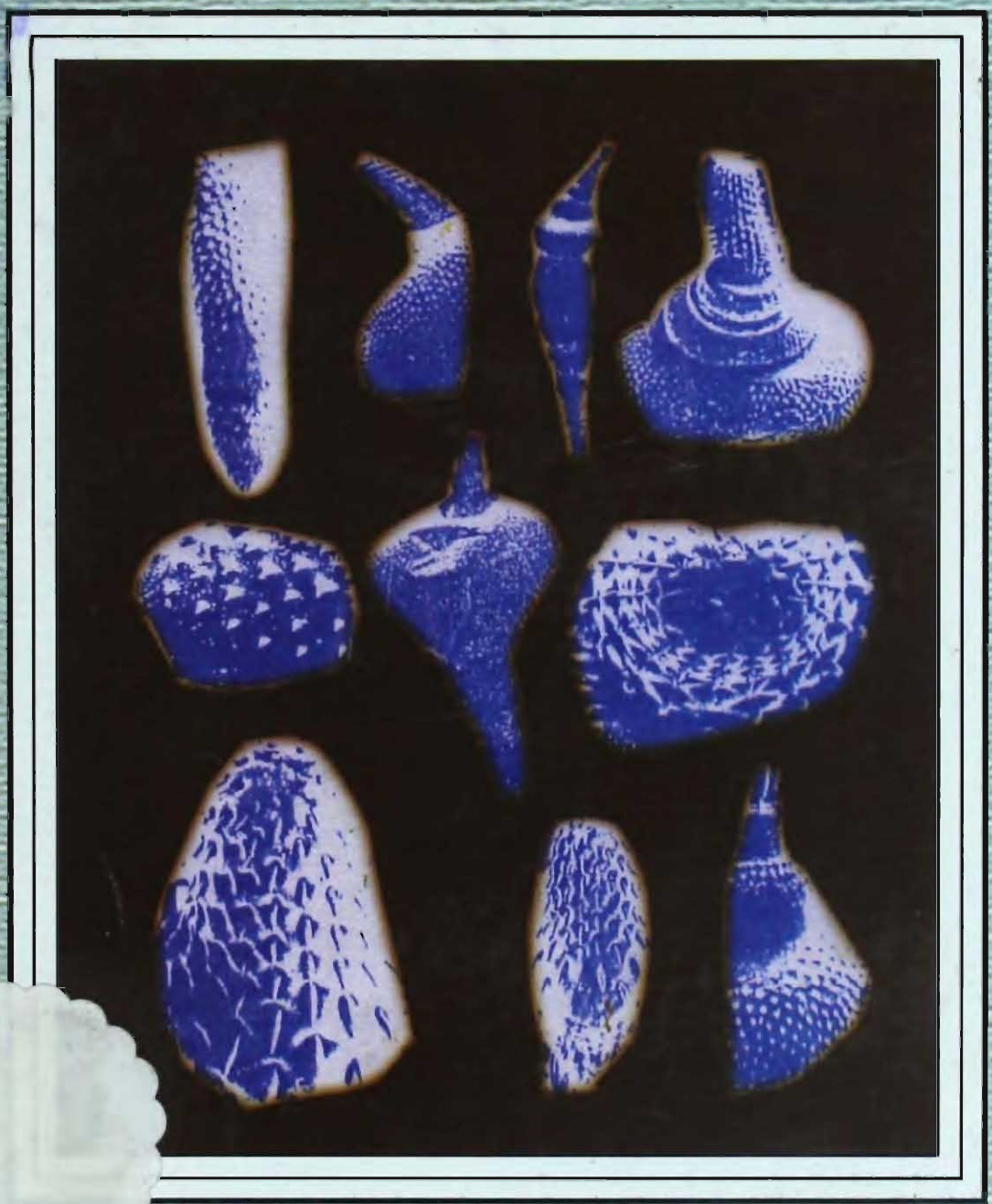
HANDBOOK ON INDIAN ACANTHOCEPHALA

SUBHENDU BIKAS BHATTACHARYA



ZOOLOGICAL SURVEY OF INDIA

Handbook on
INDIAN ACANTHOCEPHALA

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FOREWORD

Acanthocephala, the thorny-headed worms, parasitise all groups of vertebrate including man. These helminth parasites are characterized with unique thorny probosces by dint of which they anchor inner wall of host's intestine.

Taxonomic position of this group had long been uncertain for at times it was considered under Minor Phyla owing to its little affinity with Rotifers. Later, the group was attributed to the Phylum Nemathelminthes which was also viewed as unjustified because of its nearness to phylum Platyhelminthes to a greater extent. Eventually, in atonement for the previous errors, taxonomists reached a consensus and erected the phylum Acanthocephala to accommodate the typical group of helminth.

However, studies on Indian Acanthocephala have been found to be uninspiring. Absence of comprehensive work on this group in India may be due to lesser amount of accessibility to the old books and literatures under overseas publications. This has probably slowed down the progress of studies on Indian Acanthocephala. Therefore, present handbook prepared by the author may bring stimulus to the workers to come in.

Dr. S.B. Bhattacharya has successfully compiled all the Indian species, and have placed them in the modern updated classification by dint of his knowledge and experience that he has acquired through his extensive connection with the study on Indian Acanthocephala. He has also added some new taxa to this encyclopedic work along with those reported by him in his earlier publications under State Fauna Series of Zoological Survey of India. This handbook deals with 251 Indian species. The diagrams of all the species, and key to species as far as possible, have been provided with this book. This is undoubtedly an unique piece of work.

I hope, this onerous task of writing the handbook on such an unorganized group of helminth will definitely encourage him to write more on other groups of helminth too by his interest and dedication in the study of helminth in general. I am sure that this handbook will definitely enthuse the researchers and help them as an identification guide for the purpose of enriching the knowledge of Indian Acanthocephala.

J.R.B. Alfred
Director
Zoological Survey of India

July, 2006

PREFACE

During my long association with the helminth section of Zoological Survey of India, I have got the opportunity to study a huge collection comprising various groups of animal parasitic helminth. Studies on those collections obtained from different vertebrate hosts of marine, fresh water and terrestrial habitats of the country have helped me acquire functional knowledge on different groups of helminth. Above and beyond, I have set my mind to work on a good collection of Acanthocephala brought from various vertebrate hosts of the country in the course of my faunistic survey tours under the stewardship of Dr. T.D. Soota, the eminent nematologist of Zoological Survey of India and other renowned helminthologists of the department.

Publication of some important observations on Indian Acanthocephala in the Records and in the State-fauna Series of Meghalaya, Tripura, Sikkim and Andhra Pradesh of the Zoological Survey of India are the consequence of my long association with the study on this group.

Although, a significant number of species of Acanthocephala has hitherto been known from India and adjoining countries, it is still far below the level of satisfaction. This number is very negligible which contrasts greatly with the number of species described so far under other groups of animal parasitic helminth.

India is rich in vast and varied animal population. The amount of exploration of animal hosts for this group is not commensurate with what has been done for the other groups. Therefore, extensive examination of hosts may depict the potential number of species of Acanthocephala and their distribution in the country. It is an admitted fact that the incidence of infection of Acanthocephala is not as high as it is found in case of Digenea, Monogenea, Cestoda and animal parasitic Nematoda.

It is experienced that the study on Indian Acanthocephala calls for a comprehensive work. Such work may help the beginners to eliminate initial hurdles of procuring literatures. Sporadic descriptions of species in various journals of the country or beyond, often create an uphill task in procuring them. Probably, this initial difficulty hinders the progress of work on this group. My long association with the study of this group has helped me to assume the arduous task of preparing the handbook which has been assigned to me by the Director, Zoological survey of India. I have tried to carry out the task with best of my ability and sincerity. I hope, this work may help researchers to get first hand knowledge on Indian Acanthocephala and help them to overcome the initial difficulties in procuring literatures which are published in different national and international journals.

I have tried my best to improve the quality of work honestly. I admit that this work has deficiency in providing original descriptions of species in some cases where the

literatures are not available. I consider it a failure from my part. In such cases re-descriptions of the species made by other authors have been provided with. All the Indian forms have been carefully subsumed in the revised classification made by Golvan (1969; 1994); Amin (1987); Schmidt (1992).

I have included few essential review works on generic and specific levels in this book. I have proposed a new genus and a new species under a new subfamily. Some new species belonging to various genera have also been proposed here.

All the diagrams including the camera-lucida drawings, inking, manual and computer typing etc. are done by myself.

I may not have been successful in eliminating errors, omissions and printing mistakes that are likely to occur in this book. So it is prudent to apologize in advance.

Altogether, 251 Indian species under 50 genera have been incorporated in this book. The species reported from Pakistan, Myanmar, Bangladesh have been excluded from this work.

All the measurements provided with the description of new species and measurements in the description of species are in millimeter.

This book is intended for inspiration of the scholars who will turn to enrich the knowledge on Indian Acanthocephala.

S. B. Bhattacharya
Zoological Survey of India

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude and indebtedness to Dr. J.R.B. Alfred, Director, Zoological Survey of India for his kind and spurring support to take up the assignment of writing this Handbook, and also for the facilities that he has constantly extended to me during the course of preparation of this Handbook.

I must express my thanks to Dr. T.D. Soota, the Ex-Deputy Director, Zoological Survey of India whom I consider as my teacher and mentor in the field of studies of Acanthocephala. I am profoundly grateful to Dr. C. B. Srivastava, Dr. R. K. Ghosh and Dr. R. P. Mukherjee, the eminent helminthilogists of Zoological Survey of India whose constant inspiration and encouragement have made this work successful.

I am especially thankful to Dr. Amalendu Chatterjee, Scientist 'E', Officer in-charge of the Platyhelminthes Section, Dr. A.K. Sanyal, my Divisional Head for their valuable suggestions and help in planning the work as a whole. I am personally indebted to Dr. R.A. Khan, Sc-'E' and Dr Ramakrishna Sc-'E' for their constant pursuit in finalizing the work.

I am grateful to Dr. S.C. Ghosh, Mrs. S. Banerjee, Mr. S.R. Deysarker, Mr. S. Chakravorty, Mr. V.V. Gantait, Mr. D. Sen of my Division for their direct or indirect help and encouragement to make the work, ready for press.

I owe to all the Library personnel of Zoological Survey of India. I am thankful to Librarian, School of Tropical Medicine, Kolkata and Librarian, University of Calcutta for their co-operation. I am personally thankful to Mr. S.R. Joy, Mr. P.K. Naskar, Mrs S. Sen and Mr. Ali of our Library for their help in procuring literatures from other agencies.

My special thanks are due to my research guide Prof. K.C. Pandey, Ex-Vice Chancellor, Meerut University and Prof. (Mrs.) N. Agarwal, Head, Department of Zoology, University of Lucknow for their enormous support to carry out the work.

I feel it necessary to express my gratefulness to the eminent helminthologists belonging to University of Kashmir, Punjab university, University of lucknow, Andhra University, Madras University, Kanpur Unversity, Allahabad University and other Institutions who by means of their sincere and hard work have enriched the knowledge of Indian Acanthocephala.

I express my sincere gratitude to Mr. Rati Ram Verma, the Publication Production Officer, Zoological Survey of India for successfully publishing the Handbook.

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Phylum ACANTHOCEPHALA

CLASS

1. EOACANTHOCEPHALA	2. PALAEACANTHOCEPHALA	3. ARCHIACANTHOCEPHALA	4. POLYACANTHOCEPHALA
Order	**Order**	**Order**	**Order**
1. Gyracannthocephala	1. Echinorhynchida	2. Polymorphida	1. Apororhinchida	1. Polyacanthorhynchida
Family	**Family**	**Family**	**Family**	**Family**
1 Quadrigyridae	1. Fessisentidae	1. Polymorphidae	i) Apororhynchidae	1. Polyacanthorhynchidae
Subfamily	2. Hypoechinorhynchidae	2. Gentrorhynchidae	**Order**	
i) Quadrigyrinae	3. Pomphorhynchidae	3. Plagiorhynchidae	2. Oligacanthorhynchida	
ii) Pallisentinae	4. Diplosentidae	**Subfamily**	**Family**	
Family	**Subfamily**	i) Plagiorhynchinae	ii) Oligacanthorhynchidae	
2. Tenuisentidae	i) Allorhadinorhynchinae	ii) Porrorchinae	**Order**	
3. Dendronucleatidae	ii) Diplosentinae	iii) Sphaerechinorhynchinae	3. Gigantorhynchida	
4. Neoechinorhynchidae	**Family**		**Family**	
Subfamily	5. Heteracanthocephalidae		iii) Gigantorhynchidae	
i) Eocollinae	**Subfamily**		**Order**	
ii) Gracilisentinae	iii) Aspersentinae		4. Moniliformida	
iii) Neoechinorhynchinae	iv) Heteracanthocephalinae		**Family**	
iv) Atactorhynchinae	**Family**		iv) Moniliformidae	
	6. Arhythmacanthidae			
	subfamily			
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INTRODUCTION

The typical group of animal parasitic helminth endowed with retractable thorny proboscis and other unique organs is very much mismatched with its counterpart in helminth kingdom. Therefore, zoologists have felt it necessary to isolate the group into a separate phylum-Acanthocephala.

Studies on Acanthocephala practically began after Redi (1684) who for the first time observed a white worm in the intestine of an eel. Later, many new forms were reported by others from various vertebrate hosts. Koelreuther (1771) recognized the group with the suitable name 'Acanthocephali' Goez and Zeder (1803) gave it a german name 'Hakenumer' which was later translated by Rudolphi (1808-1809) as 'Acanthocephala' Rudolphi (1808) gave it a rank of order which was considered later as a class under the phylum Nemathelminthes by many zoologists. Lankaster (1900) proposed to create a special phylum 'Acanthocephala' for the group. Skrjabin and Schultz (1931) treated Acanthocephala as a class under their proposed phylum 'Acanthocephales' which was followed by Petrotschenko (1956). Yamaguti (1963) treated it as a class.

Ultimately, the order 'Acanthocephala' was exalted to the rank of a phylum Acanthocephala with the favourable opinions of Lankaster (1900), Van Cleave (1941; 1948), Hymann (1951).

Several attempts have been made in the past to classify class Acanthocephala. Travassos (1926) divided the class into 4 families and 35 genera. Thapar (1927) classified into 5 families and 31 genera whereas Meyer (1933) classified into 12 families and 58 genera. Petrotschenko (1956) proposed 3 subclasses comprising 19 families and 90 genera. Yamaguti (1963) included 22 families and more than 90 genera in his classification.

Now, phylum Acanthocephala is considered to be an independent phylum with 4 classes and 8 orders consisting of about 22 families and about 21 subfamilies to accommodate a quite considerable number of species. The classification provided here, is mainly based on the outline given by Amin (1985; 1987) which basically rests on the concept of Meyer (1931; 1933); Van Cleave (1936; 1947), and Golvan (1959-1962; 1969; 1994).

Today, the group is represented by a relic of a larger population which has been lost during its long journey from free-living turbellarian ancestor towards parasitic mode of life. The fossil species of Acanthocephala, *Ottoia prolifica* is reported to have found in Burges Shale of British Columbia in 1911. The species has been estimated to belong to mid-Cambrian when vertebrates have not evolved. Later, this group of parasites have attained successful parasitic adaptation in both vertebrate and invertebrate hosts.

There is no scope of denial that the group has received poor attention of the helminthologists. A total number of only about a little more than 1000 global species of

Acanthocephala have so far been recorded. This number is very negligible and contrasts with that of other groups of helminth.

The study of Acanthocephala has been started at the dawn of helminthological study. Many of the helminthologists of the past have commendably exercised to contribute to the study of Acanthocephala. Contemporary records reveal that major contributions to this field of study are made by Linstow (1872-1909); Luhe (1905-1912); Travassos (1913-1916); Kostylew (1912-1941); Meyer (1928-1938); Harada (1928-1938); Van Cleave (1913-1952); Petrotschenko (1949-1959); Golvan (1959-1994); Yamaguti (1935-1963); Schmidt (1961-1975). Golvan, Schmidt and Amin are still continuing their relentless research and review on Acanthocephala, besides their gigantic contributions of the past.

The studies on Indian Acanthocephala has been initiated by Thapar (1928). He has put forward his natural system of classification duly supported by Van Cleave. Little contribution to the study on Indian Acanthocephala has also been made by Chandler (1925; 1934) and Van Cleave (1928). Later, Verma and Datta (1929); Bhalerao (1931; 1937); Datta (1936; '37; '40; '46; '47; '54); Podder (1938; '39; '41); Kaw (1941; 1951); Datta and Soota (1955); Soota (1955-1981); Soota and Sen (1956); Das (1956); Tripathi (1956) and many of the past workers have added their valuable contributions to the knowledge of this group. Simultaneously, S.P. Gupta; N.K. Gupta, V. Gupta, R.C. Gupta, Fotedar, Raina, Farooqi, Fatma, Lata and many more eminent helminthologists have enriched the knowledge on the existence of many more new forms and their distribution in different hosts of the country.

In India, a vast animal population is distributed in its varied ecosystem. Recent estimation reveals that a total of about 397 species of mammals, around 1200 species of birds, 239 species of snakes, 236 species of Amphibia and nearly 1240 species of marine and freshwater fishes are distributed in the bionetwork of the country. Very negligible part of such a huge population has been examined for this group. This warrants more attention to intensive investigation.

Present work bears the testimony of the notable contributions of the investigators to the knowledge on Indian Acanthocephala. In addition, author's own contribution, though negligible have found a place in this work. A total of about 249 species under 50 genera have been included in this handbook after some significant synonyms are taken into consideration. However, this number will definitely come up if exhaustive investigation is done for a definite period of time.

Investigation on pathogenecity, histology, phylogeny, development and life-history etc. have also been conducted by the zoologists, besides taxonomy. Pathogenic effect of Acanthocephala is diverse. The Parasite with the help of thorny proboscis penetrates deep into the intestinal wall which causes wound or necrosis at the site of attachment of proboscis. Moreover, in absence of digestive system, the parasites take nutrition from host through body surface hindering growth of the host. Some of the common diseases like

macracanthorhynchiasis in pigs, fillicoliasis and polymorphiasis in ducks and geese, are known to have played havoc in some countries.

Human infection has been recorded in some countries like Alaska, Czechslovakia, Indonesia, Italy with the species *Acanthocephalus raushi, Acanthocephalus bufonis, Corynosoma strumosum, Macracanthorhynchus hirudinaceus, Moniliformis moniliformis.* No serious pathogenic effect in man caused by these helminths, have been reported so far. It is believed that since, man living in some part of the globe who are used to feed on raw meat, may get exposed to infection with larval forms. *M. hirudenaceus* and *M. moniliformis* in man is old and wide. Although some studies in the country have been made on the larval development by Kaw (1941); Das (1950); Gupta (1950); Fotedar (1973) but no experimental work on life-cycle is found in India except on *Moniliformis moniliformis* by Sita Anantaraman (1949).

The study on taxonomy and systematics of Acanthocephala involves some basic difficulties in identifying species. Selection of insignificant characters for identification of new species often makes the status of the species weak and fragile which is not conducive for identification. However, some suggestions have been put forward for making identification of species more practicable.

i) Proper narcotization is required for killing and preservation of materials ii) complete protrusion of proboscis to be ensured iii) Counting of proboscis hooks to be done according to the prescribed method for the genus iv) measurement of free end of proboscis hook (point) and root of hooks to be taken separately. v) Transition of size of proboscis hooks in each row to be observed vi) selection of characters with high plasticity for taxonomic study is to be avoided as far as practicable. vii) range of measurements of each organ is to be provided. viii) distinct figures under camera lucida are to be provided. ix) description of species on larval or juvenile forms is to be avoided. x) common characters to be selected for identification of species. xi) publication to be made in the journals which are easily available.

GENERAL ORGANIZATION

Acanthocephala, being dioecious and endoparasitic worms parasitize almost all groups of vertebrate hosts. Vertebrate hosts are generally construed as definitive hosts for the parasites which take shelter in the alimentary tract of definitive hosts after ingestion of larvae or intermediate hosts. Intermediate hosts are generally invertebrates such as crustaceans, insects, mollusks etc. Sometimes some vertebrate hosts also play the role of intermediate hosts in which larvae remain encapsulated inside the body cavity or inside the muscles, as for example *Polymorphus* sp. in fish, *Corynosoma* sp. in some ichthiophagus birds and *Centrorhynchus* sp. in reptilies and amphibians. Some species penetrate the gut when they are accidentally swallowed by unsuitable hosts and remain encysted in a location where they survive without further development. Such hosts are defined as paratenic hosts e.g. *Prosthenorchis* sp. in *Perdicula asiatica* reported by Srinivasa (1993).

When such hosts are further devoured by definitive hosts, parasites come out of cyst and get attached to the intestinal mucosa. Reservoir host includes cyclostomats, fish, birds, mammals and reptiles. Thus transmission of Acanthocephala takes place from one host to other. Therefore, ability of Acanthocephala to parasitize wide variety of hosts suggests that the group is not governed by rigid rule of host specificity (Petrotschenko, 1993).

Two stages of development in Acanthocephala (Plate-1; figs., d_1–d_6) have been recognized by Van Cleave (1937) as Acanthor and Acanthella. Moore (1946) distinguished another stage *i.e.* Preacanthella which is between Acanthor and Acanthella. Petrotschenko experimentally accepted Moore's view. Therefore, it is admitted fact that attainment of adulthood of Acanthocephala takes place through three stages. Life-history of about 20-25 species of Acanthocephala are known from literature.

Acanthor : It is the first larval stage of the post embryonic development of Acanthocephala. The larva gets round and penetrates the intestinal wall of the intermediate hosts. The anterior end develops into aclid organ or rostellum consisting of hooks or spines with their muscles which aid penetration. This is a resting stage where no further development takes place. Acanthor remains viable for months or years. In some cases it can withstand subzero temperature and desiccation. It can remain viable for up to 3½ years in the soil as found in acanthors of *Micracanthorhynchus hirudenaceus.*

Preacanthella : Preacanthella stage follows the stage of Acanthor. The stage begins with gradual elongation and grows rapidly into formation of several structures through the process of organogenesis. This stage in *Polymorphus* species develops two layers. The inner coarsely granular layer grows into primordium of proboscis sheath with cephalic ganglion inside, primordium of proboscis, suspensory ligaments and the reproductive system. The outer layer is finely granular with certain number of giant nuclei. The giant nuclei gradually diminish with further development of preacanthella. At the same time, rudiments of lemnisci, suspensory ligaments and reproductive organs appear in this stage. In male, testes, undifferentiated rudiments of cement glands and copulatory bursa appear. In female, rudiments of uterine bell, uterus and the vagina develop. In late preacanthella stage the larva bears organs characteristically almost alike to that of adult Acanthocephala, although, in many cases, they are seen to be poorly developed.

Acanthella : Acanthella, the dormant stage is characterized by retraction of proboscis into proboscis sheath and the anterior part of the body is retracted into the body cavity. Likewise, posterior part of the body also recoils into the body cavity. Thus it forms a round, elongated–fusiform cyst. The acanthella is an invasive larva of the parasite which is ready to infect definitive hosts.

The parasite with its all stages of development lacks digestive tract. Intake of nutrients from the host body takes place through body surface of the larva.

Post embryonic development : The immobile and inactive larvae are eliminated by the parasites in the intestine of the definitive host and from there to the external environment.

After they enter the body of intermediate host, the development takes place in two phases : a) Inside the intermediate host (invertebrate) larvae develop into preacanthella and then into acanthella. b) Acanthella develops into maturity inside the definitive (vertebrate) host.

PHYLOGENTIC RELATIONSHIP

Acanthocephala do not bear a close relationship with any known form unlike other groups of animal parasitic helminth which have almost clear ancestral origin. With regard to the presence of pseudocoel and cuticular texture, this group is thought to have its close affinity with Nematoda and Nematomorpha. Having cilia in the excretory system, ligament sac as rudiment of intestine in Acanthocephala, the group shows proximity towards Rotifera. Nervous system, body wall, excretory system, embryonic development of Acanthocephala look like that of Turbellaria. Hence, it is stated to be derived from Turbellaria. This is emphasized by Petrotschenko (1956) who claims that it is originated from lower group of Rhabdocoela or Acoela under Turbellaria. Golvan proposed a hypothetical ancestor which he named as Protacanthocephala. However it is an established fact that this group of parasitic helminth belongs to an independent phylum-Acanthocephala.

MORPHOLOGY

The parasites are of varying size ranging from a millimeter to a meter. Largest Acanthocephala probably are *Nephridiacanthus longissimus* ranging from a few centimeter to a meter. The smallest being *Octospiniferoides chandleri* ranging from less than a millimeter to 2.4 mm.

Body : (Plate-1; figs. a_1– a_3) of Acanthocephala is divided into two regions : i) anterior part is pre-soma which comprises proboscis, proboscis sheath,neck and Lemnisci and ii) posterior part is meta-soma, the true body with different physiological systems. The two regions are separated by a partition at the level of posterior limit of the neck. The digestive system is lacking in this group of parasites, and nutrition takes place through body surface.

Body wall : (Plate-1; figs. e_1–e_2) The body is covered with thin cuticle and below the cuticle there is a thick syncytial layer. The syncytial layer may be divided into sub-cuticle and hypoderm. Syncytial body wall consists of fragments of primary nuclei in the transitional stages of development. The giant nuclei of different shape and size which are generally constant for each species are of great taxonomic value. Trunk is sack –like and encloses the internal organs of the parasites. Body spines derive from the sub-cuticle and lacunar system exists in the hypoderm. Just below the hypoderm there is a thin membrane, followed by muscle layers. The lacunar system of pre-soma and meta-soma is separate.

Hypoderm bears lacunar system. The system consists of longitudinal and transverse canals which anastomose to form reticulation. Meyer (1931), on the basis of the

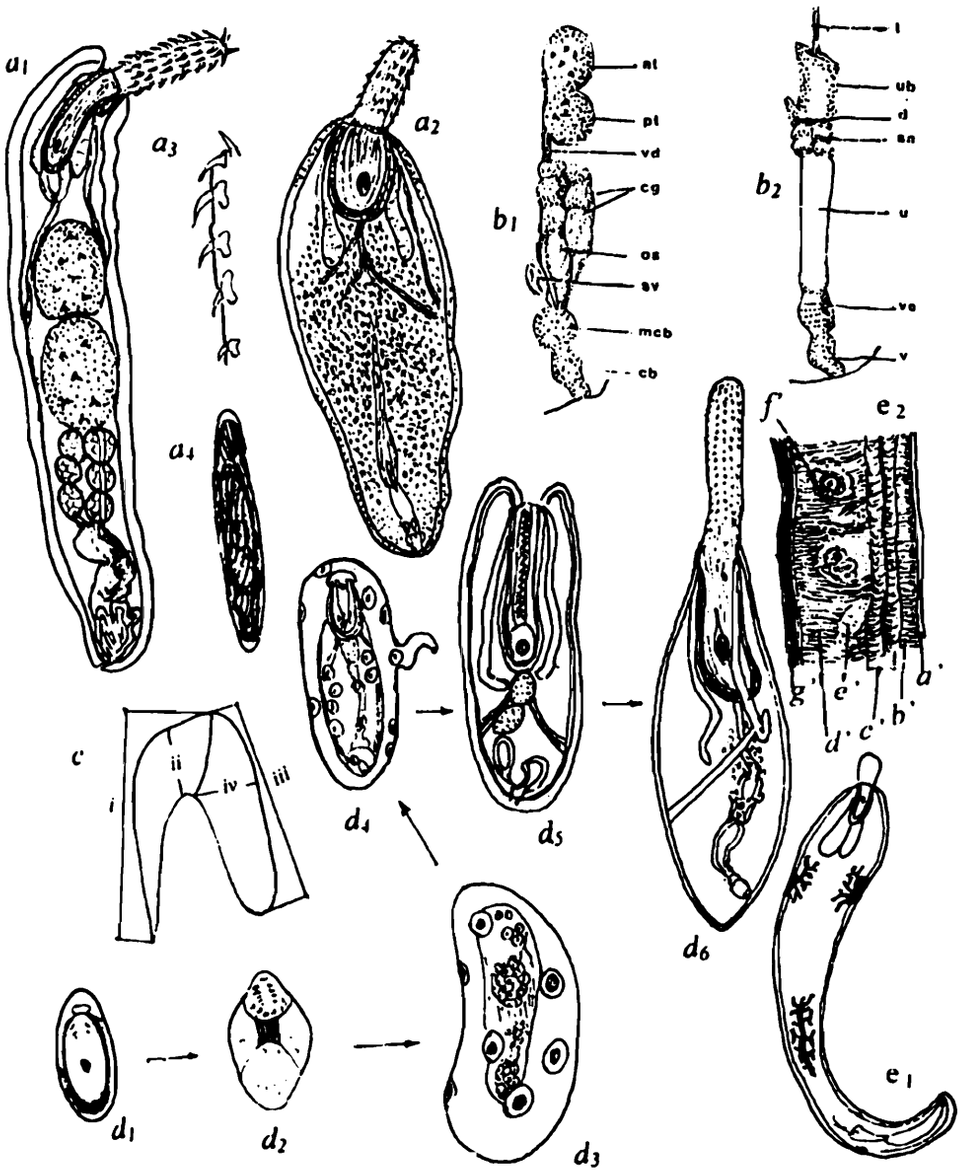


Plate-1

a_1–Acanthocephalus opsariichthydis (Male); a_2 –Acanthocephalus minor (Female); a_3–Proboscis hooks; a_4 – Egg. b_1–Male genital organ : at–anterior testis; pt–posterior testis; vd–vas deferens; cg–cement gland; os–organ of Saefftigen; sv–seminal vesicle; mcb- mascular portion of copulatory bursa; cb-membranous portion of copulatory bursa (after Arai H. P., 1989 : Guide to parasites of fishes of Canada; (part-III), Can. Publ. Fish. Aquat. Sci. 107 : p. 95); b_2–Female genital organ of Acanthocephala : l–ligament; ub- uterine bell; d–diverticulum; sa–selective apparatus; u–uterus; vs–vaginal sphincter; v–vulva (after Arai H. P., 1989 : Guide to parasites of fishes of Canada; (part-III), Can. Publ. Fish. Aquat. Sci. 107 : p. 95). *c*–Proboscis hook : *i*-length of point of hook; *ii*–breadth of point; *iii*–length of root; *iv*–breadth of root. (after Ptrotschenko, 1956). *d*–Developmental stages of *Plagiorhynchus formosus* Schmidt & kuntz, 1967 (after Schmidt & Olsen,1964 : *J. Parasit.* 50 : pp. 721–730). d_1–egg, containing mature acanthor; d_2–acanthor after escape from egg; d_3–preacanthella; d_4–Acanthella; d_5–late acanthella or cystacanth (male); d_6–Cystacanth (female) (after Schmidt). e_1–Acanthocephala showing body nuclei; e_2–T.S. of body wall of *Polymorphus magnus*. *a'*–cuticle; *b'*–parallel layer of subcuticle; *c'*–tomentose layer of subcuticle; *d'*–hypoderm; *e'*–lacunae of hypoderm; *f'*–nuclei in lacunae of hypoderm; *g'*–annular layer of muscle fibre (after Petrotschenko, 1956)

characteristics of dorso-ventral or lateral canals (Plate-2; figs. i_1– i_2) divided Acanthocephala into two orders. Canals are fluid-filled which may serve as circulatory system.

Proboscis : Proboscis is the anterior part of the body and generally armed with chitinized hooks to anchor the intestinal tissue of the host. It is highly retractile except in *Apororhynchus sp.* where proboscis is fixed and hooks are replaced by pits.

Hammond, R.A (1966) studied the proboscis mechanism in *Acanthocephalus ranae.* According to Hammond, the invagination of the proboscis inside the proboscis sheath and the eversion of the same take place by the proboscis retractor and the receptacle wall respectively. the trunk hydraulic system controls the position of the proboscis apparatus as a whole. Contraction of the circular muscle of the trunk causes elongation of the worm and maximum extension of the proboscis. The invagination of the proboscis into the proboscis sheath is also done by the contraction of the neck retractor.

The size and shape, and arrangement of hooks and spines on proboscis are constant and varies from species to species. Therefore, it has a great taxonomic value in identification of species. The shape of proboscis varies a great degree from one group to another. They are spherical, ovoid, cylindrical, conical, bulbous etc.

The anterior part of proboscis generally contains hooks and posterior part has spines. Hooks and spines are arranged in definite pattern. They are arranged longitudinally, diagonally, spirally or in circles (Plate-2 ; figs.-j_1 – j_2). The number of rows are of great significance in taxonomy of Acanthocephala. While counting diagonally arranged hooks on proboscis of *Mediorhynchus,* a definite cuincunx is observed at the tip of proboscis. Schmidt (1977) has suggested to count the rows longitudinally rather than diagonally in that event. In case of spirally arranged hooks, number of rows and number of hooks on each row are to be counted. Likewise, number of circles or rows and number of hooks in each circle or row are to be counted in case where hooks are arranged in circles or in longitudinal rows.

The tip of proboscis is generally devoid of hooks but sensory papillae are often present. Proboscis of mature cystacanths (late acanthella; fig. d_5) and adult Acanthocephala bear hooks of definite size, shape and number according to species and sex of the worms (Hutton and Oetinger, 1980).

Petrotschenko (1959) (Plate-1; fig. c) suggested following method of measuring of hooks :

(i) Length of hooks to be measured from the tip of hooks to its junction with the root which he has termed as 'point'

(ii) Thickness of the hooks is measured at its junction with root.

(iii) Length of root is the distance between the farthest anterior and posterior points of root.

(iv) Thickness of root is measured at its junction with hook (point).

Proboscis sheath : Proboscis sheath or proboscis receptacle is a cylindrical sac-like organ, anterior end of which is open and attached to the proboscis wall. Posterior end is half-closed. The point of attachment of proboscis sheath with proboscis is of great taxonomic significance. The attachment lies generally with the base of the neck through a constriction but in *Centrorhynchus* and *Mediorhynchus,* the attachment is found at the middle of the proboscis. Therefore, the apical part of proboscis sometimes refers to as Protoboscis and the distal part as Teloboscis. The wall of proboscis sheath is single or double layered. The cavity of the proboscis sheath corresponds to the cavity of proboscis.

The retractor muscle of proboscis pass through the cavity of proboscis sheath. One end of muscle is attached to the anterior and lateral wall of the proboscis and the other end run through the posterior end of proboscis sheath and attached to the body wall of the parasite. The contraction of these muscle help proboscis to draw inside the proboscis sheath. The retraction of proboscis begins from the anterior end and the hooks are grouped along the mid-line.

The central nerve ganglion is located inside the proboscis sheath under the cover of a thin transparent membrane with processes by means of which it is attached to the surrounding muscle (Plate-2; figs. $l_1 - l_7$). The position of nerve ganglion varies in different species. Sometimes they are anteriorly located; sometimes located at the middle; or sometimes at the posterior end. The location of nerve ganglion is of great significance in taxonomic study.

Neck : Neck is located between proboscis and the body and always remains unarmed.Lemnisci originate from the base of the neck. Size of neck varies in different groups of Acanthocephala. In *Fillicollis* and *Pomphorhynchus* the neck is elongated. The measurement of neck is required for taxonomic study.

Lemnisci : The special organ of Acanthocephala is formed by the invagination of hypoderm of the neck wall. It is often paired and lie along the sides of proboscis sheath and hang in the body cavity. The shape and size of the Lemnisci vary to a great extent. They are leaf like; ribbon like; coiled or flat with number of nuclei or sometimes ring-like. The lacunar system of the organ corresponds to that of the proboscis and probioscis sheath. The function of this organ as stated by many zoologists is secretory but majority ascribe that evagination and invagination of proboscis are done by the contraction and relaxation of lemnisci according to the intake and expulsion of fluid into the lacunae of the organ.

Holdfast : As a rule, parasites require strong holdfast mechanism. Acanthocephala consist of series of adaptations namely, proboscis armed with hooks, bulb formation of the neck, proboscis and anterior trunk, spines on the body surface, formation of comb-like structure with body spines, pseudo-segmentation of the body etc. In some larger species such as *Macracanthorhynchus hirudenaceus, Nephridiacanthus sp., Moniliformis moniliformis* etc. the body surface consists of annular folds especially at the anterior part for the

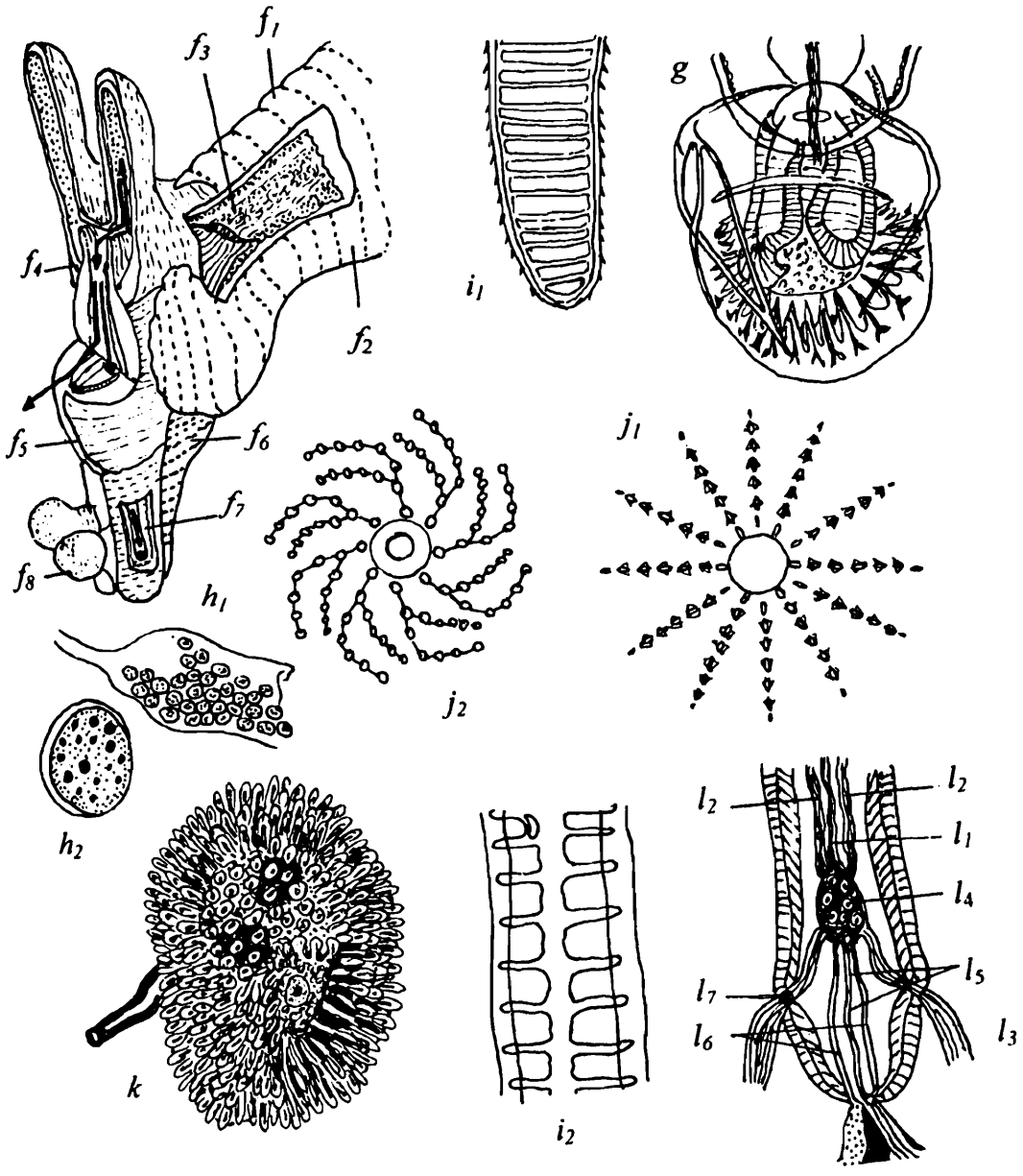


Plate-2

f-Stereogram of mature uterine bell, heavy arrows—possible routes of egg translocation (after Whitfield, P.J., 1964: *Parasitol.* 58 : pp. 671- 682); f_1–anterior chamber of uterine bell; f_2–body wall syncytium; f_3–ligament; f_4–lateral pockets; f_5–lappets; f_6–median dorsal cell; f_7–tube of uterine duct cell; f_8–ventral accessory cell. *g*–Extended copulatory bursa of *Owilfordia olseni* with numerous sensory papillae (from Schmidt & Kuntz, 1967, *J.Parasitol.* 53 : 130-141). *h*–Ovaries of *Polymorphus magnus* (after Petrotschenko,1956); h_1–ovaries in ligament sac. h_2–separate ovary, original. i_1–Lacunar system lateral in Palaeacanthocephala; i_2–lacunar system in dorsal and ventral with lateral branches. j_1–Longitudinal distribution of proboscis hooks in Palaeacanthocephala (after Meyer, 1931); j_2–spiral distribution of proboscis hooks (after Meyer, 1931). *k*–Protonephridial organ in *Oligacanthorhynchus taenioides* (after Meyer, 1931). *l*–Nervous system of Acanthocephala (after Petrotschenko, 1956); l_1–anterior median nerve; l_2– anterior nerve bundles; l_3–posterior lateral nerves; l_4–cephalic ganglion; l_5–posterior median nerve; l_6–posterior dorsolateral nerves; l_7–lateral ganglion.

purpose of added advantage for anchorage inside the intestinal wall of the host. Holdfast mechanism is more conspicuous in female than male. Females are often found to posses more number of proboscis hooks and body spines than males which refers to sexual dimorphism. This is because, females play greater role than males for the protection and survival of the species within the host body.

Suspensory ligament : (Plate 2; figs. h_1-h_2) The ligament sac extends right from the base of proboscis sheath to the genital pore. The ventral ligament sac of female communicates with the lumen of the uterine bell. The dorsal ligament sac breaks down due to developing germ cell masses and terminates in a thin solid string which enters the uterine bell. Male suspensory ligament contains the testes.

Reproductive System : Male : (Plate 1; fig. b_1) Male reproductive system comprises of two testes, vasa deferentia, ductus deferens, seminal vesicle, ductus ejaculatorius, cirrus and accessory organs. Accessory organs consists of cement glands, cement reservoir with ducts and copulatory organs.

From the testes, vasa deferentia emarges which then unite to form ductus deferens. Ductus deferens meets muscular cirrus passing between the lateral diverticula of the bursa. Before issuing into cirrus, the ductus deferens widens to form seminal vesicle from which ductus ejaculatorius emerges and finally meets cirrus. Cement gland is an accessory organ appears as a single syncytial mass or as a multiple glands with nucleus in each. Sometimes, cement gland is followed by cement reservoir with ducts. According to Petrotschenko (1959), cement gland ducts and seminal vesicle remain within muscular sac.

Copulatory system : Copulatory system broadly comprises of Saefftigen's pouch and copulatory bursa. Saefftigen's pouch is so named by Yamaguti (1935), and according to him it is enclosed in muscular sac. This pouch contains a fluid in its spongy medulla. The pouch is connected with the bursa through a stalk.

Bursa is provided with depressor, protrusor, retractor and dialator pori genitalis (Plate-2; fig. g). By a combined mechanism of these muscles and with the squeezing of Saefftigen's pouch, fluid flows through bursa and it protrudes out of the body to start with the act of copulation. Petrotschenko (1959) however, does not mention about the role of Saefftigen's pouch but refers to Kostylev (1912) who states that by the contraction of muscular sac, fluid squeezes out into the chambers of the bursal wall for its protrusion.

Insemination : According to Meyer (1933) after eversion of the copulatory bursa, the male envelopes the posterior end of female with the extended bursa and semen is ejaculated by contraction of the ejaculatory duct and the muscle of whole reproductive system. The cirrus is then pressed between the diverticula of the bursa and is conveyed towards the female gonopore. The process of insemination ends with the emission of secretion from cement glands which occludes the female gonopore in the form of a brown plug.

Female : (Plate-1; fig. b_2) Female reproductive system comprises of ovaries and oviduct. Ovaries in the form of follicle float inside the dorsal ligament sac. The origin of ovaries

is still unknown. Ovaries produce eggs. The oviducal system comprises of uterine bell, oviducts, uterus and vagina. Uterine bell is a muscular organ and has an anterior wide opening which allows the mature and immature eggs to come into the bell. At the posterior end of the bell there are two openings, one leads into the ventral ligament sac and other into the uterine duct.

The uterine bell, uterine duct and ligament sac jointly take part in the sorting process of mature eggs into the uterus and immature eggs are eliminated into the body cavity (Pt. 2; figs. f_1-f_8). Yamaguti (1961) has expressed doubt about this phenomenon for many a time he has observed immature eggs mixed with mature ones in the uterus.

Uterus proper is a simple tube composed of an outer muscular layer and an inner syncytial layer. The uterus is followed by vagina. The posterior portion of vagina is surrounded by sphincter muscles. Vulva opens terminally or sub-terminally.

Ovaries : The reproductive organs are established in early stage, especially in acanthella or cystacanth The ovaries and testes are seen in these stage within the body of intermediate host. Ovaries are found to be inside the ligament sac in multiple balls (Pt. 2; figs. h_1-h_2). Sometimes these balls are termed as egg -spheres, balloons or ovarian fallicles. These balls develop into eggs. The exact mechanism of oogenesis is still unknown.

Embryonated eggs are oval, fusiform or elliptical and provided with three shells. Sometimes the middle shell membrane has polar prolongations.

CHARACTERS OF TAXONOMIC IMPORTANCE

General organization of Acanthocephala has been briefly discussed above but the selection of characters for taxonomic study is of great importance. Different authors have selected different characters of their own choice of importance and on the basis of that they have classified the group. Meyer (1933) gave too much importance on body spination and lacunar system and accordingly, erected two orders, Palaeacanthocephala and Archiacanthocephala. Petrotschenko (1956) divided the class Acanthocephala into two subclasses mainly on the basis of spination in embryonic larvae. Golvan ascribed too much importance to the number of cement glands ignoring the body spination. Classification of Van Cleave is based on some other morphological characters. Thus, in absence of a full-proof classification, all the classifications of Acanthocephala may be said to be superficial not natural.

However, all the external and internal characters of the worm in respect of their relative position, nature, arrangement of proboscis hooks, number of rows and hooks on each row, measurement of hooks, roots and spines etc. are required to be studied for the identification of species. Preparation of key to species in this group of helminths is somewhat difficult because of overlapping characters that are mostly found in the description of species. Therefore, the characters are to be chosen for key which are least liable to be changed within the population of a same species as suggested by eminent

workers on this group. Inclusion of too much characters, and the characters with too much plasticity in the key leads to inconsistency. Hence, comparison with the original description of species is an essential task for identification. Incomplete description of species due to poor preservation, or poor description on early juvenile species often puts major impediment on preparing a key as well as on identification.

VARIABILITY IN ACANTHOCEPHALA

Intra-specific variations are greatly observed in Acanthocephala. Luhe (1911) was probably first to report a great degree of intra-specific variation in *Acanthcephalus ranae.* Later, Van Cleave (1915, 1920, 1942, 1949); Meyer (1932); Travassos (1926); Hughes and Moor (1943); Lynch (1936) and many more investigators have recorded a great degree of variation. Sexual dimorphism as stated by Van Cleave (1920) is well pronounced in this group. Major dimorphism is generally found in body size. Females are generally larger than males, proboscis hooks and body spines are more conspicuous in females than in males as recorded by Luhe (1911) and Bullock (1962) in *Acanthocephalus ranae* and *Acanthocephalus jacksoni* respectively.

Considerable variation in shape, size and nature of the Lemnisci is recorded by many investigators. Travassos (1919) observed multiple lemnisci in the genus Lueheia, whereas Van Cleave et Williams (1951) reported un-split Lemnisci in *Luheia boreotis.* Bullock (1957) observed forked Lemnisci in *Illiosentis furcatus.* Bullock (1962) frequently observed lobed lemnisci or reduced lemniscus, or sometimes with single lemniscus in *Acanthocephalus jacksoni.* The present author also reported circinate or ring type of lemnisci around the junction of proboscis and proboscis sheath in his new genus *Circinatechinorhynchus* under the new subfamily Circinatechinorhynchinae. The Lemnisci in this case appear to be in the form of a glandular mass encircling the junction of proboscis and proboscis sheath like a wreath.

The number of cement glands is also of considerable importance in determining the higher taxonomic units of the phylum. The genera and families generally have their respective number of cement glands but variations are often found to occur in them. However, variation of number of cement gland within a single species can also be observed in many cases. Bullock (1962) reported the presence of 4, 8 or 11 cement glands in *A. jacksoni.*

Variation in number of testes has been reported in Acanthocephala. Generally acanthocephalan species bear double testes but single testes with two vasa efferentia has been recorded by many authors. Luhe (1911), Beiler (1913) observed single testis in *Acanthocephalus lucii* and *A. ranae.* They refer to this phenomenon as monorchidism where primary testes are fused to form an enlarged single testis.

Excretory system : The studies on excretory system has received least attention. Extensive studies on only *Hamanniela microcephala* and *Oligacanthorhynchus taenioides* reveal

that flame cells are in the form of branches and open into a common excretory duct in the former species and on the latter species it is in the form of a capsule and the excretory duct opens into the capsule itself. In male the protonephridial organs (Pt. 2; fig. k) lie on the anterior edge of the seminal duct but in female the same lie in front of uterine bell and opens into excretory pore through bladder like nephridial canals.

Embryonic variation is also found to occur in some species of Acanthocephala. Variation of size of embryo has been observed by Bullock (1962) in the same species of *A. jacksoni* obtained from different hosts of different location.

COLLECTION, FIXATION AND PRESERVATION

Live worms are collected from mucosa of the digestive tract carefully and washed in water of a watch-glass to make the worms free from foreign bodies. Complete protrusion of proboscis from proboscis sheath must be ensured for correct measurement of proboscis and neck and also for proper counting of hooks. In case of larger worms, the live specimens are kept in air-tight vials containing distilled water for adequate period of time in order to allow the proboscis to come out of the proboscis sheath automatically. Sometimes some obstinate worms need mild pressure of the needle. After putting the worm between the slide and the cover slip in moist condition under the binocular, mild pressure to be exerted on the cover glass in order to force the proboscis out of proboscis sheath. The pressure depends upon the size and condition of the worms. Otherwise the worm will burst. When the proboscis is fully stretched, keeping the pressure constant, one or two drops of 70% alcohol or F.A.A. solution is added to the specimen in order to kill and fix the worm. The specimens kept in air-tight vials also require needle pressure after putting them between the slide and the cover glass in order to get pressed specimens for study. Both the processes need constant watch to avoid desiccation. The specimens are then transferred carefully with the help of fine brush to vials containing 70% alcohol for preservation. Then label with full data regarding name of the host, location, locality, date and name of the collector to be written with pencil and to be put inside the vial.

The specimens are preferred to be mounted on slide without staining owing to its poor penetrability through the body cuticle. Sometimes studies under 25% to 30% aqueous solution of glycerol gives better result for study of roots of proboscis hooks.

SYSTEMATIC ACCOUNT

Class ARCHIACANTHOCEPHALA Meyer, 1931

Key to the orders of ARCHIACANTHOCEPHALA

1. Trunk short, conical, Proboscis un-retractable, Proboscis sheath absent, Parasites of birds ..... APORORHYNCHIDA, Thapar, 1927

   Trunk medium to long, cylindrical, Proboscis Retractile, proboscis sheath present. 2

2. Proboscis sub-spherical with nearly spiral rows of a few hooks each. Sensory pits present on apex of proboscis and on neck. Proboscis retractor muscles pierce dorsal wall of pr. sheath. Protonephridia present. Parasites of mammals and rarely birds ..... OLIGACANTHORHYNCHIDA, Petrotschenko, 1956

   Proboscis cylindrical or truncate, cone–shaped with nearly longitudinal rows of hooks. Sensory pits on apex of proboscis and on neck may be absent. Protonephridia absent. Proboscis retractile muscles pierce posterior or ventral wall of proboscis sheath .. 3

3. Proboscis truncate, cone-shaped with anterior hooks and posterior spines. Proboscis retractor muscles pierce ventral wall of probocis sheath .... GIGANTORHYNCHIDA, Southwell & Macfie, 1925

   Proboscis cylindrical with long rows of hooks. Proboscis retractor muscles pierce postero-ventral or posterior end of pr, sheath. Parasites of mammals and occasionally birds ..... MONILIFORMIDA Schmidt, 1972

Order APORORHYNCHIDA Thapar, 1927

Family APORORHYNCHIDAE Shipley, 1899 emend*

Family diagnosis : Apororhynchida : Body plump, with maximum width at level of proboscis or collar. Hypodermic nuclei large, amoeboid, 28-31 in number, Lacunar system consisting of dorsal and ventral main longitudinal vessels and transverse anastomoses. Proboscis globular; proboscis hooks reduced to spines which are deeply set without reaching the surface, or completely lacking. Proboscis sheath absent. Ganglion large, embedded in loose mesh of tissue, just under anterior wall of proboscis. Lemnisci very long, digitiform or tubular with central canal and 9-11 giant nuclei. Protonephridial organ absent. Testes diagonal, at or near middle trunk. Cementglands 8, pyriform. Eggs oval to elliptical, not fusifirm. With three membranes. Parasites of birds.

Type genus : *Apororhynchus* Shipley, 1899

1. Genus ***Apororhynchus*** Shipley, 1899
Synonym *Arhynchus* Shipley, 1896, preoccupied

Generic diagnosis : Apororhynchida; Apororhynchidae : Same as family diagnosis.

Type species : *Apororhynchus hemignathi* Shipley, 1897.

Type Host : *Hemignathus procerus.*

Type locality : Sand witch Isl. Brasil.

*Yamguti, S. 1963.

1. *Apororhynchus chauhani* Sen, 1975
(Pt. 3; Figs. 1a–1b)

Apororhynchus chauhani Sen, 1975 : *Dr. B.S. Chauhan Comm. Vol.;* pp. 211-215.

Host : *Athene brama.*

Location : Intestine.

Distribution : Sreesailam, Andhra Pradesh.

Diagnosis (After Sen, 1975) : Female : Body plump, 4.70 × 1.70. Proboscis 1.11 × 1.68. Spines on proboscis finger shaped and numerous; more numerous in posterior proboscis. Rest of the spines irregularly directed and sparse anteriorly. Proboscis sheath absent. Nerve ganglion large, near anterior proboscis. Lemnisci very long, unequal. Eggs not matured, 0.03-0.04 × 0.01-0.02.

Remarks : Das (1952) reported *A. bivolucrus* from *Neophron percnopterus* from India which was considered to be a strigeid trematoda by Yamaguti (1963). Hence, *A. chauhani* is the only valid species so far described from India.

Order GIGANTORHYNCHIDA Southwell and Macfie, 1925

Family GIGANTORHYNCHIDAE Hamann,1892 emend*
Synonym : Leiperacanthidae Bhalerao, 1937

Family diagnosis : Gigantorhynchida : Body medium to considerable size, with or without pseudo-segmentation. Proboscis bipartite, anterior portion with larger hooks, posterior portion with smaller rootless hooks or spines. Proboscis shrath elongate or plump, inserted at base of anterior portion of proboscis. Lemnisci long or short, slender. Protonephridial organ absent. Testes in anterior, middle or posterior portion of trunk. Cement glands 6-8, compact. Eggs oval, with concentric membranous shells. Parasites of birds and mammals.

Type genus : *Gigantorhynchus* Hamann, 1892

Key to the genera of GIGANTORHYNCHIDAE

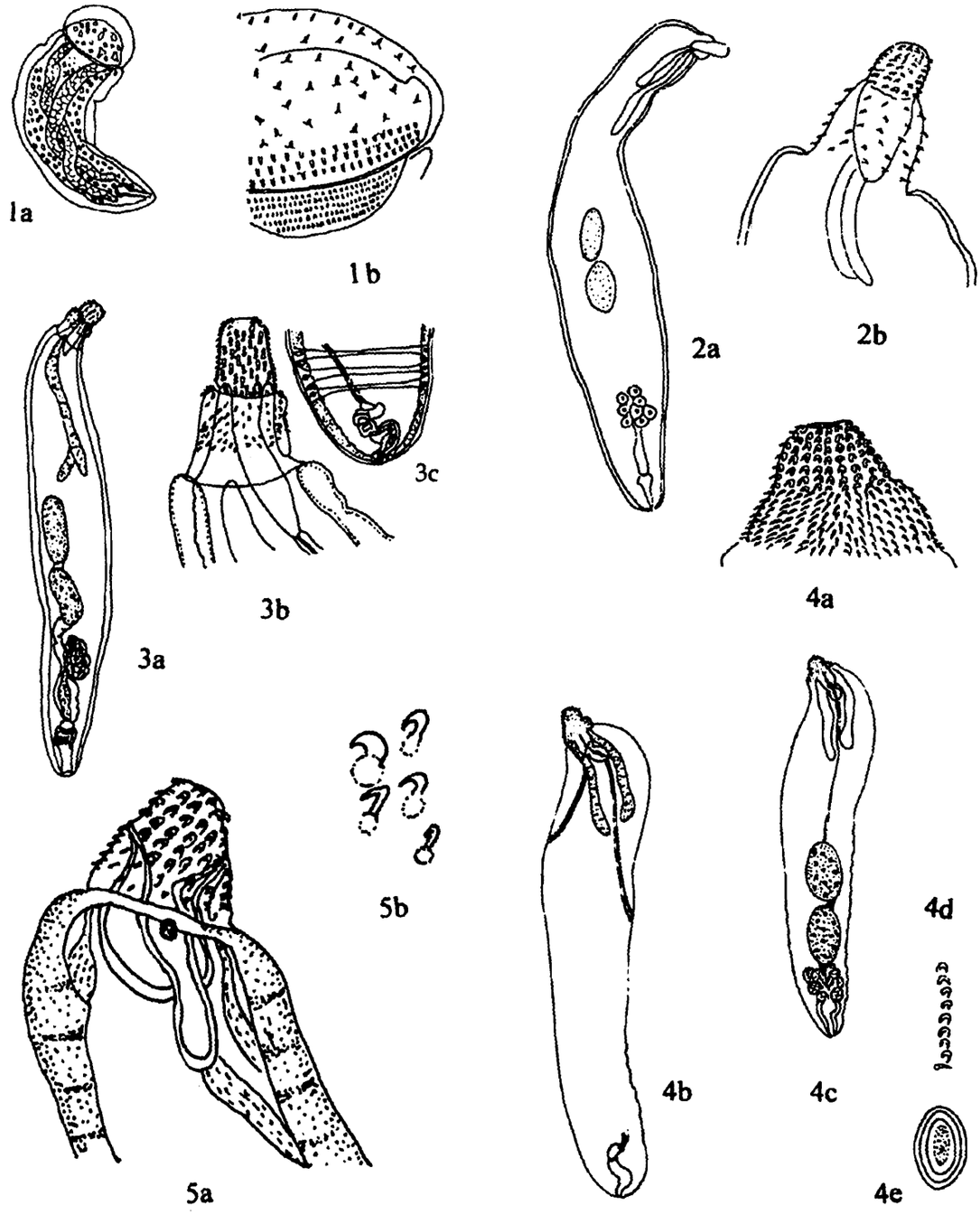
1. Proboscis with a single crown of large hooks at apex and minute spines on remaining cylindrical portion ..... ***Gigantorhynchus*** Hamann, 1899

   Proboscis hooks on anterior portion and spines on posterior portion. Proboscis conical, cylindrical, bipartite 2

2. Proboscis sheath divided into two portions, greater anterior portion double walled, posterior portion single walled ..... ***Empodisma*** Yamaguti, 1963*

   Proboscis sheath not divided 3

*Yamguti, S. 1963.



Plate–3

Fig. 1. *Apororhynchus chauhani* Sen, 1975. (a) female; (b) proboscis.

Fig. 2. *Mediorhynchus armenicus* Petrotschenko, 1958. (a) female, (b) proboscis.

Fig. 3. *Mediorhynchus cambellansis* Soota *et al.*, 1071. (a) male; (b) proboscis (c) posterior female.

Fig. 4. *Mediorhynchus channapettae* George and Nadakal, 1984 (a) proboscis; (b) female; (c) male; (d) Proboscis hooks; (e) egg.

Fig. 5. *Mediorhynchus colini* (Webster, 1948) Schmidt and Kuntz, 1977. (a) proboscis; (b) proboscis hooks.

3. Proboscis sheath single walled. Posterior proboscis hooks all spiniform ..... ***Mediorhynchus**** Van Cleave, 1916

Proboscis sheath double walled, posterior proboscis hooks partly rooted, partly rootless ..... ***Heteracanthorhynchus*** Linstrom, 1942

2. Genus *Mediorhynchus* Van Cleave, 1916

Synonym *Heteroplus* Kostlew, 1914 preoccupied
Micracanthorhynchus Travass 1917
Leiperacanthus Bhalerao, 1937

Generic diagnosis : Gigantorhynchidae : Body medium sized, Usually without pseudo-segmentation, Proboscis with hooks in spiral rows on anterior portion, and spines also in spiral rows on posterior portion; latter portion often conical, somewhat wider than former and may be folded transversely. Proboscis receptacle saccate to claviform, with single layered walls, Lemnisci long, slender. Testes in middle or posterior region of trunk. Cement glands 6-8, ovoid. Eggs oval, with concentric membranous shells. Parasites of birds.

Type species : *Mediorhynchus papillosum* Van Cleave, 1916

Type Host : *Myiochanes virens*

Type locality : N. America.

Schmidt and Kuntz (1977) revised the genus in order to remove some of the practical problems often confronted by the workers which led to confusion in the description of species. They suggested to count proboscis hooks on longitudinal rows rather than diagonal rows. They are quoted to have stated that '... basically the rows are arranged in longitudinal rows which are irregularly arranged to form quincunxes. One or two hooks may be seen misplaced giving superficial impression of disorder, but that impression can be removed by adjusting the focus of the microscope on the opposite side of the proboscis' Accordingly, they also proposed a number of Indian species as synonymous with some species occurring beyond India.

Key to species of the genus *Mediorhynchus*

1. Number of longitudinal rows of hooks and Spines equal, and number of hooks and spines in each row equal 2

   Number of spiral rows of hooks and spines 13

2. Rows of hooks and spines 14; hooks and spines in each row-4 ..... *M. peckeri*

N.B. Schmidt (1972) treated the order Apororhynchida Thapar, 1927 as a separate class. Amin (1987) maintained its status of an order under Archiacanthocephala. Amin's view is maintained by the present author.*Family diagnosis was emended by Yamaguti (1963). **The only genus *Mediorhynchus* is reported from India.

Rows of hooks and spines more 3

3. Rows of hooks and spines-16; hooks and spines in each row-8 ..... *M. pandei* n. sp

Rows of hooks and spines more 4

4. Rows of hooks and spines 20; hooks and spines in each row-4 ..... *M. quilonensis* n. sp.

Rows of hooks and spines more 5

5. Rows of hooks and spines 22-30 × 4-7 ..... *M. robustus*

Rows of hooks and spines unequal but number of hooks and spines in each row equal 6

6. Rows of hooks-16; rows of spines-18 but number of spines in each row-5 ..... *M. thrushi*

Rows of hooks and spines more 7

7. Rows of hooks-26-28 × 4-5; Rows of spines-30-32 × 4-5 ..... *M. garruli*

Rows of hooks and spines equal, hooks and spines in each row unequal 8

8. Rows of hooks-10-12 × 7; rows of spines-10-12 × 5-6 ..... *M. armenicus*

Rows of hooks and spines unequal, hooks and spines in each row unequal 9

9. Rows of hooks 14-16 × 4 rows of spines -18 × 7 ..... *M. grandis*

Rows of hooks and spines more 10

10. Rows of hooks 16-18 × 6-7; rows of spines 24-32 × 4-5 ..... *M. orientalis*

Rows of hooks and spines more 11

11. Rows of hooks 18-24 × 10-14; rows of spines 20-25 × 7-10 ..... *M. mariae*

Hooks and spines more 12

12. Rows of hooks 16-25 × 7-12; rows of spines 40-45 × 8-14 ..... *M. channapattae*

Hooks and spines in equal number of spiral rows 13

13. Hooks 7 spiral rows × 5-6; Spines 7 spiral rows × 2-3 ..... *M. passerus*

Unequal spiral rows of hooks and spines 14

14. Hooks 12 spiral rows × 4; spines 30 spiral rows × 14-15 ..... *M. rajasthanensis*

Hooks 12 spiral rows × 7; Spines 40 longitudinal rows × 3 ..... *M. colini*

Three more species have been included here which are kept beyond the key.

2. ***Mediorhynchus armenicus*** Petrotschenko, 1958
(Pt. 3; Figs. 2a–2b)

M. armenicus Petrotschenko, 1958 : Acanthocephala of domestic and Wild Animals. *Academy of Science of USSR.* Vol II, pp. 1-478.

M. armenicus : Gupta and Lata (1968); *Res. Bull. Punjab Univ.* Sci. 18; pp. 253-268. Type locality : Punjab.

M. armenicus : Bhattacharya (1999); ZSI, *Fauna of Meghalaya, State Fauna Series,* 4(Part-9) : pp. 359-392.

Host : *Picus flavinucha; Garrulax moniligers*

Location : Intestine.

Distribution : Punjab; Meghalaya.

Diagnosis (After Bhattacharya, 1999) : Male : Body 9.00-16.00 × 2.21-2.93, with pseudosegmentation. Proboscis 0.56-0.63 × 0.52-0.59 (at base), armed with 10-12 longitudinal rows of 7 hooks each, hooks 0.04 long, posterior proboscis armed with 10-12 longitudinal rows of 5-6 spines each, spines 0.03 long. Proboscis sac 0.49-0.77 × 0.24-0.43. Lemnisci short, Testes in posterior half, T/1–1.30-1.93 × 0.78-0.95; T/2– 1.29-2.17 × 0.81-0.94. Cement glands 8.

Female : Body 23.00-28.00 × 3.00-4.05; Eggs 0.04-0.06.

Remarks : The species was first reported by Gupta and Lata (1968) from India. Schmidt and Kuntz (1977) synonymised the species with *M.micracanthus* on the basis of identical dimension of body and number of cement glands. Bhattacharya (1999) opposing the synonymy re-described the species with 8 cement glands from Meghalaya and Tripura.

3. ***Mediorhynchus cambellansis*** Soota *et al.*, 1971
(Pt. 3; Figs. 3a–3c)

M. cambellensis Soota *et al.*, 1971 : *Proc. Ind. Acad. Sci.* 73; pp. 20-29.

Host : Fly catcher.

Location : Intestine.

Type locality : Cambell Bay, Great Nicobar, Andamans.

Diagnosis : (After Soota *et al.*, 1971) : *Male* : Body 9.13 × 1.2. Proboscis short, club-shaped, 0.83 long, armed with 7 spiral rows of 7-9 each, posterior proboscis too small to count the spines. Proboscis sheath 0.66. Lemnisci equal. 3.15 × 0.25. Testes equal, 1.2 × 0.44. Cement glands 4 in pairs.

Female : Body 13.00-16.00 long. Proboscis 1.00 long. Genital pore sub-terminal. Eggs 0.055 × 0.033.

Remarks : In absence of report of number of spines in posterior proboscis, the species is left out of key to species. Schmidt and Kuntz (1977) considered it as an unrecognizable species.

4. *Mediorhynchus channapettae* George and Nadakal, 1984
(Pt. 3; Figs. 4a–4e)

Mediorhynchus channapettae G & N (1987) : *Acta Parasitologica Polonica*, **29**; fase.12; pp. 97-100.

Host : *Dinopium bengalense.*

Location : Small ntestine.

Type locality : Channapetta and Bethany Hills, Kerala

Diagnosis : (After George and Nadakal) : Male : Body 6.00-12.00 × 1.00-2.00. Proboscis 0.4-0.45, anterior proboscis armed with 16-25 rows of l7-12 hooks each, posterior proboscis with 40-45 logitudinal rows, each with 8-14 spines. Anterior hooks 0.025-0.030 × 0.008-0.012, middle 0.050-0.058 × 0.010-0.016; posterior 0.025-0.030 × 0.006-0.010. Proboscis sac 0.560-0.600 × 0.200-0.252. L/1–1.7-1.9 × 0.2-0.25; L/2 1.1-1.68 × 0.15-0.19.Testes 1.6-1.7 × 0.8-0.85. Cement glands 8, pyriform, 0.300-0.560 × 0.250-0.562, Female : 8.00-20.00 × 1.35-3.00. Embryo 0.040-0.050 × 0.035-0.040.

5. *Mediorhynchus colini* (Webster, 1948) Schmidt and Kuntz, 1977
(Pt. 3; Figs. 5a–5b)

M. colini Webster, 1948 : *J. Parasitology* **34** : pp.84-86

M. colini : Gupta and Lata (1968); *Res. Bull. Punjab Univ. Sci* **18** : pp. 253-268

Host : *Colinus virginiatus* from Texas.

Location : Intestine.

Distribution : Punjab.

Diagnosis : (After Webster, 1948) : Female : Body 24.00-31.00 × 0.6-1.0. Proboscis 0.292 × 0.288,.anterior proboscis armed with 12 spiral rows with 7 hooks each, posterior proboscis armed with 40 longitudinal rows of 3 spines each, hooks 0.03-0.035 long (including roots). Proboscis sac 1.08-1.25 × 0.274. Lemnisci 3.48-3.56 long with 8-9 nuclei each. Eggs 0.029-0.036 × 0.018-0.021.

Remarks : Gupta and Lata (1968) reported the species for the first time from India. Schmidt and Kuntz (1977) synonymised the species with *M. papillosus.*

6. *Mediorhynchus garruli* Yamaguti, 1939
(Pt. 4; Figs. 6a–6b)

M. garruli Yamaguti, 1939 : *Jap. J. Zool.* **13**(3) : pp. 317-365.

M. garruli : Bhattacharya (2000); ZSI, *State Fauna Series-7; Fauna of Tripura*, Part-4 : pp. 141-162.

Host : *Garrulus glandarius japonicus;* Wood-pecker (Tripura).

Location : Intestine.

Distribution : Japan; India.

Diagnosis : (After Bhattacharya, 2000) Female : Body 25.75 × 3.37. Entire proboscis conical, 1.375 x 0.58 (at base), armed with 6-28 longitudinal rows of 4-5 hooks each, spines in 30-32 longitudinal rows of 4-5 each. Hooks–0.028-0,05 (point) and 0.05-0.06 (root); spines 0.03-0.06 long. Pr. Sheath 1.125 × 0.25. Lemnisci short with 6-7 nuclei each. Eggs 0.06 × 0.036.

Remarks : The synonymy of the species with *M. robustus* as proposed by Schmidt and Kuntz (1977) is on the basis of identical size of eggs and equal number of cement gland. This synonymy may not be agreed upon because *M. garruli* bears 8 cement glands whereas original description of *M. robustus* lacks number of cement glands.

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

M. grandis Van Cleave, 1916 : *Trans. Am. Micros. Soc.* **35** : pp. 221-232.

M. grandis : Bhattacharya (1999) : *ZSI, State Fauna Series-4; Fauna of Meghalaya* Part-9 : pp. 359-392.

Host : *Vanellus sp* (India).

Location : Intestine.

Distribution : Garo Hills, Meghalaya.

Diagnosis : (After Bhattacharya, 1999) : Female : Body 12.25 × 0.75. Proboscis cylindrical, 0.62 × 0.57 (base), anterior proboscis hooks in 14-16 longitudinal rows of 4 hooks each. Posterior proboscis with 18 longitudinal rows of 7 hooks each. Point of hooks 0.016 long and root 0.04 long. Proboscis sac 0.625 × 0.3. Lemnisci unequal. Eggs not found.

Remarks : Van Cleave (1916) described the species from North America. Bhattacharya (1999) probably, reported it for the first time from India.

8. ***Mediorhynchus gallinarum*** (Bhalerao, 1937) Van Cleave, 1947
(Pt. 4; Figs. 7a–7b)
Synonym *Leiperacanthus gallinarum* Bhalerao, 1937
M. selengensis Harris, 1973

M. gallinarum Bhalerao, 1937 : *Proc. Zoo. Soc. London, s. B*, **107**(2) : pp. 199-203

M. gallinarum Nath and Pande, 1967 : *Ind. J. Helm.* **15**(1) : pp. 31-35. Mathura, U.P.

M. gallinarum : Bhattacharya (2005); ZSI, *State Fauna Series-5; Fauna of Andhra Pradesh*, Part- 5; pp. 123-157 *Locality* : Mukteswar, India.

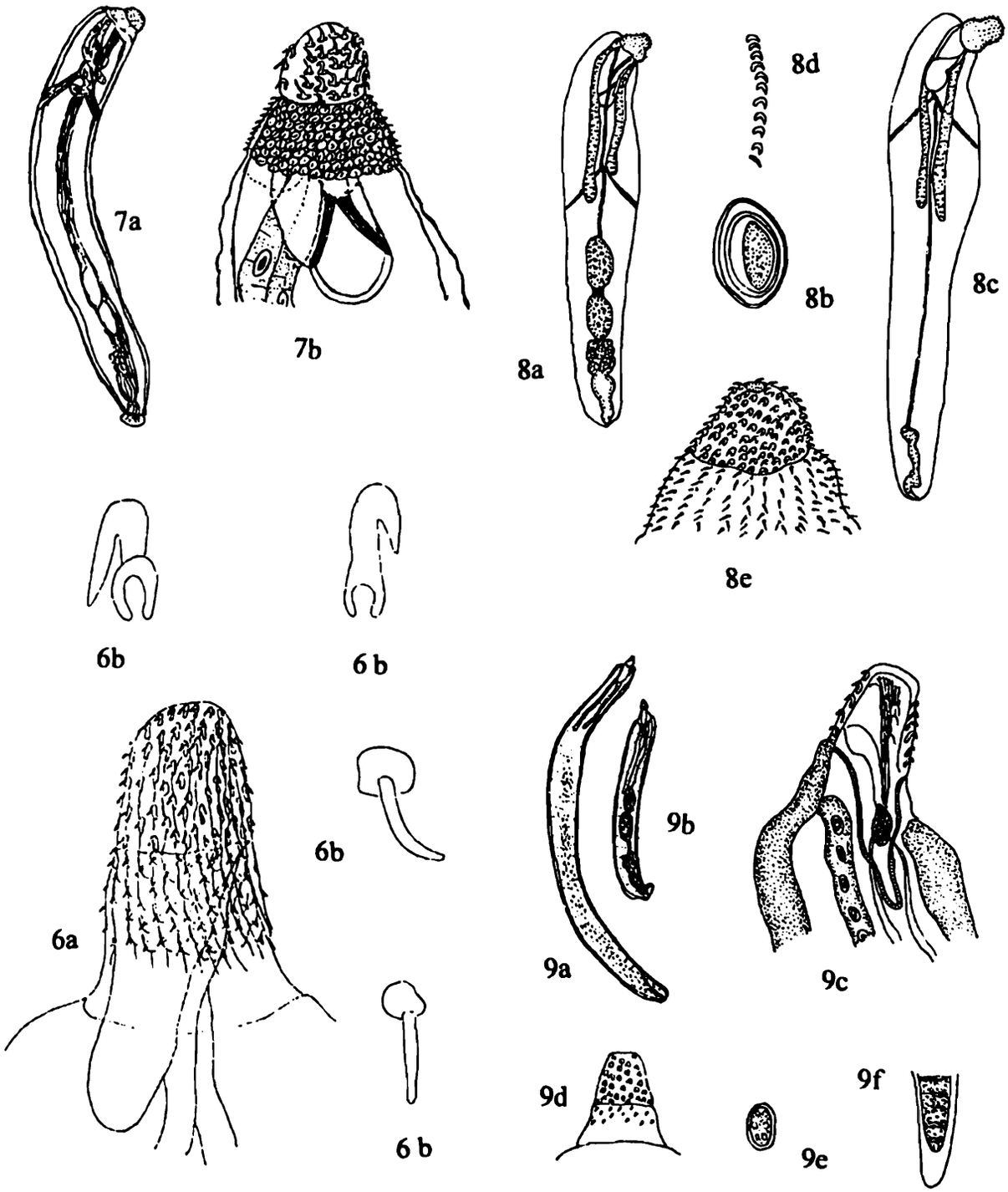


Plate-4

Fig. 6. *Mediorhynchus garruli* Yamaguti, 1939. (a) proboscis; (b) proboscis hooks.

Fig. 7. *Mediorhynchus gallinarum* (Bhalerao, 1937) Van Cleave, 1947. (a) male; (b) anterior of male with Proboscis.

Fig. 8. *Mediorhynchus mariae* George and Nadakal, 1984. (a) male; (b) egg; (c) female; (d) proboscis hooks; e) proboscis.

Fig. 9. *Mediorhynchus passerus* Das, 1951 (a) female; (b) male; (c) proboscis; (d) proboscis; (e) egg; (f) posterior female.

Host : *Gallus gallus domesticus.*

Location : Intestine.

Distribution : Mathura, Mukteswar, Kurnool, India.

Diagnosis : (After Nath and Pande, 1967) Male : Body 8.2-11.3 × 1.2-1.5. anterior proboscis sub-globular, 0.27-0.35 × 0.36-0,38. Posterior proboscis 0.28-0.32 × 0,72-0.32. Testes posterior third, 0.75-0.85.

(After Bhattacharya, 2005) : Male : Body 8.30-9.13 × 0.498. Proboscis truncate, 0.64-0.73 × 0.796–0.86 (both anterior and posterior), armed with 18-20 rows of 5 rooted hooks and 4-5 posterior spines in each row. Proboscis sac 0.531–0.581 × 0.249–0.298. Lemnisci 2.739–2.822.

Remarks : The species was described as *L. gallinarum* by Bhalerao from Mukteswar, India. Later, it was reported by Nath and Pande from India. Bhattacharya (2005) reported the species in a domestic fowl at kurnool, A.P. Schmidt and Kuntz (1977) synonymised *M.selengensis* Harris, 1973 with *M.gallinarum.*

9. ***Mediorhynchus mariae*** George and Nadakal, 1984
(Pt. 4; Figs. 8a–8e)

M. mariae George and Nadakal, 1984 : *Acta Parasitologica Polonica;* **29;** *fasc.* 12; pp. 97-106. Type locality : Kerala.

Host : *Acridotheres tristis.*

Location : Small intestine.

Distribution : Kerala.

Diagnosis : (After George and Nadakal, 1984) : *Male* : Body 6.00-15.00 × 1.00-1.15. Anterior proboscis 0.650-0.766 × 0.400-0.652, posterior proboscis 0.275-0.456 × 0.500-0.915, anterior proboscis armed with 18-24 longitudinal rows of 10-14 hooks. Anterior hooks 0.036-0.040 × 0.008-0.014, middle 0.058-0.064 × 0.010-0.018; posterior hooks 0.040-0.046 × 0.008-0.012; roots 0.035-0.040, posterior proboscis with 20-25 longitudinal rows of 7-10 spines. Pr. sh. 1.00-1.15 long. L/1–3.00-3.35 long; L/2–2.8-3.31 long T/1–1.12-1.15 × 0.4-0.45; T/2–1.00-1.17 × 0.4-0.45. Cement glands 8.

Female : Body 6.00-35.00 × 1.5-2.00. Eggs 0.060-0.076 × 0.034-0.045. Embryo 0.040- 0.050 × 0.015-0.020.

10. ***Mediorhynchus pandei*** n. sp.
(Pt. 5; Figs. 10a-10c)

Some female specimens were recovered from a bird host, *Metopodius indicus* in the district of Uttar Pradesh. Type species is deposited in the National Zoological Collection of Zoological Survey of India.

Host : *Metopodius indicus.*

Location : Intestine.

Type locality : U.P.

Diagnosis : Female : Body very long, slender, 51.625-58.5 long and 0.80-0.875 wide. Proboscis fully stretched, truncated, 0.625-0.675 long and 0.4-0.45 wide, armed with 16 longitudinal rows of 8 hooks each, spines in posterior proboscis 16 longitudinal rows of 8 spines each., points of hooks small, 0.01-0.014 long and roots 0.020-0.022 long. Proboscis sheath single walled with ganglion at centre. Lemnisci little unequal, L/1–4.5-4.55 long; L/2–4.125-4.150. Genital pore terminal. Eggs, 0.055-0.060 × 0.035-0.040, outer shell membrane appears like square case.

Remarks : The species is characterized by equal number of longitudinal rows of hooks and spines and equal number of hooks and spines in each row. The size of hooks and spines on proboscis is very small as compared to that of *M.peckeri* and *M.quilonensis* which bear same number of rows of hooks and spines and same number of hooks and spines in each row. Moreover, *M.pandei* possesses unusal type of outer shell of eggs which has made it independent of other species of the genus. The species is named after Prof. K.C. Pande, Ex-Vice Chancellor Meerut University.

11. ***Mediorhynchus passerus*** Das, 1951
(Pt. 4; Figs. 9a–9f)

Mediorhynchus passerus Das, 1951 : *Rec. Ind. Mus* **49** : pp. 53-66.

Host : *Passer domesticus.*

Location : Intestine.

Type locality : Amraoti, Bihar

Diagnosis : (After Das, 1951) : *Male* : Body 5.6 × 0.6. Entire proboscis–0.36 × 0.23, armed with 7 spiral rows of 5-6 hooks on anterior proboscis, 7 spiral rows of 2-3 spines in posterior proboscis, anterior hooks 0.010-0.020; anterior roots 0.019- 0.030, rootless spines 0.014-0.018, Proboscis sh. 0.46 × 0.13. Lemnisci 2.1 with giant nuclei, T/1–0.56 X 0.31; T/2 0.8 × 0.38. Cement glands 6 or 8.

Female : Body 16.4 × 1.0. Embryo, 0.03 × 0.02.

Remarks : Schmidt and Kuntz (1977) though considered it a valid species but according to them, incongruity between the description and the figures puts the status of the species inconclusive.

12. ***Mediorhynchus peckeri*** Bhattacharya, 1999
(Pt. 5; Figs. 11a-11d)

M. peckeri Bhattacharya, 1999 : *ZSI, Fauna of Meghalaya, State Fauna Series,* **4**(Part-9) : 359-392.

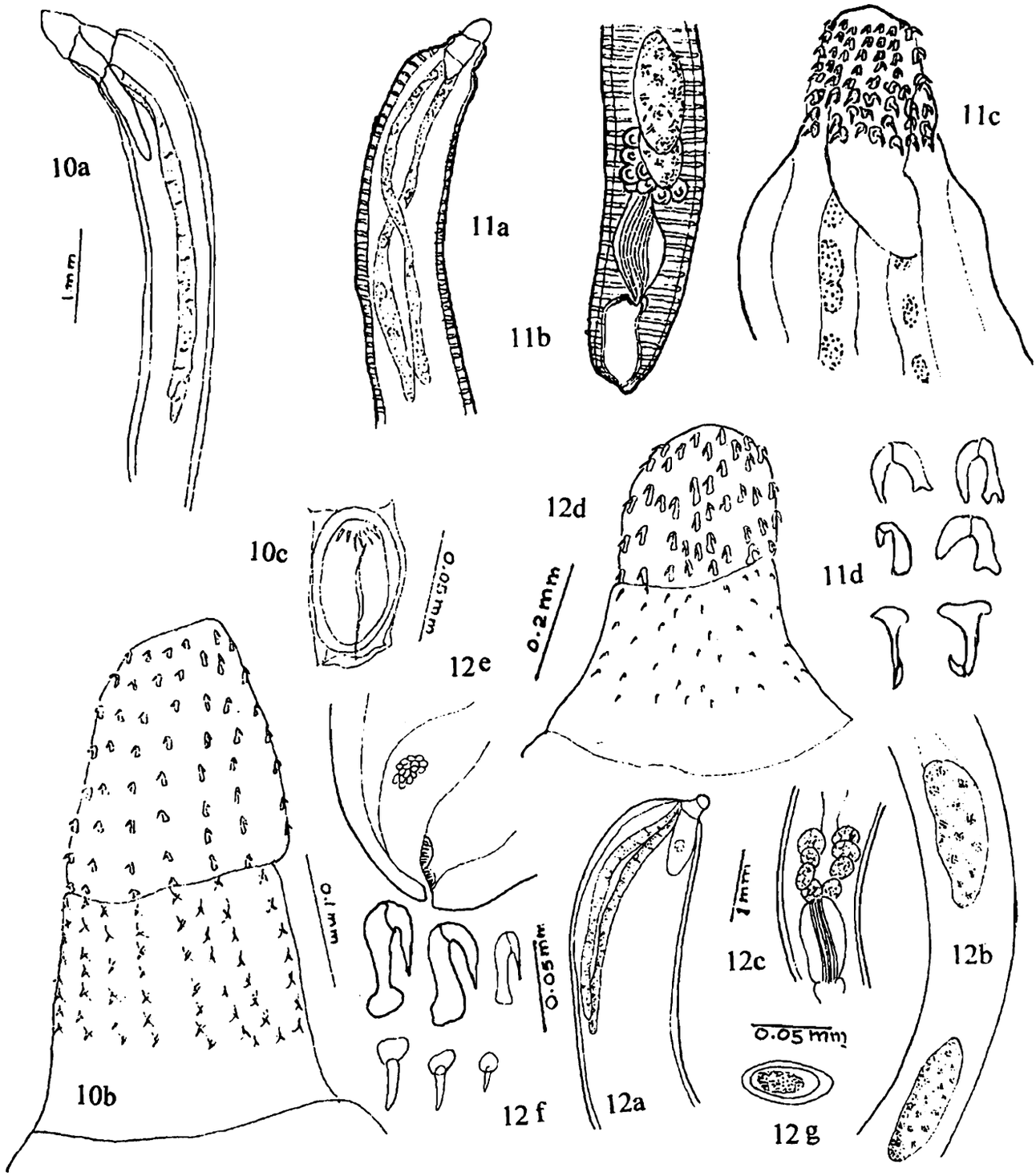


Plate-5

Fig. 10. *Mediorhynchus pandei* n. sp. (a) anterior body; (b) proboscis; (c) egg.

