayakumar & Rajendran, 1981
Glaucidium radiatum.
Centrorhynchus globocaudatus (Zeder, 1800) Lühe, 1911.
Golden plover.
Plagyarhynchus charidrii (Yamaguti, 1939) Van Cleave, 1951.
Halcyon smyrnensis (Linnaeus) Sykes.
Centrorhynchus clitoredeus (Meyer, 1931) Golvan, 1956.

Centrorhynchus magnus Fukui, 1929.
Centrorhynchus smyrnensis Bhattacharya, 2007.
Halcyon sp.
Cantrorhynchus horridus (Linstow, 1897) Yamaguti, 1963.
Haliaeter indicus (Boddaert).
Centrorhynchus lucknowensis Gupta, V. & Fatma, 1983.
Haliaetus leucorhyphus (Pallas).
Centrorhynchus opimus Travassos, 1919.
Hierococcyx varius (Vahl).
Centrorhynchus batrachus Das, 1952.
Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Hiractus pennatus.
Centrorhynchus golvani Anantaraman, M. & Anantaraman, S., 1969.
King fisher
Centrorhynchus fisheri Bhattacharya, 1999.
Lobivanellus indicus (Boddaert).
Pseudolueheia korathai Gupta, V. & Fatma, 1988.
Metapodius indicus.
Mediorhynchus pandei Bhattacharya, 2007.
Milvus migans (Boddaert).
Sphaerirostris lancea (Westrumb, 1821) Golvan, 1956.
Milvus migans govinda.
Centrorhynchus milvus Ward, 1956
Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
Milvus migrans migrans (Boddart). (Kite).
Centrorhynchus aluconis (Müller, 1780) Lühe, 1911.
Centrorhynchus globocaudatus (Zeder, 1800) Lühe, 1911.
Centrorhynchus migrans Zuberi & Farooqi, 1974.
Centrorhynchus milvus Ward, 1956.
Neophron percuopterus (Linnaeus).
Apororhynchus bivolucrus Das, 1952a
Nycticorax nicticorax.
Southwellina hispida (Van Cleave, 1925) Witenberg, 1932.

Oriole.

Mediorhynchus cambellensis Soota, Srivastava & Ghosh, 1969 :

Neoechinorhynchus (*Hebesoma*) *manasbalensis* Kaw, 1951.

Neoechinorhynchus (*Neoechinorhynchus*) *oreini* Fotedar, 1968.

Nephridiorhynchus (*Neoechinorhynchus*) *oreinus* Fotedar, 1968 :

Otus bakkamoena Hogson.

Centrorhynchus spilornae Schmidt & Kuntz, 1969.

Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.

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Otis bakkamoena lettia Hogson;

Centrorhynchus spilornae Schmidt & Kuntz, 1969.

Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.

Otus sp.

Centrorhynchus knowlesi Datta & Soota, 1955.

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Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924.

Owl.

Centropus globocadatus (Zeder, 1800) Petrotschenko, 1959.

Passer domesticus indicus.

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Parriah kite.

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Picus flavinucha.

Centrorhynchus clitoredeum (Meyer, 1931) Yamaguti, 1963.

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Mediorhynchus armenicus Petrotschenko, 1958

Picus sp.

Mediorhynchus orientalis Belopolskaja, 1954.

Pitangus sulfuratus maxmiliani.

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Pitta nepalensis.

Pseudolueheia arunachalensis Bhattacharya, 2007.

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Shikra.
Centrorhynchus giganticus Travassos, 1921.
Sphaechochila humei.
Mediorhynchus orientalis Belopolskaya, 1953.
Spilorne cheela
Centrorhynchus latai Golvan, 1994.
Spilorne cheela hoya.
Centrorhynchus spilornae Schmidt & Kuntz, 1969.
Sturnus malabaricus.
Prosthorhynchus deysarkari Bhattacharya, 2002.
Sturnopaster contra (Linnaeus) (Pied myna).
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Temanuchus pagaodorsum (Gmelin).
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Turdoides canadus (Dumont) (Ground thrush).
Prosthorhynchus nicobariensis Soota & Kansal, 1972.
Turdus albocinctum.
Sphaerirostris lancea (Westrumb, 1821) Ggolvan,1956
Turnis suscittor tajori.
Mediorhynchus taeniatus (Linstow, 1901) Dollfus, 1936.
Tyto alba (Scopoli), (Owl).
Centrorhynchus clitoredeus (Meyer, 1931) Golvan, 1956.
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Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.
Tyto alba javanica.
Centrorhynchus albense Rengaraju & Das, 1975.
Centrorhynchus javanicus Rengaraju & Das, 1975.
Centrorhynchus sholapurensis Rengaraju & Das, 1977.
Centrorhynchus tumidulus (Rudolphi, 1819) Neiva da Cunha & Travassos, 1914.

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Pallisentis (*Pallisentis*) *colisai* Sarkar, 1954.
Pallisentis (*Pallisentis*) *nandai* Sarkar, 1953.
Porrorchis indicus (Das, 1957) Schmidt & Kuntz, 1967.
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Centrorhynchus microrchis Fukui, 1929.
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Sphaerirostris maryasis (Datta, 1933) Golvan, 1956.
Venellus malabaricus.
Mediorhynchus quilonensis Bhattacharya, 2007.
Venellus sp.
Mediorhynchus grandis Van Cleave, 1916.
Woodpecker.
Mediorhynchus garruli Yamaguti, 1939.
Mediorhynchus peckeri Bhattacharya, 1999.
Zoothera citrina (Latham).
Prosthorhynchus nicobariensis Soota & Kansal, 1972.

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Albino rat.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Bandocoota bengalensis.
Moniliformis dubius Meyer, 1932 :
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Bandicoota sp.
Moniliformis spiralis Subramanian, 1927.
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Porrorchis chauhani Gupta, V. & Fatma, 1986.
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Felis catus.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Sphaerirostris erraticus (Chandler, 1925) Golvan, 1956.

Felis domesticus.
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Oligacatnorhynchus cati (Gupta, N. K. & Lata, 1968) Schmidt, 1972.
Herpestes auropunctatus (Hodgson).
Owifordia schmidti Gupta, V. & Fatma, 1988.
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Sphaerirostris splendi (Gupta, S.P. & Gupta, K., 1970) Golvan, 1994.
Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1956.
Herpestes sp.
Macranthorhynchus catulinus Kostylew, 1927;
Nephridiacanthus thapari (Sen & Chauhan, 1972) Golvan, 1994.
Owifordia teliger (Van Cleave, 1949) Schmidt & Kuntz, 1967.
Manis pentadactyla aurita Hodgson.
Oligacathorhynchus shillongensis (Sen & Chauhan) Amin, 1985
Nesokia bengalensis.
Moniliformis spiralis Subramanian, 1927.
Nycticebus coucana.
Prosthonorchis lemuri Machao-Filho, 1950.

Pigs

Macranthorhynchus hirudinaceus (Pallas) Travassos, 1917.
Rattus norvegicus.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Rattus rattus Linnaeus.
Moniliformis clark (Ward, 1917) Chandler, 1921.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Moniliformis spiralis Subramanian, 1927b.
Rattus rattus rufescens.
Moniliformis dubius Meyer, 1933.
Suncus caeruleus.
Monoliformis moniliformis (Bremser, 1811) Travassos, 1915.
Sus scrofa cristatus.
Macranthorhynchus hirudinaceus (Pallas) Travassos, 1917.
Sus scrofa domesticus.
Macranthorhynchus hirudinaceus (Pallas) Travassos, 1917 :

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