Fig. 11. *Mediorhynchus peckeri* Bhattacharya, 1999. (a) anterior male; (b) posterior male; (c) proboscis; (d) proboscis hooks.

Fig. 12. *Mediorhynchus quilonensis* n. sp. (a) anterior male; (b) mid-body of male; (c) posterior of male; (d) proboscis; (e) posterior female; (f) proboscis hooks; g) egg.

Host : Wood pecker.

Location : Intestine.

Type locality : Meghalaya.

Diagnosis : (After Bhattacharya, 1999) : Male : Body 22.25 × 1.125 Proboscis conical, 0.75 × 0.45, armed with 14 longitudinal rows of 4 hooks each, posterior proboscis hooks with 14 longitudinal rows of 4 spines each, anterior points of hooks 0.020-0.036, roots–0.03-0.044 and spines 0.03 long, 4th hooks of each row largest, 0.068 (point and root together). Proboscis sheath 0.675 × 0.275. Lemnisci unequal, L/1–4.5 × 0.125; L/2–4.75 × 0.125, one lemniscus with 6-7 nuclei and other with 4 nuclei. Testes 1.25 × 0.625. Cement glands 8. Genital pore terminal.

Remarks : The species is distinguished from rest of the species under the genus, with equal number of rows of hooks and spines, and equal number of spines in each row on proboscis. Moreover, it is characterized by unequal number of nuclei on lemnisci.

13. ***Mediorhynchus quilonensis*** n. sp.
(Pt. 5; Figs. 12a-12g)

Host : *Vanellus malabaricus.*

Location : Intestine.

Type locality : Quilon, Kerala

Materials : Males and females deposited in the NZC, ZSI.

Diagnosis : *Male* : Body long, cylindrical, 33.00-36.00 long and 1.375-1.40 wide. Proboscis conical, 0.55-0.62 long and 0.425-0.450 wide, armed with 20 longitudinal rows of 4 hooks each and posterior proboscis armed with 20 longitudinal rows of 4 spines each, roots longer than points of hooks, roots 0.045-0.055 long; points 0.04-0.046 long; spines, 0.03-0.032 long. Proboscis sheath single walled with ganglion in the middle, 0.85-0.88 long and 0.3-0.35 wide. Lemnisci unequal, L/1–3.25-3.36; L/2–3.20-3.50. with nuclei. Testes post-equatorial, oval, one behind other, T/1–2.00- 2.125 long and 0.625-0.676 wide; T/2–2.125-2.175 long and 0.70-0.75 wide. Cement glands 8 in two lines, pyriform,

Female : Body very long, 60.00-68.00 long and 2.00-2.125 wide. Proboscis conical, 0.58-0,65 long and 0.45-0.425 wide, armed with 20 longitudinal rows of 4 hooks each and posterior proboscis with 20 longitudinal rows of 4 spines each. Roots longer than points of hooks, points 0.042-0.045 long ; roots 0.05-0.055 long; spines 0.03-0.032 long. Genital pore sub-terminal. Eggs 0.05-0.055 long and 0.025-0.030 wide. Embryo with spines at one pole.

Remarks : The species, being very closed to *M.peckeri* Bhattacharya (1999) and *M.pandei* n. sp., in respect of equal number of hooks and spines on proboscis, differs from the former with greater number of hooks and spines, and greater size of points and roots of

hooks. Similarly, it differs from the latter by having lesser size of roots and points of hooks. The species by possessing cement glands in two lines, claims its distinction from all the species under the genus.

14. *Mediorhynchus rajasthanensis* Gupta, 1976
(Pt. 6; Figs. 13a-13e)

Mediorhynchus rajasthanensis Gupta, 1976 : *J. Bombay Nat. Hist. Soc.* 75(1) : pp. 182-183.

Host : *Choriotis nigriceps* (Great Indian Bustard).

Location : Intestine.

Type locality : Pokhran, Rajasthan.

Diagnosis : (After Gupta, 1976) : *Male* : Body 9.44 × 0.828. Proboscis 0.966 × 0.540-0.612, armed with 12 spiral rows of 4 hooks each, hooks, 0.100-0.120 × 0.016- 0.020. posterior proboscis armed with 30 spiral rows of 14-15 spines each. Pr.sheath 0.756-0.80 × 0.396-0.468. Lemnisci unequal, 1.980-2.840 × 0.144, each with 7 nuclei. T/1–0.684 × 0.216; T/2–0.648 × 0.216. Cement gland 8. Eggs 0.062- 0.081 × 0.031-0.050.

15. *Mediorhynchus taeniatus* (Linstow, 1901) Dollfus, 1936
(Pt. 6; Figs. 14a–14b)

Synonym *Echinorhynchus taeniatus* Linstow, 1901
Echinorhynchus segmentatus Marval, 1902
Empodius taeniatus (Linstow, 1901) Petrotschenko, 1959

Ehinorhynchus taeniatus Linstow, 1901 : *Bull. Acad. Imper. Sci. St. Petersberg*, 5. a, v, 15(3) : pp. 271-292.

Echinorhynchus taeniatus : Rao, B.S. (1994) : *C.B. Srivastava Comm. Vol.* pp. 81-84

Host : *Turnix suscilator.*

Location : Intestine.

Distribution : Andhra Pradesh.

Diagnosis : (After Meyer, 1933) : Body with distinct pseudo-metamerism. Male and female 90.00-115.00 × 2.5-3.0. proboscis 0.86 × 0.4, armed with 6 spiral rows of 5 hooks each, posterior proboscis armed with 12 spiral rows of spines of 16 each. Lemnisci with 5 nuclei. Testes 3.00 long. Eggs 0.1 × 0.04.

Remarks : *Echinorhynchus taeniatus* was first described by Linstow (1901). Travassos (1916) transferred the species to the genus *Empodius* as its type. Dollfus (1936) again transferred it to the genus *Mediorhynchus*. Rao (1994) reported the species for the first time from Andhra Pradesh in *Turnix suscilator* while studying seasonal incidence of infection of the species. No description of species has been provided by him.

16. *Mediorhynchus thrushi* Bhattacharya, 2000
(Pt. 6; Figs. 15a–15e)

M. thrushi Bhattacharya, 2000 : *ZSI, State Fauna Series-7; Fauna of Tripura;* Part-4; pp. 141-162. Type locality : Paratia, Tripura.

Host : *Garrulus moniligers.*

Location : Intestine.

Distribution : Tripura.

Diagnosis : (After Bhattacharya, 2000) : *Male* : Body 4.48-5.25 × 1.42-.1.5. Proboscis 0.48-0.55 × 0.645 at base, armed with 16 longitudinal rows of 5 hooks each, posterior proboscis with 18 longitudinal rows of 5 spines each, points of hooks 0.041-0.055 long, roots 0.043-0.058 long, spines 0.025 long. Proboscis sheath 0.45-0.70 × 0.25-0.28. Lemnisci with 4 nuclei each. Testes contiguous, T/1–0.98-1.00 × 0.50-0.55; T/2–1.00-1.15 × 0.55-0.58. Cement gland 6 in pairs. Genital pore terminal. No female specimens.

Remarks : Equal number of hooks and spines in each row and unequal number of rows of proboscis hooks and spines along with the presence of 4 nuclei in each lemniscus are the main characteristic features of the species.

17. *Mediorhynchus orientalis* Belopolskaya, 1953
Synonym *M. bullocki* Gupta and Jain, 1973
(Pt. 6 & 7; Figs. 16a-16f)

M. orientalis Belopolskaya, 1953 : *Zap.Leningrad. Ser. Biol. Nauk* B. **28**(141) : pp. 158-159.

M. orientalis : Bhattacharya (1999) : *ZSI, State Fauna Series-4; Fauna of Meghalaya,* Part-9; pp. 359-392.

M. orientalis : Bhattacharya (2005) : *ZSI, State Fauna Series- ; Fauna of Andhra Pradesh,* Part-; pp.

Host : *Sphaechochila humei.*

Location : Intestine.

Locality : Tirup, Arunachal Pradesh.

Other Indian hosts : *Picus sp.* (Meghalaya), *Pomatorhinus horsfieldei* (Arunachal Pradesh).

Distribution : Meghalaya, Andhra Pradesh, Arunachal Pradesh.

Diagnosis : *Male* : Body long, slender, lacking pseudo-segmentation, 46.125 long and 1.5 wide. Main lacunar canals with regular branches. Proboscis conical, 0.8 long and 0.45 wide at base. Anterior proboscis hooks in 16-18 longitudinal rows of 6-7 each, posterior proboscis in 30-32 rows of 4-5 spines each point of hooks 0.02-0.03 long, roots0.02-0.03long spines 0.0175-0.02. Lemnisci with 6-7 nuclei in each anteriorly, L/1–2.20-2.25 long .Proboscis sac 0.925-1.0 long and 0.20-0.25 wide. Nerve-ganglion near middle. Testes post-equatorial, T/1–1.125–0.132 long and 0.055 wide; T/2–1.125-1.135 long and 0.65 wide. Cement gland 8, pyriform, with one nucleus each.

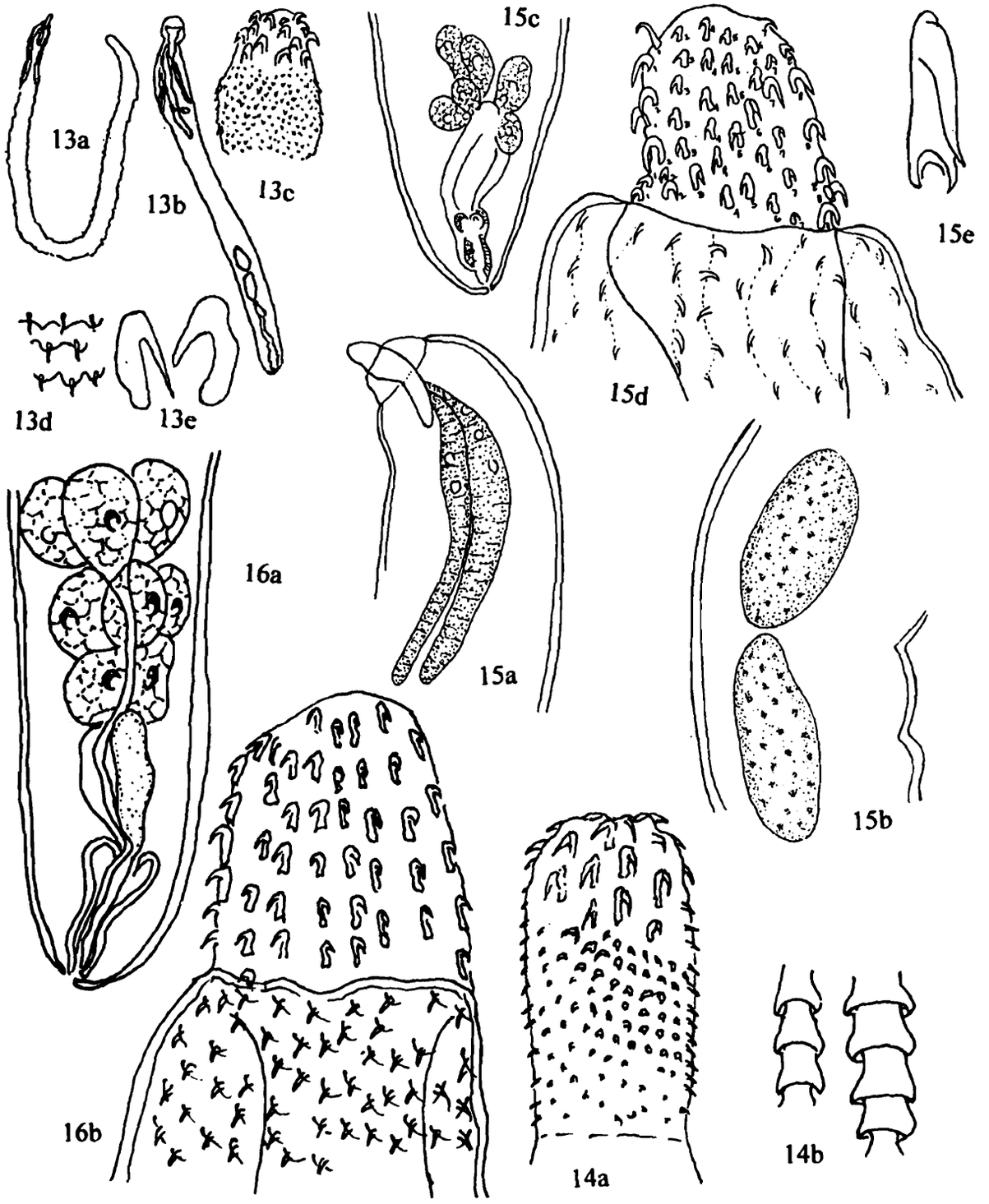


Plate-6

Fig. 13. *Mediorhynchus rajasthanensis* Guptā, 1976. (a) female; (b) male; (c) proboscis; (d) trunk spines; e) proboscis hooks.

Fig. 14. *Mediorhynchus taeniatus* (Linstow, 1901) Dollfus, 1936. (a) proboscis; (b) body.

Fig. 15. *Mediorhynchus thrushi* Bhattacharya, 2000. (a) anterior male; (b) midbody of male; (c) posterior of male; (d) proboscis; (e) proboscis hook.

Fig. 16. *Mediorhynchus orientalis* Belopolskaya, 1911. (a) posterior of male; (b) proboscis.

Female : Body long, 43.5 long and 1.625 wide. Proboscis conical, 0.67 long and 0.45 wide at base. Number of hooks and spines same as in male, size of hooks little larger than that of male, points of hooks 0.0415 long, roots 0.0415 long; spines 0.0332 long. Lemnisci larger than that of male, L/1–2.575 × 0.3; L/2–3.825 × 0.3 with 6-7 nuclei each anteriorly. Genital pore terminal. Eggs 0.05-0.055 long, embryo echinate.

Remarks : *M.orientalis* has been reported by Bhattacharya from Meghalaya as mentioned above. Description of the species given by Schmidt and Kuntz (1977) on the specimens obtained from Taiwan, Borneo and Hawaii reveals a great degree of variation of measurement of different organs. Wide variation of measurement in Indian specimens is also observed by the author. The description given here is on the specimens obtained from *S. humei* at 77 miles off Tirup on Gandhinagar Road, Arunachal Pradesh. Schmidt and Kuntz (1977) made *M. bullocki* Gupta and Jain, 1973 a junior synonym of *M. orientalis*

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

M. robustus : Bhattacharya (2005) : *ZSI, State Fauna Series-5* : *Fauna of Andhra Pradesh*, Part-5 : pp. 123-157.

Host : Drongo and Racket tail drongo.

Location : Intestine.

Distribution : Kurnool, Andhra Pradesh.

Diagnosis : (After Bhattacharya, 2005) : Body 6.30-10.62 long and 0.664-0.667 wide. Proboscis 0.664-0.913 long and 0.332-0.664 wide, anterior proboscis armed with 28-30 rows of 4-5 hooks each,. posterior proboscis armed with 28-30 rows of spines with 4-5 hooks each, points of anterior hooks0.025 long; roots 0.04-0.045 long; spines 0.015-0.0375 long. Proboscis sheath0.913-0.99 × 0.166-0.249. Lemnisci 2.90-3.486 long. Genital pore terminal. Eggs not developed.

Remarks : The original description of species lacks number of rows of spines. Only 24 rows of hooks are reported in it. Schmidt and Kuntz (1977) reported 22-26 rows of 4-7 hooks each.

Order OLIGACANTHORHYNCHIDA Petrotschenko, 1956

*Family OLIGACANTHORHYNCHIDAE Southwell & Macfie, 1925

Family Diagnosis : Trunk medium-sized to very long. Proboscis subspherical, with short, approximately straight, longitudinal rows of few hooks each. All but basal hooks with anterior manubrium and strong root. Sensory papilla present on apex of proboscis and each side of neck. Proboscis receptacle with thick muscular wall and no outer wall. Proboscis retractor muscle pierces dorsal wall of receptacle. Brain on ventral inner surface

*emended by Schmidt (1972)

of receptacle. Lemnisci long, flat, distal ends not bound to body wall, with a giant nuclei. Testes elongate, tandem. Cement glands compact, 8 in number, usually each with single giant nucleus. Protonephridial organs present in both sexes, near anterior cement gland in males, on uterine bell of female. Eggs oval, with sculptured or punctuate thin outer membrane, and thick middle membrane. Parasites of birds and mammals.

Type genus : *Oligacanthorhynchus* Meyer, 1931.

Schmidt (1972) while reviewing the class Archiacanthocephala treated *Nephridiacanthus; Echinopardalis; Hamanniella* and *Travassosia* synonymous with *Oligacanthorhynchus*. Golvan (1994) had repudiated the view and revalidated *Nephridiacanthus* and *Echinopardalis*. He transferred *Nephridiorhynchus thapari* to the genus *Nephridiacanthus*. Following is the key to genera prepaired by Schmidt (1972).

Key to Genera of OLIGACANTHORHYNCHIDAE

1. Anterior trunk with dorsal and ventral sagittal crests ..... ***Tchadorhynchus*** Troncy, 1970

   anterior trunk lacking such crests 2

2. Proboscis with 12 longitudinal; regularly alternating rows of 2 and 3 hooks each, total of 30 ..... ***Neonicola*** Schmidt 1972

   Proboscis with more than 30 hooks 3

3. Proboscis with 36 hooks 4

   Proboscis with more than 36 hooks 7

4. Testes both post equatorial; anterior trunk narrower than posterior trunk ..... ***Oligacanthorhynchus***, Travassos, 1915

   Testes anterior to mid body 5

5. Small process at female genital aperture ..... ***Echinopardalis*** Travassos, 1918

   At least one testis pre-equatorial; anterior trunk wider than posterior trunk 6

6. Trunk very long; females over 100 mm long ..... ***Macracanthorhynchus***, Travassos, 1917

   Trunk short to medium, long; female under 100 mm long ..... ***Onicola*** Travassos, 1916

7. Anterior trunk narrower than posterior trunk; proboscis hooks in 6 spiral rows of 6 each or more ..... ***Nephridiacanthus*** Meyer, 1931

   Trunk plump; lemnisci flattened and band like 8

8. Anterior trunk wider than posterior trunk; proboscis hooks in 12 longitudinal, regularly

or irregularly alternating rows of 3 to 12 each, total 42 to 102 .....
..... ***Pachysentis*** Meyer, 1931

outer shell of eggs with reticular sculpturing ..... ***Prosthenorchis*** Travassos, 1915

*3. Genus ***Oligacanthorhynchus*** Meyer, 1931
Synonyms *Hamanniella* Travassos, 1915
Travassosia Meyer, 1931

Generic Diagnosis : Oligacanthorhynchidae : Trunk long, slender, anterior end narrower than posterior end; usually fixed with numerous transverse wrinkles. Proboscis subspherical, with 12 regularly alternating, approximately longitudinal rows of 3 hooks each. Hooks with large , anterior manubria and powerful roots, except for basal spines ; points commonly barbed. Testes tandem, post-equatorial, Cement glands compact, 8 in number, 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.

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

Key to species of *Oligacanthorhynchus*

Body 5.75 × 1.60; proboscis armed with 3 spiral rows of 6-8 hooks each .....
.....*O. indicus* Renguraju & Das, 1981

Body 29.00-29.3; proboscis armed with 10 longitudinal rows of 2-3 hooks each.....
..... *O. cati* (Gupta & Lata, 1968) Schmidt, 1972

19. ***Oligacanthorhynchus cati*** (Gupta and Lata, 1968) Schmidt, 1972
(Pt. 7; Figs. 17a–17b)

Hamanniella cati Gupta and Lata, 1968c : *Res. Bull. Punjab Univ (Sci)*, 18 (3/4); pp. 253-268.

Host : *Felis domesticus.*

Location : Intestine.

Type locality : Chandigarh, Punjab.

Diagnosis : (After Gupta and Lata, 1967) : *Male* : Body 29.00-29.3 × 1.8-1.9. Proboscis 0.30-0.64 × 0.49-0.54, armed with 10 longitudinal rows of 2-3 hooks each., marginal hooks 0.084 × 0.028. Pr. sheath 1.23-1.47 × 0.25-0.44. Lemniscus-0.23-0.28. T/1–3.2-3.5 × 0.77-0.84. Cement glands 4 pairs. Genital sheath 2.54-3.05 × 0.96-0.99.

Remarks : Gupta and Lata (1968c) described *H.cati* which is now transferred to the genus *Oligacanthorhynchus* after the genus *Hamanniella* has been synononymised with *Oligacanthorhynchus* by Schmidt (1972)

*emended by Schmidt (1972)

20. ***Oligacanthorhynchus indicus*** Renguraju and Das, 1981
(Pt -7; Figs. 18a–18d)

Oligacanthorhynchus indicus Renguraju & Das, 1991 : *Rec. Zool. Surv. India* 78 : pp. 37-40.

Host : *Ptyas mucosus.*

Location : Mesentery.

Type locality : Amraoti, Maharastra.

Diagnosis : (After Renguraju & Das, 1981) *Female* (juv.) : Body 5.75 × 0.95-1.60, surface wrinkled, Proboscis 0.80 × 0.79, armed with 3 spiral rows of 6-8 hooks each. Hooks with large manubria and roots. Root 0.55 X 0.18. Proboscis sheath 1,0 × 0.75. lemnisci filiform, looped, each about 5.00 long with giant nuclei. Pr. sh. 1.0 × 0.75

Remarks : The description of the species is based on some encysted juvenile forms obtained from the mesentery of a paratenic host. Schmidt (1972) has treated *Echinopardalis bangalorensis* as *incertae sedis*, with the view that most juveniles of the family Oligacanthorhynchidae are insufficiently developed and are not conducive for proper identification of species. Therefore, the status of *O.indicus* may be said to be doubtful and uncertain.

4. Genus ***Nephridiacanthus*** Meyer, 1931

Generic Diagnosis : Oliganthorhynchidae : Body medium to considerable size, slightly flattened from side to side..Lacunar system consisting of dorsal and ventral longitudinal main vessels and transverse anastomoses. Protonephridial organ present. Proboscis rounded, with 6 leotropic spiral rows of 6 hooks each. Neck with a papilla on each side anteriorly. Proboscis receptacle plump, similar in structure to that of *Nephridiorhynchus,* with ganglion close to base of receptacle. Lemnisci long, slender, with a central canal and to base of receptacle. Lemnisci long, slender, with a central canal and few nuclei. Eggs oval; outer shell compact, granular, with characteristic sculpturing on surface and a median longitudinal groove all round, Parasites of Edentata

Type species : *N. kamerunensis* Meyer, 1931

Key to species of *Nephridiacanthus*

Body 8.00-10.00 long with 13 nuclei on lemnisci ..... *N. thapari*

Body 100.00-120.00 long with few nuclei on lemnisci ..... *N. shillongensis*

21. ***Nephridiacanthus thapari*** (Sen & Chauhan, 1972) Golvan, 1994
(Pt. 7; Figs. 19a–19b)

Nephridiorhynchus thapari Sen and Chauhan, 1972 : *J, Zool. Soc. India,* **24**(1) : pp. 39-45. Type locality : Allahabad, U. P.

Host : *Herpestes sp.*

Location : Intestine.

Distribution : Allahabad, U.P.

Diagnosis : (After Sen & Chauhan, 1972) : *Male* : Body 8.00-10.00 long and 1.54 wide, Proboscis 0.57 long and 0.54 wide, armed with 6 spiral rows of 8 hooks each, hooks 0.11-0.13 long. Pr. sh. 1.92 × 0.52. Lemnisci filiform with 13 nuclei. Testes at mid-body. T/1–0.56 × 0.28; T/2–0.49 × 0.28. Cement glands 4 in pairs (8).

Remarks : Schmidt (1972) synonymised *Nephridiacanthus* with *Oligacanthorhynchus* Golvan (1994) removed synonymy and resurrected *Nephridiacanthus*. He transferred *Nephridiorhynchus thapari* to the genus *Nephridiacanthus* as a new combination.

22. ***Nephridiacanthus shillongensis*** Sen and Chauhan, 1972 (Pt. 7; Figs. 20a–20b)

N. shillongensis Sen and Chauhan, 1972 : *J. Zool. Soc. India* 24(1) : pp. 39-45. Type locality : Shillong, Meghalaya.

Host : *Manis pentadactyla aurita* (Pangolin).

Location : Intestine.

Distribution : Shillong.

Diagnosis : (After Sen & Chauhan, 1972) : *Female* : Body 100.00-120.00 long and 1.51 wide. Proboscis 0.52 × 0.52, armed with 6 spiral rows of 6 hooks each. Hooks 0.08-0.10 long. Pr.sh. 0.98 × 0.48. Lemnisci filiform with few nuclei. Eggs 0.06 × 0.03-0.04.

5. Genus ***Echinopardalis*** Travassos, 1918

Generic Diagnosis : Oligacanthorhynchidae : Body elongate, with a small dorso-terminal appendix in mature female. Longitudinal lacunar vessels present, but circular anastomoses comparatively weekly developed. Protinephridial organ present. Proboscis globular, with 6 spiral rows of 6 hooks each; root of each hook prolonged anteriorly and the tip of blade truncated obliquely. Neck present, with a papilla on each side. Proboscis receptacle single walled, inserted into base of proboscis; ventral wall attenuated ventrally,ganglion posterior to middle. Lemnisci long, slender,with few nuclei. Testes at or near middle of body. Cement glands 8, by twos in tandem. Eggs oval, with concentric membranes; outer shell not compact; middle shell lamellar or striated. Parasites of carnivore.

Type species : *Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1918

Key to species

6 spiral rows of 5 hooks each ..... *E. pardalis*

6 spiral rows of 6 hooks each ..... *E. bangalorensis*

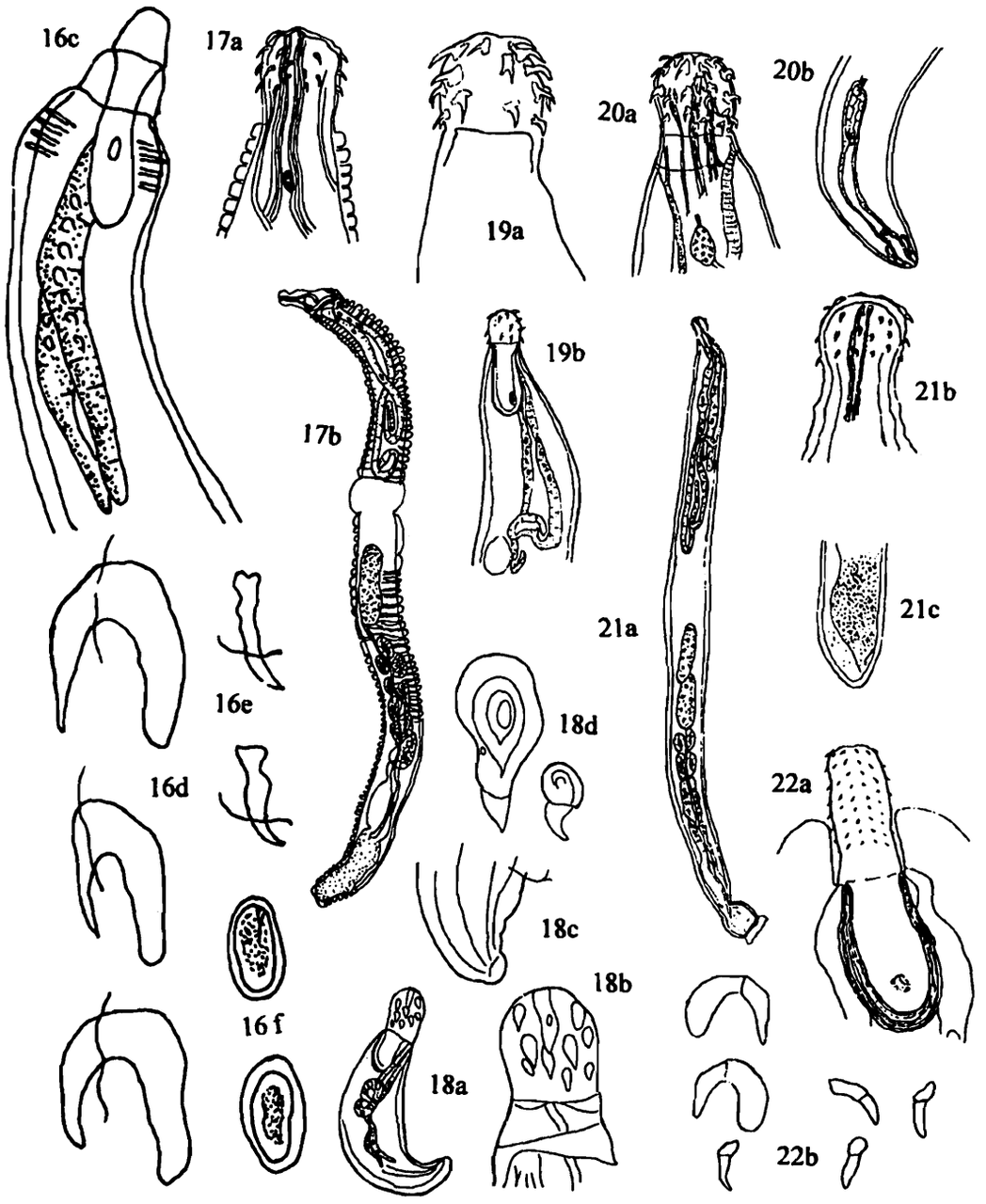


Plate- 7

Fig. 16. *Mediorhynchus orientalis* Belopolskaya, 1911. (c) anterior of male; (d) anterior proboscis hooks; (e) posterior proboscis hooks; (f) eggs.

Fig. 17. *Oligacanthorhynchus cati* (Gupta and Lata, 1968) Schmidt, 1972; (a) proboscis; (b) male.

Fig. 18. *Oligacanthorhynchus indicus* Renguraju and Das, 1981. (a) female; (b) proboscis; (c) posterior of female; (d) proboscis hooks.

Fig. 19. *Nephridiacanthus thapari* (Sen & Chauhan, 1972) Golvan, (a) proboscis; (b) anterior body.

Fig. 20. *Nephridiacanthus shillongensis* Sen and Chauhan, 1972. (a) proboscis; (b) posterior female.

Fig. 21. *Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1918. (a) male; (b) proboscis; (c) posterior female.

Fig. 22. *Moniliformis moniliformis* (Bremser in Rudolphi, 1819). (a) proboscis; (b) proboscis hooks.

23. *Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1918
(Pt. 7; Figs. 21a–21c)

Echinopardalis pardalis : Gupta and Lata (1968c) : *Res. Bull. Punjab Univ. (sci)*; 18(3/4); pp. 395-403

Host : *Felis domestica.*

Location : Intestine.

Distribution : Chandigarh, Punjab.

Diagnosis : (After Gupta and Lata, 1968c) : *Male* : Body 30.38-37.66.Proboscis 0.50-0.86 × 0.33-0.46, armed with 10 longitudinal rows of 3 hooks each (equivalent to 6 spiral rows of 5 hooks each) hooks 0.042-0.070 × 0.014. Lemnisci 0.19-0.24. T/1-3.4-4.00 × 0.57-0.91. T/2 3.2-3.8 × 0.78-1.07 at mid-body. Cement gland 8, 0.92-2.50 × 0.25-0.67.

Female : Body 42.3-42.4. Eggs 0.050-0.056 X 0.034-0.038.

Remarks : The species *E. pardalis* reported for the first time from India. The specimens represent total hooks of 30 on proboscis against 36 prescribed for the genus.

24. *Echinopardalis bangalorensis* Pujatti, 1951

E. bangalorensis Pujatti, 1951a, b : *Rev. Parsit.* 12(I) & 12(4) pp. 1-14 & 119-127

Host : *Francolinus pondicerianus* (Bird) & *Bufo malanostictus,*

Location. : encysted in the tissue of the neck region

Locality : W. India.

Diagnosis : (after Pujatti, 1951) *Male* : Body 15-16.5 × 1-1.5. Proboscis hemispherical 0.525 × 0.430 armed with 36 hooks (6 spiral rows of 6 hooks each., hooks of 1st row 0.209, 2nd row 0.240, 3rd row, 0.182, 4th 0.1-0.11, 5th 0.074-0.084, 6th 0.0.070-0.080. Proboscis sheath 1-1.2, Lemnisci 0.156, Testes ellipsoidal, 1.05 × 0.325. Cement glands 8.

Remarks : Pujatti (1951) described a juvenile of *E. bangalorensis* occurring under the skin of a gallanaceus bird and from an amphibian host of W. India which was considered as species inquirendum by Schmidt (1972). According to him, identification of oligacanthorhynchid juveniles upto generic level is impossible.

6. Genus *Macracanthorhynchus* Travassos, 1917

Generic Diagnosis : Oligacanthorhynchidae : Trunk long, anterior end much wider than posterior end, usually with transverse wrinkles. Proboscis subspherical, with 12 longitudinal, approximately straight, regularly alternating rows of 3 hooks each. Hooks with large manubria and powerful roots, except basal spines. Tips of hooks lacking barbs. Testes pre-equatorial. Cement glands compact, 8 in number, each with single giant nucleus. Eggs with sculptured outer shell. Parasites of pigs and carnivore. Cosmopolitan in distribution.

Type species : *Macracanthorhynchus hirudinaceus* (Pallas, 1781) Travassos, 1917.

*emended by Schmidt (1972)

25. ***Macracanthorhynchus hirudinaceus*** (Pallas, 1781) Travassos, 1917 (Pt. 17; Figs. 95a-95c)

Macracanthorhynchus hirudinaceus : Ahluwalia (1959) : *Ind. J. vet. Sci. Anim. Husb.*, **29** (2/3) : 100-107.

Macracanthorhynchus hirudinaceus : Bhattacharya *et al.* (2003) : *Rec. Zool. Surv. India.* : 101 (1-2) : pp. 87-91.

Host : *Sus scrofa cristata* (wild boar).

Location : Intestine.

Distribution : Raimona, dist. Goalpara, Assam, Bengal, Uttar Pradesh.

Diagnosis : (After Bhattacharya *et al*, 2003); *Male* : Body large, anterior half broad, pseudo-segmentation at anterior broad portion, 39.00-50.00.long and 3.5-3.75 wide. Proboscis orbicular, 0.625-0.7 × 0.650-0.875, armed with 6 spiral rows of 6 hooks each, hooks 0.15-0.25 with crenated points. Neck 1.325-1.35 long. Lemnisci long, flat, coiled, 21.00-25.00 × 1.5-1.6, posterior portion broad with few giant nuclei. Testes oval, pre-equatorial, contiguous. Cement glands 8, ellipsoidal, in pairs.

Female : Body larger than male, 225.00-260.00 × 8.7-10.00, ventrally curved, anterior trunk broad. Eggs 0.08-0.09.

Remarks : *M. hirudinaceus* from wild boar is reported by Bhattacharya (2003) for the first time from India. Maplestone (1930) and Ahluwalia (1959,1962) have reported the species in *Sus scrofa domestica* from Bengal and U.P.

7. Genus ***Onicola*** Travassos, 1916

**Generic diagnosis* : Oligacanthorhynchidae : Trunk fairly wide in proportion to length, anterior trunk somewhat wider than posterior trunk. Proboscis sub-spherical, with 12 longitudinal, regularly alternating, approximately straight rows of 3 hooks each. Hooks with large, complex manubria and roots except on basal spines. Tips of hooks with or without barbs. Testes tandem, at least 1 pre-equatorial. Cement glands compact, 8 in number, each with single giant nucleus. Eggs with sculptured outer shell. Parasites of Carnivora and Primates.

Type species : *Onicola onicola* (Ihering, 1892) Travassos, 1916

26. ***Onicola*** sp.

Remarks : Patnaik and Acharya (1970) reported *Onicola sp.*in *Felis canis* from Orissa.

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

Generic Diagnosis : Oligacanthorhynchidae : Body cylindrical, curved ventrad or spirally, irregularly wrinkled transversely. Anterior extremity of trunk may be festooned

*emended by Schmidt (1972)

exceptionally (*P. elegans*). Protonephridial organ observed in some species. Neck present. Proboscis globular, with 5-7 transverse (spiral) rows of stout hooks, the root of which is produced anteriorly. Proboscis receptacle short, single walled, with ventral slit for retractor muscle. Lemnisci long, slender, flattened. Testes usually in anrterior or middle region of trunk. Cement glands 8, compact, one pressed against another or in pairs, well apart from posterior testis. Uterine bell with two very prominent lateral diverticula. Eggs oval, outer shell granular, with reticular sculpturing. Parasites of mammals, especially of monkeys, rarely of birds.

Type species : *Prosthenorchis spirula* (Olfers in Rud., 1819)

27. ***Prosthenorchis*** sp.

Ref. Srenivasa, R.B. (1993) : *Agricultural and Biological Research;* **9(1)** : pp. 6-10.

Remarks : Srenivasa, R.B. (1993) reported *Prosthenorchis sp.* in *Perdicula asiatica* (bird) from Nalgonda, Dist. Ranga Reddy, Andhra Pradesh. This is the only report on the occurrence of a member of the genus from India. The occurrence of *Prosthenorchis sp.* in bird is rare.

Order MONILIFORMIDA Schmidt, 1972

Family MONILIFORMIDAE Van Cleave, 1924

Family diagnosis : Moniliformida: Body long, often with external pseudosegmentations of body wall. Lacunar system consisting of median (dorsal and ventral or only dorsal) main vessels and transverse anastomoses. Protonephridial organ absent. Proboscis claviform, or flask shaped, with numerous small hooks in longitudinal, or somewhat irregular, or spiral rows. Each hook with backwardly directed root.Proboscis sac comparatively short, double walled, with ganglion near or at its base. Outer wall consisting of spiral muscles. Lemnisci filiform, long. Testes tandem in posterior portion 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. Parasits of mammals, occasionally of birds, including only one genus.

Type genus : *Moniliformis* Travassos, 1915

9. Genus ***Moniliformis*** Travassos, 1915

Generic Diagnosis : Same as Family diagnosis.

Type species : *Moniliformis moniliformis* (Bremser, 1911)

Key to species of *Moniliformis*

1. Equal number of rows of hooks and equal number of hooks in each row .... *M. spiralis*

Unequal number of rows and unequal number of hooks in each row 2

2. 13 spiral rows of 6 each ..... *M. clarki*

Spiral rows less, hooks per row more 3

3. 12 rows of 7-8 ..... *M. moniliformis*

12 rows of 10-11 ..... *M. dubius*

28. ***Moniliformis moniliformis*** (Bremser in Rudolphi, 1819)
(Pt. 7- 8; Figs. 22a–22d)

Monilioformis moniliformis (Bremser in Rudolphi, 1819) : *Nilitia insignis vermium intestinalium Collections vindo. bonensis,* 31. pp. Viennae.

M. moniliformis : Bhattacharya (2000) : *ZSI. Fauna of Tripura. State Fauna Series,* 7(part-4) p. 157

Host : Rat.

Location : intestine.

Distribution : Cosmopolitan.

Diagnosis : (After Bhattacharya, 2000) : *Male* : Body 15.625-40.00 × 0.875-2.375 with pseudosegmentation. Proboscis 0.375 × 0.225, armed with 12 longitudinal rows of 7-8 hooks each. Hooks equal in size, anterior hooks curved. Proboscis sheath 0.875-0.9 × 0.325-0.4, double walled, ganglion at base. Lemnisci with 5-6 nuclei each. Testes post-equatorial. T/1-4.00 × 1.25, T/2 4.00 × 1.25. Cement glands 6-8, compact.

(After Petrotschenko, 1958) : *Male* : 82.00 × 2.00, Female about 131.00 × 2.00. Proboscis 0.36-0.40 × 0.16, armed with 12-14 longitudinal rows of 7-8 hooks each, hooks equal in size. 8 orbicular cement glands.

Remarks : The species has been recorded from different parts of the country. The difference of body dimension, number of hooks and their size is considered to be intra-specific variations. Meyer (1933) observed the species in three different forms but Petroschenko (1958) described the forms under three different subspecies Later, Yamaguti (1960) considered them as a single species of *M. moniliformis.*

29. ***Moniliformis spiralis*** Subrahmaniam, 1927
(Pt. 35; Figs 195a–195c)

Moniliformis spiralis Subrahmaniam, 1927 : *Ann. Mag. Nat. Hist. Ser.* 9 pp. 645-650. Type locality : Rangoon, Myanmar.

Moniliformis spialis : Sen and Chauhan, 1972 : *J Zool. Soclnd.,* **24**(1) 39-45.

Moniliformis spiralis : Bhattacharya, 2003 : ZSI *Fauna of Sikkim, State Fauna Series,* 9(Part-15) : 71-78.

Host : *Nesokia bengalensis* (Rangoon); *Bandicoota sp.* (Kolkata), Rat, Sikkim.

Location : Intestine.

Distribution : Rangoon; Kolkata.

Diagnosis : (After Sen And Chauhan, 1972) : *Male* : Body 16.94 × 0.56. Proboscis claviform, 0.43 × 0.1, armed with 12-14 longitudinal rows of 12-14 hooks each, hooks 0.04 long. Pr.sh. 0.85 long and 0.24 wide. Testes at posterior end, T/1–0.81 × 0.25; T/2–0.83 × 0.28. Cement gland 6-8. (After Subrahmaniam) : *Male* : 33.00-44.00; PH-12 × 10-13; *Female* : 46.00. Pseudosegmented. Eggs 1.24-1.27 × 0.71-0.74.

(After Bhattacharya, 2003) *Male* : Body with pseudosegmentation. 40.656 × 0.576. Proboscis 0.414 × 0.166, armed with 12–16 rows of 10–12 hooks each row. point 0.018-0.024 hooks with roots. Proboscis sac double walled, outer wall with spiral striations,0.696 × 0.248. Lemnisci equal, 2.04 long. Testes at posterior end, Cement gland 6-8.

Remarks : Sen and Chauhan did not provide figure with their description. Intra-specific variations are found to exist in the description of species.

30. ***Moniliformis clarki*** (Ward, 1917) Van Cleave, 1924
(Pt. 8; Figs. 23a)

Moniliformis clarki Ward, 1917 : *J. Parasit.* 3; p. 141.

Moniliformis clarki : Sen and Chauhan (1872) : *J. Zool Soc. Ind.* **24**(1) : pp. 39-45

Host : *Rattus rattus.*

Location : Intestine.

Distribution : Goa.

Diagnosis : (after Sen and Chauhan, 1972) : *Male* : Body : 36.00-40.00 × 1.25-1.41 proboscis 0.35-0.42 × 0.13-0.17, armed with 13 spiral rows of 6 hooks each, hooks 0.02-0.03 long. Pr. sh. 0.36-0.43 × 0.17-0.18. Testes tandem, T/1–2.21-3.03 × 0.81-0.85. T/2–2.84-3.03 × 0.85-0.91. Cement gland 6-8. *Female* : 62.00-81.00 × 1.37. (After Ward, 1917) : 100.00-130.00 long. Proboscis 0.30-0.35 × 0.106-0.120, PH 12-16 longitudinal rows of 6-8 hooks. Eggs 0.06-0.09 × 0.024-0.038.

Remarks : Sen and Chauhan have not provided figures with their description. The difference of measurements and number of hooks from the original description, is probably due to intra-specific variations.

31. ***Moniliformis dubius*** Meyer, 1933

Moniliformis dubius : Susheela (1991) : *Geobios, New Reports* **10**(1) : pp. 81-84

Host : *Bandicoota bengalensis and Rattus rattus rufescens.*

Location : Intestine.

Distribution : Hyderabad, Andhra Pradesh.

Diagnosis : (After Meyer, 1933 with additional data by Chandler) : Body markedly annular, especially the female. Male 30.00-145.00. Proboscis 0.55-0.60 × 0.15, armed with 12 longitudinal rows of 10-11 hooks each. Lemnisci about 4 .00 long Testes about 2.00 long. Cement glands 6. *Female* : 140.00-270.00 × 3.2. Eggs 0.112-0.120 X 0.056- 0.060 and 0.09-0.118 × 0.04-0.054.

Remarks : Susheela has reported the species from Hyderabad while studying the seasonal influence and density on helminth infection in three rat species. No description and figures of the species are found in the literature. Therefore, on the basis of her report on occurrence of the species in India, original description of the species has been provided with.

Class EOACANTHOCEPHALA Van Cleave, 1948

Diagnosis : Acanthocephala : Body generally small (with rare exception) and delicate, cylindrical or fusiform with well developed lacunar system; main longitudinal canals of lacunar system pass dorso-ventrally, hypodermic nuclei few, ovate or amoeboid giant nuclei. Trunk spines present or absent. Proboscis small, ovate or cylindrical. Proboscis hooks few, arranged in circular or spiral-diagonal rows. In case of long proboscis (family-Tenuisentidae) hooks are arranged in quincunx. Proboscis sheath saclike, single layered muscular wall. Cement glands undifferentiated syncytial mass containing giant round nuclei. In female two ligament sacs, dorsal and ventral. Larva oval or elongate-oval enclosed in three oval membranes. Parasites of fresh water and marine fishes.

Eoacanthocephala comprises of two orders :

1. Gyracanthocephala Van Cleave, 1936
2. Neoechinorhynchida Southwell et Macfie, 1925.

Key to orders of EOACANTHOCEPHALA

Trunk entirely or only anteriorly spined; parasites of freshwater and marine fishes ..... GYRACANTHOCEPHALA

Trunk not spined ..... NEOECHINORHYNCHIDA

Order GYRACANTHOCEPHALA Van Cleave, 1936

Diagnosis : Eocanthocephala : Body generally small or of medium size, covered to a greater or lesser degree with spines. Hypodermic nuclei giant, circular or ramified, rarely with numerous nuclear fragments. Lacunar system reticulate, without clearly expressed main canals. Proboscis sheath sacciform, with single layered wall. Cement glands syncytial containing a certain number of nuclei. Eggs small, oval, with no protrusions of the membranes at the poles. Embryo oval, without hooks or spines. Parasites of freshwater or marine fish.

Remarks : Petrotschenko proposed synoymy of Gyracanthocephala with Acanthogyrida. Acanthogyrida consists of two families Acanthogyridae and Quadrigyridae. Having found both the families identical, Tadros (1966) treated Quadrigyridae as valid and emended the Diagnosis of Quadrigyridae. Later, Amin (1987) revalidated Gyracanthocephala with the single family Quadrigyridae.

Family QUADRIGYRIDAE Van Cleave, 1920

Diagnosis : Gyracanthocephala : Body small, delicate, covered with spines , generally in anterior region, or may reach mid-body or beyond it. Hypodermic nuclei giant or numerous fragments. Lacunar system reticular or not, with or without main vessels. Proboscis globular or elongate with few spiral rows. Proboscis sheath single layered with ganglion near its base. Lemnisci long, filiform, short or saccate, or claviform. Cemrent gland syncytial. Embryo small, rounded or elliptical. Parasites of fresh water or marine fish.

Type genus : *Quadrigyrus* Van Cleave, 1920

The family consists of two subfamilies :

1. Quadrigyrinae Amin, 1985
2. Pallisentinae Amin, 1985

Key to the subfamilies

Trunk armed only anteriorly with circles of spines; circles usually incomplete dorsally ..... QUADRIGYRINAE

Trunk armed anteriorly with complete circles of spines in 1 or 2 regions seperated by an unarmed zone; spines in second region may extend over rest of trunk in circles or in longitudinal rows ..... PALLISENTINAE

10. Genus ***Quadrigyrus*** Van Cleave, 1920

Generic Diagnosis : Quadrigyridae; Quadrigyrinae : Body medium, anterior region of trunk usually with 4-10 circular rows of spines, which may be interrupted dorsally, proboscis hooks in 3-4 circular rows. Hypodermic nuclei of two types; anterior nuclei mid-dorsal and mid-ventral, others usually lateral and strongly branched. Proboscis sac single layered , thick, muscular with ganglion closed to its base. Lemnisci claviform, with a giant nucleus. Testes oval to elliptical or fusiform, may be wide apart from each other. Cement gland a compact or elongated mass, with several nuclei. Genital pore of female ventro-subterminal. Eggs oval, Parasites of fishes.

Type species : *Quadrigyrus torquatus* Van Cleave, 1920.

Key to species of *Quadrigyrus*

Anterior giant nuclei oval, anterior trunk spines 8-10 circles of 18-20 spines each .. .. *Q. simhai*

Anterior giant nuclei branched, anterior trunk spines 13 circles of 8-14 hooks each ..... *Q. guptai*

32. ***Quadrigyrus guptei*** Gupta and Sinha, 1991
(Pt. 8; figs. 24a–24e)

Quadrigyrus guptei Gupta and Sinha, 1991 : *Indian J. Helminth.* **43**(2) : 108-118. Type locality : Puri coast, Orissa.

Host : *Caranx kalla* (Carangeidae).

Location : Intestine.

Diagnosis : (after Gupta and Sinha, 1991) : *Male* : Body 14.30 × 0.055. Proboscis armed with 4 circles of 6 hooks each, 1st circle of hooks 0.11-0.12 × 0.03-0.032; 2nd 0.07-0.074 × 0.022-0.024; 3rd 0.04-0.042 × 0.012-0.014; 4th 0.034-0.038 × 0.008-0.010. Anterior trunk with 13 circles of 8-14 hooks each with roots. Giant nuclei two, not highly branched (lateral). Proboscis sac single walled 0.60-0.20. Testes elliptical, contiguous, prequatorial. T/1–1.90 × 0.38; T/2–1.95 × 0.38 Cement gland 2.60 × 0.36, syncytial. Cement reservoir 0.98 × 0.38. Saefftigen's pouch 1.00 × 0.65. *Female* : Body 20.70 × 0.65. Eggs 0.048-0.052 × 0.036-0.038.

Remarks : Occurrence of the genus in a marine fish is unusual.

33. ***Quadrigyrus simhai*** Gupta and Fatma, 1985
(Pt. 8; Figs. 25a–25e)

Quadrigyrus simhai Gupta and Fatma, 1985 : *Ind. J. Helminth.* 37(2) : pp. 149-180. Type locality : Ghagra river, U.P.

Host : *Barbus stigma*.

Location : Intestine.

Distribution : Ghagra river, Rudauli, Lucknow, U.P.

Diagnosis : (After Gupta and Fatma, 1985) : *Male* : Body cylindrical, 8.6 × 0.54. Proboscis globular, 0.19 × 0.23 srmed with 4 circles of 5 hooks each, 1st circle 0.070–0.072; 2nd. 0.060-0.061; 3rd. 0.038-0.044; 4th. 0.032-0.035 long. Sensory pits present on both sides of neck. Anterior trunk with 8-10 circles of 18-20 spines each. Proboscis sac single layered, ganglion at base, 0.80 × 0.18. Giant nuclei mid-dorsal and mid-ventral, posterior nuclei lateral, 1-3 highly branched. Testes equatorial, T/1–0.95 × 0.26; T/2–0.81 × 0.25. Cement gland syncytial with 10-12 giant nuclei. Cement reservoir pyriform. Saefftigen's pouch 0.56 × 0.25.

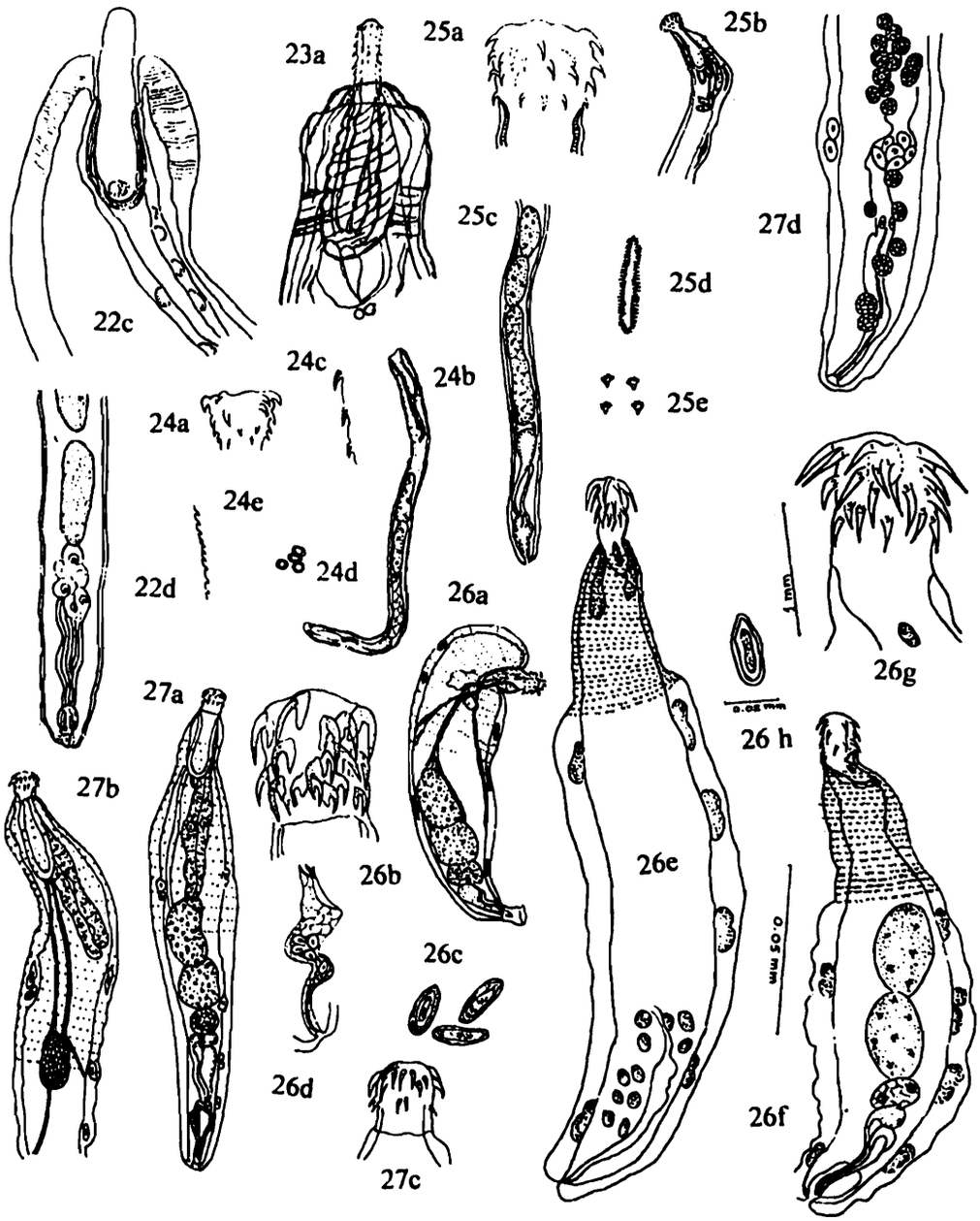


Plate-8

Fig. 22. *Moniliformis moniliformis* (Bremser in Rudolphi, 1819). (c) anterior male; (d) posterior male.

Fig. 23. *Moniliformis clarki* (Ward, 1917) Van Cleave, 1924; (a) anterior of male.

Fig. 24. *Quadrigyrus guptei* Gupta and sinha, 1991. (a) proboscis; (b) male; (c) proboscis hooks; (d) eggs; (e) trunk spines,

Fig. 25. *Quadrigyrus simhai* Gupta and Fatma,1985. (a) proboscis; (b) anterior of male. (c) posterior of male; (d) hypodermal nuclei; (e) trunk spines.

Fig. 26. *Acanthosentis antespinus* Verma et Datta, 1929 (after verma & Datta) (a) male; (b) proboscis; (c) eggs; (d) female genitalia (after Bhattacharya; (e) female; (f) male; (g) proboscis; (h) egg.

Fig. 27. *Acanthosentis bacailai* Verma, 1973. (a) male; (b) anterior female; (c) proboscis; (d) posterior female.

Remarks : Only two species under the genus have been reported from India. One is reported from marine host and other from fresh water host.

Subfamily PALLISENTINAE Amin, 1985

Key to genera of PALLISENTINAE

1. Trunk spines divided into two separate regions ..... ***Pallisentis***

   Trunk spines not divided into two separate regions 2

2. Trunk spines in anterior part but elsewhere in two lateral longitudinal rows ..... ***Acanthogyrus***

   Trunk spines restricted to anterior region only 3

3. Anterior trunk with 16-17 circles of spines; 4 circles of proboscis hooks with anterior two circles larger than posterior two circles; spineless space between 2nd and 3rd circles ..... ***Raosentis***

   Anterior trunk spines closely set and wide apart as they proceed backward; proboscis with 3 circles of 6 hooks each ..... ***Acanthosentis***

11. Genus ***Acanthosentis*** Verma et Datta, 1929

Generic Diagnosis : Quadrigyridae; Pallisentinae : Body small, curved ventrad, Trunk spines closely set anteriorly but wider apart as they proceed backward, posterior region of body usually devoid of spines, especially, in mature specimens. Proboscis short, globular to cylindrical, with 3 circles of 6 hooks each. Proboscis receptacle cylindrical, with single layered walls, with ganglion at base. Hypodermic nuclei few, oval or branched, exclusively median. Lacunar system reticular, with prominent transverse vessels. Lemnisci cylindrical to claviform, longer than proboscis sac. Testes approximately rounded, tandem, contiguous in posterior region of body. Cement gland syncytial with several nuclei. Genital pore of female ventro-terminal ; uterine bell with ventral anterior opening. Eggs elongate. Parasites of fish.

Type species : *Acanthosentis antespinus* Verma et Datta, 1929.

Type Host : *Mystus gulio (Aoria (Macrones) gulio)*

Type locality : Calcutta.

Key to species of *Acanthosentis*

1. Trunk spines extending all over the body 2

   Trunk spines not extending all over the body 5

2. Hypodermal nuclei 3 dorsal, 2-3 ventral ..... *A. antespinus*

Hypodermal nuclei more 3

3. Hypodermal nuclei 4-6 dorsal, 2 ventral ..... *A. dattai*

More number of hypodermal nuclei 4

4. 5-6 dorsal nuclei, 2 mid-ventral ..... *A. golvani*

Hypodermal nuclei not reported but eggs 0.015 ..... *A. betwai*

5. Hypodermal nuclei 2 or 3 ..... *A. cameroni*

More number of hypodermal nuclei 6

6. 3 dorsal and 3 ventral nuclei ..... *A. indicus*

Number of nuclei more 7

7. 5 dorsal and 2 ventral nuclei ..... *A. sircari*

More number of hypodermal nuclei 8

8. 8-15 hypodermal nuclei ..... *A. vittatusi.*

Hypodermal nuclei not reported but nuclei in cement gland not more than 5 9

9. Cement gland nuclei 5 ..... *A. shuklai*

More number of nuclei 10

10. 6-11 nuclei in cement gland ..... *A. seenghalae*

Nuclei in cement gland more 11

11. 12-13 nuclei in cement gland ..... *A. baccailai*

Nuclei in cement gland not reported but eggs less than 0.03 12

12. Eggs 0.01-0.011 ..... *A. vancleavei*

Eggs larger 13

13. Eggs 0.028 ..... *A. putitorae*

Larger eggs 14

14. Eggs 0.032 ..... *A. bilaspurensis*

Eggs 0.03-0.10 ..... *A. giuris*

34. *Acanthosentis antespinus* Verma et Datta, 1929

(Pt. 8; Figs. 26a–26h)

Synonym *A. oligospinus* Anantharaman, 1980

A. antespinus Verma et Datta, 1929 : *Ann. Trop. Med. Par.* **23**(4) : 483-500. Type locality : Kolkata, India.

A. oligospinus Anantharaman, 1980, *Indian J. Parasit.*, **4**(1) : 21-24. Type locality : Madras coast, Tamil Nadu.

Host : *Mystus gulio.*

Location : Intestine.

Type locality : Calcutta.

Other locality : Allahabad, Chilka, Madras.

Diagnosis : (after Verma et Datta, 1929) : *Male* : Body 0.8-2.4 × 0.08-0.67. Trunk spines in 30 circles. Hypodermal nuclei 3 dorsally, 2-3 ventrally. Proboscis 0.04-0.17 × 0.04-0.05, armed with 3 circles of 6 hooks each, hooks 1st.0.072; 2nd. 0.054; 3rd. 0.048; ratio between 1st. and 3rd-1.5 : 1. Lemnisci equal, 0.04-0.34. T/1–0.08-0.47 × 0.06-0.13; T/2–0.06-0.034 × 0.05-0.032. Cement gland syncytial with 6-8 nuclei. *Female* : Body 0.85-4.5 × 0.25-1.2. Eggs 0.026 × 0.008.

Remarks : I have personally collected a number of examples of *A. antespinus* from same host in sewage-fed ponds at Bantala, Kolkata, and have deposited them in the National Zoological Collection of ZSI. Gupta and Chowhan (1980) and Chowhan *et al.* (1987) have considered *A. oligospinus* Anantharaman, 1980 a junior synonym of *A. antespinus.*

35. ***Acanthosentis bacailai*** Verma, 1973
(Pt. 8; Figs. 27a–27d)

A. bacailai Verma, 1973 : *Proc. Nat. Acad. Sci. India.* **43** (B) IV : 265-272. Type locality : River Gomti, Lucknow.

Host : *Chela bacaila.*

Location : Intestine.

Distribution : River Gomti, Lucknow.

Diagnosis : (after Verma, 1973) : *Male* : Body 2.05-5.6 × 0.35-1.05. Trunk spines anterior with 25-26 rows. Epidermal nuclei 7-8. Proboscis 0.08-0.15 × 0.08-0.09, armed with 3 circles of 6 hooks each, 1st and 2nd circles of hooks 0.02-0.031; 3rd circle 0.015-0.02. Lemnisci unequal, L/1–0.78-1.15; L/2-0.08-1.35; T/1–0.28-1.25 × 0.15-0.55; T/2–0.21-1.1 × 0.55-0.72. Cement gland syncytial with 12-13 nuclei. Saefftigen's pouch present. *Female* : Body 3.24-3.64 × 0.35-0.42. Eggs not reported.

36. ***Acanthosentis betwai*** Tripathi, 1959
(Pt. 9; Figs. 28)

A. betwai Tripathi, 1959 : *Rec. Ind. Mus.* **54**(1&2) : 61-99. Type locality : River Betwa at Bhopal.

Host : *Labeo gonius.*

Distribution : River Betwa, Bhopal.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 8.75 × 1.25, Trunk spines all over the body with 42-44 rows. Proboscis 0.127-0.133 × 0.127, armed with 3 circles of 6 hooks each, hooks of 1st circle 0.057-0.068; 2nd circle 0.038-0.053; 3rd circle 0.024-0.041. T/1–0.942 X 0.652; T/2–0.797 × 0.435. *Female* : Body 9.83 × 2.08. Eggs 0.015.

Remarks : Gupta and Kajaji (1969) proposed *A. betwai* to be a junior synonym of *A. antespinus*. Later, Gupta and Jain (1980) revalidated *A. betwai*.

37. ***Acanthosentis bilaspurensis*** Chowhan *et al.*, 1987
(Pt. 9; Figs. 29a–29e)

A. bilaspurensis Chowhan *et al.*, 1987 : *Res. Bull.Punjab Univ.Sci.* **38**(1-11); 59-65. Type locality : Govindsagar Lake.

Host : *Cirrhinus reba.*

Location : Intestine.

Distribution : Bilaspur, Bhakra-Nangal and Lothiani.

Diagnosis : (after Chowhan *et al.*, 1987) : *Male* : Body 3.9-5.6 × 1.2. Trunk spines in 20-22 circles. Proboscis 0.12 × 0.11, armed with 3 circles of 6 hooks each, 1st. circle 0.033 × 0.008-0.010; 2nd. Circle 0.024-0.028 × 0.005; 3rd. 0.024-0.028 × 0.005. Lemnisci subequal, 0.49-0.78, T/1–0.51-0.66 × 0.52-0.61; T/2–0.52-0.7 × 0.59-0.69. Cement gland 0.43-0.54 × 0.33-0.46. Cement reservoir 0.41-0.93 × 0.26-0.31; Saefftigen's pouch 0.36-0.71 × 0.1-0.15. *Female* : Body 6.03-7.12 × 1.27-1.62; Eggs 0.032 × 0.010 with conical polar processes of the outer most layer of shell.

38. ***Acanthosentis cameroni*** Gupta & Kajaji, 1969
(Pt. 9; Figs. 30a-30d)

A. cameroni Gupta and Kajaji, 1969 : *J. fish. Res. Bd. Canada*, **26** : 965-974. Type locality : River Gomti, Lucknow.

Host : *Rohtee cotio.*

Location : Intestine.

Distribution : River Gomti, Lucknow.

Diagnosis : (After Gupta and Kajaji, 1969) : *Male* : Body 2.0-3.89 × 0.31-0.51. Trunk spines anterior with 10-18 circles, Hypodermic nuclei 2 or 3. Proboscis 0.11-0.18 × 0.05-0.08 armed with 3 circles of 6hooks each, 1st. circle 0.035-0.045; 2nd circle 0.019-0.028; 3rd circle 0.015-0.025; ratio of 1st and 2nd 1.8 : 1. Lemnisci unequal, L/1–0.52-0.80; L/2–0.56-0.89. T/1–0.39-1.12, T/2–0.22-0.42. Cement gland syncytial with 8 nuclei. Female: Body 5.48-7.90 × 0.50-0.70. Eggs. 025-0.039 × 0.01-0.012.

39. ***Acanthosentis dattai*** Podder, 1938
(Pt. 9; Figs. 31a-31b)
Synonym *A. holospinus* Sen, 1938

A. dattai Podder, 1938; *Parasitology.* **30** : 171-175. Type locality : Kolkata.

A. holospinus Sen. 1938 : *Proc. Indian. acad. Sci.* **7**(1), Sec. B. Locality : Salt Lake, Kolkata.

Host : *Barbus ticto; Barbus stigma.*

Location : Intestine.

Distribution : Kolkata and Salt Lake, Kolkata.

Diagnosis : (after Podder, 1938) : *Male* : Body 1.34-3.34 x 0.24-0.42. Trunk spines all over the body. Hypodermal nuclei 2 ventral and 4-6 dorsal. Proboscis 0.12 × 0.55, armed with 3 circles of 6 hooks each; 1st circle 0.05-0.057; 2nd circle 0.03-0.038; 3rd. circle 0.026-0.034. ratio of 1st. and 2nd. Circle 1.92 : 1. Lemnisci 0.68 × 0.27, slightly unequal. T/1–0.48 × 0.031; T/2–0.29 × 0.27. Cement gland syncytial with 6-8 nuclei. Female: 1.67-9.46 × 0.44-0.90. Eggs 0.026 long.

Remarks : Baylis (1947) observed both the species identical and synonymised *A. dattai* with *A holospinus*. Petrotschenko (1959) revalidated *A. dattai* by treating *A. holospinus* as synonym on the ground of incomplete and vague description of the latter.

40. ***Acanthosentis indicus*** Tripathi, 1959
(Pt. 9; Figs. 32a, 32b)
Synonym *A. hilsai* Pal, 1963

A. indicus Tripathi, 1959 : *Rec. Indian. Mus.* **54**(1&2) : 61-99. Type locality : River Ganga at Buxar.

A. hilsai Pal, 1963 : *Indian. J. Helminth.* **15**(2) : 100-104. Type locality : River Ganga at U.P.

A. indicus : Rai (1967) : *Indian J. Helminth.* **19**(1) : 27-44; Location : intestinal lining and lumen. *Distribution* : Gorakhpur, U.P.

Hosts : *Setipinna phasa and Hilsa ilisha* for *A. indicus; Hilsa ilisha* for *A. hilsai.*

Location : Intestine.

Distribution : River Ganga at Buxar, Gorakhpur. U.P.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 7.26-8.55 × 0.768-0.899. Trunk spines at anterior region with 19-20 rows. Hypodermic nuclei 3 dorsal and 3 ventral. Proboscis 0.145-0.217 × 0.08-0.11, armed with 3 circles with 6 hooks each. 1st. circle 0.041-0.045, 2nd circle 0.038, 3rd. circle 0.026-0.031, ratio of 1st. and 2nd. Circle 1.57 : 1. T/1–1.087 × 0.58; T/2–0.87 × 0.45. Cement gland syncytial. *Female* : 7.48-8.26 × 1.01. Eggs 0.026-0.03 × 0.0076-0.0095.

Remarks : Rai (1967), who had critically studied a large number of parasites obtained from *Hilsa ilisha* at Gorakhpur, designated them as *A. indicus*. He suppressed *A. hilsai* Pal,

1963 after observing its conformity with the description of *A. indicus*. The figure of *A hilsai* is provided in the plate no. 9 and figure no. 32b.

41. ***Acanthosentis putitorae*** Chowhan *et al.*, 1988
(Pt. 9; Figs. 33a–33e)

A. putitorae Chowhan *et al.*, 1988 : *Res. Bull. Punjab Univ Sci.*, **39**(3-4) : 197-206. Type locality : Sutlej river at Nangal and Ropar

Host : *Tor putitora.*

Location : Intestine.

Distribution : Nangal, Ropar.

Diagnosis : (after Chowhan *et al.*, 1988) : *Male* : Body 2.72-3.40 × 0.48-0.67. Trunk spines 7-10 rows with 20-27 hooks each. Proboscis 0.12 × 0.08-0.12, with an apical pit, armed with 3 circles of 6 hooks each, 1st. circle 0.057-0.078 × 0.010-0.016, 2nd circle 0.041-0.058 × 0.007; 3rd. circle 0.033-0.041 × 0.007. Lemnisci subequal, 0.06-1.74. T/1–0.36-0.57 × 0.33-0.38; T/2–0.31-0.45 × 0.33-0.39; Cement gland 0.20-0.35 × 0.20-0.26. *Female* : Body 5.08-6.04 × 0.80-0.93. Lemnisci equal. Eggs 0.028 × 0.014.

42. ***Acanthosentis shuklai*** Agarwal et Singh, 1982
(Pt. 9; Figs. 34a–34c)

A. shuklai Agrawal et Singh, 1982 : *J. Adv. Zool.* **3**(1) : 85-87. Type Locality : Gorakhpur, U.P.

Host : *Labeo rohita.*

Location : Intestine.

Distribution : Gorakhpur, U.P.

Diagnosis : (after Agrawal et Singh, 1982) : *Male* : Body 1.6 × 0.2; Trunk spines small, Proboscis 0.2-0.18, armed with 3 rows of 6 hooks each. Lemnisci equal. T/1–0.9 × 1.1; T/2–1.1-1.3. Cement gland syncytial with 5 nuclei. *Female* : Body 1.4-0.2. Eggs 0.15 x 0.9.

Remarks : Original description lacks complete information of the species.

43. ***Acanthosentis sircari*** Podder, 1941
(Pt. 9; Figs, 35a–35c)

A. sircari Podder, 1941 : *Rec. Indian. Mus.* **13** : 137-142. Type locality : Kolkata.

Host : *Rasbora elonga.*

Location : Intestine.

Distribution : Kolkata.

Diagnosis : (after Podder, 1941) : *Male* : Body 3.11-4.76 × 0.48-0.67. Trunk spines anterior. Hypodermal nuclei dorsal 5 and ventral 2, some nuclei with processes. Proboscis armed

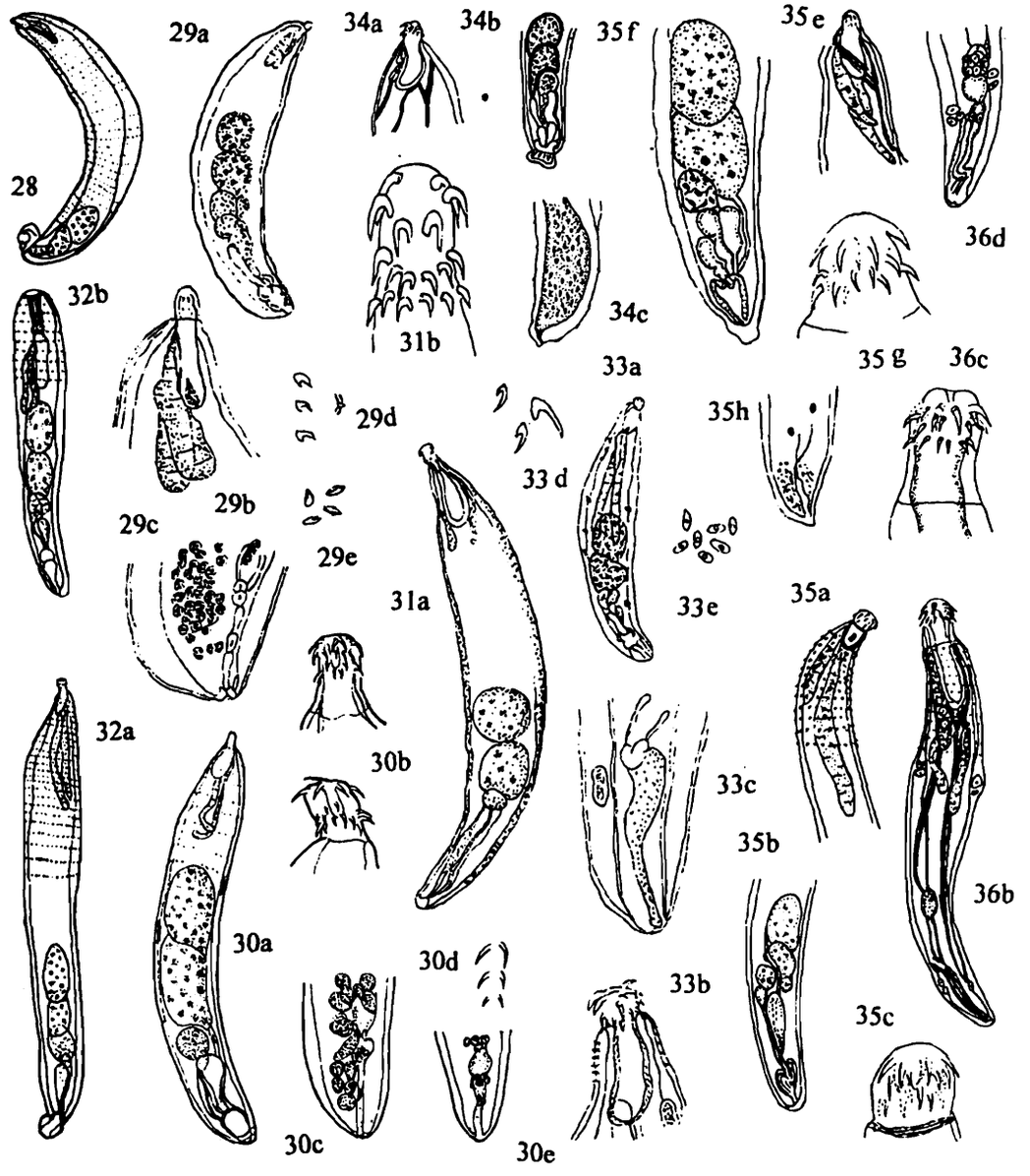


Plate-9

Fig. 28. *Acanthosentis betwai* Tripathi, 1959; male

Fig. 29. *Acanthosentis bilaspurensis* Chowhan *et al.*, 1987. (a) male; (b) anterior of male; (c) posterior female; (d) proboscis hooks & trunk spines; (e) egg.

Fig. 30. *Acanthosentis cameroni* Gupta & Kajaji, 1969. (a) male; (b) proboscis; (c) posterior segments of female; (d) proboscis hooks.

Fig. 31. *Acanthosentis dattai* Podder, 1938; (a) male; (b) proboscis.

Fig. 32. *Acanthosentis indicus* Tripathi, 1959; (a) male; (b) male.

Fig. 33. *Acanthosentis putitorae* Chowhan *et al.*, 1988. (a) male; (b) proboscis; (c) posterior of female; (d) proboscis hooks; (e) eggs.

Fig. 34. *Acanthosentis shuklai* Agarwal et Singh, 1982. (a) anterior of male; (b) posterior of male; (c) posterior of female.

Fig. 35. *Acanthosentis sircari* Podder, 1941. (a) anterior of male; (b) posterior of male; (c) proboscis.

Fig. 36. *Acanthosentis vittatusi* Verma, 1973. (b) femle; (c) proboscis; (d) posterior of female.

with 6 spiral rows of 3 hooks each. 1st row 0.055; 2nd row 0.048; 3rd 0.018; ratio of 1st and 2nd 3.05 : 1. L/1–0.92 with 3 nuclei; L/2–1.93 with 2 nuclei. Testes contiguous, 0.37-0.39 × 0.32-0.34. Cement gland syncytial with•6-8 nuclei.

Remarks : Podder has described 6 circles of 3 hooks on proboscis whereas the number is reverse according to the diagnosis of the genus. Golvan (1959) has proposed *A. sircari* a synonym of *A. holospinus*. The latter has already been treated as synonym of *A. dattai* by Petrotschenko(1959). However, unequal lemnisci, and higher size ratio of 1st and 2nd circle of proboscis in contrast with that of *A. dattai* are in fravour of the validity of the species.

44. *Acanthosentis vittatusi* Verma, 1973
(Pt. 9-10; Figs. 36a–36d)

A. vittatusi Verma, 1973 : *Proc. Nat. Acad. Sc. India* **43**(B) : 265-272. Type locality : Allahabad, U.P.

Host : *Mystus vittatusi.*

Location : Intestine.

Distribution : Allahabad, U.P.

Diagnosis : (after Verma, 1973) : *Male* : Body 1.15-1.32 × 0.25-0.28. Trunk spines in anterior region with 17-19 rows of spines. Hypodermic nuclei 8-15. Proboscis 0.06-0.15 × 0.07-0.10, armed with 3 circles of 6 hooks each. 1st circle 0.037-0.045; 2nd 0.032-0.039; 3rd 0.02-0.03. L/1–0.40-0.565; L/2-0.44-0.528; T/1–0.077-0.09 × 0.06-0.075; T/2–0.081-0.092 × 0.065-0.078. Cement gland syncytial with 6 nuclei. Saefftigen's pouch present. *Female* : 1.49-1.85 × 0.22-0.30. Eggs not developed.

45. *Acanthosentis seenghalae* Chowan *et al.*, 1988
(Pt. 10; Figs. 37a–37c)

A. seenghalae Chowhan *et al.*, 1988 : *Res. bull. Punjab Univ. Sci.*, **39**(3-4) : 197-206; Type locality : Nangal.

Host : *Mystus seenghala.*

Location : Intestine.

Distribution : Nangal, Punjab.

Diagnosis : (after Chowhan *et al.*, 1988) : *Male* : Body 2.87-3.18 × 0.72-1.00. Trunk spines anterior 1/3 of the body with 12-14 circles of 20-24 spines each. Proboscis 0.06-0.08 × 0.07-0.08, armed with 3 circles of 6 hooks each, 1st circle 0.029-0.030 × 0.006-0.008; 2nd ci 0.020-0.027 × 0.003-0.004; 3rd circle 0.016-0.024 × 0.002-0.004. Lemnisci subequal, 0.59-0.91 × 0.30-0.41. Cement gland syncytial with 6-11 nuclei. *Female* : Body 2.87-4.35 × 0.70-0.98; Eggs not developed. Posterior extremity with papilla-like protruberence.

46. ***Acanthosentis giuris*** Soota and Sen, 1954
(Pt. 10; Figs. 38a–38d)

A. giuris Soota and Sen, 1954 : *Rec. Indian Mus.* **61**(2-4) : 363-366. Type Locality : Palta, 24-Parganas (N).

Host : *Glossogobius giuris.*

Location : Intestine.

Distribution : Palta, 24-Parganas(N).

Diagnosis : (after Soota and Sen, 1954) : *Male* : Body 4.35-4.48. Trunk spines anterior with 23 rows. (Number of hypodermic nuclei not given by the author). Proboscis 0.07 × 0.10, armed with 3 circles of 6 hooks each. 1st circle 0.04; 2nd 0.03; 3rd 0.02. Proboscis and neck covered with thick layer of cuticle. Lemnisci unequal. T/1–0.53 × 0.29; T/2–0.50 × 0.27. Cement gland syncytial with 8 nuclei. *Female* : 5.22-6.5 × 0.55-0.63. Eggs 0.03-0.10 × 0.03-0.08.

47. ***Acanthosentis gobindi*** Chowhan *et al.*, 1987
(Pt. 10; Figs. 39a–39b)

A.gobindi Chowhan *et al.* 1987 : *Res. Bull. Punjab Univ. Sci.* **38**(1-11), pp 59-65. Type locality : Nangal, Punjab.

Host : *Labeo rohita.*

Location : Intestine.

Diagnosis : (after Chowhan *et al.*, 1987) : *Male* : Body 3.32-4.38 × 0.92-1.09. proboscis 0.12-0.13 × 0.12-0.13 armed with 3 circles of 6 hooks each, 1st circle 0.057-0.061 × 0.011-0.012; 2nd circle 0.032-0.041 × 0.006-0.008; 3rd circle 0.028-0.040 × 0.006-0.008. Body spines 7-8 circles of 25-30 each. Hypodermal nuclei 10-12 dorsal and 3-4 ventral.Proboscis receptacle 0.30-0.31 × 0.12. L/1–1.13-1.57, L/2-0.09-0.16 extend up to anterior testis. T/1–0.54-0.69 × 0.54-0.60, T/2–0.57-0.79 × 0.48-0.61. Cement gland 0.38-0.41 × 0.31. Cement reservoir 0.11-0.16 × 0.13-0.16. Saefftigen's pouch 0.44-0.54 × 0.08-0.10. Seminal vesicle 0.39-0.57 × 0.13-0.21. *Female* : 4.16-8.13 × 0.70-1.62. Eggs not found.

48. ***Acanthosentis golvani*** Gupta and Jain, 1980

A. golvani Gupta and Jain, 1980 : *Revta. iber. Parasit.*, **40**(2) : 149-160. Type locality : Chandigarh.

Host : *Mystus seenghala.*

Location : Intestine.

Distribution : Chandigarh. Punjab.

Diagnosis : (after Gupta and Jain, 1980) : *Male* : 7.3-10.7. Proboscis 3 circles of 6 hooks each, anterior circle at two levels. Hypodermic nuclei 5-6 mid-dorsal, 2 mid ventral. Body

spines in 31-36 circles, extending to posterior region. *Female* : 9.9-11.7, Lemnisci unequal, one with single nucleus and other with two nuclei.

Remarks : Description provided from *Helm. Abst.*

49. ***Acanthosentis vancleavi*** Gupta et Fatma, 1985
(Pt. 34; Figs. 189a–189d)

A. vancleavi Gupta and Fatma, 1985 : *Indian J. Helminth.* **37**(2) : 153-156. *Type locality* : Lucknow.

Host : *Labeo rohita.*

Location : Intestine.

Diagnosis : (after Gupta & Fatma, 1985) : *Male* : Body 10.25 × 1.4, Proboscis 0.15 × 0.12. armed with three transverse rows, anterior rows largest; anterior hooks 0.055 long; middle 0.05 long, basal 0.040 long. Proboscis receptacle 0.55 × 0.18. L/1–1.12 long; L/2–1.6 long with two nuclei each. Testes ovoid, contiguous, overlapping, post equatorial. T/1–1.15 × 0.74; T/2–1.05 × 0.78. Cement gland syncytial with 6 nuclei. Saefftigen's pouch club shaped. Female: Body 12.4–12.96 × 0.92–0.96. Genital pore terminal. Eggs elongated, 0.01-0.011 long.

50. ***Acanthosentis thapari*** Prashad, Sahay & Nath, 1969

A. thapari Prasad, Sahay and Nath, 1969 : *Zool. Anz.*, **183**(3/4) : 278-283.

Remarks : The species is reported in *Hilsa ilisha.*

12. Genus ***Acanthogyrus*** Thapar, 1927

Generic Diagnosis : Quadrigyridae; Pallisentinae: Proboscis sub-globular with 3 transverse rows of 8 hooks each. Trunk spines arranged in circular rows in anterior part but elsewhere in two lateral longitudinal rows which extend down to the genital pore. Lemnisci long, ganglion at base of proboscis sheath. Testes tandem. Cement gland 2, each with two or more nuclei. Eggs rounded. Embryos elliptical. Parasites of fishes.

Type species : *Acanthogyrus acanthogyrus* Thapar, 1927.

Farooqi (1989) emended the genus on the basis of mature *A. acanthogyrus* obtained from *Labeo rohita.*

Diagnosis : (emended) Body slender, spinose, trunk spines extend posteriorly to the genital pore; proboscis oval or oblong with 3 rows of 4-8 hooks each. Lemnisci digitate or spatulate, longer than proboscis sac. Testes tandem, in posterior half of the trunk; cement gland single, large, cyncytial, with few large nuclei; bursal rays rudimentary. Genital pore subterminal.

Farooqi (1989) emended the family Acanthogyridae with the type genus *Acanthogyrus.* The family Acanthogyridae is no more valid. *A tripathi* and *A. guptei* have been considered as synomyms of *A. acanthogyrus* by Farooqi. (1989).

Key to species of *Acanthogyrus*

1. Ratio of size of 1st and 3rd circles of proboscis hooks 1.38 : 1 ..... *A. tripathi*

   Ratio of 1st and 3rd circles more 2

2. Ratio of 1st and 3rd circles 1.5 : 1 ..... *A. acanthogyrus*

   Ratio of 1st and 3rd circles 1.74-1.79 : 1 ..... *A. guptei*

51. *Acanthogyrus acanthogyrus* Thapar, 1927
(Pt. 10; Figs. 40a–40d)

A. acanthogyrus Thapar, 1927 : *J. Helminth.* **5** : 109-120. Type locality : India.

Host : *Catla catla.*

Location : Intestine.

Distribution : India.

Other Host : *Labeo rohita.*

Diagnosis : (after Thapar, 1927) : *Male* : Body 2.3 long. Proboscis 0.09-0.11, armed with 3 circles of 8 hooks each. Proboscis hooks 1st circle 0.06. 2nd circle 0.05; 3rd circle 0.04. (Ratio of 1st and 3rd circles 1.5 : 1). Trunk spines in 12-20 rows. Lemnisci 0.35 long T/1–0.17 long; T/2–0.14 long. Cement gland 2, each with 2 or more nuclei. Genital pores in both sexes surrounded by small spines which are in direct continuation of lateral bands of spines. Female : body 6.00 × 0.9. Eggs circular 0.04 in diameter, Embryo elliptical 0.03 × 0.15.

Remarks : The species in the illustration appears to be one of the early stages of development. Hence, testes and cement glands are yet to attain normal size. Particularly cement glands are syncytial rudiments of two separate elements as opined by Petrotschenko (1959). Size ratio of proboscis hooks in parenthesis is provided by the present author.

52. *Acanthogyrus tripathi* Rai, 1967
(Pt. 10; Figs. 41a–41e)

A. tripathi Rai, 1967 : *Indian. J. Helminth.* **19**(1) : 27-44. Type locality : Mathura, U.P.

Host : *Catla catla.*

Location : Intestine.

Distribution : Mathura.

Diagnosis : (after Rai, 1967) : *Male* : Body 3.5-4.3 × 0.77-0.93. Trunk spines 18-25 rows, extend to posterior. Proboscis 0.11-0.14 × 0.097-0.010, armed with 3 circles of 8 hooks each. 1st circle of hooks 0.054; 2nd circle 0.046; 3rd 0.039, (ratio of 1st and 3rd circles 1.38 : 1). Lemnisci 0.70-0.82. T/1–0.25-0.39 × 0.17-0.19; T/2–0.28-0.42 × 0.15-0.42. Cement glands

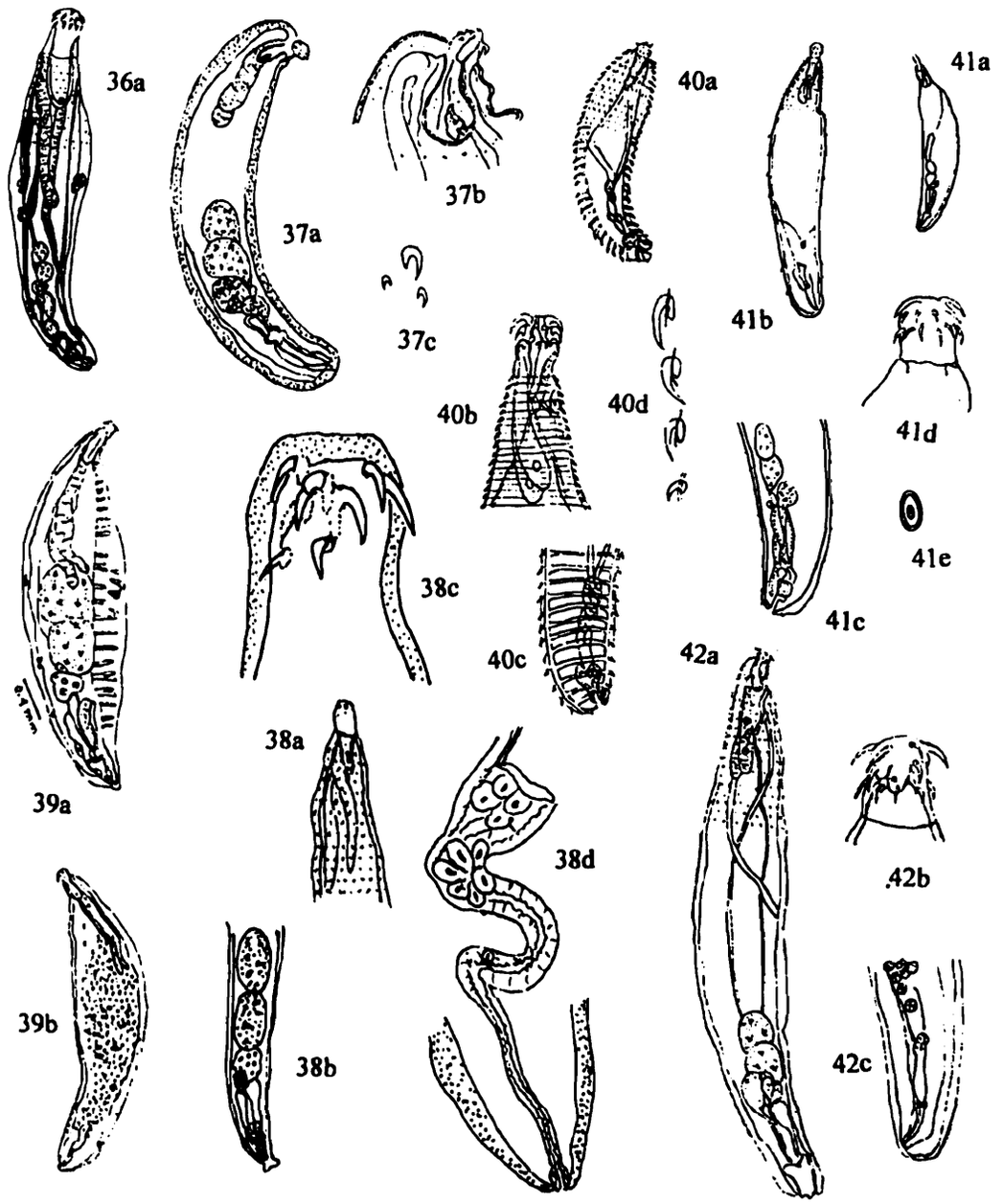


Plate-10

Fig. 36. *Acanthosentis vittatusi* Verma, 1973. (a) male.

Fig. 37. *Acanthosentis seenghalae* Chowan *et al.*, 1988. (a) male; (b) anterior of male; (c) proboscis hooks.

Fig. 38. *Acanthosentis giuris* Soota and Sen, 1954. (a) anterior of male; (b) posterior of male; (c) Proboscis; (d) female genitalia.

Fig. 39. *Acanthosentis gobindi* Chowhan *et al.*, 1987. (a) male; (b) female.

Fig. 40. *Acanthogyrus acanthogyrus* Thapar, 1927. (a) female; (b) anterior male; (c) posterior female; (d) proboscis hooks.

Fig. 41. *Acanthogyrus tripathi* Rai, 1967. (a) male; (b) female; (c) posterior of male; (d) proboscis; (e) egg.

Fig. 42. *Acanthogyrus guptei* Gupta and Verma, 1977. (a) male; (b) proboscis; (c) posterior female.

two with 2 nuclei each.1st cement gland 0.25-0.27; 2nd cement gland 0.11-0.13. Cement reservoir 0.096-0.10. Saefftigen's pouch, 0.14-0.07 × 0.078-0.09. *Female* : 5.3-6.1 × 1.0-1.40. Proboscis 0.12-0.14 × 0.09-0.13. eggs 0.027-0.031 × 0.014-0.015.

Remarks : Rai has carefully studied his material and has come to the conclusion that his specimens bear two prominent cement glands with two nuclei each. Synonymy of *A. tripathi* with *A. acanthogyrus*, as proposed by Farooqi, may not be justified unless detail examination of the materials is conducted. Size ratio of proboscis hooks in parenthesis is provided by the present author.

53. ***Acanthogyrus guptei*** Gupta and Verma, 1977
(Pt. 10; Figs. 42a–42c)

A. guptei Gupta and Verma, 19767 : *Riv. Parassit.* **37**(23) : 143-149. Type locality : Lucknow, U.P.

Host : *Labeo rohita.*

Location : Intestine.

Distribution : Lucknow.

Diagnosis : (after Gupta and Verma,1976) : *Male* : Body 2.72-3.81. Anterior trunk spines in 17-28 rows Proboscis 0.07-0.14 × 0.06-0.08, armed with 3 circles of 8 hooks each, 1st circle of hooks 0.048-0.061; 2nd circle 0.032-0.04; 3rd circle 0.03-0.034.(Ratio of 1st and 3rd circle 1.6-1.79 : 1). Proboscis sheath 0.12-0.24 X 0.07-0.11. L/1–0.49-0.74; L/2–0.51-0.79. T/1–0.25-0.34 × 0.17-0.26; T/2–0.30-0.33 × 0.15-0.22. Cement gland 4, largest cement gland 0.21-0.28; smallest 0.08-0.13. Saefftigen's pouch 0.22-0.34 × 0.10-0.12. *Female* : Body 3.3-4.7.

Remarks : The description of the species lacks information regarding presence of spines near genital pore which contrasts with the characteristics of *A acanthogyrus.* However, presence of 4 cement glands instead of two may arouse doubt on the validity of the species as suggested by Farooqi (1989). I therefore, agree with Farooqi and consider it to be a synonym of *A. acanthogyrus.* Size ratio of proboscis hooks in parenthesis is provided by the present author.

13. Genus ***Raosentis*** Datta, 1947

Generic Diagnosis : Quadrigyridae; Pallisentinae : Body small, fusiform. Hypodermic nuclei small, 4 or 5 pairs dorsally, 1 or 2 ventrally. Proboscis globular to elongate. 4 circles of proboscis hooks, anterior two circles of hooks longer and shorter than posterior two circles with hookless free space in between. Proboscis sheath single layered with ganglion at base. Anterior trunk with 16-17 circles of rose–thorn spines. Testes contiguous, tandem, near posterior extremity. Cement gland syncytial with 8-10 nuclei. Vagina with two sphincters. Eggs elliptical, small. Parasites in the intestine of fish.

Type species : *Raosentis poddari* Datta, 1947

Key to species of *Raosentis*

1. Ratio of size of proboscis hooks 1.5 : 1; 1.2 : 1; 1.3 : 1 ..... *R. ivaniosi*

   Ratio of 2nd and 3rd rows of hooks more 2

2. Ratio of 2nd and 3rd rows 2 : 1 ..... *R. thapari*

   Ratio of 2nd and 3rd rows of hooks 2.3 : 1 ..... *R. dattai*

54. ***Raosentis dattai*** Gupta and Fatma, 1985
(Pt. 11; figs. 43a–43b)

R. dattai Gupta and Fatma, 1985: *Indian J. Helminth.*, **37**(2) : 149-180.

Host : *Eutropiicthys vacha.*

Location : Intestine.

Locality : Gomti river, Lucknow.

Discussion : (after gupta and Sinha, 1985) : *Male* : Body small, with hypodermic nuclei 4-5 pairs dorsally and 2-3 pairs ventrally, 2.68 × 0.7 Proboscis 0.24 × 0.18. armed with 4 circles of hooks arranged in 6,6,8,8 per row. 1st circle of hooks 0.060-0.065; 2nd 0.055-0.058; 3rd 0.020-0.025. Proboscis sheath 0.61 × 0.15. L/1–0.70 × 0.10; L/2–0.75 × 0.08. Anterior trunk spines extending up to anterior testes. T/1–0.34 × 0.32; T/2–0.32 × 0.28. Cement gland suncytial 0.21-0.25 × 0.18-0.20. *Female* : Body 1.54-2.74 × 0.45-0.90. Eggs oval, 0.040-0.045 × 0.02-0.022.

55. ***Raosentis podderi*** Datta, 1947
(Pt, 11; Figs. 44a–44b)

R. podderi Datta, 1947 : *Rec. Indian. Mus.* **44** : 363-365. Type locality : Calcutta.

Host : *Mystus cavasius.*

Location : Intestine.

Distribution : Calcutta.

Diagnosis : (after Datta, 1947) : *Male* : Body 0.67-2.37. Proboscis hooks 6 in 1st and 2nd circle; 7 in 3rd and 4th circle. hypodermal nuclei 2 dorsal and 1 ventral. anterior trunk spines in 16-17 circles. Cement gland cyncytial with 8-10 nuclei Female: Body 1.31-2.53. Two tubular vagina. Eggs 0.050 × 0.020.

Remarks : In absence of measurement of proboscis hooks, ratio of size of the same cannot be drawn.. Therefore the species is left out of the key.

56. ***Raosentis thapari*** Rai, 1967
(Pt. 11; Figs. 45a–45e)

R. thapari Rai, 1967 : *Ind.J.Helminth.* **19**(1); pp. 27-44. Type locality : Gorakhpur, U.P.

Host : *Mystus vittatus; Mastacembelus armatus.*

Location : Intestine.

Distribution : Gorakhpur. Mathura.

Diagnosis : (after Rai, 1967) : *Male* : Body 1.7-2.37 × 0.57-0.68. Proboscis 0.14-0.24 × 0.11-0.16, armed with 4 circles, anteriopr two circles with 6 hooks each, while, posterior two circles with 8 hooks each, non-spined area between 2nd and 3rd circles 0.058-0.078. 1st circle of hooks 0.085; 2nd 0.058; 3rd 0.028; 4th 0.020. Trunk spines anterior with 9 rows of 25-30 each. Proboscis sac 0.39-0.56 × 0.097-0.11, ganglion at base. Lemnisci equal, 0.55 × 0.075, hypodermic nuclei dorsally and ventrally 3 pairs. T/1–0.25-0.27 × 0.27-0.5. T/2–0.26-0.33 × 0.31-0.35. Eggs 0.039-0.04 × 0.02-0.022.

Remarks : The species claims its distinction from *R. podderi* mainly on the number of hypodermic nuclei on dorsal and ventral trunk..

57. ***Raosentis ivaniosi*** George and Nadakal, 1978
(Pt. 11; Figs 46a–46c)

R. ivaniosi George and Nadakal, 1978 : *Aquatic Biology*, **3** : 79-90. *Type Locality* : Veli Lake, Puvar and Vellayani, Kerala.

Host : *Arius platystomus.*

Location : Small Intestine.

Distribution : Veli Lake, Kerala.

Diagnosis : (after George and Nadakal, 1078) : *Male* : Body 1.5-5.0 × 0.3-0.67. Proboscis 0.110-0.160 × 0.040-0.075, armed with 4 circles of 8-10 hooks each, 1st and 2nd circles larger and stouter than 3rd and 4th circle s, larger hooks of 1st circle 0.060-0.090 × 0.004-0.008; 2nd 0.050-0.058 × 0.004-0.007; 3rd 0.030-0.046 × 0.003-0.005; 4th 0.024-0.035 × 0.002-0.005; roots of 1st and 2nd circles of hooks 0.016-0.018. L/1–0.370-0.380 × 0.020-0.040; L/2–0.300-0.350. Proboscis sac 0.180-0.200; T/1–0.200-0.260 × 0.175-0.250; T/2–0.300-0.350 × 0.200-0.300. cement glands 0.120-0.200 × 0.200-0.250. *Female* : Body 2.0-7.0 × 0.85-2.0. Eggs 0.040-0.060 × 0.020-0.030.

14. Genus ***Pallisentis*** Van Cleave, 1928
Synonym *Neosentis* Van Cleave, 1928; *Farzandia* Thapar, 1931
Saccosentis Tadross, 1966; *Devendrosentis* Sahay *et al.*, 1971

Generic Diagnosis : Quadrigyridae; Pallisentinae: Trunk with a collar of spines arranged in 6-14 closely set rings near anterior extremity. Posterior to this collar of spines is an unspined zone which is followed by 20-40 widely spaced rings of spines, remaining part devoid of spines. Proboscis short, cylindrical to globular, with 4 circles of 6-10 hooks each. Proboscis receptacle cylindrical to saccate, with single layered muscular walls reaching to

second spinose region when the proboscis is introverted; ganglion near base of proboscis receptacle, Lemnisci long, slender, cylindrical. Testes oval to cylindrical, contiguous. Cement gland long, cylindrical, syncytial, containing a number of nuclei. Parasites of fresh water fishes.

Type species : *Pallisentis umbellatus* Van Cleave, 1928.

Members of the genus *Pallisentis* are basically parasites of fresh-water fish especially of the family Channidae. Occurrence of some *Pallisentis* species in marine and estuarine fish-host, reported recently, appears to be unusual. During my long course of examination of a large variety of marine and estuarine fish across the vast peninsular India, not a single species of *Pallisentis* has been found to occur in them. They are usually found to occur in either channid fish or in other fresh-water fish. *P. clupei* and *P. fotedari* in *Clupea longiceps* and *P. mehrai* in *Caranx kalla* are the exceptions.

Sexual dimorphism is well pronounced in *Pallisentis*. Females are more conspicuous than males in respect of dimension of body, trunk spines and distribution of trunk spines. Individuals of each species group under the genus also cover a wide rang of variation in size of lemnisci, cement gland, cement reservoir with ducts, seminal vesicle, Saefftigen's pouch, bursa, uterus with uterine bell etc. owing to high plasticity of these organs. Sometimes improper killing and fixing of live specimens sufficiently cause certain amount of variation of different organs including proboscis. All such variations along with the normal variation of size due to age growth often tend to deviate from correct identification of species. Intra-specific variations is so extensive in *Pallisentis* that while dealing with a large collection, there is likelihood to consider an identical species of the same lot obtained from the same host and locality as different species. Therefore, selection of stable characters for identification of *Pallisentis* species is essential to obviate over-crowding of species under the genus. Otherwise, it will make the identification more intricate. Narrow margin of difference among the species has probably necessitated Amin *et al* (1999) to erect three sub-genera of Pallisentis *viz, Pallisentis (Brevitritospinus)* ; *Pallisentis (Pallisentis)* and *Pallisentis (Demidueterospinus)*.

There are instances where too much importance has been given on presence of the organ of Saefftigen of male for establishing the status of new species in *Pallisentis* in spite of having other prominent characters identical with that of a known species. Soota and Bhattacharya (1982) have pointed out incongruity between descriptions of the organ of Saefftigen and its illustrations in some species where the organ has been taken as a significant character for establishing new species. However, they have not taken it as a major distinguishing character for determining a new species in *Pallisentis*. In fact, The organ of Saefftigen is an organ of copulatory system of male Acanthocephala which plays the role of a hydraulic pump to help protrusion of copulatory bursa during copulation. This organ has never been taken into consideration for generic diagnosis of *Farzandia, Pallisentis, Neosentis* and *Devendrosentis*. Petrotschenko (1956) and Yamaguti (1963) have never mentioned the organ in their emended diagnosis of the genus *Pallisentis*.

Critical study on a huge collection of *Pallisentis* and on the type specimens of *P. ophiocephali* and *P. colisai* that are present in the national zoological collection of Zoological Survey of India reveals that two distinct groups of species are found to exist in *Pallisentis* which are distinguished by the size, shape and transition of size of proboscis hooks. One group bears first circle of stout, broad and re-curved proboscis hooks where the transition of size of hooks is gradual toward base of proboscis, and the other group bears first two circles of thin and slender hooks with sharp points where transition of size of hooks from 2nd to 3rd circle is abrupt. The size of 3rd and 4th circle of proboscis hooks in the latter group is almost half of the 2nd circle. Both the groups have prominent sexual dimorphism in respect of dimension of body and size and distribution of cuticular spines.

Soota and Bhattacharya (1982) have divided the species of *Pallisentis* into two distinct groups as stated above The former group has been represented by *P. ophiocephali* and *P. colisai* for the latter. However, Amin *et al.* (1999) have removed the synonmy made by Soota and Bhattacharya subsuming the species into their proposed sub-genera. For the convenience of study in the light of above observation, all the species have been included here irrespective of their synonyms.. At the same time, assignment of species under the subgenera as proposed by Amin *et al.* (1999), and key for identification of species have been avoided here owing to lack of detail knowledge on the justification given by Amin in favour of erection of subgenera for *Pallisentis.* This lapse is due to non-availability of original publication of Amin *et al* (1999).

58. ***Pallisentis allahabadii*** Agrawal, 1958
(Pt. 11; Figs. 47a–47d)

P. allahabadii Agrawal, 1958 : *Curr. Sci.*, **27**; 107. from *Ophiocephalus punctatus. Location* : intestine. *Locality* : Allahabad.

P. allahabadii : Jain and Gupta (1979) : *Helminthologia,* **16**(2) : 173-183.

Host : *Ophiocephalus marulius; Wallago attu.*

Location Intestine, stomach of the latter Host.

Distribution : Ottu, Haryana.

Diagnosis : (after Jain and Gupta, 1979) : *Male* : Body 3.45-5.97 × 0.309-0.424. Proboscis 0.085-0.118 × 0.118-0.163 armed with 4 circles of 9-10 hooks each. 1st circle of hooks 0.061-0.073; 2nd 0.057-0.069; 3rd 0.024-0.029; 4th 0.016-0.025. Proboscis sheath 0.375-0.587 × 0.081-0.13. L/1–0.652-1.141 × 0.041-0.065; L/2–0.587-1.141 × 0.041-0.073. Collar spines 15-16 circles of 12-16 each, trunk spines 20-26 of 2-14 each. T/1(ant.)–0.44-0.962 × 0.146-0.212. T/2–0.424-0.718 × 0.163-0.228. Cement gland 0.538-0.718 × 0.146-0.22. with 10-12 nuclei. Cement reservoir 0.293-0.554 × 0.146-0.22. Saefftigen's pouch 0.309-0.456 × 0.049-0.065. *Female* : Body 7.351-11.954 × 0.57-0.799. Eggs 0.057-0.082 × 0.02-0.037.

Remarks : Agarwal (1958) has described the species in brief but without figure. There is no mention of Saeffftigen's pouch in the original description of the species. Jain and

Gupta (1979) have re-described the species in detail and have reported Saefftigen's pouch in *P. allahabadii.* Size and shape of proboscis hooks described by Jain and Gupta have been properly reflected in the diagrams which clearly conform with that of *P. buckleyi, P. colisai, P. basiri* and some other allied species where the transition of size of hooks between 2nd and 3rd circles is abrupt unlike that of *P. ophiocephali, P. nagpurensis P. nandai* where the transition of size is gradual. Original description of *P. allahabadii* lacks detail measurement of proboscis hooks of different circles but transition of hookss size from 2nd to 3rd circle as found in the specimens of Jain and Gupta (1979) clearly reveals that *P buckleyi* and *P. allahabadii* are same species. At the same time, *P. allahabadii* owing to its abrupt transition of hooks from 2nd to 3rd circle like that of *P. colisai,* deserves to be a junior synonym of the latter. This has been observed earlier by Soota and Bhattacharya (1982). However, the synonymy proposed by Soota and Bhattacharya (1982) has been removed and *P. allahabadi* is made the type species of the subgenus *P. (Brevitritospinus)* by Amin *et al.* (2000).

59. ***Pallisentis basiri*** Farooqi, 1958
(Pt. 11; Figs. 48a–48g)

P. basiri Farooqi, 1958 : *Z. ParasitKde., Bd.* **18.** : 457-46. *Type Locality* : Aligarh, U.P.

Host : *Rhynchobdella aculeata.*

Location : Intestine.

Distribution : Aligarh, U.P.

P. basiri : Gupta and Fatma (1985) : *Indian J. helminth.* **37**(2) : 149-180.

Host : *Ophiocephalus striatus.*

Location : Intestine.

Locality : River Gomti, Lucknow.

Diagnosis : (after Farooqi, 1958) : *Male* : Body 8.28 × 0.24. proboscis 1.1 × 0.3, armed with 4 circles of 9 hooks each. H/1–0.1; H/2- 0.058; H/3–0.03; h/4-0.02. Proboscis sheath 0.4 × 0.17. L/1–0.76; L/2–0.66. Collar spines 15 × 14. trunk spines 26 circles. T/1–0.95 × 0.35, T/2–0.7 × 0.35. Cement gland syncytial 0.9 × 0.34 with 9 nuclei, pyriform, bladder like Saefftigen's pouch 0.78. *Female* : 10.00 × 0.4-0.05. Eggs 0.036 × 0.021.

Remarks : Farooqi was the first to report Saefftigen's pouch in *Pallisentis* but he did not report seminal vesicle either in his description or in the illustration. Gupta and Fatma (1985) in their redescription of species reported Saefftigen's pouch along with seminal vesicle and cement reservoir but those organs were not clear in their illustration. Soota and Bhattacharya (1982) observed similarity of *P. basiri* with *P. colisai* with regard to size and shape of proboscis hooks and the abrupt transition of size of kooks in 2nd and 3rd circle except the Saeefftigen's pouch which was not reported in the latter. Therefore, they

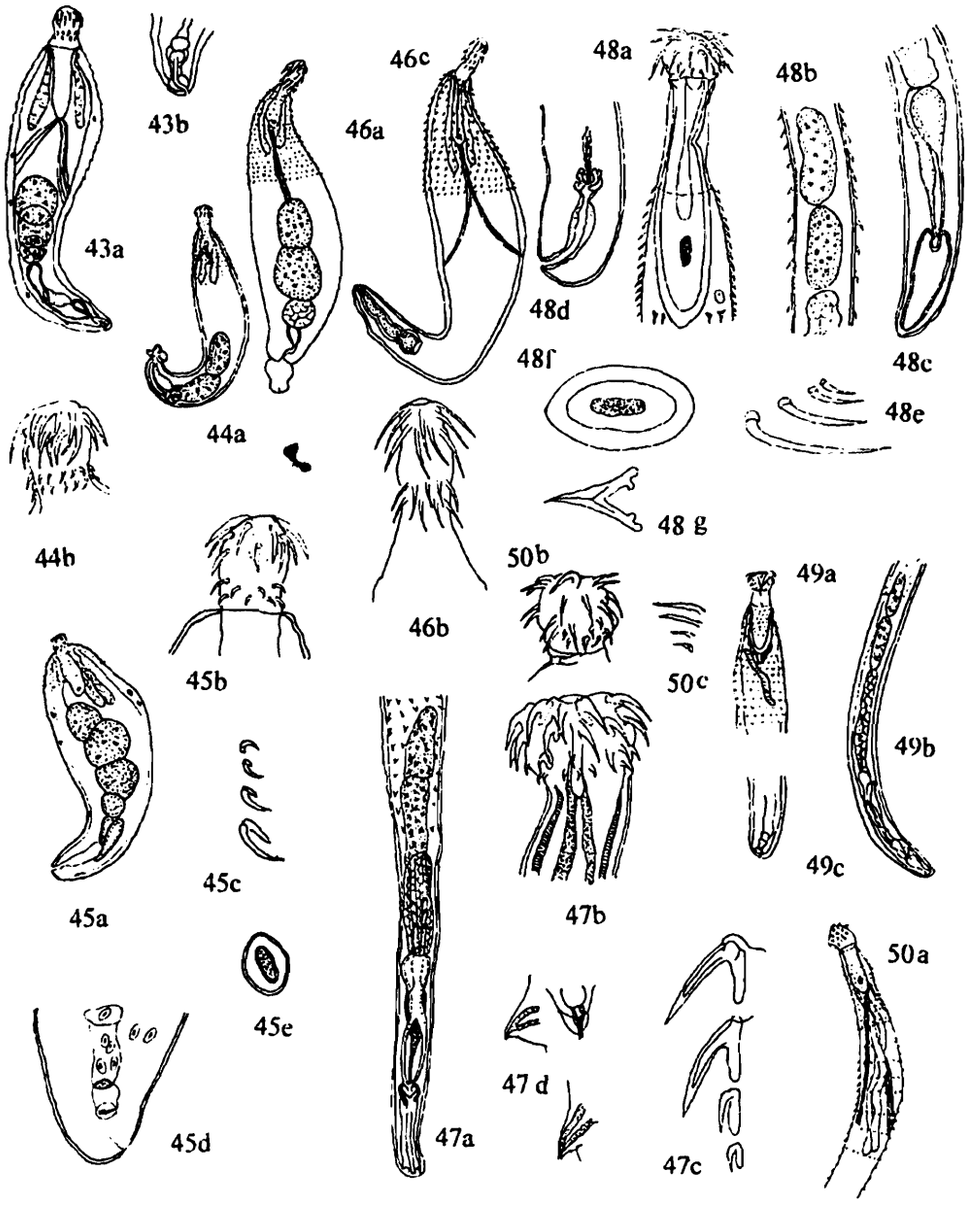


Plate-11

Fig. 43. *Raosentis dattai* Gupta and Fatma, 1985. (a) male; (b) posterior of female.

Fig. 44. *Raosentis podderi* Datta, 1947. (a) male; (b) proboscis.

Fig. 45. *Raosentis thapari* Rai, 1967. (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior female; (e) egg.

Fig. 46. *Raosentis ivaniosi* George and Nadakal,1978. (a) male; (b) proboscis. (c) female.

Fig. 47. *Pallisentis allahabadii* Agrawal, 1958. (a) posterior of female; (b) proboscis; (c) proboscis hooks; (d) trunk spines;

Fig. 48. *Pallisentis basiri* Farooqi, 1958. (a) anterior of male; (b) mid-body of male; (c) posterior of male; (d) posterior of female; (e) proboscis hooks; (f) egg trunk spine.

Fig. 49. *Pallisentis clupei* Gupta and Gupta, 1979. (a) anterior of male; (b) posterior of male; (c) posterior of female.

Fig. 50. *Pallisentis colisai* Sarkar, 1954, (a) anterior body; (b) proboscis; (c) proboscis hooks.

proposed synonymy of *P. basiri* with *P. colisai*. However, Amin *et al.* (2000) had removed the synonymy and transferred *P. basiri* to the sub-genus *P. (Demidueterospinus)*. Different shape and size of proboscis hooks and the transition of size of hooks of 2nd and 3rd circles distinctly differentiate two groups of species under *Pallisentis*.

60. ***Pallisentis buckleyi*** Tadross, 1966

P. buckleyi Tadross, 1966 : *J. Helminth.* **40** : 155-180. Type locality : Aligarh, U. P.

Host : Unidentified fish.

Location : Intestine.

Distribution : Aligarh.

Diagnosis : (after Tadross, 1966) : *Male* : Body 3.5-6.4 × 0.24-0.381. Proboscis 0.112-0.127 × 0.159-0.163, armed with 4 circles of 10 hooks each. H/1–0.07-0.077; H/2–0.060-0.064; H/3–0.020-0.028; H/4–0.016-0.020. Pr. sh. 0.525-0.53 × 0.125-0.154. L/1–1.0-1.82 × 0.029-0.04. L/2–0.85-1.425 × 0.029-0.04. collar spines 16-18 circles of 12-14 each. Trunk spines 26-28 circles of 10-12 each. T/1–0.35-0.64 × 0.15-0.2; T/2–0.36-0.46 × 0.15-0.2. cement gland 0.3-0.73 × 0.088-0.227, with 12 nuclei. Cement reservoir 0.175-0.59 × 0.085-0.236. Saefftigen's pouch 0.25-0.71 × 0.075-0.15.

Remarks : Jain and Gupta (1979) proposed synonymy of the species with *P. allahabadii.* which was reported by them in *Ophiocephalus marulius* and *Wallago attu* from Ottu, Haryana, mainly on the basis of presence of Saefftigen's pouch in both the species. Amin *et al.* (2000) accepted the synonymy and designated *P. allahabadii* as type species for the subgenus *P. (Brevitritospinus).*

61. ***Pallisentis clupei*** Gupta and Gupta, 1979
(Pt. 11; Figs. 49a–49c)

P. clupei Gupta and Gupta, 1979 : *Indian J.Helmintn.* **31**(2) : 135-156. Type Locality : Quilon, Kerala

Host : *Clupea longiceps.*

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1979) : *Male* : Body 8.27-8.64 × 0.60-0.63. Proboscis 0.15-0.21 × 0.26-0.31, armed with 4 circles of 8 hooks each. Collar spines 12-13 circles of 14-20 spines. Trunk spines 28-30 circles and 61 circles in female H/1- 0.11-0.15; H/2–0.07-0.09; H/3–0.055-0.07; H/4–0.03-0.04. Pr.sh. 0.81-0.88 x 0.20-0.28. L/1–0.95-0.36 × 0.07-0.08; L/2–1.25-2.07 × 0.07-0.08. Testes post-equatorial, T/1–0.61-0.74 × 0.18-0.20; T/2–0.71-0.75 × 0.18-0.19. Cement gland 1.39-1.5 × 0.16-0.20 with 9-16 nuclei. Cement reservoir 0.46-0.50 × 0.17-0.18. Seminal vesicle 0.51-0.72 × 0.12-0.17. Saefftigen's pouch 0.58-0.60 × 0.11-0.16. *Female* : 11.30 × 0.70.

Remarks : The transition of size of hooks from 1st to 4th circle is gradual which appears to be like that of *P. ophiocephali.*

62. ***Pallisentis colisai*** Sarkar, 1954
(Pt.-11; Figs. 50a–50c)

P. colisai Sarkar, 1954 : *Rec. Indian Mus.* **52** : 349-362. Type locality : Delhi. from *Colisa fasciatus*. *Location* : Intestine.

P. colisai : Soota and Bhattacharya (1982) : *Rec. zool. Surv. India*, **80** : 157-167.

Host : Eel, *Channa sp. Channa punctatus*.

Location : Intestine.

Distribution : Delhi, Rajgir, Patna, Tripura, Meghalaya, AndhraPradesh.

Diagnosis : (after Type material present in ZSI under Reg.No.W 3855/1). *Male* : 4.125 × 0.385. Proboscis 0.132 × 0.154, armed with 4 circles of 10 hooks each. H/1–0.076 × 0.0068; H/2–0.068; H/3–0.0306; H/4–0.0255. Proboscis sheath 0.605 × 0.11-0.165. Neck-0.264 × 0.165. L/1–2.2 × 0.05. Collar spnes 16 circles of 14-16 spines each. Trunk spines 22 ciecles of 12-6 spines each. T/1–0.385 × 0.165; T/2–0.352 × 0.165. Cement gland 0.44 × 0.187 with 8-15 nuclei each. Cement reservoir 0.20-0.42 × 0.12-0.13. Seminal vesicle 0.27-0.38 × 0.11-0.13. *Female* : 5.4-12.9 × 0.61-0.62. Eggs not found.

Remarks : Measurements given here from type specimens deposited in NZC of ZSI, Calcutta. It is to be noted that first two circles of proboscis hooks are large and posterior two circles are very small, and transition of size of hooks of 2nd and 3rd circles is abrupt. 3rd and 4th circles of hooks are half of the size of 1st and 2nd circles of hooks.

63. ***Pallisentis guntei*** Sahay *et al.*, 1967
(Pt. 12; Figs. 52a–52d)

P. guntei Sahay et al, 1967 : *Zool. Anz.* 178 (5/6) : 348-353. Type locality : Ranchi, Bihar.

Host : *Lepidocephalicthys guntea*.

Location : Intestine.

Distribution : Ranchi, Bihar.

Diagnosis : (after Sahay *et al.*, 1967) : *Male* : Body 1.75-1.95. Proboscis 0.135-0.150, armed with 4 circles of 8-10 each, H/1-0.085; H/2-0.085; H/3–0.03-0.045; H/4-0.025-0.03. Collar spines 16-17. (Trunk spines not mentioned.) T/1–0.2-0.3 × 0.10-0.11; T/2–0.175-0.25 × 0.10-0.11. Cement gland 0.125 -0.18 (no. of nuclei not mentioned). Female: 4.15-4.5. (eggs not mentioned).

Remarks : Soota and Bhattacharya (1982) made the species synonymous with *P. colisai* but Amin et al (2000) revalidated it and referred it to the subgenus *P. (Brevitritospinus)*. The transition of size of hooks of 2nd and 3rd circle is abrupt and the shape of hooks are thin and elongated like that of *P. colisai*. Hence, Soota and Bhattacharya (1982) opined for the synonymy of the species with *P. colisai*.

64. *Pallisentis guptai* Gupta and Fatma, 1985
(Pt. 12; Figs. 53a–53d)

P. guptai Gupta and Fatma, 1985 : *Indian J. Helminth.* **37**(2) : 159-180.

Host : *Nandas nandus.*

Location : Intestine.

Locality : Gomti river, Lucknow.

Diagnosis : (after Gupta and Fatma, 1985) : Male : Body 5.54-6.86 x 0.50-0.55. proboscis 0.25-0.30 × 0.22-0.28. armed with 4 circles of 8 hooks each. H/1–0.06-0.08; H/2–052-0.058; H/3–0.04-0.045; H/4–0.03-0.04. proboscis sheath 0.80-0.85. L/1–1, 4-1.8; L/2–1.2-1.6 Collar spines 13-14. Trunk spines 16-20. T/1–0.48-0.50 × 0.18-0.22; T/2-0.52-0.58 × 0.18-0.23, equatorial. Cement gland 0.50-0.58 × 0.20-0.25 with 10-12 nuclei. *Female* : 14.26-20.50 × 0.45-0.66.Eggs 0.055-0.057 × 0.030-0.031 with polar prolongations of middle shell.

Remarks : Re-curved and broad anterior hooks with gradual transition of the size of hooks in the proboscis are the characteristics of *P. ophiocephali*. Polar prolongations of middle shell as shown in the comparative chart is impossible in the order Gyracanthocephala. Hence, *P. guptei* may be a synonym of *P. ophiocephali*

65. *Pallisentis mehrai* Gupta and Fatma, 1985
(Pt. 12; Figs. 54a–54d)

P. mehrai Gupta and Fatma, 1985 : *Indian J. Helminth.* **37**(2) : 159-180.

Host : *Caranx kalla.*

Location : Intestine.

Locality : Mandapam, Tamil Nadu.

Diagnosis : (after Gupta and Fatma, 1985) : *Male* : Body 5.72-6.68 × 0.50-0.56. Proboscis 0.18-0.26 × 0.32-0.45 armed with 4 circles of 10-12 hooks each. H/1–0.10-0.125; H/2–0.10-0.12; H/3–0.052-0.065; H/4–0.04-0.045.Pr. sheath 0.70-0.75. L/1–1.5-2.0; L/2–1.5-2.0 Collar spines 10-12, trunk spines 20-30, extended up to posterior end. T/1–0.60-0.65 × 0.10-0.12; T/2-0.62-0.68 × 10.00-15.00, post equatorial. Cement gland 0.60-0.68 × 0.15-0.16 with 10-15 nuclei. Saefftigen;s pouch 0.50-0.65. *Female* : 8.6-10.5 × 0.45-0.58. Eggs 0.055-0.07 × 0.030-0.035.

Remarks : The occurrence of the species in marine host is unusual. Size, shape and transition of size of hooks in 2nd and 3rd circle is abrupt. All these characteristics conform with that of *P. colisai*. Egg is reported to have polar prolongations of middle shell which is against the diagnostic feature of the class Eoacanthocephala. However, the figure does not show any polar prolongations of middle shell.

66. ***Pallisentis Ophiocephali*** (Thapar, 1930) Baylis, 1933
Synonym *Farzandia ophiocephali* Thapar, 1930
(Pt. 12; Figs. 55a–55b)

F. ophiocephali Thapar, 1930 : *Ann. Mag. nat. Hist.* Ser. 10, **4** : 76.

P. ophiocephali (Thapar, 1930) Baylis, 1933. *Ann. Mag. nat. Hist.* **10** : 443-449.

Host : *Channa marulius.*

Location : Intestine.

Distribution : Several places in India.

Diagnosis : (after Thapar, 1930) : *Male* : Body 5.5-60.00 × 0.32. Proboscis globular 0.18 long, armed with 4 circles of 8 each. H/1–1.10; H/2–0.05; H/3–0.04; H/4–0.03. Collar spines 11 circles. Trunk spines extend to posterior end of body. Lemnisci extend upto 1st testis. Testes equal, 0.65. Cement gland syncytial with 4-5 nuclei. Embryo 0.01 × 0.03.

Remarks : Size of body and measurement of different organs of the species reported by different workers from the country display a wide range. The recurved and broad anterior hooks of proboscis and the transition of size of hooks of 1st to 4th circle is gradual. Amin *et al.* (2000) designated the species as type species of his subgenus *P. (Demidueterospinus).*

67. ***Pallisentis nagpurensis*** Bhalerao, 1931
(Pt. 12; Figs. 56a–65d)

P. nagpurensis Bhalerao, 1931 : *Ann. Mag. nat. Hist.* Ser. 10, **7** : 569. Type Locality : Nagpur, Maharastra.

Host : *Ophiocephalus striatus* (*Channa striatus*).

Location Intestine.

Distribution : Many places in India.

Diagnosis : (after Bhalerao, 1933) : *Male* : Body : 2.4-19.00 × 0.43-0.9. Proboscis 0.35 × 0.3, armed with 4 circles of 8-10 hooks each. H/1–0.076; H/4 0.03. Collar spines 12-14 circles Body spines30-63 rings of 8-14 spines each. Pr. sh. 0.47, ganglion at posterior end. Lemnisci coiled. T/1–0.63-1.82 × 0.16-0.37; T/2–0.49-1.28 × 0.17-0.36. Cement gland 1.15-1.18 with 20-30 nuclei. *Female* : body size not given. Eggs 0.116-0.214 × 0.083-0.115. Embryo 0.112 × 0.07.

Remarks : Measurements of different organs vary according to size of male and female. The species has been synonymised with *P. ophiocephali* by Soota and Bhattacharya (1982). Later, Amin *et al.* (2000) have removed from synonymy and have placed it under the subgenus *P. (Pallisentis).*

68. ***Pallisentis nandai*** Sarkar, 1953
(Pt. 12; Figs. 51)

P. nandai Sarkar, 1953 : *Proc. zool. Soc. Bengal,* **6**(2) : 139-147.

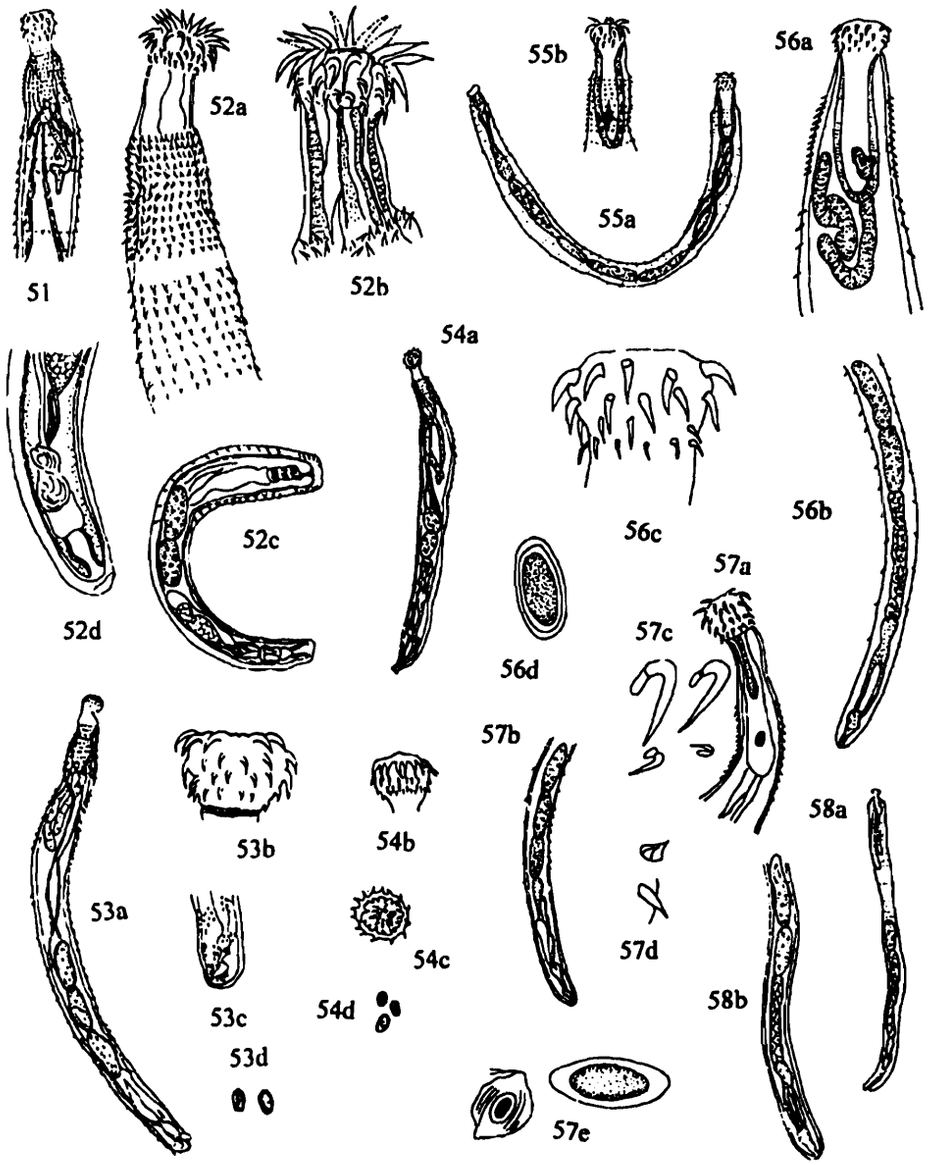


Plate-12

Fig. 51. *Pallisentis nandai* Sarkar, 1953, anterior body.

Fig. 52. *Pallisentis guntei* Sahay *et al.*, 1967. (a) anterior male; (b) Proboscis; (c) male; (d) posterior female.

Fig. 53. *Pallisentis guptai* Gupta and Fatma, 1985. (a) male; (b) proboscis; (c) posterior female; (d) eggs

Fig. 54. *Pallisentis mehrai* Gupta and Fatma, 1985. (a) male; (b) proboscis; (c) circular hooks; (d) eggs.

Fig. 55. *Pallisentis Ophiocephali* (Thapar, 1930) Baylis, 1933. (a) male; (b) anterior of male.

Fig. 56. *Pallisentis nagpurensis* Bhalerao, 1931. (a) anterior of male; (b) poaterior of male; (c) proboscis; (d) egg.

Fig. 57. *Pallisentis pandei* Rai, 1967. (a) anterior male; (b) posterior male; (c) proboscis hooks; (d) trunk spines; (e) eggs.

Fig. 58. *Pallisentis fotedari* Gupta and Sinha, 1991. (a) male; (b) posterior male;

Host : *Nandus nandus.*

Location : Intestine.

Distribution : Calcutta.

Diagnosis : (after Sarkar, 1953) : *Male* : Body 5.6-9.9 × 0.37-0.63 Proboscis 0.17-0.48 × 0.19-0.32 H/1–0.09; H/2–0.08-0.09; H/3–0.06; H/4–0.03; Proboscis sh. 0.44-0.84 × 0.12-0.25 Collar spines 18-20 × 16-20. Body spines 28-34 circles. L/1–1.1 X 0.04; L/2–0.76 × 0.04. T/1–0.57 × 0.14; T/2–0.53 × 0.14. Cement gland 0.77 × 0.14 ; Cement reservoir 0.32 × 0.13. Seminal vesicle 0.30 × 0.13. *Female* : 6.3-10.4 × 0.35-0.56. Eggs not described.

Remarks : Synonymy of the species with *P. ophiocephali* made by Soota and Bhattacharya (1982) has been removed and *P. nandai* is placed under the subgenus *P. (Pallisentis)* by Amin *et al.* (1999).

69. ***Pallisentis pandei*** Rai, 1967
(Pt. 12; Figs. 57a–57e)

P. pandei Rai, 1967 : *Indian J. Helminth.*, **19**(1) : 27-44.

Host : *Channa punctatus.*

Location : Intestine.

Distribution : Raya, U.P.

Diagnosis : (after Rai, 1967) : *Male* : Body : 5.07-6.00 × 0.30-0.35. Proboscis 0.14-0.16 × 0.14-0.17, armed with 4 circles of 10 hooks each. H/1–0.07-0.08; H/2–0.031-0.039; H/3–0.02-0.031; H/4–0.02-0.03. Pr. sh. 0.35-0.46 × 0.13-0.15. Collar spines 14-16 circles of 16 each. Trunk spines 20-28 circles. T/1–0.58-0.62 × 0.13-0.15; T/2–0.51-0.56 × 0.13-0.14. Cement gland syncytial, 0.47-0.63 × 0.12-0.14 with 8 nuclei. *Female* : 6.1-13.24 × 0.61-0.76. Eggs 0.08-0.10 × 0.04-0.049, membranous outer shell filamentous at one pole.

Remarks : The species has been placed under the subgenus *P. (Demidueterospinus)* by Amin *et al.* (1999) after removal of its synonymy with *P.colisai* made by Soota and Bhattacharya (1982). The transition of size of hooks is abrupt as that of *P. colisai.* The filamentous egg shell is unusal in the genus.

70. ***Pallisentis fotedari*** Gupta and Sinha, 1991
(Pt. 12–13; Figs. 58a–58d)

P. fotedari Gupta and Sinha, 1991 : *Indian. J. Helminth.* **43**(1) : 19-26. Type Locality : Puri, Orissa.

Host : *Clupea longiceps.*

Location : Intestine.

Distribution : Puri.

Diagnosis : (after Gupta and Sinha, 1991) : *Male* : Body 12.48-12.60 × 0.55-0.66. Proboscis 0.25-0.30 × 0.40-0.45, armed with 4 circles of 10 hooks each. H/1–0.11-0.12; H/2–0.09-0.098; H/3–0.04-0.05; H/4–0.04-0.05. Pr. sh. 0.70-0.90 × 0.26-0.30. Lemnisci subequal. L/1–2.75; L/2–2.20. Testes equatorial, T/1–1.40-1.75 × 0.30-0.35; T/2–1.05-1.35 × 0.30-0.40. *Female* : 13.30-14.60 × 0.55-0.64. Eggs. 0.032-0.078 × 0.030-0.068.

Remarks : Occurrence of *Pallisentis* species in marine fish is unusual. Transition of size of proboscis hooks toward base is abrupt. It is to be noted that Gupta and Gupta (1979) have described *P. clupei* from the same marine host *Clupea longiceps* at Quilon. In both the cases, the typical hooks and their transition of size are found to be similar with that of *P. colisai.*

71. ***Pallisentis jagani*** Koul *et al.*, 1991
(Pt. 13; Figs. 59a–59e)

P. jagani Koul *et al.*, 1991 : *Indian J. Helminth.*, **43**(2) : 124-128. Type locality : Jammu,Kashmir.

Host : *Channa channa.*

Location : Intestine.

Distribution : Jammu.

Diagnosis : (after Koul *et al.*, 1991) : *Male* : Body : 3.153 × 0.246. Proboscis armed with 4 circles of hooks. H/1–0.046-0.061; H/2–0.046-0.056; H/3–0.012-0.014; H/4–0.012-0.014. Collar spines 15-16 rings with 8-15spines each. Trunk spines 22-24 circles. Pr. sh. 0.338 × 0.03. T/1–0.276 × 0.076; T/2–0.184 × 0.076. Cement gland syncytial 0.277 × 0.092 with 6 nuclei. Saefftigen's pouch 0.346 × 0.38, Seminal vesicle 0.261 × 0.338. *Female* : 5.2 × 0.54. Eggs 0.045-0.047 × 0.015-0.017 with polar prolongations of middle shell.

Remarks : Transition of hook-size from 2nd to 3rd circle is abrupt. Size of 3rd and 4th circles is more than half of the anterior two circles of hooks. Polar prolongations of middle shell membrane of egg is absolutely impossible in the class Eoacanthocephala. Presence of seminal vesicle, Saefftigen's pouch and Cement reservoir are not clear in figures. Hence, the status of the species is doubtful.

72. ***Pallisentis garuai*** (Sahay *et al.*, 1971) Jain and Gupta, 1979
(Pt. 13; Figs. 60a–60f)

Devendrasentis gaurai Sahay *et al.*, 1971, *Annls. Parasit;* **46** : 69-80. Type locality : Patna.

Host : *Clupisoma garua.*

Location : Intestine.

Distribution : Patna.

Diagnosis : (after Sahay *et al.*, 1971) : *Male* : Body 8.97-10.49 × 0.58-0.78. Proboscis 0.224-0.261, armed with 4 circles of 6 hooks each, H/1–0.08-0.10; H/2–0.06-0.08; H/3–0.04-0.06;

0.032-0.06. Collar spines 13-15 circles. Trunk spines 28-32 circles. Pr. sh. 0.841-0.916. Lemnisci 2.767.Testes at mid-body. T/1–0.729-0.748 × 0.095-0.205; T/2–0.654-0.841 × 0.093-0.392. Cement gland 1.683-2.47 × 0.132-0.34, nuclei not determined. *Female* : 14.02-28.723 × 0.430-0.598. Eggs. 0.05-0.067 × 0.018-0.08.

Remarks : Jain and Gupta (1979) correctly evaluated the validity of the genus and transferred the species to *Pallisentis*. Hence, it is *P.garuai* (Sahay *et al.*, 1971) Gupta and Jain, 1979.

Other species reported from India :

73. ***Pallisentis gomtii*** Gupta and Verma, 1980
74. ***Pallisentis croftoni*** Mithal and Lal, 1981
75 ***Pallisentis indica*** Mithal and lal,1981
76. ***Pallisentis fasciati*** Gupta and Verma, 1980
77. ***Pallisentis cavasii*** Gupta and Verma, 1980

All the species of *Pallisentis* have been placed by Amin *et al.* (1999) under three different subgenera erected by him.

Order NEOECHINORHYNCHIDA Southwell et Macfie, 1925

Key to the families of NEOECHINORHYNCHIDA

1. Proboscis armed with hooks arranged in spiral, circular or diagonal 2

   Proboscis armed with hooks arranged quincuncially ..... TENUISENTIDAE*

2. Trunk with hypodermic nuclei dendritically branched .. DENDRONUCLEATIDAE*

   Trunk without dendritic hypodermic nuclei ..... NEOECHINORHYNCHIDAE

Family NEOECHINORHYNCHIDAE Van Cleave, 1919

Family Diagnosis : Neoechinorhynchida : Trunk aspinose, hypodermic nuclei giant, few in number, mainly in median line. Proboscis variable in shape, with hooks in longitudinal, spiral or transverse rows. Proboscis receptacle inserted at base of proboscis, with single layered wall. 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 freshwater fish.

Type genus : *Neoechinorhynchus* Hamann, 1892.

The family has been divided into four subfamilies. Representatives of only two subfamilies have been reported from India

Key to subfamilies of NEOECHINORHYNCHIDAE

1. Neck long with anterior bulbous expansion. Parasites of fresh water fish ..... EOCOLLINAE**

   Neck short or not pronounced, without expansion 2

2. Proboscis sub-cylindrical with few circular rings of hooks. Parasites of fish ..... GRACILISENTINAE

   Proboscis sub-globular or rarely cylindroid with spiral or diagonal rows of hooks. 3

3. Proboscis usually sub-globular with few spiral rows of hooks, Parasites of aquatic vertebrates ..... NEOECHINORHYNCHINAE

   Proboscis sub-cylindrical with diagonal, relatively irregular rows of hooks. Parasites of fresh water and marine fish ..... ATACTORHYNCHINAE**

Subfamily GRACILISENTINAE Petrotschenko, 1956

Subfamily Diagnosis : Neoechinorhynchidae with circular rows of proboscis hooks. Parasites of fish.

15. Genus ***Gracilisentis*** Van Cleave, 1919

Generic Diagnosis : Neoecinorhynchidae; Gracilisentinae: Body small, lacunar system in two median longitudinal vessels and transverse anastomoses. Hypodermic giant nuclei mainly in mid-dorsal line. Proboscis short, cylindrical,armed with 12 longitudinal rows of 3 hooks each (or 3 transverse rows of 12 each). Basal row is wider apart from the second row than the later is from the first, and each hook has a narrower root than that of the other two rows. Proboscis sheath cylindrical with ganglion at base. Lemnisci slender, longer than proboscis sheath. Testes near posterior extremity than to anterior. Cement gland syncytial with nuclei. Parasites of fishes. Type *Gracilisentis gracilisentis*

Type locality : N. America.

78. ***Gracilisentis mugilus*** Gupta and Lata, 1967
(Pt. 13; Figs. 61a–61c)

Gracilisentis mugilus Gupta and Lata, 1967 : *Res. Bull. Punjab. Univ. Sc.* **18**(3/4) : 253-268.

Host : *Mugil* sp.

Location : Intestine.

Distribution : India.

Diagnosis : (after Gupta and Lata, 1967) : *Female* : Body fusiform 5.5 × 0.6. Proboscis globular, 0.12 × 0.14, armed with 12 rows of 2 hooks each. Marginal hooks 0.07 × 0.010,

larger hooks 0.054 × 0.010, smaller hooks 0.02 × 0.004. Pr. sh. 0.36 × 0.15. Uterus 0.14 × 0.042. Eggs 0.036-0.040 × 0.024-0.030.

Remarks : The description lacks some of the important diagnostic features for the genus.

79. ***Gracilisentis gracilisentis*** Gupta and Lata, 1968c

80. ***Gracilisentis variabilis*** Gupta and Lata, 1968c

Remarks : No description of species could be provided due to non-availability of literature.

Subfamily NEOECHINORHYNCHINAE Travassos, 1926

Subfamily Diagnosis : Neoechinorhynchidae : Delicate body structure. Proboscis small, rounded, with spiral rows of hooks. Neck short. Eggs oval, without polar prolongations of middle shell membrane. Parasites of fishes.

Key to the genera of NEOECHINORHYNCHINAE

1. Proboscis hooks in 6 spiral rows 2

   Proboscis hooks in 8 spiral rows of 3 hooks each ..... ***Octospinifer***

2. 3 hooks in each row ..... ***Neoechinorhynchus****

   Hooks in each row more 3

3. 4 hooks in each row ..... ***Hexaspiron***

   5 hooks in each row ..... ***Paulisentis***

16. Genus *Neoechinorhynchus* Hamann, 1892

Synonym *Echinorhynchus* Zoega in Muller, 1776, partim
Neorhynchus Hamann, 1892
Eorhynchus Hamann, 1892
Eosentis Van Cleave, 1928

Generic Diagnosis : Neoechinorhynchidae; Neoechinorhynchinae : Body usually small, cylindrical, bowed or straight. Lacunar system consisting of median (dorsal and ventral) longitudinal vessels and circular vessels with anastomoses. Giant hypodermic nuclei almost always few (usually 4-5 dorsally and 4-5 ventrally). Proboscis short, somewhat globular; proboscis hooks in 6 spiral rows of 3 hooks each; anterior hooks larger and stouter than others. Proboscis receptacle subcylindrical, rather short, single layered, with ganglion at

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* Representatives of the families are not reported from India.

** Representatives of the subfamilies are not reported from India.

or close to its base. Lemnisci digitiform or filiform, with few giant nuclei. Testes contiguous or not, at or near midregion, sometimes in posterior half of trunk. Cement gland syncytial, with several nuclei; cement reservoir rounded. Eggs oval to elliptical, with concentric shells, Parasites of marine and fresh water fiishes, batrachians and chelonians.

Type *Neoechinorhynchus ruttili* (muller, 1780)

Key to species of *Neoechinorhynchus**

1. Body short, not more than 5 mm 2

   Body long upto 8 mm 8

2. Proboscis of male 0.0415 × 0.0249 with apical hooks not more than 0.03 .. *N. sootai*

   Size of proboscis larger 3

3. Size of male proboscis 0.13 × 0.07 with apical hooks not more than 0,025 long ..... *N. cyanophlycti*

   Size of proboscis greater 4

4. Size of Proboscis of male 0.114 × 0.091 with apical hooks not more than 0,068 ..... *N. ovalis*

   Size of proboscis greater 5

5. Size of proboscis of male 0.132 × 0.99 with apical hooks not more than 0.09 ..... *N. devdevi*

   Size of proboscis larger 6

6. Size of proboscis of male 0.132 × 0.143 with apical hooks not more than 0.08 ..... *N. dattai*

   Size of proboscis larger 7

7. Proboscis of male 0.145 × 0.145 with apical hooks not more than 0.083 ..... *N. nematolosi*

   Size of proboscis of male 0.14-0.18 × 0.07-0.15 with apical hooks not more than 0.10 ..... *N. kallarensis*

8. Size of proboscis of male 0.116 with apical hooks not more than 0.048 ..... *N. elongatus*

   Size little larger 9

9. Size of proboscis of male 0.121 × 0.11 with apical hooks not more than 0.07 ..... *N. chilkaensis*

   Proboscis larger 10

*The genus *Neoechinorhynchus* is the only representative in India.

10. Proboscis size of male 0.132 × 0.110 with apical hooks not more than 0.08.. *N. yalei*

    Larger proboscis 11

11. Size of proboscis of male 0.126-0.165 × 0.095-0.138 with apical hooks not more than 0.06 ..... *N. manasbalensis*

    Larger size of proboscis 12

12. Proboscis of male 1.21 × 1.10 with apical hooks not more than 0.13 ..... *N. rigidus*

    Body of male long, more than 8 mm to 28 mm 13

13. Body of male 9.0-12.00, size of proboscis 0.076–0.118 × 0.089-0.106 ..... *N. bangoni*

    Size of proboscis larger 14

14. Body of male long, 12.60-19.80 with maximum size of proboscis 0.144 × 0.144 .... *N. tylosuri*

    Body of male longer 15

15. Body of male 21.7–26.97 ..... *N. johnii*

    Body of male maximum of 28.5 ..... *N. topseyi*

81. ***Neoechinorhynchus agilis*** (Rudolphi, 1819) Petrotschenko, 1956

N.agilis : Bhattacharya, S.B. (2005) : *ZSI, Fauna of Andhra Pradesh, State Fauna Series,* 5(Part-5) : pp. 123-157.

Host : *Mugil persia; Mugil cephalus.*

Location : Intestine.

Locality : Machhlipatnam, Andhra Pradesh.

Diagnosis : *Male* : Body 7.138 × 0.913. Hypodermic nuclei dorsal 5-6 and ventral 1-2. Proboscis hooks in 3 circles of 6 hooks each, apical hooks largest, 1st circle 0.0875-0.95 × 0.0125; 2nd 0.0625-0.07 × 0.0125; 3rd 0.03-0.075 × 0.005. Proboscis sac 0.45 × 0.20. Lemnisci equal, 2.70 × 0.13. Testes tandem, T/1–0.80 × 0.60; T/2–0.85 × 0.60. Cement gland 0.90 × 0.45, number of nuclei in the cyncytial cement gland not clear. Seminal vesicle 1.40 long. Cement reservoir 0.70 long. Saefftigen's pouch 0.35 wide. *Female* : larger than male. Eggs 0.015-0.02.

Remarks : Bhattacharya(2005) recorded the species from Andhra Pradesh for the first time from India.

82. ***Neoechinorhynchus chilkaensis*** Podder, 1937
(Pt. 13; Figs. 62a–62b)

N. chilkaensis Podder, 1937 : *Parasitology,* **29**(3) : 407-416. Type locality : Chilka lake, Orissa.

N. chilkaensis : Gupta and Jain (1983) : *Acta parasit. pol.*, **28**, fasc. 43 : 407-416.

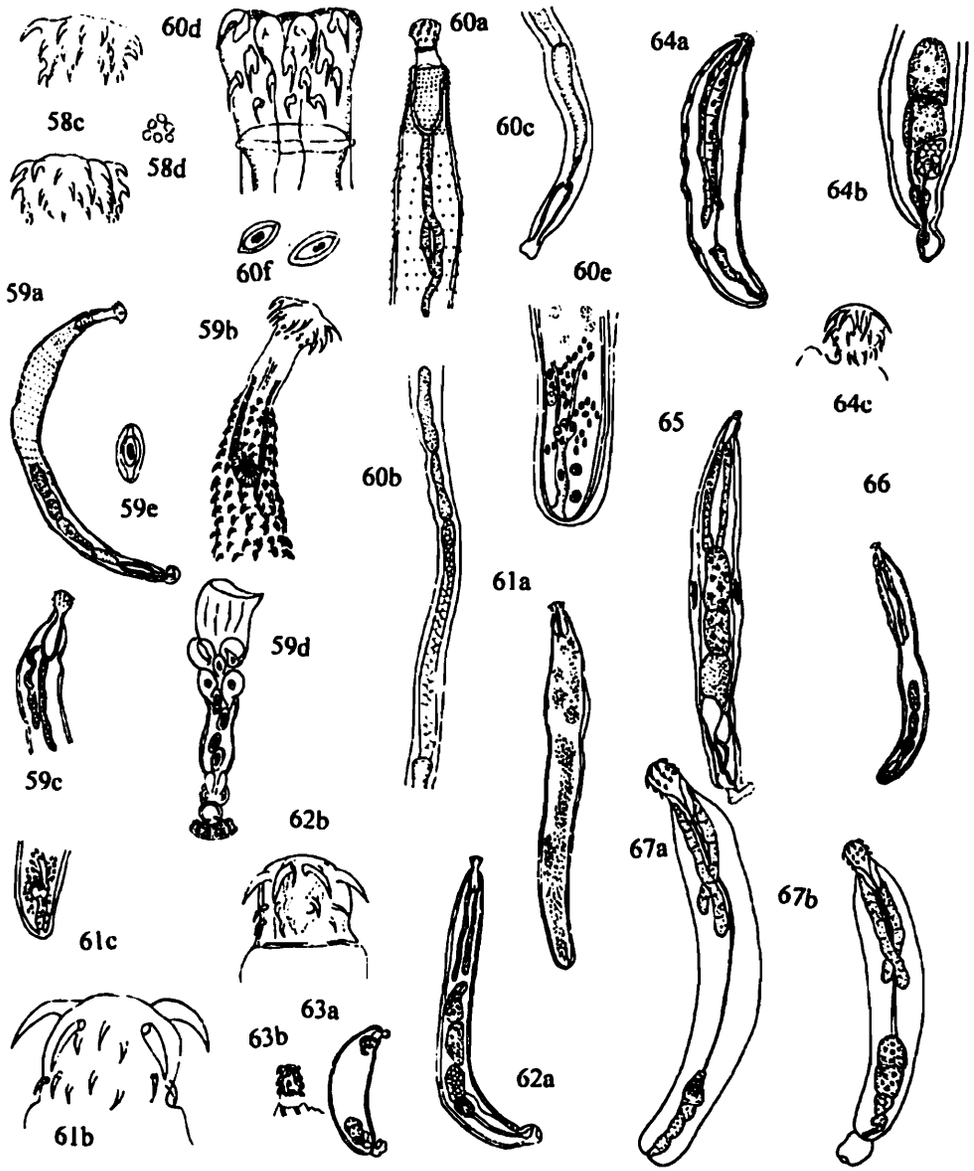

Plate-13

Fig. 58. *Pallisentis fotedari* Gupta and Sinha, 1991. (c) probosces; (d) eggs.

Fig. 59. *Pallisentis jagani* Koul *et al.*, 1991. (a) male; (b) anterior male; (c) anterior female; (d) female genitalia; (e) egg.

Fig. 60. *Pallisentis garuai* (Sahay *et al.*, 1971) Jain and Gupta, 1979. (a) anterior male; (b) mid-body of male; (c) posterior of male; (d) proboscis; (e) posterior of female; (f) eggs.

Fig. 61. *Gracilisentis mugilus* Gupta and Lata, 1967. (a) male; (b) proboscis; (c) posterior of female;

Fig. 62. *Neoechinorhynchus chilkaensis* Podder, 1937. (a) male; (b) proboscis.

Fig. 63. *Neoechinorhynchus cyanophlyctis* Kaw, 1951. (a) male; (b) proboscis.

Fig. 64. *Neoechinorhynchus devdevi* (Datta, 1936) Kaw, 1951. (a) female; (b) posterior male; (c) proboscis.

Fig. 65. *Neoechinorhynchus elongatus* Tripathi, 1959, male.

Fig. 66. *Neoechinorhynchus hutchinsoni* (Datta, 1936) Kaw, 1951, male.

Fig. 67. *Neoechinorhynchus kallarensis* George *et al.*, 1978. (a) female; (b) male;

Host : *Mugil cephalus* (type *Host*); *Mugil parsia* at Vasco-da-gama and *Siganus vermiculatus* at Panjim, Goa (reported by Gupta and Jain); *Mugil cirrahanus* of Fort Cochin and *Mugil olegolepis* of Ellore, Tamil Nadu.

Location : Intestine.

N.B. Some more species have been included here which are not present in the key.

Diagnosis : (after Podder, 1937) : *Male* : Body 4.2-7.8 × 0.20-1.03. Proboscis 0.121 × 0.11 armed with 3 rows of 6 hooks each. 1st row 0.07; middle 0.03; basal 0.027, hypodermic nuclei 4-5 on mid-dorsal and 2 on mid-ventral. Pr. sh. 0.46 × 0.14. L/1–1.85 × 0.11; L/2–1.61 × 0.11. T/1–1.21 × 0.53; T/2–0.77 × 0.59. cement gland 1.69 × 0.66. cement reservoir 0.44 × 0.26. Female : Body 5.0-18.70 × 0.31-1.08. Ova 0.023 long.

Remarks : The author has also reported the species in *M. cirrahanus* and *M. olegolepis* from Tamil Nadu and deposited the specimens in the NZC of ZSI, Kolkata.

83. ***Neoechinorhynchus cyanophlyctis*** Kaw, 1951
(Pt. 13; Figs. 63a–63b)

N. cyanophlyctis Kaw, 1951 : *Indian. J. Helminth.* **3**(2); 117-132. Type Locality : Dal Lake, Kashmir.

Host : *Rana cyanophlyctis.*

Location : Intestine.

Diagnosis : (after Kaw, 1951) : *Male* : Body 2.46 × 0.55. Proboscis 0.13 × 0.07, armed with 3 circles of 6 hooks each, hooks 0.014-0.025 long and maximum root-length 0.033. Pr. sh. 0.18 × 0.1. L/1–0.36 × 0.05; L/2–0.23 × 0.07. T/1–0.32 × 0.25; T/2–0.2 × 0.21. Cement gland 0.15 × 0.08.

84. ***Neoechinorhynchus dattai*** Golvan, 1994 nom. nov.
(= *Neoechinorhynchus rutili* Datta (1936) nec Muller, 1780
(Pt. 28; Figs. 149a–149c)
Synonym *Echinorhynchus rutili* Muller, 1780
Neorhynchus rutili (Muller, 1980) Van Cleave, 1914
Echinorhynchus clavaeceps Zeder, 1800
Echinorhynchus tuberosus Zeder, 1803

N. rutili : Datta (1936) : *Rec. Indian Mus.* **38** : 211. Type locality : Kashmir.

Host : *Nemacheilus stoliczkae; Nemacheilus vittatus.*

Location : Intestine.

Diagnosis : (after Datta, 1936) : *Male* : 3.0-4.20 × 0.50-0.80. Proboscis 0.132 × 0.143, apical proboscis hooks 0.080; middle 0.040; basal 0.037. L/1–1.584 × 0.088. L/2–1.276 × 0.088. T/1–0.77 × 0.374; T/2–0.77 × 0.374. cement gland 0.814 × 0.330. Cement reservoir 0.286 × 0.198. *Female* : Body 7.50-8.00 × 0.60-1.50. Eggs 0.50 × 0.013.

Remarks : *N. rutili* reported by Datta (1936) is not recognized by Golvan. Therefore, he has renamed the species as *N. dattai* Golvan, 1994 nom. nov. after M.N. Datta, the helminthologist of ZSI.

85. ***Neoechinorhynchus devdevi*** (Datta, 1936) Kaw, 1951
(Pt. 13; Figs. 64a–64c)
Synonym *Eosentis devdevi* Datta, 1936

E. devdevi Datta, 1936 : *Rec. Ind. Mus.* 38 : pp. 211. Type locality : Kashmir Valley.

Host : *Schizothorax planiforms.*

Location : Intestine.

Diagnosis : (after Datta, 1936) : *Male* : 2.290-3.30 × 0.730-1.080. Proboscis 0.132 × 0.099. Terminal hooks 0.09; Middle 0.045; basal 0.040 Pr.sh.0.264 × 0.132. L/1–1.870 × 0.132; L/2–1.782 × 0.132. T/1–0.704 × 0.440; T/2–0.616 × 0.440. cement gland 0.440 × 0.308; Seminal vesicle 0.374 × 0.198. *Female* : 2.970-7.590 × 0.616-1.276; Eggs 0.020 × 0.005

86. ***Neoechinorhynchus elongatus*** Tripathi, 1959
(Pt. 13; Figs. 65)

N. elongatus Tripathi, 1959: *Rec.Ind.Mus* **54**(1&2) : 61-99. Type Host : *Mugil subviridis.* Type locality : Chilka, Orissa.

N. elongatus : Bhattachaarya (2005) : *ZSI, State Fauna Series* : *Fauna of Andhra Pradesh.*

Host : *Mugil dussumieri, Mugil sp.*

Location : Intestine.

Locality : Kakinada, Andhra Pradesh.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 5.3-7.1 × 0.75-0.87. Proboscis 0.116 × 0.087-0.101. Lemnisci 1.45-1.49 × 0.087-0.101. Testes 0.58-0.72 × 0.333-0.348. Cement gland 0.652-0.797 × 0.401. Proboscis hooks 1st 0.048; 2nd 0.03; 3rd 0.019. *Female* : 9.00-13.2 × 1.45-1.6. Eggs 0.11 × 0.0266.

87. ***Neoechinorhynchus glyptosternumi*** Dhar and Kharoo, 1984
(Pt. **28**. Figs. 150a-150c)

N. glyptosternumi Dhar and Kharoo, 1984 : *Ind. J. Helm.* **36**(1) : pp. 36-39. Type locality : River Jhelum near Burmulla, Kashmir.

Host : *Glyposternum sp.*

Location : Intestine.

Diagnosis : *Male* : Body 5.05 × 0.82. Proboscis 0.11 × 0.07, terminal hooks 0.07 long; middle 0.06 long; basal 0.02 long. Anterior testis 0.98 × 0.55; posterior testis 1.47 × 0.78. Cement gland 0.74 × 0.4 Bursa 0.46 × 0.38.

88. ***Neoechinorhynchus hutchinsoni*** (Datta, 1936) Kaw, 1951
(Pt. 13; Figs.-66)
Synonym *Eosentis hutchinsoni* Datta, 1936

N. hutchinsoni Datta, 1951 : *Rec. Indian Mus.* **38**; p. 211. Type locality : Leh, Kashmir (11,500 ft.)

Host : *Diptychus maculatus.*

Location : Intestine.

Diagnosis : (after Datta, 1936) : *Male* : 7.8-8.2 × 0.8-1.00. Proboscis 0.077-1.00 × 0.099-0.110. Pr. sh. 0.264 × 0.99. L/1–2.728 × 0.176. L/2–1.50 × 0.176; T/1–1.188 × 0.484; T/2–1.122 × 0.484. Terminal hooks 0.050; middle, 0.037; basal 0.035. *Female* : 18.0 × 1.30; Eggs 0.154 × 0.55.

89. ***Neoechinorhynchus johnii*** Yamaguti, 1939
(Pt. **35** Figs. 196a-196d)

N. johnii : Gupta and Jain (1989) : *Acta parasit. pol.* 18 fasc. 43 : pp. 407-416.

Host : P*seudosciaena diacanthus* (reported by Gupta and Jain). From Panaji, Goa; *Belone strongylurus* (reported by author).

Location : Intestine.

Distribution : Pullicut Lake, Andhra Pradesh.

Diagnosis : (after Gupta and Jain, 1983) : *Male* : body 21.7-26.97. Proboscis 0.10-0.14, armed with 6 spiral rows of 3 hooks each, anterior hooks 0.089-0.093, median 0.02-0.024; posterior 0.02-0.024. Lemnisci 1.82-2.92 T/1–1.95-2.44; T/2–2.11-4.27. cement gland 3.22-4.83 with 12-13 nuclei. *Female* : Not reported. Eggs 0.033-0.038 × 0.02-0.022.

Remarks : Bhattacharya (2005) has reported male and female species from *Belone strongylurus* from Pullicut lake, Andhra Pradesh with some variations in measurement. Female is reported with the dimension of 31.25-32.00 × 0.50-0.55 without eggs.

90. ***Neoechinorhynchus kallarensis*** George *et al.*, 1978
(Pt. 13-14. Figs. 67a–67c)

N. kallarensis George *et al.*, 1978 : *Aquatic Biology*, **3** : 79-90. Type Locality : Kallar Dam, Trivundrum.

Host : *Laubuea dadybergori* and *Rasbora rasbora* (definitive *Host*).

Location : Small Intestine.

Diagnosis : (after George *et al.*, 1978) : *Male* : Body 2.00-4.00 × 0.37-0.8. Proboscis 0.14-0.18 × 0.07-0.15, armed with 3 circles of 6-8 hooks each. 1st row 0.060-0.100 × 0.015- 0.030; 2nd 0.030-0.040; 3rd 0.015-0.020 × 0.006-0.010. 1st and 2nd hooks with roots but 3rd without root. Lemnisci 1.25-1.32. Pr. sh. 0.18-0.200 × 0.14-0.10. Testes 0.300-0.320 × 0.280-

0.310. Cement glands 0.200-0.235 × 0.120-0.150. Cement res. 0.080-0.130 × 0.125-0.180. *Female* : Body 3.00–7.00 × 0.4-0.9. Eggs 0.70-0.85 × 0.024-0.032.

Remarks : The specimens have been deposited in NZC of ZSI under Reg. No. WN- 311.

91. *Neoechinorhynchus manasbalensis* kaw, 1951
(Pt. 14; Figs. 68a–68e)

N. manasbalensis Kaw, 1951 : *Indian. J. Helminth.* 3(2) : 117-132. Type locality : Lake Manasbal, Kashmir.

Host : *Oreinus sinuatus.*

Location : Intestine.

Diagnosis : (after Kaw, 1951) : Male : Body fusiform, 2.88-7.7 × 0.84-1.3. Proboscis 0.126-0.165 × 0.095-0.138, armed with 3 circles of 6 hooks each, anterior hooks 0.046-0.06, ant. roots 0.032-0.05; middle hooks 0.03-0.038. roots of mid-hooks 0.02, posterior hooks 0.028- 0.034, posterior roots very small. Pr. sh. 0.22-0.37 × 0.08-0.14, body nuclei mid-dorsal 8-12 and mid-ventral 2-3. L/1–1.15-1.85 × 0.9-1.8, L/2–1.1-1.77 × 0.09-0.2; T/1–0.36-0.56 × 0.4-0.5; T/2–0.3-0.53 × 0.23-0.38. Cement gland 0.3 × 0.23 with 4-6 nuclei. Female : 2.8-11.8 × 0.52-1.8. Eggs 0.023-0.027 × 0.009-0.01

92. *Neoechinorhynchus nematolusi* Tripathi, 1959
(Pt. 14; Figs. 69a–69b)

N. nematolusi Tripathi, 1959 : *Rec. Ind. Mus.* 54(1&2) : 61-99. Type Locality : Chilka lake.

Host : *Nematolosa nasus.*

Location : Intestine.

Distribution : Chilka, Orissa.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 2.33 × 0 24. Proboscis 0.145 × 0.145, 1st row of hooks 0.076-0.083; 2nd 0.038-0.044; 3rd 0.026-0.03. T/1–0.217 × 0.174; T/2–0.29 × 0.174. Cement gland 0.217 × 0.145. *Female* : Body 3.248-7.00 × 0.29-0.68. Eggs 0.019-0.026 × 0.0057.

93. *Neoechinorhynchus oreini* Fotedar, 1968
(Pt. 14; Figs. 70a–70b)

N. oreini Fotedar, 1968 : *Kashmir Science*, 5(1-2) : 147-152. Type locality : Arapat stream, Anantanag, Kashmir.

Host : *Oreinus sinuatus.*

Location : Intestine.

Diagnosis : (after Fotedar, 1968) : *Male* : Body 8.00-11.75 × 0.9-1.45. Proboscis 0.13-0.18 × 0.1-0.16, armed with 3 rows of 6 hooks each, 1st and 2nd rows 0.075-0.088 and 0.073-

0.085 respectively, basal rows 0.048-0.053. Pr. sh. 0.3-0.38 × 0.085-0.17, body nuclei 5-7 at mid-dorsal and 2 at mid-ventral. L/1–1.59-2.9; L/2–1.32-2.68. T/1–0.8-1.5 × 0.56-0.78; T/2–0.69-1.4 × 0.49-0.6. Cement gland syncytial 0.6-0.8 × 0.48-0.7. Sem. Ves. 0.48-0.75 × 0.2-0.35. *Female* : 11.5-16.8 × 1.2-1.7. Eggs 0.030-0.042 × 0.012-0.015.

94. ***Neoechinorhynchus ovalis*** Tripathi, 1959
(Pt. 14; Figs. 71)

N. ovalis Tripathi, 1959 : *Rec. Ind. Mus.* **54**(1&2) : 61-99. Type locality : Chilka Lake, Orissa.

Host : *Elops saurus.*

Location : Intestine.

Distribution : Chilka Lake, Orissa.

Diagnosis : (after Tripathi, 1954) : *Male* : 0.725 × 0.217. Proboscis 0.114 × 0.091. Probosacis hooks 1st. row 0.060-0.068; 2nd & 3rd 0.053. Lemnisci 0.247 × 0.045-0.079. Pr. sh. 0.098 × 0.06. *Female* : (Proboscis invaginated) 0.652 × 0.203.

95. ***Neoechinorhynchus rigidus*** (Van Cl., 1928) Yamaguti, 1963
(Pt. 15; Figs. 75a -75b)
Synonym *Eosentis rigidus* Van Cleave, 1928

Eosentis rigidus : Datta (1937) : *Rec. Indian Mus.* **39** : 303-304.

Host : *Schizothorax zarudnyi.*

Location : Intestine.

Distribution : Kashmir.

Diagnosis : (after Datta, 1937) : *Male* : Body 2.4-7.5 × 0.65-0.92. Proboscis 1.21 × 1.10, armed with 3 circles of 6 hooks each, anterior hooks 0.13, middle 0.050, basal 0.045. Pr.sh. 0.35 × 0.22, L/1–4.31 × 0.24. L/2–3.92 × 0.24, T/1–1.12 × 0 0.65; T/2–1.10 × 0.70. Cement gland 0.79 × 0.40, with 6-8 nuclei. Female : 4.8-12.0 × 0.7-1.5.

Remarks : Yamaguti (1963) has synonymised *Eosentis* with *Neoechinorhynchus*. Van Cleave (1928) has described the species on one female only. Datta (1937) has given a complete description of *E. rigidus* from the same host from Kashmir.

96. ***Neoechinorhynchus sootai*** Bhattacharya, 1999
(Pt. 35; Figs. 193a–193c)

N. sootai Bhattacharya, 1999 : *ZSI, Fauna of Meghalaya, State Fauna Series,* **4**(Part 9) : pp. 352-392. Type locality : Shillong, Meghalaya.

Host : *Puntius sp.*

Location : Intestine.

Diagnosis : (after Bhattacharya, 1999) : *Male* : Body 2.328 × 0.389. Giant hypodermic nuclei 2 dorsally, 2 ventrally. Proboscis 0.0415 × 0.0249, armed with 6 spiral rows of 3 hooks each, apical hooks 0.03 × 0.008; sub-apical 0.016 × 0.004; basal 0.016 × 0.004. Pr. sh. 0.207 × 0.041. Lemnisci 0.439 × 0.058. T/1–0.331 × 0.264; 0.248-0.223. Cement gland syncytial 0.231-0.166 with 6-7 nuclei.Cement res. 0.248. *Female* : Body 2.204 × 0.331. Eggs 0.012-0.016 × 0.006.

97. *Neoechinorhynchus topseyi* Podder, 1937
(Pt. 14; Figs. 73a-73d)

N. topseyei Podder, 1937 : *Parasitology* **29**(3) : 365-369. Type locality : Calcutta.

N. topseyei : Gupta and Jain (1983) : *Acta parasit. pol.*, **28**, fasc. 43 : 407-416.

Host : *Polynemus heptadactylus* (Type *Host*); *Cyanoglossus lingua* Malta river (reported by Tripathi, 1959).

Location : Intestine.

Diagnosis : (after Podder, 1937) : *Male* : Body 1.30-28.5 × 0.17-1.1. Proboscis 0.14-0.15, armed with 6 spiral rows of 3 hooks each, anterior hooks 0.095 long, midian 0.025, posterior 0.024. Pr. sh. 0.410 × 0.132. Testes elongate–oval, 0.63-0.99 × 0.220. Cement gland syncytial, 1.1 × 0.154. *Female* : 7.0-69.0 × 0.5-1.5. Eggs not matured.

Remarks : Gupta and Jain reported the species in *P. heptadactylus* from Arabian sea.

98. *Neoechinorhynchus tylosuri* Yamaguti, 1939
(Pt. 14; Figs. 72a–72e)
Synonym *Neoechinorhynchus asymetricus* Belous, 1952

N. tylosuri Yamaguti, 1939 : Gupta and Gupta (1971) : *Res. bull. (N.S.) Punjab Univ. Sci.* **22**(3-4) : 417-420.

Host : *Otolithus brunneus.*

Location : Intestine.

Distribution : Mumbai.

Diagnosis (after Gupta and Gupta, 1971) : *Male* : Body long, slender, 12.60-19.80 × 0.270-0.810. Proboscis 0.090-0.144 × 0.108-0.144, armed with 6 spiral rows of 3 hooks each, anterior hooks 0.065-0.1 × 0.01-0.015, basal hooks 0.025-0.03 × 0.005-0.007. Lemnisci 1.53-2.898 × 0.054-0.11. Pr. sh. 0.318-0.558 × 0.12-0.18. T/1–1.35-2.70 × 0.216-0.270; T/2–1.530-2.79 × 0.162-0.198. Cement gland syncytial with many nuclei, 1.890-2.286 × 0.108-0.144. Saefftigen's pouch 0.468 × 0.072-0.126. *Female* : 21.00-29.43. Eggs 0.045 × 0.018

Remarks : Saefftigen's pouch has not been reported by Yamaguti (1939) in *N. tylosuri.*

99. *Neoechinorhynchus yalei* (Datta, 1936) Kaw, 1951
Synonym *Eosentis yalei* Datta, 1936

Eosentis yalei (data, 1936) : *Rec. Indian Mus.* **38;** 211. Type locality : Kashmir Valley.

Host : *Schizothorax esocinus.*

Location : Intestine.

Diagnosis : (after Datta,1936) : *Male* : Body 5.390 × 0.880. Proboscis 0.132 × 0.110. Pr. sh. 0.242 × 0.132. L/1–2.090 × 0.162. L/2–1.870 × 0.242. T/1–1.144 × 0.616; T/2–1.100 × 0.528. Cement gland 0.396 × 0.242. Terminal hooks 0.080, middle 0.040, basal 0.040.

Remarks : No figure has been provided.

100. *Neoechinorhynchus argentatus* Chandra *et al.*, 1987
(Pt. 15; Figs. 76a–76c)

N. argentatus Chandra, *et al.*, 1987 : *Revista de Parasitologia,* **1/45** (1); pp. 49-52. Type locality : Waltair, Andhra Pradesh.

Host : *Pennahia argentata.*

Location : Intestine.

Diagnosis : Male: Body filiform, 19.2 × 0.312. Proboscis rounded, anterior proboscis hooks 0.096 long; middle 0.018 long; posterior 0.012 long. Proboscis receptacle 0.210 × 0.084. Nerve ganglion at posterior end, 0.069 × 0.039. Lemnisci equal, 1.092 × 0.036 Neck short 0.123 × 0.099.

101. *Neoechinorhynchus bangoni* Tripathi, 1959
(Pt. 14; Figs. 74a–74b)

N. bangoni Tripathi, 1959 : *Rec. Ind. Mus.* **54**(1&2) : 61-99. Type locality : Calcutta.

Host : *Mugil tade.*

Location : Intestine.

Distribution : Calcutta.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 9.0-12.0 × 0.725-0.94. Proboscis 0.076-0.118 × 0.089-0.106. Proboscis hooks 0.026-0.038 × 0.019-0.023 and 0.019-0.021 long. Pr. sh. 0.391-0.71 × 0.101-0.162. Lemnisci long, L/1–1.45-2.07 × 0.059-0.072, L/2–3.99 × 0.101-0.162. T/1–0.94-1.45 × 0.212-0.36; T/2–0.87-1.305 × 0.212-0.362. Cement gland 0.65-1.88 × 0.26-0.536. *Female* : Body 15.00-20.00 × 0.65-0.94 Eggs 0.034-0.038 × 0.007-0.013.

Remarks : Number of rows of proboscis hooks and their number in each row are not reported. Hypodermic nuclei and number of nuclei in cement gland are also not mentioned.

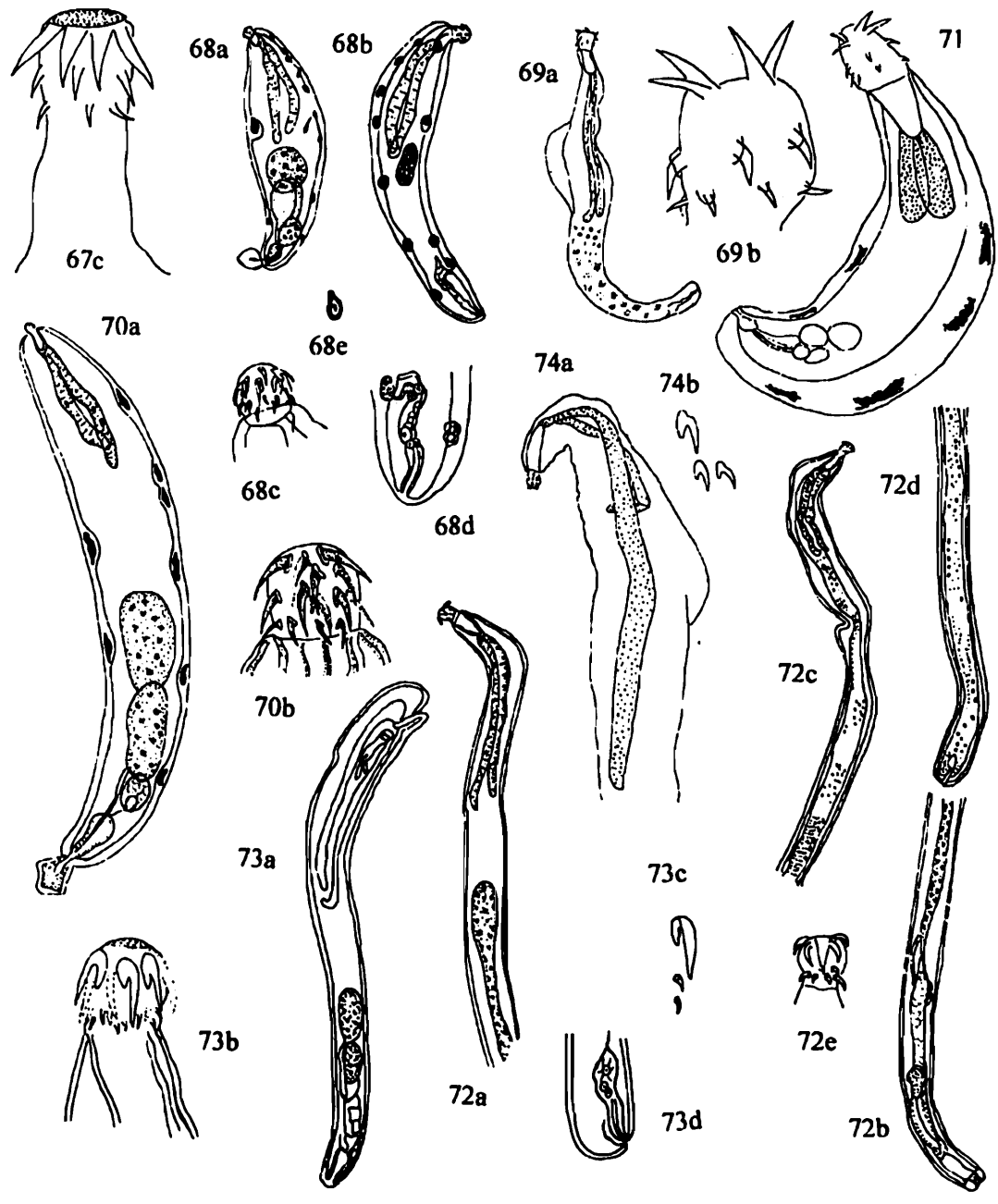

Plate-14

Fig. 67. *Neoechinorhynchus kallarensis* George *et al.*, 1978. (c) proboscis.

Fig. 68. *Neoechinorhynchus manasbalensis* Kaw, 1951. (a) male; (b) female; (c) proboscis; (d) female; (e) egg.

Fig. 69. *Neoechinorhynchus nematolusi* Tripathi, 1959. (a) female; (b) proboscis.

Fig. 70. *Neoechinorhynchus oreini* Fotedar, 1968. (a) male; (b) proboscis.

Fig. 71. *Neoechinorhynchus ovalis* Tripathi, 1959, male.

Fig. 72. *Neoechinorhynchus tylosuri* Yamaguti, 1939. (a) anterior of male; (b) posterior of male; (c) anterior of female. (d) posterior of female; (e) proboscis.

Fig. 73. *Neoechinorhynchus topseyi* Podder, 1937. (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior of female.

Fig. 74. *Neoechinorhynchus bangoni* Tripathi, 1959. (a) anterior body; (b) proboscis hooks.

Class PALAEACANTHOCEPHALA Meyer, 1931

Key to orders of PALAEACANTHOCEPHALA

Parasites of fishes and amphibians ..... ECHINORHYNCHIDA

Parasites of reptiles (rare), birds and mammals ..... POLYMORPHIDA

Order ECHINORHYNCHIDA Southwell and Macfie, 1925

Diagnosis : Trunk never pseudosegmented. Proboscis cylindrical to spheroid, with longitudinal, regularly alternating rows of hooks, sensory papillae present or absent. Proboscis receptacle double walled. Proboscis retractor muscles pierce posterior end of receptacle. Brain near middle or posterior end of receptacle.

Key to families of ECHINORHYNCHIDA

1. Outer wall of Proboscis sac with nuclear pouch at posterior extremity. Eggs considerably elongated ..... FESSISENTIDAE

   Outer wall of proboscis sac without nuclear pouch. Eggs fusiform or elliptical 2

2. Neck very long and cylindrical or spirally twisted, with or without bulbous swelling.

   Proboscis sac long and inserted at base of proboscis ..... POMPHORHYNCHIDAE

   Neck and proboscis sac not long 3

3. Trunk enlarged anteriorly. Proboscis nearly round, subterminal. Parasites of fresh water and marine fish ..... HYPOECHINORHYNCHIDAE

   Trunk usually without anterior enlargement or prominent lacunar reticulation. Proboscis cylindrical to claviform, or spherical, terminal 4

4. Cement glands 2, tubular or cylindrical. Parasites of marine fishes ..... DIPLOSENTIDAE

   Cement glands more than 2, variable 5

5. Ventral proboscis hooks considerably larger than dorsal. Parasites of fresh water and marine fishes ..... HETERACANTHOCEPHALIDAE

   Ventral proboscis hooks not significantly different from dorsal 6

6. Proboscis with 2 or 3 distinct types of hooks; transition abrupt. Parasitesof marine fish ..... ARHYTHMACANTHIDAE

   Proboscis armature not as above 7

7. Trunk unarmed. Proboscis cylindrical with many hooks or spheroid with few hooks.

   Cement glands 6 or 8, usually pyriform to spherical and compact. ..... ECHINORHYNCHIDAE

Trunk armed 8

8. Armed individuals with anterior minute circular spines. Proboscis claviform to long and slender. Cement glands 4, elongate, tubular, or filiform ..... CAVISOMIDAE

Trunk spined in one undivided region anteriorly and often at posterior extremity 9

9. Cement glands 8, elongate pyriform. Parasites of marine and fresh water fishes .... ILLIOSENTIDAE

Cement glands 4-6, elongate or tubular or short and pyriform. Parasites of marine and fresh water fishes ..... RHADINORHYNCHIDAE

Family RHADINORHYNCHIDAE Travassos, 1923
Synonym *Gorgorhynchidae* Van Cleave et Lincicome, 1940
Raorhynchidae Tripathi, 1959

Family Diagnosis : Palaeacanthocephala; Echinorhynchidae : Trunk long and slender, or swollen in anterior or middle third, spined extensively or on anterior part only, occasionally at posterior extremity too; the spines may be lost secondarily and present in young individuals alone. Hypodermic nuclei large and few, or small and numerous. Proboscis long or short, conical. Proboscis sheath usually cylindrical, ganglion at or near base, or equatorial. Lemnisci variable in length, longer or shorter than proboscis sheath. 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. Eggs elongate or oval, claviform, cylindrical, or very long and slender. Eggs elongate or oval.

Type genus : *Rhadinorhynchus* Luhe, 1911

Golvan (1969) subdivided the family into Rhadinorhynchinae; Gorgorhynchinae and Serrasentinae. Later, Amin (1987) added two more subfamilies viz. Serrasentoidinae and Golvacanthinae.

Key to the subfamilies of RHADINORHYNCHIDAE

1. Trunk with pseudosegmentation and cuticular combs 2

Trunk without cuticular combs 3

2. Trunk with cuticular combs on ventral surface ..... SERRASENTINAE

Trunk with only two cuticular combs on lateral surface, directly behind anterior collar of spines ..... SERRASENTOIDINAE

3. Cuticular spines cover trunk anteriorly and posteriorly ..... GOLVACANTHINAE

Cuticular spines only anteriorly, spined in one region or in two, separated by unarmed zone 4

4. Proboscis long, usually with numerous hooks, cement glands 4 long, tubular..... ..... RHADINORHYNCHINAE

Proboscis usually short, fusiform, anteriorly enlarged, cement glands 4-6, elongate tubular or short and pyriform, 8 in unspined genera..... GORGORHYNCHINAE

Subfamily RHADINORHYNCHINAE Luhe, 1911*

Subfamily Diagnosis : Rhadinorhynchidae : Body medium to large, Trunk spines limited to anterior portion or extending nearly to posterior extremity. Proboscis cylindrical or claviform, long, with numerous hooks. Proboscis sheath double walled, with ganglion near its middle or anterior extremity. Lemnisci usually long and slender. Cement glands long, tubular or clavate, 2-8. Eggs spindle shaped, with polar prolongations of middle shell. Parasites of marine fishes.

Type genus : *Rhadinorhynchus* Luhe, 1911*

Key to genera of RHADINORHYNCHINAE

Trunk not pseudo-segmented; proboscis cylindrical, lemnisci slender, but not very long; male and female genital pores sub-terminal..... ***Raorhynchus***

Trunk not pseudo-segmented, with reticular anastomoses; lemnisci long and slender; genital pore terminal in male and sub-terminal in female..... ***Rhadinorhynchus***

17. Genus ***Rhadinorhynchus*** Luhe, 1911
Synonym *Echinosoma* Porta, 1907, partim
Nipporhynchus Chandler, 1934**
Protorhadinorhynchus Petrotschenko, 1956

Generic Diagnosis : Rhadinorhhynchidae; Rhadinorhynchinae : Body cylindrical, hypodermic nuclei small, numerous, lacunar system consisting of lateral main vessels and reticular anastomoses. Trunk spines usually separated by aspinose area into two groups, of which the anterior encircles the body but the posterior is confined to the ventral side and extends further backward in the female than in the male. Proboscis usually very long,

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*According to Golvan (1969), the subfamily comprises of five genera out of which *Megistacantha, Cathyacanthus* and *Paragorgorhynchus* have not been reported from India.

**The genus *Nipporhynchus* Chandler,1934 was synonymised with *Rhadinorhynchus* by Golvan (1969). Diaz Ungria and Farooqi (1981) revalidated the genus with the diagnosis proboscis sheath long, double walled, with ganglion near middle. Lemnisci usually long, slender. Testes elongate, tandem. Cement glands 2, long, tubular. Genital pore terminal in male, subterminal in female, both not surrounded by spines. Uterus very long. Eggs elongate with polar prolongations of middle shell membrane. Parasites of marine, sometimes fresh water fishes. Gupta and Fatma (1981, 1986) described *N. erumeii* and *N. chandleri* which have not been dealt with.

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.

Type species : *Rhadnorhynchus pristis* (Rudolphi, 1802) Luhe, 1911

Type locality : Parasites of fish of Baltique.

Type host : *Belone belone* (definitive host)

102. ***Rhadinorhynchus asturi*** Gupta and Lata, 1967
(Pt. 15; Figs. 77a–77b.)

R. asturi Gupta and Lata (1967) : *Res. Bull. Punjab* Univ. Sci. 18(3/4) : 253-268. Type locality : Hoshiarpur, Punjab.

Host : *Astur badius.*

Location : Intestine.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 8.5 × 0.42. Proboscis 0.85-0.14 armed with 8 rows of 24-25 hooks each, apical hooks 0.032-0.036; sub-apical 0.042 × 0.006; basal 0.012 × 0.002. Pr. sh. 2.47 × 0.25. Lemnisci 1.62. Embryo 0.04-0.05 × 0.01.

Remarks : Occurrence of *Rhadinorhynchus* sp. in bird is unusual. The genus is basically the representative of a marine fish parasite. In this case, the host is a preying bird somewhere at Hoshiarpur which is far away from sea. Therefore, the occurrence of the species in such host merits doubt.

103. ***Rhadinorhynchus dolfusi*** Gupta and Fatma, 1987
(Pt. 15; Figs. 78a–78d)

R. dolfusi Gupta and Fatma, 1987 : *Indian. J. Helminth.* **39**(1) : 1-26. Type Locality : Quilon, Kerala.

Host : *Pelamis chilensis.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 0.85-0.60. Proboscis 1.60 × 0.22 armed with 12-14 rows of 24-26 hooks each, anterior proboscis hooks 0.035 long. Anterior trunk spines in 3 circles of 6 spines each. Cement gland 2. *Female* : Eggs 0.12-0.15 × 0.03-0.035.

Remarks : The original description lacks information about size of female, size of testes etc.

104. ***Rhadinorhynchus echeneisi*** Gupta and Gupta, 1979
(Pt. 15; Figs. 79a-79e)

R. echeneisi Gupta and Gupta, 1979 : *Indian. J. Helminth.* **31**(2) : 135-156. Type locality : Quilone

Host : *Echeneis naucratis.*

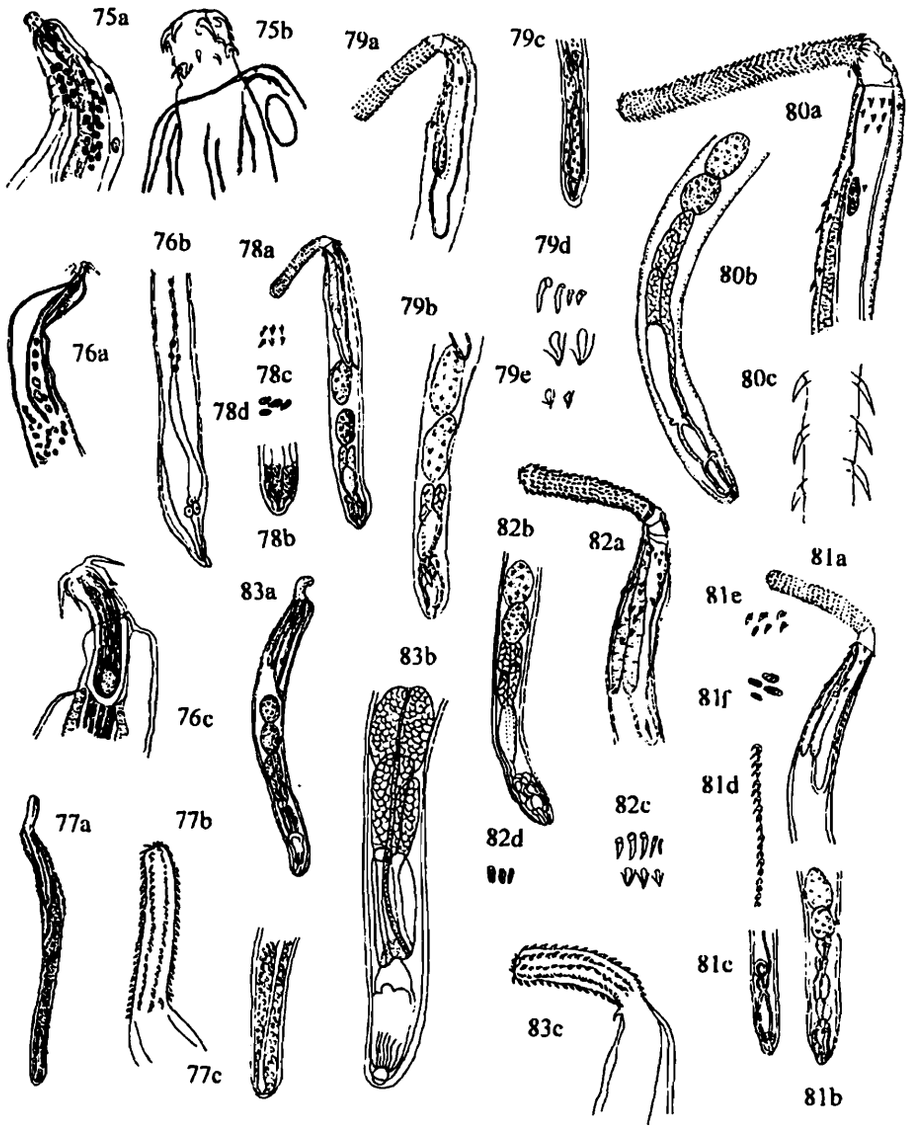

Plate-15

Fig. 75. *Neoechinorhynchus rigidus* (VanCl., 1928) Yamaguti, 1963. (a) anterior of female; (b) proboscis.

Fig. 76. *Neoechinorhynchus argentatus* Chandra *et al.*, 1987. (a) anterior of female; (b) posterior of female; (c) proboscis.

Fig. 77. *Rhadinorhynchus asturi* Gupta and Lata, 1967. (a) female; (b) proboscsis.

Fig. 78. *Rhadinorhynchus dolfusi* Gupta and Fatma, 1987. (a) Male; (b) posterior of female; (c) trunk spines; d) eggs.

Fig. 79. *Rhadinorhynchus echeneisi* Gupta and Gupta, 1979. (a) anterior of male; (b) posterior of female; (c) posterior of female; (d) proboscis hooks; (e) trunk spines.

Fig. 80. *Rhadinorhynchus hiansi* Soota and Bhattacharya, 1981. (a) anterior of male; (b) posterior of male; (c) proboscis hooks.

Fig. 81. *Rhadinorhynchus keralensis* Gupta and Fatma, 1987 (a) anterior of male; (b) posterior of male; (c) posterior of female; (d) proboscis; (e) trunk spines; (f) eggs.

Fig. 82. *Rhadinorhynchus pelmysi* Gupta and Gupta, 1979. (a) anterior of male; (b) posterior of male; (c) proboscis hooks and trunk spines; (d) eggs.

Fig. 83. *Rhadinorhynchus polynemi* Gupta and Lata, 1967. (a) male; (b) posterior of male; (c) proboscis.

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1979) : *Male* : Body 7.27-7.48 × 0.58-0.59. Proboscis 1.47-1.57 × 0.20-0.27, armed with 24-26 rows of 14-18 hooks each, apical hooks 0.26-0.27; sub-apical 0.055-0.075; median 0.062-0.065; basal 0.065-0.07. L/1–1.66-1.82. L/2–1.56-1.58. Testes tandem, contiguous. T/1–0.57-0.92 × 0.21-0.37; T/2–0.48-0.88 × 0.18-0.36. Cement gland two, 0.35-0.76 × 0.12-0.16. Saefftigen's pouch 0.44-0.65 × 0.17-0.23. *Female* : 11.62-13.05 × 0.56-0.63. Eggs not observed.

105. ***Rhadinorhynchus hiansi*** Soota and Bhattacharya, 1981
(Pt. 15; Figs. 80a–80c.)

R. hiansi Soota and Bhattacharya, 1981 : *Bull. zool. Surv. India*, 3(3) : 227-233. Type locality : Trivundrum.

Host : *Ablennis hians.*

Location : Intestine.

Diagnosis : (after Soota and Bhattacharya, 1981) : *Male* : Body 8.5-10.00 × 0.44-0.55. Proboscis 2.2-2.25 armed with 22-24 rows of 40-44 hooks each, two dissimilar types of hooks dorsoventrally, ventral hooks thicker and shorter 0.033-0.055 than dorsal 0.033-0.066, basal hooks conspicuous 0.066-0.079 long. Lemnisci 2.5-2.6 long. Trunk spines anterior with two zones. T/1–0.47-0.49 × 0.22-0.29. T/2-0.44-0.46 × 0.27-0.33. Cement gland 4, genital pore terminal.

Remarks : The description is based on male only.

106. ***Rhadinorhynchus keralensis*** Gupta and Fatma, 1987
(Pt.-15; Figs. 81a-81f)

R. keralensis Gupta and Fatma,1987 : *Indian J.Helminth.* 39(1) : 1-26. Type Locality : Quilon, Kerala.

Host : *Polydactylus indicus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 7.65-7.80 × 0.60-0.68. Proboscis 1.55-1.70 × 0.25-0.28, armed with 14-16 rows of 26-28 hooks each. Trunk spines anterior with 5 complete circles of 5-6 each. 3-4 spines ventrally extended. Lemnisci equal, 1.75-1.90. Testes post equatorial, T/1–0.62-0.85 × 1.80-2.40; T/2–0.50-0.58 × 0.26-0.30. Cement gland 4, pyriform. Genital pore terminal. *Female* : Body 1.6-1.8 × 0.25-0.26. genital pore terminal. Eggs 0.1-0.12 × 0.30-0.32 with polar prolongations of middle shell.

107. ***Rhadinorhynchus pelmysi*** Gupta and Gupta, 1979
(Pt.-15; Figs. 82a–82d)

R. pelmysi Gupta and Gupta, 1979 : *Indian. J. Helminth*, 31(2) : 135-156. Type locality : Quilone.

Host : *Pelamys chilensia.*

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1979) : *Male* : Body 6.8-13.71 × 0.46-1.1. Proboscis 1.34-1.57 × 0.19-0.21 armed with 23-27 rows of 12-16 hooks each. apical hooks 0.06-0.075; median 0.050-0.065; basal 0.055-0.061. L/1–1.54-2.8 (equal). T/1–0.52-1.08 × 0.36-0.52, T/2–0.38-0.75 × 0.31-0.55. Cement gland 4, tubular, 0.33-1.35 × 0.17-0.30. Saefftigen's pouch 0.6-1.05 × 0.22-0.32. *Female* : 7.53-20.25 × 0.46-0.76. Genital pore sub-terminal.

108. ***Rhadinorhynchus polynemi*** Gupta and Lata, 1967
(Pt. 15; Figs. 83a–83c)

R. polynemi Gupta and Lata, 1967 : *Res. Bull. Punjab Univ. Sci.* **18**(3/4) : 253-268. Type locality : India.

Host : *Polynemus heptadactylus.*

Location : Intestine.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 5.8-6.8 × 0.47-0.51. Proboscis armed with 20-21 recurved hooks, apical hooks 0.028 × 0.008; sub-apical 0.030 × 0.006; basal 0.006 × 0.002. Proboscis sheath 1.79-2.73 × 0.18-0.29. Lemnisci 1.26-1.59 × 0.042-0.056. Cement glands 4, oval, in pairs. T/1–0.56-0.71 × 0.36-0.47; T/2–0.50-0.56 × 0.39-0.42. Female : Body 6.9-10.1 × 0.53-0.58. Embryo 0.032-0.040 × 0.008-0.01.

Remarks : The original description of the species is given here only for comparison. The species is considered as junior synonym of *Raorhynchus polynemi* Tripathi, 1959 by Golvan (1969).

109. ***Rhadinorhynchus stunkardii*** Gupta and Fatma,1987
(Pt. 16; Figs. 84a–84e)

R. stunkardii Gupta and Fatma, 1987 : *Indian J. Helminth.* **39**(1) : 1-26. Type Locality : Puri, Orissa.

Host : *Cyanoglossus lingua.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : Male : Body 6.00-6.50 × 0.4-0.72. Proboscis 0.95-1.10 × 0.2-0.25, armed with 8-10 rows of 24-26 hooks each. anterior hooks 0.042-0.046; basal hooks 0.30-0.45. Anterior trunk spines 8-9 complete circles with 8-10 each, 3-4 spines extended ventrally. Lemnisci 1.50-1.60. T/1–0.86 × 0.20-0.22; T/2–0.85-0.95 × 0.22-0.25. Cement glands 4, pyriform. 0.55-0.60. *Female* : Body 1.05-1.10 × 0.20-0.21. Eggs 0.12-0.15 × 0.025-0.028 with polar prolongations of middle shell.

110. ***Rhadinorhynchus trivundricus*** George and Nadakal, 1978
(Pt. 16; Figs. 85a–85c)

R. trivundricus George and Nadakal, 1978 : *Aquatic Biology* **3** : 79-90. Type locality : Veli Lake, Vellayani and Neendakara, Keraka.

Host : *Arius platystomus.*

Location : Intestine.

Diagnosis : (after George and Nadakal, 1978) : *Male* : Body 6.00-9.00 × 1.00-2.00, anterior trunk wide. Proboscis 1.4-1.5 × 0.4-0.45, armed with 18-22 rows of 20-26 hooks each, anterior hooks 0.030-0.050 × 0.010-0.018; middle 0.040-0.050 × 0.012-0.016; posterior 0.024-0032 × 0.008-0.012. Trunk spines 18-20 circles of 16-25 spines each. Lemnisci 1.4-1.7 × 0.05-0.07. Proboscis sh. 1.5-1.65 × 0.13-0.26. Testes 0.30-0.34 × 0.35-0.382. Cement gland 8, pyriform 0.14-0.16 × 0.15-0.160. *Female* : Body 6.00-9.00 × 1.00-2.00. Eggs 0.040-0.070 × 0.02-0.035.

Remarks : Figure of paratype female displays terminal genital pore which is sub-terminal in female of *Rhadinorhynchus* species.

111. ***Rhadinorhynchus ganapati*** Chandra *et al.*, 1985
(Pt. 16; Figs. 88a–88d)

R. ganapati Chandra *et al.*, 1985 : *Revista Iberica de Parasitologia*, **45**(4) : pp. 293-302. *Type locality* : Coast of Andhra Pradesh.

Host : *Euthynnus affinis; Scomboerides commersonianus; Scomberomorus guttatus; Lepturacanthus savala.*

Location : Intestine.

Diagnosis : *Male* : Body 4.764-0.320 × 0.372-0.608. Proboscis 0.963-1.164 × 0.138-1.175 armed with 16-18 rows with 23-25 hooks per row. Proboscis sheath 1.920-3.560 × 0.078-0.240, ganglion at posterior end, 0.144-0.175 × 0.128-0.144. Lemnisci 2.100-3.600 × 0.180-0.208. Testes tandem, T/1–0.696- 1.128 × 0.300-0.432.; T/2–0.456-0.480 × 0.276-0.320. Cement gland 4; Saefftigen's pouch present. *Female* : Body 10.720-15.424 × 0.512-0.640. Genital pore subterminal. Eggs 0.042-0.054 × 0.011.

18. Genus ***Raorhynchus*** Tripathi, 1959

Generic Diagnosis : Rhadinorhynchidae; Rhadinorhynchinae : Trunk long, cylindrical, curved dorsally, with rows of spines anteriorly. Lacunar anastomoses ? Proboscis cylindrical, with 11-26 rows of 22-37 hooks each which vary in size and shape dorsoventrally as well as anteroposteriorly as in *Rhadinorhynchus*. Neck short. Proboscis sheath cylindrical, long, double walled; ganglion? Lemnisci slender, somewhat shorter than proboscis sheath.Testes directly tandem, largely pre-equatorial. Cement glands 2, (Golvan, 1969 amended as 4), tubular. Male genital sub-terminal. Posterior extremity curved. Uterus long and narrow; vaginal sphincter single, vaginal bulb ? Vulva sub-terminal. Eggs with polar prolongations of middle shell. Parasitic in marine teleosts.

Type species : *Raorhynchus terebra* (Rudolphi, 1819) Tripathi, 1959.

Type locality : unknown

Key to species of *Raorhynchus*

1. Proboscis hooks in 19 × 14-26 ..... *R. cadenati*
   Proboscis hooks less 2
2. Proboscis hooks 10 × 21-22 ..... *R. guptei*
   Proboscis hooks 11-12 × 22-24; eggs 0.076 long ..... *R. polynemi*

112. ***Raorhynchus cadenati*** Gupta and Sinha, 1991
(Pt. 16; Figs. 86a–86c)

R. cadenati Gupta and Sinha, 1991 : *Ind. J. Helminth.* **43**(1) : pp. 108-118. Type locality : Puri, Orissa.

Host : *Stromateus cinereus.*

Location : Intestine.

Diagnosis : (after Gupta and Sinha, 1991) : *Male* : Body 19.80 × 0.65. Proboscis club shaped 0.50 × 0.25, armed with 19 rows of 14-26 hooks each, anterior hooks 0.44-0.058; middle 0.060-0.062; posterior 0.052-0.058 with roots. Pr. sh. 0.95 × 0.25. L/1–n1.78 long. L/2–1.86. T/1–0.60 × 0.20; T/2–1.95 × 0.40. cement gland 2, 9.85 × 0.10-0.12. Saefftigen's pouch 1.68 × 0.28.

Remarks : Terminal genital pore as stated in the description contradicts with what is shown in the figure where it is little sub-terminal. Presence of two cement glands needs histological confirmation.

113. ***Raorhynchus guptei*** Gupta and Kumar, 1987

R. guptei Gupta and Kumar, 1987 : *Kanpur University Research journal (Sci)* ; **5** : 75-80. Type locality : Off Puri coast, Orissa.

Host : *Polynemus sextarius.*

Location : Intestine.

Diagnosis : (after Gupta and Kumar, 1987) : Proboscis hooks in 10 longitudinal rows of 21-22 hooks per row.

Remarks : Information obtained from Helm. Abstract.

114. ***Raorhynchus polynemi*** Tripathi, 1959
(Pt. 16; Figs. 87a–87h)
Synonym *Rhadinorhynchus polynemi* Gupta and Lata, 1967

R. polynemi Tripathi, 1959 : *Rec. Indian. Mus.* **54** (1&2) : 61-99. Type locality : Puri, orissa.

Rhadinorhynchus polynemi Gupta and lata, 1967 : *Res. bull. Punjab Univ. (sci).*, **18**(3/4) : 253-268.

R. polynemi : Soota and Bhattacharya(1981) : *Bull.zool.Surv.India*, **3**(3) : 227-233.

Hosts : *Polynemus sextarius* (type *Host*).

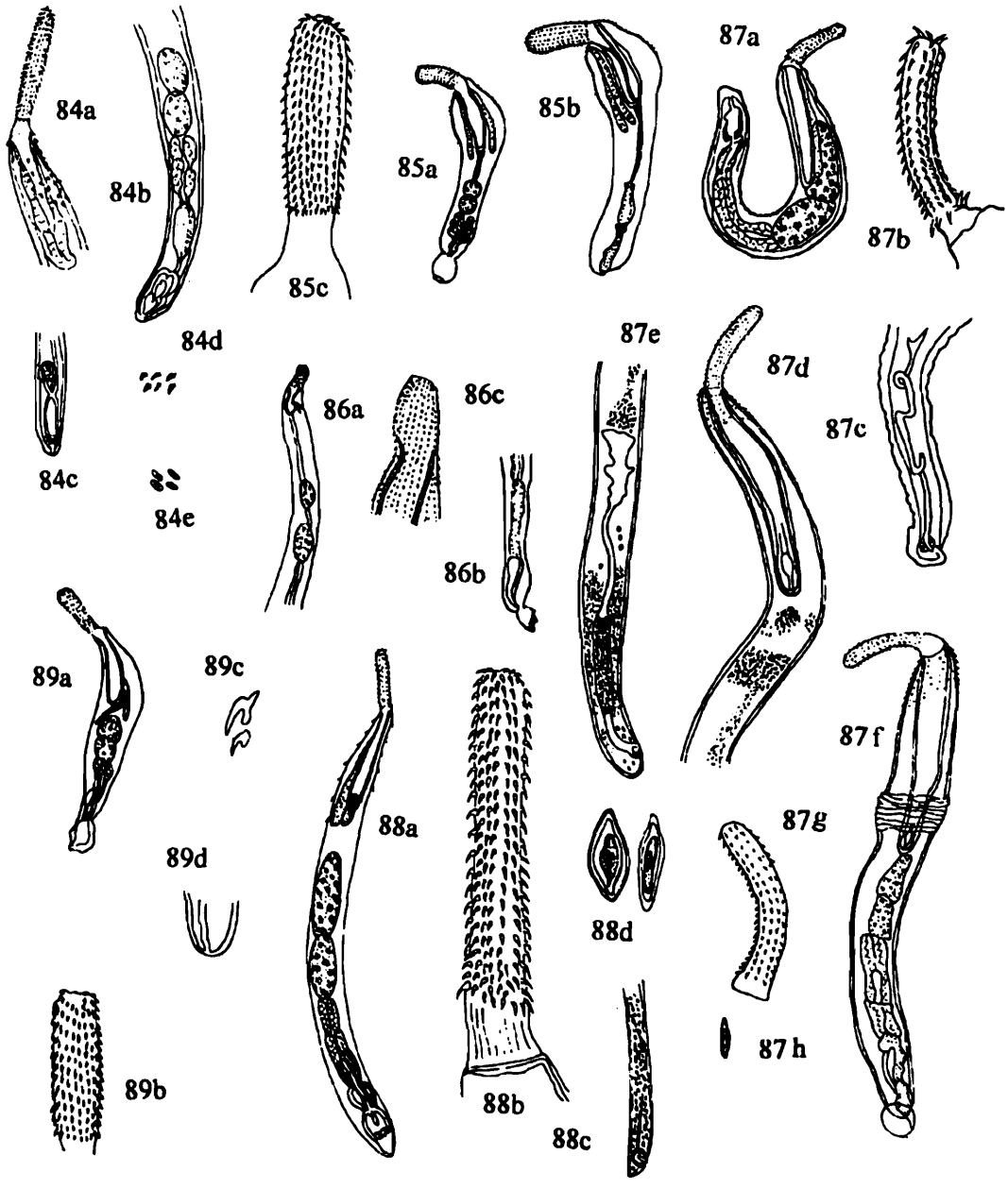

Plate-16

Fig. 84. *Rhadinorhynchus stunkardii* Gupta and Fatma, 1987. (a) anterior of male; (b) posterior of male; (c) posterior of female; (d) trunk spines; (e) eggs.

Fig. 85. *Rhadinorhynchus trivundricus* George and Nadakal, 1978. (a) male; (b) female; (c) proboscis.

Fig. 86. *Raorhynchus cadenati* Gupta and Sinha, 1991. (a) anterior of male; (b) posterior of male; (c) proboscis.

Fig. 87. *Raorhynchus polynemi* Tripathi, 1959. (a) male; (b) proboscis; (c) posterior of female; (after Gupta and Gupta, 1970, (d) posterior of female; (e) posterior of female; (f) male; (g) proboscis; (h) egg.

Fig. 88. *Rhadinorhynchus ganapati* Chandra *et al.*, 1985. (a) male (b) proboscis; (c) posterior of female; (d) egg.

Fig. 89. *Micracanthorhynchina golvani* Gupta and Sinha, 1991. (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior female.

Other Hosts : *Polynemus heptadactylus* (by Gupta and Lata,1967); *Polynemus plebius* (karaikal); *Alectis indica* (Pondicherry); *Harpodon sp.* (Pondicherry); *Polynemus sp.* (Mangalore); *Alectis indica* (Tuticorin). [reported by Soota and Bhattacharya, 1981].

Location : Intestine.

Diagnosis : (after Tripathi, 1959) : *Male* : Body 6.06-6.29 × 0.62-0.652. Proboscis 0.725-1.23 × 0.116-0.145, armed with 11-12 rows of 22-24 hooks each. Hooks on dorsal side smaller and more curved than slender ventral hooks , hooks on dorsal and ventral become smaller at base of proboscis, last row abruptly larger. Pr. sh. 1.45-1.986 × 0.180-0.203. Lemnisci 1.23-1.52 × 0.145.T/1–0.797- 1.087 × 0.275-0.33; T/2–0.58-0.768 × 0.333. Cement gland 2, 0.217-0 .29. Female : Body 4.42-9.5 × 0.551-0.696. Vagina opens laterally. Eggs 0.076 × 0.015.

Remarks : Golvan (1959) histologically confirmed the presence of 4 cement glands in *Raorhynchus.* He also confirmed the presence of 4 cement glands in *Rhadinorhynchus polynemi* Gupta & Lata,1967 and accordingly, he considered it to be the junior synonym of *Raorhynchus polynemi.* Gupta and Gupta (1971) reported 2 cement glands in their specimens of *Raorhynchus polynemi.*

115. ***Raorhynchus thapari*** Gupta and Fatma, 1981

R. thapari Gupta and Fatma, 1981 : *Revta. parasit.* **42**(3) : 443-449. Type locality : Tamil Nadu.

Remarks : Literature not available.

Subfamily **Gorgorhynchinae** Van Cleave et Lincicome, 1940

Diagnosis : Rhadinorhynchidae: Trunk spines similarly in 1 or 2 regions anteriorly, or infrequently absent or replaced by sclerotized plaques. Proboscis usually short, claviform, anteriorly enlarged or sub-cylindrical, with fewer hooks. Cement glands 4-6, elongate to tubular or short and pyriform; 8 in unpaired genera.

Type genus : *Gorgorhynchus* Chandler, 1934

Key to genera of Gorgorhynchinae

1. Lemnisci 4 ..... ***Australorhynchus***

   Lemnisci 2 2

2. Trunk spines divided into two groups ..... ***Cleaveius****

   Trunk spines not divided into two groups 3

3. Cement glands compact or pyriform ..... ***Micracanthorhynchina****

   Cement glands very long and slender ..... ***Gorgorhynchus***

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*The genera *Cleavius* and *Micracanthorhynchina* only have so far been reported from India under the subfamily Gorgorhynchinae.

19. Genus ***Micracanthorhynchina*** Strand, 1936
Synonym *Micracanthorhynchus* Harada, 1936
Micracanthocephalus Harada, 1938
Bolbosentis Belous, 1052

Generic Diagnosis : Rhadinorhynchidae; Gorgorhynchinae : Body very small, fusiform, Trunk spines anterior, middle third, posterior rows confined to ventral side only. Proboscis claviform, ventrally inclined with 12 longitudinal rows of 8-11 hooks each, large anterior hooks with bifurcated roots, dorso-ventrally dissimilar and anterior hooks larger than posterior. Proboscis sheath saccate, double walled, with ganglion about its middle. Lemnisci sacciform, as long as proboscis sheath. Testes contiguous, at middle third of trunk. Cement glands 4, pyriform. Genital pore ventroterminal, termino-dorsal in male. Eggs ellipsoidal with polar prolongations of middle shell membrane.

Type species : Micracanthorhynchina motomurai (Harada, 1935) Ward, 1951.

Definitive Host : *Zacco* sp. *Zacco temmincki* and *Zacco platypus* (fam. Cyprinidae).

Type locality : Korea; Formosa.

116. ***Micracanthorhynchina chandrai*** nom. nov.
(= *Hanumantharhynchus hemirhamphi* sensu Chandra, K. J. 1983)
(Pt. 17; Figs. 90a–90d)

H. hemirhamphi Chandra, 1983 *n.g. n. sp. Revta. iber. Parasit.*, **43**(2) : 119-124.

Host : *Hemirhamphus marginatus.*

Location : Intestine.

Diagnosis : (after Chandra, 1983) : *Male* : Body 3.56-3.96 × 0.53-0.55. proboscis short, 0.28-0.30 × 0.12-0.13 armed with 6 spiral rows of 10-11 hooks each, anterior hooks larger and stouter than posterior, hooks, anterior hooks 0.054-0.063; posterior hooks 0.012-0.036. Trunk spines in 10 circles covering about 1/5 of the body, 18 spines in anterior-most and 24 spines in posterior circle. Proboscis sheath double walled 0.80-0.81 × 0.096-0.120, ganglion 0.045 × 0.030 at middle. Lemnisci larger than pr. sh. 0.96-0.99 long. T/1–0.46-0.48 × 0.264; T/2–0.472-0.480 × 0.264-0.188. Cement glands 4, pyriform, 0.300-0.360 × 0.096-0.132. Cement reservoir 2, Saefftigen's pouch present. Genital pore dorsally sub-terminal.

Remarks : Chandra (1983) erected the genus *Hanumantharaorhynchus* with the type *H. hemirhamphi* under Micracanthorhynchidae. Golvan (1969) and Amin (1987) transferred *Micracanthorhynchina* to the family Rhadinorhynchidae. After careful studies on the diagnosis of the genus *Hanumantharaorhynchus* and the description of the type species it is observed that the genus closely resembles the genus *Micracanthorhynchina* in following aspects :

(i) *H. hemirhanphi* exhibits 10-12 longitudinal rows of proboscis hooks with 4-5 hooks in each row as diagnosed for the genus *Micracanthorhynchina.*

(ii) Presence of 4 cement glands in Chandra's specimens is common in *Micracanthorhynchina.*

(iii) The diagnostic features for the new genus closely resemble with that of *Micracanthorhynchina* with regard to body dimension, trunk spination, extension of lemnisci and dorso-terminal male genital orifice which is termed as termino-dorsal orifice in the latter genus by Golvan (1969).

Presence of two cement reservoirs in Chandra's specimen is not enough for the status of a new genus until more study in this point is accomplished. Resting on the above points, I do not regard the status of *Hanumantharhynchus* as a new genus and therefore, I refer the species to the genus *Micracanthorhynchina* and propose a new name *Micracanthorhynchina chandrai* nom.nov.for the species because of the above reasons and also because of the species *M. hemirhamphi* is preoccupied.

117. ***Micracanthorhynchina indica*** Farooqi, 1981

M. indica Farooqi, 1981 : *Ind, J. Parasitology;* pp. 179-192.

Remarks : Description could not be provided in absenc of literature.

118. ***Micracanthorhynchina golvani*** Gupta and Sinha, 1991
(Pt. 16; Figs. 89a–89d)

M. golvani Gupta and Sinha, 1991 : *Ind. J. Helm.* **43**(2) : pp. 108-118. Type locality : Bay of Bengal, Puri.

Location : Intestine.

Diagnosis : *Male* : Body 3.90-4.65 × 0.62-0.65. Proboscis 0.70-0.95 × 0.16-0.20, armed with 10-13 rows of minute spines with 6-8 anterior rows and posterior spines confined ventrally, anterior hooks 0.046-0.048, basal hooks 0.036-0.038. Trunk spines 0.032-0.036 × 0.012-0.016. L/1–1.55long; L/2–1.70 long. Testes equatorial, T/1–0.45-0.48 × 0.32-0.42; T/2–0.52-0.56 × 0.30-0.36. Cement gland 4. Saefftigen's pouch present. Genital pore sub terminal or terminal. *Female* : Body 4.55 × 0.50. Proboscis 0.70 long. Genital pore terminal. Egg 0.020-0.024 × 0.012–0.016.

20 Genus ***Cleaveius*** Subrahmanian, 1927
Synonym *Mehrarhynchus* Datta, 1940

Cleaveius Subrahmanian, 1927 : *Ann. Mag. nat. Hist. ser.* 9, v, **19** : 275-279.

Generic Diagnosis : Rhadinorhynchidae; Gorgorhynchinae : Body medium sized, cylindrical. Trunk spines divided into two groups, spines disordered anteriorly but further back arranged in transverse rows. In male, section of disorderly arranged spines absent. Cement glands elongate, pear-shaped to intestiform. Short proboscis armed with 18 longitudinal rows of 4 hooks each. Pr. sh. long, ganglion at little anterior to base. Cement glands 4 compact, pyriform to tubular. Parasites of fresh water fish.

Type species : *Cleaveius circumspinifer* Subrahmanian, 1927.

Type locality : Burma.

Type host : Fish (undetermined).

Golvan (1969) did not accept the status of *Mehrarhynchus*. He therefore, merged the genus with *Cleaveius*. Subrahamanian (1927) described the genus *Cleaveius* with type species *C. circumspinifer* from an undetermined fish *Host*.

Key to species of *Cleaveius*

1. Lemnisci bifurcated ..... *C. prashadi*

   Lemnisci not bifurcated 2

2. Proboscis hooks in 12-14 × 16-18 ..... *C. inglishi*

   Proboscis hooks more 3

3. Proboscis hooks 14-18 × 15-17 ..... *C. mysti*

   Proboscis hooks more 4

4. Proboscis hooks 18-20 × 16-18 ..... *C. secundus*

   Proboscis hooks 16-18 × 18-20 with polar prolongations of middle shell membrane ..... *C. singhai*

119. *Cleaveius durdance* Kumar, 1992

C. durdance Kumar, 1992 : *Revista de Parasitologica*, **9**(3) : 333-336. Type locality : Chilka, Orissa.

Host : *Clarius batrachus*.

Location : Intestine.

Remarks : Literature not available.

120. *Cleaveius fotedari* (Gupta and Naqvi, 1982) Kumar, 1992

M. fotedari Gupta and Naqvi, 1982 : *Indian J. Helminth.*, **34** : 61-64.

Remarks : Literature not available.

121. *Cleaveius inglishi* (Gupta and Fatma, 1987) Kumar, 1992
(Pt. 17; Figs. 91a–91e)

M. inglishi Gupta and Fatma, 1987 : *Ind. J. Helminth.* **39**(1) : pp. 1-2

C. inglishi (G & F., 1987) Kumar, 1992 : *Rev. de Parasit.* **9**(3) : pp. 333-336.

Host : *Mugil tade*.

Location : Intestine.

Type locality : Quilon, Kerala.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : 4.85-5.30 × 0.95-1.2. Proboscis armed with 12-14 rows with 16-18 hooks each. Anterior hooks 0.03-0.035; middle 0.025; basal 0.023. Trunk spines in 8-10 circles. Pr. sh. 1.35-1.40. L/1–1.90-2.05; L/2–2.10-2.5. T/1–0.50-0.55 × 0.32-0.36. Cement glands 4, pyriform. *Female* : 5.5-5.85 × 0.35-1.0. Eggs 0.076-0.078 × 0.02-0.025.

Remarks : Kumar (1992) in terms of Golvan's view transferred *M. inglishi* to the genus *Cleaveius*.

122. ***Cleaveius mysti*** (Sahay et Sinha, 1971) n. comb.

M. mysti Sahay et Sinha, 1971 : *Indian. J. Helminth.* **23** : 66-70. Type locality : Ranchi, Bihar.

Host : *Mystus seenghala.*

Location : Intestine.

Diagnosis : (after Sahay et Sinha, 1971) : *Female* : Body 4.77-5.31 × 0.65-0.69. proboscis 0.80 × 0.93, armed with 14-18 rows of 15-17 hooks each. Lemnisci not bifurcated.

Remarks : Since, the status of *Mehrarhynchus* is no more valid, the species has been treated as *Cleaveius mysti* (Sahay et Sinha, 1971) n. comb.

123. ***Cleaveius prashadi*** (Datta, 1940) Golvan, 1969
(Pt. 17; Figs. 92a–92c)

Mehrarhynchus prashadi Datta, 1940 : *Rec. Indian. Mus.* **42** : 81-87. *Type locality* : Kolkata.

Cleaveius prashadi (Datta, 1940) Golvan 1969 n. comb. : *Mem. du. Mus. Nat. ser. A, Tom.* **57** : p. 109.

Host : *Pangasius pangasius.*

Location : Intestine.

Diagnosis : (after Datta,1940) : Male : Body 4.62-6.71 × 0.68-0.79. Proboscis 0.95 × 0.33, armed with 12-14 rows of 20-22 hooks each. Lemnisci equal, bifurcated at free end, longer than pr. sh. T/1–0.22 × 0.37; T/2–0.33 × 0.37. Cement gland 4. Saefftigen's pouch 0.81 long.

124. ***Cleaveius secundus*** (Tripathi, 1959) Golvan, 1969
(Pt. **17**; Figs 93a, 93b)

M. secundus Tripathi, 1959[191] : *Rec. Ind. Mus.* 54; (1-2) : pp. 61-99. Type locality : Malta river, W.B. and Chilka. Orissa.

Cleaveius secundus (Tripathi, 1959) Golvan, 1969 : *Mem. du. Mus. Nat. ser. A; Tom.* **57** : p. 111.

Host : *Pama pama, Osteogeneiosus militaris* from Malta : *Plotosus canius* from Chilka, Orissa.

Location : Intestine.

Diagnosis : (after Tripathi, 1959) *Male* : Body 2.07-2.49 × 0.377-0.49. Proboscis 0.551-0.797 × 0.244-0.304, flexed at an angle with body, armed with 18-20 rows of 16-18 hooks each.; roots longer than barb; hooks 0.049-0.053. Trunk spines anterior, with 9-10 row, 0.019-0.022; Lemnisci 0.785 × 0.029; Testes 0.116-0.145 × 0.145-0.188; Cement gland 4, pyriform, 0.065 wide. Saefftigen's pouch 0.10 diametre. *Female* : 1.84-2.697 × 0.29-0.4. Eggs not described.

Remarks : Tripathi (1959) reported two cement glands in *M. secundus* but figure shows four.

125. ***Cleaveius singhai*** (Gupta and Fatma, 1987) Kumar, 1992
(Pt. 17; Figs. 94a–94e)

M. singhai Gupta and Fatma, 1987 : *Indian J. Helminth.*, **39**(1) : 1-26. Type locality : Quilon, Kerala.

Cleaveius singhai (G&F, 1987) Kumar, 1992 : *Rivista de Parasitologia*, **9**(3) : pp. 333-336.

Host : *Osteogeneiosus militaris.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 5.54-5.85 × 1.0-1.2. Proboscis armed with 16-18 rows of 18-20 hooks each. Anterior hooks 0.03-0.05; middle 0.025; basal 0.030. Pr. sh. 1.4-1.5 × 0.40-0.45. Trunk spines 9-11 circles. Lemnisci 1.95-2.0. Testes tandem, post equatorial, T/1–0.40- 0.50 × 0.30-0.35; T/2–0.45-0.55 × 0.32 long. Cement glands 4, pyriform. *Female* : 5.40-6.55 × 0.90-1.0. Eggs 0.030-0.035 × 0.015-0.022 with polar prolongations of middle shell membrane.

Remarks : The characteristic of the egg with polar prolongations of middle shell as reported in the species requires to be included in the generic diagnosis.

Other species :

126. ***Cleaveius leiognathi*** Jain and Gupta, 1979

127. ***Cleaveius portblairensis*** Jain and Gupta, 1979

128. ***Cleaveius puriensis*** Gupta and Sinha, 1992

129. ***Cleaveius clupeia*** Gupta and Sinha, 1992

Subfamily SERRASENTINAE Petrotschenko, 1956

Subfamily Diagnosis : Rhadinorhynchindae: Body massive, armed with spines arranged in anterior part but also with cuticular plates arranged in regular transverse rows on

ventral side over entire length of the body. Proboscis long and relatively thick, massive, slightly widened in middle part.

Type species : *Serrasentis* Van Cleave, 1923.

21. Genus ***Serrasentis*** Van cleave, 1923
Synonym *Echinorhynchus* Muller, 1776
Echinogaster Monticelli, 1905
Echinosoma Porta, 1907

Generic Diagnosis : Rhadinorhynchidae; Serrasentinae : Body covered on ventral side with spines arranged in transverse rows in pits, where spines are transformed into strong plates. Proboscis not long, almost cylindrical but slightly widened anteriorly. Body nuclei and lacunae unknown. Parasites of sea fish.

Type species : *Serrasentis sagittifer* (Linton, 1889) Linton, 1932

130. ***Serrasentis sagittifer*** (Linton, 1889) Linton, 1932
(Pt. 17; Figs. 96a–95h)

Synonym	*Echinorhynchus socialis* Leidy, 1951
	Echinorhynchus sagittifer, Linton, 1889
	Serrasentis socialis (Leidy, 1851) Van Cleave, 1924
(Adult)	*S. chauhani* Datta, 1954 : *Rec. Ind. Mus.*; **51** : p. 52
,,	*S. longa* Tripathi, 1959; *Rec. Ind. Mus*; **54** : p. 75
(Adult)	*S. socialis* : Yamaguti (1963); *Syst. Helminthum*; **5** : p. 111.
,,	*S. longiformis* Bilqees, 1971; *Pak. J. Zool.*; **3**(1) : p. 64
,,	*S. mujibi* Bilqees, 1972; *Pak. J. Zool*; **24**(3-6) : p. 121
,,	*S. sciaenus* Bilqees, 1972; *Pak. J. Zool.*, **24**(3-6) : p. 124
,,	*S. engraulisi* Gupta and Gupta, 1976; *Proc. 63rd Ind. Sci. Cong. Assn.*; p. 111 (Abst.) : p. 205
,,	*S. fotedari* Gupta and Fatma, 1980; *Ind.J.Helminth.* 31 (1) : p. 45
(Adult)	*S. giganticus* Bilqees, 1972; *Agri. Res. Coun. Govt. of Pakistan* : p. 60 from *Rachycentron canadum.*
,,	*S. socialis* : Gupta and Jain (1977) : *All. India Symp.*
Synonym	*Helminthology*, Srinagar
(Adult)	*S. socialis* : Farooqi (1980) : *Ind. J. Parasit.* 3, Suppl. : p. 17.
(Juv.)	*S. psenesi* Gupta and Gupta, 1985 : *Ind. J. Helminth.* : 31(2) : pp. 135-156.
,,	*S. golvani* Gupta and kumar, 1987 : *Kanpur Univ. Res. J. Sci.*, 5 : pp. 75-80.
,,	*S. indicus* Singh *et al.*, 1998 : *J. Parasit and Appl. Anim. Biol.*, 7(2) : pp. 73-81 from *Elops saurus.*

N.B. *Mehrarhynchus puriensis* from *Pama pama and M. clupeia from Clupea longiceps* described by Gupta and Sinha (1992) may belong to *Cleaveius.* Relevant literature is not available.

Serrasentis sagittifer Soota and Bhattacharya (1981) : *Bull. zool. Surv. India,* 3(3) : pp. 227-233.

Host : *Rachycentron canadum* (Definitive Host); *Elecate nigra.*

Other Hosts : (*juveniles*) : *Psettodes erumei; Johnius dussumieri; Elops saurus; Lutjanus sp.; Nemipterus sp.; Synapura cornuata; Trachinocephalus myops; Psenes indicus; Pseudorhombus sp.; Engraulis malabaricus.*

Location : Intestine and mesentry; pyloric caeca.

Distribution : Indian coasts.

Diagnosis : (after Soota and Bhattacharya, 1981) : *Male* (Adult) : Body 40.5-65.5 × 3.2-8.7. Proboscis 1.1-1.3 × 0.55-1.15, armed with 22-24 rows of 14-18 hooks each, body spines in 6-8 rows, body combs in 19-25, anterior testis 0.93-1.5 × 0.066-0.14, posterior testis 1.0-1.3 × 0.07-0.15. *Female* (Adult) : 24.7-52.0 × 4.4-6.5. Body combs 20-26.

Remarks : Golvan (1969) synonymised *S. socialis* (Leidy,1851) Van Cleave,1924 with *S. sagittifer* (Linton, 1889) Linton, 1932. Gupta and Jain (1977); and Farooqi (1980) reported *S. socialis* (Adult) in *Rachicentron canadum* and *Elecate nigre.* Since, *S. socialis* is junior synonym of *S. sagittifer,* synonymy of three juvenile and one adult species proposed by Gupta and Jain (1977) with the former is no more valid. I, therefore, in the light of Golvan's observation, propose those species along with *S. psenesis, S. golvani* and *S. indica* as synonym of *S. sagittifer.* The earlier synonymy of Indian species made by Soota and Bhattacharya (1981) with *S. sagittifer* remains valid.

Family ARHYTHMACANTHIDAE Yamaguti, 1935

Family Diagnosis : Echinorhynchida : Body small to medium sized. Proboscis short, with different types of hooks (2 or 3 distinct types) of which sub-apical hooks are larger than the posterior or with nearly uniform hooks; ventral hooks may be larger than dorsal ones. Neck short. Trunk containing numerous scattered nuclei, covered with spines on its anterior portion. Proboscis sheath double walled, with ganglion at base or middle. Testes usually contiguous, Cement glands 4-8, usually compact, may be pyriform or more elongate. Eggs with polar prolongations of middle shell membrane. Parasites of marine fishes.

Type genus : *Arhythmacanthus* Yamaguti, 1935.

Key to the subfamily ARHYTHMACANTHIDAE

1. Trunk unarmed ..... PARACANTHOCEPHALOIDINAE Golvan, 1969

   Trunk armed at least anteriorly 2

2. Trunk armed anteriorly, occasionally posteriorly. Proboscis cylindrical with large anterior rooted hooks and small rootless spines .....
   ..... NEOACANTHOCEPHALOIDINAE* Golvan, 1960

Trunk armed anteriorly. Proboscis globular to spheroid or claviform with large anterior rooted hooks and small 3

3. Posterior rootless spines or with an additional set of small apical rootless spines ... . ARHYTHMANTHINAE Yamaguti, 1935

Subfamily PARACANTHOCEPHALOIDINAE Golvan, 1969

Subfamily Diagnosis : Echinorhynchida; Arhythmacanthidae : Body fusiform, smaller or medium, anterior part anterior part dilated, then cylindrical. Trunk unarmed. Proboscis short, two types of proboscis hooks, apical long and with roots, basal spiniform and rudimentary. No spines between the two different rows of hooks. Nerve ganglion at base of proboscis sheath. Parasites of marine fishes.

Type genus : *Paracanthocephaloides* Golvan, 1969.

Key to genera of PARACANTHOCEPHALOIDINAE

Body medium, cylindrical ..... ***Euzetacanthus***

Body small, fusiform ..... ***Paracanthocephaloides***

22. Genus ***Paracanthocephaloides*** Golvan, 1969

Generic Diagnosis : Arhythmacanthidae; Paracanthocephaloidinae : Body small, fusiform, Proboscis short, two types of proboscis hooks, anterior hooks large with roots, basal hooks very small. Trunk spines absent, Nerve ganglion at base of proboscis sheath. Male genital organs posterior. Parasites of marine fish.

Type species : *Paracanthocephaloides chabanaudi* (Dollfus, 1851) Golvan, 1969.

Type locality : Zanzibar.

131. ***Paracanthocephaloides tripathii***
(= *Heterosentis plotosi* sensu Tripathi, 1959) Golvan, 1969
(Pt. 18; Figs. 97a–97c)

P. tripathii Golvan, 1969 nom. nov. : *Mem. Du Mus. Nat. ser. A; Tom.* **57** : p. 178. Type locality : Chilka, Orissa; Port Canning, W.B.

P. tripathii : Bhattacharya (2005) : *ZSI, State Fauna Series, Fauna of Andhra Pradesh.*

Host : *Plotosus caninus*; Cat fish and *Mugil cephalus* from Pulicut lake, Andhra Pradesh (reported by Bhattacharya, 2005).

Location : Intestine.

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* No record from India.

Diagnosis : (after Tripathi, 1959); *Male* : Body 2.39-2.52 × 0.36-0.50. Proboscis 0.17-0.29 × 0.11-0.20, armed with 6 spiral rows of 5 hooks each anteriorly and 13-14 rows of 3-4 hooks each posteriorly. Anterior hooks 0.057-0.064, Posterior hooks 0.015. Female : 5.29 × 0.72.

Diagnosis : (after Bhattacharya, 2005) : *Male* : Body 2.80 long (proboscis not protruded). Neck 0.02 × 0.18. Proboscis sheath 0.05 × 0.09; Lemnisci 0.06 × 0.04. Testes at posterior half, T/1–0.35 × 0.20; T/2–0.35 × 0.20. Cement gland 6.Female: Body 3.56-5.81 × 0.12-0.08, armed with 12-14 rows of 6 hooks each, anterior 3 hooks per row rooted and large, posterior 3 spines per row without roots, anterior points of hooks 0.04-0.045, and roots 0.04-0.05; middle points 0.075-0.09, and roots 0.07-0.08; posterior rootless spines 0.015-0.02.

Remarks : Golvan (1969) merged *Heterosentis* with *Aspersentis* Van Cleave,1929 but referred *H. plotosi* to the genus *Paracanthocephaloides* Golvan,1969 and renamed *H. plotosi* reported by Tripathi (1959) from India as *Paracanthocephaloides tripathii* nom.nov. Later, Schmidt and Paperna (1978) freed *H. plotosi* from the merger and transferred it to the genus *Arhythmacanthus.* Further, Pichelin and Cribb (1999) reviewed the family Arhythmacanthidae and considered *Heterosentis* as a valid genus. However, at present I am at one with Golvan's view The figure (87a and 97b) belong to the species *P. tripathii* reported by Bhattacharya (2005).from Pulicut Lake.

132. ***Paracanthocephaloides cabelleroi*** (Gupta & Fatma, 1983) n.comb.
(Pt. 18; Figs. 98a–98c)

Heterosentis cabelleroi Gupta & Fatma, 1983 : *Ind. J. Helm.* 35(2) : pp.137-154. Type locality : Mandapam, Tamil Nadu.

Host : *Polynemus paradasius.*

Location : Intestine.

Diagnosis : *Male* : Body 1.14-1.22 × 0.16-0.20. Trunk armed anteriorly, hypodermic nuclei numerous. Proboscis globular, 0.15-0.18 × 0.12-0.15, armed with 10 rows of 6 hooks each. Two types of hooks, anterior rooted hooks 0.054-0.062, posterior less developed rooted hooks 0.022-0.026. Proboscis receptacle 0.140-0.22 × 0.02-0.05. L/1–0.09-0.18; L/2–0.016-0.02. Testes middle of trunk, T/1–0.12-0.14 × 0.08-0.10; T/2–0.10-0.12 × 0.060-0.085. Cement glands 6, pyriform.

Remarks : Gupta and Fatma (1983) described the species with exceedingly fine anterior body spines but the number of spines was neither mentioned nor was shown in their diagram of the species. Therefore, the species is transferred to the genus *Paracanthocephaloides.*

23. Genus ***Euzetacanthus*** Golvan et Huin, 1964

Generic Diagnosis : Arhythmacanthidae; Paracanthocephaloidinae : Body medium, cylindrical, aspinose, anterior body dilated, with cuticular giant nuclei; lacunar system

with lateral anastomoses. Proboscis short, cylindroid, anterior proboscis hooks larger with strong roots, posterior hooks smaller with small roots. Proboscis sheath double walled with ganglion at base. Lemnisci as long as proboscis sheath. Male genital organs in posterior extremity at 1/4th part of trunk. Cement glands 6, not in pairs. Female genital pore ventro-subterminal. Eggs with polar prolongations of middle shell membrane. Parasites of marine fish.

Type species : *Euzetacanthus simplex* (Rudolphi, 1810)

Type Host : *Mullus surmulatus.*

Type locality : Denmark.

133. ***Euzetacanthus golvani*** Gupta and Fatma, 1983
(Pt. 18; Figs. 99a–99c)

E. golvani Gupta and Fatma, 1983 : *Indian J. Helminth.* **35**(2) : 137-154. Type locality : Mandapam, Tamil Nadu.

Host : *Tachysurus jella.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1983) : *Male* : Body cylindrical, swollen anteriorly, 6.42 × 0.45. Proboscis cylindrical, 0.50 × 0.10 armed with 14 rows of 8 hooks each. 1st row of hooks 0.03; 2nd 0.029; 3rd 0.028; 4th 0.025; 5th 0.025; 6th 0.024; 7th 0.022; 8th 0.021. Pr. sh. double walled, 0.90 × 0.15, with ganglion at base. Lemnisci claviform, 0.90. T/1–0.42 × 0.22; T/2–0.48 × 0.22. Cement glands 6, pyriform, 3 tandem, in pairs. Genital pore terminal.

Remarks : Gupta and Fatma (1983) described the genus, *Ezetacanthus* under the family Echinorhynchidae. Golvan (1969) and Amin (1987) placed the genus in the subfamily Paracanthocephaloidinae under the family Arhythmacanthidae. The species is reported for the first time from India.

134. ***Euzetacanthus chorinemusi*** Gupta and Naqvi,1986

E. chorinemusi Gupta & Naqvi, 1986 : *Ind. J. Helminth.* (1982). 34 : pp. 61-64

Remarks : Literature is not available.

Subfamily ARHYTHMACANTHINAE Yamaguti, 1935

Subfamily Diagnosis : Trunk spinose anteriorly. Proboscis globular to spheroid or claviform with large anterior rooted hooks and small posterior rootless spines or with an additional set of small apical rootless spines.

Type genus : *Arhythmacanthus* Yamaguti, 1935.

Other genus : *Gorgorhynchoides* Cable and Linderoth, 1963

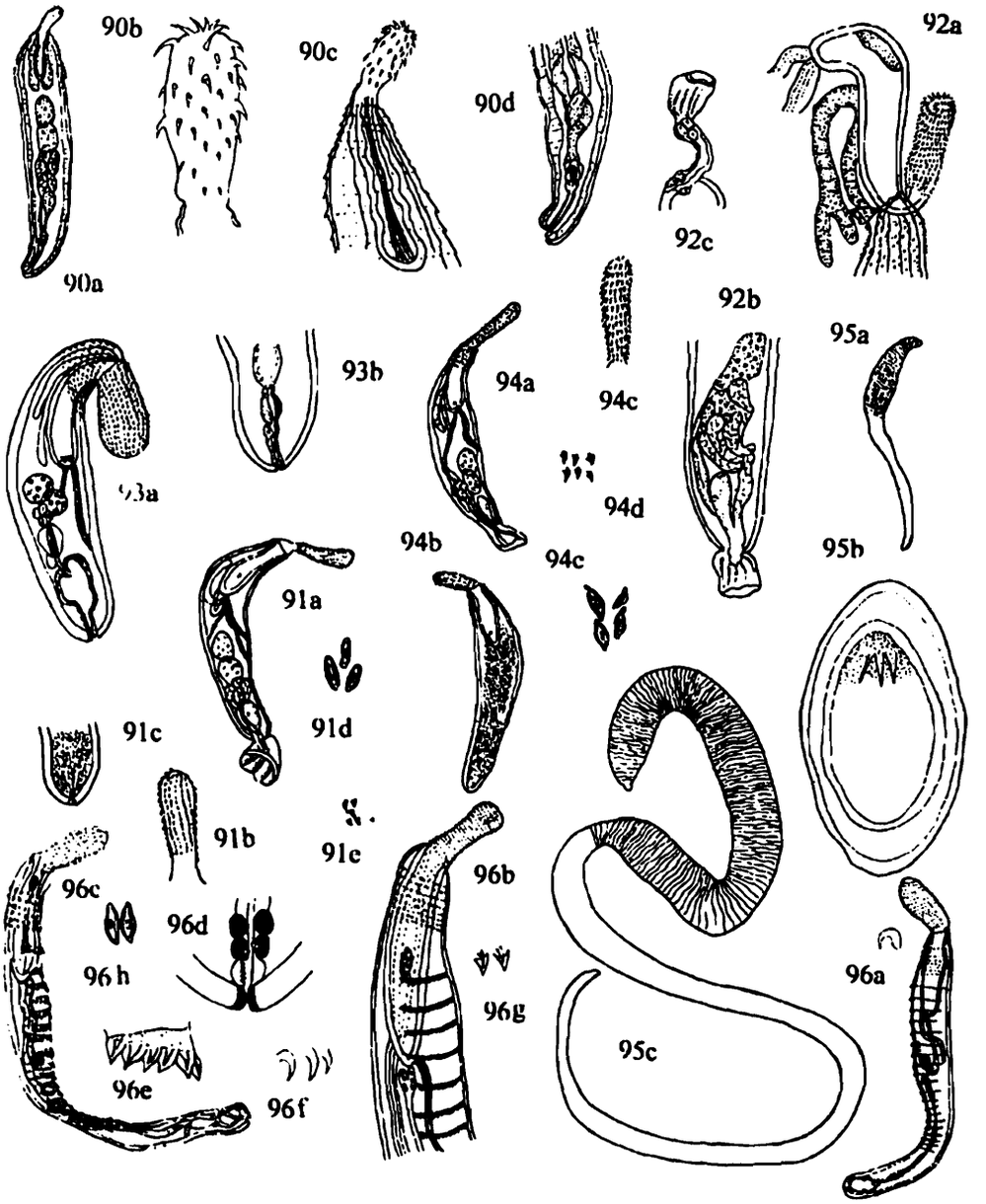

Plate-17

Fig. 90. *Micracanthorhynchina chandrai* nom. nov. (a) male; (b) proboscis; (c) anterior of male; (d) posterior of female.

Fig. 91. *Cleaveius inglishi* (Gupta and Fatma, 1987) Kumar, 1992. (a) male; (b) proboscis; (c) posterior of female; (d) eggs; (e) trunk spines.

Fig. 92. *Cleaveius prashadi* (Datta, 1940) Golvan, 1969. (a) anterior of male; (b) posterior of male; (c) female genitalia.

Fig. 93. *Cleaveius secundus* (Tripathi, 1959) Golvan, 1969. (a) male; (b) posterior of female.

Fig. 94. *Cleaveius singhai* (Gupta and Fatma, 1987) Kumar, 1992. (a) male; (b) female; (c) proboscis; (d) trunk spines; (e) eggs.

Fig. 95. *Macracanthorhynchus hirudinaceus* (Pallas, 1781 Travassos, 1917 (a) male; (b) egg; (c) female.

Fig. 96. *Serrasentis sagittifer* (Linton, 1889) Linton, 1932. (a) juvenile male.
(b) anterior male; (c) juvenile male; (d) female genitalia; (e) comb; (f) proboscis hooks; (g) collar spines; (h) eggs.

Key to genera of Arhythmacanthinae

Trunk fusiform, Proboscis globular, armed with three types of hooks, apical hooks minute and radially arranged, sub-apical largest in 2 alternate rows of 7 each, basal hooks minute in 14 longitudinal rows of 3 each ..... ***Arhythmacanthus***

Trunk cylindrical, long. Proboscis clavate, armed with 20 longitudinal rows of 10 hooks each, First 3 or 4 hooks of each row large, blade-like, followed by an abrupt reduction in size of hooks after which they gradually increase in length to about mid-level of proboscis and then decrease towards base ..... ***Gorgorhynchoides***

24. Genus *Arhythmacanthus* Yamaguti, 1935

Generic 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 of third with circular rows of close -set spines which are sheathed in scale-like cuticular folds. Proboscis short, globular; proboscis hooks divided into three groups, apical, sub-apical and basal; apical hooks 18, minutes, rootless, in radial rows; sub-apical hooks large, strongly re-curved 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 sheath plump, double walled with ganglion at base. Lemnisci 2, occasionally 4, digitiform, longer than proboscis sheath. Testes contiguous,post-equatorial. Cement glands 6-8, pyriform, close together. Eggs unknown..Parasites of marine fish.

Type species : *Arhythmacanthus fusiformis* Yamaguti, 1935.

Type Host : *Sphoeroides* sp.

Type locality : Japan.

Key to species of *Arhythmacanthus*

1. Sub-apical hooks in 2 rows of 6 each ..... *A. septacanthus*

   Sub-apical rows more 2

2. Sub-apical hooks, 14 rows of 2 each. ..... *A. zdzitowieckii*

   Sub-apical hooks, 10-12 of 7-8 each ..... *A. thapari*

135. *Arhythmacanthus septacanthus* Sita Anantharaman, 1949
(Pt. 18; Figs. 100a–100b)

A. septacanthus Sita Anantharaman, 1949 : *Mem. Du. Mus. Nat. D'Hist. Naturelle. ser. A, Tom. 54;* p. 175-177. Type locality : Pulicut lake, Andhra Pradesh.

Host : *Plotosus caninus.*

Location : Intestine.

Diagnosis : (after Sita Anantharaman, 1949) : Male : Body fusiform, anterior trunk spinose, male and female of the same size. Proboscis short, 0.216 × 0.124, armed with 3 types of hooks; apical crown of hooks in 3 rows of 6 hooks each; sub-apical with 2 rows of 6 hooks each; basal hooks in 13-14 rows of 3-4 hooks each; apical hooks 0.036, sub-apical 0.056-0.060; basal 0.016. Neck absent. Proboscis sheath 0.495 × 0.120, double walled. Lemnisci 0.345 × 0.03. T/1–0.255 × 0.18; T/2–0.270 × 0.18. Cement glands 6 pyriform 0.12 long. Saefftigen's pouch 0.255 × 0.105.

Remarks : Sita Anantaraman (1949) described the species in her thesis which remained unpublished till Golvan (1969) published it in his Fascicle along with his observation and comments under the authorship of Sita.

136. ***Arhythmacanthus thapari*** Gupta and Fatma, 1979
(Pt. 18; Figs. 101a–101d)

A. thapari Gupta and Fatma, 1979 : *Ind. J. Helminth.* **31**(1) : pp. 45-53. Locality : Mandapam, Tamil Nadu.

Host : *Elops saurus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1979) : Male : Body 1.24-1.52 × 0.16-0.30. Trunk spines 6-8 circles anteriorly. Proboscis globular 0.15-0.18 × 0.072-0.85 armed with 10-12 rows of 7-8 hooks each (including basal hooks in 4-5 hooks in each row) Proboscis hooks 3 types, anterior 0.015-0.016 (root or rootless) sub-apical 0.025-0.030 (strong hooks), basal 0.01-0.011. Pr. sh. 0.25-0.30 × 0.02-0.50, ganglion posterior. L/1–0.105-0.110; L/2–0.145-0.180. T/1–0.10-0.18 × 0.08-0.15; T/2–0.10-0.16 × 0.12-0.13. Cement gland 6 pyriform in two groups. Saefftigen's pouch pyriform, 0.16-0.18 × 0.06-0.08.

137. ***Arhythmacanthus zdzitowieckii*** Kumar, 1992

A. zdzitowieckii Kumar, 1992 : *Pak J. Zool.* **24**(2) : pp. 143-144. Type locality : Chilka, Orissa.

Host : *Clarius batrachus.*

Location : Intestine.

Diagnosis : (after Kumar, 1992) : Proboscis hooks 3 types, 12 apical, 14 longitudinal rows of 2 each in sub-apical hooks; 14 longitudinal rows of 3-4 in basal hooks.

Remarks : Information based on Helminthological Abstract only. Total number of hooks on proboscis can be determined after the type of arrangement of apical hooks is confirmed.

25. Genus ***Gorgorhynchoides*** Cable and Linderoth, 1963
Synonym *Neogorgorhynchoides* Gupta and Fatma, 1987

Generic Diagnosis : Arhythmacanthidae; Arhythmacanthinae : Proboscis clavate, with anterior hooks arranged quincunxically in more than 20 longitudinal rows of at least 10

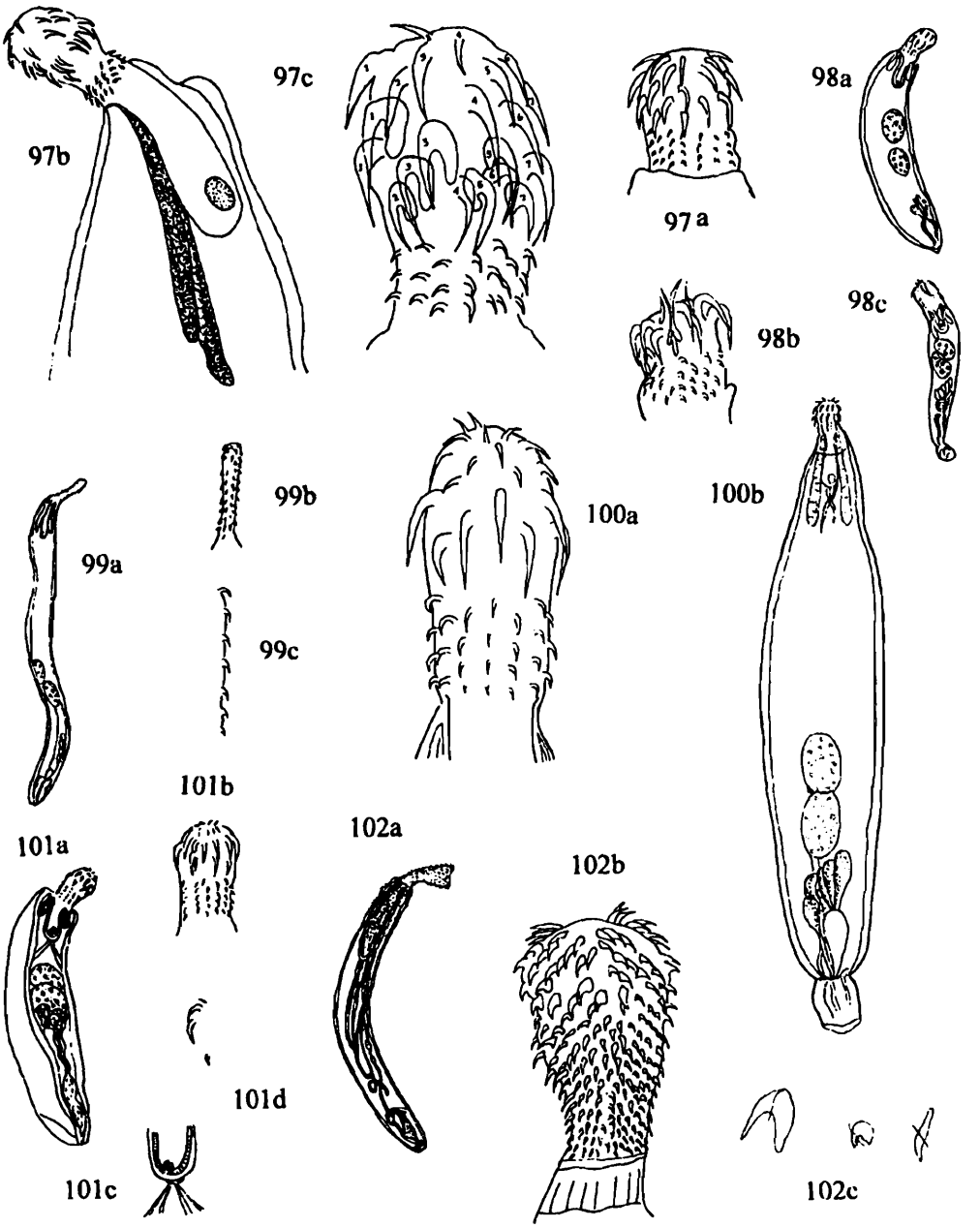

Plate-18

Fig. 97. *Paracanthocephaloides tripathii* (= *Heterosentis plotosi* sensu Tripathi, 1959) Golvan, 1969. (a) (after Tripathi) proboscis; (b) (after Bhattacharya, 2005) anterior body; (c) (after Bhattacharya, 2005) proboscis.

Fig. 98. *Paracanthocephaloides cabelleroi* (Gupta & Fatma, 1983). (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 99. *Euzetacanthus golvani* Gupta and Fatma, 1983. (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 100. *Arhythmacanthus septacanthus* Sita Anantharaman, 1949. (a) male; (b) proboscis.

Fig. 101. *Arhythmacanthus thapari* Gupta and Fatma, 1979. (a) male; (b) proboscis; (c) base of proboscis sheath; (d) proboscis hooks.

Fig. 102. *Gorgorhynchoides golvani* (Chandra *et al.*, 1984) n. comb. (a) juvenile male; (b) proboscis; (c) proboscis hooks.

hooks each. First 3 or 4 hooks of each row large, blade-like, followed by an abrupt reduction in size of hooks after which they gradually increase in length to about mid-level of the proboscis and then decrease; blade-like hooks with prominent roots; hooks somewhat stouter on ventral than dorsal region of proboscis. Neck well developed. Trunk with narrow, cylindrical or slightly tapering, anterior portion armed with numerous spines, followed by a swelling which may or may not encompass trunk, or bears spines; swelling most conspicuous dorsally. Lemnisci with many nuclei, slender, sinuous, much longer than proboscis sheath. Ligament sacs open, uterus long, vagina short. Eggs smooth, oval to broadly spindle shaped, without polar prolongations of middle shell membrane. Testes not contiguous, oval or bean shaped, well apart. Cement gland 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 and Linderoth, 1963.

Type locality : Curacao, North America.

Key to species of *Gorgorhynchoides*

The key has not been provided for juvenile-hood of two species out of four under the genus.

138. ***Gorgorhynchoides cablei*** (Gupta and Fatma, 1987) n. comb.
(Pt. 20; Figs. 105a–105c)

Neogorgorhynchoides cablei Gupta and Fatma, 1987 : *Ind. J. Helminth.* 39(1) : pp. 1-26. Type locality : Mandapam, Tamil Nadu.

Host : *Caranx kalla.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : Male : Body 6.95-7.42 × 0.56-0.86. Proboscis globular or claviform 0.95-1.02 × 0.55-0.58, armed with 24-26 rows of 14-18 hooks each, anterior hooks with re-curved roots, with abrupt reduction of size of hooks, after which they gradually increase in length about mid-level, then decrease towards base. 1st row of pr.hooks 0.072-0.080; 2nd 0.035-0.040; 3rd. 0.045-0.05; 4th. 0.02-0.025. Trunk armed with 13-14 rows of spines extending upto anterior to dorsal trunk swelling. Pr. sh. 2.10-2.15 × 0.40-0.48. L/1–4.4-4.5 × 0.10-0.12; L/2–4.7-5.3 × 0.12-0.13. T/1–0.15-0.16 × 0.13-0.135; T/2–0.15-0.155 × 0.12-0.13. Cement gland two. *Female* : Body 7.25-7.80 × 0.44-0.78; Genital pore sub-terminal. Eggs 0.030-0.042.

Remarks : The description is based on juvenile specimens with immature gonads. Number of cement glands and position of testes which is too early to be determined in a juvenile form, cannot be the criteria for establishing new genus. The other characters which suggest the genus to be congeneric with *Gorgorhynchoides*, are clavate proboscis with 4 types of hooks, the sign of anterior trunk swelling, long, slender lemnisci and

number of rows of hooks and their number in each row etc. Moreover, occurrence of *N. cablei* in carangid fish host imparts host specificity of the members of the genus *Gogorhynchnchoides*. I, therefore, refer it to the genus *Gorgorhynchoides* as a new combination.

139. ***Gorgorhynchoides golvani*** (Chandra *et al.*, 1984) n. comb.
(Pt. 18–19; Figs. 102a–102c)

Paracanthocephaloides golvani Chandra *et al.*, 1984 : *Revista Iberica de Helminthologia* (1) : pp. 347-352.
Type locality : Andhra coast.

Hosts : (The following hosts reported by Chandra *et al.*, 1984 belong to non-carangid fish hosts from coast of Andhra Pradesh) : *Saurida tumbil, Saurida Undosquamous ; Trachynocephalus myops; Herpodon nehereus; Johnius aneus; Peterotolithus maculatus; Pennahia argentata; Kathala anxillaries ; Upenius vittatus.*

Location : Intestine.

Type locality : Coast of Andhra Pradesh.

Diagnosis : (after Chandra *et al.*, 1984): Body curved, swellen at middle, 5.25-5.58 × 0.66-0.73. Trunk armed with 28-32 rows of 18-22 spines each. Proboscis claviform, 0.84-0.97 × 0.38-0.54 anteriorly armed with two types of hooks in 12-14 spiral rows of 5-7 hooks each; posteriorly 10-12 spiral rows of 12-14 hooks each; anterior hooks 0.60-0.144, gradually decrease in length posteriorly; posterior hooks hooks 0.03-0.036. Proboscis sheath 2.040-2.268 × 0.384-0.420, ganglion at middle. Lemnisci long coiled. Testes ovoid, one behind other, T/1–0.090-0.144 × 0.066-0.108. Cement glands, Saefftigen's pouch not developed.

Remarks : Description of *Paracanthocephaloides golvani* portrays the characteristics of the genus *Gorgorhynchoides* with regard to types and arrangement of hooks on claviform proboscis i.e. anterior first three or four rows large, blade-like, followed by abrupt reduction of size of hooks, then they increase in size up to mid-proboscis and again decrease at base. This typical arrangement of hooks on claviform proboscis, and long, coiled lemnisci of P. golvani Chandra *et al.*, 1984 are common in *Gorgorhynchoides*. The specimens being juvenile, do not show other characteristics of the genus such as anterior bulbous trunk swelling of adult, six cement glands etc. The description states that trunk is armed with 28-32 rows of 18-22 spines each whereas no trunk spines is reported to occur in *Paracanthocephaloides*. This observation has prompted me to consider the species as juvenile of *Gorgorhynchoides* occurring commonly in fishes other than carangid fishes as reported by me in case of *G.indicus*.

I, therefore, transfer the species to *Gorgorhynchoides* as *G. golvani* (Chandra *et al.*, 1984) n. comb.

Paracanthocephaloides golvani Chandra et al, 1984 has been incorporated by me in the Fauna of Andhra Pradesh under ZSI publication wherein it is stated that *P. golvani* is the

juvenile of *G.indicus*. Such statement is premature till the adult of *P. golvani* is reported in any of the hosts recorded by Chandra *et al.*

140. *Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003
(Pt. 19; Figs. 103a–103h)

G. indicus Bhattacharya and Banerjee, 2003 : *Rec. zool. Surv. India* : **101**(3-4) : pp. 49-54. *Type locality* : Chennai.

G. indicus : Bhattacharya (2005) : *ZSI, State Fauna Series; Fauna of Andhra Pradesh.*

Hosts : Type *Host* : *Megalaspis cordyla* (Carangidae).

Other Hosts : (Juv) *Psettodes erumei; Lutjanus fulbiflama; Polynemous tetradactylus; Triacanthus trigitifer; Gerres abreviatus; Therapon jarbua; Plectorhynchus cuveri.*

Location : Intestine.

Distribution : Chennai and Andhra Pradesh.

Diagnosis : (after Bhattacharya and Banerjee, 2003) : Male: Body 17.00-60.75 × 1.00-1.5. Proboscis 0.5-0.925 × 0.3-0.4, armed with 24-26 rows of 10-16 hooks each, anterior 3-4 rooted hooks large, blade-like, followed by few small hooks near mid-proboscis and then increase in size but decrease at base, ventral hooks little stouter than dorsal hooks. 1st hooks of each row 0.091-0.090; 2nd 0.099-0.124 × 0.024, 3rd 0.83-0.107 × 0.0415; 4th 0.083-0.091 × 0.0415; 5th 0.033- 0.091 × 0.0166; th 0.041-0.058 × 0.0166; 7th 0.083 long and basal hooks 0.033 long; roots 0.083-0.124 × 0.0249. Proboscis sh.1.5-2.5 × 0.35-0.4; T/1–0.85-1.625 × 0.275-0.4; T/2–0.825-1.75 × 0.3-0.35. Lemnisci very long, slender, multinucleated, sinuous. Cement glands 6, tubular. Trunk swelling anterior, trunk spines 24-30 rows dorsally and 20-25 rows ventrally, not reaching the swelling. *Female* : Mature females with pedosegmentation, genital pore sub-terminal, 0.6 mm from posterior end. Eggs 0.04-0.064 without polar prolongations of middle shell.

Remarks : Cable and Linderoth (1963) erected the genus *Gorgorhynchoides* with the type species *G. elongatus* from Curacao, North America. Cable and Mafarachisi (1970) emended the generic diagnosis and described two Caribbean species, *G. bullocki* and *G. lintoni.* Adults of all the three species are reported to occur in carangid fish host. Bhattacharya and Banerjee (2003) have reported adult of *G. indicus* in *Megalaspis cordyla* (Carangidae) from Chennai. and recorded many juveniles and sub-adult forms of the same species in various non-carangid fish hosts as well as in carangid fish hosts of coastal Andhra Pradesh. I have observed that anterior trunk swelling appears only in adults which is considered to be one of the important generic characteristics.

141. *Gorgorhynchoides valiyathurae* (Antony *et al.*, 1990) n. comb.
(Pt 19; Figs. 104a–104f)

M. valiyathurae Antony *et al.*, 1990 : *Zool. Anz.* 225 (5/6), s : pp. 377-382. Type locality : Valiyathura, Trivundrum, Kerala.

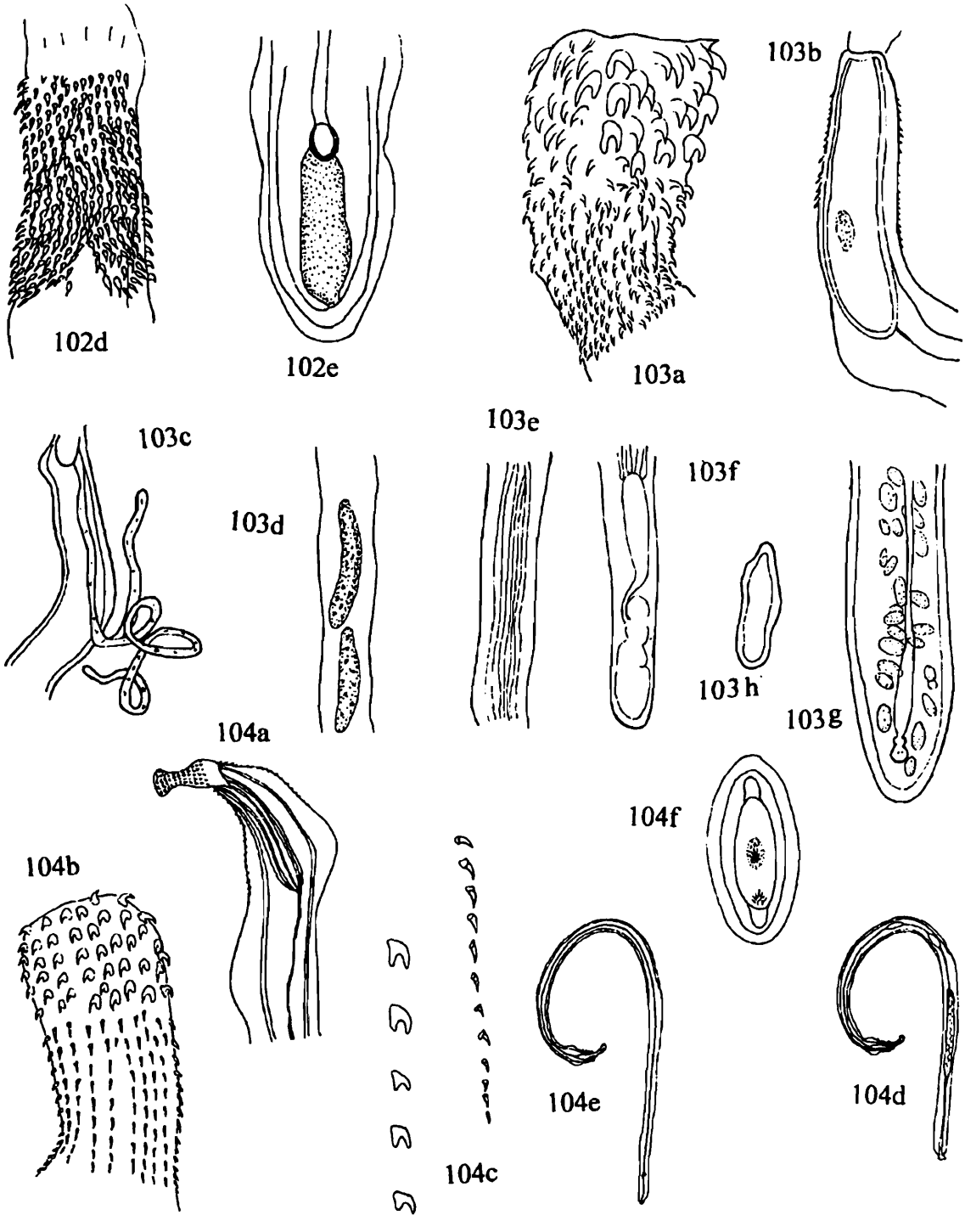

Plate-19

Fig. 102. *Gorgorhynchoides golvani* (Chandra *et al.*, 1984) n. comb. (d) body spines below the bulge; (e) posterior of female.

Fig. 103. *Gorgorhynchus indicus* Bhattacharya *et al.*, 2003. (a) proboscis; (b) anterior body with buldge; (c) nucleated and coiled Lemnisci. (d) testes; (e) elongated cement glands; (f) posterior male; (g) posterior female; (h) egg.

Fig. 104. *Gorgorhynchoides valiyathurae* (Antony *et al.*, 1990) n. comb. (a) anterior body; (b) proboscis; (c) hooks and spines of proboscis; (d) adult male; (e) adult female; (f) egg.

Hosts : *Caranx melampygus; Caranx malabaricus; Caranx nigripinnis.*

Location : Duodenum.

Diagnosis : (after Antony *et al.*, 1990) : Male : Body 78.00-112.00 × 1.56-1.75; slender, elongate and cylindrical with a characteristic collar-like swelling anteriorly, no trunk spination beyond the collar, ventral trunk spines 20-22 and dorsal spines 12-14, Proboscis club shaped, 1.01-1.06 × 0.29-0.36 × 0.48-0.54 armed with18-22 rows of 10-12 large, rooted hooks in anterior bulbous portion, each measured 0.075-0.083 long; 14-16 rows of 22-24 rootless hooks in straight portion, decreasing gradually in size posteriorly, largest hooks measured 0.05 and smallest 0.03 long. Pr. sh. 3.1-3.93 × 0.39-0.46. Lemnisci long, extended to mid-body. T/1–3.12-3.62 × 0.84-0.94; T/2–3.0-3.5 × 0.85-0.96. Cement gland six. *Female* : Body 81.00-138.00 × 1.56-1.75. Genital pore sub-terminal, more than 0.5 mm above posterior end. Eggs 0.096-0.104 × 0.029-0.035.

Remarks : On examining the paratype specimen deposited in ZSI, I conclude that the diagnostic features of the species are familiar to that of *Gorgorhynchoides* with regard to clavate proboscis, types of hooks and their pattern of arrangement on proboscis, collar-like anterior trunk swelling, long nucleated lemnisci, six cement glands, position of genital pore of female etc. Number of rows of hooks and number of hooks in each row on proboscis as studied by me are 18-24 rows of 10-16 hooks each. The configuration of proboscis hooks is typical of *Gorgorhynchoides*. Hence, I refer the species to the genus *Gorgorhynchoides*.

Family HYPOECHINORHYNCHIDAE Golvan, 1960

Family Diagnosis : Echinorhynchida : Body short, curved ventrally, anterior enlarged, aspinose, cuticle thick. Proboscis round, attached ventro-terminally but little inclined towards dorsally than ventrally. Proboscis hooks in longitudinal rows of few hooks in each row, of which posterior hooks distinctly smaller than the posterior. Neck very short. Proboscis sheath double walled, ganglion at base. Lemnisci longer than proboscis sheath, often coiled. Testes large and spheroid, contiguous, anterior part of trunk. Anterior testis dorsal to proboscis sheath. Cement glands 6 pyriform in 3 pairs. Male genital pore terminal, female genital pore ventro-terminal. Eggs ellipsoidal with polar prolongations of middle shell membrane. Parasites of marine and fresh water fish.

Type genus : *Hypoechinorhynchus* Yamaguti, 1939

26. Genus ***Hypoechinorhynchus*** Yamaguti, 1939

Generic Diagnosis : Echinrhynchida; Hypoechinorhynchidae : Body curved ventrad, broadest anteriorly. Trunk smooth, thick walled, with reticular lacunar system. Proboscis attached to trunk ventro-terminally, rounded, with 10 longitudinal rows of 2-3 hooks each ; anterior hooks large with simple backwardly directed roots; posterior hooks small, rootless. Proboscis sheath bulbous or subcylindrical, double walled, with ganglion at its base. Neck

very short. Lemnisci cylindrical, may be more or less crumpled. Testes large, contiguous, in anterior part of trunk. Cement glands6, elliptical or elongate pyriform, close together. Eggs elongate oval, with polar prolongations of middle shell. Parasites of marine fish.

Type species : *Hypoechinorhynchus alaeopis* Yamaguti, 1939

Type Host : *Alaeopis plinthus.*

Type locality : Japan

142. ***Hypoechinorhynchus golvani*** Gupta and Kumar, 1987

H. golvani : Gupta and Kumar,1987 : *Kanpur Univ. Res. Journal Sci.* : 4 ; pp. 85-89.

Type Host : *Clarius batrachus.*

Type Locality : Chilka, Orissa.

Location : Intestine.

Diagnosis : (after Gupta and Kumar, 1987) : *Male* : Body 3.57 × 1.1. Anterior proboscis with 3 hooks in each spiral row; posterior proboscis with 4 rows of 7 hooks each. Cement gland 4.

Remarks : Source of description is Helm. Abst. However, longitudinal arrangement of proboscis hooks for the genus does not approve the spiral arrangement of proboscis hooks and their numbers as described by the authors. Thus, identity of the species is doubtful till the description of the species is studied in detail.

Family ECHINORHYNCHIDAE Cobbold, 1876

Family Diagnosis : Echinorhynchida : Trunk aspinose, only exceptionally faintly spinose, hypodermic nuclei usually small, numerous. Lacunar system with lateral main vessels. Proboscis more or less cylindrical, or moderate length and usually with numerous hooks or spherical and with a small number of hooks. Proboscis sheath inserted at base of proboscis, with double layered walls; ganglion at varying levels. Lemnisci 2, more or less claviform, Cement glands 4-8, usually pyriform, rarely tubular. Eggs elliptical to fusiform. Parasites of fishes.

Type genus : *Echinorhynchus* Muller, 1876

Key to subfamilies of ECHINORHYNCHIDAE

1. Trunk with minute spines anteriorly, transition between true apical proboscis hooks and basal spiniform hooks abrupt ..... YAMAGUTISENTINAE

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

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

Lemnisci circinate or ring-like compact mass, encircling the junction of proboscis and proboscis sheath ..... CIRCINATECHINORHYNCHINAE n. subfam.

Golvan (1969) erected the genus *Yamagutisentis* and subfamily Yamagutisintinae under Echinorhynchidae which was accepted by Amin (1987). I propose a new genus *Circinatechinorhynchus* under a proposed new subfamily Circinatechinorhynchinae with the presence of a unique feature of the Lemnisci. Proposed new genus is characterized by the presence of a circinate or ring-like compact mass round the junction between proboscis and proboscis sheath instead of usual form of Lemnisci. All other characteristics of the genus suggest the species to be under the family Echinorhynchidae.

Subfamily YAMAGUTISENTINAE Golvan, 1969

Subfamily Diagnosis : Echinorhynchidae : Body medium, fusiform. Anterior trunk bears minute cuticular spines only on the margin of the trunk. Proboscis relatively short. Transition between apical true hooks and basal spiniform hooks abrupt. Parasites of marine fishes of North Pacific.

Type genus : *Yamagutisentis* Golvan, 1969

27. Genus *Yamagutisentis* Golvan, 1969

Generic Diagnosis : Body medium, fusiform.Proboscis short. Transition between apical true proboscis hooks and basal spiniform hooks abrupt. Neck short. Anterior trunk with minute spines along the margin. Lemnisci as long as proboscis receptacle or scarcely longer than receptacle. Ganglion at base of proboscis receptacle. Male genital organs posteriorly. Genital pore in both sexes terminal. Cement glands 6, arranged roughly in pairs. Saefftigen's pouch well developed. Parasites of marine fish of North Pacific.

Type species : *Yamagutisentis rhinoplagusiae* (Yamaguti, 1935) nov. comb.

Type Host : *Rhinoplagusia japonica* (Cyanoglossidae)

143. *Yamagutisentis nicoli* Kumar, 1992

Y. nickoli Kumar, 1992 : *Proceedings of Parasitology* 14 : pp. 6-14. Type locality : Chilka lake, Orissa.

Host : *G. batasio.*

Location: Intestine.

Remarks : Diagnosis is lacking in absence of literature.

Subfamily ECHINORHYNCHINAE Cobbold, 1876

Subfamily Diagnosis : Echinorhynchidae : Body without long neck or cervical bulb. Trunk usually cylindrical. Proboscis cylindrical or sub-cylindrical, sometimes ovoid, with

large or small number of hooks in longitudinal rows. Proboscis receptacle and lemnisci more or less claviform. Testes in mid-region of trunk. Cement glands pyriform, not tubular. Eggs with polar prolongations of middle shell. Parasites of marine and fresh water fish, occasionally in amphibians and also found in reptiles.

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

Other genera : *Pseudoechinorhynchus* Petrotschenko, 1956

Metechinorhynchus Petrotschenko, 1956

Metacanthocephaloides Yamaguti, 1959

Acanthocephalus Koelroether, 1771

Pseudoacanthocephalus Petrotschenko, 1956.

Key to the genera of ECHINORHYNCHINAE

1. Eggs without polar prolongations of middle shell membrane; parasites of terrestrial amphibians ..... ***Pseudoacanthocephalus***

   Eggs with polar prolongations of middle shell membrane 2

2. Proboscis long, cylindrical; Nerve ganglion at middle of proboscis sheath .... ***Echinorhynchus***

– Proboscis ovoid, claviform; nerve ganglion at base 3

3. Proboscis hooks smaller at anterior proboscis, then increase in size and gradually decrease towards base ..... ***Acanthocephalus***

   Proboscis hooks abruptly small at base; Lemnisci two, very small, frilled .... ***Frilloechinorhynchus*** nom. nov.

28. Genus *Echinorhynchus* Zoega in Muller, 1776

Generic Diagnosis : Echinorhynchidae; Echinorhynchinae : Body small to medium-sized; hypodermic nuclei small, numerous. Lacunar system consisting of lateral main vessels and reticular anastomoses,Proboscis long, cylindrical. directed ventrad, with 9-26 longitudinal rows of 5-16 hooks each; root of hooks simple, becoming smaller toward base of proboscis where it disappears. Proboscis receptacle cylindrical to claviform, double walled, with ganglion near its middle. Lemnisci usually claviform. Testes oval to elliptical, tandem, contiguous or not, in middle third of trunk. Cement glands 6, more or less compact, one behind another or close together. Eggs much elongated, fusiform, with prominent polar prolongations of middle shell. Parasites of fresh water and marine fishes.

Type species : *Echinorhynchus gadi* Zoega in Muller, 1776

Type Host : *Gadus morrhua*

Key to species of *Echinorhynchus*

1. Proboscis hooks 12-15 rows 2

   Proboscis hooks 16 × 16 ..... *E. orientalis*

2. Rows of hooks 12-15 × 10-14 ..... *E. velli*

   Rows of hooks 12 × 16; Saefftigen's pouch present ..... *E. indicus*

144. *Echinorhynchus indicus* Chandra, 1982
(Pt. 20; Figs. 106a–106c)

E. indicus Chandra, 1982 : *Ind. J. Parasitology*, 6(2) : pp. 255-257. Type locality : Coast of Andhra Pradesh

Host : *Pomadasys maculatus*.

Location : Intestine.

Diagnosis : (after Chandra, 1982) : *Male* : Body medium, 3.50 × 0.78. Proboscis curved, 0.66 × 0.093, armed with 12 rows of 16 hooks each, ventral hooks curved and thicker than dorsal hooks, anterior 0.048, basal 0.021 long. Proboscis sac 0.72 × 0.192. Lemnisci 0.924 × 0.096. T/1–0.744 × 0.300; T/2–0.552 × 0.168. cement glands 6, spherical. Saefftigen's pouch 0.900 × 0.132.

145. *Echinorhynchus orientalis* Kaw, 1951
(Pt. 20; Figs. 107a–107c)

E. orientalis Kaw, 1951 : *Ind. j. Helminth.* 3(2) : pp. 117-132. Type locality : Dal lake, Kashmir.

Host : *Schizothorax sp.*

Location : Intestine.

Diagnosis : (after Kaw, 1951) : Female : Body fusiform, 5.6 × 1.05. Proboscis 1.00 × 0.25, armed with 16 rows of 16 hooks each, 1st row of hooks 0.022 and roots 0.027; 2nd. 0.040 × 0.032; 3rd. 0.060 × 0.054; 4th 0.067 × 0.054; 5th 0.061 × 0.054; 6th and 7th 0.070 × 0.054; 16th 0.050; maximum root length 0.060 (10th). Eggs 0.113 × 0.009.

Remarks : Golvan (1969) considered the status of the species as uncertain due to its insufficient description.

NB. Only four genera under Echinorhynchinae have been reported from India.

146. *Echinorhynchus velli* George and Nadakal, 1978
(Pt. 20; Figs. 108a–108c)

E. velli George and Nadakal, 1978 : *Aqua Biol.* 3 : pp. 79-90. Type locality : Brackish water of Kerala.

Host : *Synaptura orientalis* (Synapturidae).

Location : Intestine.

Diagnosis : (after George and Nadakal, 1978) : *Male* : Body 6.00-9.00 × 0.5-1.5, medium. Proboscis globular or cylindrical 0.3-0.45 × 0.1-0.25, armed with 12-15 rows of 10-14 hooks each, hooks progressively smaller toward base. Lemnisci 0.4-0.5 × 0.10-0.2. Proboscis sac 0.56-0.6 × 0.08-0.1. Testes anterior. T/1–0.6-0.71 × 0.3-0.35; T/2–0.45-0.61 × 0.25-0.30. Anterior proboscis hooks 0.04-0.045 × 0.015-0.25; middle 0.046-0.050 × 0.016-0.030; basal 0.030-0.035 × 0.010-0.020; roots 0.020-0.025 × 0.006-0.015. Cement glands 6, pyriform. *Female* : 7.00-15.00 × 1.00-2.00. Eggs elliptical or fusiform.

Remarks : Some type materials deposited in ZSI under registration no. WN/320 and WN/321 have been examined by the present author.

29. Genus *Acanthocephalus* Koelreuther, 1771
Synonym *Paracanthocephalus* Archmerov et Dombrowskaja-Achmerova, 1951

Generic Diagnosis : Echinorhynchidae; Echinorhynchinae: Body small to medium-sized. Trunk nearly cylindrical, with numerous, small, hypodermic nuclei. Lacunar system with reticular anastomoses. Neck short. Proboscis fairly long, ovoid or claviform to cylindrical, with 6-28 longitudinal rows of 4-15 hooks each; hooks increase in size from the apex toward the middle and thence gradually decrease toward the base. Proboscis receptacle saccate to cylindrical, double walled, with ganglion at base. Lemnisci digitiform or claviform, close togrther or in tandem pairs. Eggs greatly elongated, fusiform with prominent polar prolongations of middle shell. Parasites of fish, amphibians, and reptiles.

Type species : *Acanthocephalus anguillae* (Muller, 1780) Luhe, 1911.

Type locality : Europe, N. America.

Type Host : *Anguilla vulgaris.*

Key to species of *Acanthocephalus*

Proboscis hooks equal in size ..... *A. manipurensis*

Anterior proboscis hooks larger than posterior hooks ..... *A. kashmirensis*

NB. *Echinorhynchus robustus* Datta, 1928 has been transferred to the genus *Sphaerorostris* by Golvan (1994).

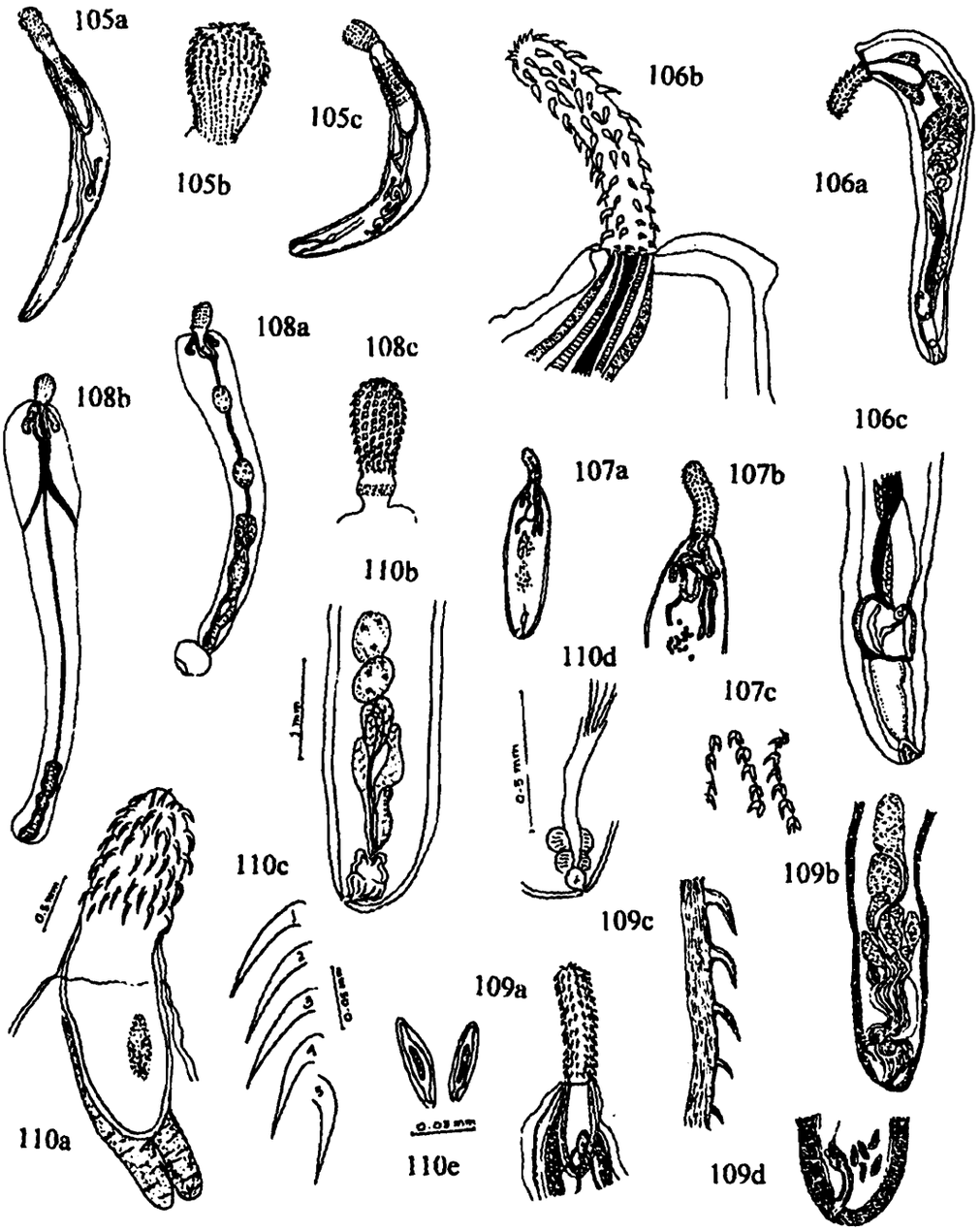

Plate-20

Fig. 105. *Gorgorhynchoides cablei* (Gupta and Fatma, 1987) n. comb. (a) juvenile female; (b) Proboscis; (c) juvenile male.

Fig. 106. *Echinorhynchus indicus* Chandra, 1982. (a) male; (b) proboscis; (c) proboscis of male.

Fig. 107. *Echinorhynchus orientalis* Kaw, 1951. (a) female; (b) anterior of female; (c) proboscis hooks.

Fig. 108. *Echinorhynchus velli* George and Nadakal, 1978. (a) male; (b) female; (c) proboscis.

Fig. 109. *Acanthocephalus kashmirensis* Datta, 1936. (a) anterior of male (b) posterior of male; (c) proboscis hooks; (d) posterior of female.

Fig. 110. *Acanthocephalus manipurensis* n. sp. (a) anterior of male; (b) posterior of male; (c) proboscis hooks.; (d) posterior female; (e) eggs.

147. *Acanthocephalus kashmirensis* Datta, 1936
(Pt. 20; Figs. 109a–109d)

A. kashmirensis Datta, 1936: *Rec. Ind. Mus.* 38(2) : pp. 211-229. Type locality : Ladak

Host : *Schizopygopsis stoliczkae.*

Location : Intestine.

Diagnosis : (after Datta,1936) : *Male* : Body 1.75-8.60 × 0.44-0.99, cylindrical. Proboscis cylindrical, armed with 13-18 rows of 6-8 hooks each, anterior hooks larger than posterior, anterior hooks 0.110; basal 0.075 × 0.019. Proboscis sac double walled, ganglion near base. Lemnisci longer than proboscis sac. Cement glands 6, run in pairs of three and meet the penis. Saefftigen's pouch present. Female : Body 3.48-14.6 × 0.57-1.00. Genital pore postero-ventral. Eggs 0.060 × 0.010, without polar prolongations of middle shell probably due to immaturity.

Remarks : Polar prolongations of middle shell of egg membrane are the characteristics of the genus *Acanthocephalus*. Such prolongations are lackng in the species. This may be due to lack of maturation of the egg.

148. *Acanthocephalus manipurensis* n. sp.
(Pt. 20; Figs. 110a–110e)

Host : *Bufo sp.*

Type locality : Manipur.

Diagnosis : *Male* : Body medium, ventrally curved, broad anteriorly, 7.075-7.375 long and 0.875-1.125 wide. Proboscis cylindrical, 0.3-0.375 long and 0.2-0.25 wide, armed with 14-16 longitudinal rows with 5-6 hooks in each row, all hooks equal in size, H/1–0.083-0.099; H/2–0.083-0.099; H/3–0.083-0.099; H/4–0.083-0.099; H/5–0.083-0.099. Neck 0.1-0.125 × 0.25-0.3. Proboscis sheath cylindrical, 0.5 × 0.175. Lemnisci longer than proboscis sheath, equal, leaf-like, 0.95 × 0.175. Testes post equatorial, contiguous, 0.5-0.675 long. Cement glands 6, elongated, compact mass, 1.00-1.5 long, Bursa 0.25 × 0.425. *Female* : Body 7.125-16.00 long. Proboscis cylindrical, 0.4-0.475 long and 0.25-0.3 wide. Genital pore ventral. Eggs 0.058-0.066 × 0.0166, elliptical, with polar prolongations of middle shell.

Remarks : Some of the species bearing eggs without polar prolongations of middle shell maembrane of the genus *Acanthocephalus*, reported from terrestrial amphibians have been transferred by Petrotschenko (1956) to his new genus *Pseudoacanthocephalus*. The species under description being a parasite of *Bufo sp.*, a terrestrial amphibian, is found to bear eggs with prominent polar prolongations of middle shell. I, therefore, have described it under *Acanthocephalus*. The species have been compared with other Indian species viz. *A. kabulensis, A. kashmirensis and A. goaensis* but found to be different from them mainly in having uniform size of proboscis hooks. Hence, the species is proposed as *Acanthocephalus manipurensis* n. sp. The species is named after its place of occurrence at Manipur.

30. Genus *Pseudoacanthocephalus* Petrotschenko, 1956

Generic Diagnosis : Echinorhynchidae; Echinorhynchinae : Body massive, spindle-shaped or cylindrical, with relatively thick walls in which a thick net work of lacunae is visible, dark grey in fixed specimens. Proboscis nearly cylindrical or slightly broadening at middle. Hooks on proboscis more or less equal except for the most posterior which are usually smaller than the others. Cement glands pyriform or reniform, lying in a compact group. Eggs oval, with three oval membranes, the medium of which is thickest and lustrous. There are no protrusions at poles. Embryonal larva holoechinate (and completely covered with spines). Parasites generally of terrestrial amphibians.

Type species : *Pseudoacanthocephalus bufonis* (Shipley, 1903) Petrotschenko, 1956.

Type locality : Celebes.

Key to species of *Pseudoacanthocephalus*

1. Proboscis hooks 20-22 longitudinal rows of 10-11 hooks each ..... *P. raushi*

   Proboscis hooks less 2

2. Proboscis hooks in 14 rows of 5 hooks each ..... *P. shillongensis*

   Proboscis hooks in 20 rows of 5 hooks each ..... *P. paratiensis*

149. *Pseudoacanthocephalus shillongensis* Bhattacharya, 1999
(Pt. 21; Figs. 111a–11d)

P. shillongensis Bhattacharya, 1999 : ZSI, *Fauna of Meghalaya, State Fauna Series*, 4(Part-9) : pp. 359-392. Type locality : Shillong, Meghalaya.

Host : *Bufo melanostictus*.

Location : Intestine.

Distribution : Manu, Tripura.

Diagnosis : (after Bhattacharya, 1999) : *Male* : Body 6.0-9.75 × 1.0-1.75. Proboscis 0.325-0.4 × 0.25-0.325, armed with 14 longitudinal rows of 5 hooks each., more or less equal in size and with roots, points larger than roots, points of hooks 0.084-0.09, roots 0.04-0.05. Proboscis sheath 0.625 × 0.25, double walled, ganglion near base. Genital organs at posterior half of the body. Testes 2.05 × 0.375, Cement glands 6, *Female* : Body 8.125 × 0.875.Genital pore sub-terminal. Eggs 0.06 × 0.02, without polar prolongations of middle shell.

150. *Pseudoacanthocephalus rauschi* Gupta and Fatma, 1985
(Pt. 21; Figs. 112a–112c)

P. rauschi Gupta and Fatma, 1985 : *Ind. J. Helm.* 37(11) : pp. 137-148. Type locality : Lucknow.

Host : *Rana tigrina*.

Location : Intestine.

Diagnosis : *Male* : Body 5.15-6.35 × 0.82-0.88. Proboscis 0.51-0.72 × 0.51-0.61, armed with 20-22 rows of 10-11 hooks per row, anterior hooks to middle hooks 0.05-0.052 long, middle to base, 0.03-0.04 long. Proboscis receptacle 1.62-1.65 × 0.43-0.51. Lemnisci 1.80-2.40 × 0.15-0.18. Testes equatorial, T/1–0.24-0.42 × 0.42-0.45; T/2–0.30-0.45 × 0.40-0.45. Cement gland 8 pyriform, 0.91-1.45 × 0.12-0.15. Genital pore terminal. *Female* : Body : 8.22-9.20 × 0.94-0.96. No egg reported.

151. ***Pseudoacanthocephalus paratiensis*** Bhattacharya, 2000
(Pt. 21; figs. 113a–113c)

P. paratiensis Bhattacharya, 2000 : ZSI, *Fauna of Tripura, State Fauna Series*, 7(part-4) : 141-162.

Host : *Bufo melanostictus.*

Location : Intestine.

Type locality : Paratia, Tripura.

Diagnosis : (after Bhattacharya, 2000) : *Female* : Body 18.5 × 2.25, cylindrical. Proboscis 0.625 × 0.45, armed with 20 longitudinal rows of 5 hooks each, hooks more or less equal in size, roots with anterior tip buldged, points of hooks 0.0913, roots 0.0664. Proboscis sheath 1.125 × 0.5, double walled, nerve ganglion at base. Lemnisci equal, leaf-like, 1.025 × 0.375, longer than proboscis sheath. Genital pore sub-terminal. Eggs oval, no polar prolongations of middle shell.

31. Genus ***Frilloechinorhynchus*** (Gupta and Naqvi, 1986) nom. nov.
Homonym *Echinorhynchoides* Gupta and Naqvi, 1986

Generic Diagnosis : Echinorhynchidae; Echinorhynchinae : Body spinose, elongated, almost cylindrical, with numerous small hypodermic nuclei, lacunar system with lateral main vessels and reticular anastomoses. Proboscis ovoid or subcylindrical armed with 18-20 longitudinal rows of 5-6 hooks per row. Proboscis hooks largest at greater sub-apical part becoming abruptly small at base with simple roots. Neck small, proboscis sheath saccate or subcylindrical, double walled with ganglion a little anterior to base. Lemnisci two, very small, frilled, 1/3rd or 1/4th of length of proboscis sheath. Testes oval or elliptical, tandem, separate or contiguous, pre-equatorial. Cement glands 6, pyriform or claviform, one behind anterior or close together. Bursa without bursal rays or papillae Vgina surrounded by mascular bands. Eggs fusiform with polar prolongations of middle shell membrane. Genital pore terminal in male and subterminal in female.Parasites of marine fishes.

Type species : Frilloechinorhynchus meyeri (Gupta and Naqvi, 1986) nom. nov.

Type Host : *Synaptura orientalis.*

Type locality : Ernakulum, Kerala.

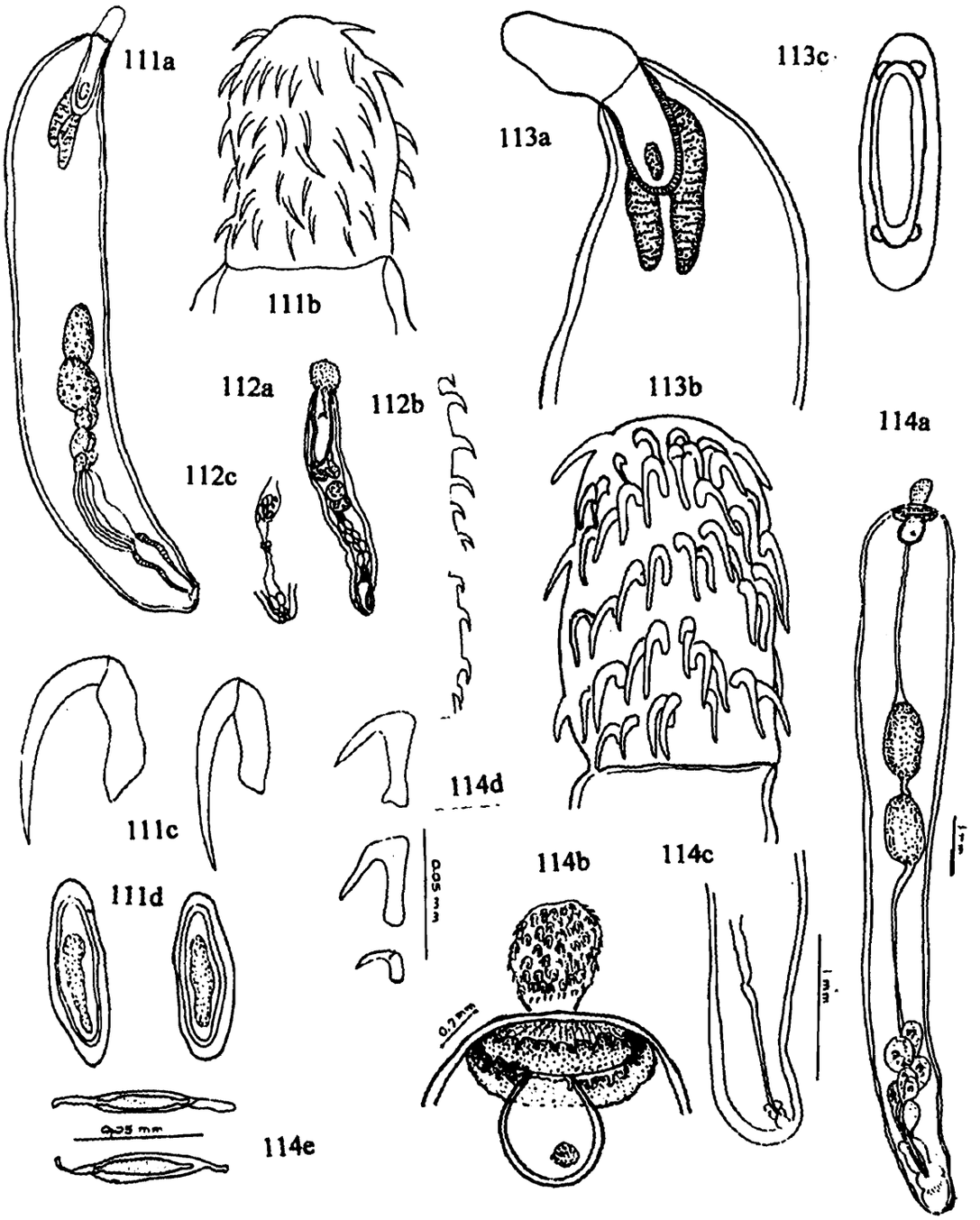

Plate-21

Fig. 111. *Pseudoacanthocephalus shillongensis* Bhattacharya, 1999. (a) male; (b) proboscis; (c) proboscis hooks; (d) eggs.

Fig. 112. *Pseudoacanthocephalus rauschi* Gupta and Fatma, 1985. (a) male; (b) female genitalia; (c) proboscis hooks.

Fig. 113. *Pseudoacanthocephalus paratiensis* Bhattacharya, 2000. (a) anterior body; (b) proboscis; (c) egg.

Fig. 114. *Circotechinorhynchus pseudorhombi* n.g. n.sp. (a) male; (b) proboscis with circinate (ring-like) type of lemnisci; (c) posterior of female; (d) proboscis hooks; (e) eggs.

Gupta and Naqvi (1986) erected the genus *Echinorhynchoides* with type species *E. meyeri* n.g.n.sp. from the intestine and body cavity of a flat fish *Synaptura orientalis* from Ernakulum, Kerala. Acherow et Dombrowskaja-Achmerova (1941) also erected he genus *Echinorhynchoides* having four cement glands, with the type species *E. dogieli* under the family Fessisentidae Van Cleave (1931). Golvan (1969) considered the genus *Echinorhynchoides* as valid. Therefore, the genus *Echinorhynchoides* described by Gupta and Naqvi (1986) is preoccupied for the species *E. meyeri* n.g.n.sp. The genus *Echinorhynchoides* is distinguished by Gupta and Naqvi (1986) from rest of the genera of the subfamily Echinorhynchine with the size of last row of proboscis hooks and very short, frilled Lemnisci. Therefore, it is a valid species but the name being preoccupied, I consider it a homonym and propose for a new name. Hence, the species is named as *Frilloechinorhynchus meyeri* (Gupta and Naqvi, 1986) nom. nov. as per Art. 67h; E-15 and E-21 of ICZN.

152. ***Frilloechinorhynchus meyeri*** (Gupta and Naqvi, 1986) nom. nov.

Echinorhynchoides meyeri; Gupta and Naqvi, 1986 : *Indian J. Helminth*, **34**(1) : pp. 61-84.

Diagnosis : As given in generic diagnosis.

Subfamily CIRCINATECHINORHYNCHINAE n. subfamily

Subfamily Diagnosis : Echinorhynchidae : Body aspinose, medium, sub-cylindrical, anterior trunk broad, hypodermic nuclei small or large, few or many, main lateral canals with reticular anastomoses. Proboscis spheroid or sub-cylindrical, hooks almost uniform in size and with roots, basal row of hooks much reduced. Proboscis sheath double walled, ganglion at middle or posterior. Lemnisci a compact mass, circinate or ring –like, encircle the junction of proboscis and proboscis sheath. Free border of the lemnisci stretches with the evertion of the proboscis and during invagination the frilled end folds to form a compact ring around the junction of the proboscis and proboscis sac. Usual type of Lemnisci is absent. Testes usually in the middle or posterior. Cement glands 6, spherical or pyriform. Eggs elongate, thinly elliptical with prominent polar prolongations of middle shell. Parasites of marine fish (Pleuronectiformis).

Type genus : *Circinatechinorhynchus* n. g.

32. Genus ***Circinatechinorhynchus*** n.g.

Generic Diagnosis : Same as diagnosis of the subfamily.

Type species : *Circinatechinorhynchus pseudorhombi* n.g.n.sp.

Type Host : *Pseudorhombus atsius.*

Other Hosts : *Synaptura sp.; Solea sp.*

Type locality : Chennai, Tamil Nadu; Mangalore, Karnataka.

153. ***Circinatechinorhynchus pseudorhombi*** n.g. n.sp.
(Pt. 21; Figs. 114a–114e)

Type Host : *Pseudorhombus arsius.*

Other Hosts : *Synaptura sp.; Solea sp.*

Location : Intestine.

Distribution : Mangalore and Kotyam, Kerala; Chennai, Tamil Nadu.

Diagnosis : *Male* : Body aspinose, medium, anterior trunk broad, 7.25-12.37 × 1.00-1.25, Hypodermic nuclei on the trunk 3 or 4. Proboscis ovoid or sub-cylindrical, little ventrad, 0.325-0.426 × 0.426 × 0.275-0.325; armed with 14-18 longitudinal rows of 7-8 hooks in each row, with a little 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 hoks 0.02-0.022; roots 0.02-0.022; sub-apical points 0.024-0.03; roots 0.03-0.032; points of last row 0.014-0.016. Neck 0.124-0.166 × 0.182-0.231. Lemnisci, a compact glandular mass, circinate or ring-like encircling the junction of proboscis sheath and proboscis, 0.35-0.40 long and 0.50-0.55 wide when proboscis is protruded. Free border of of the lemnisci stretches with the evertion of the proboscis and during invagination the frilled end folds to form a compact ring around the junction of the proboscis and proboscis sac. Usual type of Lemnisci is absent. Proboscis sheath double walled, 0.725 long and 0.375 wide, nerve ganglion at base of proboscis. Testes equatorial, anterior testes little pre-equatorial, T/1–1.00-1.2 × 0.50-0.55; T/2–1.25-1.3 × 0.50-0.55. Cement glands 6, pyriform or spheroid, with one nucleus in the centre of each gland, arrangement irregular. Genital pore terminal.

Female : Body 13.375-17.5 × 1.00-1.5, anterior broad, proboscis 0.325-0.426 × 0.275-0.325 armed with 14-18 rows of 7-8 hooks each. Proboscis 0.325-0.426 × 0.275-0.325 armed with 14-18 rows of 7-8 hooks each. Proboscis sheath 1.00-1,25 × 0.35-0.375, ganglion at base. Uterus 2.25-2.50 long. Genital pore sub-terminal. eggs thinly elliptical with prominent polar prolongations of middle shell membrane. 0.058-0.07 long.

Remarks : A total number of about twenty specimens were collected from some pleuronectiformid fish hosts belonging to Bothidae (left-eyed flounders) and Soleidae (right-eyed flounders) from east coast of India at Chennai and from west coast at Mangalore, Karnataka.

The parasites bear a unique circinate or ring-like compact mass encircling the junction of proboscis and the proboscis receptacle instead of two hanging lemnisci. The ring appears like a wreath around the junction of proboscis and proboscis sheath which in live specimens moves up and down with the eversion and invagination of proboscis. Free border of the lemnisci stretches with the contraction of the circular muscle which causes eversion of the proboscis and during contraction of the neck retractor, invagination of the proboscis takes place inside the proboscis sheath. Then the free border of the mass of lemnisci folds to form a compact ring around the junction of the proboscis

and proboscis sac. No usual type of Lemnisci is present. A critical examination through dissection under binocular reveals that the ring is a compact glandular mass. It is not a membranous sac which encloses the lemnisci. The type of lemnisci is not complying with that of the genus *Diplosentis*.

Such a typical lemnisci in Acanthocephala has not been reported so far in any of the members of the phylum Acanthocephala. The spheroid proboscis and proboscis receptacle of the present form resemble with that of the members of the genus *Hypoechinorhynchus* and *Bolborhynchoides* of the family Hypoechinorhynchidae. But the new form basically stands with circinate or ring-like lemnisci, and the uniform size of proboscis hooks against longer apical hooks of the members of the said genera. At the same time the proposed new genus with its typical ring-like lemnisci differs from the genus *Yamagutisentis* of the family Yamagutisentidae. It also differs from the genera *Echinorhynchus, Pseudoechinorhynchus, Metechinorhynchus, Metacanthocephaloides, Acanthocephalus* and *Pseudoacanthocephalus* of the family Echinorhynchidae with such type of Lemnisci and uniform size of proboscis hooks except the basal small ones. All the other characteristics of this group of parasites such as, size and shape of proboscis hooks, shape and position of testes and pyriform cement glands etc. suggest it to be a member of the subfamily Echinorhynchinae but the presence of such lemnisci favours for creation of a new subfamily under the family Echinorhynchidae. Hence, new subfamily Circinatechinorhynchinae has been proposed to accommodate the new genus and new species under the family Echinorhynchidae.

The abstract of this paper has been published under the Abst. No. AP-9 in the 'Symposium on Parasitology', organized by the University of Calcutta between 27th–28th March, 2006 at Calcutta.

Family DIPLOSENTIDAE Tubangui et Masilungan, 1937

Family Diagnosis : Echinorhynchida: Trunk aspinose or spinose anteriorly with lateral lacunar vessels. Proboscis elongate, with rather numerous hooks, proboscis sheath double walled. Cement glands 2, tubular. Parasites of fishes.

Type genus : *Diplosentis* Tubangui et Musilungan, 1937

Ket to the subfamilies of DIPLOSENTIDAE

Trunk spinose anteriorly ..... ALLORHADINORHYNCHINAE*

Trunk aspinose ..... DIPLOSENTINAE

Key to the genera of DIPLOSENTINAE

Nerve ganglion anterior to middle of proboscis sheath; proboscis claviform .....
..... ***Diplosentis***

Nerve ganglion near posterior end of proboscis sheath; proboscis long and cylindrical ..... ***Pararhadinorhynchus*****

33 Genus ***Diplosentis*** Tubangui et Masilungan, 1937

Generic Diagnosis : Diplosentidae; Diplosentinae : Trunk sub-cylindrical, cuticle unarmed, wrinkled transversely, longitudinal lacunar vessels lateral. Protonephridial organ absent. Proboscis club shaped, with 12 longitudinal rows of 8-9 hooks each. Proboscis sheath double walled, containing ganglion anterior to its middle. Neck absent. Lemnisci much coiled, enclosed in membranous sac. Testes contiguous, pre-equatorial. Cement glands 2, tubular. Cement reservoir tubular. Eggs elliptical, with polar prolongations of middle shell. Parasitic in marine fishes.

Type species : *Diplosentis amphacanthi* Tubangui et Musilungam, 1937.

Type Host : *Siganus oramin.*

Type locality : Philippines.

154. ***Diplosentis manteri*** Gupta and Fatma, 1979
(Pt. 22; Figs. 115a–115c)

D. manteri Gupta and Fatma, 1979 : *Ind. J. Helminth.* **31**(1) : pp. 45-53. Type locality : Mandapam, Tamil Nadu.

Pararhadinorhynchus manteri (Gupta and Fatma, 1979) n. comb. : Pichelin *et al.*, 2001 : *Folia Parasitologica* (Ceske Budej Voice), **48**(4) : pp. 289-303.

Host : *Arius arius.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1979) : *Male* : Body Sub-cylindrical, 3.85 × 0.4, unarmed. Proboscis 0.32 long, armed with 13 rows of 6 hooks each, hooks gradually decrease in size towards base of proboscis, 1st row of hooks 0.040; 2nd 0.035; 3rd and 4th 0.03; 5th 0.025; basal 0.023. Proboscis sheath double walled 0.42 × 0.12, ganglion anterior to middle. Lemnisci 0.25 × 0.15, coiled, enclosed in membranous sac. Testes post equatorial, T/1–0.15 × 0.08; T/2–0.135 × 0.095. Cement glands 2. Saefftigen's pouch present.

Remarks : Gupta and Fatma (1979) described the species under the genus *Diplosentis* for the first time from India. Pichelin *et al.* (2001) transferred the species to *Pararhadinorhynhus*. I don't think this transfer is justified because, nature of lemnisci, position of nerve ganglion and position of male genital organs in the posterior trunk warrant the species to be a member of the genus *Diplosentis* not *Pararhadinorhynchus*. Therefore, I propose for removal of the species from *Pararhadinorhynchus* and reinstate it to the genus *Diplosentis*. The reinstatement is absolutely on the basis of literature.

*The subfamily is not reported from India.**Genus has not been reported from India.

Family HETERACANTHOCEPHALIDAE

Key to family HETERACANTHOCEPHALIDAE

Trunk spinose anteriorly ..... ASPERSENTINAE

Trunk unarmed ..... HETERACANTHOCEPHALINAE

Subfamily HETERACANTHOCEPHALINAE

34. Genus ***Bullockrhynchus*** Chandra *et. al.*, 1985

Generic Diagnosis : No literature is available.

155. ***Bullockrhynchus indicus*** Chandra *et al.*, 1985.

Bullockrhynchus indicus Chandra *et al.*,1985 : *Rev. Iber. de. Parasit.*. **45**(4) : pp. 293-302.

Host : *Leiognathus equalis.*

Location : Intestine.

Locality : Andhra coast.

Remarks : Chandra *et al.* (1985) erected the genus *Bullockrhynchus* with type species *B. indicus* n.g.n.sp. from a marine fish host of Andhra coast. No description of species is provided due to non availability of literature.

Family ILLIOSENTIDAE Golvan, 1960

Family Diagnosis : Palaeacanthocephala; Echinorhynchida: Medium-sized. Trunk spined anterior ly as well as at extreme posterior end or anteriorly alone, spines at genital pore may or may not present. Proboscis cylindrical or slightly enlarged posteriorly, with numerous hooks, which gradually diminish in size toward base of proboscis, hooks on proboscis in longitudinal rows and dorso-ventrally asymmetric. Proboscis sheath double walled with ganglion near middle. Lemnisci long and variable in size. Cement glands compact or elongate pyriform, close together. Eggs oval to fusiform. Parasites of marine fishes.

Type genus : *Illiosentis* Van Cleave, et Linicome, 1939.

Golvan (1960) erected the subfamily Illiosentinae under the family Rhadinorhynchidae with the genera *Illiosentis* and *Telosentis* Later, he raised the subfamily to the family Illiosentidae Golvan, 1960 containing eight genera *viz. Illiosentis; Telosentis; Dollfusentis; Tegorhynchus; Metarhadinorhynchus; Indorhynchus; Pseudorhadinorhynchus; Dentitruncus.* Subsequently, *Paradentitruncus* and *Goacanthus* are added under it by Moravec *et al.*, (1990) and Gupta and Jain (1980) respectively. Only four out of ten genera are reported so far from India.

Key to the genera of ILLIOSENTIDAE

1. Anterior trunk spines in a single field 4

   Trunk spines not only anterior but posterior 2

2. Spines around genital pore in both sexes at least in female ..... ***Telosentis***

   Spines scattered in posterior than anterior trunk 3

3. Number of proboscis hooks in each longitudinal row less ..... ***Goacanthus***

   Number in each row many 4

4. Anterior trunk spines extend further backward ventrally than dorsally, 6-8 cement glands ..... ***Pseudorhadinorhynchus***

   Anterior trunk spines with circular rows, 8 cement glands ..... ***Indorhynchus***

35. Genus ***Goacanthus*** Gupta and Jain, 1980

Generic Diagnosis : Illiosentidae : Trunk armed. Proboscis long, proboscis hooks dorso-ventrally and antero-posteriorly asymmetrical. Cement glands 8, spherical.

Type species : *Goacanthus panajiensis.*

Type Host : *Leiognathus (= Equla) splendens.*

Type locality : Goa, India.

156. ***Goacanthus panajiensis*** Gupta and Jain, 1980

G. panajiensis Gupta and Jain, 1980 : *Rivista di Parasitologia*, **41**(1): pp. 47-59. Type locality : Goa, India.

Host : *Leiognathus splendens.*

Location : Intestine.

Diagnosis : (Reported from Helminth. Abst.) : Male : Proboscis long, armed with 14 longitudinal rows of 42-44 hooks each (49-50 in female). Proboscis hooks exhibit dorso-ventral and antero-posterior asymestry. Trunk spined, anterior spines smaller and more scattered in posterior than in the anterior region. Cement gland 8, spherical.

Remarks : Original description of the genus and the species could not be provided for want of literature.

36. Genus ***Pseudorhadinorhynchus*** Achmerow et Dombrovskaja-Achmerova, 1841, emend
Synonym *Hemiechinorhynchus* Krotov et Petrotschenko, 1956

Generic Diagnosis : Illiosentidae : Medium sized. Trunk cylindrical, may be slightly swollen anteriorly, where it is armed with spines. Trunk spines distributed all round

anteriorly, but extend ventrally further backward than dorsally, sometimes also at posterior end. Proboscis sheath double walled, with ganglion at base. Cement glands claviform to tubular, 6 or 8 in number. Eggs with polar prolongations of middle shell. Parasites of fishes.

Type species : *Pseudorhyadinorhynchus markewitchi* Achmerow et Domb.-Achmerova, 1941.

Type *host* : *Pseudaspius leptocephalus.*

Type locality : Russia.

Key to the species of *Pseudorhadinorhynchus*

1. Longitudinal rows of hooks on proboscis less than 20 2

   Longitudinal rows more than 20 4

2. Longitudinal rows 16-18 × 14-15 ..... *P. srivastavi*

   Hooks per row not more than 15 3

3. Longitudinal rows 18-20 × 12-14 ..... *P. orissai*

   Longitudinal rows 20 × 12-13 ..... *P. dussamicitatum*

4. Longitudinal rows 20-22 × 15-17 ..... *P. cochinensis*

   Longitudinal rows on anterior proboscis 22 × 5-7; posterior proboscis 26 × 6-7 ..... *P. ernaculensis*

157. ***Pseudorhadinorhynchus cochinensis*** Gupta and Naqvi, 1981

P.*cochinensis* Gupta and Naqvi, 1981 : *Ind. J. Helminth.* **33**(2) : pp. 144-152. Type locality : Cochin, Kerala.

Host : *Caranx malabaricus.*

Location : Intestine.

Diagnosis (after Gupta and Naqvi,1981) : *Male* : Body 2.64-2.88 × 0.42-0.48, both end tapering and broad at middle, anterior trunk with spines, more ventrally than dorsally. Proboscis 0.69-0.75 × 0.16-0.24, armed with 20-22 rows of 15-17 hooks each, 0.041-0.047. Trunk spines 0.019-0.022 × 0.014-0.017. Proboscis sheath 0.56-0.88 × 0.10-0.21. Lemnisci claviform, 1.05-1.25 long. Testes tandem, post-equatorial, T/1–0.80-1.01; T/2–0.73-0.78. Cement glands 6, pyriform. Saefftigen's pouch 0.32-0.41 × 0.12-0.16. *Female* : Body 3.55-3.85 × 0.51-0.54. Eggs not observed. Genital pore terminal in both sexes.

Remarks : Gupta and Naqvi (1981) also described two new species, *P. mujibi* and *P. cinereus* from *Stromateus cinereus* of Karachi, Pakistan.

158. ***Pseudorhadinorhynchus dussamicitatum*** Gupta and Gupta, 1970 (Pt. 22; Figs 116a–116c)

P. dussamicitatum Gupta and Gupta, 1970 : *Res. Bull. (N.S.), Punjab Univ.*, 22(3-4) : pp. 345-351. Type locality : Ernaculam

Host : *Ariodes dussumeiri.*

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1970) : *Male* : Body 5.52 × 0.30-0.81. Anterior trunk with minute spines, spines 0.015 × 0.010. Proboscis claviform, 0.52 × 0.25, armed with 20 rows of 12-13 each, all hooks with well developed roots, anterior hooks 0.035X 0.007, posterior hooks 0.020 × 0.009, basal hooks 0.045 × 0.007. T/1–0.36 × 0.34; T/2–0.23 × 0.27. Cement glands 8 claviform.

159. ***Pseudorhadinorhynchus ernaculensis*** Gupta and Gupta, 1969 (Pt. 22; Figs. 117a–117b)

P. ernaculensis Gupta and Gupta, 1969 : *Res. Bull. (N. S), Punjab Univ.*, 22. pp. 345-351. Type locality : Ernaculam.

Host : *Therapon jarbua.*

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1969) : *Male* : Body 2.25 × 0.13. Proboscis 0.59 × 0.21 armed with 22 rows of 5-7 anteriorly, 26 rows of 6-7 each posteriorly. all hooks with roots, anterior hooks 0.05 × 0.01, Posterior hooks 0.04 × 0.007.

Remarks : Incomplete description of species is found in the literature.

160. ***Pseudorhadinorhynchus orissai*** Gupta and Fatma, 1983 (Pt. 22; Figs. 118a–118e)

P. orissai Gupta and Fatma, 1983 : *Ind, J. Helminth.* 34(2) : 137-154. Type locality : Puri, Orissa

Host : *Mugil subviridis.*

Location : Intestine.

Diagnosis (after Gupta and Fatma, 1982) : *Male* : Body 5.50-5.58 × 0.70-0.82. Anterior trunk spines more extensive ventrally, 20-22 circular rows of 8-12 spines per row. Proboscis armed with 18-20 rows of 12-14 hooks each, anterior hooks 0.045-0.06, posterior hooks 0.03-0.04. Lemnisci 2.0-2.2. T/1–0.40-0.45 × 0.35-0.38; T/2–0.36-0.38 × 0.36-0.40. Cement glands pyriform. saefftigen's pouch 1.0-1.08 × 0.20-0.24. *Female* : Body 6.21-6.50 × 1.0-1.21. proboscis 1.01-1.15 × 0.30-0.34. eggs 0.055-0.060 × 0.015-0.020 with polar prolongations of middle shell membrane.

161. ***Pseudorhadinorhynchus srivastavi*** Gupta and Fatma, 1983
(Pt. 22; Figs. 119a–119e)

P. srivastavi Gupta and Fatma, 1983 : *Ind. J. Helmintn.*, **34**(2) : pp. 137-154. Type locality : Puri, Orissa.

Host : *Mugil cephalus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1983); *Male* : Body 4.05-4.8 × 0.69-0.95. Anterior trunk spines extensive ventrally than dorsally, spines 9-12 circular rows 10-14 each. Proboscis 0.70-0.80 × 0.20-0.32 armed with 16-18 rows of 14-15 hooks each. Lemnisci two, L/1–1.60-2.10; L/2–1.85- 2.30. T/1–0.31- 0.40 × 0.22-0.30; T/2–0.30-0.35 × 0.20-0.32. Cement glands 8, pyriform. Saefftigen's pouch 0.50-0.60 × 0.25-0.28. *Female* : Body 6.0-6.50 × 1.0-1.25. Eggs 0.04-0.045 × 0.01-0.015.

Other species :

*162. ***P. dhari*** Kumar, 1992 from ***Tachysurus nenga*** at Chilka

*163. ***P. machidai*** Kumar, 1992 from ***Gogata cenia*** at Chilka

Ref. : Kumar, 1992 : *Proceedings of Parasitology,* **14** : pp. 6-14.

37 Genus ***Indorhynchus*** Golvan, 1969

Generic Diagnosis : Illiosentidae : Trunk long, Cylindrical, Circular spines anterior, Proboscis claviform, proboscis hooks not differentiated dorsoventrally, no larger hooks at base of proboscis. Proboscis sheath long. Lemnisci long, reaching anterior testis. Cement glands pyriform, Saefftigen's pouch large. Parasites of marine siluroid fish.

Type species : *Indorhynchus indicus* (Tripathi, 1959) Golvan, 1969

Type *host* : *Tachysurus jella.*

Other host : *Osteogeneisis militaris.*

Type locality : Chilka lake, and Puri, Orissa.

164. ***Indorhynchus indicus*** (Tripathi, 1959) Golvan, 1969
(Pt. 22; Figs. 120a–120c)

Rhadinorhynchus indicus Tripathi, 1959 : *Rec. Ind. Mus.*, **54**(1&2) : pp. 61-99. Type locality : Chilka Lake, orissa.

Host : *Tachysurus jella; Osteogeneisus militaris.*

Location : Intestine.

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*Description of the species could not be provided for want of literature.

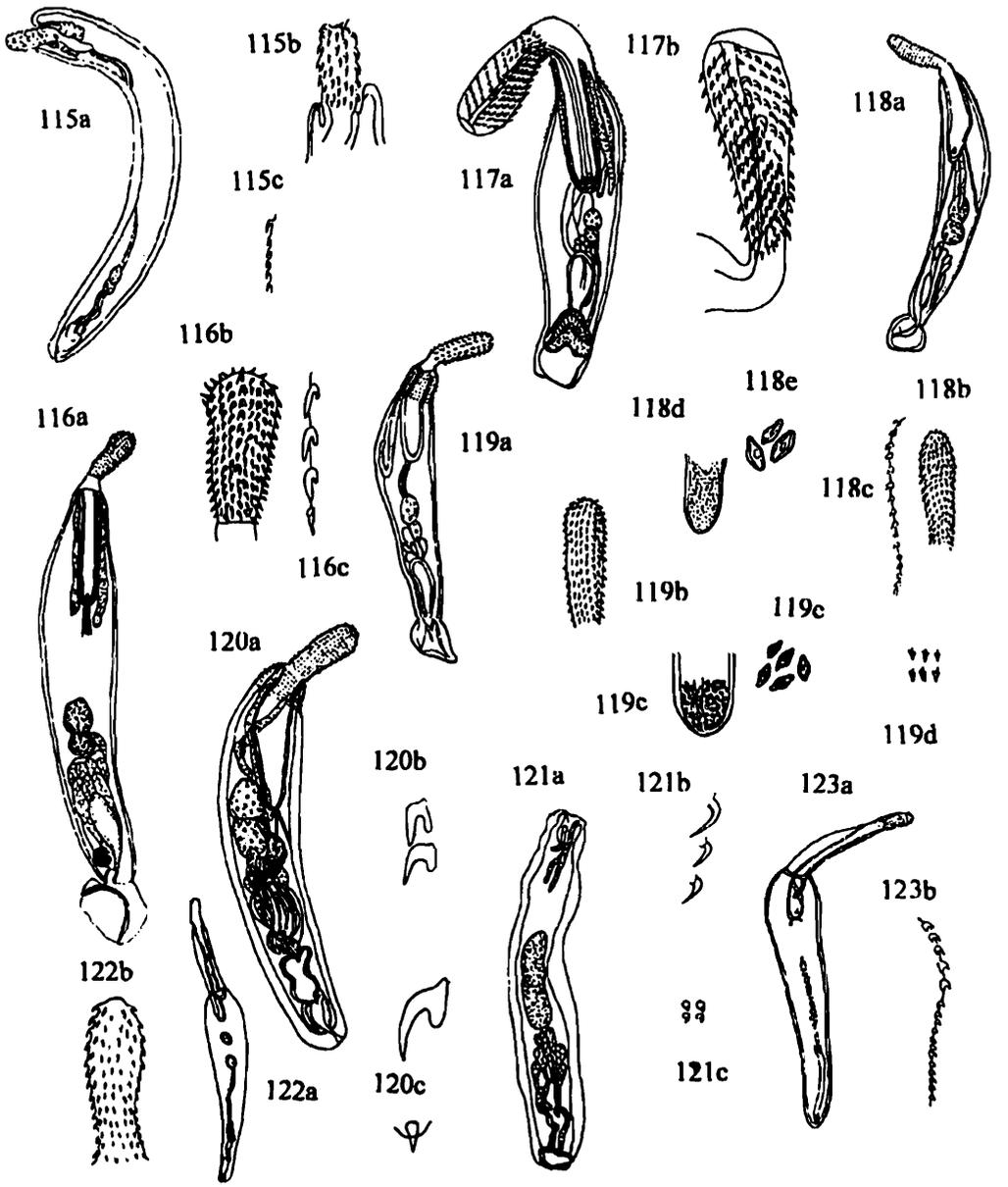

Plate-22

Fig. 115. *Diplosentis manteri* Gupta and Fatma, 1979. (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 116. *Pseudorhadinorhynchus dussamicitatum* Gupta and Gupta, 1970. (a) male; (b) proboscis and hooks; (c) Proboscis hooks.

Fig. 117. *Pseudorhadinorhynchus ernakulensis* Gupta and Gupta, 1969 (a) male; (b) proboscis.

Fig. 118. *Pseudorhadinorhynchus orissai* Gupta and Fatma, 1983. (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior of female; (e) eggs.

Fig. 119. *Pseudorhadinorhynchus srivastavi* Gupta and Fatma, 1983. (a) male; (b) proboscis; (c) posterior of female; (d) anterior body spines; (e) eggs.

Fig. 120. *Indorhynchus indicus* (Tripathi, 1959) Golvan, 1969. (a) male; (b) proboscis hooks; (c) anterior body spine;

Fig. 121. *Telosentis mizellei* Gupta and Fatma, 1987. (a) male; (b) proboscis hooks; (c) trunk spines.

Fig. 122. *Tenuiproboscis clupei* Gupta and Sinha, 1991. (a) juvenile male; (b) proboscis.

Fig. 123. *Tenuiproboscis guptai* Gupta and Sinha, 1989. (a) female; (b) proboscis hooks.

Diagnosis : (after Tripathi, 1959) : Male : Body 4.9-5.8 × 0.84-1.01. Proboscis 0.6-0.79 × 0.29-0.36 armed with 14 (18-20 in the table) rows of 20-22 hooks each, anterior hooks 0.041, basal hooks 0.041. Trunk spines anterior in 6-9 (9-12 in the table) circular rows, last row with 36 spines, larger hooks on base of proboscis absent. Proboscis sheath 1.45-1.59 × 0.29-0.36. Testes in anterior half of body. Lemnisci reaching anterior testis. Cement glands pyriform, 8 in number. Saefftigen's pouch present ? *Female* : Body 6.27-7.55 × 1.07-1.21. Eggs 0.79 × 0.019.

Remarks : Tripathi (1959) described the species *Rhadinorhynchus indicus* from marine siluroid fish at Chilka. His improper diagnosis of the species has made Golvan (1969) to erect a new genus with *I. indicus* as its type species. Tripathi (1959) did not report Saefftigen's pouch in his description. Golvan (1969) had observed the massive structure at the posterior part of the trunk in the figure and expressed it as Saefftigen's pouch.

38. Genus *Telosentis* Van Cleave, 1923

Generic Diagnosis : Illiosentidae : Trunk armed with spines at anterior and posterior extremities. Proboscis cylindrical to claviform, with 10-14 longitudinal rows of 16-26 or more hooks. Proboscis sheath long with ganglion wide apart from its base. Lemnisci not markedly longer than proboscis sheath. Cement glands more than 6, close together. Genital pore of male sub-terminal. Eggs oval or more elongate. Parasites of marine fishes.

Type species : *Telosentis molini* Van Cleave, 1923.

Type Host : *Atherena hepsetus.*

Type locality : Mediterranean.

165. *Telosentis mizellei* Gupta and Fatma, 1987
(Pt. 22; Figs. 121a–121c)

T. mizellei Gupta and Fatma,1987 : *Ind. J. Helminth.*, 39(2) : pp. 128-142. Type locality : Tamil Nadu.

Host : *Lutjanus johni.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 7.0 × 1.55, trunk spines in 15 circles extending up to posterior end of body. Proboscis 0.60 × 0.56 armed with 16 rows of 20 hooks each, hooks of anterior to middle 0.050-0.060, basal hooks large, 0.060-0.070 long. Proboscis sheath 0.7 × 0.22 Lemnisci sub-equal, L/1–0.40 × 0.05; L/2–0.45 × 0.052. Anterior testis 1.11 × 0.41; posterior testis 1.1 × 0.46. Cement glands 8, pyriform. Genital pores terminal with few genital spines.

166. *Telosentis lutianusi* Gupta and Gupta, 1989

T. lutianusi Gupta and Gupta, 1989 : *Revista Parasitol.* 6(3) : pp. 306-310.

Host : *Lutianus leiglossus.*

Location : Puri Coast, Orissa.

Remarks : Description could not be provided due to lack of literature.

Family POMPHORHYNCHIDAE Yamaguti, 1939
Synonym Spirorhynchidae Harada, 1935

Family Diagnosis : Palaeacanthocephala; Echinorhynchida : Trunk aspinose, Lacunar system consisting of lateral main vessels and reticular anastomoses. Proboscis usually cylindrical, uniformly armed. Neck very long, cylindrical, twisted, with or without bulbous swelling. Proboscis sheath long, double walled, inserted at base of proboscis. Lemnisci short or rudimentary. Testes oval, never cylindrical, in mid-region of trunk. Cement glands usually compact, 4 or 6 in number. eggs with polar prolongations of middle shell. Parasites of fish.

Type genus : *Pomphorhynchus* Monticelli, 1905

Key to the genera of POMPHORHYNCHIDAE

1. Proboscis short, cylindrical, neck more or less spirally twisted ..... ***Longicollum***

   Proboscis long 2

2. Proboscis long, cylindrical, neck with bulb ..... ***Pomphorhynchus***

   Proboscis nearly filiform to claviform; neck slender, not spirally twisted, without bulb ..... ***Tenuiproboscis***

39. Genus ***Tenuiproboscis*** Yamaguti, 1935

Generic Diagnosis : Pomphorhynchidae : Trunk approximately cylindrical, fairly long in female, but short in male. 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 sheath slender, double walled, reaching a little into trunk. Lemnisci slender, digitiform or claviform. Testes in middle third of body. Cement glands 4-6 (usually 6), spherical to oval, close together. Eggs with polar prolongations of middle shell. Parasites of fresh water fish, accidentally in dogs.

Type species : *Tenuiproboscis misgurni* Yamaguti, 1935.

Type locality : Japan.

Key to species

Cement glands 4 ..... *T. guptai* Gupta and Sinha, 1989

Cement glands 6 ..... *T clupei* Gupta and Sinha, 1991

167. ***Tenuiproboscis clupei*** Gupta and Sinha, 1991
(Pt. 22; Figs. 122a–122b)

T. clupei Gupta and Gupta,1991: *Ind. J. Helminth.* **43**(2) : pp. 108-118. Type locality : Puri coast, Orissa.

Host : *Clupea longiceps.*

Location : Intestine.

Diagnosis : (after Gupta and Sinha, 1991) : Male: Body 5.80-7.60 × 0.85-1. 20. proboscis 0.58-0.60 × 0.24-0.26, armed with 14-16 rows of 10 hooks each; anterior 5 rows longer, 0.042-0.046; middle 0.038-0.040; basal largest 0.050-0.058. proboscis sheath 2.35-2.6 × 0.15-0.20. Lemnisci 0.55-0.60 × 0.05-0.08. Testes oval, tandem, T/1–0.45-0.48 × 0.20-0.22; T/2–0.45-0.48 × 0.20-0.22. Cement gland 6, elongated. Saefftigen's pouch 0.55-0.70 × 0.15-0.25. Genital pore terminal.

168. ***Tenuiproboscis guptai*** Gupta and Sinha, 1989
(Pt. 22-23; Figs. 123a–123e)

T. guptai Gupta and Sinha, 1989 : *Ind. J. Helminth.*, **41**(2) : pp. 104-107. Type locality : Calcutta.

Host : *Gerres setifer.*

Location : Intestine.

Remarks : No literature is available.

40. Genus ***Pomphprhynchus*** Monticelli, 1905

Generic Diagnosis : Pomohorhynchidae : Body small. Trunk aspinose, hypodermic nuclei small, numerous. Lacunar system with reticular anastomoses. Neck very long, cylindrical, with 12-20 longitudinal rows of 10-14 hooks each; posterior hooks much more slender than anterior. Proboscis sheath double walled, inserted at posterior end of proboscis and extending backward throughout neck. Lemnisci short, claviform. Testes tandem, near middle of trunk. Cement glands 6, rounded to oval. Genital pore of both sexes terminal, not surrounded by spines. Eggs fusiform, with prominent polar prolongations of middle shell. Parasites of fish.

Type species : *Pomphorhynchus laevis* (Zoega in Muller, 1776) Van Cleave, 1924.

Key to species of *Pomphorhynchus*

1. Proboscis hooks in 14 long. rows of 11 hooks each ..... *P. bufonis*

   More longitudinal rows on proboscis 2

2. Longitudinal rows of hooks 14-16 ..... *P. kashmirensis*

   Longitudinal rows of hooks 18 ..... *P. dubious*

169. ***Pomphohynchus bufonis*** Fotedar *et al.*, 1970
(Pt. 23; Figs. 124a–124c)

P. bufonis Fotedar *et al.*,1970: *Ind. J. Helminth.*, **22**(1) : pp. 41-45. Type locality : Kashmir

Host : *Bufo viridis.*

Location : Intestine.

Diagnosis : (after Fotedar *et al.*, 1970) : *Male* : Body 6.5 × 1.00. Proboscis 0.62 × 0.2, armed with 14 longitudinal rows with 11 hooks each. Hooks 0.20-0.32. Neck 1.5 × 0.2; bulb 0.9 (diameter). Proboscis sheath 2.00. L/1–0.7; L/2–0.8. Testes equal, 0.4 × 0.24. Cement glands 6. Saefftigen's pouch present.

Remarks : The species of the genus are generally fish parasites. The authors reported it from amphibian host. The size and shape of different organs displayed by the species appear to be juvenile. The status of the species may be said to be uncertain till the adult specimens are obtained and examined from the same locality.

170. ***Pomphorhynchus dubious*** Kaw, 1941
(Pt. 23; Figs. 125a–125d)

P. dubious Kaw, 1941 : *Proc. Indian Acad. Sci.*, **13**(6); Sec. A : pp. 369-378. Type locality : Kashmir

Host : *Rana cyanophlictis.*

Location : Intestine.

Diagnosis : (after Kaw, 1941) : *Male* : (Juv.) : Body 6.9-7.1 long. Proboscis cylindrical, 0.75-1.00 × 0.21-0.28, armed with 18 rows with 13 hooks each, hooks 0.095 long. Lemnisci 0.6-0.9 long. Cement glands 6, with nuclear fragments. *Female* : 8.75-10.3 long.

Remarks : Kaw (1941) reported the juvenile species in an amphibian host of Kashmir but the number of hooks on proboscis is more than that of *P. bufonis.*

171. ***Pomphorhynchus kashmirensis*** Kaw, 1941
(Pt. 23; Figs. 126a–126c)

P. kashmirensis Kaw, 1941 : *Proc. Indian Acad. Sci.*, **13**(6); Sec. B : pp. 369-378. Type locality : Srinagar, Kashmir

P. kashmirensis : Dhar and Majda (1987) : from *Schizothorax sp* and *Nemacheilus sp.* at Wular lake, Kashmir

Host : *Nemacheilus kashmirensis; Schizothorax Sp. and Nemacheilus sp.*

Location : Intestine.

Diagnosis : (after Kaw, 1941) : *Male* : Body 10.3-11.6. Proboscis cylindrical, 0.55-0.62 × 0.25-0.36, armed with 14-16 rows of 11-12 hooks each, posterior-most hooks in horizontal

row, anterior hooks decrease in size to the posterior, roots of anterior hooks indistinct, those of posterior hooks with small process, hooks 0.024-0.028, posterior hooks 0.041 long, anterior roots bifurcated. Neck long, with bulbous expansion, 0.90-1.05 × 0.25-0.50; bulb occupies 0.65-1.03 of length of neck; and 0.65-1.50 wide. Proboscis sheath sacciform, 2.2-2.8, double walled but outer layer incomplete, ganglion at base. Lemnisci cylindrical, 0.80-1.35 × 0.26-0.45, with many nuclei. Testes 1.4 × 1.0 and 1.3 × 1.0. cement glands 5-8, pear shaped, with many nuclei. Eggs 0.075-0.085 × 0.010-0.017.

Remarks : Kaw (1941) for the first time reported an adult species of *Pomphorhynchus* in fish host of Kashmir. He has also reported some juvenile forms in amphibian hosts of Kashmir which might be considered as intermediate hosts. There is a great alikeness between *P. bufonis* and *P. kashmirensis* with regard to number of rows and hooks per row on proboscis, number of cement glands, diameter of the neck bulb etc. The only difference in size and host is due to its juvenile-hood. Therefore, it is presumed that *P. bufonis* may be the juvenile of *P. kashmirensis.*

Other species :

172. ***Pomphorhynchus megacanthus*** Fotedar & Dhar, 1977 from Kashmir

173. ***Pomphorhynchus kawi,*** Fotedar and Dhar, 1977 from Kashmir

174. ***Pomphorhynchus tori*** Fotedar and Dhar, 1977 from Kashmir

175. ***Pomphorhynchus jammuensis*** Fotedar and Dhar, 1977 from Kashmir

176. ***Pomphorhynchus orieni*** Fotedar and Dhar, 1977 from Kashmir

177. ***Pomphorhynchus orientalis*** Fotedar and Dhar, 1977 from Kashmir

178. ***Pomphorhynchus bullocki*** Gupta and Lata 1968c from Kashmir

41. Genus ***Longicollum*** Yamaguti, 1935

Synonym *Spirorhynchus* Harada, 1935 preoccupied
Spiracanthorhynchus Harada, 1938
Spirorhynchodes Strand, 1942

Generic Diagnosis : Pomphorhynchidae : Trunk elongate, nearly cylindrical.with reticular lacunar system Proboscis short, cylindrical, with hooks of different shapes. Neck unarmed, very long, more or less spirally twisted, conspicuously expanded at convex side but not forming true bulb or bulla. Proboscis sheath double walled, with ganglion at little front of its base. Lemnisci rudimentary, short saccular or forming a ring-like thickening. Testes contiguous, equatorial or post-equatorial. Cement glands 6, oval or more elongate. Eggs much elongated, middle shell prolonged at each pole, inner shell unusually thick. Parasites of marine fish.

Type species : Longicollum pagrosomi Yamaguti, 1935

179. ***Longicollum psettodesai*** Gupta and Gupta, 1979
(Pt. 23; Figs. 127a–127c)

L. psettodesai Gupta and Gupta, 1979 : *Ind. J. Helminth.* 31(2) : pp. 135-156. Type locality : Quilon, Kerala.

Host : *Psettodes erumei.*

Location : Intestine.

Diagnosis : (after Gupta and Gupta, 1979) : *Male* : Body 9.78 × 1.06, swollen anteriorly. Proboscis 0.71 × 0.26 armed with 14-16 rows of 10-12 hooks each, largest hooks 0.05-0.055 at anterior region, hooks pf middle region 0.02-0.03, posterior hooks 0.039-0.05. Neck unarmed, very long more or less spirally twisted, 3.25 × 0.32. Proboscis sheath 3.72 × 0.22, ganglion at posterior extremity. Lemnisci short, equal 0.60. T/1–0.32 × 0.22; T/2–0.34 × 0.22. Cement gland 6. saefftigen's pouch well developed.

180. ***Longicollum engraulisi*** Gupta and Fatma, 1983
(Pt. 23; Figs. 128a–128c)

L. engraulisi Gupta and Fatma, 1983 : *Ind. J. Helminth.*, 35(2) : pp. 137-154. Type locality : Quilon, Kerala.

Host : *Engraulis malabaricus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1983) : *Male* : Body elongate, 8.90, swollen anteriorly and tapering posteriorly. Proboscis short and cylindrical, 0.68 × 0.25, armed with 14 longitudinal rows of 13-14 hooks each, anterior hooks curved, 0.055-0.060, middle 0.045-0.048; basal 0.065-0.070. Neck very long 3.80 × 0.035, spirally twisted. Proboscis sheath double walled, 3.75 × 0.22, ganglion near posterior end. Lemnisci 0.58-0.60. Testes tandem, 6, elongated, 0.27-0.33 × 0.085-0.13. Saefftigen's pouch 0.68 × 0.22. Genital pore terminal

181. ***Longicollum indicum*** Gupta and Gupta, 1971

L. indicum Gupta and Gupta, 1971 : *Res. Bull. Punjab. Univ.*, 23(3/4) : pp. 417-420. Type locality : Ernaculum.

Host : *Strongylura strongylura* (type host); *L. indicum* : Soota and Bhattacharya (1981): Bull.zool. Surv. India, 3(3) : pp. 227-233.

Other Hosts : *Protonibea diacanthus; Scatophagus argus; Lethrinus reticulatus; Pennahia macropthalmus; Lobotes surinamensis; Epinephelus chlorostigma.*

Location : Intestion.

N.B. Kaw (1951) also reported a juvenile *Pomphorhynchus sp.* from *Botia berdi* at Dal lake,Kashmir but identification of species was probably not possible because of major identifying characteristics were not developed.

Distribution : Calicut and Ernaculum.

Diagnosis : (after Soota and Bhattacharya 1981) : *Male* : Body 9.5-10.5 long. Proboscis 0.77-1.0 long. Anterior testis 0.3-0.72 and posterior testis 0.37-0.67 long. *Female* : Body 8.0-10.5 long. Proboscis 0.95-1.1 long.

Remarks : Brief report published by Soota and Bhattacharya (1981) is given here in absence of original literature.

182. ***Longicollum lutiani*** Jain and Gupta, 1980

L. lutiani Jain & Gupta, 1980. *Rev. Iber. de Parasit,* 40(3) : pp. 269-281

Host : *Lutjanus jonii.*

Location : Intestine and rectum.

Locallity : Panaji, Goa.

Other Hosts : *Pomadassys gnoraka. Gerres filamentosus.*

Diagnosis : (Immature); Proboscis hooks in 12-13 longitudinal rows of 14-15 hooks each. Neck 1.455-2.580 long in male and 1.455-3.07 long in female. Digitiform lemnisci extending slightly beyond posterior end of proboscis sac.

Remarks : Source of description is Helminthological Abstract.

Family CAVISOMIDAE Meyer, 1932

Family Diagnosis : Echinorhynchida : Proboscis claviform to long and slender. Cement glands 4, elongate, tubular, or filiform. Parasites of fresh water and marine fish.

Type genus : *Cavisoma* Van Cleave, 1931

Key to genera of CAVISOMIDAE

1. Testes near posterior extremity ..... ***Cavisoma***

   Testes far away from posterior extremity 2

2. Proboscis long and slender; ganglion at base of proboscis receptacle; lemnisci long ..... ***Filisoma***

   Proboscis claviform or cylindrical 3

3. Proboscis claviform; ganglion at base of proboscis sheath ..... ***Paracavisoma***

   Proboscis cylindrical; ganglion near middle 4

4. Cement glands all at same level ..... ***Rhadinorhynchoides***

   Cement glands by twos in tandem ..... ***Neorhadinorhynchus***

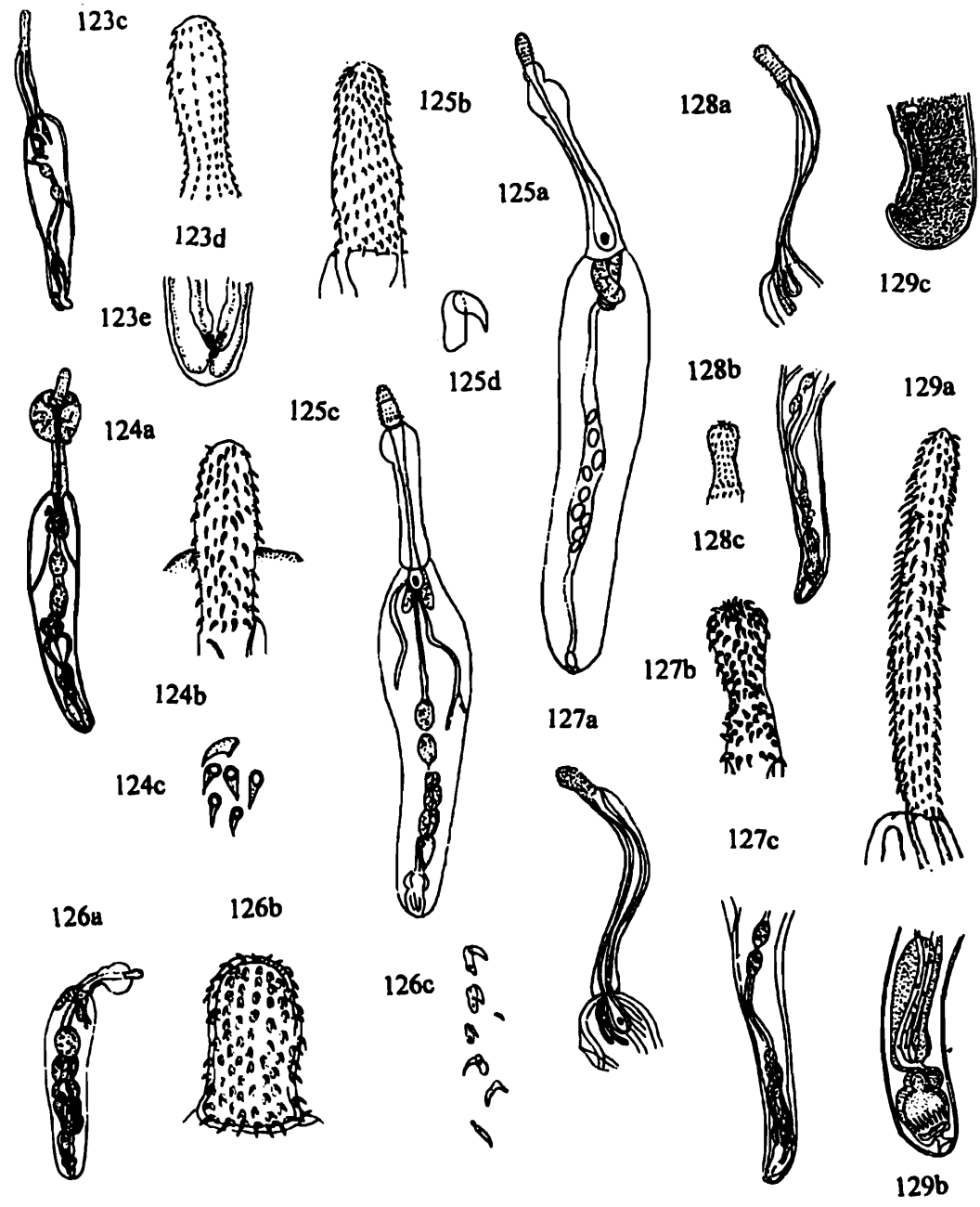

Plate-23

Fig. 123. *Tenuiproboscis guptai* Gupta and Sinha, 1989. (c) male; (d) proboscis; (e) posterior female.

Fig. 124. *Pomphohynchus bufonis* Fotedar *et al.*, 1970. (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 125. *Pomphorhynchus dubious* Kaw, 1941. (a) female; (b) proboscis; (c) male; (d) proboscis hooks.

Fig. 126. *Pomphorhynchus kashmirensis* Kaw, 1941. (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 127. *Longicollum psettodesai* Gupta and Gupta, 1979. (a) anterior of male; (b) proboscis; (c) posterior of male;

Fig. 128. *Longicollum engraulisi* Gupta and Fatma, 1983. (a) anterior of male; (b) posterior of male; (c) proboscis.

Fig. 129. *Filisoma indicum* Van Cleave, 1928. (a) proboscis; (b) posterior end of male. (c) posterior of female.

Golvan (1969) accommodated above genera in the family Fessisentidae Van Cleave, 1931. He synonymised Cavisomatidae; Cavisomatinae and Cavisomidae with Fessisentidae. Amin (1987) distinguished Fessisentidae from Cavisomidae with nuclear pouch at posterior end of outer wall of proboscis sheath and nerve ganglion at base of proboscis sheath of the former family. He, therefore, revalidated the family Cavisomidae. I agree with Amin and reassign the above mentioned genera under Cavisomidae. Only two genera viz. *Filisoma and Neorhadinorhynchus* have so far been reported from India. *Rhadinorhynchoides chromitidis* reported by Gupta and Lata (1967) was found to be of uncertain status by Golvan (1969) due its doubtful host and doubtful cement glands etc. However, I have placed the species under the family Cavisomidae temporarily.

*Gupta and Lata (1961) have reported *Rhadinorhynchoides chromitidis* with syncytial cement gland from a doubtful host, *Tenthis bamin.* Presence of syncytial cement gland in Palaeacanthocephala and occurrence of the parasite in a non-existing host in India have led Golvan (1969) to treat it a species of uncertain status.

42. Genus *Fillisoma* Van Cleave, 1928

Generic Diagnosis : Echinorhynchida; Cavisomidae : Body very long, slender, aspinose. Proboscis cylindrical, long. slender, arcuate with 16-24 longitudinal rows of 24-45 hooks each which decrease in size towards anterior and posterior ends of proboscis. Lemnisci nearly as long as, or longer than proboscis sheath. Proboscis sheath long, double walled, with ganglion at its base. Male gonads at posterior half of trunk. Cement glands 4, very long. A pair of lateral cuticular papillae may be present at level of ventral genital pore. Parasites of marine fish.

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

Type locality : Chilka lake, Orissa.

Type Host : *Scatophagus argus.*

Key to species of *Filisoma*

1. Proboscis hooks in 14-17 longitudinal rows of 20-24 hooks each ..... *F. indicum*
2. Proboscis hooks in 14-16 longitudinal rows of 26-32 hooks each ..... *F. scatophagusi*

183. *Filisoma indicum* Van Cleave, 1928
(Pt. 23; Figs. 129a–129c)
Synonym *Filisoma hoogliensis* Datta and Soota, 1962

F. indicum Van Cleave,1928 : *Rec. Ind. Mus.*, 30(2) : pp. 147-149. Type locality : Chilka, Orissa.

F. indicum : Soota and Bhattacharya (1981) *Bull. zool. Surv. India*, 3(3) : pp. 227-233.

N.B. Gupta and Naqvi (1986) described *F. inglishi* which has not been included here.

F. hoogliensis Datta and Soota, 1962 : *Rec. Ind. Mus.*, **58**(2) : pp. 67-70.

Host : *Scatophagus argus.*

Location : Intestine.

Distribution : Chilka Lake, Porto Novo, Tamil Nadu.

Diagnosis : (after Van Cleave, 1928) : *Male* : Body 20.00-30.00 × 0.28, unarmed. Proboscis 1.5 × 0.089, cylindrical, armed with 14 longitudinal rows of 24 hooks each. Median hooks 0.035 long but decreasing in size towards both ends. Proboscis sheath 1.3 long. Testes 1.2 × 0.25. Genital pore opens ventrally between two papillae. Cement glands 4, elongated, intestiform (after Van Cleave and Lincicome, 1940).

(after Yamaguti, 1954) : *Male* : 28.00-34.00 long, and 0.40-0.55 wide. Proboscis 0.6-0.8 × 0.06-0.010. armed with 14-17 longitudinal rows with 20-24 hooks in each row. Saefftigen's pouch claviform, 1.3-1.45 × 0.3-0.36. Testes 1.2-2.2 × 0..35-0.5. Cement glands 6. Female: 38.00-56.00. × 0.65-0.95. vulva ventro-terminal. Eggs 0.054-0.057 × 0.016-0.017 with polar prolongations of middle shell.

Remarks : Description reproduced from Fascicule Unique by Golvan (1969). Gupta and Jain (1979) considered *F. hoogliensis* a junior synonym of *F. indicum.*

184. ***Filisoma scatophagusi*** Datta and Soota, 1962
(Pt. 24; Figs. 130)

F. scatophagusi Datta and Soota, 1962 : *Rec. Ind. Mus.* **58(2)** : pp. 67-70. Type locality : River Highly, Calcutta.

Host : *Scatophagus argus.*

Location : Intestine.

Diagnosis : (after Datta and Soota, 1962) : Female : Body 115.00 × 0.5-1.6. Proboscis 1,1 × 0.9, armed with 14-16 rows of 26-32 hooks each, dorsal and ventral markedly different, apical hooks fewer, 10 mid-dorsal hooks exceptionally large and stout, measuring 0.04-0.06 long and 0.01-0.02 long, hooks reduce progressively towards base, measuring 0.02-0.04 × 0.004-0.01 long; 2nd dorsal sub-median 0.02-0.04 × 0.008. ventral hooks 0.008-0.03 × 0.004. Proboscis sheath double walled, Neck 0.1 × 0.3.

185. ***Filisoma hoogliensis*** Datta and Soota, 1962
(Pt 24; Figs. 131)

F. hoogliensis Datta and Soota, 1962 : *Rec. Ind. Mus.* **58**(2) : PP. 67-70. Type locality : River Highly, Calcutta.

Host : *Scatophagus argus.*

Location : Intestine.

Diagnosis : *Female* : Body 43.00 long. Proboscis 0.8 × 0.1 armed with 14 rows with 24-28 hooks each, anterior hooks 0.02-0.04 × 0.004-0.01, dorsal and ventral hooks different, ventral hooks 0.01-0.04 × 0.008.

Remarks : Gupta and Jain (1979) synonymised the species with *F. indicum.* Therefore *it is not included in the key to species.*

43. Genus ***Neorhadinorhynchus*** (Yamaguti, 1939) status emended
Synonym *Neogorgorhynchus* Golvan, 1960

Generic Diagnosis : Echinorhynchida; Cavisomidae: trunk sub-cylindrical, slender, aspinose. Proboscis cylindrical, with 14-18 longitudinal rows of 17-25 hooks each; ventral hooks may be little larger than dorsal hooks. Neck present. Proboscis sheath double walled, with ganglion at middle or more anteriorly. Lemnisci claviform, moderately long. Testes contiguous, equatorial or post-equatorial. Cement glands 4, by twos in tandem. Parasites of marine fish.

Type species : *Neorhadinorhynchus aspinosum* (Fukui et Morishita, 1937) Yamaguti, 1939

Type Host : *Teuthis fuscescens.*

Type locality : Japan.

186. ***Neorhadinorhynchus robustus*** (Edmonds, 1964) Golvan, 1969
(Pt. 24; Figs. 132a–132f)
Synonym *Neogorgorhynchus robustus* Edmonds, 1964

Neogorgorhynchus robustus Edmmonds, 1964 : *Transac. Roy. Soc. South Australia,* 57 : pp. 44-45. Type locality : Queensland. Type Host : *Siganus lineatus*

Host : *Siganus canaliculatus.*

Location : Intestine.

Distribution : Tuticorin, Tamil Nadu.

Diagnosis : *Male* : Body medium, slender, ventrally curved, 12.00-15.5 × 1.5-1.625, aspinose Proboscis cylindrical, 0.60-0.675 × 0.2-0.225 armed with 14-16 longitudinal rows with 12-13 hooks each, no difference in size of dorsal and ventral hooks, size of hooks 0.0415-0.0581, hooks of apical and basal smaller than rest. Lemnisci claviform, longer than proboscis sheath. Proboscis sheath double walled, ganglion near middle, 1.12-1.125 × 0.15-0.175. Gonads post-equatorial. testes tandem, T/1–0.6-0.625 × 0.40-0.45; T/2–0.60-0.65 × 0.45-0.50. Cement glands 4 by twos in tandem. Seminal vesicle long. *Female* : 12.75-29.75 × 1.00-1.625. Genital pore terminal. Eggs 0.041-0.045 × 0.012-0.015, with polar prolongations of middle shell.

Remarks : Edmonds (1964) described *Neogorgorhynchus robustus* from *Siganus lineatus* at Queensland which has been transferred to the genus *Neorhadinorhynchus* by Golvan (1969).

The present form under description is obtained from *Siganus canaliculatus* at Tuticorin. A series of specimens have been examined by me which characteristically conforms with the description of *N. robustus* except some variations in measurements. These variations are regarded as intraspecific.

*187. ***Rhadinorhynchoides chromitidis*** (Cable and Quick, 1954) Yamaguti, 1961
(Pt. 24; Figs. 133)

Ref. N.K. Gupta and V. Lata,1967 : *Res. Bull. Punjab. Univ. Sci.* 58(3-4) : pp. 325-341

Host : *Tenthis bamin.*

Type locality : India.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 7.4-10.1. Trunk fusiform. proboscis cylindrical 0.32-0.36 × 0.15-0.18 armed with 14 longitudinal rows of 8-9 hooks each, larger hooks 0.020-0.024, smaller hooks 0.014 long. Pr. sheath cylindrical 1.06-1.14 × 0.22-0.25. Lemnisci cylindrical, 1.01-1.33 long.Testes at middle of trunk, T/1–0.61-0.96 × 0.53-0.71; T/2–0.60-0.85 × 0.42-0.70. Cement glands syncytial, 0.98-2.45 × 0.29-0.56. Cement reservoir 0.70 × 0.56. Saefftigen's pouch 0.43 × 0.30.

Remarks : Golvan (1969) transferred *Rhadinorhynchoides chromatidis* to *Pseudocavisoma* Golvan & Houin (1964) under Fessisentidae and treated it as type species.of *Pseudocavisoma*. *R. Chomitidis* reported by Gupta and Lata (1967) has been considered as a species of doubtful status by Golvan (1969) because, the presence of syncytial cement gland as described by Gupta and Lata in their specimen is inconceivable for any member of Palaeacanthocephala. Moreover, according to his view, the distribution of the host species, *Teuthis bamin* instead of *Tenthis bamin* (doubtful genus reported by G & L) in India is also doubtful.

Order POLYMORPHIDA Golvan, 1956

Order Diagnosis : Palaeacanthocephala : Proboscis spheroid to cylindrical, armed with numerous hooks in alternating longitudinal rows. Proboscis receptacle double walled, with ganglion near centre. Parasites of reptiles, birds and mammals.

Key to families of POLYMORPHIDA

1. Trunk spinose, Parasites of vertebrates especially aquatic birds and mammals ..... POLYMORPHIDAE

   Trunk aspinose 2

2. Proboscis divided by the insertion of its receptacle into 2 regions. Parasites of terrestrial birds and mammals (one species in lizard) ..... CENTRORHYNCHIDAE

   Proboscis not divided, receptacle inserted at base of proboscis ..... PLAGIORHYNCHIDAE

Family POLYMORPHIDAE Meyer, 1931
Synonym FILICOLIDAE Petrotschenko, 1956

Family Diagnosis : Polymorphida : Trunk spinose, hypodermic nuclei small and numerous. Proboscis or trunk may be bulbous. Proboscis receptacle double walled, with ganglion near its middle. Lemnisci long, often flattened. Cement glands 2-6, exceptionally 8, unusually tubular. Parasites of vertebrates, especially of birds and mammals.

Type genus : *Polymorphus* Luhe, 1911.

Key to genera of POLYMORPHIDAE

1. Cement glands kidney shaped. Proboscis of adult female greatly swollen, with hooks restricted to short, radially arranged rows on anterior surface. Parasites of water birds ..... ***Filicolis***

   Cement glands claviform or tubular. Proboscis swollen or not; when swollen, longitudinal rows of hooks cover entire proboscis 2

2. Genital spines present on at least one sex. Parasites of aquatic birds and mammals ..... ***Corynosoma***

   Genital spines absent in both sexes 3

3. Anterior end of trunk greatly swollen, separated from rest of trunk by conspicuous constriction 4

   Anterior trunk not separated from posterior portion by narrow constriction 5

4. Anterior trunk with one field of spines surrounding it, Parasites of cetaceans ..... ***Bolbosoma***

   Anterior trunk with two fields of spines surrounding it. Parasites of cetaceans ..... ***Diplospinifer***

5. Hypodermic nuclei restricted to swollen fore trunk 6

   Hypodermic nuclei distributed throughout entire trunk 7

6. Two fields of trunk spines in at least one sex; trunk not extremely elongated. Cement glands 4. Parasites of fish eating birds ..... ***Southwellina***

   Cement glands more than 4; anterior trunk swollen, with genital spines in at least one sex ..... ***Andracantha***

7. One field of trunk spines, trunk extremely elongated, two or 4 cement glands ..... ***Arhythmorhynchus***

8 Cement glands. Parasites of aquatic birds, rarely aquatic mammals .... ***Polymorphus***

44. Genus ***Polymorphus*** Luhe, 1911

Synonym *Parafilicolis* Petrotschenk, 1956
Falsifilicolis Webstec, 1948
Hexaglandula Peteotschenko, 1950
Subcorinosoma Heklova, 1967

Generic Diagnosis : Polymorphidae: Body small, more or less plump. Anterior part of trunk spinose and shallowly constricted off from rest of body. Proboscis cylindrical or somewhat ovoid, with variable number (12-22) of longitudinal rows of 6-16 hooks each. which increase in size from the apex of the proboscis backwards but become smaller again toward the base, with reduction of their roots. Neck distinct. Proboscis sac double walled, arising from base of proboscis, with ganglion a little anterior to its base. Lemnisci cylindrical or clavate. Hypodermic nuclei small, numerous. Lacunar system reticular. Testes tandem or oblique usually anterior; Cement glands tubular, (3 according to Golvan, 1960). Genital pore terminal, not spined. Eggs fusiform, with polar prolongations of middle shell. Parasites of aquatic or semi-aquatic birds, occasionally of mammals.

Type species : *Polymorphus minutus* (Goez, 1782) Luhe, 1911

188. ***Polymorphus minutus*** (Goez, 1782) Luhe, 1911

(Pt. 24; Figs. 134a–134e)

Synonym *Polymorphus magnus* Skrjabin, 1913

P. magnus : Fotedar et Dhar (1973) : *Journal of Science, Univ. of Kashmir*, **1**(1-2).

P. magnus : Bhattacharya *et al.* (2003) : *Rec. zool. Surv. India*, **101**(1-2) pp. 87-91

Host : Juvenile from *Rana cyanophlictis* and adult from Duck.

Location : Rectum of the *Host* of juvenile and intestine of the host of adult worms.

Locality : Kashmir.

Host : *Anas querquedula* (Garganey Teal).

Location : Intestine.

Locality : Allahabad, U.P. (By Bhattacharya, 2003).

Diagnosis : (after Fotedar et Dhar, 1973) : Juvenile, anterior part of trunk spinose. Proboscis armed with 14 longitudinal rows of 8 hooks each, 1st and 2nd rows of hooks 0.030-0.035; 3rd 0.040; 4th and 5th 0.030; 7th and 8th 0.040-0.050; maximum size of hooks 0.060.

(after Bhattacharya *et al.*, 2003) : *Male* : Body small, fusiform, 5.875 × 1.125. Trunk spines 18-20 rows of 28-30 each, spines 0.249. Proboscis 0.55 × 0.32, armed with 14-16 rows of 8-9 hooks each, anterior 4 hooks of each row large and with prominent roots, size of hooks 0.415-0.585 × 0.0166-0.0249. Proboscis sheath double walled, 1.25 × 0.375, ganglion

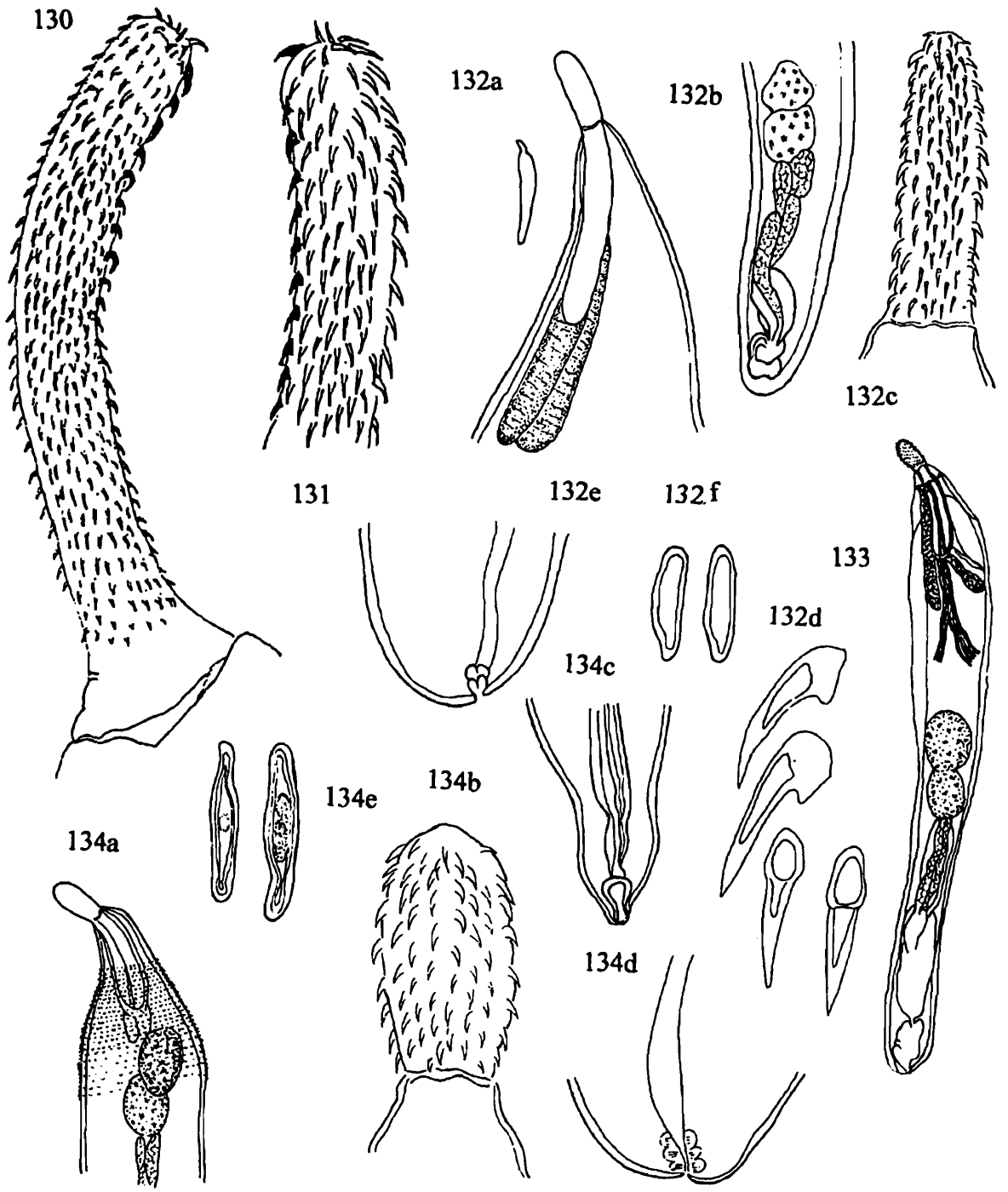

Plate-24

Fig. 130. *Filisoma scatophagusi* Datta and Soota, 1962, proboscis

Fig. 131. *Filisoma hoogliensis* Datta and Soota, 1962, proboscis.

Fig. 132. *Neorhadinorhynchus robustus* (Edmonds, 1964) Golvan, 1969 (a) Male; anterior of male; (b) posterior of male; (c) proboscis; (d) proboscis; (e) posterior of female; (f) eggs.

Fig. 133. *Rhadinorhynchoides chromitidis* (Cable and Quick, 1954). male.

Fig. 134. *Polymorphus minutus* (Goez, 1782) Luhe, 1911. (a) anterior of male; (b) proboscis; (c) posterior of male; (d) posterior of female; (e) eggs.

near centre. Lemnisci longer than proboscis sheath, 1.625 × 0.2. Testes contiguous, T/1–2.25 × 0.425; T/2–2.125 × 0.425. Cement glands 4. *Female* : 8.125-8.3 × 1.70-1.75. Eggs elliptical, 0.058-0.107 × 0.0166 with polar prolongations of middle shell.

Remarks : Fotedar and Dhar (1973) reported semi-adults and adults species in ducks of Kashmir without description. Therefore, it necessitated present author to include here the description of adult Indian form reported by Bhattacharya (2003). Amin (1992) made *P. magnus* as junior synonym of *P. minutus* and divided the genus into two subgenera viz. *Polymorphus (Polymorphus)* and *Polymorphus (Profilicolis)*. Further study may justify the necessity of such division only. Hence, the species is kept under the genus *Polymouphus*.

45. Genus ***Southwellina*** Witenberg, 1932. re-defined by Schmidt, 1972

Generic Diagnosis : Trunk swollen in anterior portion, posterior slender. Hypodermic nuclei confined in anterior trunk. Anterior trunk with 2 fields of spines on at least one sex. Anterior fields may be incomplete dorsally. Proboscis cylindrical with or without swollen area, armed with numerous longitudinal rows of hooks. Neck conspicuous. Proboscis sheath double walled inserted at base of proboscis. Lemnisci not bound to body wall at distal ends. Testes at anterior trunk. 4 tubular cement glands. Parasites of aquatic birds.

Distribution : Circum-boreal.

Intermidiate hosts : (where known) cray fish.

Paratenic hosts : Fish, amphibians, reptiles.

Type species : *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932.

Type Host : *Nycticorax nycticorax* (heron).

Key to species of *Southwellina*

1. Longitudinal rows of hooks on proboscis 17-24 with 14-17 hooks each ..... *S. hispida*

   Longitudinal rows of hooks 14 with 15 hooks each ..... *S. sacra*

189. ***Southwellina hispida*** (Van Cleave, 1925) Witenberg, 1932

(Pt. 25; Figs. 135a-135e)

Synonym *Arhythmorhynchus hispidus* Van Cleave, 1925
Arhythmorhynchus duocinctus Chandler, 1935
**Arhythmorhynchus tigrinus* Moghe et Das, 1953
Polymorphus ardae Belopolskaia, 1958
Hemiechinosoma ponticum Petrotschenko et Smogorjevskia, 1962
Arhythmorhynchus fuscus Harada, 1929

Arhythmorhynchus tigrinus Moghe et Das, 1953 : *Thapar's Comm. Vol.* pp. 211-217.

Southwellina hispida : Bhattacharya *et al.* (2002) : *Rec. zool. Surv. India*, 100(3-4) pp. 73-83.

Host : *Nycticorax nycticorax; Haliaster Indus.*

Host : *Rana tigrina.*

Locality : India (By Moghe & Das, 1953).

Location : Intestine.

Locality : Chilka Lake, Orissa.

Diagnosis : (after Bhattacharyaet al, 2002) : *Male* : (from Haliaster Indus) : Body 12.5-14.3 × 1.65-3.12. Proboscis 0.8 × 0.375, armed with 20-22 rows of 16-17 hooks each, 2-3 hooks per row at mid-proboscis stout and broad, anterior and posterior hooks 0.0249-0.498 × 0.0083, anterior roots 0.033-0.066 × 0.0083, roots of mid-proboscis 0.066-0.0664 × 0.0166-0.0249. Neck 2.25-0.45 × 0.55-0.575. Proboscis sheath 0.3 × 0.55, ganglion near centre. Lemnisci 1.75 × 0.825. Testes at anterior trunk, ruptured. Cement glands 4, 4.625-5.815. Trunk spines anterior, sparse, in two fields, not very clear. Female: Body 10.5-15.6 × 1.06-3.5. proboscis 0.675-0.094 × 0.289-0.3. Eggs 0.083-0.125 × 0.025-0.05.

*Synonym : ***Arhythmorhynchus tigrinus*** Moghe and Das, 1953
(Pt. 34; Figs. 190a–190c)

A. tigrinus Moghe and Das,1953: *Thapar Comm.Vol.* pp. 211-216. Locality : Chilka, Orissa.

Host : *Rana tigrina.*

Location : Intestine.

Diagnosis : (after Moghe and Das, 1953) *Male* : Body 0.25 × 0.55. Proboscis 0.7 × 0.25 (mid-proboscis) armed with 17-18 rows of 14-15 hooks each., anterior hooks 0.03; middle 0.04; base 0.03. Proboscis receptacle 0.06. Lemnisci 1.00 × 0.15. T/1–0.15; T/2- 0.15. number of cemrnt gland not mentioned. Trunk spines in 2 fields, 1st 0.12 wide with 40-44 rows of spines; 2nd 0.2 wide with 48-52 rows of spines.

Remarks : Van Cleave (1925) described *Arhythmorhynchus hispidus.* Witenberg (1932) erected the new genus *Southwellina* with the type species *S.hispida* (Van Cleave, 1925). Yamaguti (1963) suppressed the genus which was later resurrected by Schmidt (1972). Further, Scholz *et al.* (1992) had appreciated the work of Schmidt and gave detail description of *S. hispida* obtained from *Phalacrocorax carbo sinensis* at Czechoslovakia. After critical examination of description of **Arhythmorhynchus tigrinus,* Bhattacharya *et al.* (2002) found similarity with *S. hispida* and synonymised it with *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932.

190. ***Southwellina sacra*** Bhattacharya *et al.*, 2002
(Pt. 25; Figs. 136a–136e)

S. sacra Bhattacharya *et al.*, 2002 : *Rec. zool. Surv. India,* 100 (3-4) : pp. 73-83. Type locality : Port Blair, Andaman Is.

Host : *Egretta sacra.*

Location : Intestine.

Diagnosis : (after Bhattacharya *et al.*, 2002) : *Male* : Body 4.875 × 0.75 (anterior) and 0.27 (posterior). Proboscis 0.675-0.696 × 0.2 (mid-proboscis), armed with 14 rows of 15 hooks each, hooks (tip) 0.03-0.036 × 0.004-0.01; middle 0.036-0.042 × 0.018; basal hooks 0.036-0.052 × 0.01-0.012. Hypodermic nuclei at anterior trunk, trunk spines in two fields at broad anterior trunk, 1st field 0.166-0.182 wide, with 8-10 rows of spines, 2nd field 0.248-0.289 wide with 8-12 rows of spines. Proboscis sheath 0.85 × 0.225, ganglion near centre. L/1–0.75 × 0.125; L/2–1.05 × 0.225; T/1–0.375 × 0.25. T/2–0.347 × 0.207. Cement glands 4, 0.375 long. Female : Body 4.5-5.5 × 1.00-1.75, Trunk spines in two fields. Eggs 0.083-1.00 × 0.024-0.033, with polar prolongations of middle shell.

Family PLAGIORHYNCHIDAE Golvan, 1960. emended by Yamaguti, 1963

Family Diagnosis : Polymorphida : Trunk aspinose, fusiform or cylindrical. Proboscis cylindrical or somewhat bulbous, usually short, with more or less uniform hooks, though basal hooks are smaller. 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 prolongations of middle shell. Parasites of birds, occasionally of reptiles.

Type genus : *Plagiorhynchus* Luhe, 1911

Key to subfamilies of PLAGIORHYNCHIDAE

1. Proboscis cylindrical, proboscis hooks similar, with posteriorly directed roots except one or more rows of rootless basal spines. Parasites of birds ..... PLAGIORHYNCHINAE

   Proboscis ovoid to spheroid. Posterior hooks spiniform and rootless 2

2. Posterior hooks numerous, diminish in size apically and posteriorly; manubria directed anteriorly. Cement glands 2-4. Parasites of birds and mammals ..... PORRORCHINAE

   Proboscis hooks fewer, diminish in size posteriorly; manubria complex. Cement glands 4-6. Parasites of reptiles ..... SPHAERECHINORHYNCHINAE

Subfamily PLAGIORHYNCHINAE Meyer, 1931

Subfamily Diagnosis : Plagiorhynchidae : Trunk fusiform or cylindrical. Proboscis cylindrical or somewhat bulbous, with numerous hooks. Lemnisci slender, without central canal. Cement glands tubular or reniform. Parasites of birds.

Type genus : *Plagiorhynchus* Luhe, 1911.

Schmidt and Kuntz (1966) had divided the genus Plagiorhynchus and transferred all the species to two sub-genera according to structure of eggs, and position of female

genital pore of each species. Later, Golvan (1994) in his work on "Nomenclature of the Acanthocephala" had opposed many of such transfer and re-instated a number of species of the genus. I, presently maintain the views of S & K (1966) and report accordingly.

46. Genus ***Plagiorhynchus*** Luhe, 1911
Synonym *Prosthorhynchus* Kostylew, 1915

Generic Diagnosis : Plagiorhynchidae; Plagiorhynchinae: Body cylindrical or slightly ovoid, aspinose, numerous hypodermal nuclei. Proboscis cylindrical with numerous hooks. Hooks similar, simple with backwardly directed roots, except one or more rootless spines usually present basally. Proboscis sheath double walled, cylindrical, inserted at base of proboscis, ganglion at middle third of sheath Lemnisci tubular, usually long. Testes in middle to anterior third of trunk. Cement glands long, tubular, 3-6. Genital pore terminal or sub-terminal. Eggs oval or elongate, outer shell sculptured or not, middle shell thick, with or without polar prolongations. Parasites of birds rarely of mammals.

Type species : *Plagiorhynchus crassicolle* (Villot, 1875) Luhe, 1911.

Key to the subgenera of *Plagiorhynchus*

Female genital pore terminal, Eggs with outer shell smooth, middle shell with polar swellings ..... ***Plagiorhynchus (Plagiorhynchus)***

Female genital pore sub-terminal, Eggs oval with outer shell sculptured with ridges and grooves, middle shell without polar swellings ..... ***Plagiorhynchus (Prosthorhynchus)***

Subgenus ***Plagiorhynchus (Plagiorhynchus)*** Schmidt and Kuntz, 1966

Diagnosis : *Plagiorhynchus* : *Male* : Characteristics of the genus Pagiorhynchus. Female genital pore terminal. Eggs elongate with outer shell smooth, middle shell with polar swellings. Usually parasites of aquatic birds. Intermediate *Host* unknown.

Type species : *Plagiorhynchus (Plagiorhynchus) crassicolle* (Villot, 1875) Luhe 1911

191. ***Plagiorhynchus (Plagiorhynchus) charadrii*** (Yamaguti, 1939) Van Cleave, 1951
(Pt. 25; Figs. 137a–137d)

P. charadrii : Soota *et al.* (1971) : *Proc. Ind. Acad. Sci.* 73 B(1) : pp. 20-29. Type locality : Cambell Bay, Great Nicobar.

Host : Golden plover.

Location : Intestine.

Diagnosis : (after Soota *et al.*, 1971) : Female : Body plump, fusiform, 11.2 × 2.0. Proboscis cylindrical, claviform, 1.0 × 0.2, armed with 18 longitudinal rows of 18-20 hooks each,

distal hooks stout, 0.060 long; mid-proboscis hooks 0.048 long basal 3 or 4 hooks per row spiniform with abbreviated roots. Proboscis sheath 2.0 long; retinacula posterior, Lemnisci long, reaching mid-body. Genital pore sub-terminal. Eggs elliptical, 0.100-0.110 × 0.033-0.044, middle shell with distinct polar bulb.

Remarks : Yamaguti (1939) described *Prosthorhynchus charadrii* from plover of Japan. Van Cleave (1951) had reported the same species in some Charadriformis birds of Alaska and assigned the species to the genus *Plagiorhynchus*. Subsequently, Golvan (1956), and Schmidt and Kuntz (1966) accepted such placement.

Subgenus ***Plagiorhynchus (Prosthorhynchus)*** Schmidt and Kuntz, 1966

Diagnosis : Plagiorhynchus : *Male* : characteristics of the genus *Plagiorhynchus*. Female genital pore sub-terminal. Eggs oval with outer shell sculptured, with ridges and grooves, middle shell without polar swellings. Usually parasites of terrestrial birds. Intermediate hosts are terrestrial isopods.

Type species : *P. (P.) cilindraceus* (Goez, 1782) Schmidt and Kuntz, 1966.

The basic difference between two sub-genera is sub-terminal female genital pore, and oval eggs without polar prolongations of middle shell in *P. (Prosthorhynchus)*, and terminal genital pore in female with polar prolongations of middle shell of elongated eggs of *P. (Plagiorhynhchus)*.

Key to species of the subgenus *P. (Prosthorhynchus)*

1. Proboscis hooks in 14 longitudinal rows of 14 hooks each ..... *P. (P) deysarkari*

   More than 15 rows of hooks on proboscis 2

2. Pr. hooks in 16-17 rows of 13-14 hooks each ..... *P. (P) kuntzi*

   Pr. hooks in 18-20 rows of 16 hooks each ..... *P. (P) nicobarensis*

192. ***Plagiorhynchus (Prosthorhynchus) deysarkari*** Bhattacharya, 2002
(Pt. 25; Figs. 138a–138f)

P. (P) deysarkari Bhattacharya, 2002 : *ZSI., Fauna of Tripura, State Fauna Series*, 7(Part-4) : pp. 141-162. Type locality : Ambasa, North district of Tripura.

Host : *Sturnus malabaricus*.

Location : Intestine.

Diagnosis : (after Bhattacharya, 2002) : *Male* : Body plumpy, 7.625 × 1.625. Proboscis 0.95 × 0.225, cylindrical, armed with 14 longitudinal rows of 14 hooks each, basal hooks smaller than anterior hooks, all hooks rooted except last two of ech longitudinal row, anterior hooks 0.054-0.064 (points); 0.052-0.094 (roots); basal hooks0.03 long. Proboscis

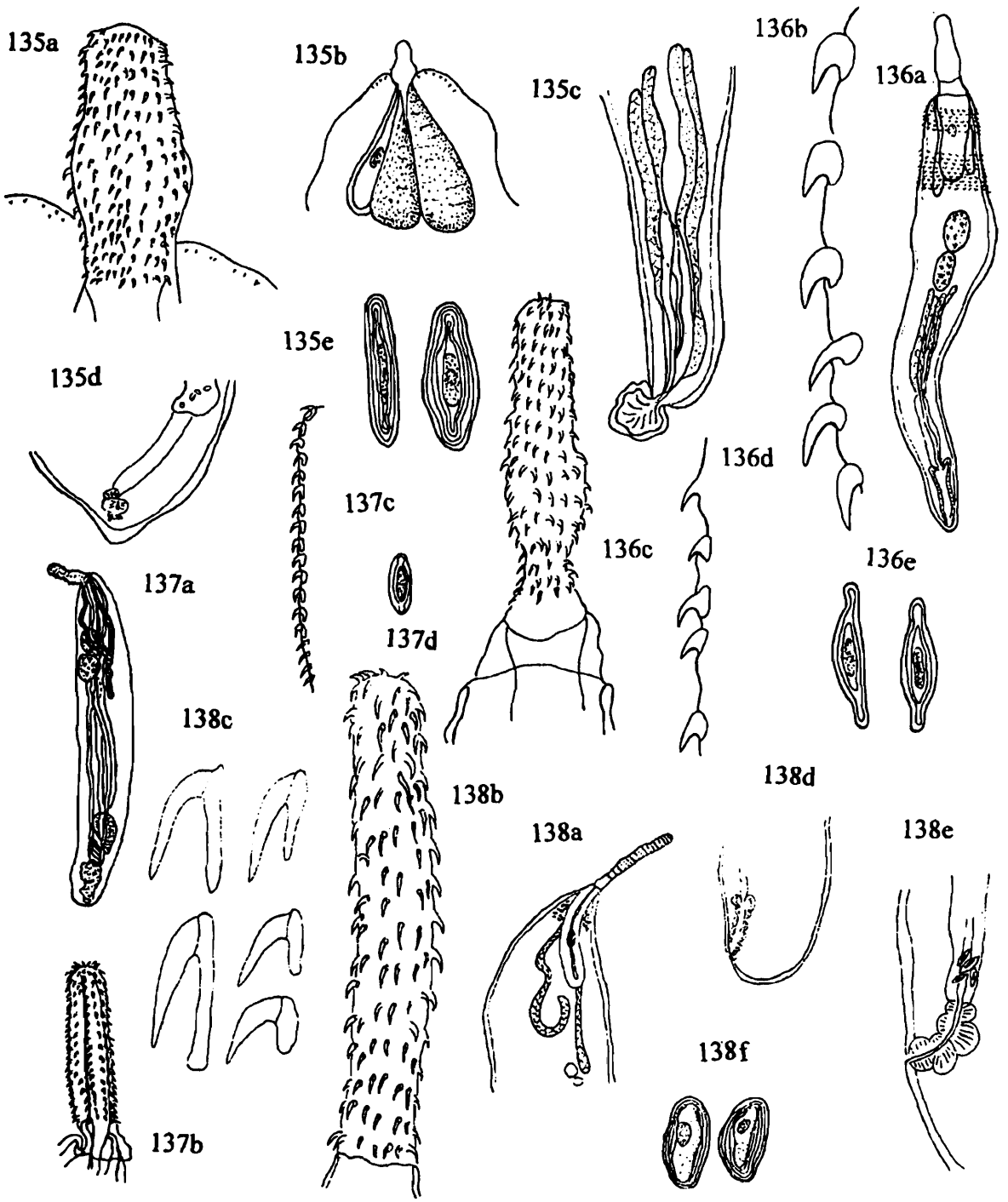

Plate-25

Fig. 135. *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932. (a) pproboscis; (b) anterior of male; (c) posterior of male; (d) posterior of female; (e) eggs.

Fig. 136. *Southwellina sacra* Bhattacharya *et al.*, 2002. (a) male; (b) proboscis hooks; (c) proboscis; (d) trunk spines in two fields. (e) eggs.

Fig. 137. *Plagiorhynchus (Plagiorhynchus) charadrii* (Yamaguti, 1939). (a) male; (b) proboscis; (c) proboscis hooks; (d) egg.

Fig. 138. *Plagiorhynchus (Prosthorhynchus) deysarkari* Bhattacharya, 2002 (a) anterior of female; (b) proboscis; (c) proboscis hooks; (d) posterior of female; (e) posterior of female; (f) eggs.

sheath 1.5 × 0.5, double walled, ganglion at the middle. Lemnisci long, slender, coiled. Testes 1.425 × 0.625, overlapping. Cement glands 4, Genital pore terminal. *Female* : Body 11.125 × 1.875, hypodermic nuclei present. Genital pore sub-terminal. Eggs 0.041-0.074 × 0.024-0.033, without polar prolongations of middle shell.

193. ***Plagiorhynchus (Prosthorhynchus) kuntzi*** (Gupta and Fatma, 1987) n. comb.
(Pt. 26; Figs. 140a–140c)

Plagiorhynchus kuntzi Gupta and Fatma, 1987 : *Ind. J. Helminth*, 39(2) : pp. 128-142. Type locality : Prince of Wales Zoo. Garden, Lucknow.

Host : *Dichoceros bicornis* (Great hornbill).

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 7.55 × 1.55, Hypodermal nuclei numerous, Proboscis 0.46 × 0.20, armed with 16-17 rows of 13-14 hooks each, hooks uniform, basal hooks smaller and one or two hooks per row rootless, remaining hooks with backwardly directed roots, average hooks 0.03-0.046 long, rootless spines 0.040-0.042. Proboscis sheath double walled with ganglion near middle. L/1–0.88 long; L/2–1.22 long. Testes pre-equatorial, T/1–0.85 × 0.60; T/2–0.85 × 0.63. cement glands 4. Genital pore terminal. Female: Body 11.70-12.55 × 0.65-0.80. Eggs oval, 0.060-0.065 × 0.035-0.038. Genital pore terminal or subterminal.

Remarks : The distinguishing features of the subgenus *P.(Plagiorhynchus)* are not clear in the original description of the species. However, study of the diagrams reveals that it bears eggs without polar prolongations of middle shell, and female genital pore is slightly sub-terminal. On the basis of this observation, I refer the species to the sub-genus *P. (Prosthorhynchus).*

194. ***Plagiorhynchus (Prosthorhynchus) nicobarensis*** (Soota and Kansal, 1972) Zafar and Farooqi, 1981
(Pt. 26; Figs. 139a–139e)

Prosthorhynchus nicobarensis Soota and Kansal, 1972 : *Rec. zool. Surv. India*, 66 : pp. 303-307. Type locality : Car Nicobar Is.

Plagiorhynchus nicobarensis (Soota and Kansal, 1972) : Zafar and Farooqi, 1981. *Indian J. Parasitology*, 5(2) : pp. 179-182. Locality : Aligarh.

Host : *Zootheria citrine* (Type *Host*); *Turdoides caudatus* from Aligarh.

Location : Small intestine.

Diagnosis : (after Zafar and Farooqi, 1981) : *Male* : Body fusiform, 8.0-10.0 × 1.5-2.0. Proboscis cylindrical, 0.85 × 0.2; armed with 18-20 longitudinal rows of 16 hooks each, anterior hooks 0.075 long, size decreasing posteriorly, basal 2-3 rows of hooks spiniform, 0.040 long. Neck truncate. Proboscis sheath 1.65 long ganglion at anterior middle.

L/1–2.65; L/2–2.75. Testes oval tandem. T/1–1.27 × 0.65; T/2–1.10 × 0.75. Cement glands 4; in two tandem pairs. Saefftigen's pouch large.

Remarks : Zafar and farooqi (1981) transferred the species to the sub-genus *P. (Prosthorhynchus)* as they observed unsculptured outer egg shell, sub-terminal genital pore of the females and absence of polar swellings of the middle shell in their specimens as well as in the original description.

Subfamily PORRORCHINAE Golvan, 1956

Subfamily Diagnosis : Plagiorhynchidae: Proboscis ovoid to spheroid. Anterior proboscis hooks strong with posteriorly directed roots, posterior hooks spiniform 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

Key to the genera of the subfamily PORRORCHINAE

1. Lemnisci many ..... ***Luehia****
   Lemnisci two 2
2. Distal end of lemnisci bound to body wall with ligaments ..... ***Pseudoluehia***
   Distal end of lemnisci free in the body cavity 3
3. Genital pore terminal in both sex ..... ***Owilfordia***
   Genital pore terminal or sub-terminal in both sex ..... ***Porrorchis***

47. Genus ***Porrorchis*** Fukui, 1929
Synonym *Psedoporrorchis* Ioyeux et Baer, 1935

Generiic Diagnosis : Plagiorhynchidae; Porrorchinae : Trunk elongate cylindrical, slightly swollen near anterior end in both sexes and at the posterior end in females. Terminal digitiform process sometimes present on gravid females. Internal pseudometamerism due to circular muscle bands usually quite distinct. Hypodermic nuclei small, moderately numerous, distributed only at anterior swelling. Main lacunar canals lateral. Proboscis ovoid, bearing numerous longitudinal rows of hooks. First few hooks in each row strong, with well developed simple roots; remaining spines rootless but with delicate, simple, anteriorly directed manubrium. Proboscis sheath double walled, inserted at base of proboscis; brain at about middle of sheath. Lemnisci long, flat, bound to body wall by

* The genus *Oligoterorhynchus* under Porrorchinae is poorly defined. Schmidt and Kuntz (1967) expressed doubt in the validity of the genus. The genus *Luehia* has not been reported so far from India.

ligaments. Testes oval, tandem, well separated or close together, in anterior third of trunk. Cement glands long, tubular. Genital pore terminal or sub-terminal in both sexes. Eggs oval, without polar swellings; outer shell sculptured, especially towards poles. Parasites of birds. (after S & K (1967).

Type species : *Porrorchis elongatus* Fukui, 1929.

Type locality : Japan.

Schmidt and Kuntz (1967) have thoroughly revised the genera, *Porrorchis* and *Pseudoporrorchis* in the light of little difference between the two. They have observed that the difference lies only on the position of testes and presence of accessory suckers on bursa in the latter genus of which the first point is not of much significance but the second point according to them, may be due to partial eversion of muscular cap of bursa. Therefore, they have synonymised the latter with the former owing to its priority.

Key to Species of *Porrorchis*

1. Proboscis hooks more than 30 rows 2

   Proboscis hooks less than 30 rows 3

2. Proboscis hooks 30-32 × 11-12 ..... *P. brevicanthus*

   Proboscis hooks 30-32 × 10-12, with 4 cement glands ..... *P. herpistis* n. sp.

3. 26-28 × 10-12 rows of hooks with 4 cement glands ..... *P. chauhani*

   Number of hooks less 4

4. Proboscis hooks 28 × 8-9 ..... *P. hylae*

   Number of hooks less 5

5. 20-24 × 8-9 hooks with 6 cement glands ..... *P. crocidurai*

   24 × 9 hooks with 4 cement glands ..... *P. indicus*

195. ***Porrorchis brevicanthus*** (Das, 1949) Golvan, 1994

Centrorhynchus brevicanthus Das, 1949 : *Rec. Ind. Mus.* **47**(3-4) : pp. 291-301. Type locality : India.

P. brevicanthus (Das, 1949) Golvan, 1994 : *Research and Review in Parasitology*, **54**(3) : pp. 135-205.

Host : *Temenuchus pagodarum.*

Diagnosis : (Juvenile) : Proboscis hooks 30-32 longitudinal rows of 11-12 hooks each.

Remarks : Golvan (1956) had expressed doubt in identification of the species and later, in 1994, he transferred the species to the genus *Porrorchis*. In absence of literature, only hooks count has been provided here.

196. ***Porrorchis chauhani*** Gupta and Fatma, 1985
(Pt. 26; Figs.141a–141c)

P. chauhani Gupta and Fatma, 1985 : *Ind. J. Helminth.* 37(2) : pp. 137-148. Type locality : Lucknow.

Host : *Crocidura perrotteti.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1985) : *Male* : Body : 14.0 × 2.5. Proboscis 0.7 × 0.75, armed with 26-28 rows of 10-12 hooks per row; anterior 4-5 hooks of each row rooted, roots 0.058-0./060 long; rootless hooks 0.042-0.048. Pr. sheath 1.8 × 0.45. Lemnisci 3.75-4.0.T/1–0.70 × 0.32; T/2–0.72 × 0.38. Cement glands 4, Genital pore terminal. *Female* : Body 10.9-15.0 × 1.8-2.0. Ovarian balls 0.085-0.095.

Remarks : Gupta and Fatma (1985) have recorded two new species from the same *Host* and same locality within the same period of time. The significant difference between the two species is presence of 4 cement glands in *P.chauhani* and 6 cement glands in *P. crocidura.* Presence of 2-4 cement glands in the subfamily Porrorchinae has been emphasized by Amin (1987).

197. ***Porrorchis crocidurai*** Gupta and Fatma, 1985
(Pt. 26; Figs. 142a–142e)

P. crocidurai Gupta and Fatma,1985: *Ind.J.Helminth,* 37(2) : pp. 137-148. Type locality : Lucknow.

Host : *Crocidura perrotteti.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1985) : *Male* : Body 8.50-9.0 × 0.70-0.85. Proboscis 0.55-0.60 × 0.40-0.50, armed with 20-24 rows of 8-9 hooks each, anterior 3-4 hooks of each row with roots, 0.06-0.062 long, rootless spines with anteriorly directed manubria. Pr. sh. 0.62-0.65 × 0.15-0.18. L/1–1.50-1.60; L/2–1.88-1.90.Testes post equatorial, T/1–0.40-0.45 × 0.25-0.30; T/2–0.45-0.48 × 0.30-0.32. Cement glands 6, 2.0-2.5 long. Genital pore terminal. *Female* : Body 10.0-12.85 × 1.0-1.8. Eggs oval, 0.040-0.042 × 0.026-0.030.

198. ***Porrorchis herpistis*** n. sp.
(Pt. 26; Figs.143a–143g)

Host : *Herpistis auropunctatus.*

Location : Intestine.

Type locality : Satpura, M.P.

Other locality : Bhira, U.P. Materials : Many.

Diagnosis : *Male* : Body : 25.00-29.5 long and 1.00-2.37 wide.Proboscis ovate, 0.65-0.75 long and 0.60-0.70 wide, armed with 30-32 longitudinal rows with 10-12 hooks in each row. Anterior hooks with strong roots, posterior hooks rootless, roots without process,

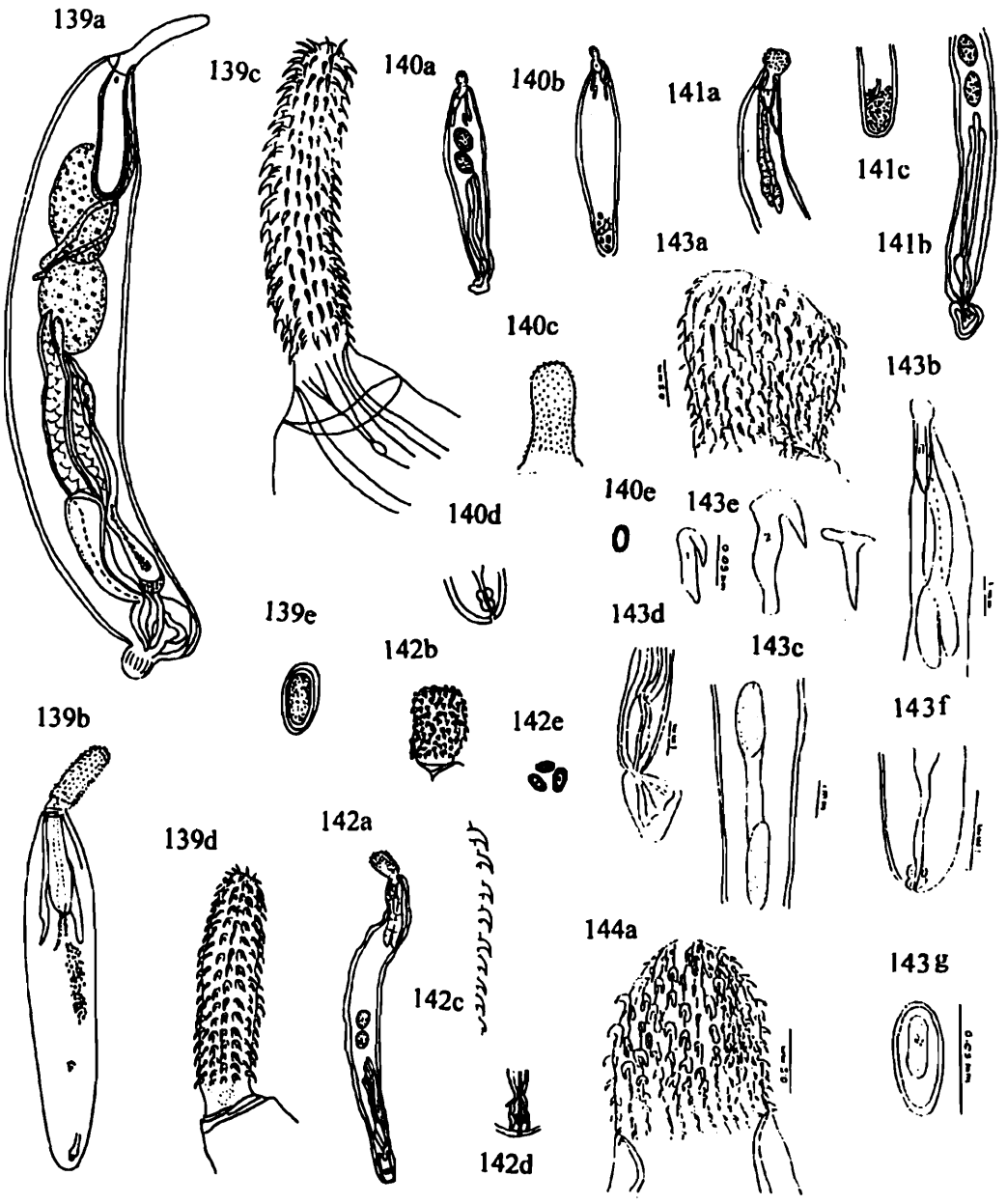

Plate-26

Fig. 139. *Plagiorhynchus (Prosthorhynchus) nicobarensis* (Soota and Kansal, 1972) Zafar and Farooqi, 1981. (a) male; (b) female; (c) proboscis; (d) proboscis of female; (e) egg.

Fig. 140. *Plagiorhynchus (Prosthorhynchus) kuntzi* (Gupta and Fatma, 1987) n. comb. (a) male; (b) female; (c) proboscis; (d) posterior of female; (e) egg.

Fig. 141. *Porrorchis chauhani* Gupta and Fatma, 1985. (a) anterior male; (b) posterior male; (c) posterior female.

Fig. 142. *Porrorchis crocidurai* Gupta and Fatma,1985. (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior female; (e) egg.

Fig. 143. *Porrorchis herpistis* n. sp. (a) proboscis; (b) anterior male; (c) testes in mid-body; (d) posterior of male; (e) proboscis hooks; (f) posterior of female; (g) egg.

Fig. 144. *Porrorchis hylae* (Johnston, 1914) S & K, 1967. (a) (after Bhattacharya, 2000), proboscis.

roots of 2nd, 3rd and 4th hooks of each row very long, 0.104-0.116 long. Points of hooks 0.064-0.07 long, rootless hooks at base 0.05-0.06 long. Neck truncate, 0.575 long and 0.625 wide. Proboscis sheath narrow, cylindrical, double walled, 2.00 long and 0.375 wide, ganglion near centre. Lemnisci longer than proboscis sheath. L/1–5.625-6.00 long and 0.575 wide, L/2–6.00-6.125 long and 0.575 wide. Testes ellipsoidal, one after other, T/1–2.00-2.08 long and 0.90-0.95. T/2–2.00-2.08 long and 0.075-0.08 wide. Cement glands 4, long and tubular, 9.30-9.375. Female : Body 42.5-44.00 long and 1.00-2.5 wide. Proboscis armed with 30-32 longitudinal rows with 10-12 hooks in each row; largest root 0.11-0.12; largest point of hook 0.064-0.07. Genital pore terminal. Eggs 0.05-0.06 long and 0.02-0.026 wide.

Remarks : Juvenile representatives of *Porrorchis* are generally reported from Indian reptiles, and adults are reported from birds and mammals. *P. teleger* reported from *Herpistis auropunctatus* has been transferred to the genus *Owilfordia* by S & K (1967). *P. herpistis* under report being the parasites of same mammalian hosts, have been thoroughly compared with *O. teleger*. The present form under report has clear distinction from *O. teleger* with its greater number of proboscis hooks and triangular process or broad base of roots of anterior proboscis hooks along with some other generic differences. The adult of *P. indicus* which have been reported mainly from *Centropus spp*. have been examined and found to differ with the present form mainly in having lesser number of rows of hooks, and lesser size of hooks and roots on proboscis. *P. crocidura and P. chauhani* being the parasites of mammalian host possess lesser number of hooks and smaller dimension of body than that of the present form. All other juvenile forms recorded so far from India and abroad do not conform to the species under report with regard to number of hooks, size of roots etc.

The species is thus found to be independent of all the existing species under the genus. I, therefore, propose it for a new species with the name *Porrorchis herpistis* n.sp.

199. ***Porrorchis hylae*** (Johnston, 1914) S & K, 1967
Synonym *Pseudoporrorchis hylae* Johnston, 1914
(Pt. 26–27; Figs. 144a–144e)

Porrorchis hylae : Gupta & Jain (1975) : *Acta parasit. pol.*, **23**(26-40) : 381-388.

Host : *Boiga trigonata.*

Locality : Chandigarh, Punjab.

Diagnosis. (after Gupta and Jain, 1975) : Juvenile Male : 1.38 × 0.53. Proboscis oval, 0.42-0.43 × 0.32-0.38 armed with 28 longitudinal rows of 8-9 hooks each, anterior 5 hooks of each row with well developed roots, hooks 0.012-0.046 long, middle hokks longest and stoutest. Pr. sheath 0.21-0.43 × 0.18-0.21, nerve ganglion at anterior half of proboscis sheath.testes oval, 0.065 × 0.039. Female : Anterior part of female 1.33 × 0.47, posterior part 0.71 × 0.43.

Remarks : The species is reported for the first time from India.

200. ***Porrorchis indicus*** (Das, 1957) S&K, 1967
Synonym *Pseudoporrorchis indicus* Das, 1957
(Pt. 34-35; Figs. 192a-192c & 197a–197e)

Pseudoporrorchis indicus Das, 1957 : *J. Parasit.*, **43**(6) : 659-663. Type Host : *Centropus castanopterus*

P. indicus : Gupta and Jain (1975) : *Acta Parasit.* Pol., **23** fasc. 34 : 381-388. Host : *Centropus sp.* Locality : Chandigarh.

P. indicus : Soota and Kansal (1972) : *Rec. zool. Surv. India.*, **66** : 303-307.

Diagnosis : (after Gupta and Jain 1975) : Male : Body large, 29.75 × 1.55. Proboscis spherical, 0.45 × 0.39, armed with 24 longitudinal rows of 9 hooks each, anterior 5 hooks of each row are longer and stouter than posterior hooks, 0.037-0.058 × 0.008-0.017, posterior hooks 0.021-0.025 long, anterior 4 hooks with well developed posteriorly directed roots, roots of the posterior hooks reduced at mid-proboscis. Neck small, 0.14 × 0.27.Proboscis sheath 1.4 × 0.27, nerve ganglion near middle. Lemnisci 2.38-2.83 × 0.37. T/1–1.58 × 0.65; T/2–1.54 × 0.84. Cement gland 4, tubular. female: More than 32.82 × 1.84. Genital pore subterminal. Eggs : ovoid, 0.035-0.055 × 0.017-0.026.

Remarks : Bhattacharya (1999) reported *P. indicus* from Meghalaya. Proboscis hooks reported by him is 20-22 longitudinal rows of 8-9 hooks in each row.

201. ***Porrorchis keralensis*** George and Nadakal, 1984
(Pt. 27; Figs. 145a–145e)

P. keralensis G&N, 1984 : *Acta Parasitologica Polonica*, **29**(12) : pp. 97-106. Type locality : Bethany Hills, Kerala.

Host : *Centropus sinensis.*

Location : Small intestine.

Diagnosis : (after G & N, 1984) : Male : Body : 30.00-35.00 × 0.5-2.00. Proboscis 0.6-0.8 × 0.2-0.39, armed with 22-26 rows of 8-10 hooks each, anterior 4 hooks with roots, 1st, row of hooks 0.02-0.03; 2nd,0.037-0.04; 3rd and 4th row 0.047-0.05; remaining rows 0.034-0.038; roots 0.02-0.03 × 0.03 × 0.003-0.008. Lemnisci 1.00-1.6 × 0.15-0.16. Pr. sh. 1.00-1.15 × 0.37-0.38. T/1–0.9-1.2 × 0.07-0.08. T/2–0.825-0.9 × 0.07-0.08. Cement glands 8.00-14.00 × 0.15-0.17. Female : 32.00-42.00 × 0.54-3.00. Eggs 0.05-0.06.

48. Genus ***Pseudolueheia*** Schmidt and Kuntz, 1967

Generic Diagnosis : Plagiorhynchidae; Porrorchinae : Trunk aspinose. Main lateral lacunar canals irregular, reticular. Hypodermal nuclei small, evenly distributed. Proboscis ovoid to spheroid with numerous longitudinal rows of nearly uniform hooks having long, well developed roots, except basal spines which are rootless. Proboscis sheath double walled, brain middle-third of sheath. Lemnisci broad, flat, two in number, bound to body wall by ligaments at distal ends. Testes tandem or nearly so, in anterior half of trunk. Cement glands long, tubular. Female genital pore sub-terminal. Male genital pore nearly terminal.

Eggs oval or elliptical, middle shell thick, with or without small polar swellings, outer shell thin, heavily sculptured especially towards poles. Parasites of birds.

Type species : *Pseudolueheia pittae* Schmidt and Kuntz, 1967

Type locality : Terabanan, Puerto Princesa, Palawan.

Key to species of *Pseudolueheia*

Proboscis armed with 22 longitudinal rows of 11 hooks each row .....
..... *P. korathai* Gupta and Fatma

Proboscis armed with 26-28 longitudinal rows of 8-10 hooks each row .....
..... *P. arunachalensis* n. sp.

202. ***Pseudolueheia korathai*** Gupta and Fatma 1987
(Pt. 27; Figs. 146a–146c)

P. korathai Gupta and Fatma, 1987 : *Ind. J. Helm.* 39 (2); pp. 128-142. Type locality : Prince of Wales Zoo. Garden, Lucknow.

Host : *Lobivanellus indicus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 12.7 × 1.8. Proboscis 0.75 × 0.45, armed with 22 longitudinal rows of 11 hooks each. 1or 2 apical rooted hooks 0.030-0.032, remaining rooted hooks 0.032-0.038, rootless hooks 0.025-0.030. Pr. sheath 1.0-1.8 × 0.37-0.45, ganglion at middle. Distal ends of lemnisci bound to body wall with ligaments., nucleus at the tip of ligament. L/1–2.2-3.0; L/2–2.4-3.5. Testes pre-equatorial. T/1–1.7 × 0.90; T/2–2.5 × 0.25. Cement glands 4, tubular. *Female* : 12.2 × 2.00. Proboscis 0.95 × 0.6. Eggs 0.030-0.035 × 0.020-0.022.

Remarks : Gupta and Fatma (1987) reported the species under the genus for the first time from India.

203. ***Pseudolueheia arunachalensis*** n. sp.
(Pt. 27; Figs. 147a–147f)

Host : *Pitta nepalensis.*

Location : Intestine.

Type locality : Gandhigram, Dist. : Tirup, Arunachal Pradesh.

Materials : 1 male and 2 females.

Diagnosis : Male : Body medium, plumpy, ventrally curved,10.625 long and 2,00 wide. Proboscis ovoid, 0.475 long and 0.475 wide; armed with 26-28 longitudinal rows with 8-10 hooks each; apical hooks smaller than the hooks of mid-proboscis; roots of 1st, 2nd and 3rd hooks of each row longer than points of hooks; basal hooks rootless; points of apical

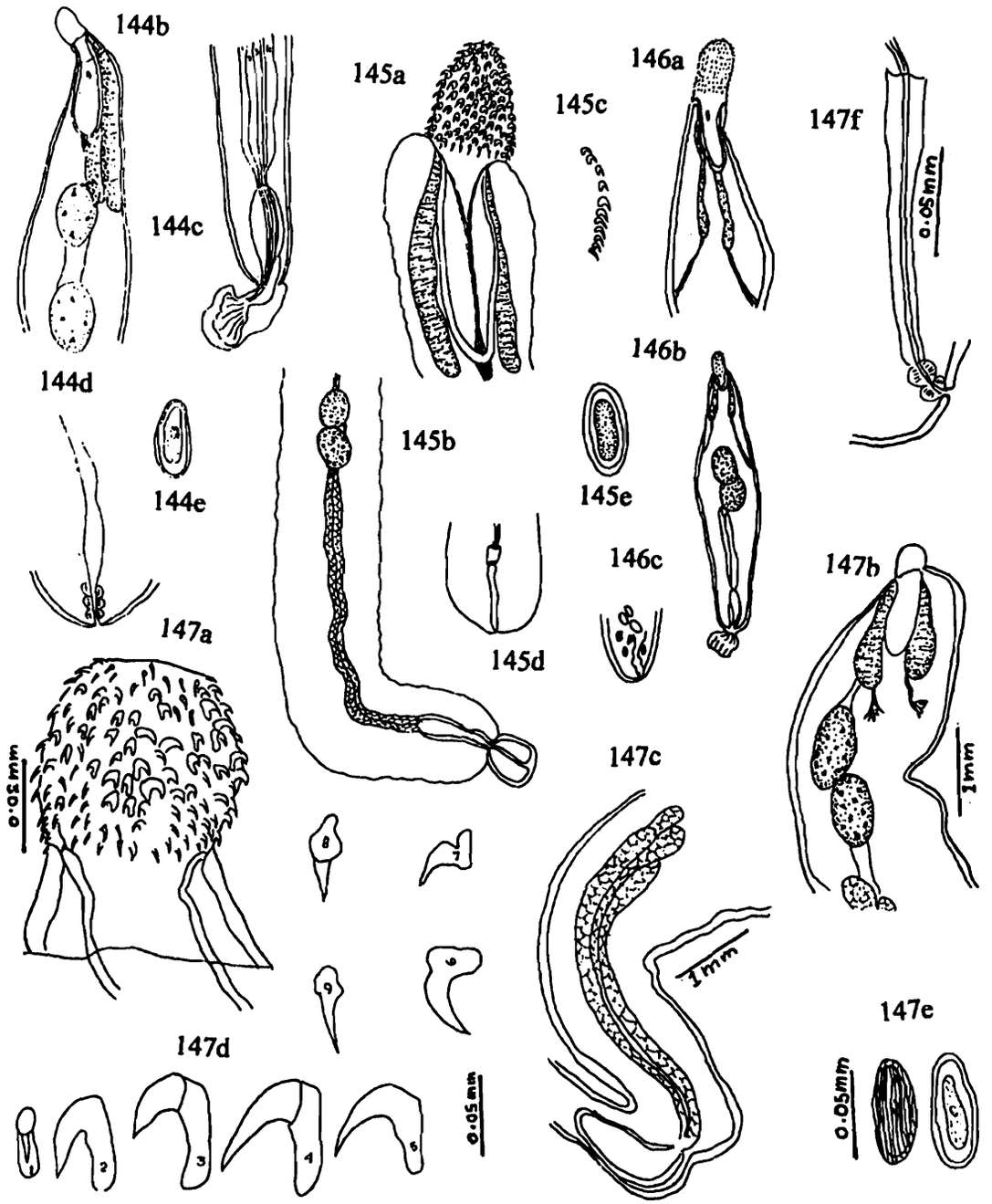

Plate-27

Fig. 144. *Porrorchis hylae* (Johnston, 1914.) S & K, 1967. (b) (after Bhattacharya, 2000), anterior of male; (c) posterior of male; (d) posterior of female; (e) egg.

Fig. 145. *Porrorchis keralensis* George and Nadakal, 1984. (a) anterior male; (b) posterior of male; (c) proboscis hooks; (d) posterior end of female; (e) egg.

Fig. 146. *Pseudolueheia korathai* Gupta and Fatma. 1987. (a) anterior male; (b) male; (c) posterior end of female.

Fig. 147. *Pseudolueheia arunachalensis* n. sp. (a) proboscis; (b) anterior of male; (c) posterior of male; (d) proboscis hooks (1-9); (e) eggs; (f) posterior of female.

hooks 0.033-0.035 long and 0.0083 wide; points of hooks of mid-proboscis 0.040-0.0415 long 0.0166 wide; points of hooks of base 0.03-0.033 long and 0.0083 wide; roots of apical hooks 0.045-0.049 long; roots of mid-proboscis 0.070-0.0749 long; roots of hooks near to base 0.038-0.0415 long. Neck short, wider than long, 0.25 long and 0.525 wide. Proboscis sheath double walled; ganglion near centre, 1.125 long and 0.4 wide. Lemnisci nearly equal, leaf-like, distal tips bounded to the body wall by ligaments. L/1–1.75 long and 0.5 wide, L/2–1.625 long and 0.3 wide. Testes two, oval, one behind other, near to lemnisci; posterior testis ruptured, T/1–1.375 long and 0.625 wide. Cement gland 4, long, tubular, average length 4.30, bursa protruded.

Female : longer than male, 16.125-18.875 long and 3.00-3.25 wide. Proboscis ovoid,0.5-0.52 long and 0.45-0.48 wide, armed with 26-28 longitudinal rows of 8-10 hooks each. Genital aperture sub-terminal. Uterus 1.25-1.50 long and vagina 0.5-0.55 long, with sphincter muscle. Immature eggs 0.024-0.034 long and 0.006-0.008 wide, mature eggs 0.055-0.06 long and 0.015-0.018 wide without polar prolongations of middle shell, some eggs with sculptured outer shell.

Host : *Pitta nepalensis.*

Location : intestine.

Locality : Gandhigram, Dist. Tirup, Arunachal Pradesh.

Remarks : Schmidt and Kuntz (1967) erected the genus *Pseudolueheia* with *P. pittae* as its type species from *Pitta s. sorida, Pitta erythrogaster* and *Dinopium javanense.* The authors included another species *P. boreotis* (Van Cleave and Williams, 1951) n. comb. under *Pseudolueheia.* Gupta and Fatma (1989) reported the genus with *Pseudolueheia korathai* in *Lobivanellus indicus* from Lucknow for the first time from India. The new species *P.arunachalensis* under report is distinguishable from *P. pittae* in having 26-28 rows of 8-10 hooks on proboscis while the latter has 31-34 rows of hooks. *P. pittae* bears 4 or 5 rootless hooks on base of proboscis whereas the present form bears 2 or 3 rootless hooks on base of proboscis. *P. boreotis* differs from the present form in having testes nearer to proboscis sheath and in possessing split roots of hooks, and eggs with polar swelling of middle shell. *P. korathai* is distinguished by 22 rows of hooks on its proboscis, and nucleated tip of ligaments binding lemnisci to its body wall.

Thus, the present form has clear distinction from all the three species and I, therefore, propose it for a new species with the name *Pseudolueheia arunachalensis* n. sp.

49. Genus ***Owilfordia*** Schmidt and kuntz, 1967

Generic Diagnosis : Plagiorhynchidae; Porrorchinae : Trunk elongate, cylindrical, approximately equal in diameter throughout its length except for distal end in mature females, which is swollen. No terminal digitiform process. Internal pseudometamerism indistinct. Body wall thin. Hypodermal nuclei numerous, distributed evenly throughout length of trunk except extreme distal end. Main lacunar canal lateral. Proboscis ovoid, bearing numerous longitudinal rows of two types of hooks. First few hooks in each row

strong with long, slender roots, each with delicate lateral wings, remaining spines strong, rootless, each with an anteriorly directed manubrium. Manubrium at least on the most anterior spines in each row spilt into two horn-like processes. Sensory pit not associated with papilla, located on each side of neck quite close to last spines. Apical organ prominent. Proboscis sheath double walled, inserted at base of proboscis, brain at middle of sheath. Lemnisci slender, flat, quite long, not bound to body wall by ligaments. Testes oval, tandem, well separated, in anterior third of trunk. Cement glands long, tubular. Genital pore terminal in both sexes. Eggs oval and symmetrical or elongate and flattened on one side, with or without polar swellings. Outer shell sculptured, especially towards poles. Parasites of birds and mammals.

Type species : *Owilfordia olseni* Schmidt and Kuntz, 1967.

204. ***Owilfordia schmidti*** Gupta and Fatma, 1987
(Pt. 28; Figs. 148a–148f)

O. schmidti Gupta and Fatma, 1987: *Ind.J.Helminth.*, 39 (2) : pp. 128-142. Type locality : Chinhat forest, Lucknow.

Host : *Herpestes auropunctatus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1987) : *Male* : Body 8.52-13.00 × 0.55-0.85. Internal metamerism not distinct. Proboscis armed with 24-26 longitudinal rows of 10-12 hooks each. Anterior 4-5 hooks strong, 0.050-0.065; middle hooks 0.052-0.085; basal spines 0.040-0.050, anterior hooks with slender roots, each with delicate lateral wings, rootless spines with anteriorly directed manubria, each manubrium split into two horn-like processes. Sensory pits present on each side of neck, neck short. L/1–3.15-4.5; L/2–3.15-5.5. Testes in anterior third of trunk. T/1–0.23-0.46 × 0.32-0.90; T/2–0.20-0.45 × 0.32-0.70.Cement glands 4 long, tubular. *Female* : Body 20.0-26.85 × 0.50-0.58. Pr. sheath 1.25-4.85 × 0.45-0.66. Eggs ovoid, 0.060-0.065 × 0.035-0.045 without polar prolongations of middle shell.

Family CENTRORHYNCHIDAE Van Cleave, 1916
Synonym Centrorhynchidae Golvan, 1960

Family Diagnosis : Polymorphida : Trunk slender, aspinose, occasionally with internal pseudo-segmentation. Hypodermic nuclei small and numerous, or large and less numerous; lacunar system with lateral main vessels and circular or reticular anastomoses. Proboscis usually cylindrical, sometimes swollen basally, divided by insertion of its receptacle into two regions, well armed with longitudinal rows of hooks. Proboscis sheath elongate, double walled, inserted at about middle of proboscis, with ganglion in its mid-region. Lemnisci long. Testes in anterior portion of trunk. Cement glands 3-6, slender. Eggs with concentric membranous shells, without polar prolongations of middle shell. Parasites of birds and mammals.

Type genus : *Centrorhynchus* Luhe, 1911

50. Genus ***Centrorhynchus*** Luhe, 1911

Synonym *Paradoxites Lindermann*, 1865, preoccupied
Echinorhynchus Zoega in Muller, 1776, partim
Chentrosoma Porta, 1906, partim, nec. Monticelli, 1905
Gordiorhynchus Meyer, 1931
Travassosina Witenberg, 1932

Generic Diagnosis : Centrorhynchidae : Body cylindrical, slender, some times fusiform, aspinose, occasionally showing internal pseudo-segmentation is stated to be artifact by Golvan (1956). Proboscis usually cylindrical, sometimes may be swollen, divided by insertion of receptacle into two regions, of which anterior is entirely or partly armed with rooted hooks, and posterior with rootless spines, hooks and spines are arranged in 16-48 longitudinal rows of 8-40 each. Proboscis receptacle cylindrical or sub-cylinsrical, double walled, inserted to inside of proboscis at about its middle. ganglion usually at middle of proboscis sheath. Neck absent, sometimes posterior- most part is termed as neck. Lemnisci usually slender, reaching back of proboscis receptacle. Testes tandem, near anterior end of trunk. Cement glands 3-6, very long and slender, not well defined from their ducts. Genital pores not exactly terminal, not surrounded by spines, occasionally with digitiform appendage and/or a small protruberence Eggs oval to elliptical, with concentric membranes; thick middle shell without polar prolongations. Adults parasitic in birds, usually Raptatores, and mammals; larvae in invertebrates, amphibians, reptiles or mammals.

Type species : *Centrorhynchus aluconis* (Muller, 1780) Luhe, 1911

Golvan (1956) divided the genus into two sub-genera *Longirostris* and *Sphaerorostris*. Again in 1965 he added a new subgenus, *Malagacanthus* with the species bearing 2 cement glands and a sub-penial sphincter at the termination of cement glands at base of bursa. *Longirostris* being preoccupied, was replaced by the sub-genus *Centrorhynchus*. Sub-generic concept for *Centrorhynchus* has not been followed by majority. Eventually, Golvan (1994) had discarded the concept and raised the sub-genera to generic level. Amin (1997) added a new genus *Neolacunisoma* to the family Centrorhynchidae. Golvan (1994) transferred some Indian species of *Centrorhynchus* to the genus *Sphaerorostris*.

Narrow inter-specific differences of characters in the Indian species of *Centrorhynchus* do not appear to be conducive for preparation of an effective key to species. Therefore, it is avoided in the present work..

205. ***Centrorhynchus atheni*** Gupta and Fatma, 1981
(Pt. 28; Figs. 151a–151d)

C. atheni Gupta and Fatma, 1981 : *Ind. J. Helminth.*, 33(2) : pp. 105-120. Type locality : Prince of Wales Zool. Garden, Lucknow.

Host : *Athene brama*.

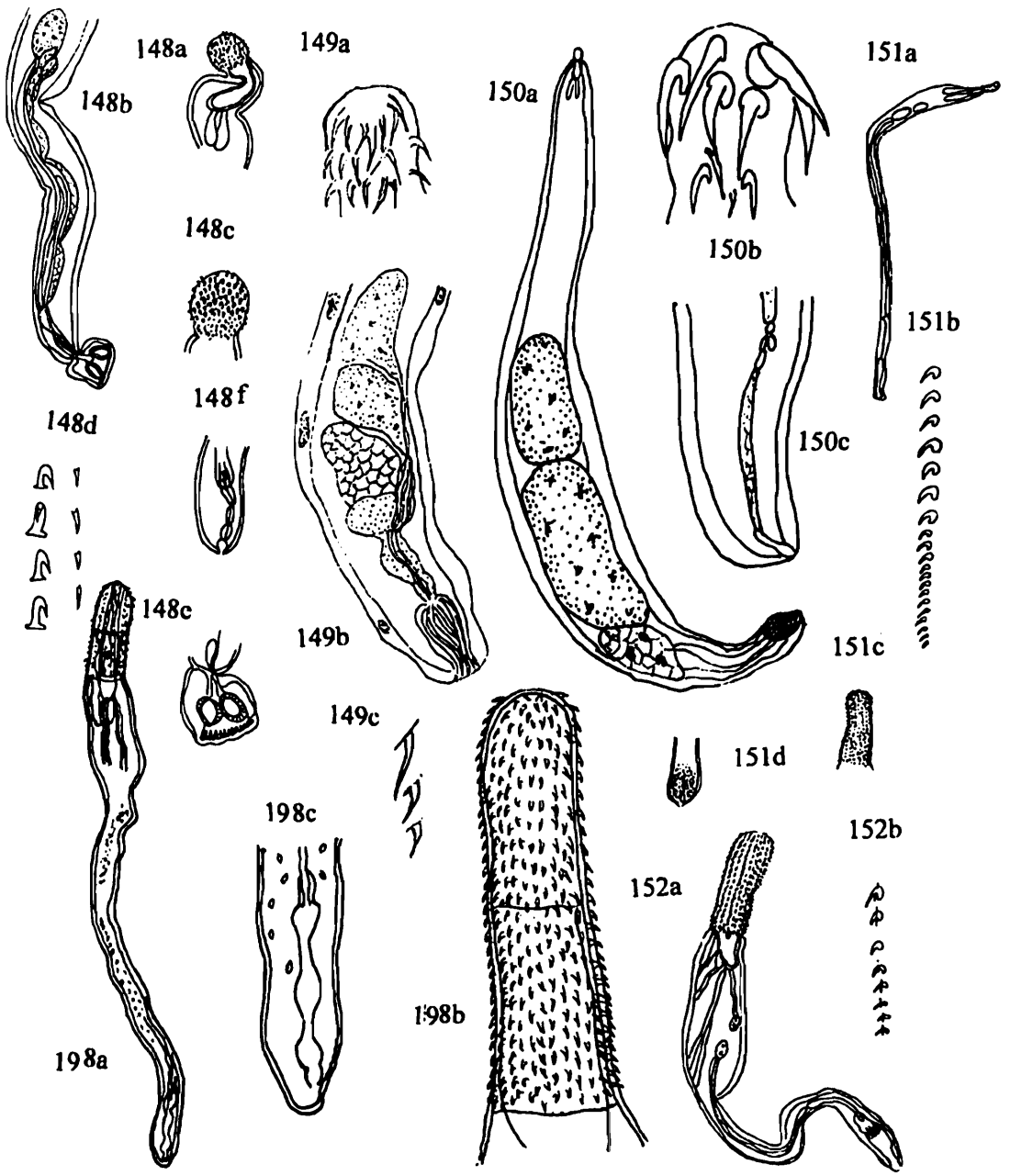

Plate-28

Fig. 148. *Owilfordia schmidti* Gupta and Fatma, 1987. (a) anterior of male; (b) posterior of male; (c) proboscis; (d) proboscis hooks; (e) bursa; (f) posterior of female.

Fig. 149. *Neoechinorhynchus dattai* (*N. rutili* reported by Datta 1936) Golvan, 1994 nom. nov. (a) proboscis; (b) posterior of male; (c) proboscis hooks.

Fig. 150. *Neoechinorhynchus glyptosternumi* Dhar and Kharoo, 1984. (a) male; (b) proboscis; (c) posterior of female.

Fig. 151. *Centrorhynchus atheni* Gupta and Fatma, 1981. (a) male; (b) proboscis hooks; (c) proboscis; (d) posterior of female.

Fig. 152. *Centrorhynchus buckleyi* Gupta and Fatma, 1981. (a) male; (b) proboscis hooks.

Fig. 198. *Centrorhynchus sharmai* (Gupta and Lata, 1967) (a) female; (b) proboscis; (c) posterior of female.

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1981) : Male : Body 18.5-21.24 × 0.61-0.84, Hypodermal nuclei numerous, evenly distributed. Proboscis cylindrical, 0.85-0.86 × 0.30-0.60. Proboscis cac 0.82-0.90 × 0.15-0.20. Lemnisci 1.15-1.56 long. Testes pre-equatorial, overlapping, T/1–0.72-0.76 × 0.20-0.22.; T/2– 0.72-0.76 × 0.20-0.22. Cement glands 2, tubular Sub-penial sphincter at base of bursa. Genital pore terminal. Female : Body 30.0 × 0.78. Eggs elliptical, without polar prolongations of middle shell, 0.028-0.049 × 0.018-0.020. Genital pore with a digitiform appendage.

206. ***Centrorhynchus buckleyi*** Gupta and Fatma, 1981
(Pt. 28; Figs. 152a–152b)

C. buckleyi Gupta and Fatma, 1981 : *Ind. J. Helminth.* **33**(2) : pp. 105-120. Type locality : Prince of Wales Zool. Garden, Lucknow.

Host : *Anastomus ascitans.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1981) : Male : Body divided into two portions due to constriction in the middle, 4.54 × 0.40. Hypodermal nuclei numerous. Proboscis 0.03 × 0.25, armed with 26 longitudinal rows of 20-25 hooks each, 10 anterior hooks with recurved blade, 0.022-0.028; remaining spines 0.015-0.016. Proboscis sheath double walled 0.6 × 0.2. L/1–0.32 × 0.015; L/2–0.35 × 0.015. Testes ovoid, T/1–0.12 × 0.095. T/2–0.12 × 0.090. Cement glands 2, cylindrical.

Remarks : Presence of two cement glands in the species needs confirmation.

207. ***Centrorhynchus lucknowensis*** Gupta and Fatma, 1981
(Pt. 29; Figs. 153a–153d)

C. lucknowensis Gupta and Fatma, 1981 : *Ind. J. Helminth.* **33**(2) : pp. 105-120. Type locality : Lucknow

Host : *Haliaster indus.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma, 1981) : Male : Body 6. 29-6.90 × 0.81-0.90, internal segmentation present, anterior part swollen. proboscis 0.50-0.54 × 0.21-0.24, armed with 30-32 longitudinal rows of 20-22 hooks each, 9-10 anterior hooks rooted, 0.035-0.040, remaining spines 0.028-0.030 long. Proboscis sheath 0.68-0.72 × 0.20-0.22. L/1–0.48-0.80 × 0.10-0.12; L/2–0.62 × 0.12-0.15. Testes prequaatorial, T/1–0.42-0.45 × 0.30-0.35; T/2–0.40-0.42 × 0.30-0.32. cement glands 3, tubular, 2.7-3.0 long. Sub- penial sphincter absent. *Female* : Body 6.94-7.23 × 0.90-0.96. Eggs oval, 0.025-0.035 × 0.015-0.018. Genital pore sub-terminal.

208. ***Centrorhynchus ptysus*** Gupta, P. V., 1950
(Pt. 29; Figs. 154)

C. ptysus Gupta, 1950 : *Ind. J. Helmintn.* **11**(1) : pp. 41-48. Type locality : Lucknow.

Host : *Ptyas mucosa* (Rat snake).

Location : Intestine.

Diagnosis : (after Gupta, 1950) : *Male* : (Juvenile) : Body 2.35 × 0.68. Proboscis hooks 22-24 rows with 26-28 hooks each. Longest hook 0.025 long. Cement glands tubular.

Remarks : Gupta (1950) described the juvenile pre-infective and infective stages of the species obtained from mesentery of the host *P. mucosa.*

209. ***Centrorhynchus mysentry*** Gupta and Fatma, 1981
(Pt. 29; Figs. 155a–155c)

C. mysentry Gupta and Fatma, 1981 : *Ind. J. Helminth.*, 33(2) : pp. 105-120. Type locality : Lucknow.

Host : *Rana tigrina. Location*: Intestinal mysentery.

Diagnosis : (after Gupta and Fatma, 1981) : *Male* : Body 2.6-4.15 × 0.84-0.85. Proboscis and neck, 70-0.80 × 0.30-0.32, armed with 24-26 rows of 9-10 hooks each; 4-5 anterior hooks strong, curved, 0.040-0.045 long, remaining spines rootless, 0.30-0.32 long. Proboscis sheath 0.70-1.05 × 0.5-0.62. Lemnisci 1.15-1.3 long, Testes equatorial, T/1–0.17-0.32 × 0.11-0.25 × 0.58-0.80; T/2–0.16-0.30 × 0.11-0.25. Cement glands 2, tubular, 0.41-0.85. *Female* : Body 3.15-4.5 × 0.60-0.65. Genital pore ventroterminal.

Remarks : The status of the new species is doubtful for it is a juvenile where most of the organs are poorly developed.

210. ***Centrorhynchus spilornae*** Schmidt and Kuntz, 1069
Synonym *Centrorhynchus andamanensis* Soota and Kansal, 1972
(Pt. 29; Figs. 156a–156c)

C. andamanensis Soota and Kansal, 1972 : *Rec. Zool. Surv.* **66** : pp. 303-307. Locality : Car Nicobar, Andaman.

C. spilornae Zafar and Farooqi (1981) : *Ind. J. Parasit.*, **5**(2) : pp. 179-182.

C. spilornae : Bhattacharya (2000) : ZSI, *Fauna af Tripura, State Funa Series,* **7**(Part-4) : p. 157.

Host : Owlet

Host : *Spilornis cheela* (creasted serpent eagle).

Diagnosis : (after Zafar and Farooqi,1981) : Male : Body 30.00-3?.000 × 0.9-1.15. Proboscis 2.15 × 0.4, armed with 28-30 rows of 30-32 hooks each, hooks per row 16+6+18, size of hooks 0.036-0.054. Proboscis sheath 1.7-2.0 × 2.6-3.0. Lemnisci 2.3-2.5 × 0.25-0.35. T/1–1.2 × 0.52; T/2–1.4 × 0.46. Cement glands 4. Female : Body 55-65 × 0.9-1.27. Eggs 0.040-0.050

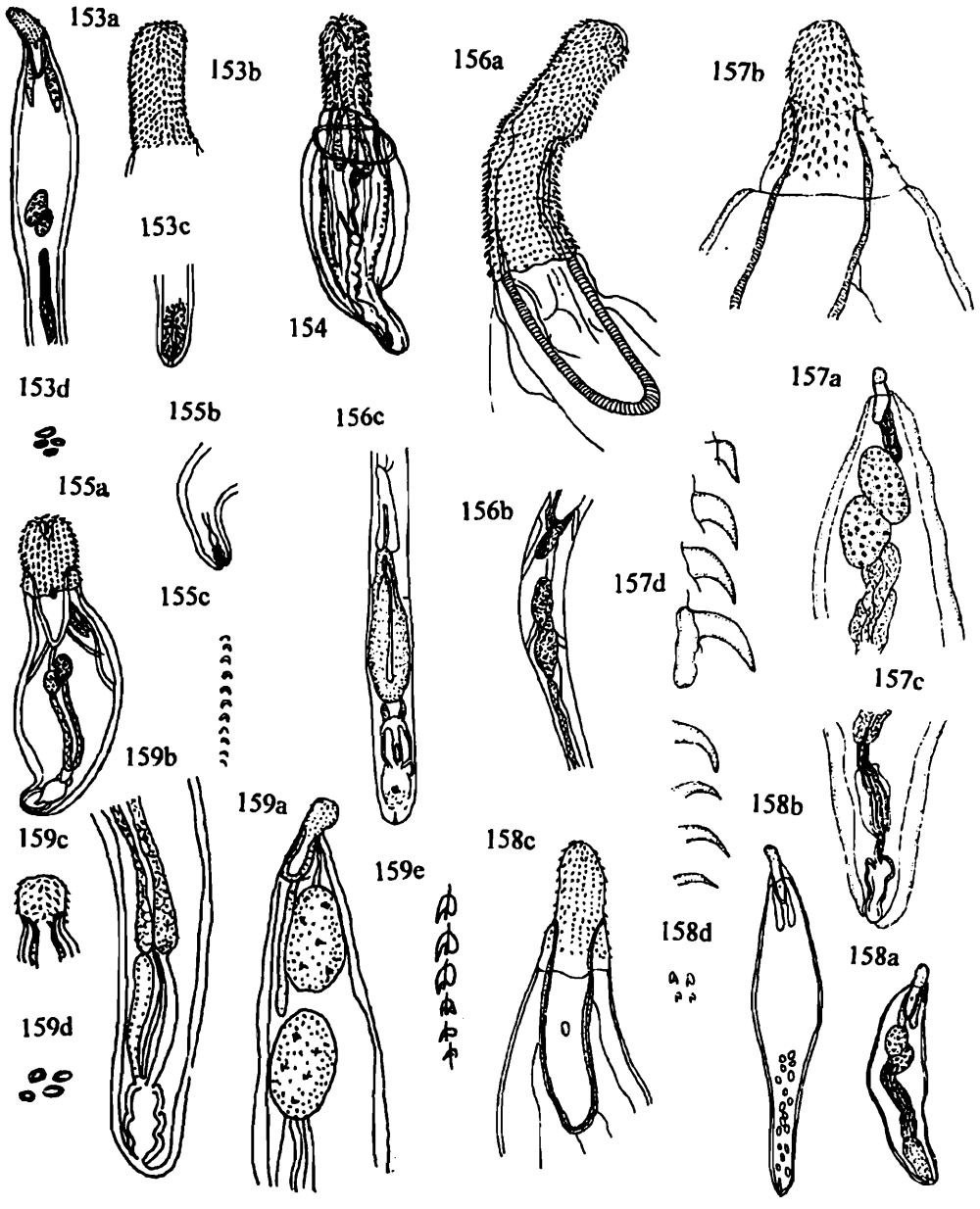

Plate-29

Fig. 153. *Centrorhynchus lucknowensis* Gupta and Fatma, 1981. (a) anterior of male; (b) proboscis; (c) posterior of female; (d) egg.

Fig. 154. *Centrorhynchus ptysus* Gupta, P.V., 1950, juvenile male.

Fig. 155. *Centrorhynchus mysentry* Gupta and Fatma, 1981. (a) juvenile male; (b) posterior of female; (c) proboscis hooks.

Fig. 156. *Centrorhynchus spilornae* Schmidt and Kuntz, 1069. (after Soota and Kansal) (a) anterior of male; (b) testes at mid-body; (c) posterior of male.

Fig. 157. *Centrorhynchus lancea* (Westrumb, 1821) Golvan, 1960. (a) anterior of male; (b) proboscis; (c) posterior of male; (d) proboscis hooks.

Fig. 158. *Centrorhynchus lanceoides* Petrotschenko, 1949. (syn. of *C. lancea*) (a) male; (b) female; (c) proboscis; (d) proboscis hooks.

Fig. 159. *Centrorhynchus hargisi* Gupta and Fatma, 1981. (a) anterior of male; (b) posterior of male; (c) proboscis; (d) eggs; (e) proboscis hooks.

× 0.020-0.025. (after Soota and Kansal, 1972) : Body : 34.00-36.00 × 2.25-0.6. Proboscis 1.3 × 0.25-0.4, armed with 24-28 rows of 38-40 hooks each (14+6+18).

Remarks : Zafar and Farooqi (1981) have considered *C. andamanensis* as a synonym of *C. spilornae* and according to them, two cement glands of the former against 4 in the latter has been construed as an intraspecific variation.

211. ***Centrorhynchus lancea*** (Westrumb, 1821) Golvan, 1960
Synonym *Centroyjynchus lanceoides* Petrotschenko, 1949
(Pt. 29; Figs. 157a–157d)

C. lancea : Jain and Gupta (1983) : *Res. Bull. Punjab Univ. (Sc.)*, 37(3-4) : pp. 15-17.

C. lancea : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc)*, 37(3-4) : pp. 25-31.

C. lancea : Bhattacharya (2003) : *ZSI, Fauna of Sikkim, State Fauna Series*, 9(Part-5) : pp. 71-78.

Host : *Acridotheris tristis.*

Locality : Punjab *Turdus albocinctum* of Sikkim. *Dendrocitta vagabonda* of Punjab by Duggal *et al.*

Location : Intestine.

Other Host : *Milvus migrans* of Simla.

Diagnosis : (after Bhattacharya,2003) : *Male* : Body spindle shaped, 4.5-13.00 × 1.00-2.5. Proboscis 0.5-0.575 × 0.3, armed with 24-28 rows of 11-12 hooks each, anterior hooks 0.033 × 0.0166, rootless hooks 0.024 long. Lemnisci 1.5-2.00 long, T/1–1.625 × 0.875, T/2–1.55 × 0.875. Cement glands 4, long. *Female* : (after Duggal *et al.*, 1986) : Body 11.5-13.95 × 1.8-2.4. Proboscis 0.49-0.6 × 0.27-0.43, anterior hooks 0.03-0.045 × 0.01-0.015, rootless hooks 0.01-0.02 × 0.0075.

Remarks : Skrjabin's description of the species conforms with the description given above. Amin (1985) describes *C. lanceoides* Petrotschenko, 1949 a synonym of *C. lancea.*

212. ***Centrorhynchus hargisi*** Gupta and Fatma, 1981
(Pt. 29; Figs. 159a-159e)

C. hargisi Gupta and Fatma, 1981 : *Ind. J. Helminth.*, 33(2) : pp. 105-120. Type locality : Lucknow.

Host : *Corvus splendens.*

Location : Intestine.

Diagnosis : (after Gupta and Fatma,1981) : *Male* : Body 13.00-14.5 × 1.94-4.50. Proboscis 0.45-0.95 × 0.3-0.4, armed with 18-20 rows of 10-12 hooks each, anterior 8-9 hooks strong and with broad roots, 0.025-0.035, remaining hooks 0.010-0.020. Proboscis sheath 0.8-1.2 × 0.22-0.32. L/1–2.02-2.40 × 0.12-0.25; L/2–2.26-2.60 × 0.15-0.25. T/1–1.50-1.92 × 0.76-1.2; T/2–1.38-1.70 × 0.8-1.22. Cement glands 6, tubular, 3.65-5.00 long. Female: Body 17.93-22.00 × 2.5-6.00. Ova 0.020-0.025. Genital pore sub-terminal.

Remarks : The species has been referred to the genus *Sphaerorostris* by Golvan (1994). The reasons for the transfer can not be justified till the materials are studied in depth.

213. ***Centrorhynchus turdi*** Yamaguti, 1939
(Pt. 30; Figs. 161a–161b)

C. turdi : Jain and Gupta (1983) : *Res. Bull. Punjab Univ. (Sc.)* : 34 (1-2).

Host : *Centropus sp.*

Locality : Chandigarh, Punjab.

C. turdi : Duggal *et al.* (1986): *Res.Bull.Punjab Univ. Sc.* 37(3-9) : pp. 25-31.

Host : *Acridotheris tristis.*

Locality : Punjab.

C. turdi : Bhattacharya (2000) *ZSI, Fauna of Tripura, State Fauna Series,* 7(Part-4) : pp. 141-162.

Host : *Acridotheris tristis.*

Locality : Punjab.

Diagnosis : (after Bhattacharya, 2000) : Male : Body medium, cylindrical 7.21 × 1.67. Proboscis cylindrical, 0.98 × 0.55, armed with 26-28 longitudinal rows of 11 hooks each. 4th and 5th hooks from the anterior with strongest roots. Maximum length of hooks 0.04. Proboscis sheath elongate, double walled 1.27 × 0.41. Nerve ganglion at its middle. Lemnisci long and almost equal, testes and cement glands badly damaged.

Remarks : The species is recorded for the first time from a state beyond Punjab.

214. ***Centrorhynchus aluconis*** (Muller, 1780) Luhe, 1911
(Pt. 30; Figs. 162a–162c)

C. aluconis : Subrahmanian, K.A. (1927) : *Ann. Mag. Nat. Hist. Sen.* 9; Vol. 19 : p. 275.

C. aluconis : Jain and Gupta (1983) : *Res. Bull. Punjab Univ. (Sc.),* 34(1-11) : pp. 15-17.

C.aluconis : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ.(Sc.),* 37(3-4) : pp. 25-31.

C. aluconis : Bhattacharya (2003) : *ZSI, Fauna of Sikkim, State Fauna Series,* 9(Part-5) : pp. 71-78

Host : Toad from Rangoon; *Falco jugger* from U.P; *Milvus migrans* from Punjab; encysted juveniles from toad of Sikkim

Location : Intestine.

Diagnosis : (after Duggal *et al.*, 1986) *Female* : Body 6.45 × 0.91. Anterior proboscis 0.50 × 0.30; posterior proboscis 0.23 × 0.2, armed with 28 rows of 15 each (according to Jain and Gupta, 1983, anterior 4 hooks of each row longer than posterior ones). Proboscis sheath 1.32 × 0.27. Lemnisci equal, 1.39 × 0.15.

(after Bhattacharya, 2003) *Female* : Immature body spindle shaped, 3.625 long. Proboscis 0.656 × 0.289, armed with 30-32 longitudinal rows of 15-16 hooks each, first 4-5 hooks of each row with roots, 1st hook point–0.03; root-0.04; 2nd point–0.04; root–0.05; 3rd point–0.04; root–0.05; 4th. point–0.04; root–0.03. remaining hooks 0.03-0.04 long. Proboscis sac 0.414 long and 0.248. female sex organs poorly developed.

Remarks : The number of hooks and size of hooks have similarity with that of *C. aluconis*. Subrahmanian (1927) reported the juvenile of this species from toad of Rangoon. Bhattacharya reported an encysted form in toad from Silkkim with a new locality record.

215. ***Centrorhynchus splendi*** Gupta and Gupta, 1970

C.splendi Gupta and Gupta, 1970 : *Res. Bull. Punjab Univ. (sc)*, **37**(3-4) : p. 101.

C. splendi : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc.)*, **37**(3-4) : pp. 25-31.

Host : *Hierococcyx varius.*

Location : Intestine.

Locality : Punjab.

Diagnosis : (after Duggal *et al.*, 1986) : Female : Body 11.7 × 1.82. Proboscis armed with 28 rows of 9-10 hooks each. Proboscis sheath 1.26 × 0.4. Lemnisci 1.95 × 0.3.

Remarks : Golvan (1994) transferred the species to the genus *Sphaerorostris.*

216. ***Centrorhynchus clitorideum*** (Meyer, 1931) Yamaguti, 1963

Synonym *Gordiothynchus clitorideum* Meyer, 1931
Centrorhynchus cinctum (Rud., 1919) Meyer, 1931
(Pt. 30; Figs. 163a–163e)

C. clitorideum : Gupta and Lata, (1967) : *Res. Bull. Punjab Univ. (Sc.)*, **34**(3-4) pp. 325-341.

Host : *Astur badius.*

Location : Intestine; Locality : Punjab.

C. clitorideum : Jain and Gupta, (1983) : *Res. Bull. Punjab Univ. (Sc.)*, **34**(1-2) : pp. 15-17.

Host : *Halcyon smyrnensis.*

Location : Intestine.

Locality : Kasipur, U.P.

C. clitorideum : Duggal *et al.* (1986) : *Res. Punjab Univ. (Sc.)*, 37(3-4) : pp. 25-31.

Host : *Tyto alba.*

Location : Intestine.

Locality : Punjab.

C. clitorideum : Bhattacharya (2003) : *ZSI, State Fauna Series 9 : Fauna of Sikkim, Part-5* : pp. 71-78.

Host : *Picus flavinucha.*

Location : Intestine.

Locality : Melli Bazar, Sikkim.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 20.8 × 1.5. Proboscis 0.56-0.65 × 0.35-0.37, armed with 30 rows of 12-13 hooks each, neck 0.29-0.42 × 0.42-0.51, armed with 30 roews of 8-9 rootless hooks, hooks 0.020-0.028; basal hooks 0.006. Proboscis sheath 1.51-1.54 × 0.42-0.44. Lemnisci 1,76 × 0.56. T/1–1.24 × 0.63; T/2–1.21 × 0.70. Cement gland 3 syncitial, tubular, 11.55 × 0.61.

Remarks : Gupta and Lata (1967) have described posterior proboscis as 'neck' with 30 rows of 8-9 hooks each which together with the hooks of anterior proboscis comes to 30 rows of 20-22 hooks in each row. The syncytial cement gland as described by them probably denotes each cement gland with a large nucleus. Jain and Gupta (1983) report their specimens with 34 rows of 21 hooks in each row whereas Bhattacharya (2003) describes 36-40 rows of 18-20 hooks each in his specimens.

217. ***Centrorhynchus areolatum*** (Rud., 1819) Petrotschenko, 1059
Synonym *Echinorhynchus areolatum* Rudolphi, 1819

C. areolatum : Duggla *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc.),* 37(3-4) : pp. 25-31.

Host : *Sturnopastor contra.*

Location : Intestine.

Locality : Punjab.

Diagnosis : (after Duggal *et al.*, 1983) : *Male* : Body 5.91 × 0.84. anterior proboscis 0.37 × 0.3, posterior proboscis 0.27 × 0.24. Proboscis sheath 1.28 × 0.29. Lemnisci 1.42 × 0.18 extending to posterior testis; T/1–0.60 × 0.24; T/2–0.72 × 0.33. Cement glands 3; 1.87 × 0.30.

Remarks : Rudolphi (1819) has described the species with 24-26 rows of 12-14 (5+7-8) hooks in each row on proboscis. Duggal *et al.* (1986) have assigned their specimens to *C. areolatum* without mentioning the number of proboscis hooks.

218. ***Centrorhynchus tumidulum*** (Rud., 1819) Yamaguti, 1961
Synonym *Echinorhynchus tumidulum* Rudolphi, 1819
Echinorhynchus caudatus Rud., 1819 nec. Zeder, 1809
Echinorhynchus megacephalus Westrumb, 1821
(Pt. 30; Figs. 164a–164c)

C. tumidulum : Gupta and Lata (1967) : *Res. Bull. Punjab Univ. (Sc.)* : 18 (3-4) : pp. 325-341;

Host : *Athene brama.*

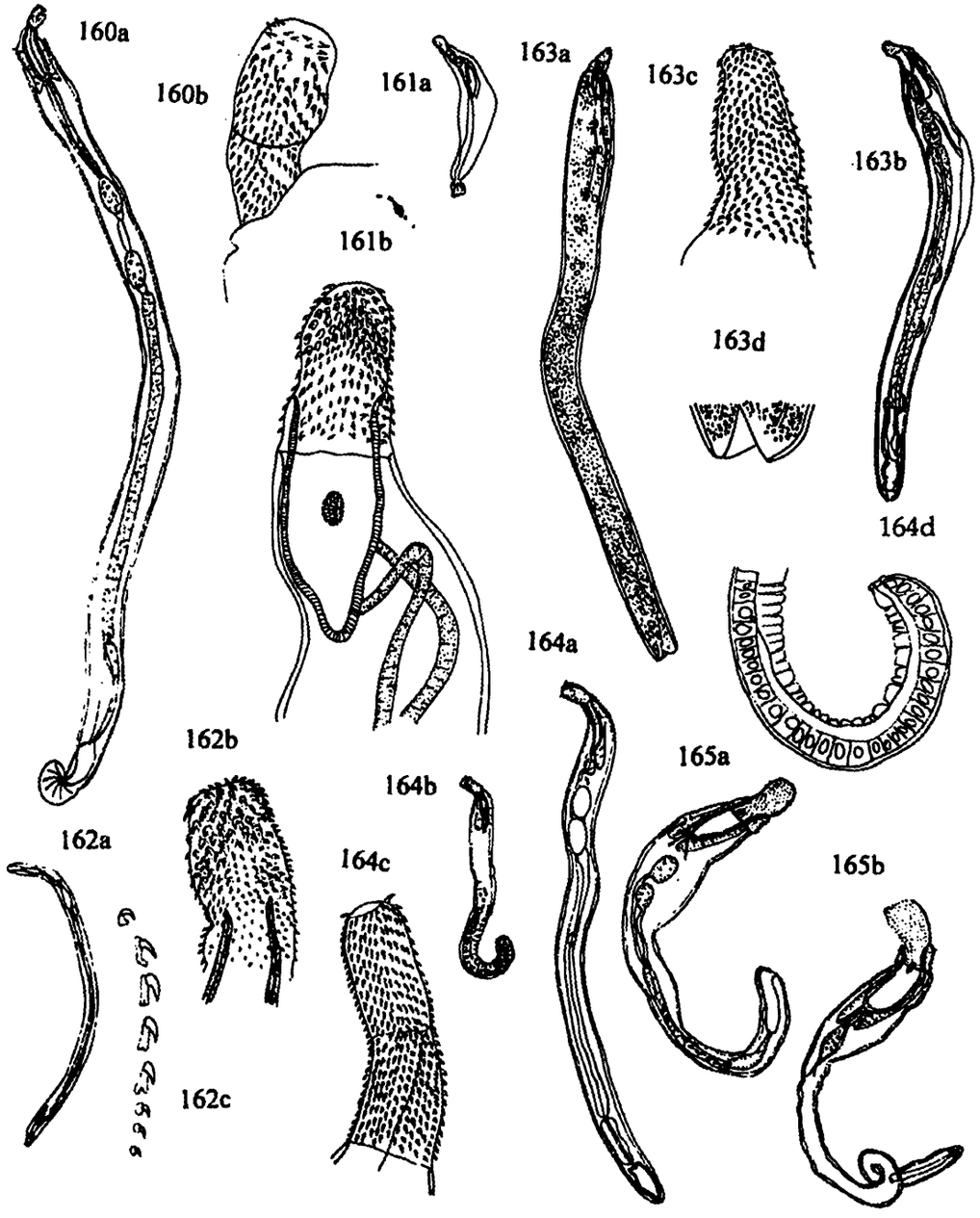

Plate-30

Fig. 160. *Centrorhynchus opimum* Travassos, 1921. (a) male; (b) proboscis.

Fig. 161. *Centrorhynchus turdi* Yamaguti, 1939. (a) juvenile (b) proboscis with proboscis sac.

Fig. 162. *Centrorhynchus aluconis* (Muller, 1780) Luhe, 1911 (a) male; (b) proboscis; (c) proboscis hooks.

Fig. 163. *Centrorhynchus clitorideum* (Meyer, 1931) Yamaguti, 1963. (a) female; (b) male; (c) proboscis; (d) female genital end.

Fig. 164. *Centrorhynchus tumidulum* (Rud., 1819) Yamaguti, 1961. (a) male; (b) female; (c) proboscis; (d) posterior of female.

Fig. 165. *Centrorhynchus bengalensis* Datta and Soota, 1954. (a) male; (b) female.

Location : Intestine.

Locality : India.

C. tumidulum : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc.);* **37**(3-4) : 25-31.

Host : *Tyto alba.*

Location : Intestine.

Locality : Panjab.

C. tumidulum : Bhattacharya (1999) : *ZSI, State Fauna Series 4; Fauna of Meghlaya* (part-9) : 359-392.

Host : *Athene brama.*

Location : Intestine.

Locality : Meghalaya.

Diagnosis : (after Gupta and Lata,1967) : *Male* : body 13.5-18.9 × 0.49-0.85. Proboscis 0.49-0.58 × 0.25-0.30, armed with 26 rows of 11-12 hooks each. Neck 0.46-0.57 × 0.37-0.42, armed with 26 rows of 11-12 hooks each, apical hooks 0.028, sub-apical hooks 0.022, basal hooks 0.010. Proboscis sheath 0.98-1.34 × 0.18-0.33. Lemnisci 0.65-1.37 × 0.18-0.23. T/1–0.64-0.93 × 0.46-0.51; T/2–0.61-0.96 × 0.44-0.51. Cement glands 2 or 4, 0.014-0.098. Female: 7.4-13.5 × 0.47-0.50. Eggs 0.1-0.178 × 0.082-0.92.

Remarks : 'Neck' as described by the authors, being posterior proboscis contains 26 rows of 11-12 hooks in each row which together with the number of hooks of anterior proboscis come about 26 rows of 22-24.

219. *Centrorhynchus corvi* Fukui, 1929

Synonym *Travassosia corvi* (Fukui,1929) Witenberg, 1932
Centrorhynchus skrjabini Petrotschenko, 1949

C. corvi : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc);* **37**(3-4) : pp. 25-31.

Host : *Corvus splendens* from Punjab.

Location : Intestine.

Locality : Punjab.

Diagnosis : (after Duggal *et al.*, 1986) : *Male* : Body 12.0 × 1.58. Anterior proboscis 0.39 × 0.3; posterior proboscis cylindrical, 0.225 × 0.33. Proboscis sheath 1.37 × 0.36. Lemnisci equal, 1.78 × 0.24. T/1–1.20 × 0.76; T/2–1.14 × 0.84. Cement glands 4; 5.8 × 0.48.

Remarks : No figure and number of proboscis hooks have been provided by the authors.

220. *Centrorhynchus lanceoides* Petrotschenko, 1949

(Pt. 29; Figs. 158a–158d)

C. lanceoides : Duggal *et al.* (1986) : *Res. Bull. Punjab Univ. (Sc.);* **37**(3-4) : pp. 25-31.

Host : *Pastor roseus.*

Location : Intestine.

Locality : Punjab.

Diagnosis : (after Duggal *et al.*, 1986) : *Male* : 7.462 × 1.45. Anterior proboscis 0.3 × 0.24, posterioe proboscis 0.15 × 0.37, armed with 36 longitudinal rows of 12 hooks each, rooted chooks 0.030 × 0.0075; rootless hooks 0.018 × 0.006. Proboscis sheath 1.05 × 0.3. Lemnisci 1.27 × 0.18.T/1–0.9 × 0.52; T/2–0.87 × 0.6. cement glands 3; 1.8 × 0.3. *Female* : Body 8.62 × 1.65, anterior proboscis 0.45 × 0.3, posterior proboscis 0.15 × 0.33. No eggs found.

Remarks : Amin O. M. (1985) has made the species a junior synonym of *C. lancea* (Westrumb, 1921). Description of the species has been provided here for the convenience of the workers.

221. ***Centrorhynchus globocaudatus*** (Zeder, 1800) Petrotschenko, 959

(Pt. 34; Figs. 191a–191b)

Synonym *Echinorhynchus tuba* Rud., 1802

Echinorhynchus globocaudatus Zeder, 1800

C. globocaudatum : Gupta and Gupta (1972) : *Res. Bull. Punjab Univ. (Sc.)*; 23 (1) : 1-12.

C. globocaudatus : Bhattacharya (2000): *ZSI, Fauna of Tripura, State Fauna series,* 7(part-4) : 141-162.

C. globocaudatus : Bhattacharya (2003) : *ZSI, Fauna of Sikkim, State Fauna Series,* 9(part-5) : 71-78.

Host : *Milvus migrans.*

Location : Intestine.

Locality : Chandigarh.

Other hosts : *Ottus sp. Location* : Intestine. *Locality* : Tripura; Owl. *Location* : Intestine. *Locality* : Sikkim.

Diagnosis : (after Gupta and Gupta, 1972) : *Male* : Body 16. 41 long. Proboscis 0.540 × 0.306, armed with 30 rows of 18 (5-6 + 11-13) hooks each, apical hooks 0.040-0.050 × 0.010, posterior hooks 0.020 × 0.005. Proboscis sheath 1.40-0.234. T/1–0.468 × 0.36, posterior testis distorted. Cement glands 4; 8.028 × 0.216-0.360. Saefftigen's pouch 2.520 × 0.288. *Female* : (after Bhattacharya, 2000) Body 21.00-30.00, posterior end flat, broad, shoe-like. Proboscis armed with 30-32 rows of 18-20 hooks each. Eggs 0.042 × 0.021.

Remarks : Bhattacharya (2000) reported 2 or 3 cement glands in his specimens.

222. ***Centrorhynchus erraticus*** Chandler, 1925

C. erraticus Chandler, 1925 *Ind. J. Med. Res.* 13 : P. 213.

Host : *Felis catus.*

Location : Small intestine.

Type locality : Kolkata.

Diagnosis : (after Chandler, 1925) : Body immature, 7.5-8.5 × 1.2-1.4. Proboscis 1.1-1.2 long × 0.39-0.43, armed with 36 rows of 21-22 hooks each, anterior hooks with roots, 0.055-0.065; rootless hooks 0.042. Genital organs insufficiently developed.

Remarks : Sex of the species has not been mentioned.

223. ***Centrorhynchus bengalensis*** Datta and Soota, 1954
(Pt. 30 & 35; Figs. 165a–165b; 194a–194c)

C. bengalensis Datta and Soota, 1954 : *Rec. Ind. Mus.*, 52(1) : pp. 15-20.

C. bengalensis : Sahay *et al.* (1969) : *Sonderdruck aus 'Zool. Anz. Bd, Heft* 3/4.

Host : *Dinopium sp.*

Location : Intestine.

Type locality : Kolkata Zoo.

Other host : *Corvus splendens. Location* : Intestine. *Locality* : Patna (by Sahay *et al.*, 1969).

Diagnosis : (after Datta and Soota, 1954) : *Male* : Body 5.35 × 0.59 (anterior broad part) and 0.03 (posterior narrow part). Proboscis armed with 35-40 rows of 14-18 hooks each; anterior hooks 0.02-0.04; posterior hooks 0.022-0.025.

Remarks : Description given by the authors is not sufficient to establish a new taxon. Proboscis hooks of Sahay's specimens are 11-12 rows of 16-20 hooks in each row which is not in agreement with that of type species.

224. ***Centrorhynchus knowlesi*** Datta and Soota, 1954
(Pt. 31; Figs. 166a–166d)

C. knowlesi Datta and Soota, 1954 : *Rec. Ind. Mus.*, **52**(1) : pp. 15-20.

Host : *Ottus sp.*

Location : Intestine.

Type locality : Kolkata.

Diagnosis : (after Datta and Soota, 1954) : *Male* : Body 7.87 × 0.48 (width at anterior broad part) and 0.23 (width at posterior narrow part). Proboscis hooks armed with 42-46 rows of 14-16 hooks each; anterior hooks 0.03-0.04; posterior hooks 0.02-0.022. *Female* : Body 9.36 × 0.46 (anterior broad part) and 0.21 (posterior narrow part).

225. ***Centrorhynchus crocidurus*** Das, 1950
(Pt. 31; Figs. 167a-167c)

C. crocidurus Das, 1950 : *Ind. J. Helminth.*, **2**(1) : pp. 49-56.

Host : *Crocidura caerulea.*

Location : Cyst on the viscera and in the peritineum.

Type locality : Nagpur.

C. crocidurus : Jain and Gupta (1983) : *Res. Bull. Punjab Univ. (Sc.)* : **34**(1-2).

Host : *Bangarus caeruleus.*

Location : Intestine.

Locality : Chandipur, Orissa.

Diagnosis : (after Das, 1950) : Juvenile : Body 2.4 × 0.39. Proboscis 0.49-0.69, armed with 34-38 rows of 24-25 hooks each; anterior hooks 0.038; posterior hooks 0.030; hooks at junction of anterior and posterior proboscis 0.019. Proboscis sheath 0.38 × 0.13. Lemnisci 0.2 long.

Remarks : Jain and gupta (1983) have described the maximum length of proboscis *i.e.* 1.14, armed with 36 rows of 23-25 hooks each.

226. ***Centrorhynchus amphibias*** Das, 1950
(Pt. 31; Figs.168a-168b)

C. amphibias Das, 1950 : *Ind. J. Helminth.*, **2**(1) : pp. 49-56.

Host : *Ptyas mucosus* and *Rana tigrina.*

Location : Mesentery.

Type locality : Amraoti, Berar.

Diagnosis : (after Das, 1950) : Juvenile : Body 4.2-5.25 × 0.88-0.96. Proboscis 1.02-1.06. Proboscis sheah 0.82 × 0.3, armed with 26-38 longitudinal rows with 20-21 each; anterior hooks 0.036-0.042; posterior hooks 0.030.

Remarks : Schmidt and Kuntz (1969) reported some adults of *C. amphibias* in Chinese goshawk, Japanese sparrow hawk and swallow from Taiwam.

227. ***Centrorhynchus longicephalus*** Das, 1950
(Pt. 31; Figs. 169a–169b)

C. longicephalus Das, 1950 : *Ind. J. Helminth.*, **2**(1) : pp. 49-56.

C. longicephalus : Jain and Gupta (1983) : *Res. Bull. Punjab Univ. (Sc.)* : **34**(1-2).

Host : Lycodon Sp.

Location : visceral peritoneum.

Type locality : Amraoti, Berar, M.P.

Other host : *Ptyas mucosus, Rana tigrina* and *Tropidonotus sp.*

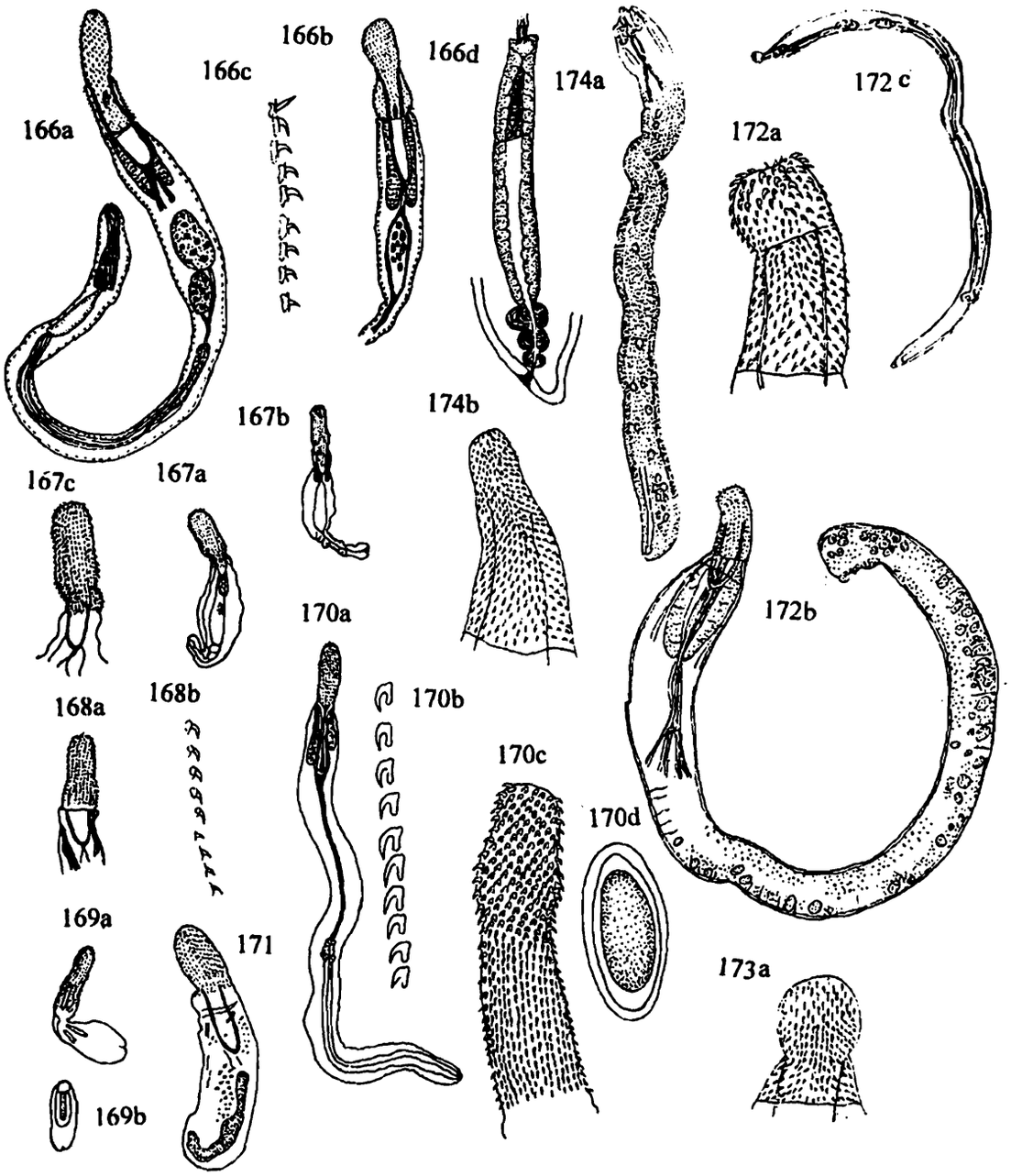

Plate-31

Fig. 166. *Centrorhynchus knowlesi* Datta and Soota, 1954. (a) male; (b) female; (c) proboscis hooks; (d) female genitalia.

Fig. 167. *Centrorhynchus crocidurus* Das, 1950. (a) juvenile female; (b) juvenile; (c) proboscis.

Fig. 168. *Centrorhynchus amphibias* Das, 1950. (a) proboscis; (b) proboscis hooks

Fig. 169. *Centrorhynchus longicephalus* Das, 1950. (a) larval form of the species. (b) preacanthella.

Fig. 170. *Centrorhynchus bethaniae* George and Nadakal, 1987. (a) female; (b) proboscis hooks; (c) proboscis; (d) egg.

Fig. 171. *Centrorhynchus batrachus* Das, 1952. juvenile female.

Fig. 172. *Centrorhynchus conspectum* Van Cleave et Pratt, 1940. (a) male; (b) female; (c) proboscis.

Fig. 173. *Centrorhynchus buteonis* (Schrank, 1788) Kostylew, 1914. (a) proboscis.

Fig. 174. *Centrorhynchus microcephalus* (Bravo Hollis, 1947). (a) female; (b) proboscis.

Location : Mesentery.

Locality : Chandigarh.

Diagnosis : (after Das, 1950) : Juvenile : Body 2.4 long. Anterior proboscis 0.7; posterior proboscis 1.16 long, armed with 24-26 rows of 21-23 hooks each. Proboscis sheath 0.79 × 0.3.

Remarks : Jain and Gupta (1983) reported 30 longitudinal rows of 22 hooks each on proboscis.

228. ***Centrorhynchus microcervicanthus*** Das, 1950
(Pt. 34; Figs. 188)

C. microcervicanthus Das, 1950 : *Ind. J. Helminth.*, **2**(1) : pp. 49-56.

Host : *Naja tripudians.*

Type locality : Amraoti, M.P.

Location : Wall of duodenum.

Diagnosis : (after Das, 1950) : Juvenile : Body 5.12 × 0.81. Proboscis 1.4 × 0.65 (including posterior proboscis).Proboscis sheath 1.11 × 0.31, armed with 26-30 rows of 19-22 hooks each; anterior hooks 0.038 and posterior hooks 0.019.

229. ***Centrorhynchus bethaniae*** George and Nadakal, 1987
(Pt. 31; Figs. 170a–170d)

C. bethaniae George and Nadakal, 1987 : *Jpn. J. Parasitol.*, 36(1) : pp. 9-12.

Host : *Accipiter badius.*

Location : Intestine.

Type locality : Bethani hills, Trivundrum.

Diagnosis : (after G & N, 1987) : *Male* : Body 10.0-30.0 × 0.5-2.0. Proboscis 0.8-1.2 × 0.33-0.38, anterior proboscis armed with 30-35 rows of 10-14 each, posterior proboscis armed with 32-38 rows of 16-20 hooks each, rooted hooks 0.035-0.055 × 0.016-0.030; roots 0.030-0.036; spines 0.020-0.030 × 0.006-0.010. Proboscis sheath 1.6-1.65 × 0.2-0.25. L/1–0.975-1.025 × 0.1-0.18; L/2–0.9-1.0. T/1–0.30-0.36 × 0.20-0.26. cement glands 4. *Female* : Body 15.00-46.00 × 1.00-3.00. Eggs 0.048-0.056 × 0.020-0.026.

230. ***Centrorhynchus batrachus*** Das, 1952
(Pt. 31; Figs. 171)

C. batrachus Das, 1952 : *Rec. Ind. Mus.*, **50**(2) : pp. 147-156.

Host : *Rana tigrina.*

Location : Visceral wall (Acanthor and Acanthella).

Type locality : India.

Diagnosis : (after Das, 1952) : Body 3.23 × 0.63. Proboscis 0.51 × 0.3, armed with 32-33 rows of 10 hooks each in anterior proboscis and 32-33 rows of 2 hooks each in posterior proboscis.

231. ***Centrorhynchus microcephalus*** (Bravo Hollis, 1947)
(Pt. 31; Figs. 174a–174b)

C. microcephalus : Gupta and Gupta (1972) : *Res. Bull. Punjab Univ. (Sc.),* **23**(1) : pp. 1-12.

Host : *Athene brama.*

Location : Intestine.

Locality : Chandigarh.

Diagnosis : (after Gupta and Gupta, 1972) : *Female* : Body 19.62-20.55 × 1.44-1.65. Anterior proboscis 0.63 × 0.36, armed with 32 rows of 10-13 hooks each, posterior proboscis 0.46 long, armed with 38 rows of 9-12 hooks each; anterior hooks 0.045 × 0.006; posterior hooks with poorly developed roots, 0.024-0.033. Proboscis sheath 1.22-1.37 × 0.43. Lemnisci 2.10-2.16 × 0.41 each. Eggs oval 0.042-0.057 × 0.021-0.027.

232 ***Centrorhynchus conspectum*** Van Cleave et Pratt, 1940
(Pt. 31; Figs 172a–172c)

C. conspectum: Gupta and Gupta (1972) : *Res. Bull. Punjab Univ. (Sc.);* **23**(1) : pp. 1-12.

Host : *Athene brama.*

Location : Intestine.

Locality : Chandigarh.

Diagnosis : (after G & G, 1972) : Male : body 26.64 × 0.57-0.72. Proboscis 0.35-0.41 × 0.32-0.45, armed with 28-32 rows of 11-13 hooks each, anterior hooks with roots 0.045-0.066 × 0.006; posterior proboscis 0.63-0.72 × 0.35-0.64, armed with 28-32 rows of 7-8 hooks with poorly developed reoots, 0.039-0.040 × 0.008-0.009; basal spines 0.033 × 0.004. proboscis sheath 1.07-1.36 × 0.18-0.25. lemnisci 1.20-1.35 × 0.16-0.19. Testes oval, T/1–1.008 × 0.378; T/2–1.170-0.342. Cement glands 3; 14.99 × 0.270.

Remarks : Gupta and Gupta (1972) described posterior proboscis as 'neck' Separate measurements of anterior and posterior proboscis (neck), and number of hooks on each are given by the authors. Proboscis hooks should be measured and counted together. Golvan (1994) renamed *C. conspectum* reported by Hartwich (1956) as *Centrorhynchus hartwichi* (Hartwich, 1956) nom. nov. for the former species was preoccupied.

233. ***Centrorhynchus buteonis*** (Schrank, 1788) Kostylew, 1914
(Pt. 31-32; Figs. 173a–173b)
Synonym *Echinorhynchus nyctae* Schrank, 1788
Echinorhynchus caudatus Zeder, 1803
Echinorhynchus haliaeti Rud., 1819
Echinorhynchus polyacanthoides Crepl., 1825
Echinorhynchus tenuicaudatus Marotel, 1899

C. buteonis : Gupta and Gupta (1972) : *Res. bull. Punjab Univ. Sci.*, **23**(1) : pp. 1-12.

Host : *Buteo sp.* (Hawk).

Location : Intestine.

Locality : Chandigarh, Punjab.

Diagnosis : (after Gupta and Gupta, 1972) : *Female* : Body 23.40-24.01 × 0.99-1.08. Anterior proboscis armed with 32 rows of 8 rooted hooks each; posterior proboscis (neck) 0.39-0.41 × 0.59-0.63, armed with 32 rows of 5-6 hooks each.; anterior hooks 0.048-0.064 × 0.012; posterior hooks 0.20-0.24 × 0.004-0.008. Proboscis sheath 1.20-1.29 × 0.34-0.39. Lemnisci 1.28-2.46 × 0.24. Eggs oval, 0.039-0.054 × 0.012-0.021.

Remarks : No measurement of posterior proboscis is given by the authors.

234. ***Centrorhynchus milvus*** Ward, 1956
(Pt. 32; Figs. 175a–175c)

C. milvus: Gupta and Lata (1967) : *Res. Bull. Punjab Univ. Sci.* **18**(3-4) : pp. 325-341.

C milvus : Bhattacharya (1999) : *ZSI, Fauna of Meghalaya, State Fauna Series*, **4**(part 9) : pp. 359-392.

Host : *Astur badius.*

Location : Intestine.

Locality : Hoshiarpur, Punjab.

Other hosts : *Milvus migrans govinda* from Meghalaya; *Corvus splendens* from Rajasthan.

Location : Intestine.

Diagnosis : (after Gupta and Lata, 1967) : *Female* : Body 7.42-10.40. Anterior proboscis 0.49-0.74 × 0.29-0.36, armed with 32 rows of 13 rooted hooks each, neck 0.30-0.49 × 0.29-0.36, armed with 32 rows of 8-9 rootless spines each; rooted hooks 0.022-0.024 × 0.008-0.01. Prob. sheath 1.09-1.26 × 0.30-0.40. Lemnisci 1.09-1.91 × 0.21-0.35. Eggs rounded or oval 0.06-0.15 × 0.03-0.09.

Remarks : 30-34 rows of 10 rooted hooks in each row, and14 rootless spines in each row have been reported by Bhattacharya (1999) in his specimens. Rathore (1984) has reported the species in *Corvus splendens* from Rajasthan.

235. ***Centrorhynchus maryasis*** Datta, 1932
(Pt. 32; Figs. 176a–176b)

C. maryasis Datta,1932: *Rec. Ind. Mus.* 35 : pp. 325-333.

C. maryasis : Gupta and Lata (1967) : *Res. bull. Punjab Univ. Sci.* 18(3-4) : p. 333.

Host : *Urocissa melanocephala occipitalis.*

Location : Intestine.

Type locality : Northern India; From Unknown bird.

Location : Intestine.

Other locality : Hoshiarpur, Punjab.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 17.9 × 0.91. Proboscis 0.44 × 0.39, armed with 24 rows of 7-8 hooks each, hooks 0.028 × 0.006. Neck 0.44 × 0.32, armed with 24 rows of 6-7 hooks each, basal spines 0.010-0.018 × 0.004. Prob. sh. 1.61 × 0.29. Lemnisci 1.96 × 0.4. T/1–0.75 × 0.44; T/2–1.05 × 0.42. Cement glands 3.

236. ***Centrorhynchus microrchis*** Fukui, 1929
(Pt. 32; Figs. 177a–177d)

C. microrchis : Gupta and Lata (1967) : *Res. Bull, Punjab Univ. Sci.* 18(3-4) : pp. 325-341.

Host : Unidentified bird.

Location : Intestine.

Locality : Hoshiarpur, Punjab.

Diagnosis : (after Gupta and Lata, 1967) : *Male* : Body 9.8-11.2 × 1.3-1.4. Anterior proboscis 0.65-0.77 × 0.28-0.40, armrd with 32 rows of 13 hooks each. Neck 0.39-0.56 × 0.30-0.518, armed with 32 rows of 10 hoooks each, anterior hooks 0.022 × 0.006; posterior hooks 0.012 × 0.004. Prob. sh. 0.84-1.31 × 0.18-0.35. Lemnisci 0.91-1.21 × 0.18-0.19. T/1–0.49-0.56 × 0.26-0.32; T/2–0.56-0.58 × 0.26-0.32. Cement gland 3, 4.06-4.8 × 0.056-0.084. *Female* : Body 5.8-15.2 long. Eggs 0.028-0.015 × 0.010-0.084.

Remarks : Petrotschenko (1959) has considered the species as a synonym of *C. magnus* Fukui, 1929. Proboscis armature according to Fukui (1929) in anterior proboscis is 38-40 rows and in posterior proboscis 40-42 rows. Number of hooks in each row is 26-27 out of which anterior 15-17 are large with roots and 9-11 are rootless.

237. ***Centrorhynchus horridum*** (Linstow, 1997) Yamaguti, 1963
Synonym *Echinorhynchus horridum* Linstow, 1897
(Pt. 32; Figs. 178a–178b)

C. horridum : Bhattacharya (2000) *ZSI, Fauna of Tripura, State Fauna Series,* 7(part-4) : pp. 141-162.

Host : *Halcyon Sp.*

Location : Intestine.

Locality : Bismark Archipelago, Tripura.

Diagnosis : (after Bhattacharya, 2000) : *Male* : Body medium 6.48 × 1.29. Proboscis 0.81 × 0.46, armed with 28-32 rows of 15-17 hooks each, anterior 6-7 rooted hooks in each row, remaining rootless. Prob. sh. 0.98 × 0.31. Lemnisci reaching beyond pr. sh. Testes in anterior broadest part. T/1–0.66 × 0.43; T/2–0.74 × 0.46. Cement glands two.

Remarks : 26-28 rows of 15-16 hooks on proboscis are described in Type species.

238. ***Centrorhynchus elongatum*** Yamaguti, 1935
(Pt. 32; Figs. 179a–179b)

C. elongatum: Bhattacharya (1999) : *ZSI, Fauna of Meghalaya, State Fauna Series,* 4(part-9) : 359-392.

Host : *Accipiter badius.*

Location : Intestine.

Locality : Meghalaya.

Diagnosis : (after Bhattacharya, 1999) : *Male* : Body 36.09 × 0.84. Proboscis 0.78 × 0.29, armed with 30-32 rows of 20-22 hiooks each, anterior hooks 4-5 with roots. Prob. sh.1.54 × 0.36.Lemnisci two equal. T/1–1.08 × 0.71.T/2–1.34 × 0.66. Cement glands long, tubular, 2.76 × 0.66. *Female* : Body longer than male. Eggs 0.056 × 0.025.

Remarks : Number of cement glands not mentioned. The description of type species also lacks the number of cement glands.

239. ***Centrorhynchus bramae*** Renguraju and Das, 1980
(Pt. 32; Figs. 180a–180e)

C. bramae R & D, 1980 : *Rec. Zool. Surv. India,* **76** : pp. 83-85.

Host : *Athene brama.*

Location : Intestine.

Type locality : Sholapur.

Diagnosis : (after R & D, 1980) : *Male* : Body 17.00 × 0.59. Proboscis 0.80 × 0.40, armed with 28 rows of 20 (10+10) hooks each, hooks 0.03-0.04 long and spines 0.015 long. Proboscis sheath 1.0 × 0.40. Lemnisci 0.8. T/1–0.75 × 0.25; T/2–0.95 × 0.32. Cement glands 2; 10.4 long. Saefftigen's pouch 2.7 long. *Female* : Body 19.0 × 0.60. Ova ovate, 0.029 × 0.013.

240. ***Centrorhynchus sikkimensis*** Bhattacharya, 2003
(Pt. 32; Figs. 181a–181e)

C. sikkimensis Bhattacharya, 2003 : *ZSI, State Fauna Series 9; Fauna of Sikkim;* Part-5 : pp. 71-78.

Host : Eagle.

Location : Intestine.

Type locality : Singtam, Sikkim.

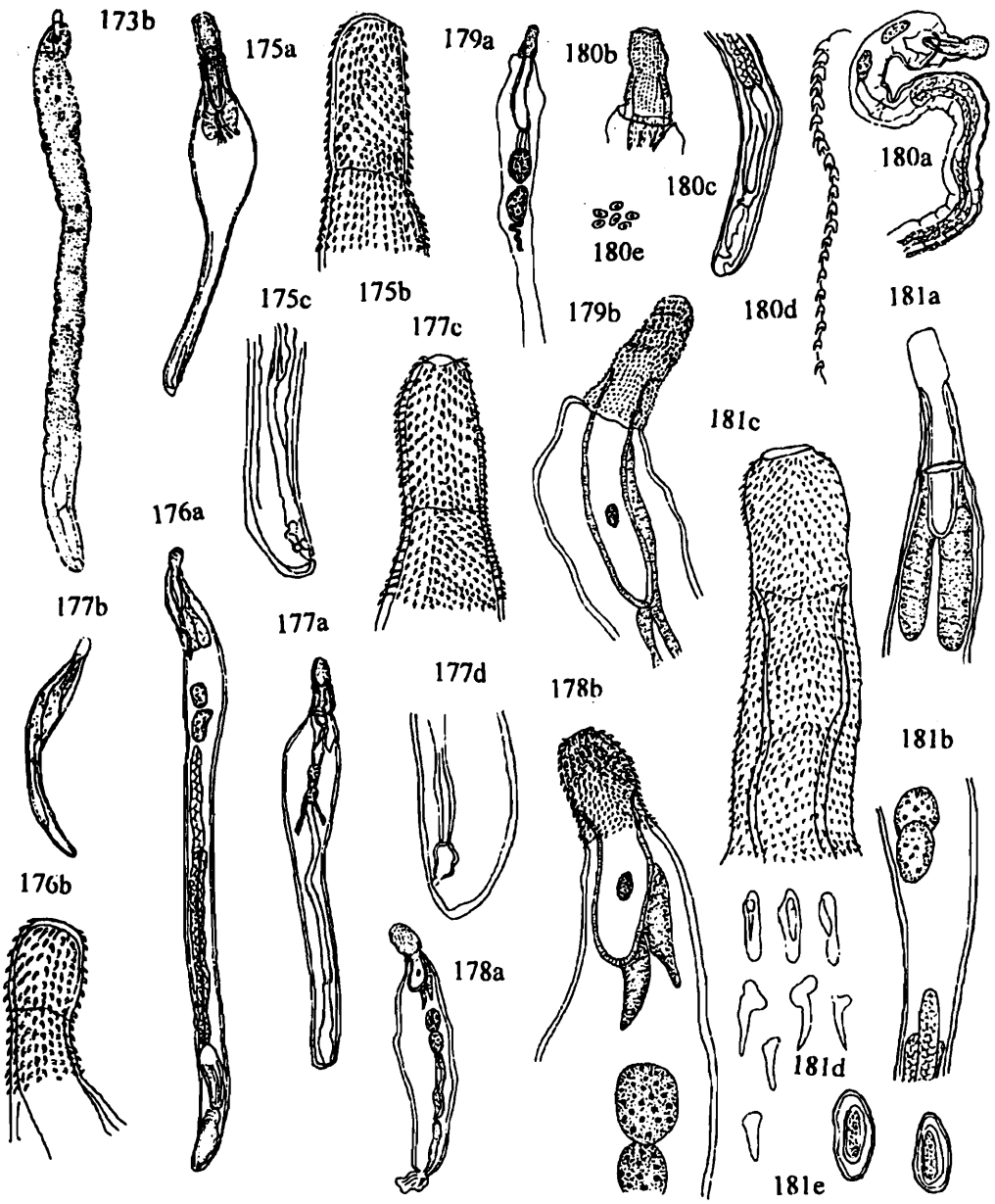

Plate-32

Fig. 173. *Centrorhynchus buteonis* (Schrank, 1788) Kostylew, 1914. (b) female (after Gupta and Gupta, 1972)

Fig. 175. *Centrorhynchus milvus* Ward, 1956. (a) female; (b) proboscis; (c) posterior proboscis.

Fig. 176. *Centrorhynchus maryasis* Datta, 1932. (a) male; (b) peoboscis.

Fig. 177. *Centrorhynchus microrchis* Fukui, 1929. (a) male; (b) female; (c) proboscis; (d) posterior of female.

Fig. 178. *Centrorhynchus horridum* (Linstow, 1997) Yamaguti, 1963. (a) male; (b) anterior of male.

Fig. 179. *Centrorhynchus elongatum* Yamaguti, 1935. (a) anterior male; (b) proboscis.

Fig. 180. *Centrorhynchus bramae* Renguraju and Das, 1980. (a) anterior male; (b) proboscis; (c) posterior male; (d) proboscis hooks. (e) egg.

Fig. 181. *Centrorhynchus sikkimensis* Bhattacharya, 2003. (a) anterior male; (b) mid-body of male; (c) proboscis. (d) proboscis hooks; (e) eggs.

Diagnosis : (after Bhattacharya, 2003) : Male: Body 43.75 × 0.55. Proboscis 1.5 × 0.375, armed with 40-42 rows of 28-30 hooks and spines each; anterior 10 hooks rooted and rest rootless, roots longer than points except points with triangular roots, points 0.024-0.036 long; roots 0.036-0.04; triangular roots 0.014 × 0.01. Proboscis sh. 1.75 × 0.3; ganglion near centre. Lemnisci longer than proboscis sh. L/1–2.125 long; L/2–2.00 long; Testes 0.875 long. Cement gland 2. *Female* : Body 61.5 × 1.625, digitate pricess at posterior end. Eggs 0.04-0.046 × 0.016-0.018.

241. ***Centrorhynchus owli*** Bhattacharya 1999
(Pt. 33; Figs. 182a–182d)

C. owli Bhattacharya, 1999 : *ZSI, Fauna of Meghalaya, State Fauna Series,* **4**(part-9) : pp. 359-392.

Host : Owl (*Bubo sp.*).

Location : Intestine.

Type locality : Near shillong, Meghalaya.

Diagnosis : (after Bhattacharya, 1999) : *Male* : Body 30.00 long with anterior swelling Proboscis 1.2 × 0.325., armed with 30-32 rows of 20-22 hooks each, 3 types of rooted hooks, rest rootless. Simple roots of 1st and 2nd hooks of each row followed by bifurcated roots of 3rd and 4th; roots of 5th to 7th hooks of each row with two dorsal manubria; rest rootless. roots of 1st and 2nd 0.034 × 0.006 and points 0.036 × 0.002; roots of 3rd and 4th 0.034 × 0.008 and points 0.026 × 0.006; roots of 5th to 7th 0.016 and points 0.016 ; rootless hooks 0.03-0.036. Proboscis sheath 1.125 × 0.2. Lemnisci 1.875. T/1–0.875 × 0.425; T/2–0.9 × 0.425.Cement glands 2, tubular.

Remarks : The number of cement glands probably warrants the species to be referred to the genus *Malagacanthus* Golvan, 1965. However, taking other characteristics into consideration, I retain the species in *Centrorhynchus.*

242. ***Centrorhynchus fisheri*** Bhattacharya, 1999
(Pt. 33; Figs. 183a–183e)

C. fisheri Bhattacharya,1999 : *ZSI, Fauna of Meghalaya, State Fauna Series,* **4**(part 9) : pp. 359-392.

Host : King fisher.

Location : Intestine.

Type locality : Meghalaya.

Diagnosis : (after Bhattacharya, 1999) : *Male* : Body 22.5 × 0.75. Proboscis 0.875 × 0.3 with broad mid-proboscis, armed with 28 rows of 15-16 hooks each, 6-7 hooks of each row with strong roots, roots of 1st hooks 0.026 and points 0.04; roots of 2nd hooks 0.04 and points 0.044; roots of 3rd 0.03 and points 0.024; roots of 4th hooks 0.036 and points 0.02; roots of 5th 0.036 and points 0.024; roots of 6th hooks 0.03 and points 0.026; rootless hooks 0.02. Proboscis sh. 1.875 × 0.25. Lemnisci 3.5 × 0.5 each. Testes 0.875 × 0.5. Cement glands 3. *Female* : Body 30.5 × 1.25. Genital pore sub-terminal. Eggs 0.056-0.058 × 0.024.

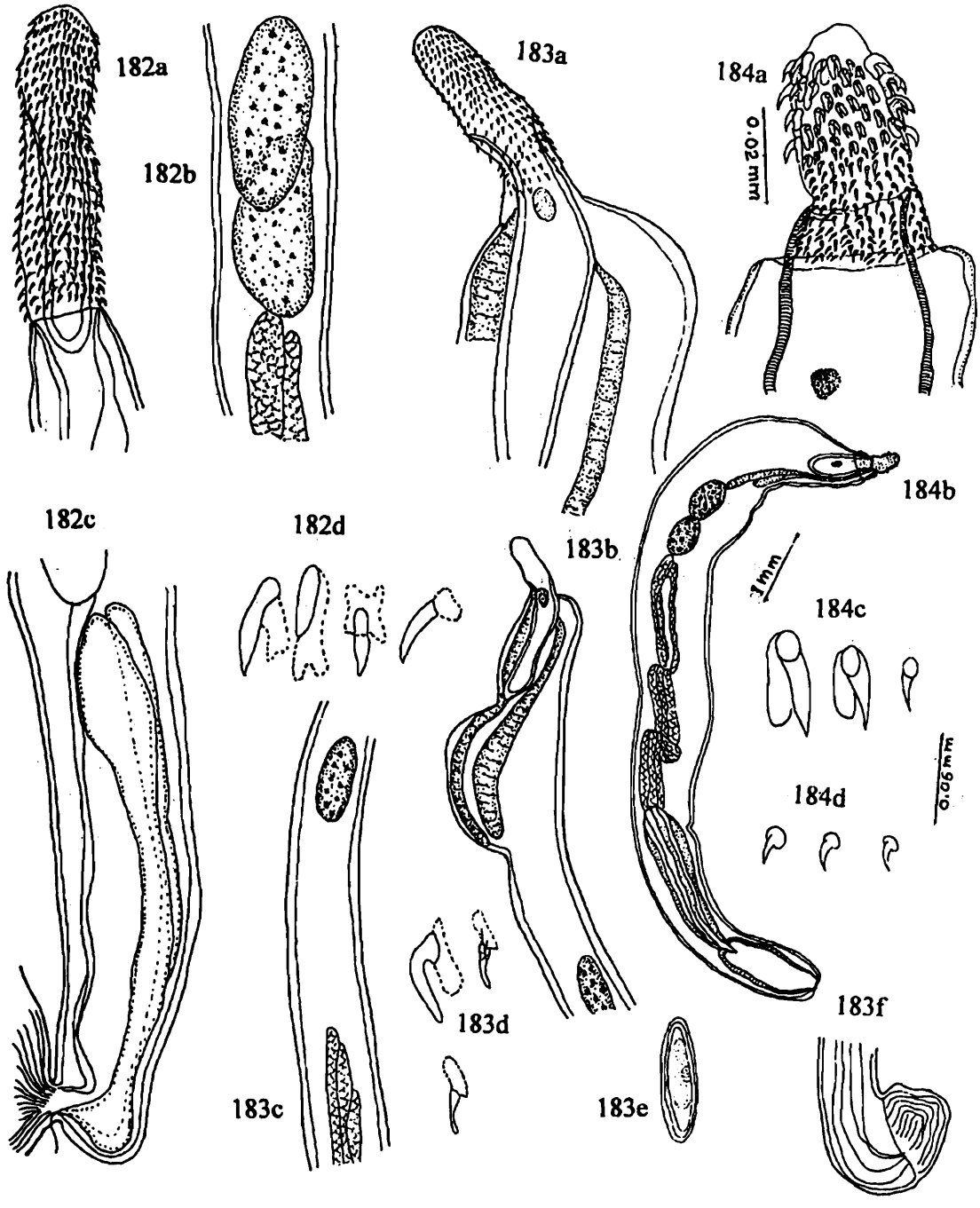

Plate-33

Fig. 182. *Centrorhynchus owli* Bhattacharya. 1999. (a) anterior of male; (b) mid-body of male; (c) posterior of male; (d) proboscis hooks.

Fig. 183. *Centrorhynchus fisheri* Bhattacharya, 1999. (a) proboscis; (b) anterior of male; (c) posterior of male; (d) proboscis hooks; (e) egg.

Fig. 184. *Centrorhynchus smyrnensis* n. sp. (a) proboscis; (b) male; (c) proboscis hooks; (d) posterior proboscis hooks.

243. ***Centrorhynchus smyrnensis*** n. sp.
(Pt. 33; Figs. 184a–184d)

Host : *Halcyon smyrnensis.*

Location : Intestine.

Locality : Calcutta.

Materials : 2 male specimens.

Diagnosis : *Male* : Body medium, ventrally curved, 10.00-10.75. × 1.25-1.30. Proboscis 0.50-0.52 × 0.25-0.30, armed with 18 longitudinal rows of 15-16 hooks each, large area of proboscis tip hookless, anterior 4-5 hooks of each row rooted, conspicuous , almost double than the rootless hooks. remaining hooks rootless, basal hooks very minute, roots almost equal to points. Points 0.049-0.05 × 0.0166; roots 0.045-0.05 × 0.0249; rootless hooks 0.0038-0.0249 long. Neck short. Proboscis sheath double walled, 0.95-1.00 long and 0.35-0.375 wide with ganglion near centre. Lemnisci long, reaching anterior testis, unequal. L1–2.00-2.125 long and L-2–1.70-1.875 long. Testes pre-equatorial, oval, contiguous, T1–0. 65-0.70 long and 0.35-0.375 wide, T2–0.70-0.75 long and 0.375-0.385 wide. Cement glands 3, long, tubular. Seminal vesicle 2.25-2.50 long.

Remarks : Jain and Gupta (1983) reported *Centrorhynchus clitoredeum* in *Halcyon smyrnensis* at Kashipur, Calcutta with 34 rows of proboscis hooks of 21 hooks in each row and a digitiform process at the posterior end. The present species has less number of hooks and no such process at posterior end of the body. The new form is distinguished from all other species of the genus by having 18 rows of proboscis hooks with a large hookless area on the tip of the proboscis, equal size of point and roots of hooks, conspicuous and almost double in size of the anterior rooted hooks than the hooks towards base of proboscis as well as having 3 cement glands. Therefore, the new form is proposed as *Centrorhynchus smyrnensis* n. sp.

244. ***Centrorhynchus latai*** Golvan,1994 nom. nov.
(=*P. indicus* Gupta and Lata, 1967 nec Gupta and Fatma, 1981)
(Pt. 34; Figs. 185a-185c)

Pomphorhynchus indicus Gupta and Lata, 1967 : *Res. Bull. Punjab Univ. Sci.* **18**(3/4) : pp. 253-268.

Host : *Astur badius.*

Location : Intestine.

Locality : India.

Diagnosis : (after Gupta and Lata, 1967) : *Female* : Body 11.2 long, anterior trunk swollen, hind trunk tubular. Anterior proboscis 0.56 × 0.26, armed with 32 longitudinal rows of 10-11 hooks each, anterior hooks 0.01-0.014 × 0.006; Neck (posterior proboscis) 0.47 × 0.32., armed with 32 rows of 13-14 hooks each, anterior hooks with roots. Proboscis sheath 0.74 × 0.25; ganglion anterior. Eggs round or oval, 0.024-0.040 × 0.020.

Remarks : Gupta and Lata (1967) described *Pomphorhynchus indicus* from *Astur badius*

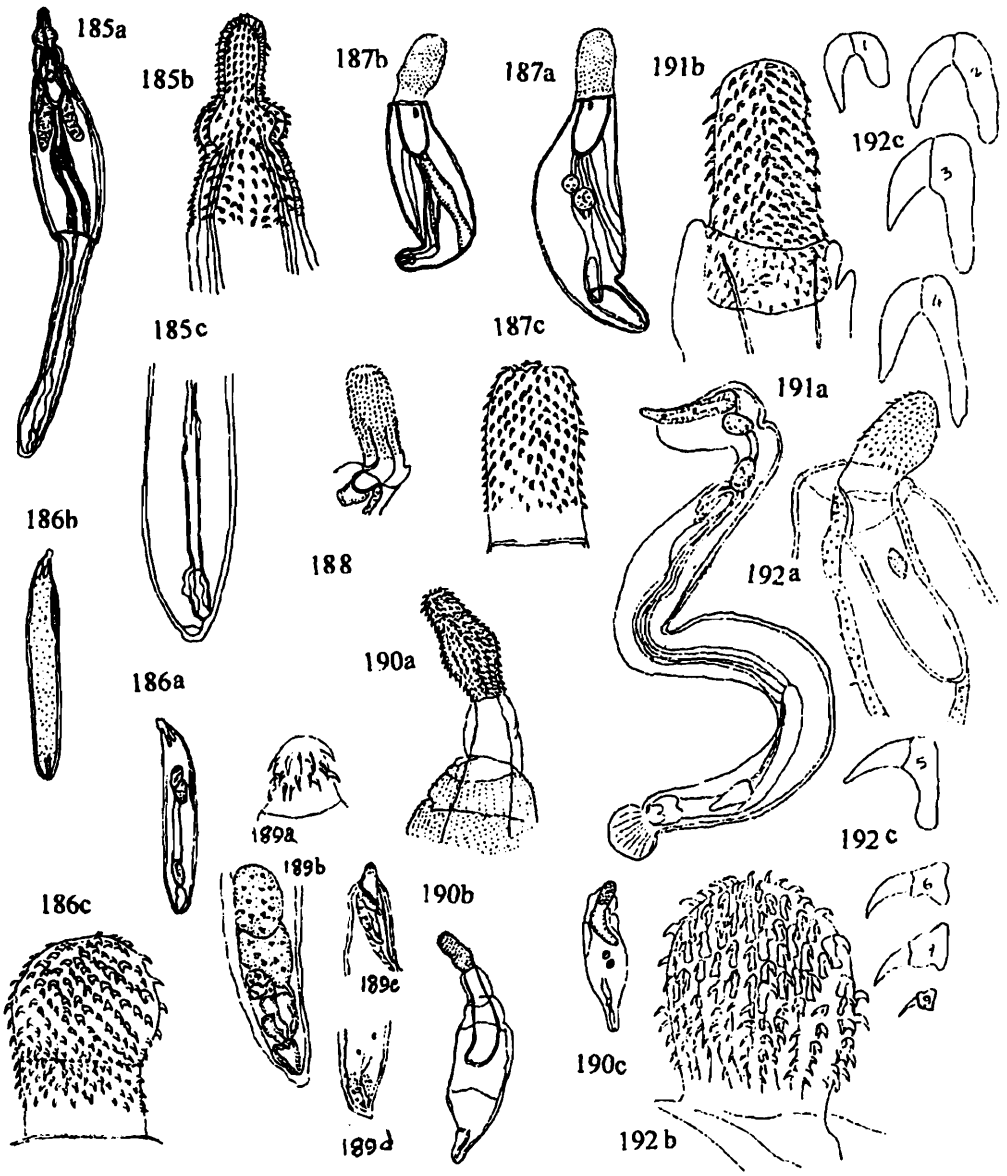

Plate-34

Fig. 185. *Centrorhynchus latai* Golvan 1994 (= *P. indicus* Gupta and Lata, 1967 nec Gupta and Fatma, 1953) (a) female; (b) Proboscis; (c) Posterior of female.

Fig. 186. *Centrorhynchus globuli* (a) male; (b) female; (c) proboscis.

Fig. 187. *Centrorhynchus sexicoloides* (a) male; (b) female; (c) proboscis.

Fig. 188. *Centrorhynchus microcervicanthus* Das, 1950; proboscis.

Fig. 189. *Acanthosentis vancleavei* Gupta & Fatma, 1985 (a) proboscis; (b) posterior of male; (c) anterior of male; (d) posterior of female.

Fig. 190. *Arhythmorhynchus tigrinus* syn. of *Southwellina hispidus* (a) anterior of female; (b) juvenile of female; (c) juvenile of male.

Fig. 191. *Centrorhynchus globocaudatus* (Zeder, 1800) Petrotschenko, 1959. (a) male; (b) proboscis.

Fig. 192. *Porrorchis indicus* (Das, 1957) S & K, 1967; (a) anterior of male; (b) proboscis; (c) Proboscis hooks. (By Bhattacharya, 1999) (Figs. 197a–197e by Gupta & Jain, 1975)

which is unnatural for the members of the genus *Phomphorhynchus*. *Pomphorhynchus* spp. are basically fish parasites. Gupta and Fatma (1981) refer *P. indicus* to the genus *Centrorhynchus* as *Centrorhynchus indicus* which is preoccupied because *Gordiorhynchus falconis* Johnston and Best, 1943 reported by Das (1949) in *Ptyssus mucosa* from India. was transferred to the genus *Centrorhynchus* and was renamed as *C. indicus* by Golvan (1956). Later, when Gupta and Fatma (1981) renamed *Pomphorhynchus indicus* as *Centrorhynchus indicus* it was found different from *C. indicus* and hence, the name was found preoccupied by Golvan (1994). Thus Golvan (1994) renamed it *Centrorhynchus latai* (Gupta and Lata, 1967) nom. nov. after the name of the second author of *P. indicus*.

245. ***Centrorhynchus sharmai*** (Gupta and Lata, 1967) nov. comb. (Pt. 28; Figs. 198a–198c)

Mediorhynchus sharmai Gupta and Lata, 1967 : *Res. Bull. Punjab Univ. (Sc)* : **18**(3/4) : pp. 253-268.

Host : *Mugil* Sp.

Location : Intestine; India.

Diagnosis : (after Gupta and Lata, 1967) : *Female* : Body 11.2 long. × 0.54 at anterior swollen part. neck 0.47 × 0.32, armed with 32 longitudinal rows of spines of 13-14 spines each. spines 0.02 × 0.004 and the marginal spines 0.22 × 0.004. Proboscis 0.56 × 0.26 armed with 32 rows of 10-11 spines each, spines 0.01-0.026 × 0.006. basal spines 0.008 × 0.002. All the spines with well developed roots. Proboscis sac 0.74 × 0.25. Eggs 0.024-0.040 × 0.020.

Remarks : Gupta and Lata (1967) described *Mediorhynchus sharmai* from *Mugil* sp. The species did not belong to the genus *Mediorhynchus*. It was wrongly identified. Therefore, Schmidt and Kuntz (1977) while revising the genus *Mediorhymchus* opined that this was definitely a *Centrorhynchus* sp. and they considered the species of uncertain status. After examining the literature, I transfer the species to the genus *Centrorhynchus* but at the same time I still express doubt on the occurrence of the species in an estuarine fish host.

246. ***Centrorhynchus giganteum*** Travassos, 1921

C. giganteum : Bhattacharya (2005) : ZSI, *Fauna of Andhra Pradesh, State Fauna Series*, **5**(Part-5) : 123-157.

Host : Shikra.

Location : Intestine.

Locality : Sreesailam, Andhra Pradesh.

Diagnosis : Male : Body 24.50 × 0.75. Proboscis 0.85 long, armed with 22-24 longitudinal rows of hooks with 24-26 hooks each, 14-16 anterior hooks rooted. Maximum size of point of hooks 0.0325; maximum size of roots 0.05. Testes at anterior region, T/1–1.00 × 0.35; T/2–1.10 × 0.25.

Remarks : Travassos (1921) described the species from a bird of prey of the family Falconidae. Bhattacharya (2005) reported the species from a shikra, the bird of prey. Rows

of proboscis hooks and the number of each row conform with *C. giganteus* especially with the number of rooted hooks. Bhattacharya reported the species for the first time from India.

247. ***Centrorhynchus opimum*** Travassos, 1921
(Pt. 30; Figs. 160a–160b)

C. opimum : Gupta and gupta (1972) : *Res. Bull. Punjab Univ. (Sc)*, **23**(1) : pp. 1-12.

Host : *Pitangus sulfuratus maximilani; Haliaetus leucoryphus; Dicrurus macrocercus.*

Location : Intestine.

Locality : Punjab.

Diagnosis :.(after Gupta and Gupta, 1972) : Male: Body 19.67 × 0.59-0.79. Proboscis 0.54 × 0.36, armed with 24 rows of 12-14 hooks each, anterior 6-7 hooks with roots, rooted hooks 0.055 × 0.012, basal hooks 0.030 × 0.009. Proboscis sheath 1.27 × 0.62. Lemnisci slightly longer than pr.sh. T/1–0.82 × 0.36; T/2–0.86 × 0.34. Cement glands syncytial, 3, 7.95 × 0.27. Saefftigen's pouch present. Female : (after Duggal *et al.*, 1986) : Body 10-95 × 1.2, Proboscis 0.37 × 0.4. Eggs 0.03-0.06 × 0.01-0.02.

Remarks : Syncytial cement glands in the species probably denote each cement gland with a large nucleus. The organ of Saefftgen is not mentioned in the original description by Travassos (1921).

248. ***Centrorhynchus globuli*** Nama and Rathore, 1984
(Pt. 34; Figs. 186a-186c)

C. globuli Nama & Rathore, 1984 : *Ind. J. Helminth* **34**(2) : pp. 143-150

Host : Bird of Rajasthan.

Remarks : Golvan (1994) referred the species to *Sphaerorostris.*

249. ***Centrorhynchus sexicoloides*** Nama & Rathore, 1984
(Pt. 34; Figs. 187a-187c)

C. sexicoloides Nama & Rathore, 1984 : *Ind. J. Helminth.* : pp. 143-150.

Host : Bird of Rajasthan.

Remarks : Golvan (1994) referred the species to *Sphaerorostris.*

250. ***Centrorhynchus cinctum*** (Rudolphi, 1819) Meyer, 1931

Remarks : Reported from India by Datta and Soota (1955).

251. ***Centrorhynchus spinosus*** (Kaiser, 1893) Van Cleave, 1924

Remarks : Reported from Bangalore by Pujatti (1950 : 1952) : (Juveniles) : 3 from Amphibia; 9 from Reptilia; 3 from Mammalia. (Adults) : from *Milvus migrans; Corvus coronoides; Corvus s. splendens; Tyto alba.*

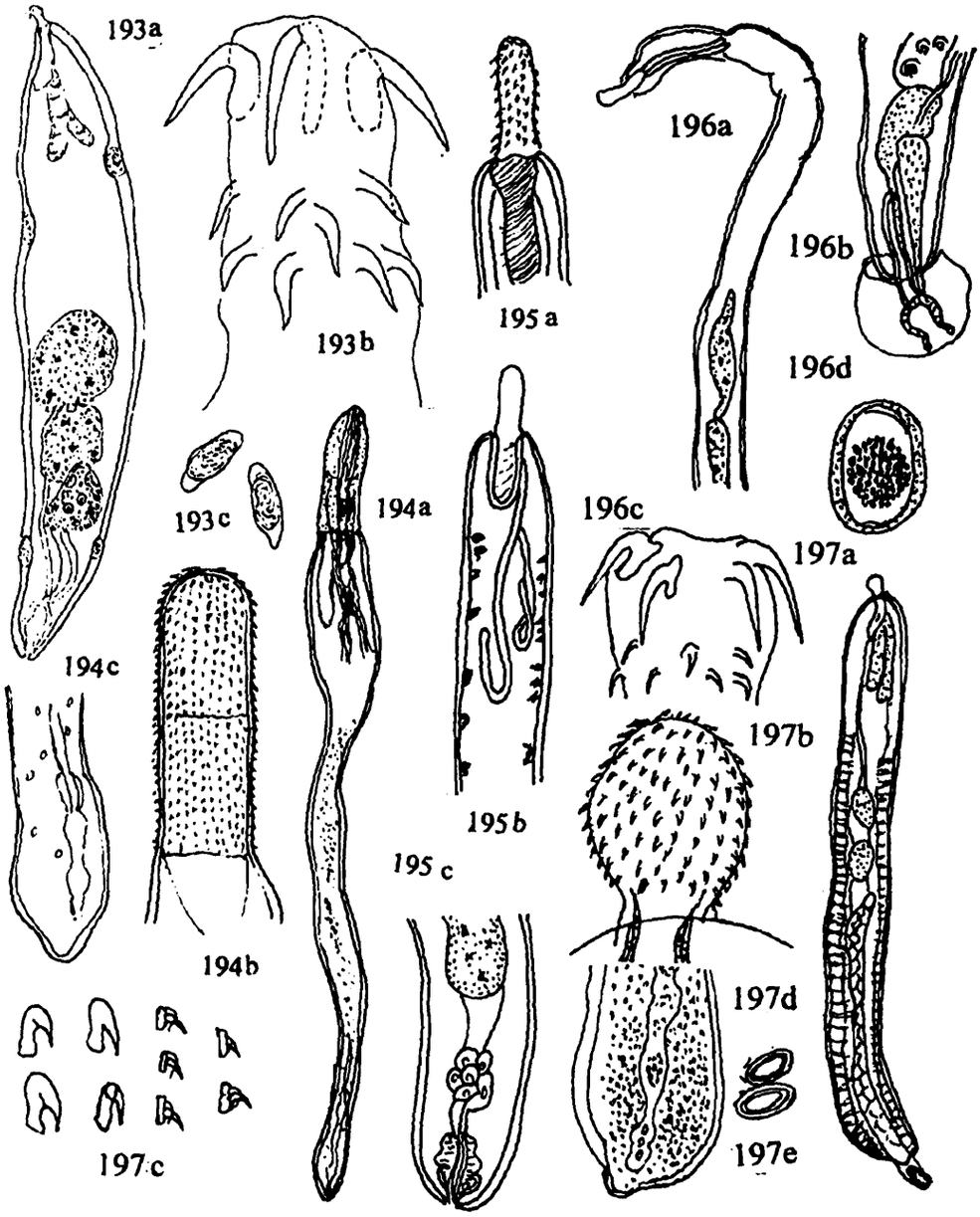

Plate-35

Fig. 193. *Neoechinorhynchus sootai* Bhattacharya, 1999. (a) male; (b) Proboscis; (c) esggs.

Fig. 194. *Centrorhynchus bengalensis* of Sahay *et al.*, (a) female; (b) proboscis; (c) Posterior of memale

Fig. 195. *Moniliformis spiralis* Subrahmanian, 1927. (a) proboscis; (b) anterior of male : (c) posterior of male

Fig. 196. *Neoechinorhynchus johnii* Yamaguti, 1939. (a) anterior of male; (b) posterior of male; (c) proboscis; (d) egg.

Fig. 197. *Porrorchis indicus;* (a) male; (b) proboscis; (c) proboscis hooks; (d) posterior of femaole; (e) eggs, (By Gupta and Jain, 1975)

HOST-PARASITE LIST OF INDIAN ACANTHOSEPHALA

HOST	PARASITE
AVES	
Anastomus ascitans	*Centrorhynchus buckleyi* Gupta & Fatma, 1981
Anas querquedula	*Polymorphus minutus* (Goez, 1782) Luhe, 1911
Accipiter badius	*Centrorhynchus elongatum* Yamaguti, 1935
	Centrorhynchus bethaniae George & Nadakal, 1987
Acridotheres tristis	*Mediorhynchus mariae* George and Nadakal, 1984
	Centrorhynchus lancea (Westrumb, 1821) Golvan, 1960
	Centrorhynchus turdi Yamaguti, 1939
Astur badius	*Rhadinorhynchus asturi* Gupta and Lata, 1967
	Centrorhynchus latai Golvan 1994 (= C. *indicus* Gupta and Lata, 1967) Golvan, 1994 nec Gupta and Fatma, 1953
	Centrorhynchus clitorideum (Meyer, 1931) Yamaguti, 1963
	Centrorhynchus milvus Ward, 1956
Athene brama	*Apororhynchus chauhani* Sen, 1975
	Centrorhynchus Bramae Renguraju & Das 1980
	Centrorhynchus atheni Gupta and Fatma, 1981
Athene brama	*Centrorhynchus tumidulum* (Rud.,1819) Yamaguti, 1961
	Centrorhynchus conspectum Van Cleave et Pratt, 1940
	Centrorhynchus microcephalus (Hollis, 1947)
Bravo Black kite; Baz & kite	*Centrorhynchus milvus* Ward, 1956
Bird	*Mediorhynchus colini* (Webster, 1948) Schmidt and Kuntz, 1977
Buteo sp	*Centrorhynchus buteonis* (Schrank, 1788) Kostylew, 1914
Centropus sp.	*Porrorchis indicus* (Das, 1957) S & K, 1967
Centropus castanopterus	*Porrorchis indicus* (Das, 1957) S & K, 1967
Centropus sinensis	*Porrorchis keralensis* George and Nadakal, 1984
	Porrorchis indicus (Das, 1957) S&K, 1967
Centropus sp	*Centrorhynchus turdi* Yamaguti, 1939
Choriotis nigriceps	*Mediorhynchus rajasthanensis* Gupta, 1976
Corvus splendens	*Centrorhynchus hargisi* Gupta and Fatma, 1981
	Centrorhynchus corvi Fukui, 1929
	Centrorhynchus bengalensis Datta and Soota, 1954

HOST	PARASITE
Corvus coronocides culminates	*Centrorhynchus spinosus* (Kaizer, 1893)
Corvus splendens splendens	*Centrorhynchus spinosus* (Kaizer, 1893)
	Echinorhynchus robustus Sp inq.
Dendrocitta vagabonda	*Centrorhynchus lancea* (Westrumb, 1821) Golvan, 1960
Dendrocitta sp.	*Centrorhynchus turdi*
Dicrurus macrocercus	*Centrorhynchus opimum;* Travassos, 1921
Dichoceros bicornis	*Plagiorhynchus (Prosthorhynchus) kuntzi* (Gupta and Fatma, 1987) n. comb.
Dinopium bengalense	*Mediorhynchus chaannapettae* George and Nadakal, 1984
Dinopium sp.	*Centrorhynchus bengalensis* Datta and Soota, 1954
Drongo and Racket tail drongo	*Mediorhynchus robustus* Van Cleave, 1916
Eagle	*Centrorhynchus sikkimensis* Bhattacharya, 2003
Egretta sacra	*Southwellina sacra* Bhattacharya *et al.*, 2002
Falco liniculatus	*Mediorhynchus armenicus* Petrotschenko, 1958
Falco jugger	*Centrorhynchus aluconis* (Muller, 1780) Luhe, 1911
Fly catcher	*Mediorhynchus cambellansis* Soota and Kansal, 1971
Francolinus pondicerianus	*Echinopardalis bangalorensis* Pujatti, 1951
Gallus gallus domesticus	*Mediorhynchus gallinarum* (Bhalerao, 1937) Van Cleave, 1947
Garrulus glandarius japonicus	*Mediorhynchus garruli* Yamaguti, 1939
Garrulus moniligers	*Mediorhynchus thrushi* Bhattacharya, 2000
Garrulus moniligers	*Mediorhynchus armenicus* Petrotschenko 1958
Golden plover	*Plagiorhynchus (Plagiorhynchus) charadrii* (Yamaguti, 1939) Van Cleave, 1951
Halcyon Sp.	*Centrorhynchus horridum* (Linstow, 1997) Yamaguti, 1963
Halcyon smyrnensis	*Centrorhynchus smyrnensis* n. sp.
	Centrorhynchus clitorideum (Meyer, 1931) Yamaguti, 1963
Haliaster Indus	*Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932
	Centrorhynchus lucknowensis Gupta & Fatma, 1981
Haliaetus leucoryphus;	*Centrorhynchus opimum* Travassos, 1921
Hierococcyx varius	*Centrorhynchus splendi* Gupta and Gupta, 1970
Hieraetus pennatus	*Centrorhynchus golvani* Anantaraman & Anantaramah 1969

HOST	PARASITE
King fisher	*Centrorhynchus fisheri* Bhattacharya, 1999
Lobivanellus indicus	*Pseudolueheia korathai* Gupta and Fatma. 1987
Metopodius indicus	*Mediorhynchus pandei n. sp.*
Milvus migrans	*Centrorhynchus lancea* (Westrumb, 1821) Golvan, 1960
Milvus migrans	*Centrorhynchus aluconis* (Mul1er, 1780) Luhe, 1911
Milvus migrans	*Centrorhynchus lancea* (Westrumb, 1821) polvan, 1960
	Centrorhynchus globocaudatus (Zeder, 1800) Petrotschenko, 1959
Milvus migrans govinda	*Centrorhynchus milvus* Ward, 1956
Milvus migrans govinda	*Centrorhynchus spinosus* (Kaizer, 1893)
Nycticorax nycticorax	*Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932
Owl *(Bubo sp.)*	*Centrorhynchus owli* Bhattacharya 1999
owl	*Centrorhynchus globocaudatus* (Zeder, 1800) Petrotschenko, 1959
Ottus sp.	*Centrorhynchus knowlesi* Datta & Soota, 1955
	Centrorhynchus globocaudatus (Zeder, 1800) Petrotschenko, 1959
Ottus backemoena	*Centrorhynchus globocaudatus* (Zeder, 1800)
Pastor roseus	*Centrorhynchus lanceoides* Petrotschenko, 1949
Passer domesticus indicus	*Mediorhynchus passerus* Das, 1951
Perdicula Asiatic	*Prosthenorchis sp*
Picus flavinucha	*Mediorhynchus armenicus* Petrotschenko, 1958
Perriah kite	*Centrorhynchus lancea* (Westrumb, 1821) Skrjabin 1913
Picus sp	*Mediorhynchus orentalis* Belopolskaya, 1953
Picus flavinucha	*Centrorhynchus areolatum* (Rud., 1819) Petrotschenko, 1059
Picus flavinucha	*Centrorhynchus clitorideum* (Meyer, 1931) Yamaguti, 1963
Pitta nepalensis	*Pseudolueheia arunachalensis* n. sp.
Pitangus sulfuratus maximilan	*Centrorhynchus opimum* Travassos, 1921
Turnix suscilator	*Mediorhynchus taeniatus* (Linstow, 1901) Dollfus, 1936
Shikra	*Centrorhynchus giganteum* Travassos 1921
Sturnus malabaricus	*Plagiorhynchus (Prosthorhynchus) deysarkari* Bhattacharya, 2002
Sphaechochila humei	*Mediorhynchus orentalis* Belopolskaya, 1953

HOST	PARASITE
Spilornis cheela	*Centrorhynchus spilornae* Schmidt and Kuntz, 1069
Sturnopastor contra	*Centrorhynchus aereolatum (Rudolphi)* Petrotschenko, 1956
Temenuchus pagodarum	*Porrorchis brevicanthus* (Das, 1949) Golvan, 1994
Turdoides caudatus	*Plagiorhynchus (Prosthorhynchus) nicobarensis* (Soota and Kansal, 1972) Zafar and Farooqi, 1981
Turdus albocinctum	*Centrorhynchus lancea* (Westrumb, 1821) Golvan, 1960
Tyto alba	*Centrorhynchus clitorideum* (Meyer, 1931) Yamaguti, 1963
	Centrorhynchus tumidulum (Rud., 1819) Yamaguti, 1961
Urocissa melanocephala occipitalis	*Centrorhynchus maryas is* Datta, 1932
Unidentified bird	*Centrorhynchus maryasis* Datta, 1932
Unidentified bird	*Centrorhynchus microrchis* Fukui, 1929
Vanellus malabaricus	*Mediorhynchus quilonensis* n. sp
Vanellus sp.	*Mediorhynchus grandis* Van Cleave, 1916
Wood-pecker	*Mediorhynchus garruli* Yamaguti, 1939
	Mediorhynchus peckeri Bhattacharya, 1999
Zootheria citrine	*Plagiorhynchus (Prosthorhynchus) nicobarensis* (Soota and Kansal, 1972) Zafar and Farooqi, 1981
MAMMALIA	
Bandicoota sp	*Moniliformis spiralis* Subtahmaniam, 1927
Bandicoota bengalensis	*Moniliformis moniliformis* (Bremser in Rudolphi, 1819)
Bangarus caeruleus	*Centrorhynchus crocidurus* Das, 1950
Crocidura caerulea	*Centrorhynchus crocidurus* Das, 1950
Crocidura perrotteti	*Porrorchis chauhani* Gupta and Fatma, 1985
Crocidura perrotteti	*Porrorchis crocidurai* Gupta and Fatma, 1985
Felis canis	*Onicola sp.*
Felis catus	*Centrorhynchus erraticus* Chandler, 1925
Felis domesticus	*Oligacanthorhynchus cati* (Gupta and Lata, 1968) Schmidt, 1972)
Felis domesticus	*Echinopardalis pardalis* (Westrumb, 1821) Travassos, 1918
Herpistis auropunctatus	*Porrorchis herpistis* n. sp.
	Porrorchis schmidti Gupta and Fatma, 1987
Herpestes sp	*Nephridiacanthus thapari* (Sen & Chauhan, 1972) Golvan, 1994

HOST	PARASITE
Manis pentadactyla aurita	*Nephridiacanthus shillongensis* Sen and Chauhan, 1972
Nesokia bengalensis	*Moniliformis spiralis* Subrahmaniam, 1927
Rattus rattus	*Moniliformis clarki* (Ward, 1917) Van Cleave, 1924
Rat	*Moniliformis moniliformis* (Bremser in Rudolphi, 1819)
Rattus rattusrufescens	*Moniliformis dubius* Meyer, 1933
Sus scrofa cristata	*Macracanthorhynchus hirudinaceus* (Pallas, 1781) Travassos, 1917
Sus scrofa domestica	*Macracanthorhynchus hirudinaceus* (Pallas, 1781) Travassos, 1917
REPTILIA	
Boiga trigonata	*Porrorchis hylae* (Johnston, 1914) S & K, 1967
Dryophis myeterizans	*Centrorhynchus spinosus* (Kaiser, 1983)
Lycodon sp.	*Centrorhynchus longieephalus* Das, 1950
	Porrorehis indicus (Das, 1957) S & K, 1967
Lycodon flavomaeulatus	*Centrorhynchus spinosus* (Kaiser, 1983)
Naja tripudians	*Centrorhynchus mierocervieanthus* Das, 1950
Naja hannah	*Centrorhynchus reptans* (Bhalerao, 1931)
Ptyas mueosus	*Oligaeanthorhynchus indicus* Renguraju and Das, 1981
	Centrorhynchus ptysus Gupta, P. V., 1950
	Centrorhynchus brevieaudatus Das, 1950
	Centrorhynchus indieum (Das, 1949) Golvan 1956 nom. nov. (nec *Gordiorhynchus falconis* Johnston & Best, 1943)
	Centrorhynchus laneea (Westrumb 1821) Golvan, 1960
Sinotes arnensis	*Centrorhynchus spinosus* (Kaiser, 1983)
Tropidonotus sp.	*Centrorhynchus longieephalus* Das, 1950
Zamenis graeilia	*Centrorhynchus spinosus* (Kaiser, 1 983)
AMPHIBIA	
Bufo malanostiefus,	*Eehinopardalis bangalorensis* Pujatti, 1951
	Pseudoacanthocephalus paratiensis Bhattacharya, 2000
	Pseudoacanthocephalus shillongensis Bhattacharya 1999
Bufo sp	*Acanthocephalus manipurensis* n. sp. Centrorhynchus aluconis (Muller, 1780) Luhe, 1911

HOST	PARASITE
Bufo viridis	*Pomphohynchus bufonis* Fotedar *et al.*, 1970
Rana cyanophlyctis	*Neoechinorhynchus cyanophlyctis* Kaw, 1951
	Polymorphus minutus (Goez, 1782) Luhe, 1911
Rana tigrina	*Centrorhynchus mysentry* Gupta and Fatma,1981
	Centrorhynchus amphibias Das, 1950
	Centrorhynchus batrachus Das, 19??
	Southwellina hispida (Van Cleave, 1925)
	Pseudoacanthocephalus rauschi Gupta and Fatma, 1985
Rana cyanophlictis	*Pomphorhynchus dubious* Kaw, 1941
	Neoechinorhynchus cyanophlyctis Kaw, 1951
	Arhythmorhynchus tigrinus Moghe & Das, 1953
Schizopygopsis stoliczkae	*Acanthocephalus kashmiriensis.* Datta, 1936
PISCES	
AblFmnis hians	*Rhadinorhynchus hiansi* Soota and Bhattacharya, 1981
Alettis indica	*Raorhynchus polynemi* Tripathi, 1959
Ariodes dussumieri	*Pseudorhadinorhynchus dussamieri* Gupta and Gupta, 1970
Arius arius	*Diplosentis manteri* Gupta and Fatma, 1979
	Rhadinorhynchus ganapati Chandra *et al*, 1985
Arius platystomus	*Raosentis ivaniosi* George and Nadakal, 1978
	Rhadinorhynchus trivundricus George and Nadakal, 1
Arius platystomus	*Metarhadinorhynchus thaparus* Gupta, R.C. & Gupta, 1975
Barbus stigma	*Quadrigyrus simhai* Gupta and Fatma, 1985
	Acanthosentis dattai Podder, 1938
Barbus ticto;	*Acanthosentis dattai* Podder, 193
Belone strongylurus	*Neoechinorhynchus johnii* Yamaguti, 1939
Belone choram	*Longicollum indicum* Gupta & Gupta 1970
	Longicollum quiloni Gupta and Naqvi, 1986
Botia berdi	*Pomphorhynchus* sp.
Cat fish	*Paracanthocephaloides tripathii* (Tripathi,19590 nom. nov.
Caranx kalla	*Quadrigyrus guptei* Gupta and sinha, 1991
Caranx kalla	*Pallisentis mehrai* Gupta and Fatma, 1985
	Gorgorhynchoides cablei (Gupta and

HOST	PARASITE
Caranx melampygus	
Caranx malabaricus	*Pseudorhadinorhynchus cochinensis* Gupta & Naqvi, 1981
	Pseudorhadinorhynchus cinereus Gupta & Naqvi, 1984
Caranx nigripinnis	*Gorgorhynchoides valiyathurae* (Antony *et al.*, 1990) n. comb.
Caranx malabaricus	*Pseudoechinorhynchus cochinensis* Gupta and Naqvi, 1981
Catla catla	*Acanthogyrus acanthogyrus* Thapar, 1927
	Acanthogyrus tripathi Rai, 1967 Fatma, 1987) n. comb
Cat fish	*Paracanthocephaloides tripathii* (= *Heterosentis plotosi* sensu Tripathi, 1959) Golvan, 1969
Chela bacaila	*Acanthosentis bacailai* Verma, 1973
Channa gachua	*Pallisentis Ophiocephali* (Thapar, 1930) Baylis, 1933
Channa punctatus	*Pallisentis allahabadii* Agrawal, 1958
	Pallisentis colisai Sarkar, 1954
	Pallisentis pandei Rai, 1967
	Pallisentis Ophiocephali (Thapar, 1930)v Baylis, 1933
Channa marulius	*Pallisentis allahabadii* Agrawal, 1958
	Pallisentis Ophiocephali (Thapar, 1930) Baylis, 1933
Channa striatus	*Pallisentis basiri* Farooqi, 1958
	Pallisentis nagpurensis Bhalerao, 1931
Channa channa	*Pallisentis jagani* Koul *et al.*, 1991
Channa sp.	*Pallisentis ophiocephali* (Thapar, 1930) Baylis, 1933
	Centrorhynchus brevicaudatus Das, 1950
Clupea longlceps	*Pallisentis clupei* Gupta and Gupta, 1979
	Cleaveius clupeia (Gupta and Sinha, 1992)
	Tenuiproboscis clupei Gupta and Sinha, 1991
Clupisoma garua	*Pallisentis garuai* (Sahay *et al.*, 1971) Jain and Gupta, 1979
Cirrhinus reba	*Acanthosentis bilaspurensis Chowhan et al.*, 1987
Colisa fasciatus	*Pallisentis colisai* Sarkar, 1954
Channa sp.	*Pallisentis colisai* Sarkar, 1954
Clarius batrachus	*Cleaveius durdance* Kumar, 1992
	Ahythmacanthus zdzitowieckii Kumar, 1992
	Hypoechinorhynchus golvani Gupta and Kumar, 1987

HOST	PARASITE
Cyanoglossus lingua	*Neoechinorhynchus topseyi* Podder, 1937
	Rhadinorhynchus stunkardii Gupta and Fatma, 1987
Dlptychus maculates	*Neoechinorhynchus hutchinsoni* (Datta, 1936) Kaw, 1951
Echeneis naucratis	*Rhadinorhynchus echeneisi* Gupta and Gupta, 1979
Eel,	*Pallisentis colisai* Sarkar, 1954
Elops saurus	*Neoechinorhynchus ovalis* Tripathi, 1959
	Serrasentis sagittifer (Linton, 1889) Linton, 1932
	Arhythmacanthus thapari Gupta and Fatma, 1979
Elecate nigra	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Engaulis malabaricus	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
	Pseudorhadinorhynchus longicollum Gupta & Naqvi, 1986
Engraulis malabaricus	*Longicollum engraulisi* Gupta and Fatma, 1983
Epinephelus chlorostigma	*Longicollum indicum* Gupta and Gupta, 1971
Eutropiicthys vacha	*Raosentis dattai* Gupta and Fatma, 1985
	Neoechinorhynchus sp.
Euthynnus affinis	*Raorhynchus cadenati* Gupta and Sinha, 1991
Gerres abreviatus	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003
Gerres filamenosus	*Longicollum lutiani* Jain & Gupta, 1980
Gerres setifer	*Tenuiproboscis guptai* Gupta and Sinha, 1989
	Longicollum cadenati Gupta and Naqvi, 1986
Glossogobius giuris	*Acanthosentis giuris* Soota and Sen, 1954
	Pallisentis Ophiocephali (Thapar, 1930) Baylis, 1933
Glyposternum sp.	*Neoechinorhynchus glyptosternumi* Dhar and Kharoo, 1984
Gogata cenia	*Pseudorhadinorhynchus machidai* Kumar, 1992
Gogata batasio	*Yamagutisentis nicoli* Kumar, 1992
Hemirhamphus marginatus	*Micracanthorhynchina chandrai* nom. nov.
Herpodon nehereus	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv)
Harpodon sp.	*Raorhynchus polynemi* Tripathi, 1959
Hilsa ilisha	*Acanthosentis hilsai* Pal, 1963
Johnius dussumieri	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Johnius aneus	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv)
Kathala anxillaries	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv)
Labeo gonius	*Acanthosentis betwai* Tripathi, 1959

HOST	PARASITE
Laubuea dadybergori	*Neoechinorhynchus kallarensis* George *et al.*, 1978
Labeo rohita	*Acanthosentis gobindi* Chowhan *et al.*, 1987
	Acanthosentis vancleavi Gupta et Fatma, 1985
	Acanthogyrus acanthogyrus Thapar, 1927
	Acanthogyrus guptei Gupta and Verma, 1977
	Acanthosentis shuklai Agarwal et Singh, 1982
Lepidocephalicthys guntea	*Pallisentis guntei* Sahay *et al.*, 1967
Lepturacanthus savala	*Rhadinorhynchus ganapati* Chandra *et al.*, 1985
Lethrinus reticulate	*Longicollum indicum* Gupta and Gupta, 1971
Lobotes surinamensis	*Longicollum indicum* Gupta and Gupta, 1971
Lutjanus sp.	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Lutjanus fulbiflama	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003
Leiognathus splendens	*Goacanthus panajiensis* Gupta and Jain, 1980
	Cleave ius leiognathi Jain & Gupta 1979
	Cleaveius portblairensis Jain & Gupta, 1979
Leiognathus equalis	*Bullockrhynchus indicus* Chandra *et al.*, 1985
Lutjanus fulbiflama	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003 (juv.)
Lutjanus johnii.	*Telosentis mizellei* Gupta and Fatma, 1987
	Longicollum lutiani Jain & Gupta, 1980
Lutianus leiglossus	*Telosentis lutianusi* Gupta and Gupta, 1989
Mastacembelus armatus	*Raosentis thapari* Rai, 1967
Megalaspis cordyla	*Gorgorhynchoides indicus* Bhattacharya *et al*, 2003 (adult).
Mugil sp	*Gracilisentis mugilus* Gupta and Lata, 1967
	Centrorhynchus sharmai (Gupta and Lata, 1967) Gupta and Fatma, 1981
	Neoechinorhynchus elongatus Tripathi, 1959
Mugil persia	*Neoechinorhynchus agilis* (Rudolphi, 1819) Petrotschenko, 1956
Mugil tade	*Neoechinorhynchus bangoni* Tripathi,1959
	Cleaveius inglishi (Gupta and Fatma, 1987) Kumar, 1992
Mugil cirrahanus	*Neoechinorhynchus chilkaensis* Podder, 1937
	Acanthosentis seenghalae Chowan *et al.*, 1988
	Cleave ius mysti (Sahay et Sinha, 1971)

HOST	PARASITE
Mugil olegolepis	*Neoechinorhynchus chilkaensis* Podder, 1937
Mugil cephalus	*Neoechinorhynchus agilis* (Rudolphi, 1819) Petrotschenko, 1956
Mugil parsia	*Neoechinorhynchus chilkaensis* Podder, 1937
Mugil dussumieri	*Neoechinorhynchus kallarensis* George *et al*, 1978
Mugil subviridis	*Pseudorhadinorhynchus orissai* Gupta and Fatma, 1983
Mugil cephalus	*Paracanthocephaloides tripathii* (= *Heterosentis plotosi* sensu Tripathi, 1959) Golvan, 1969
	Pseudorhadinorhynchus srivastavi Gupta and Fatma, 1986
Mugil sp.	*Centrorhynchus sharmai* (Gupta and Lata, 1967) Gupta and Fatma, 1981
Mugil vermicularis	*Neoechinorhynchus chilkaensis* Podder, 1937
Mystus vitiatus	*Raosentis thapari* Rai, 1967
	Raosentis podderi Datta, 1927
	Acanthosentis vittatusi Verma, 1973
Mystus cavasius	*Raosentis podderi* Datta, 1947
Mystus gulio	*Acanthosentis antes pinus* Verma et Datta, 1929
	Acanthosentis oligospinus Anantaraman, S 1980
Mystus seenghala	*Acanthosentis golvani* Gupta and Jain, 1980
	Acanthosentis seenghalae Chowan *et al.*, 1988
	Cleaveius mysti (Sahay et Sinha, 1971)
Nandas nandus	*Pallisentis guptai* Gupta and Fatma, 1985.
	Pallisentis nandai Sarkar, 1953
	Pallisentis Ophiocephali (Thapar, 1930) Baylis, 1933
Nemacheilus stoliczkae	*Neoechinorhynchus dattai* Golvan, 1994
Nemacheilus vittatus	*Neoechinorhynchus dattai* Golvan, 1994
Nemacheilus kashmiriensis	*Pomphorhynchus knshmirensis* Kaw, 1941
Nemacheilus sp.	*Pomphorhynchus kashmirensis* Kaw, 1941
Nematolosa nasus	*Neoechinorhynchus nematolusi* Tripathi, 1959
Nemipterus sp	*Serrasentis sag;ttifer* (Linton, 1889) Linton 1932 (161)
Oreinus sinuatus	*Neoechinorhynchus manasbalensis* kaw, 1951
	Neoechinorhynchus oreini Fotedar, 1968

HOST	PARASITE
Osteogeneiosus militaris	*Cleaveius singhai* (Gupta and Fatma, 1987) Kumar, 1992
	Cleave ius secundus (Tripathi, 1959) Golvan, 1969
	Indorhynchus indicus (Tripathi, 1959) Golvan, 1969
Otolithus brunneus	*Neoechinorhynchus tylosuri* Yamaguti, 1939
Pama pama	*Cleaveius puriensis* (Gupta and Sinha, 1992)
Pangasius pangasius	*Cleave ius prashadi* (Datta, 1940) Golvan, 1969
Pelamys chilensis	*Rhadinorhynchus dolfusi* Gupta and Fatma, 1987
	Rhadinorhynchus pelmysi Gupta and Gupta, 1979
Pelamys sarda	*Raorhynchus terebra* Tripathi, 1959
Pennahia argentata	*Neoechinorhynchus argentatus* Chandra *et al.*, 1987
	Gorgorhynchoides golvani (Chandra *et al.*, 1984) n. comb
Pennahia macropthalmus	*Longicollum indicum* Gupta and Gupta, 1971
Peterotolithus maculates	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv.)
Plectorhynchus cuveri	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003 (juv.)
Pennahia argentata	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv.)
Pristipoma hasta	*Acanthocephalus gqaensis* Jain & Gupta, 1982
Pseudorhombus arsius	*Circinatechinorhynchus pseudorhombi* n.g.n.sp.
Psettodes erumei	*Longicollum psettodesai* Gupta and Gupta, 1979
Plotosus canius	*Cleaveius secundus* (Tripathi, 1959) Golvan, 1969
Plotosus caninus	*Arhythmacanthus septacanthus* Sita Anantharaman, 1949
Pseudosciaena diacanthus	*Neoechinorhynchus kallarensis* George *et al.*, 1978
Polynemus heptadactylus	*Raorhynchus polynemi* Tripathi, 1959
Polynemus heptadactylus	*Neoechinorhynchus topseyi* Podder, 1937
	Rhadinorhynchus polynemi Gupta and Lata, 1967
	Raorhynchus guptei Gupta and Kumar, 1987
Polynemus sextarius	*Raorhynchus guptei* Gupta and Kumar, 1987
Polynemus plebius	*Raorhynchus guptei* Gupta and Kumar
Polynemus sp	*Raorhynchus polynemi* Tripathi, 1959
Polynemous tetradactylus	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003 (juv.)
Polydactylus indicus	*Rhadinorhynchus keralensis* Gupta and Fatma, 1987
Polydactylus sextarius	*Raorhynchus polynemi* Tripathi, 1959
	Raorhynchus polynemi Gupta and Gupta, 1972
	Raorhynchus polynemi Gupta and Kumar, 1989
	Raorhynchus guptai, 1987

HOST	PARASITE
Polynemous paradaiseus	*Heterosentis cabellaroi, Gupta & Fatma,* 1986
Pomadasys maculatus	*Echinorhynchus indicus* Chandra *et al.,* 1982
Pomadasys gnoraka	*Longicollum lutiani* Jain & Gupta, 1980
Protonibea diacanthus	*Longicollum indicum* Gupta and Gupta, 1971
Psettodes erumei	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
	Gorgorhynchoides indicus Bhattacharya *et al.,* 2003 (juv.)
	Longicollum psettodensai Gupta and Gupta, 1979
	Nipporhynchus erumeii Gupta and Fatma, 1981
Psenes indicus	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Pseudorhombus sp.	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Pseudorhombus arseus	*Circinatechinorhynchus pseudorhombi.* n.g.n.sp.
Plotosus caninus	*Arhythmacanthus septacanthus* Sita Aanantaraman, 1969
	Paracanthocephaloides tripathii Tripathi, 195 Golvan, 1969
Plotosus caninus	*Cleave ius secundus* (Tripathi, 1959) Golvan, 1969 (191)
Polynemus paradasius	*Paracanthocephaloides cabelleroi* (Gupta & Fatma, 1983)
Polynemus heptadactylus	*Neoechinorhynchus topseyi* Podder, 1937
Protonibea diacanthus	*Longicollum indicwn* Gupta & Gupta, 1971
Puntius sp.	*Neoechinorhynchus sootai* Bhattacharya, 1999
Rachycentron canadum (Definitive host)	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Rasbora elonga	*Acanthosentis sircari* Podder, 1941
Rasbora rasbora	*Neoechinorhynchus kallarensis* George *et al.,* 1978
Rhynchobdella aculeate	*Pallisentis basiri* Farooqi, 1958
	Pallisentis nagpurensis Bhalerao, 1931
Rhynchobatis djeddensis	*Serrasentis longa* Tripathi, 1956
Rohtee cotio	*Acanthosentis cameroni* Gupta & Kajaji, 1969
Saurus myops	*Filisoma inglishi* Gupta & Naqvi, 1986
Saurida tumbil	*Gorgorhynchoides golvani* (Chandra *et al.,* 1984) (juv.)
Saurida undosquamous	*Gorgorhynchoides golvani* (Chandra *et al.,* 1984) (juv.)
Scatophagus argus	*Filisoma indicum* Van Cleave, 1928
	Filisoma hoogliensis Datta and Soota, 1962
	Filisoma scatophagusi Datta and Soota, 1962

HOST	PARASITE
Scatophagus argus	*Longicollum indicum* Gupta and Gupta, 1971
Schizothorax planiforms	*Neoechinorhynchus devdevi* (Datta, 1936) Kaw, 1951
Schizothorax zarudnyi	*Neoechinorhynchus rigidus* (VanCl., 1928) Yamaguti, 1963
Schizothorax esocinus	*Neoechinorhynchus yalei* (Datta, 1936) Kaw, 1951
	Pomphorhynchus kashmirensis Kaw, 1941
Schizothorax niger	*Pomphorhynchus kashmirensis* Kaw, 1941
Schizothorax planifrons	*Neoechinorhynchus devdevi* (Datta, 1936) Kaw, 1951
Schizothorax sp.	*Echinorhynchus orientalis* Kaw, 1951
Schizopygopsis stoliczkae	*Acanthocephalus kashmirensis* Datta, 1936
Scomber japonicus	*Rhadinorhynchus (j) meyeri*
Setipinna phasa	*Acanthosentis indicus* Tripathi, 1959
Scomboerides commersonianus	*Rhadinorhynchus ganapati* Chandra *et al.*, 1985
Scomberomorus guttatus	*Rhadinorhynchus ganapati* Chandra *et al.*, 1985
Stromateus cinereus	*Raorhynchus cadenati* Gupta and Sinha, 1991
Siganus vermiculatus	*Neoechinorhynchus chilkaensis* Podder, 1937
Siganus canaliculatus	*Neorhadinorhynchus robustus* (Edmonds, 1964) Galvan, 1969
Solea sp	*Circinatechinorhynchus pseudorhombi.* n.g.n.sp.
Strongylura strongylura	*Longicollum indicumGupta* & Gupta, 1971
Synapura cornuata	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Synaptura sp	*Circinatechinorhynchus pseudorhombi* n.g.n.sp
Synaptura orientalis	*Echinorhynchus velli* George and Nadakal, 1978
Tachysurus jella	*Euzetacanthus golvani* Gupta and Fatma, 1983
	Indorhynchus indicus (Tripathi, 1956)
Tachysurus nenga	*Pseudorhadinorhynchus dhari* Kumar, 1992
Tenthis bamin	*Rhadinorhynchoides chromitidis* (Cable and Quick, 1954) Yamaguti, 1961
Trachinocephalus myops	*Serrasentis sagittifer* (Linton, 1889) Linton, 1932
Therapon jarbua	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003 (juv.)
	Pseudorhadinorhynchus ernakulensis Gupta and Gupta, 1969
	Gorgorhynchoides indicus Bhattacharya *et al.*, 2003 (juv.)
Triacanthus trigitifer	*Gorgorhynchoides indicus* Bhattacharya *et al.*, 2003 (juv.)
Trachynocephalus myops	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv.)

HOST	PARASITE
Tor putitora	*Acanthosentis putitorae* Chowhan *et al.*, 1988
Unidentified fish	*Pallisentis buckleyi* Tadross, 1966
Upenius vittatus	*Gorgorhynchoides golvani* (Chandra *et al.*, 1984) (juv.)
Wallago attu.	*Pallisentis allahabadii* Agrawal, 1958
	Pallisentis Ophiocephali (Thapar, 1930) Baylis, 1933
INSECTA :	
Periplaneta Americana	*Moniliformis moniliformis*
Phyllodromia germanica	*Moniliformis kalahariensis* Meyer, 1933.

BIBLIOGRAPHY

Achmerow, A.K. & Dombrovskaya-Achmerova, O.S. 1941. [New Acanthocephala of fishes of the Amur river] (Russian Text). *Dokl. Akad. Nauk USSR n.s.* 9 an., **31**(5) : 517-520.

Agarwal, N. & Singh, H.S. 1982. On a new Acanthocephalan from a fresh water fish of district Gorakhpur. *Journal Adv. Zool.*, **3**(1) : 85-87.

Agarwal, S.C. 1958. A new species of the genus *Pallisentis* (Acanthocephala). *Curr. Sci.*, **27**(3) : 107

Ahluwalia, S.S. 1959. A survey of the helminth parasites of the domestic pigs in western U.P. with a note on Pseudanoplocephala crawfordi Baylis. *Ind. J. vet. Sci. Anim. Husb.*, **29**(2/3) : 100-107.

— 1962. Studies on some helminthes of domestic pigs *(Sus scrofa domestica)* in western Uttar Pradesh. *J. Helminth.*, **36**(4) : 347-465.

Amin, O.M. 1985. Biology of the Acanthocephala : Classification : 27-72. Cambridge University Press.

— 1989. Key to the families and Subfamilies of Acanthocephala with the erection of a new class (Polyacanthocephala) and a new order (Polyacanthorhynchida). *J. Parasit.*, **73**(6).

— 1992. Review of the genus *Polymorphus* Luhe, 1911 (Acanthocephala : Polymorphidae) with the synonymisation of *Hexaglandula*, Petrotschenko, 1950 and *Subcorynosoma* Hoklova, 1967, and a key to spp. *Qurt. Univ. Sci. J.*, **12** : 115-123.

Amin, O.M. *et al.*, 1999. A taxonomic reconsideration of the genus *Plagiorhynchus* s.lat. (Acanthocephala: Plagiorhynchidae) with description of South African *Plagiorhynchus (Prosthorhynchus) cylindraceus* from shore birds and *P. (P.) malayensis*, and a key to the species of *Prosthorhynchus. J. Helminth. Soc. Wash.*, **66**(2) : 123-132.

Amin, O.M. *et al.*, 1999. A taxonomic reconsideration of the genus *Pallisentis* s.lat. (Acanthocephala : Quadrigyridae) with the erection of three new subgenera, the description of *Pallisentis (Brevitritospinus) vietnamensis* subgenus et sp. n, a key to species of Pallisentis and the description of a new quadrigyrid genus *Pararaosentis* gen.n. *Comparative Parasitology.* **67**(1) : 40-50.

Anantaraman, M. 1966. Parasites in Indian Rodents with special reference to diseases in man and animals. *Proc. Indian Rodent, Symp.* : 224-230.

Anantaraman, M. & Anantaraman, S. 1970. A synopsis of acanthocephalan described from India. *Prof. Ganapati Sha's Commem. Vol.*

Anantaraman, S. & Anantaraman M. 1969. On *Centrorhynchus (Centrorhynchus) golvani*, a new species of an acanthocephsalan from the booted eagle, *Hieraetus pennatus. Annls. Parasit. hum. Comp.*, **44**(1) : 5-12.

Anantaraman, S. 1980. *Acanthosentis oligospinus* n.sp. an acanthocephalan parasite of the brackish water fish *Mystus (Macrones) gulio* in Madras. *Indian J.Parasit.*, **4**(1) : 21-24.

Anantaraman, S. & Ravindranath, M.N. 1976. *Acanthosentis sp.* from *Mystus gulio.* identified as *A.oligospinus.* Z. Parasit Kde., **48**(3-4) : 224-238.

Antony, M. *et al.*, 1990. *Metarhadinorhynchus valiyathurae* sp. nov., an Acanthocephalid worm, parasitic in marine fish, *Caranx melampygus. Zool. Anz.* **225**(5/6), s : 377-382.

Baylis, H.A. 1933. On some parasitic worms from Java with *Remarks* on the Acanthocephalan genus *Pallisentis. Ann.. Mag. nat. Hist.*, **10** : 559-573.

Belopolskaya, M.M. 1983. Acanthocephalans of Charadriformes in the European USSR. *Biologiya*, **3**.

Bhalerao, G.D. 1931. On a new species of Acanthocephala from *Ophiocephalus striatus Ann. Mag. nat.Hist.* Ser. 10, **7** : 569-573.

— 1935. Helminth Parasites of domesticated animals in India. I.C.A.R. *Memoir* No. **6** : 365.

— 1937. On a remarkable Acanthocephala from a fowl in India. *Proc. zool. Soc. London.* Ser. B, **107**(2) : 199-203.

Bhattacharya S.B. 1999. *Zool.Surv. India, State Fauna Series* 4 : *Fauna of Meghalaya* (Acanthocephala), Part-9 : 359-392. [18 species of which 5 new species under 7 genera and 7 families.]

— 2000,. *Zool. Surv. India, State Fauna Series* 7 : *Fauna of Tripura* (Acanthocephala), Part-4 : 141-162. [17 species of which 4 new species under 9 genera and 7 families]

— 2003. *Zool. Surv. India, State fauna Series* 9 : *Fauna of Sikkim* (Acanthocephala), Part-5 : 71-78. [8 species of which one new species under 4 genera and 4 families.]

— 2003. First report on the occurrence of *Macracanthothynchus hirudenaceus* (Pallas, 1781) and *Polymorphus magnus* Skrjabin, 1913 (Acanthocephala) in wild pig and Garganey teal in India. *Rec zool. Surv. India*, **101**(1-2) : 87-91.

— 2005. Zool. Surv. India, *State Fauna Series* 5, *Fauna of Andhra Pradesh*, Part-5 : pp.123-157 [39 species under 20 genera].

Bhattacharya, S.B. & Banerjee, S. 2003. New record of the genus *Gorgorhynchoides* Cable and Linderoth, 1963 (Acanthocephala; Palaeacanthocephala) with *G. indicus* n.sp. from carangeid fish of Indian coast. *Rec. zool. Surv. India*, **101**(3-4) : 49-54.

Bhattacharya, S.B.; Pande, K. C. & Srivastava, C.B. 2002. New locality and host record for *Southwellina hispida* (Van Cleave, 1925) Witenberg, 1932 (Acanthocephala : Polymorphidae) from Chilka, Orissa, and a new species, *S. sacra* from Andaman. *Rec zool. Surv. India*, **100**(3-4) : 73-83.

Bieler, W. 1913. Uber den Kittapparatvon Neorhynchus. *Zool. Anz.* **41**(5) : 234-236.

Bullock, W.L. 1957. The Acanthocephalan parasites of the fishes of the Texas coast. *Public. Inst. Marine Sc.* **4**(2) : 278-283.

Bullock, W.L. 1962, A new species of Acanthocephales from New England fishes with observations on variability. *J. Parasit.*, **48**(3) : 442-451.

— 1969. Morphological features as tools and as pitfalls in Acanthocephalan systematics. In Schmidt, G.D., editor. Problems of systematics of parasites. University Park Press, Baltimore : 9-43.

Chandler, A.C. 1925. The helminth parasites of cats in Calcutta, and the relation of cats to human helminthic infections. *Indian. J. Med. Res.*, **13** : 213.

— 1934. A revision of the genus *Rhadinorhynchus* (Acanthocephala) with descriptions of new genera and species. *Parasitology.* **26** : 352-358.

Chandra, K.J. 1983. *Hanumantharhynchus hemirhamphi* gen. nov. et sp. n. a new Acanthocephalan from the marine fish *Hemirhamphus marginatus.* Revta iber. Parasit., **43**(2) : 119-124.

— 1984. *Paracanthocephaloides golvani* n.sp. from some marine fishes of Waltair coast. *Revta iber. Parasit.* **44**(1) : 347-352.

Chandra, K.J., Rao, K.H. & Shyamsundari, K. 1982. *Echinorhynchus indicus* n. sp. an Acanthocephalan parasite of marine fish, *Pomadasys maculates* (Bloch) and *Neoechinorhynchus chilkaensis* from marine fish *Mugil cephalus* from Waltair coast. *Indian J.Parasitol.*, **6**(2) : 255-257.

— 1985 Two new acanthocephalan parasites from marine fishes of Andhra coast. (*Bullockrhynchus* n.g. n. sp. and *Rhadinorhynchus ganapati* n. sp.) *Revta. iber. Parasit.*, **45**(4) : 293-302.

— 1987. On *Neoechinorhynchus argentatus* n.sp., an Acanthocephalan parasite from marine fish of Waltair. *Revta. iber. Parasit.*, **45**(1) : 49-52.

Chowhan, J. S., Gupta, N. K. & Khera, S. 1987. On two new species of the genus *Acanthosentis* Verma et Datta, 1929 (Acanthocephala : Quadrigyridae) from fresh water fishes. *Res. Bull. Punjab Univ. Sci.*, **38** (1-2) : 59-85.

— 1987. On two species of the genus *Pallisentis* Van Cleave, 1928 from fishes of Gobindsagar Lake and synonymy of the genus *Saccosentis* Tadross, 1966. *Res. Bull. Punjab Univ. Sci.*, **38**(3-4) : 21-26.

— 1988. On *A. putitorae* sp. nov. and A. *seenghalae sp. nov.* (Acanthocephala : Quadrigyridae) from fresh water fishes of Northern India. *Res. Bull. Punjab Univ. Sci.*, **39**(3-4) : 197-206.

Cobbold, T.C. 1876. Parasites of the Hog. (*Echinorhynchus gigas*). *Veterinarian*, Ser. 4, **49**(22) : 90-91.

Crompton D.W.T. 1975. Relationships between Acanthocephala and their *Hosts Symposium of the Society for experimental Biology.*, **29** : 467-504. (Symbiosis. Cambridge University Press, Cambridge, England).

Das, E.N. 1950 a. On some juvenile forms of Acanthocephala of the genus *Centrorhynchus* from India. *Indian .J.Helminth.*, **2**(1) : 49-56.

— 1950b. On some new species of the genus *Centrorhynchus* Luhe,1911. *Rec. Indian Mus.*, **47**(3/4) : 191-301.

— 1952 a. On a new species of *Apororhynchus* from the white scavenger Vulture, *Neophron percnopterus* (Linn.) from India. *Rec. Indian Mus.*, **48**(3/4) 43-49.

— 1952 b. On a new species of the genus *Mediorhynchus* Van Cleave, 1916, from India (Acanthocephala : Gigantorhynchidae). *Rec. Indian Mus.*, **49**(1) : 55-66.

— 1952 c. On some interesting larval stages of an Acanthocephalan *Centrorhynchus batrachus* from the frog, *Rana tigrina* (Daud) from India.*Rec.Indian Mus.*, **50**(2) : 147-156.

— 1957a. Les stades larvaries de *Centrorhynchus falconis* Das, 1950. *Ann. Parasit, hum. comp.*, **32**(1/2) : 71-82.

— 1957b. On juvenile and adult forms of *Pseudopororchis indicus*, a new species of Acanthocephala from India. *J. Parast.*, **43**(6) : 659-663.

Datta, M.N. 1928. On *Echinorhynchus* sp. from common crow *Corvus corax* and *Corvus splendens* of Allhabad. *Allahabad Univ. Studies*, **4**. 41-61.

— 1933. Acanthocephala from Northern India. II, A new species of *Centrorhynchus* from a Himalayan bird *Urocissa melanocephala occipitalis* (Blyth). *Rec.Indian. Mus.*, **35**(3) : 325-330.

— 1936 Scientific result of the Yale North India, Expedition Biological Report No. 20. Helminth Parasites of fishes of North India., With special reference to Acanthocephalans. *Rec. Indian. Mus.*, **38**(2) : 211-229.

— 1937. Acanthocephala from India. Description of the male *Eosentis rigidus* Van Cleave occurring in the intestine of *Schizothorax zerudnyi* from Seistan. *Rec. Indian Mus.*, **39**(3) : 303-304.

— 1940. Acanthocephala from India II. On a new genus of Acanthocephala of the family Rhadinorhynchidae from a local fish, *Pangasius pangasius* (Ham). *Rec. Indian Mus.*, **42**(1) : 81-87.

— 1947. Acanthocephala III. a new genus of acanthocephalan parasite of the family Quadrigyridae from Calcutta fish, *Mystus cavasius. Rec Indian Mus.*, **44** : 363-365.

— 1953. On a new species of acanthocephalan parasite from fishes of Bombay. *Rec.Indian.Mus.*, **51**(1) : 51-55.

Datta, M.N. & Podder, T.N. 1935. Acanthocephalan parasites of certain fishes from Calcutta. *Rec. Indian Mus.*, **37**(2) : 231-236.

Datta, M.N. & Soota, T.D. 1955. A new species of Acanthocephalan parasite of birds. *Rec. Indian Mus.*, **52**(1) : 15-20.

— 1956. On a new species of the genus *Acanthocephalus* from *Rana sp.*, and a new *Host* record of *Centrorhynchus cinctus* (Rud). *Rec. Indian Mus.*, **52**(2/4) : 185-188.

— 1962. Two new Acanthocephala from the fish *Scatophagus argus* (Bloch) from India. *Rec. Indian Mus.*, **58**(2) : 67-70

Dhar, R.L. & Kharoo,V.K. 1984. A new species of Acanthocephala *Neoechinorhynchus glyptosternumi* n.sp. from Intestine of a Kashmir fish, *Glyptosternum* sp. *Indian. J. Helminth.*, **36**(1) : 36-39.

Dhar, R.L. & Majdah, M., 1987. Fish parasitisation by helminthes in Wular Lake, Kashmir. *Indian. J. Helminth,*, **39**(2) : 143-152.

Diaz-Ungria, C. & Farooqi, H.U.1981. *Nipporhynchus atheri. Ind. J. Parasit.* pp. 179-192.

— 1987. A redescription of *Acanthodelta scorzai* with the erection of the family Acanthodeltidae *Riv. Parassit.*, **48**(2) : 151-155.

Duggal, C.L. & Kaur, H. 1986. On *Neoechinorhynchus chilkaensis* Podder, 11037 and *Serrasentis socialis* (Leidy, 1851) ; Acanthocephalan parasite of fishes of India. *Res. Bull. Punjab Univ. Sci.*, **37** (1-2) : 151-153.

— 1986. On two Quadrigyrid Acanthocephalans parasitizing fishes of Punjab. (Saccosentis ophiocephali & Acanthosentis golvani). *Res. Bull. Punjab Univ. Sci.*, **37**(1-2) : 139-142.

Duggal, C.L. *et al.*, 1986 On some acanthocephalans parasitizing birds of Punjab. *(Centrorhynchus) Res. Bull. Punjab Univ. Sci.*, **37** (3-4) : 25-31 [*c. lancea; c. opimum.* etc]

Farooqi, H.U. 1958. A new species of the genus *Pallisentis* from a fresh water eel. *Z. ParasitKde*, Bd., **18** : 457-464.

— 1989. Redescription of *Acanthogyrus acanthogyrus* Thapar,1927. (Acanthocephala : Acanthogyridae) and its taxonomic status. *Riv. Parassit.*, **48**(2) : 157-163.

Fotedar, D.N. 1968. New species of *Neoechinorhynchus* Hamann,1892 from *Oreinus sinuatus*, fresh water fish of Kashmir. *Kashmir Sci.*, **5** : 147-152.

Fotedar, D.N. & Dhar, R.L. 1973. On first record of a late juvenile form of an Acanthocephalan genus, *Polymorphus* Luhe, 1911 from the rectum of *Rana cyanophlyctis* in Kashmir. *J. Sci. Univ. Kashmir*, I(1-2) : 55-56.

— 1977. On five new species of the genus *Pomphorhynchus* Monticelli, 1905 from fresh water fishes of Jammu & Kashmir. *Indian. J. Zoology.*, **5** : 15-24.

— 1977. Wide range of infection of *Neoechinorhynchus* Hamann,1892 in the fresh water fishes of J&K [Abs]. *All India Symposium on Helminthology,* Srinagar, 8-11 August, 1977 : 17-18.

Fotedar, D.N., Duda, P.L. & Raina, M.K. 1970 : A new species of the genus *Pomphorhynchus* Monticelli, 1905, from *Bufo viridis* in Kashmir. *Indian. J. Helminth.,* **22**(1) : 41-45.

Fukui, T. 1929. On some Acanthocephala found in Japan. *Annot. Zool. Jap.,* **12** : 255-270.

Gee, R.J. 1988. The anterior Nervous system of the presoma of five species of the genus *Neoechinorhynchus. Canadian J. Zoology,* **66**(4) : 782-789.

George, P.V. & Nadakal, A.M. 1978. Four new species of Acanthocephala from brackish and fresh water fishes of Kerala. *Aquatic Biology.,* Vol. **3** : 79-90.

— 1984. Three new species of Acanthocephala (Gigantorhynchidae) from birds of Kerala. *Acta parasit. pol.,* **29**(9-19) : 97-106. [Med. mariae; channapetti; P. keralensis]

— 1987. *Centrorhynchus bethaniae* sp. n. (Acanthocephala : Gigantorhynchidae) from bird, *Accipeter badius* (Guvelin) of Kerala. India. *Japanese J. Parasitol.,* **36** (1) 9-12.

Gmelin, J. F. 1791. Caroli a Linne' *Systema Naturae.* Edit. 13 8, Tome 1, *pars* 6, *Lipsiae.*

Golvan, Y.J. 1959. Le phylum des Acanthocephala, note 2 La classes des Eoacanthocephala (Van Cleave, 1936). *Ann. Parasit.,* **34** : 5-52.

— 1960-61. Le phylum des Acanthocephala, note 3. La classe de Palaeacanthocephala Meyer,1931. *Ann. Parsit.* **35** : 138-165, 350-386, 713-723 and **36** : 76-91.

— 1962. Le phylum des Acanthocephala (Meyer, 1931). *Ann. Parasitol.,* **37** : 1-72.

Golvan, Y.J. 1965. Acanthocephalés de Madagascar récoltés par E. R. Brygoo. (Première note). Ann Parasite. **40** : 303-316.

Golvan, Y.J. 1969. Systematique des Acanthocephales (Acanthocephala Rudolphi, 1801), L'Ordre des Palaeacanthocephala Meyer, 1931, La super-famille des Echinorhynchoidea (Cobbold, 1876) Golvan et Huin, 1963. *Memoires du Museum National D'histoire Naturelle.***57**, ser. A : 1-373.

— 1994. Nomenclature of the Acanthocephala. *Research and Review in Parasitology.,* **54**(3) : 135-205.

Golvan Y.J. & Huin, R. 1964. Revision des Palaeacanthocephala. Deuxieme note. La famille des Gorgorhynchidae Van Cleave et Lincicime 1940. *Annls Parasit hum.comp.* **39** : 610-611.

Gupta, N.K. & Gupta, K. 1971. Longicollum indicum n.sp. an acanthocephalan parasite of a marine fish, *Tylosurus strongylurus* from Ernakulum. *Res. Bull. (njab Univ. Sci.* **21**(3/4) : 507-510.

— 1971. Two new species of *Pseudorhadinorhynchus* Achmerow et Dombrovskaja–Achmerova, 1941 (Acanthocephala : Micracanthorhynchinidae Yamaguti,1961) from marine food fishes at Ernakulum, *Res. Bull. Punjab Univ. Sci.*, **22** : 345-351.

— 1971. Observation on two Acanthocephalan parasites from marine fishes in India. *Res. Bull. Punjab Univ. Sci.*, **22** (1-4) : 417-420.

Gupta, N.K. & Jain, M. 1975. On two already known species of Acanthocephala of the genus *Porrorchis* Fukui, 1929 (Gigantorhynchidae : Prosthorhynchidae) from Chandigarh, India. *Acta parasit. pol.*, **23** fasc. 34 : 381-387.

— 1977. On *Serrasentis socialis* (Leidy, 1851) Van Cleave,1924 and discussion on synonymy of some related species with it. [Abs.]. *All India Symposium Helminthology, Srinagar* : 3.

— 1979. On *Neoechinorhynchus cirrhinae.* n. sp. an Acanthocephala (Illiosentidae, Golvan, 1960) *Riv. Parasit.* **41** : 47-59.

— 1980. On *Goacanthus panajiensis* n.g.n.sp. (Acanthocephala : Illiosentidae, Golvan, 1960) *Riv. Parassit.*, **41**(1) : 47-59.

— 1980. On a new species of Acanthocephalan parasite *Acanthosentis golvani* n.sp. from a fresh water fish at Chandigarh. *Revta. iber. Parasit.*, **40** : 149-160.

— 1983. On three already known species of *Neoechinorhynchus* 1802 from fish of Arabian sea. *Acta parasit. pol.*, **18**(43) 407-416.

— 1982. On two new species of the genus *Acanthocephalus* Koelreuther, 1771 (Acanthocephala : Echinorhynchidae) including the description of a new species, *A. goaensis. Rev. Parasit.*, **42** : 163-176.

Gupta, N.K. & Lata, V. 1967. Observations on eight already known Acanthocephalan parasites from vertebrate *Hosts., Res. Bull. Punjab Univ. Sci.*, **18**(3/4) : 325-341.

— 1967. On six new species of Acanthocephala from some vertebrate *Hosts* in India. *Res. Bull. Punjab Univ. Sci.*, **18**(3/4) : 253-268.

— 1967. On the morphology of *Echinopardalis pardalis,* an Acanthocephalan parasite of *Felis domestica* in India. *Res. Bull. Punjab Univ. Sci.*, **18**(3/4) : 395-403

— 1968c *Res. Bull. Punjab Univ Sci.*, **18** : 253-268

— 1980. On *Goacanthus panajiensis* n.g.n.sp. (Acanthocephala : Illiosentidae Golvan., 1960. *Riv. Parassit.*, **41**(1) : 47-50.

— 1980. On a new species of Acanthocephalan parasite, *Acanthosentis golvani* n.sp. from a fresh water fish at Chandigarh. *Revta. iber. Parasit.* **40**(2) : 149-160.

— 1983. On three already known species of the genus *Neoechinorhynchus* Hamann,1802 from fish of the Arabian Sea. *Acta Parasit.pol.*, **28**(38/42) : 407-416.

— 1985. On *Serrasentis socialis* (Leidy, 1951) Van Cleave, 1924 and discussion on the synonymy of some related species with it. *Res. Bull. Punjab. Univ. Sci.*, **36**(1-2) : 23-26.

Gupta, P. C. & Kumar, P. 1984. Two new species of Acanthocephalan parasites (Rhadinorhynchidae) of marine fishes from Bay of Bengal off Puri coast, Orissa. *Kanpur Univ. Res. J. (Sci)*, **5** : 75-80.

— 1987. Two new species of Acanthocephalan parasites (Rhadinorhynchidae) of marine fishes off Puri coast. *Kanpur Univ. Res. Journal (Science).*, **5** : 75-80. [Raorhynchus guptei & Serrasentis golvani.]

— 1987. *"Hypoechinorhynchus golvani"* sp. nov. (Acanthocephala : Hypoechinorhynchidae) from estuarine fish *Clarius batrachus* of Chilka Lake, Orissa. *Kanpur Univ. Res. Journal (Sci.)*, **4** : 85-89.

Gupta, P.D. 1976. A new species of the *Mediorhynchus* (Acanthocephala : Gigantorhynchidae) from the great Indian Bustard, *Choriotis nigriceps* (Vigors). *J. Bombay nat. Hist. Soc.*, **73**(1) : 182-183.

Gupta, P.V. 1950. On some stages in the development of the Acanthocephalan genus *Centrorhynchus. Indian. J. Helminth.*, **2**(1) : 41-48.

Gupta, R.C. & Gupta, S.P. 1975. On a new Acanthocephalan *Metarhadinorhynchus thapari* n.sp. from the intestine of a marine fish *Arius platystomus* from Puri, Orissa. *Proc. 62nd Ind. Sci. Cong. Delhi, 1975*, Part-3, Ser.B.

Gupta S.P. & Gupta, R.C. 1979. On six new Acanthocephalan parasites from marine fishes of Arabian sea at Quilon, Kerala. *Indian J. Helminth.*, **31** : 135-156.

Gupta, S.P. & Kajaji, V.L. 1969. A new acanthocephalan parasite, *Acanthosentis cameroni* n.sp. from the intestine of a fresh water fish, *Rohtee cotio* Sykes, 1839 from Lucknow. *J. fish Res. Bd. Can.*, **26**(4) : 965-974.

Gupta and Naqvi, 1981 : *Ind. J. Helminth.* **33**(2) : pp. 144-152.

Gupta, S.P. & Naqvi, M. 1983. Acanthocephalan parasites of fishes on three new Acanthocephalan parasites of the genus *Pseudorhadinorhynchus* Achmerow et Dombrovskaja Achmerova, 1941 from marine fishes of Arabian sea. *Indian J. Parasit.*, **33**(2) : 144-153.

Gupta, S.P. & Naqvi, M. 1986. On some Acanthocephalan parasites of marine fishes of India and Pakistan. *Indian J. Helminth*, **34**(1) : 61-84.

— 1992. On four species of the genus *Tenuiproboscis* Yamaguti, 1935. (Acanthocephala : Pomphorhynchidae) from marine fishes of Kerala. *J. Helminth.*, **44**(1) : 17-26.

Gupta, S.P. & Verma, S.L. 1977. On a new Acanthocephala, *Acanthogyrus guptei* n.sp. from the intestine of a fresh water fish, *Labeo rohita* from Lucknow. *Riv. Parassit.*, **37**(2/3) : 143-149.

Gupta, S.P. & Verma, S.L. 1980. On three new Acanthocephalan parasites of the genus *Pallisentis* Van Cleave,1928 from fresh water fishes of Lucknow. *Helminthologia*, **17**(4) : 269-282.

Gupta, V. & Fatma, S. 1980. On three new species of Acanthocephalan parasites of marine fishes of Mandapam, Tamil Nadu. *Indian. J.Helminth.*, **31**(1) : 45-53.

— 1981. On five new species of the genus *Centrorhynchus* Luhe, 1911 (Acanthocephala : Centrorhynchidae) from avian and amphibian *Hosts* of Lucknow. *Indan J. Helminth.*, **33**(2) : 102-120.

— 1981. On three Acanthocephalan parasites of fishes from Tamil Nadu. *Riv. Parassit.*, **42**(3) : 443-449.

— 1983. On some Acanthocephalan parasites of fishes. *Indian J. Helminth.*, **35**(2) : 137-154.

— 1985 Three Acanthocephalan parasites of amphibian and mammalian *Hosts* from Lucknow. *Indian. J. Helminth.*, **37**(2) : 137-148.

— 1985 On some Acanthocephalan parasites (Quadrigyridae) from fishes of Uttar Pradesh and Tamil Nadu. *Indian. J. Helminth.*, **37**(2) : 149-180..

— 1987. On some Acanthocephalan parasites (Rhadinorhynchidae) from marine fishes of Kerala, Puri and Tamil Nadu. *Indian. J. Helminth.*, **39**(1) : 1-26.

— 1987. On four Acanthocephalan parasites of vertebrates from Uttar Pradesh and Tamil Nadu. *Indian. J. Helminth.* **39**(2) : 128-142.

Gupta, V. & Sinha, G. 1989. On a new Acanthocephala, *Tenuiproboscis guptai* sp.nov. (Pomphorhynchidae Yamaguti,1939) from marine fish *Gerres setifer* (Ham.) from Calcutta, West Bengal. *Indian J. Helminth.*, **41** : 104-107.

— 1990. Checklist of Acanthocephalan parasites of fishes of India. & Pakistan. *Indian J. Helminth.*, **42**(1) : 41-66

— 1991. On some Acanthocephalan parasites from marine fishes of Bay of Bengal, Puri coast, Orissa. *Indian J. Helminth.*, **43**(2) : 108-118.

— 1991. On new Acanthocephalan parasite *Metarhadinorhynchus echeneisi* (Rhadinorhynchidae Luhe, 1912) from a marine fish *Echeinis naucratis*, Cochin, Kerala. *Riv. Parassit.*, **8**(2) : 115-118.

— 1991. On a new Acanthocephalan parasite *Pallisentis fotedari* sp. nov. from the intestine of a marine fish *Clupea longiceps* Gunther from Puri coast. *Indian J. Helminth.* **43**(1) : 19-26.

— 1992. On two new species of the genus *Mehrarhynchus* Datta,1940 from marine fish of Bay of Bengal. Puri coast, Orissa. *Riv. Parassit.*, **8**(1) : 47-52.

— 1993. Two new species of the genus Pseudorhadinorhynchus Achmerow *et al.*, 1941 from marine fishes of Cochin, Kerala. *Pakist. J. Zool.*, **25**(1) : 7-10.

Hamann, O. 1892. Das system der Acanthocephalen. *Zool. Anz.*, **15** : 195-197.

Hammond, R.A., 1966. The proboscis Mechanism of *Acanthocephalus ranae. Journal. Exp. Biol.*, **45**(2) : 203-213.

Harada, J. 1935. Zur Acanthocephalenfauna von Japan *Mem. Fac. Sci. a, Agric. Imp.Univ.*, **14**(2) : 7-23.

Hemkar, R.R. & Renapurkar, D.M. 1991. Studies on prevalence and *Distribution* of *Moniliformis moniliformis* in commensal rats and shrews of Bombay. *Indian J. Helminth.* **43**(2) : 134-138.

Hutton, T.L.& Oetinger, D.F. 1980 : Morphogenesis of Proboscis hooks of an Archiacanthocephalan, *Moniliformis moniliformis moniliformis* (Bremser, 1811) Travassos, 1915.

Hyman, L.H. 1951. The invertebrates : Acanthocephala, Aschelminthen, and Entoprocta, Ed. 1 : 572.

Jain, M. 1980. *Centrorhynchus splendens* Gupta and Gupta, 1970 (Acanthocephala) as the adult of *C. batrachus* Das, 1952. Indian *J. Parasit.*, **4**(1) : 25.

Jain, M. & Gupta, N.K. 1979. On *Saccosentis ophiocephali* n.sp. (Acanthocephala: Quadrigyridae) from fresh water fish of Delhi. *Bioresearch*, **3**(2) : 7-10.

— 1979. On two already known species of the genus *Pallisentis* Van Cleave, 1928 (Acanthocephala) and discussion on the validity of *Pallisentis buckleyi* Tadross, 1966 and genus *Devendrosentis* Sahay *et al.*, 1971. *Helminthologia*, **16** : 173-183.

— 1979. *Cleaveius leiognathi* n. sp. *Proc. Indian Acad. Sci.* Sect. B. *Animal Sci.*, **88**(4; Pt.-1) : 305-310.

— 1980. A new Acanthocephalan parasite of the genus *Longicollum* Yamaguti,1935 from fish of Goa, *Revta. iber. Parasit.*, **40**(3) : 269-281. [L. lutjani.]

— 1983. On some already known species of the genus *Centrorhynchus* Luhe, 1911 (Acanthocephala) from varied vertebrate *Hosts* in India. *Res. Bull. Punjab Univ. Sci.* **34**(1-3) : 15-17.

Johnston, T.H. & Edmonds, S.J. 1948. Australian Acanthocephala No. 7. *Tr. Roy. Soc. South Australia.* **72** : 69-76.

Joyeux, C.E. & Baer, J. C. 1935. Etude de quelques Acanthocephales d'Indochine. *Ann. Mus. Hist. Nat.*, **27**, Mem., 2 : 1-15.

Kates, K.C. 1943. Development of swine thorn-headed worm, *Macracanthorhynchus hirudenaceus* in its intermediate *Host. Am. J. vet. Res.*, **4** : 173-181.

Kaw B.L. 1941. Studies on the helminth parasites of Kashmir, Part-1. Description of the genus *Pomphorhynchus. Proc.Indian Acad. Sci.*, **13**(6) : 369-378.

— 1948. New *Host* records of *Pomphorhynchus kashmiriensis* (Abtt), *Proc. 34 Indian Sci. Cong.* 1947., Part-3, Sec. 7 : 173.

— 1951. Studies in Helminthology : Helminth parasites of Kashmir, Part-2. Acanthocephala. *Indian J. Helminth.*, 3(2) : 117-132.

Koelreuther, J.T. 1771. Descriptio Cyprini Rutili quem Halawel Russivocant Historico-anatomica. Nov. Comment. *Acad. Scient. Imper, Petropolitanae,* **15** : 494-503.

Kostylew, N.N. 1926. Acanthocephalen der Hauskatze und des Haushundes. *Zool. Anz.,* **68** (9-10) : 264-269.

Koul, P. L. *et al.*, 1991. *Pallisentis jagani* sp.nov. from *Channa channa* in Jammu. *Indian J. Helminth.*, **43**(2) : 124-128.

Kumar, P. 1992. *Cleaveius durdanae* n.sp. (Acanthocephala: Rhadinorhynchidae) from estuarine fish of Chilka Lake, orissa, India. *Riv. Parasit.* 9(3) : 333-336.

— 1992. *Arhythmacanthus zdzitowieckii* n.sp. (Acanthocephala: Arhythmacanthidae) from estuarine fish, *Clarius batrachus* of Chilka, Orissa. *Pakist. J. Zool.* **24** (2) : 143-144.

— 1992. Three new Acanthocephalan parasites from estuarine fishes of Chilka, Orissa. Proc.Parasit., 14 : 6-14. 156. Lankaster, R. 1900. A treatise on Zoology, Adam and Charles Black, London.

Leeuwenhoek, A. van. 1995. Derde Vervolog der Brieven, gescgreven aan de Koningliike Societeit tet London. *Tot Delft.* 1693-1695, *St. Missive* : 518-520.

Leukckart, R. 1828. Breves animalium descriptions. Heidelberg. 1828.

Leidy, J. 1851. Contributions to helminthology. *Proc. Acad. nat. Sci. Philad.*, **5** : 155-251

Linton, E. 1889. Notes on Entozoa of marine fishes of New- England, with description of several new species, *Rep. U.S. Fish. Comm.*, **14** : 453-511.

— 1932. On taxonomic position of Echinorhynchus sagittifer Linton. *Science,* **76** : 193.

Linstow, O.von. 1905. Helminthen der Russischen Polarexpedition (1900-1903). *Mem. Acad. Sci.* St.-P., Ser. 8, Cl. phys.-math. **18**.

Luhe, A. 1911. Acanthocephalen. Brauer, Suswasserfauna Deutschlands H : 11-16.

Maplestone, P.A. 1930. Nematode parasites of pigs in Bengal. *Rec. Ind. Mus.* **32**(2) : 77-105.

Meyer, A. 1931. *Gordiorhynchus* ein neues Acanthocephalen genus mit innerernovarialer Pseudosegmentierung. *Zool. Jb.*, **60** : 437-470.

Meyer, A. 1933. Bronn's Klassen and ordnungen des tierreichs.Acanthocephala, **4** : 582.

Mithal, R.P. & Lal, S. S. 1981. Two new Acanthocephalan worms *Pallisentis croftoni* n. sp. and *P. indicus* n.sp. from fresh water fishes of the genus *Ophiocephalus. Indian J. Zool.*, **17** : 165-175.

Moghe, M.A. & Das, E.N. 1953. On a new species of Acanthocephala of the genus *Arhythmorhynchus* (Luhe, 1911) from India. *Thapar Commem.Volume* : 211-216.

Monticelli, F.S. 1905. Su di un echinorinco della collezione del Museo Zoologico di Napoli (*Echinorhynchus rhytitodes* Montic). *Annuar, R. Mus.zool. R. Univ. Napoli., N.S.*, **I**(25) : table 5.

Moore, D. 1942. An improved technique for the study of the acanthor stage in certain Acanthocephala life-histories. *J. Parasit.*, **28** : 495.

— 1946. Studies on the Life-history of development of *Macracanthorhynchus ingens* Meyer, 1933, with a redescription of adult worm. *J. Parasit.*, **32**(4) : 387-399.

— 1946a. Studies and Life-history and development of *Moniliformis dubius* Meyer, 1933. *J. Parasit.*, **32** : 257-271.

Moore, D.V. 1962. Morphology, Life-history, and development of the Acanthocephalan, *Mediorhynchus grandis* Van Cleave, 1916, *J. Parasit.* **48**(1) : 76-85.

Muller, O.F. 1776. Zoologiae Danicae Prodrums seu Animalium Daniae et Norvegiae Indigenarium Characteres–*Nomina et synonyma imprimis popularium*, **8** : 314-315.

Nama, H.S. & Rathore, G.S. 1984. The acanthocephalan genus *Centrorhynchus* occurring in Indian birds with description of two new species from Rajasthan. *Indian J. Helm.* **34**(2) : 143-150.

Nath, D. & Pande, B.P. 1963. A note on the acanthocephalan infection of domestic fowl. *Indian J.Helminth.*, **15**(2) : 31-35.

Pal, R.N. 1963a. A new Acanthocephalan parasite, *Acanthosentis hilsai* n. sp. from the Indian shad, *Hilsa ilisha* (Ham) *Indian J. Helminth.*, **15**(2) : 96-99.

— 1963 b. Observation on fluctuations in parasitisation of the Indian shad, *Hilsa ilisha* (Ham) of the hooghly estuary. *Indian J. Helminth.*, **15**(2) : 119-126.

Patnaik, M.M. & Acharjya, L.N. 1970. *Onicola* sp.from *Felis canius* from Orissa.

Petrotschenko, V.I. 1956. Acanthocephala of domestic and wild animals. *Acad. Sci.* USSR., Vol. **I** : 1-412.

— 1958. Acanthocephala of domestic and wild animals. *Acad. Sci.* USSR. Vol. **II** : 1-420.

Pichelin, S. & Cribb,T.H. 1999. A review of the Arhythmacanthidae (Acanthocephala) with a description of *Heterosentis hirsutus* n. sp. from *Cnidoglanis macrocephalus* (Plotosidae) in Australia. *Parasitology*, **6**(4) : 293-302.

Podder, T.N. 1937 a. On a new species of *Neoechinorhynchus* parasitic in *Mugil cephalus* Linn.from Chilka Lake. *Rec. Ind. Mus.* **39**(2) : 129-131.

— 1937 b. A new species of Acanthocephala *Neoechinorhynchus topseyi* n.sp. from Calcutta fish, *Polynemus heptadactylus* (Cur. et Val.), *Parasitology*, **29**(3) : 365-369.

— 1938. A new species of Acanthocephala, *Acanthosentis dattai* n.sp. from a fresh water fish of Bengal, *Barbus ticto* and *B.stigma.Parasitology*, **30**(2) : 171-175.

— 1941. On a new Acanthocephala, *Acanthosentis sircari* sp.n. from a Calcutta fish, *Rasbora elonga* (Ham). *Rec. Ind. Mus.*, **43**(2) : 137-142.

Prasad, D. ; Sahay, U. & Shambhunath, G. 1969. On a new species of an Acanthocephala of the genus *Acanthosentis* Verma and Datta, 1929 from a fresh water fish *Hilsa ilisha*. *Zool. Anz.*, **183**(3/4) : 278-283.

Pujatti, D. 1950a. *Centrorhynchus spinosus* Kaiser,1893 nel Sud India. Ospiti intermedi (Acanthocephala), Dorina **1**(10) : 1-4.

— 1950b. *Centrorhynchus spinosus* Kaiser, 1893 nel Sud India. Ospiti definitive (Acanthocephala), Dorina., **1**(12) : 1-14.

— 1951a. Una nouva apecie del genere Echinopardalis Trav. 1918, rinvenuta in India. *Riv. Parassit.*, **12**(1) : 119-127.

— 1951b. Probabili acanthellae di *Echinopardalis bangalorensis* Pujatti nel *Bufo melanostictus*. *Riv. Parassit*, **12**(4) : 251-255.

— 1952. Ospiti intermedi di *Centrorhynchus spinosus* Kaiser, 1893 (Acanthocephala). Dorina, **1**(32) : 1-7.

Rai, P. 1967. On four Acanthocephalan genera parasitic in fresh water fishes with description of three new species. *Indian.J.Helminth.* **19**(1) : 27-44.

Raina, *et al.*, 1984. Male reproductive system of *Neoechinorhynchus manasbalense* (Acanthocephala : Neoechinorhynchidae), **25**(2) : 71-78.

Rao, S.B. 1993. Qualitative structural grouping of helminth and Acanthocephalan parasites in the population of Perdicula asiatica. *Agricultural and Biological Reasearch.*, **9**(1) : 6-10.

Rao, S. B. 1994. On relative density of helminth parasites in the *Host* body. C. B. Srivastava Comm. Vol. : 81-84.

Redi, F. 1684. Observation interno agli animali viventi che si trovano negli animali viventi, 12° Firezi.

Renguraju, V. & Das, E.N. 1975. On some new species of avian Acanthocephala from India. *Indian. J. Helminth.* **27** : 33-45.

Renguraju, V. & Das, E.N. 1976. A review on the taxonomy of Acanthocephala. *J. Shivaji Univ.(Science).*, **16** : 95-98.

— 1980. A new species of the genus *Centrorhynchus* Luhe (Acanthocephala) from India. *Records zool. Surv. India.* **76**(1/4) 83-85.

— 1981. On a new species of the genus *Oligacanthorhynchus* Travassos,1915 (Acanthocephala : Oligacanthorhynchidae) from India. *Rec. zool. Surv. India,* **78**(1/4) : 37-40.

Rudolphi, K.A. 1808. Entozoorum sive *vermium intestinalium historia naturalis.*

Sarkar, H. L. 1953. On a new Acanthocephala, *Pallisentis nandai,* from the fish *Nandus nandus,* with notes on the other species of the genus. *Proc. zool. Soc. Bengal.,* **6**(2) : 139-147.

— 1954. On a new acanthocephalan, *Pallisentis colisai,* from the fish *Colisa fasciatus* with a note on *Acanthogyrus acanthogyrus* Thapar, from the fish *Labeo rohita. Rec. Indian Mus.* **52**(2/4) : 349-362.

Sita E. (Anantaraman, S.). 1949. The life-cycle of *Moniliformis miniliformis* (Bremser, 1811) Acanthocephala. *Curr. Sci.* **18**(6) : 216-218.

Sahay, U. ; Sinha, H. & Narayan, S. 1967. On an acanthocephalan of the genus *Acanthosentis* Verma et Datta, 1929 (Neoechinorhynchidea : Quadrigyridae) from a new *Host Mystus seenghala. An. Inst. Biol. Univ. Mex. Ser. Zool.,* **38**(1) : 17-22.

Sahay, U.; Nath, S. & Sinha, A. 1967. On Acanthocephala from a hill sream fish *Lepidocephalicthys guntea.* (Ham) from Patna. *Zool.Anz.,* **178** : 348-353.

Sahay, U; Nath, A. & Ghosh, A.K. 1971. On *Devendrasentis garuai* gen.et.sp.nov. (Neoechinorhynchidae Southwell and Macfie, 1925, Quadrigyridae Van Cleave, 1920, Acanthocephala from a fresh water Indian fish *Clupisoma garua.* (Ham). *Annals. Parasit.,* (Paris). t. **46**(1) : 69-80.

Sahay, S. & Sinha, A. 1969 : On a new *Host* record of *Centrorhynchus bengalensis* Datta and Soota,1954 (Centrorhynchidae Van Cleave, 1916 : *Centrorhynchus* Luhe, 1911), *Zool. Anz.* Bd. **183**(3/4) 292-298.

— 1971. On *Mehrarhynchus mysti* n. sp. (Echinorhynchidae Southwell & Macfie,1925; Rhadinorhynchidae Travassos, 1923: Rhadinorhynchinae Luhe,1912.) frpm the intestine of a fresh water fish, *Mystus seenghala. Indian J. Helminth.* **23**(1) : 66-70.

Schmidt, G.D. 1972. Revision of the class Archiacanthocephala Meyer, 1931 (Phylum Acanthocephala), with emphasis on Oligacanthorhynchidae Southwell & Macfie, 1925. *J. Parasit.,* **58**(2) : 290-297.

Schmidt, G.D. 1973. Resurrection of *Southwellina* Witenberg, 1932 with a description of *Southwellina dimorpha* sp.n., and a key to the genera in Polymorphidae (canthocephala), *J. Parasitol.,* **59** : 299-305.

Schmidt, G.D. 1982. Foundations of Parasitology (Phylum-Acanthocephala : thorny-headed worms) Chapter-32.

Schmidt, G. D. & Kuntz, R. E. 1966. New and little known plagiorhynchid Acanthocephala from Taiwan and the Pescadores Islands. *J. Parasit.,* **52** : 520-527.

—1967. Revision of the Porrorchinae (Acanthocephala : Plagiorhynchidae) with descriptions of two new genera and three new species.

—1969. *Centrorhynchus spilornae* sp.n. (Acanthocephala) and other Centrorhynchids from far east. *J.Parasit.*, **55**(2) : 329-331.

— 1977. Revision of *Mediorhynchus* Van Cleave,1916 (Acanthocephala) with a key to species. *J.Parasit.* **63**(3) : 500-507.

Schmidt,G.D. & Paperna, I. 1978. *Golvanacanthus blennii* Peggi et Orecchia, 1972, *J. Parasit.*, **64**(5) : 846-850.

Sen, J.K. 1975. On a new species of *Apororhynchus* Shipley, 1899 (Apororhynchidea : Apororhynchidae) from India. *Dr. B.S. Chauhan Comm. Vol.* : 211-213.

Sen, J.K. & Chauhan, B.S. 1972. On some Acanthocephalan parasites from Indian mammals, with descriptions of two new species. *J. zool. Soc. India.*, **24**(1) : 39-45.

Sen, P. 1938. On a new species of Acanthocephalan, *Acanthosentis holospinus* sp. n. from the fish *Barbus stigma. Proc. Ind. Acad. Sci.* B. **7**(1) : 41-46.

Soota, T.D. & Bhattacharya, S.B. 1981. On some Acanthocephalans from marine fishes. *Bull. zool. Surv. India.*, **3**(3) : 227-233.

— 1982. On the validity of the species of the genus *Pallisentis* Van Cleave, 1928 (Acanthocephala : Pallisentidae) from the Indian sub-continent. *Rec. zool. Surv. India*, **80** : 157-167.

Soota, T.D.& Kansal, K.C. 1972 The helminth fauna of Andaman & Nicobar (Acanthocephala), *Rec. zool. Surv. India*, **66** : 303-307.

Soota, T.D. & Sen, J.K. 1954. On a new species of *Acanthosentis* Verma et Datta, 1929 from *Glossogobius giuris* (Ham), *Rec. Ind. Mus.* **52**(2-4): 363-365.

Soota, T.D.; Srivastava, C.B. & Ghosh, R.K., 1971. Studies on the helminth fauna of Great Nicobar Island., Part-2, Nematoda & Acanthocephala., *Proc. Indian Acad. Sci.*, **73**(1), Sec. B : 20-29.

Southwell, T. & Macfie, S. 1925. On a collection of Acanthocephala in the Liverpool School of Tropical Medicine. *Ann.Trop. Med. Par.*, **19** : 141-184.

Strand, E. 1936. Miscellanea memenclatoria zoological et palaeontilogica. *Folia Zool. Hydrobiol. Riga*, **9** : 167-176.

Subrahmanian, K.A. 1927. On a small collection of Acanthocephalan from *Rangoon. Ann. Mag. nat. Hist.*, Ser. 9. V. **19** : 275-279.

— 1936. Studies on Acanthocephalan fauna of Burma. *Rec.Indian Mus.* **38**(3) : 311-315.

Susheela, G. 1991. The influence of seasons on the helminth infections in the three rat species. *Geobios.* New Reports. **10**(1) : 81-84.

Tadross, G. 1966. On three new Acanthocephala of the genera *Pallisentis* Van Cleave, *Saccosentis* gen. nov. and *Acanthocephalus* Koelreuther, from fish. *J. Helminth.*, **40** (1/2) : 155-180.

Travassos, L. 1915. Revisao dos Acanthocephalos brazilieros. II. Familia Echinorhynchidae Hamann, 1892. *Brazil Medico*, Rio de Janeiro, **48** : 377.

— 1924. Contribucoes para o conhecimento da fauna helmintologica braziliera., 17. Revisao dos Acanthocephalos brazilieros. Part-1. Fam. Gigantorhynchidae Hamann, 1892. Supplemento-*Mems. Inst. Oswaldo Cruz.*, **17** : 365-375.

Travassos, L. 1923. Gigantorhynchidos novos. Folha Med. Rio de Jeneiro, Ann. 4, 2 : 12.

Travassos, L. 1926. Acanthocephales nouveaux. C.R. *Soc. Biol.*, **95** : 935-937.

Thapar, G.S. 1927. On *Acanthogyrus* n.g. from the intestine of the Indian fish, *Labeo rohita*, with a note on the classification of the Acanthocephala. *J. Helminth.*, 5(2) : 109-120.

— 1930. On *Farzandia*, A new genus of Acanthocephalid worms, from the intestine of *Ophiocephalus marulius*. *Ann. Mag. nat. Hist. Ser.* 10, **6** : 76.

Tripathi, Y. R. 1959. Studies on parasites of Indian fishes, 5, Acanthocephala. *Rec. Indian Mus.*, **54**(1/2) : 61-99.

Van Cleave, H. J. 1913. The genus *Neorhynchus* in North America. *Zool. Anz.*, **43** : 177-180.

— 1916c. Acanthocephala of the genera *Centrorhynchus* and *Mediorhynchus* (New Genus) from North American birds. *Trans. Am. microsc. Aoc.*, **35** : 221-232

— 1919. Acanthocephala from the Illinois river, with descriptions of species and a synopsis of the family Neoechinorhynchidae. *Bull. Ill. Nat. Hist. Surv.* 13(8) : 225-257.

— 1920. Sexual dimorphism in the Acanthocephala. *Trans. 3, n. State Acad. Sci.*, **13** : 280-292.

— 1920. Notes on life-cycle of two species of Acanthocephala from fresh water fishes. *J. Parasit.*, **6** : 167-172.

— 1923. Acanthocephala from the fishes of Oneida Lake, New York. Roosevelt Wild-life forest. Exper. Stat. *Roosevelt Wild-life Bull.*, **2**(1) : 73-84.

— 1923. *Telosentis*, the new genus of Acanthocephala from South Europe. *J. Parasit.*, **9** : 174-175.

— 1928. Two new genera and species of Acanthocephala from fishes of India. *Rec. Indian Mus.*, **30**(2) : 147-149.

— 1936. The recognition of a new order in the Acanthocephala. *J. Parasit.* **22**(2) : 202-206.

— 1937b. Developmental stages in Acanthocephalan life-histories-Sbornik, posvyash chennyi Skrjabinu, : 732-743. VASKh NIL. Moskva.

— 1941. Hooks pattern on the Acanthocephalan proboscis. *Qurt. Rev. Biol.*, **16**(2) : 157-172.

— 1947. The acanthocephalan genus *Mediorhynchus*. its history and a review of the species occurring in the United States. *J. Parasit.*, **33**(4) : 293-315.

— 1947. Major taxonomic groupings in the Phylum Acanthocephala Rev. Kuba. Med. Trop. Parasit. **3**(3) : 61-62.

— 1948. Expanding horizons in the recognition of a Phylum. *J. Parsit.*, **34**(1) : 1-20.

— 1948. A detailed comparative study of cement glands in males of the Acanthocephala. *J. Parasit.*, **36**(6), Sec. 2 : Suppl. : 20.

— 1949. *Pseudoporrorchis teleger*, a new species of Acanthocephala from Java. *Parasitology.* **39**(3-4) : 214-217.

Van Cleave, H.J. & Lincicome, D.R. 1939. On a new genus and species of Rhadinorhynchidae (Acanthocephala), *Parasitoligy*, **31**(4) : 413-416.

Verma, S.L. 1973. *Acanthosentis baccailai* n.sp. *Proc. nat. Acad. Sci.*, **43**(4), Sec. B : 265-272.

Verma, S.C. & Datta, M.N. 1928. Two Acanthocephalan worms from Indian fishes. *Proc. 15 th. Indian Sci. Cong.* (Calcutta) : 194.

— 1929. Acanthocephala from Northern India. 1-A New genus *Acanthosentis* from a Calcutta fish. *Ann. Trop. Med. Parasit.*, **23**(4): 483-496

— 1929. Acanthocephala from Northern India, 1, A new genus *Acanthosentis* from a Calcutta fish. *Ann. Trop. Med. Parasit.*, **23**, 483-500.

Webster, J. 1948. A new Acanthocephalan from Bob-white. *J. Parasit.* **34**(2) : 84-86

Westrumb, A.H.L. 1821. De Helminthibus Acanthocephalis. Commentatio historico anatomica adenexo recensu animalium, in Museo Vindobanensis circa helminthes dissectorum et singularum speciarum harum in illis repertarum. *Hnnoverae* Helwig. : 85.

Yamaguti, S. 1963. Systema Helminthum. Vol. 5 : Acanthocephala. Interscience Publish. New York, London. 1-423.

Zafar, M. M. & Farooqi, H.U. 1981. Description of *Plagiorhynchus nicobarensis* (Soota and Kansal, 1972) n.comb. with coments on *Centrorhynchus spilornae* Schmidt & Kuntz, 1969. *Indian J. Parasit.*, **5**(2) : 179-182.

Zdzitowiecki, K. 1984. Description of *Heterosentis heteracanthus* (Linstow,1806) from Antarctic fishes and *Remarks* on the taxonomic status of *Heterosentis* Van Cleave,1931 (Acanthocephala : Arhythmacanthidae). *Acta parasit. pol.*, **29**(9-19) : 111-115.

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